

2audio

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30.2

ANGLE

MOD



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- **Manual:** Andrew Souter

Thanks

Many thanks to our beta team for helping us release bug-free software. Additional thanks to all of the great minds who have come before us as well as our contemporary peers who continue to help advance the art and science of digital audio signal processing. And finally, special thanks to our friends and families who are kind and forgiving enough to tolerate the level of obsessiveness necessary to make a product such as Precedence.

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Introduction

Welcome to 2CAudio

First, we would like to thank for your purchase and welcome you to the 2CAudio family. 2CAudio develops industry-leading audio plug-ins in VST, AU, and AAX formats. Its primary focus is on spatial processing, advanced creative effects, and other future-forward ideas. The 2CAudio corporate motto is: **Convergent Creative Precision**.

Convergent represents our understanding of the universal trend in knowledge and discovery that tells us that over time disparate segments of art, science, technology, and thought merge and become one, and therefore wisdom and progress in one discipline can often be successfully applied to another.

Creative represents our commitment to innovation, independent thought, and invention. We learn from the past, but we do not wish to limit ourselves to mere emulation and duplication. We seek not to emulate the great minds that have come before us, but rather to understand the questions they struggled with, and explore new solutions, ideas, and discoveries using the latest tools of our generation. Moreover, our products are designed to encourage these ideals in our users, and our largest reward is hearing of enhanced creativity that was inspired by our products.

Precision represents our obsessive commitment to rigorous scientific standards of technical and numerical accuracy. The words “Good Enough” are simply not in our vocabulary, and we strive for perfection in all areas of our endeavors.

2CAudio is passionate about both art and science and we consider them both invaluable leaves on the tree of knowledge.

2CAudio prides itself on active engagement with our customers and the market as a whole, and we are always open to your feedback. Our corporate vision is not immutable, and we attempt to mold and form our products to the needs of our customers. We value your input and thank you for providing it to us. We are always listening at info@2caudio.com

Technical support is provided via email at support@2caudio.com

To learn more about 2CAudio, please visit our website at www.2caudio.com

Welcome to Precedence

Congratulations on your purchase of Precedence. Precedence is a unified field theory of direct sound spatialization and positioning. It produces a self-modulating stereo-image that creates an instantaneous sense of width and presence similar to stereo microphone techniques used in live acoustic spaces. Precedence positions this image within a virtual stage giving ultra precise left-to-right, and front-to-back localization.

Precedence 1.5 can optionally be linked with Breeze 2.5 (and future versions of other 2CAudio reverbs), whereby it communicates position information to the reverb engines, which in turn seamlessly update their own algorithm parameters in an automatically synched manner to create an incredible sense of hyper-realistic 3D space and specific positioning within this space! Precedence can display and edit position information and other parameters for multiple instances from within a single shared GUI editor, including any reverb instances linked to Precedence. A single GUI editor can effectively control tens or hundreds of linked plugins, allowing them to function as a part of a unified space, yet providing individual positioning within this space for each instrument track. This system represents one of the most exciting and novel developments in spatial processing to come to market in a long time. It offers all of the convenience of the traditional method of using mixer gain panning together with a shared reverb on a send bus, but provides truly unprecedented degrees of realism via supplying individually correct psychoacoustic properties for every track in the mix!

System Requirements

Absolute Minimum Hardware Requirements: 1-core CPU with SSE3 support. 512MB of RAM. (Any Intel Core CPU or higher or equivalent AMD CPU)

Recommended Minimum Hardware: 4-core CPU with AVX1 or AVX2 support running at least at 2.0GHz. 2GB of RAM. (Intel Sandy-Bridge or later generation CPU or equivalent AMD CPU)

Best Possible Hardware (For Reference – **NOT REQUIRED):** multi-core CPU with AVX512 support running at least at 2.0GHz. These are new to the market in 2018 and 2CAudio is among the first if not THE first, to offer optimization for these machines. (iMac Pro, 2019 Mac Pro, Intel X-Series HEDT CPUs, Xeon W, Silver/Gold/Platinum Xeon SP). Easily **over one thousand instances** are possible on such systems as a reference, which is obviously more than is needed in even the largest real world projects.

The Precedence algorithm benefits greatly from faster RAM and larger CPU cache size. In some cases, performance is in fact bound by these factors more than raw CPU clock speed. More recent processors with large caches are ideal, though certainly not required.

Supported Windows Operating Systems: Win 8 64 bit, Win 10 64 bit. Win 10 is recommended.

Supported Mac OS X Operating Systems: X.10 and higher including Yosemite (10), El Capitan (11), Sierra (12), High Sierra (13), Mojave (14) and higher. X.15 Catalina was announced as of writing this manual, and will be tested and validated.

Supported Hosts: Precedence is compatible with most known VST, AU, and AAX hosts so long as they conform to the plug-in format standard and work with the hardware and operating systems above. If unsure, please try the demo to verify compatibility with your system, and feel free to email us for additional information.

Installation & Authorization

Windows Installation (64bit)

To install the plug-in simply launch "setup.exe" and follow the instructions. You will have the option to install either or both the 64-bit VST version and/or the 64-bit AAX version.

Installation of the plug-in is subject to accepting the End-User License Agreement that you can read during installation.

Note: *In rare cases some users have reported that clicking on the installer application ("setup.exe") does not successfully launch the installer. The reason for this is generally that the installer has been downloaded to a network drive, a shared local drive, or is saved deep in the folder hierarchy of the users systems. In such cases Windows may block the launch of our installer for "security" reasons. If this occurs, simply temporally move the installer folder to either your "Desktop" or to your "Program Files" folder and run the installer from this location. This will solve the issue. Upon successful installation you may move or delete the installer from this temporary location as desired.*

Mac OSX Installation (64bit)

To install the plug-in double-click on "Install 2C-Precedence.mpkg". A standard OSX Installer will launch. Follow the installer instructions. By default, VST, Audio Units, and AAX versions are installed. If you would like to install only one

particular format, please follow the installer instructions on the readme page. Installation of the plug-in is subject to accepting the End-User License Agreement that you can read during installation.

Note: Be sure to allow OSX to install apps downloaded “From Anywhere” by changing the preference found here:

/ System Preferences / Security & Privacy / “Allow Apps Downloaded From” /

...to “From Anywhere”.

Authorization

Upon loading the plug-in in your host application for the first time the plug-in will automatically display the Info page where you can authorize the product. To authorize the product you need to enter the serial number that you were provided when you purchased the product. The serial has the following form:

XXXXX-XXXXX-XXXXX-XXXXX-XXXX

You can always find your Serial Number in the “My Downloads” area of the Designer Sound Web Store, where you purchased the product:

<https://www.designersound.com/mydownloads>

To authorize Precedence, simply select your entire Serial Number from the link above using any web browser, and copy it to the Windows/OSX clipboard. Then simply click on the Serial Number field found on the INFO page of the Precedence GUI. This will automatically paste your Serial Number from the clipboard, instantly authorizing Precedence.

As long as the plug-in remains unauthorized, it will not perform any audio processing. Once it has been successfully authorized, processing will begin and you may navigate to the Main or Browser Page to begin using the plug-in.

Note: If clicking on the serial number field does not successfully authorize Precedence, please check that you have successfully copied by the serial number from the link above, by attempting to paste it into a third party text editor or email client. Be sure you are pasting only the SN, and no additional leading or trailing characters such as spaces or line breaks. Be sure you have copied the Precedence serial number, NOT another product serial number. If are you certain all of this is correct and still can not authorize Precedence, please email support@2caudio.com

Entering User Info

Below the Serial Number field are found the “User Name & Info” fields. Please enter your name into the left field, and optionally any information you might like to include, such as a company name or website in the right field. If you create your own custom presets, this information will be saved into the presets. This information is also displayed on the Browser Page of the product GUI if available, and if you share your presets with others this is a good way to gain recognition and credit for your work.

File Management

Windows File Management

All Precedence-related program files and resources are saved in a folder named “/Program Files/2C-Audio/Precedence” that is created by our installer.

User Presets are stored in “C:\Users*you*\Documents\Precedence\Preset\Full\User”.

The 64-bit VST shell and AAX shell, are saved in the host's respective plug-in folders. These files serve to connect the host to the plug-in and resources found in ".../Program Files/2C-Audio/Precedence/". They do not contain any user data.

This information is really only needed when changing operating systems or upgrading to a new computer if you have created custom User Presets.

OSX File Management

The Precedence Audio Unit shell is installed here:

.../Library/Audio/Plug-Ins/Components/

The Precedence VST shell is installed here:

.../Library/Audio/Plug-Ins/VST/

The Precedence AAX shell is installed here:

.../Library/Application Support/Digidesign/Plug-Ins/

These files serve to connect the hosts to the plug-ins and resources found in "/Library/Application Support/2C-Audio/Precedence/". They do not contain any user data.

All supporting files, presets, and resources are installed here:

.../Library/Application Support/2C-Audio/Precedence/

User Presets are stored in ".../Application Support/2C-Audio/Precedence/Presets/Full/User/".

This information is really only needed when changing operating systems or upgrading to a new computer if you have created custom User Presets.

Uninstalling

2CAudio installers do not create hidden files on your system. Windows users may use Windows' "Add/Remove Programs" feature or run the uninstaller included within Precedence's setup folder. To uninstall on OSX you simply have to delete the plug-in files and the associated resource files. The location of these files is described in the previous section. If you intend to reinstall Precedence again at any point in the future, and if you have created your own User Presets, be sure to back these up before deleting your installation.

The GUI

The Navigation Bar

The Precedence GUI is segmented in two main pages: the Main Page and the Info Page. At the top of both of these pages is found a common area called the Navigation Bar. This area has two functions: to allow navigation to the various GUI pages, and to handle global preset and file needs. The navigation bar is shown below.



Page Navigation

On the left side of the Navigation Bar is found the Page Navigation area. To switch the Main Page, click on Main. To switch on the Info Page, click on Info. The Main page is where the product's functionality is found. The Info page is used for authorization, version info, reference data, and changing preferences.

File & Instance Actions Area

On the right side of the Navigation Bar is found the File & Instance Actions Area. Historically this area of the Navigation Bar was used exclusively to handle changes to the Preset state. For sake of convenience, its functionality has been expanded to allow you switch between three modes:

- **Preset (@ symbol)** : allows you to change, load and save Presets
- **Color (© symbol)** : allows you to change, load and save Color Preferences from the Main page of the GUI so that you can easily browse color preferences while viewing them instantly
- **Instance (• symbol)** : allows you to view and change the currently selected Instance when using Multi-Edit Groups

The controls have the following functions:

- **Preset/Color/Instance Selector (@ © •)** : changes the resource target for the next three controls, to allow this part of the Nav Bar to be used to change Presets, Color Preferences, or Instance Selection
- **Preset/Color/Instance Decrement ◀** : changes the Preset, Color Preference or Instance to the previous available item in the directory list
- **Preset/Color/Instance Increment ▶** : changes the Preset, Color Preference or Instance to the next available item in the directory list
- **Preset/Color/Instance Name and Menu Access ▼** : displays the name of the currently active Preset, currently active Color Preference, or selected Instance. A mouse-click in this areas accesses the list menu drop-down and

allows a single Preset, or Color Preference to be selected from anywhere within the hierarchical directory, or the Selected Instance to be changed.

- **Note:** *when displaying presets, the name shown is the last loaded preset from existing factory or user presets. If you make changes to the preset settings, the preset name will not change automatically, and there will be some differences between the settings stored in the Active Preset name and the actual current settings. Note that host applications save all current settings exactly as they are, so your edits will be preserved. However if you return to a project at a later date you may see the Active Preset name displayed as one of the factory presets, and you may try to load this preset into another project to achieve the same sound without realizing that you have made substantial changes to the preset at an earlier date. Therefore, if you edit the preset substantially and you think you may like to use these settings at a later date in another project, it is a good idea to save the settings as your own custom User Preset.*
- **Group:** 2CAudio products such as Precedence and Breeze 2 are able to display data from and edit parameters of multiple instances of the plug-in from within a single GUI editor. To use Multi-Instance Editing features, an instance must be part of an Edit Group. By default, Multi-Instance Editing is turned off. To enable it, click on the Group button. Once Multi-Instance Editing is enabled the Group button will split into two buttons: Group Number, and Global Broadcast.
- **Group Number:** If Multi-Instance Editing is enabled, the Group Number button is displayed. Eight Edit Groups are available. Left and right mouse-clicks on the Group Number will increase/decrease the Group Number. Cycling through all options will return Group behavior to the disabled mode and hide the Group Number and Global Broadcast buttons. Control/Apple-Click on the Group Number will also disable group behavior. See the Multi-Instance Editing section of the manual for more details.
- **Global Broadcast:** If Multi-Instance Editing is enabled, the Global Broadcast button is displayed. Traditionally if a user is using multiple instances of a plug-in within a DAW, each instance is accessed by opening it from the DAW mixer or arrangement window and changes made from within the open GUI editor apply only to the instance that was opened. If changes need to be made to many instances, each instance must be opened and edited individually in a rather tedious and time-consuming process. Global Broadcast solves this by allowing the user to apply parameter changes to all members of the selected Group with a single command from within a single GUI editor. Changes may include changing single parameters, or may be macro actions such as changing complete presets. **If Broadcast is enabled, any change made within the current GUI editor is applied to ALL members of the Group.** If Group members are also using the Precedence Link feature, changes made while using Broadcast may result not-only in changes to tens or hundreds of instances of Precedence, but also in changes to all linked reverb instances as well. See the Multi-Instance Editing section of the manual for more details.
 - **Tip:** *Broadcast is an incredibly powerful feature. Changes made while Broadcast is enabled may potentially have effect on hundreds of plug-in instances! It allows a Group to behave like a unified space with global characteristics while still maintaining individual variations and discrete positions within the space defined for the Group.*
 - **Note:** *Due to its potential to change parameter settings of an entire mix with a single click, the Broadcast Button state, is intentionally made visually “loud” and hard to ignore when it is active. While becoming familiar with the power of the Broadcast feature, users may like to keep it in the Off state when not actively trying to make Multi-Instance changes for safe practice.*
- **File Menu:** Accesses the file list menu drop-down and gives access to the following file operations:

- **Active State (A | B):** 2CAudio plug-ins store two independent sets of parameter settings: A and B. Clicking on the Active State button switches between
 - Saving potential preset matches while browsing presets: if for example you are trying different presets in the Browser Page and you find a good candidate but you would like to try some others, you can quickly copy the candidate to the inactive State and continue browsing. When you find another one that you like, you can compare it to the previous candidate to decide which is better.
 - Comparing changes made to presets with the original preset: you may use the same technique to check changes you are making to a preset by first copying the preset to the inactive State and then performing your edits and finally switching States again to compare the results
 - Blind listening tests: oftentimes engineers succumb to the weakness of using their eyes or minds more than their ears, and particular numerical values or aesthetic GUI settings are chosen over simple listening preference. Blind listening tests can cure this problem. This can be accomplished by saving two different presets in State A and State B, closing your eyes, and clicking an unknown number of times on the Active State button such that you no longer know if you are using State A or State B. At this point keep your eyes closed and listen critically while you slowly cycle back and forth between settings while comparing the results with your ears only. Once you have chosen the State that sounds the best, open your eyes and look at your selection. Repeat this process for confirmation if desired. This is a powerful technique.
- **Copy State ◀▶ :** Copies the settings of the Active State to the inactive state. For example if State A is active, the settings are copied to State B. This allows easy comparisons between states to be made as described above.
- **Replace Preset:** Saves the current preset state to the last loaded preset, overwriting it. This is useful for preset designers who may make incremental adjustments to their presets
- **Save Preset to My Presets:** saves the current plug-in state to the /User/My Presets folder and adds it to the preset list.
- **Save Preset to Folder:** saves the current plug-in state to a different folder location other than the default User/My Presets/. By default, the file dialog points to the folder of the currently active host project file if this information is available. This is useful for archiving favorite presets together with host projects and for sharing a given preset with peers on either local or global networks.
- **Load Preset:** loads a single preset file into the current plug-in state. This is useful for loading presets that were saved and/or shared with the “Save Preset to Folder” action.
- **Import Preset to My Presets:** Copies a single preset to /User/My Presets/. This is useful to copy a single preset that perhaps someone shared on a web forum or other similar scenarios.
- **Import Preset Expansion:** Copies and installs a commercial paid preset expansion
- **ColorPref Preset (various options):** Allow all of the above operations for Color Preferences so that they may be edited, saved, shared etc.

The Main Page

Two Sections

Precedence's GUI is divided into two pages: the Main page and the Info page. The Main page displays approximately 20 controls and GUI elements. Precedence's Main Page is conceptually separated into three sections: the Upper Controls Area, the Lower Controls Area, and in-between is found the Position Display.



Note: 2CAudio products have GUI theme and color variations. The interface may appear differently then as described in this manual. This document uses Default 01 theme primarily.

The Info Page

The Info Page contains one main functional area that is tabbed and has 3 Tabs: Karma, Preferences, and Color. The Karma tab deals with product authorization and user info. The Preferences tab deals with general behavior of the plug-in and GUI. The Color Tab deals with user adjustable color settings.





PREFERENCES



COLOR

Mouse and Keyboard Interface Gestures

Mouse-Click Behaviors

- **Click-Drag:** selects a knob and changes its value at normal rate
- **Shift-Click-Drag:** selects a knob and changes its value at a slow, fine-tune rate
- **Control-Click (Win):** sets the knob value to the default value for the parameter
- **Command-Click (OSX):** sets the knob value to the default value for the parameter
- **Alt-Click:** creates a new variation using the same general parameter range
- **Double-Click:** opens the text-entry edit box for the selected knob or value box

Mouse-Wheel Behaviors

- In most hosts it is possible to use the mouse wheel to change a knob value. To do so, click on the knob you want to control using the left mouse button, and then simply use mouse wheel.
- Holding down the Shift key on the keyboard while using the mouse wheel, will change the values at a slow, fine-tune rate

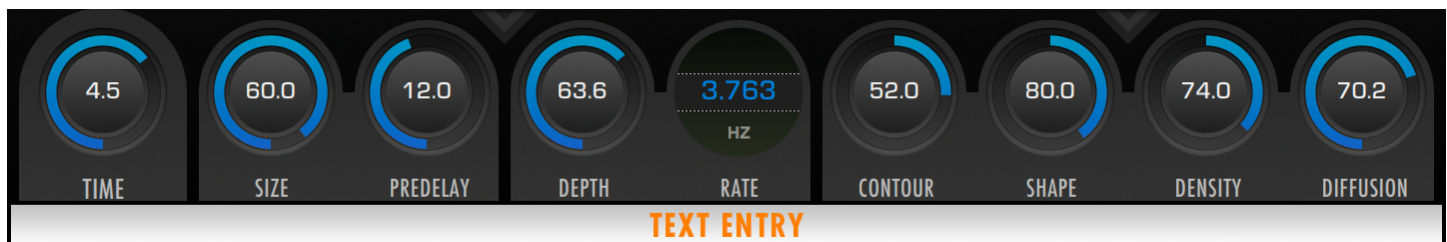
Keyboard Shortcuts

In some hosts you can use keyboard keys to change knob values and switch presets in the Preset Browser. To activate keyboard control, first click somewhere in the Preset Browser window or on the knob you wish to control. The keyboard shortcuts as follows:

- **Preset Browser Keyboard Shortcuts**
 - **Left / Right / Up / Down Arrow Keys:** moves preset selection one step in the respective direction
 - **Page-Up / Page-Down:** shifts the column display one step left or right
 - **Home:** Selects the first preset
 - **End:** Selects the last preset
- **Knob & Slider Keyboard Shortcuts**
 - **Up / Down Arrow Keys:** changes value by 1.0%
 - **Left / Right Arrow Keys:** changes value by 0.1% (fine tune)
- **Multi-Instance Editing Keyboard Shortcuts**
 - **Page-Up / Page-Down:** changes instance selection

Text Entry

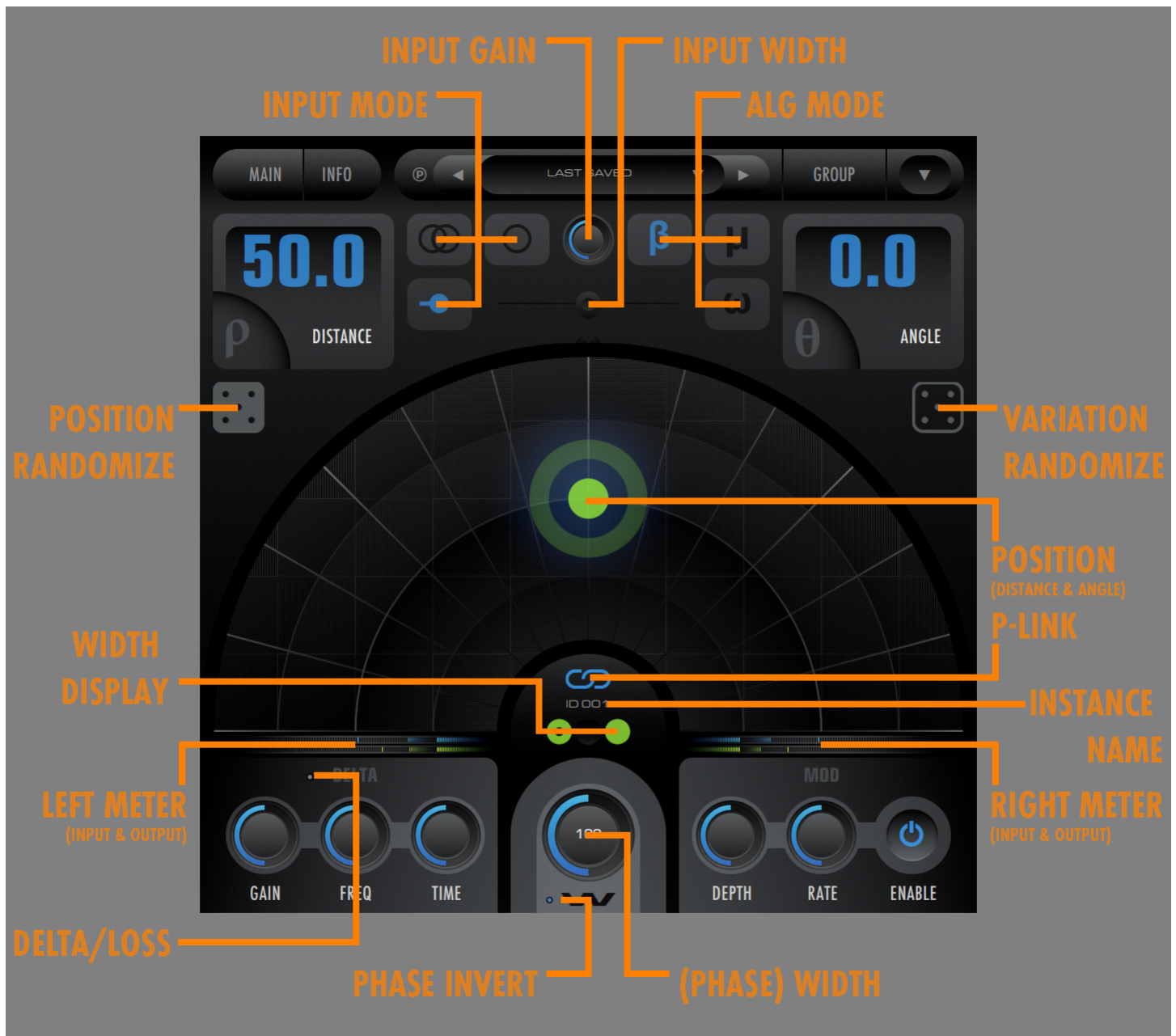
Double-clicking on a control (knobs, sliders, numeric controls, text fields, etc.) opens the Text Entry mode for the control. Double precision floating point values may be entered with any desired decimal precision. The initial precision displayed in the text entry mode when first opening it is formatted to fit within the given text entry field. Full precision is stored in preset files and used in the DSP calculations. Parameter units (i.e. Seconds, Hertz, Decibels, Percent etc.) are displayed below the text entry field. (The Image below is taken from Breeze 2, but text entry behavior and look is shared by all 2CAudio products including Precedence.)



Main Page Parameters & GUI Details

Overview

Precedence's Main page displays approximately 20 controls and GUI elements. Most controls are clearly labeled. The few that do not have explicit labels are detailed below.



Displays

Position Display/Control

The Position Display is the primary functional GUI object in Precedence. It serves to wrap two parameters, Distance and Angle, into a single control whose values are mapped to Rho and Theta polar coordinates respectively. If that sounds excessively mathematical, don't worry; it is actually extremely intuitive. The Position Display contains the Position Node circle, which can be dragged to different locations within the Position Display, simultaneously changing the Distance and Angle parameter values:

- Moving the Position Node **farther from the center increases the Distance** parameter value
- Moving the Position Node **closer to the center decreases the Distance** parameter value
- Moving the Position Node **clockwise in an arc (to the right) increases the Angle** parameter value
- Moving the Position Node **counter-clockwise in an arc (to the left) decreases the Angle** parameter value

As you can see, simply by moving the Position node you can easily control both lateral left-to-right “azimuth” of the source sound, as well as its apparent distance to the listener.

The Position Node can be changed in several ways:

- Dragging it manually without key-combination provides the standard mouse tracking
- Dragging it manually while holding down the shift key provides a fine tuning mode
- The keyboard up & down arrows will increase/decrease the Distance value in 5% increments
- The keyboard left & right arrows will increase/decrease the Angle value in 5% increments
- Combining the shift-key modifier with the above keyboard commands allows 0.5% changes to Distance and Angle
- A mouse-click on any unoccupied area within the Position Display will move the Position Node to the mouse location

If Modulation is enabled, the Position Display also shows an animating “Modulation Cloud” that moves around the current Position Node and gives a visual indication of the effects of the current Mod Rate and Mod Depth parameter settings. The Modulation Cloud is also sensitive to input signal level.

- **Brightness** of the Modulation Cloud is effected by input signal, making it pulse in sync to input signals
- The relative **Size & Position** of the Modulation Cloud is effected by the Mod Rate and Mod Depth parameter settings
- The absolute size of the Modulation Cloud is dependent also upon the Distance parameter value
- The Modulation Cloud animation may be disabled on the Preferences tab of the Info Page of the GUI, if CPU resources are limited or personal tastes dictate

NOTE: Precedence is designed primarily as a positioning tool not a motion special-FX tool.

Precedence is primarily for virtual stage positioning where we expect many lightweight instances to be used in parallel as a replacement for traditional track panners and imaging tools. It is expected that many instances will run in parallel in your DAW, and Precedence offers multi-instance editing to facilitate such goals. In large scoring templates and other similar projects the expected instance count may be well over 100 simultaneous instances, and therefore CPU-usage must remain as minimal as possible. Parameter edits may also affect more than one instance when using Broadcast features. Furthermore, Precedence may be linked to 2CAudio reverb engines, to achieve next-generation depth positioning within virtual acoustic environments. In such usage cases, changing Angle or Distance values not only updates Precedence's DSP, but also fully updates the reverb engine DSP in a synchronized manner.

Do to all of the above, smooth modulation and motion are limited to the internal modulation process at the moment. Precedence is not currently designed for smooth/continuous parameter automation from the DAW. We may attempt to

make a fully automatable motion FX tool at some point, but it will likely require a lot more CPU resources, and potentially significant design changes. A dedicated special-FX tool dedicated to such goals may make the most sense in our opinion. These topics are on our radar, and we are certainly aware of the desire to automate position in some cases.

Within the current design, most parameters in Precedence and 2CAudio reverb engines are non-continuous in nature and simply cannot automate smoothly from user input because they change in discrete manners. This is true of the Distance and Angle parameters, and therefore when the Position Node is updated in Precedence by manually dragging it to a new location, simultaneously updating the Distance and Angle parameter values, a series of discrete updates will occur. Precedence will perform these updates as quickly as your CPU allows, creating many such updates per second. Each update will result in a small click as various algorithm internals are updated and memory objects are cleared. If Precedence is linked to Breeze 2 or our other reverb engines, the linked reverb plug-in will also undergo a similar update process. On fast computers, the update rate may be so fast that the resulting rapid generation of small update clicks may sound like "stuttering" or "buffer noise".

In short, at the moment, smooth automation of Angle and Distance is not currently possible for all of the reasons above.

Tip: There is an alternative to avoid the potential aforementioned "noisy updates": **in the Position Display you can click on any free space within in the Position Display and the Position Node will instantly jump to this new location with only one update and only one very minor click.** To reiterate: if you drag circle manually Precedence will attempt to make as many updates as possible as quickly as your CPU allows, and each update generates one small click. Therefore if you perform many updates by dragging the circle it will generate many clicks, sounding something like stuttering as explained above. If you find this update noise objectionable, try the single-click method to jump to new positions. It is generally free of unwanted update noise. The keyboard commands are also a good option to try.

Width Display

The Width Display is designed to represent the spacing of two microphones. Each of the two colored circles represents one microphone or pickup position. The Width knob below this display controls the spacing between these two virtual microphones and the Width Display serves as a fast visual aid to help identify the current settings. The Phase Invert button shown below the Width knob allows the Left or the Right channel to be phase inverted to correct any potential phase issues. If the left or right channel is phase inverted, its respective virtual microphone circle will display a circular cutout/hole in the middle of it. There will also be a matching circle next to the Phase Invert Button for additional visual reinforcement of the phase inversion state. In short the Width Display communicates inter-channel phase differences.



Meters

The Meter Displays show the input and output levels of the plugin and includes clip indicators that show when the signal exceeds 0dB. Meters are organized with the Left channel input and output meters on the Left of the GUI, and the Right channel meters on the right of the GUI. The input meters are above the output meters and are shown in different color.

50% of the meter range represents -12dB. Three different values are shown for each meter:

- **Peak Hold:** displays the highest peak value in the last 4 seconds
- **Fast Peak Value:** shows the current peak value using fast meter ballistics in a more transparent drawing style
- **Slow RMS Value:** shows the RMS value using very slow meter ballistics in a more opaque drawing style

The Clip Indicator is simply a matter of convention. Precedence is a completely floating-point process, and levels exceeding 0dB at Input or Output and anywhere inside the Precedence alg, are not innately a problem and cause absolutely zero distortion or negative effects so long as the final output of your DAW or host application is not clipping (does not exceed 0dB). Nonetheless it is a good policy to practice reasonable gain staging inside your DAW in case other third party plug-ins have non-linearities that are dependent on signal gain.

Parameters

Input Gain

The Input Gain control simply applies gain scaling to the input of the plug-in before any other processing. It has a range of $-\infty$ to +12dB. Processing inside Precedence occurs using 64-bit floating point math, and gain inside the plug-in does not matter too much in any practice sense, as it can be adjusted before or after Precedence as needed in the DAW. As a matter of convention, it may be convenient to have input signals peaking somewhere close to 0dB to keep meters and the modulation cloud showing meaningful ranges, but it's not critical.

A potential advanced workflow to consider in terms of gain staging is the following:

1. Insert a 3rd party track limiter on each track in the last Pre-Fader Insert and set the threshold such that it causes the peak value to reach 0dB, with conservative limiting producing gain reduction of approximately 0.5 dB or less.
2. Insert Precedence Post Fader in your DAW
3. Optionally insert a Precedence Aware reverb such as Breeze 2 after Precedence

Work with Precedence in one of two ways (explained later in the manual):

- **Standard Loss Mode:** here you will continue to use your DAW mixer faders to level balance the track
- **X-Range Loss Mode:** here the Precedence Distance parameter can have extreme effect on track gain and allow you to use the Position Display to control track gain completely, effectively mixing within Precedence

In either of these ways, the meters and Mod Cloud within Precedence will reflect the actual final levels of each track, which may be helpful. In either way, the Input Gain parameter would just be left at 0dB typically.

Input Mode

Precedence offers three different input modes to suit the needs of various source sounds. The Input Mode selection control is provided as a radio button control to the left of the Input Gain knob, with three options.

- **Direct:** accepts the incoming stereo signal exactly as it is with no additional processing
- **Forced Mono:** allows the user to select one of the input channels (Left or Right) and use it to feed both channels of the algorithm, effectively discarding spatial information contained within the stereo source sound
- **Input Width Manipulation:** mixes the input channels together using a Mid-Side matrix process, to either reduce or enhance existing spatial information contained within the stereo source sound

Input Mode: Direct

The Direct Input Mode has no additional controls. If Precedence is being used to reposition the input signal laterally, the Direct Input Mode is best used when the differences between the input channels are relatively minor such as in these circumstances:

- The incoming signal is effectively mono or something close to it

- The incoming signal is a sample instrument that was close mic'ed and recorded as dry as possible with a centered spatial image. The signal may still have spatial differences between channels that create some general sense of limited width, such as an acoustic guitar that was mic'ed at the neck and the body, but the image should ideally not have a strong positional identity itself.
- The incoming signal does not already contain extreme panning
- The incoming signal does not already contain excessive spatial widening from effects such as delays or auto-panners etc.
- The incoming signal does not already contain excessive reverb, early reflections or room ambience

The Direct Input Mode can also be used if lateral re-positioning of the source sound is not the intended goal, and instead Precedence will supply only additional depth positioning, modulation effects, and potentially reverb balance via utilization of the Link feature with 2CAudio reverbs. In this case the Angle parameter can simply be kept center at 0%, and Precedence will keep the original lateral stereo image more or less intact. This may be appropriate for various synth instruments that already have many effects applied to them via the effects engines built into the synth.

Tip: Use the Direct Input Mode when either there are no strong spatial cues in your source signal that may conflict with wherever you would like to reposition it to, or if you do not wish to reposition the source and only wish to enhance it spatially.

Input Mode: Forced Mono

The Forced Mono Input Mode, allows users to completely discard lateral position information in the source sound and greatly reduce the perception of existing room ambience or early reflections that may be “baked into” existing sample libraries. This is useful in the following circumstances:

- Repositioning sample libraries that were recorded “In Situ”, particularly solo instruments
- Repositioning solo acoustic instruments that were recorded with stereo microphone methods such as A-B, ORTF, or other spaced microphone techniques that introduce time and phase differences between channels
- Attempting to minimize existing room sound as much as possible

Precedence's positioning ability works by creating psychoacoustic cues and differences between channels including interaural level, time, phase, and spectral differences. Stereo microphone techniques operate on the same general principals; therefore if the techniques that were used in the original recording produce one set of psychoacoustic cues and these conflict strongly with those created by Precedence, the result is likely to be confused. The Forced Mono Input mode can solve this problem.

The Input Width Manipulation mode can also help alleviate such issues, but some spaced microphone techniques that introduce time delays between channels are not ideal to collapse to mono via summing with Mid-Side processing. Doing so may create comb filtering in these circumstances. This is particularly true if the source signal was something close to a “point source” such as a solo instrument. In these cases it can be safer to simply use one of the source signal channels and discard the others.

When using the Forced Mono Input Mode, a set of Input Channel Selection tools is shown on the GUI below the Input Gain knob. The plus and minus symbols increment and decrement the channel selection respectively, and the selected channel is shown in-between them.

Tip: Consider the Forced Mono Input Mode when using stereo-mic'ed solo instruments that have been recorded with spaced microphone techniques if they contain conflicting position information.

Input Mode: Input Width Manipulation

The Input Width Manipulation Mode also allows users to manipulate the spatial properties of the input signal before it is fed into the Precedence algorithm in effort to handle cases of conflicting spatial cues. It is intended to allow users to narrow the spatial image of the input signal before repositioning it, and is useful in the following circumstances:

- Repositioning large ensemble sample libraries that were recorded “In Situ” with copious amounts of room sound
- Reposition synth sounds such as pads or leads that have already passed through multiple effects such as chorus, delay, phaser, flanger, auto-panning, and other general stereo effects
- Intentionally widening the source sound for special FX and/or electronic music.

In the case of orchestral sample libraries it is less problematic to apply mid-side processing techniques when dealing with ensemble sources because the phase relationship between the channels is typically already extremely complex and the correlation is typically close to zero to start with; therefore strong comb filtering will not typically be a problem when collapsing channels. If the first and second violin sections were recorded “In Situ” left in classical period positions, and you would like to adapt one section to move to the right of the stage for a more modern scoring position, using this input mode could be appropriate for example.

Tip: For acoustic instruments the general criteria for using this mode should be that the input channels should ideally have either very little to no timing differences, such as would occur with XY microphone techniques, or should have a very complex relationship between channels as would typically occur with large ensembles or overly reverberant recordings.

Tip: This mode can also be very useful for synth sounds in electronic music production where there are fewer rules and users are more concerned with interesting and creative aesthetic results than exact acoustic authenticity. As with everything, your ear is your guide. Feel free to experiment and/or disregard our suggestions above. If it sounds good, it is good!

When using the Input Width Manipulation Mode, the Input Width Slider is shown below the Input Gain Knob.

Input Width Slider

The Input Width Slider applies Mid-Side processing to the input signal before it is fed into the Precedence algorithm.

- 0% collapses the input signal completely to mono by summing both channels
- 0-100% narrows the input signal
- 100% produces no change at all
- >100% increases the width of the signal by increasing the gain of the “side” (i.e. difference) aspect of the signal

Tip: Values of around 50% can be nice to try when the source signal is a wide signal or has lots of motion in it from processes such as delays or various synth effects. This approach can tame aspects of the source that may compete with the positioning created by Precedence, while still allowing some of the original character and motion to be present.

Tip: Values of over 100% can be useful for special effects on synths to create very wide results that can stand out of dense mixes if desired. Values of over 100% will also tend to increase the level of any reverb or spatial effects that are already preset in the source sound.

Remap Input Button (←→)

When dealing with stereo sources that were recorded “In Situ” sometimes a source sound may have strong inter-channel level, timing, or spectral differences baked into the recording. If the source is very strongly positioned left for example, and you would like to reposition it to be strongly right, it can be beneficial as a starting point, to simply remap (i.e. flip) the input channels, making the left channel feed the right channel in Precedence and vice versa. This allows Precedence to work a little more gently and may allow you to continue to use the full stereo source recording instead of reverting to using Force Mono Input Mode, or having to greatly reduce the Input Width Slider, when using Input Width Manipulation mode. It

remains highly desirable to use the rest of the Precedence algorithm to fine tune the result, but if the source sound has strong positional information “baked-in”, it is ideal if it agrees as much as possible with the final desired position. This little utility button can help such circumstances. It may also be useful in other circumstances such as:

- Inverting the perspective of “large source width” instruments such as acoustic piano to change from player-perspective to audience perspective
- Inverting the image of stereo recording that have non-trivial differences between channels such as an acoustic guitar that was stereo mic’ed at the neck and the body. If one channel has characteristics that are desirable to accent it can be beneficial to have this input channel mapped to agree with the desired position from Precedence.

The Remap Input Button is available when using the Direct Input Mode, or the Input Width Manipulation Mode.

Algorithm Mode

Precedence offers three different Algorithm Modes to suite the needs of various source sounds and target applications. The Algorithm Mode selection control is provided as a radio button control to the right of the Input Gain knob, with three options:

- **β : Beta** : the default mode providing the most specific positioning using a full set of psychoacoustic principals
- **μ : Mu** : an enhanced mono-compatibility mode
- **ω : Omega** : an enhanced diffusive mode with extra widening designed for synths and modern FX

Each mode is described in more detail below.

Tip: It is perfectly acceptable to mix and match Algorithm Modes in complex projects, particularly when working in modern musical styles. There are fewer rules when working with electronic music, compared to classical chamber music for example. You may find you like Beta Mode on drums, Mu Mode on vocals, and Omega mode on synths for example, or any other secret formula you come up with.

Algorithm Mode: Beta

Beta Mode is the default Alg Mode in Precedence. It uses a full suite of psychoacoustic principles to very specifically position source sounds within the stereo field. It makes full use of interaural time delays and other advanced time-based techniques to achieve the most precise positioning possible. It can be considered a pseudo-binaural mode; it utilizes the most universal aspects of binaural hearing without the limitations of traditional binaural signal processing techniques, and works equally well over both speakers and headphones. The Beta name and symbol on the GUI is a mnemonic to remind users that some binaural aspects are utilized to achieve its highly specific positioning abilities.

The Beta Mode targets an average phase correlation of 0%, which means some specific frequencies within the spectrum can have negative correlation while others will have positive correlation. The exact correlation of the complex signal coming out of Precedence is completely dependent on the frequency content of the input signal. On musical signals it is possible to end up with strong negative correlation with some combinations of input signal and parameter settings in Precedence. This is true particularly if the input signal happens to have a narrow frequency range. This changes drastically, even chaotically depending on the input signal, and even different notes from the same instrument may have drastically different results.

This behavior is completely accurate to the real physical world and the same phenomena are created by stereo microphone techniques that employ any form of spaced microphones. If there is any space whatsoever between multiple microphones there will be at least one frequency that is exactly 180 degrees out of phase when measured at these two distinct points in space. The distance between microphones, or ears, determine what frequencies are out of phase. This is how a sense of width is created. This is an innate aspect of the psychoacoustics of spatial hearing.

Care has been taken to ensure the best possible mono-compatibility for this type of processing, but strictly speaking any form of interaural time delay is not perfectly mono-compatible in the mathematical sense. Some degree of comb filtering

effects can result upon collapsing the signal to mono for the reasons above. Generally, these effects are limited to high frequencies in Precedence, and care has been taken to ensure good mono compatibility in the bass frequency range where it is normally considered to be most important. Precedence is of course a product that has the explicit purpose of spatializing sounds in a stereo field. Mono is the degenerate case; it is not the primary target. The Beta mode therefore concentrates fully on making the stereo effect as good as it can possibly be, with reasonable mono-compatibility as a secondary consideration.

Tip: As in all modes, mono-compatibility improves as the Width parameter value gets smaller. Settings of 50% or less should generally be considered completely mono-compatible in almost all contexts. Exactly mathematically perfect mono-compatibility is also possible simply by reducing the Width parameter to 0%. This does not completely defeat the benefits of Precedence. Lateral and depth positioning is still possible, and modulation is still active. Extreme Width settings that approach 200% have less mono-compatibility.

Algorithm Mode: Mu

The Mu Mode was designed to provide enhanced mono-compatibility. It attempts to retain as many psychoacoustic localization principles as possible, within the constraint that the average phase correlation should be around +50%. Mu Mode does not allow strongly negative correlation, and is therefore a safer choice to use compared to the Beta Mode when mono-compatibility is of critical importance. Stereo imaging feels slightly more narrow than the Beta Mode, as indeed it is in the mathematical sense, but the Mu Mode still is able to retain many psychoacoustic benefits over standard gain panning, including rather surprisingly some degree of time differences. Mu Mode is able to create arrival time differences, as occur in Beta Mode, but does so in a way that retains as high of a degree of mono-compatibility as possible.

The Greek letter "mu" is equivalent to the Latin/English letter "m", and users can use the mnemonic "mono", or perhaps "unity" given that lower-case "mu" looks like "u", to remind themselves that the focus of this mode is mono-compatibility.

Tip: Like the Beta mode, mono-compatibility is also affected by the Width parameter. Extreme Width values such as 200% will have some reduced mono-compatibility. Values of 100% and less are considered completely mono-compatible, with both channels becoming exactly equal once again at 0%.

Algorithm Mode: Omega

The Omega Mode is a special effects mode that employs spectral shuffling to achieve width. This means different frequencies are panned differently within the spectrum to achieve width. Width can be controlled quite exactly in this mode. The result is similar to the effects caused by early reflections in real physical rooms, and indeed the Mu Mode allows exaggerated time constants to approach results normally associated with early reflections.

Unlike the Beta and Mu modes, some degree of coloration is imparted on the signal by the spectral filters employed in Mu Mode. Lateral positioning is possible, but is slightly less distinct as the Beta and Mu modes. Spectral magnitude differences can cause unavoidable minor panning effects, which vary with frequency and may partially confuse the position that the user is attempting to obtain. Some additional coloration is furthermore unavoidable when using extreme Angle values.

On the plus side, mono compatibility is exactly perfect when there is no panning (i.e. when Angle is exactly 0% in Precedence). Mono compatibility remains very good even at extreme Angle values, albeit the mono result will retain some of the coloration imparted by the spectral filters.

Omega Mode is a touch more artificial and less connected to real-world psychoacoustic principals. It is supplied as a special effects mode that can be used on sound effects, synths, and within modern music production styles that are not particularly concerned with achieving a completely authentic acoustic result.

Distance

The Distance parameter numerical value display is found in the upper left of the GUI. The parameter functions like standard GUI element such as a knob or slider and is responsive to mouse actions:

- Clicking and dragging anywhere within the numerical display area will allow the parameter value to update continuously as if dragging a knob or slider.
- Shift-dragging enables fine-tune adjustments.
- Double-clicking the text area will open a text-entry edit box
- The Distance parameter value is also linked to the Position Node in the position display. Changing either will update both.

The Distance parameter in Precedence controls the perceived distance between the source sound and the listener. The “listener” is represented on the GUI by the two Microphone Pickup Circles shown in the Width Display in the center of the Position Display. Smaller numerical values of the Distance parameter mean the source sound is closer to the listener. Larger numerical values of the Distance parameter mean the source sound is farther away from the listener. The Position Node moving closer or farther away to/from the Microphone Pickup Circles in the Position and Width Displays visually reinforces this.

Following are some rough guidelines:

- Distance value of approximately 0-25% represent near-field sound sources, appropriate perhaps for lead vocals, electronic music drums, and other elements that should cut through the mix
- Distance value of approximately 25-75% represent mid-field sound sources, where the majority of acoustic musical instruments sources will usually be placed for applications such as scoring and orchestral work
- Distance values of approximately 75% and greater begin to represent far-field sources. When linked with 2CAudio reverbs, the reverberant energy will begin to overtake the direct energy in this range and sound sources will become increasing distant and diffusive

Tip: It is not essential to use the full Distance range. It could be perfectly acceptable to sources between roughly 25% to 75% Distance, or any other range, if large variation of distance and depth placement is not appropriate for the aesthetic needs of a given project. There is no reason to feel compelled to use the full range in every project just because it is offered and available.

Angle

The Angle parameter numerical value display is found in the upper right of the GUI. The parameter functions like standard GUI element such as a knob or slider and is responsive to mouse actions:

- Clicking and dragging anywhere within the numerical display area will allow the parameter value to update continuously as if dragging a knob or slider.
- Shift-dragging enables fine-tune adjustments.
- Double-clicking the text area will open a text-entry edit box
- The Angle parameter value is also linked to the Position Node in the position display. Changing either will update both.

The Angle parameter in Precedence controls the perceived azimuth of the source sound. In other words, it controls the direction from which the source sound is perceived to be originating, similar to a gain panner. The Angle parameter is measured in Degrees and has a range of -90 to + 90 degrees.

- 0 Degrees is center
- Negative values are left
- Positive values are right

Tip: Precedence should replace the use of track panners. The Host DAW's panner should be kept at the center position when using Precedence.

Tip: When dealing with sparse arrangements with few instrument sources, it is not essential to use the full Angle range. It could be perfectly acceptable to keep sources within +/- 45 Degrees if there are only a few instruments for example.

Width

The Width control, controls the intensity of inter-channel time, phase, and spectral differences. In the real physical world, it can be considered something similar to the physical spacing between multiple microphones. It is largely responsible for controlling phase differences between channels.

- 0% Width results exactly in the same processing in all channels, acting like a mono microphone, gain differences will remain, but there will not be any time, phase, or spectral differences
- 100% Width is the default value, providing the optimal result in most cases
- $0 < \text{Width} < 100\%$ produces more subtle differences between channels
- $>100\%$ moves into more extreme widening special effects and will add progressively more width to lower frequencies

Tip: When working with Multi-Instance Edit Groups, it can be beneficial to use identical or at least similar Width setting for the entire group if attempting to emulate a shared virtual acoustic space.

Phase-Invert

The W logo below the Width knob conceals a special utility feature: phase inversion of either output channel. Precedence introduces phase differences between output channels. Statistically speaking the phase differences are applied in a conservative and controlled manner where in almost all cases the average correlation between channels will remain positive. This should be clarified however, to explain that “statistically speaking” effectively means when applied to mono white or pink noise or other similar broadband signals. In practice, phase differences are variable across the full bandwidth spectrum and specific frequencies may have some degree of negative correlation, while others may be strongly positive. Furthermore, the input source sound may have its own pre-existing complex phase differences that will interact with those created by Precedence in an unpredictable manner given that the source sound is unknown. A particular combination of source sound and Precedence parameter set results in strong negative correlation in the output, i.e. the output is “out of phase”, the Phase Invert button can be used to invert the phase of one channel to restore positive correlation, making the result more “in phase”. This is primarily a topic of concern when strong mono-compatibility is required. The Phase Invert Button has three states:

- **No Inversion:** no dot is shown next to the W symbol, both circles are solid in the Width display
- **Invert Left:** a dot is shown to the left of the W symbol, and the left circle in the Width display becomes a ring with a hollow center
- **Invert Right:** a dot is shown to the right of the W symbol, and the right circle in the Width display becomes a ring with a hollow center

Tip: In solo, phase inversion of either channel is more or less perceptually equivalent and it does not matter which channel is inverted. In a full mix, track blending may be slightly different depending upon which channel is inverted, so both options are made available.

Tip: The need to use the Phase Invert feature is typically rare, particularly when using the Mu and Omega Alg modes, which are designed with enhanced mono-compatibility in mind. In cases where an undesirable phase response is encountered, a click or two or three on the Variation Randomize dice may also produce a different result making phase inversion unnecessary. That should be the first thing to try. The second thing to try is to simply lower the Width knob value by a little bit. If the issue is not resolved by either of these, the Phase Invert button can be used.

Variation Randomize

The Variation Randomize button is the dice icon shown in an outlined stroke on the right side of the GUI. It creates a randomized version of the current internal DSP characters where the general perceptual position of the instrument will not change but some of the small details to the process do change. In the physical world you could think of it as very small adjustments to the microphone positions or small adjustments to source sound attributes such as source width, directivity, micro positional details, and others. Variation Randomize will have an effect on the exact phase correlation that results from the combination of a particular input source sound, and the Precedence process, and it can be used to quickly find the best result for your particular input sound.

- Variation Randomize results are effectively infinite. Clicking on the button will never produce exactly the same result twice.
- Variation Randomize can be used with Multi-Instance Edit Groups and Global Broadcast to randomize tens or hundreds of instances simultaneously with a single click
- Variation Randomize also introduces small variations in the reverb engine of any Linked 2CAudio reverb instance

Position Randomize

The Position Randomize button is the solid dice icon shown on the left side of the GUI. It does everything that Variation Randomize does, and it also randomizes the Angle and Position parameters values as well, producing an entirely random position.

Note: *At the moment, Position Randomize does not work with Global Broadcast. Only the selected instance will be randomized when working with Multi-Instance Edit Groups and using Global Broadcast.*

Delta Parameters

Precedence achieves its positioning abilities by introducing differences between the audio output channels in a manner that conforms to the various psychoacoustic properties of spatial hearing including interaural level differences, interaural spectral differences, and interaural time differences. The Delta parameters adjust the relative strength of these cues as they are affected by changes to the Angle and Distance parameters. The default values of 100% work well in most contexts, but certain genres of music and certain varieties of source sounds may benefit some adjustment. The Delta Parameters can be thought of as a method to fine-tune certain aspects of the behavior of each Alg Mode, and the behavior is variable in each mode.

Gain Delta

The Gain Delta parameter adjusts how much gain difference is applied between channels in reaction to changes to the current Angle and Distance values. It is similar to adjusting traditional Pan-Laws. The default value is a good choice for most instruments. In very dense projects with high track counts it might be desirable to achieve slightly more separation between tracks, and larger Gain Delta values could be used. Conversely, in sparse projects with a limited number of instruments, lower Gain Delta values could be useful. Increasing Gain Delta while decreasing Freq Delta by a similar amount, can useful in some electronic music contexts.

Freq Delta

The Frequency Delta parameter adjusts how strong the spectral differences between channels are in reaction to changes to the current Angle and Distance values. The default value is a good choice for most instruments. In very dense projects with high track counts it might be desirable to achieve slightly more separation between tracks, and larger Freq Delta values could be used. Conversely, in sparse projects with a limited number of instruments, lower Freq Delta values could be useful. Increasing Gain Delta while decreasing Freq Delta by a similar amount, can useful in some electronic music

contexts. Doing the opposite combined with application of lots of reverberant energy may be interesting for dramatic cinematic mixes.

Time Delta

The Time Delta parameter adjusts how strong the time domain differences between channels are in reaction to changes to the current Angle and Distance values. It also has an effect on the diffusive characteristics of the resulting impulse response and its transient response. The default value is a good choice for most instruments; however it can be adjusted as desired to best suit the needs of different source sounds and musical style. Following are some suggested guidelines:

- Drums and highly transient material may benefit from smaller Time Delta values
- Synth Pads and instruments with very slow attack times may benefit from exaggerated, large-to-extreme Time Delta values

***Tip:** When combined with large Distance values, extreme Time Delta values can result in transient smearing and the introduction of a small delay to the onset of the signal as would happen naturally with sound sources that originate from very deep in a hall. This effect may be compounded when Precedence is linked with 2CAudio reverbs due to the fact that the reverb engine may produce similar effects. In extreme settings this composite delay may be large enough to make the sound musically “late” in a perceivable manner. The same thing can happen in real orchestral halls as well where the instruments in the back of the stage can be slightly late compared to those at the front. In the real world the conductor would typically compensate for this by instructing the players in the back of the hall to play slightly before the beat. Within the DAW, the same solution can be applied. Simply apply a negative track delay by a few milliseconds if desired, to realign distant sources with the musical downbeat. This is functionally the same as having these sources play slightly early. This only really needs to be considered when using extreme Time Delta values, which are not the standard values that should be used in most cases. Extreme ranges are offered mostly for special FX needs, and creative processing.*

Loss Parameters

Clicking on the Delta/Loss Label or associated small button will tab between showing the Delta Parameters and the Loss Parameters. The Loss parameters allow users to customize some aspects of how the current Distance Parameter maps to various internal DSP values. The default values are great choices for acoustic-based music; however customization is allowed for other usage cases such as non-musical sound-design for film, TV, and games or electronic music production.

In open spaces gain and high frequency loss are two of the strongest psychoacoustic cues that humans use to judge the distance of a given sound source. In absence of reverberation, gain is naturally lost according to an inverse square law, and high frequencies are lost due to air absorption in a reasonably consistent manner for a given environment (depending on temperature, humidity, and air pressure). The brain has evolved to use such cues to judge distance.

Such cues are highly dependent on a priori knowledge of the source sound however. For example, a caveman is likely familiar with the growl of a predator animal, or the speech of his mate. Such sounds have a fairly predictable energy level and frequency contour, establishing some baseline reference from which the brain can automatically judge distance based on the difference in level and spectrum compared to the pre-existing mental model of the sound as it is experienced in close proximity; however, such cues are substantially less reliable when the listener is exposed to an unfamiliar sound source in a static position. A caveman would likely struggle to identify how close he was to a Moog Synthesizer played over a PA system for example. Such remains the case today when dealing with abstract electronic music sounds and effects. Musicians may have an established mental model for an acoustic guitar or saxophone, but not for an arbitrary patch from the latest virtual synth.

In modern music production the project may commonly include elements that did not originate from an acoustic sound source. Gain differences are also applied in the DAW by the mixer to suit the aesthetic needs of the project. Completely

authentic gain loss based on distance within a virtual acoustic space is therefore likely not completely desirable in the modern music production environment. It becomes important for virtual reality and game design where the position of the listener relative to the sound source is dynamic, but in music production extreme loss from distance emulation would tend to just make the engineer compensate by increasing the gain in the mixer to maintain his or her creative goals. In music, the primary goal is lead by aesthetics, and that goal can likely be adequately summarized by saying simply that it is desirable in most cases to have each sound source occupying its own unique location spatially so that the details of the sound are unmasked and not competing with neighboring sound sources. We'd like to be able to resolve the Oboe line from the English Horn for example, or the lead vocal from the background vocals. We are not in danger of being eaten by a savage Woodwind or Brass instrument; therefore estimating its exact distance in absolute units such as meters is not absolutely critical in the musical context. Music is more about perception and feeling; our primarily musical goal is to establish a sense of depth in the mix.

Considering the above, it is our opinion that there is no exact one-size-fits all rigid formula for mapping distance to loss values within the needs of music production. The cues themselves are indeed relevant to some degree, but implementing them in a rigidly scientific manner tends to have less than desirable aesthetic results in the musical context. Therefore, we err on the side of caution, utilizing conservative default values and allowing users to customize these values as needed.

Tip: Distance based Gain and High Frequency Losses are definitely authentic acoustic phenomena. They are easy to overdo within the context of music production however, and excessive application can result in dull mixes. It is our estimation that these effects are best kept relatively subtle within music production and we estimate our default values to be a good starting point.

Tip: The Loss parameters are not the only Distance cues created by Precedence; other phenomena are also utilized in sophisticated manners. Precedence may furthermore be linked with 2CAudio reverbs such as Breeze 2, which provide a complimentary set of Distance cues in a manner that is significantly more useful in a musical context than simply applying extreme Gain and High Frequency loss.

Tip: The Loss and Delta Parameters should generally be set to equal or at least similar values for all members of a Multi-Instance Edit Group. Users should consider these as establishing and fine tuning a set of positional rules used by the Group. With the potential exception of Time Delta, which can be adjusted in response to the transient contents of source sounds, it is ideal if Loss and Delta Parameters are consistent among Group members.

Tip: Global Broadcast can be used to change Loss and Delta values for an entire Multi-Instance Edit Group. Doing this once a mix is already established is a very powerful technique that can be used to increase or decrease "spatial contrast" and separation within the mix while maintaining the relative positions for each element in the mix. This is a very powerful method to perform macro-edits to the entire group.

Gain Loss

The Gain Loss Parameter controls how much signal gain is lost relative to the Distance parameter. The default value produces a conservative loss between 0% and 100% Distance values. In most contexts this seems heuristically to be about the proper range to keep the result the most musically useful. When using values close to the default value of 100% or less in the Standard Loss Mode, the goal is to simulate Distance loss only in ranges that might naturally occur within typical musical stages. In this workflow, the DAW mixer would still be used to handle general level balancing to suite the aesthetic goals of the project.

- At 0% Gain Loss is disabled completely
- 100% is the default value
- 200% produces twice the loss range as the default, and gain differences begin to be noticeably perceivable somewhere in this range

Precedence also allows users to optionally use the Position Display to function as a mixing environment that can in theory replace the need to make gain adjustments in the DAW mixer, when using the X-Range Loss Mode. See below.

Freq Loss

The Gain Loss Parameter controls how much high frequency energy is lost relative to the Distance parameter. The default value is a good choice for acoustic instruments; however it can be adjusted as desired to best suite the needs of different source sounds and musical style. Following are some suggested guidelines:

- Electronic music that depends heavily on bright synths may do best with smaller values of Freq Loss
- Dramatic cinematic work that has copious amounts of reverb applied to it may benefit from slightly larger values of Freq Loss
- Non-Musical sound-FX mixing may work well with extreme values of Freq Loss and use of the X-Range Loss Mode

Tip: Gain and Frequency Loss in Precedence are not tied directly to any form of absolute size parameter in real world units such as Meters. Precedence is designed to be somewhat agnostic with regard to the exact virtual acoustic model it is paired with. When paired with 2CAudio reverbs such as Breeze 2, the reverberant environment created by Breeze is aware of the position information in Precedence, and it is adjusted appropriately to complete the distance illusion. The reverb engine is also aware of its own global environmental attributes such as its Size parameter, which is measured Meters, and the reverb engine utilizes this information together with the position information from Precedence to place the sound source within this space in a synergistic manner. Precedence handles the more local and relative perceptual cues while the reverb engine handles more absolute global environmental aspects. Together they complete the spatial illusion.

X-Range Loss Mode

As explained, it is our feeling that for standard music production and mixing it is likely desirable to keep Gain and Freq Loss set to conservative values, so that they augment only the perception of distance, but not the general level balancing of tracks. The Standard Loss Mode is designed for this workflow, where level balancing would continue to be handled by the DAW mixer. It should not typically create any excessively strong sense of level difference, but rather simply a perceptual sense of distance.

It may be desirable to use more extreme loss ranges in certain circumstances, however, such as the following:

- Using Precedence's Multi-Instance Editing features together with X-Range, can allow Precedence to function as a mixing environment, allowing you to use it to control general track level balance as well as distance perception. In this workflow, the DAW mixer levels would typically be kept at 0dB, and track levels can be controlled entirely within the Precedence Position Display
- Mixing non-musical sound-FX for film, television, and games may benefit from more extreme ranges
- Extreme Freq Loss values can be interesting for creative ambient music and sound-scape mixing

The X-Range Loss Mode Button is a two state parameter:

- **Off:** This produces the default Standard Range Loss behavior, utilizing conservative ranges
- **On:** This produces the extreme X-Range Loss behavior, allowing very wide ranges

In both modes the exact range of Gain and Freq Loss is adjustable via changing the Gain Loss and Freq Loss knobs, allowing users to fine tune the behavior.

Tip: "X" in the X-Range name, is a mnemonic, than can be remembered to mean eXtreme, fX, or miX.

Tip: Precedence can be used as a mixing environment in place of using the DAW mixer gain sliders if desired, using X-Range

Mod Enable

The Mod Enable button enables or disables modulation. It is normally expected that it will be enabled, given that modulation is part of the magic, and Precedence is a low-CPU process even with modulation enabled. Nonetheless it can be disabled for creative or aesthetic choice.

Modulation in Precedence is normally reasonably subtle. It adds life and small degrees of motion to the sound source in a manner similar to what happens in the real world when players and their instruments subtly shift in position while performing. A similar process happens naturally at the listening points in the real world since listener head position is not typically perfectly still for very long. When used as intended on normal musical sources, it should be difficult to notice that modulation is active; disable it however, and a certain “je ne sais quoi” is lost. Modulation supplies some ineffable degree of magic to the result that simply makes it feel more organic in practice. It also produces additional benefits for any linked reverbs that follow Precedence in the signal chain.

If both Mod Depth and Mod Rate are set close to their maximum values, modulation can begin to produce more extreme results that can be used intentionally for special FX such as random auto-panning, and pseudo chorus effects. The exact modulation character is also subject to the Width parameter, and extreme values of Mod Depth, Mod Rate, and Width allow things to begin to get a little freaky, as can be interesting when applied to synths. It's not the primary use of Precedence, but creative sound-designers love to abuse things, so we didn't want to rob them of all their fun.

Mod Depth

Mod Depth adjusts the intensity of the modulation.

Mod Rate

Mod Rate adjusts the speed of the modulation.

Tip: Fast Mod Rates also tend to increase the perceived intensity of the modulation. Slow Mod Rates with high Mod Depth can produce slowly evolving results if desired.

Precedence Link & Multi-Instance Editing

Workflow Overview

Problem Statement

2CAudio has been an advocate of running many spatial processing and reverb engines in parallel directly on track inserts for at least a decade now. The benefits of this are explained on the product webpage for Precedence on our website, and reviewed in the end of this manual. The arguments against such workflows have historically been the excessive CPU usage requirements and the tedious burden of managing tens or even hundreds of instances across a complex project.

We solved the first issue in early 2018 with our “Sub-Zero Suspend On Silence” feature, which disables processing and removes the associated CPU burden from your system when there is no active input signal. Many composers like to auto-load massive virtual instrument templates so that they are able to have an entire orchestra and more available for instant playability. It is extremely rare that all instruments in such templates will be actively playing at the same time. Activity in such projects, and even more typical pop, rock, and electronic productions, is usually sparse in comparison to the track count. It would be ideal if only the instruments that are playing consumed CPU resources. This is what our “Suspend On Silence” feature accomplishes, allowing huge projects to be loaded with one instance of Precedence and one instance of Breeze 2 on each and every track if desired. If the project has 200 tracks, but the maximum number of tracks that play simultaneous is only 10, this feature saves approximately 95% of the CPU resources that would normally be consumed! Furthermore, if projects are left open for long periods of time such during a lunch break or overnight, CPU resources are not being consumed when there is no activity, and thus electricity consumption is also lower saving you money on your electric bill and keeping your studio from overheating.

***TIP:** It does NOT consume additional CPU resources simply to load many instances of Precedence. CPU load only increase when many instances are actively playing at the same time!*

Precedence 1.5 now solves the second, convenience, issue as well by introducing Precedence Link, Multi-Instance Editing, and Global Broadcast. We have made it exceptionally convenient to manage tens or hundreds of instances of Precedence together with Linked reverb instances. Managing 100 instances is now roughly just as easy as managing one, and in some ways it is even easier than having to constantly interact with the DAW mixer.

***TIP:** Managing 100 instances of Precedence is now just as convenient as managing one!*

Possible Workflows

There are four distinct workflows possible with Precedence:

1. Single Independent Instances, no Link
2. Single Independent Instances, using Precedence Link
3. Multi-Instance Editing, no Link
4. Multi-Instance Editing, using Precedence Link

The first workflow is the traditional workflow that has persisted in DAWs since their introduction. If a track needs some effect, it is loaded as a track insert. If many tracks need an identical effect, many instances are loaded. To change settings for multiple instances the user must open each track's respective GUI editor from the DAW mixer, make the desired edits, and then close the GUI editor. Reverb is typically supplied by having one or two instances that are on an FX buss and sends are used to send signal from each track to the shared reverb instances. For some styles of music this

is an acceptable way to work. It is perfectly fine to work with Precedence in this manner if desired. We can do much better however, when truly authentic spatialization within a virtual acoustic environment is the goal.

The second workflow removes the shared reverb instance(s) from the send bus(es), and instead pairs each instance of Precedence with a Linked instance of Breeze 2 (or other future 2CAudio reverb). Inter-plugin communication is established between each instance of Precedence and Breeze so that adjusting parameters in either plugin updates both linked plugins automatically. The pair is Linked so that Precedence and Breeze synergistically function as a cohesive process, creating a unified spatialization process. Each track has two plugins on it, and to change parameters on any track the Precedence and/or Breeze GUI editor for each track still must be opened. This workflow works best when a limited number of tracks will use Precedence and Breeze, and other tracks may continue to use traditional methods and/or third party spatialization tools.

The third workflow allows many instances of Precedence to share a single GUI Editor. This workflow shows the position of many instances of Precedence simultaneously from within a single GUI. Not only are multiple instances shown simultaneously within the Position Display, but instance selection can also be made within the Position display and changes to ANY parameters on the GUI will apply to selected instance, which does not need to be equal to the instance that was opened in the host. For example a rock song may have a lead vocal, guitar, bass, and drums. Each track has an instance of Precedence, and all four instances join an Edit Group 1 (explained below). If we open the Precedence instance that is on the lead vocal, not only do we see the lead vocal, but we also see the position of the guitar, bass, and drums instances well. We can freely move the position of all 4 instances from within the same GUI. Furthermore, if we select the guitar instance, ALL parameters on the GUI now display the parameter values for this Selected Instance, NOT the Host Instance. Thus we can change Width, Input Gain, or any other parameter for any instance within the Edit Group, all from within a single GUI editor. Reverb could be handled in the traditional manner of keeping a few shared instances on Sends in this workflow if desired.

In the fourth workflow we can combine Multi-Instance Editing with Precedence Link. We start with the previous Multi-Instance Editing setup, and we add an instance of Breeze 2 directly on each track following Precedence. We join Edit Group 1 for all Breeze instances as well. We enable Precedence Link for each instance. Now a single GUI editor of Precedence can control the DSP of many instances of Precedence AND many linked instances of Breeze 2. We can even enable Selection Sync in Breeze so that we can open a single Breeze 2 GUI editor along side Precedence and the entire Breeze 2 GUI will update in sync to the instance selection made within Precedence, allowing us to make ultra fast edits to many instances of both Precedence and Breeze, for ALL parameters on both GUIs, not only those parameters directly related to Precedence Link.

There is one final masterstroke: Global Broadcast. Global Broadcast allows you to make macro changes to all members of an Edit Group. If you have 100 instances of Precedence and Breeze 2 loaded, all part of Edit Group 1, and you find that Modulation Depth in Precedence is slightly too high, or the particular preset you are using in Breeze has a slightly too long decay time, you simply enable Global Broadcast and change Modulation Depth in Precedence or Reverb Time in Breeze. When Global Broadcast is enabled, the changes do not only apply to the Selected Instance within the Multi-Edit Group, but ALL members of the Group. **You can change parameter values for hundreds of instances with a single mouse-action! You can even change entire presets using Broadcast!** This allows the entire Edit Group, which may potentially consist of tens or hundreds of instances, to behave a like a single instance that is shared on a Send Bus, Editing 100 instances is just as fast and convenient at editing one! There is a very big difference however, in that the position data for every instance in the Edit Group is not part of the standard preset data, and therefore when changing presets, you can change the “global environment” aspects as a group, but the position data will remain specific to each instance! Additionally, each instance will automatically have its own subtle variation of the general preset so that no two instances are ever exactly the same, augmenting realism! Welcome to the next generation of spatial processing!

Tip: Precedence Link combined with Multi-Edit Groups and Global Broadcast represents the next generation in spatial processing both in workflow and in sonic results!

Tip: Another advanced technique is to use the forth workflow above with short reverb times of say 0.5 to 1.0 seconds to provide “room sound”, combined with a high-CPU reverb engine such as B2 via send to provide longer tails.

Precedence Link

Overview

The Precedence Link feature establishes inter-plugin communication between Precedence and 2CAudio reverb engines such as Breeze 2. This allows parameter updates in Precedence to be communicated to the reverb engine, which automatically updates its own parameter values and complex set of internal DSP settings to reflect changes made to the position established in Precedence. Parameters that are specifically related to position such as Angle and Distance, as well as the Precedence Algorithm Mode, and a few others are communicated to and from the reverb engine in a bi-directional manner. These parameters are shown on the reverb engine GUI as well and can be edited either in Precedence or in the reverb for maximum convenience. They will remain synched regardless of where they are edited.

The reverb engine such as Breeze 2 is responsible for establishing a global virtual acoustic environment. Precedence is responsible for positioning objects within this virtual acoustic environment. Precedence supplies the vast majority of the lateral azimuth positioning via its Angle parameter. The duty of Distance and depth placement is shared between Precedence and the reverb engine. As mentioned in the Loss Parameter section of the manual, Precedence produces loss to gain and high frequency energy and introduces other sophisticated distance cues. In an open environment with no reflecting surfaces such as being suspended in the middle of the sky, or in the middle of a very large anechoic chamber, these would be the only cues available to perceive distance. When experiencing sound in an enclosed environment however, such as a concert hall, room, chamber, church etc. (i.e. the locations where we listen to music 99.9% of the time) additional cues help establish distance, and these cues are generally more relevant to music production.

In an enclosed environment such as a concert hall, other very important distance cues occur:

- Direct vs. Reflected energy balance, i.e. Wet-Dry Mix in traditional audio engineering reverb terminology
- Initial Time Gap, i.e. Pre-Delay in traditional audio engineering reverb terminology
- Additional sophisticated distance-based changes can occur as well, such as changes to the envelope contour, the relative balance between discrete early reflections versus diffuse late reflections energy, and more

In the music production context these cues are often more useful than extreme gain and high frequency loss. Mix engineers have long used reverb mix levels to intuitively establish front-to-back depth and distance placement in the mix.

***TIP:** Sounds that are close to the listener generally have more direct energy and less reflected energy, while distant sounds have less direct energy and more reflected energy, i.e. they have a higher Wet-Dry Mix setting.*

Using pre-delay properly to help establish distance and depth, however remains a mostly misunderstood black-art, even though the general rule is simple:

***TIP:** Sounds that are close to the listener generally have more pre-delay, and distant sounds have less pre-delay.*

The more sophisticated changes are even more esoteric and generally known only by algorithmic reverb designers and psychoacoustic research scientists. They are certainly not the type of details musicians enjoy thinking about while working on music production, yet when properly established they do an excellent job of augmenting the sense of distance and depth.

All of these cues are very important to the perception of distance and depth within the type of enclosed environments where music is normally experienced. They are the domain of the reverb engine however, not Precedence, and they should be consistent with other characteristics of the global environment created by the reverb engine such as its current size and geometry. In a truly authentic virtual acoustic model, changes to Distance would ideally result both in changes to the local psychoacoustic cues created by Precedence, as well as those heavily influenced by the enclosed environment as created by the reverb engine. Ideally this would all be automatic so that musicians are free to think about more important things such as making music. **Welcome to Precedence Link!** This is exactly what it offers.

***TIP:** When using Precedence Link, the reverb engine tracks changes to position within Precedence and its internal DSP settings are readjusted completely to intelligently compliment settings in Precedence. Distance cues are supplied both by Precedence and by the reverb engine in synergistic manner consistent with acoustic reality. The process is completely automatic and transparent to users allowing them to focus on the music.*

***TIP:** Precedence Link becomes even more powerful when combined with Multi-Instance Editing and Global Broadcast.*

Precedence Link Setup

To setup Precedence Link four easy steps are required:

1. Instantiate Precedence and a Precedence-aware reverb engine such as Breeze 2.5, directly on a track as inserts, with Precedence coming **BEFORE** the reverb
2. Click on the Link button in Precedence to enable Link Mode (if it is not already on)
3. Click on the Link button in Breeze to enable Precedence Link Mode, and Distance Link DSP Mode
4. Check the instance name/ID matches in the instances of Precedence and Breeze 2 that you wish to Link.



Names will be auto-populated with “ID 001, ID 002, ID 003...” as they are instantiated in the DAW. Double-clicking on the name field will allow you to change the names to something more meaningful such as Flute, Lead Vocal, Acoustic Guitar, Bass Synth, or whatever you like. When there is a successful name match, the name text will become colorized and two small colored circle-dots will surround the name, indicating a successful link is established. If a link becomes inactive for some reason, such as a name change in only one of the linked plug-ins, the name formatting will revert to the non-linked format allowing you to easily identify this condition.

Multi-Instance Edit Groups

Multi-Instance Editing Overview

Multi-Instance Editing allows a single GUI editor to effectively be shared by many instances of the plug-in, showing data from many instances simultaneously and allowing parameter changes to be made to any or all instances within the current Edit Group. The Position Display will show the current position of all instances within the Edit Group. The rest of the parameters on the GUI apply to the Selected Instance, which may or may not be the Host Instance.

For sake of illustration, let's consider a simple example. If you have two tracks, Guitar and Bass, and they are part of the same Edit Group, and you open the Guitar instance from the host mixer, you will see not only the Guitar instance in the Position Display, but also the Bass instance. As a matter of convention, when you open any GUI editor, the Selected Instance will always be initialized to the instance that was opened from the host (i.e. the Host Instance). If you open the Guitar track instance, the Guitar instance will be selected in the Position display and all parameters on the GUI will belong to the Guitar instance. If you make any edits to any parameter they will apply to the Guitar instance because that is what is currently selected. So far, this is the standard way of working with plug-ins, with the extra benefit of being able to see the position of multiple instances at once.



We do not simply call this feature Multi-Instance Viewing, however, we call it **Multi-Instance Editing!** You are not limited to only viewing parameter data from other instances; you can actually edit it as well! In our example, if you change the selection from the Guitar Instance to the Bass instance, you can now change the Position of the Bass instance by moving it around in the Position Display. We do not stop there; in fact, ALL parameters on the GUI follow the instance selection. If you select the Bass instance, and you change the Mod Depth parameter, you are changing the value of the Bass instance, NOT the Guitar instance, even though the Guitar Instance GUI Editor is what was opened from the Host.

To facilitate the learning process of becoming familiar with the concept of Multi-Instance Editing, the Host Instance is shown in a manner that is visually distinct from all other instances in the Edit Group. The Host Instance is colorized, while all other instances are gray-scale. If you see a colorized instance in the Position Display, in addition to the Selected Instance, this quickly reinforces the fact that you are not editing Host Instance (the instance that was opened from the DAW), but are performing a Multi-Instance Edit operation. The Host Instance name is also displayed on the Info page of the GUI in case you somehow become confused. The Selected Instance is also clearly distinct from all other instances. It is larger than all other instances, has an additional ring around it, is a different color, and shows the Mod Cloud.

Tip: All parameters on the GUI follow the current instance selection. All parameters for any and all members of the Group can change from within a single GUI window simply by changing the Selected Instance. Any instance within the Edit Group can be opened from the DAW mixer, and it can be used to edit ANY or ALL group members.

Tip: An Edit Group may have tens or even hundreds of instances within it. Parameter data for all instances in the group is exceptionally fast to access and extremely simple to edit!

Changing Instance Selection

Instance selection may be changed in four ways:

- Clicking on any non-selected instance within the Position Display
- Opening the Instance List from the menu button at the bottom of the GUI to the right of the Width knob.
- Opening the Instance List or using the previous/next buttons from the Nav Bar, by switching the resource info area of the Nav Bar to Instance mode (This area can be used to show Presets, Color Preferences, or Instance.)
- **Using Keyboard Shortcuts Page-Up, and Page-Down will cycle through all available instances**

Tip: We advise you to practice using the keyboard shortcuts! One hand can use the shortcuts and the other can remain on the mouse for edits, enabling a lightning fast editing workflow!

Note: Some hosts may intercept Key-Commands or use said key-commands for their own actions. Consult your host to see if they can be disabled or reassigned if desired.

Note: When changing selection by clicking on a Non-Selected Instance in the Position Display, you will not be able to immediately drag it to a new location in a single action. You must first change the selection, then release the mouse-button, then click-drag a second time if you wish to drag to a new location. This prevents you from accidentally changing instance positions when quickly changing selections.

Edit Groups

To use Multi-Instance Editing, instances must be part of an Edit Group. Precedence offers 8 edit groups, as well as the ability to disable Multi-Instance Edit Groups and use Precedence in the traditional single independent instance workflow. These modes can be used at the same time: i.e. some instances can be part of an Edit Group while others can continue to be used independently. For simple to medium complexity projects a single Multi-Instance Edit Group may be sufficient for the entire mix. For complex projects multiple Edit Groups are offered to allow users to create different sub-mixes within large projects, where it may be desirable to group similar elements into Edit Groups instead of showing the contents of the full mix within a single Multi-Instance Editor. A few examples include, but are certainly not limited to, the following:

- Modern Scoring and Film, TV, or Game Mixing
 - Orchestra Group
 - Synth Group
 - Ambience and FX Group
 - Dialog Group
- Modern Orchestra
 - Strings Group
 - Brass Group
 - Woodwinds Group
 - Percussion Group
 - Choir Group
 - Non-Traditional Element Group
- Electronic Music
 - Synths Group
 - Drums Group

- Real Instruments & Vocals Group
- FX Group
- Grouping by Linked Reverb
 - Breeze 2 Group
 - B2 Group
 - Aether Group
 - 3rd Party Verb on Send Group

There are many other ways to use Groups. We recommend to start with using only one group to become familiar with the Multi-Instance Editing and Precedence Link workflow first, and then as your needs expand perhaps consider using multiple Edit Groups if and when needed.

Setup

To enable Multi-Instance Editing:

1. Instantiate Precedence and click on the Group button in the Nav Bar. The button will split into two buttons:
 - a. Global Broadcast
 - b. Group Number: right and left mouse click on the Group Number button will cycle through the eight available groups. Choose one.
2. Instantiate additional instances of Precedence and join the same Group Number.
3. Use the Position Display to switch the Selected Instance between available instances, and double click on the Instance Name field to rename the instances from the default "ID 001, ID 002..." names to meaningful track names.

Note: *The maximum number of instances per Edit Group is 256.*

Selection Sync

When using Precedence Link to establish inter-plugin communication between Precedence and a linked Precedence Aware reverb engine such as Breeze 2, it is possible to keep the Multi-Instance Edit Selection synced between Precedence and the reverb. When using this feature, the Precedence GUI may be kept open along side the reverb GUI, and instance selection for both can be made from the Precedence Position Display. The selection will be automatically changed in the reverb engine when a new selection is made in Precedence. This allows an ultra fast editing workflow that is dramatically more convenient than having to open many instances from the Host. Selection is synced in both directions, so selection changes are possible from the reverb GUI as well, but we find it more convenient to use Precedence as the "command center" for Multi-Instance selection do the instance visualization found in its Position Display. See the reverb manual for additional details.

Tip: *Simply make a selection from Precedence, and in one click all parameters for both Precedence AND the linked reverb engine will be instantly shown and editable for the newly selected instance.*

Limitations

Almost any and every possible user action can be made from any instance and operate on any other instance within an Edit Group. There are a few exceptions:

- **Changes to Edit Group Membership must be done to/from the Host Instance.** *If you wish to change the Guitar track from Group 1, to Group 2, you must open the Guitar track's GUI from the DAW mixer. You cannot change Group membership if the Selected Instance is not currently equal to the Host Instance. (i.e. you can not open the GUI editor from the Bass instance in the DAW, change Multi-Edit Selection to Guitar, and then attempt to change the Group Number of the Guitar track. You must open the Guitar track editor if you wish to change the Group Number for the Guitar)*

- ***Changes to Color Preferences and Color Preference Presets must likewise be done while the Selected Instance is equal to the Host Instance.***

Do to these limitations these actions are blocked from user changes until the Selected Instance is returned to being the Host Instance. As a reminder, if the Selected Instance is NOT the Host Instance, the Host Instance Node is shown as a colored object in the Position Display, while all other instances are gray scale. The disabled state of the Group Number and color Preference colors are shown in the same color, as a reminder that if you wish to use them, you simply need to first click on the colored Host Instance node in the Position Display (or equivalently, change the Selected Instance back to the Host Instance via the Multi-Instance List Menus.)

There is one other limitation:

- ***For Selection Sync to work between Precedence and Linked Reverbs, the GUI editors for the Linked Pair must be opened. If you have Group 1 that consists of Guitar and Bass, and both tracks have Precedence and a linked Breeze 2 instance, you must open the GUI editors from the same track to use Multi-Instance Selection Sync. It does not matter which track they are opened from, but they must be the same track. You cannot open the Precedence GUI editor from the Guitar track, and the Breeze editor from the Bass editor if you wish to use Selection Sync.***

Global Broadcast

Rational

Dealing with many instances of a plugin can be tedious historically. Multi-Instance Editing makes it much easier already, but often it would be convenient to be able to change a parameter or two, or an entire preset en-masse for an entire Edit Group. This is what Global Broadcast accomplishes.

Tip: When Global Broadcast is on, any changes made to individual parameters, or even changes to all parameters via preset change are applied not just to the Selected Instance, but also to the entire Edit Group.

Some parameters in Precedence are designed to be global setup parameters are not expected to change much per instance. These include the Gain Delta, Freq Delta, Time Delta (to a lesser degree), Gain Loss, Time Loss, and Width (to a lesser Degree). These parameters establish “positioning rules” and they are best used in a somewhat consistent manner within a mix in our opinion. Small per-instance tweaks can be applied as desired, of course, and rules are meant to be broken, but often it is sufficient to edit them en-masse for the entire Edit Group. Mod Depth and Mod Rate are generally fine to adjust en-masse via Global Broadcast as well.

Global Broadcast in the reverb engines is even more valuable. Users can establish an entire relative spatial mix with position information from Precedence, and use Precedence Link to communicate this information to the reverb instances, and then use Global Broadcast to browse reverb presets to find the perfect environment for our mix. The relative spatial positions will remain intact, but the mix will be transported into a new virtual acoustic space! We can change our Hall to a Chamber or anything else. The environment changes just as easily as if it were a single instance on a send buss, but it is NOT just a single instance we are dealing with. We may have tens or hundreds, each with its own variable position, and its own innate random variations.

This level of realism is simply not possible with a single shared instance on a Send Buss. It is comparable to the difference between having one impulse response of one exact point in a concert hall versus hundreds taken at many different locations! The first method applies this single impulse response to every instrument in the mix, inevitably conveying that each instrument has originated from the same point with the environment. The second method allows each instrument to occupy its own unique space within the environment. In the case of Precedence and its linked reverb

engine, we are not dealing with hundreds of impulse responses however; the variation is infinite, and time varying in an organic manner as well!

Tip: Global Broadcast allows you to change the positioning rules and macro aspects of the virtual acoustic environment, while retaining relative positions and automatically introducing variations in each and every instance even if they happen to have the same position.

The Global Broadcast method does not enforce sync to be maintained between Edit Group members. You are free to turn on Global Broadcast, make a preset change, cascading the changes to all instances in the Edit Group, then disable Global Broadcast, and finally make any per-instance adjustments you might like! You will end up with an Edit Group that is mostly similar, but may have some important per-instance variations to further optimize specific tracks with special needs. In Precedence this could include adjusting the Time Delta value for highly transient material such as drums, or using different Input Modes depending on the needs of the source material, or even using a different Alg Mode for background synths. In the reverb engine this could mean slightly adjusting the reverb gain level for specific tracks, or changing the EQ filter for specific tracks, or any other possibility.

Variation Randomize in Precedence and Alg-Randomize in the reverb engine can even be used with Global Broadcast to introduce a new random behavior for all instances in the Edit Group! Even without doing this, there are already innate differences between instances, but these features allow even larger mutations within the Edit Group.

Setup

To use Global Broadcast, click on its button in the Nav Bar to the left of the Group Number. When it is enabled, the button will be strongly colorized in a manner that is intentionally visually loud and hard to ignore. This is a reminder that you may potentially be making changes to tens or even hundreds of instances.

Note: With great power comes great responsibility. Use Global Broadcast carefully. It is potentially possible to change many aspects of an entire mix with a single click.



Limitations

Almost every possible parameter can be changed via the Global Broadcast method. There are only three exceptions:

- **Angle** is intentionally blocked because it is part of position and the entire goal of Precedence is to establish different positions for all elements in the mix. Changing all instances to have the same Angle value would not generally be useful and it would be too easy to accidentally reset carefully crafted position values for an entire mix. Both the Angle Numeric Control, as well as the Position Display are blocked from Broadcast.
- **Distance** is intentionally blocked for the same reason.
- **Position Randomize** is also intentionally blocked for the same reason.

Tip: Position information is safe with regard to changing Presets while Global Broadcast is active. When changing presets, Angle and Distance values are ignored automatically if using Edit Groups; thus they are not subject to Global Broadcast.

Info Page Details

Karma Boost

The Karma Tab of the Info Page addresses product authorization. We call it Karma Boost because our motto here is “Do unto others as you would have done to yourself.” We do not employ authoritarian copy-protection schemes or hardware dongles. We prefer to treat our customers as our friends and make product authorization easy, non-invasive, and burden free. Our language choice in this area is designed to remind you that this sort of system is only possible with your support and reciprocation of our trust. We hope you will appreciate our decision and work with us to limit the distribution of pirated software. All we ask of you is this simple rule: “Do unto others as you would have done to yourself.”

Authorization Status

The Authorization Status text field communicates exactly that. It can display several text strings:

- **Enter Serial:** This is displayed before the product has been authorized
- **Authorized:** This is displayed when the product has been properly authorized and the plug-in is functioning correctly.

Additional text strings are possible, but only occur when something is wrong. If encountered, please contact tech support.

Serial Number Field

The Serial Number Field is used to authorize the product as described in the “Installation & Authorization” section of the “Introduction” chapter of this document.

User Name

The User Name field is used to tag user presets with the author name. Whenever a user preset is saved the User Name will be saved into the preset. When the preset is loaded, the name will be displayed in the Browser page to give credit to the author. This is useful when sharing presets with peers.

User Info

The User Info field is used to tag user presets with the author information. This information could be a web URL, a company name, a group name, a motto or slogan, or any other information you wish to include with your presets. It can be left blank as well. Whenever a user preset is saved the User Info will be saved into the preset. When the preset is loaded, the Info field will be displayed in the Browser page to give credit to the author. This is useful when sharing presets with peers.

Authorization Details

This area displays our friendly reminder regarding our philosophy on copy protection, and provides our blessing and appreciation for everyone who honors it.

Additional text strings are possible, but only occur when something is wrong. If encountered, please contact tech support.

Preferences

The Preferences tab of the Info Page contains options that control the general look and behavior of the GUI as well as other miscellaneous preferences. Preferences may be changed either by directly clicking on the text field button that displays the current preference setting, or by using the associated drop down menu to directly select the desired option.

All changes to preferences take place immediately and it unnecessary to reload the plugin if dealing with a single instance. When using multiple instances of Precedence in a host project, changes to Preferences are global for all instances of Precedence; however, the host project file must be closed and reopened before all instances of Precedence will use the new Preferences. In other words, changing Preferences in a single instance of Precedence will change the settings for all instances in the project, but the project file must be closed and reloaded to automatically switch the Preferences of all of the other instances used in the project.

Font Size Adjustment Slider

The font sizes used for most GUI elements can be scaled up or down to suite personal preference. Font size scales non-linearly with GUI size already, and the base font size should be reasonable for all GUI sizes. However in modern times with high DPI screens, and potentially huge display sizes, we find that using smaller font sizes can generally look a little more eloquent and allow the GUI design to breath a little more. Alternatively, users who need visual assistance can opt to use extra large fonts to improve readability if needed.

GUI Size

Precedence offers over 30 different GUI sizes all the way from “itsy-bitsy” to ultra huge full screen height 4K & 5K resolution. The menu options display the GUI size in X & Y pixel dimensions.

Note: exact resulting pixel dimensions may also depend on OS settings if/when using on high DPI screens

Tip: Our GUIs look extremely sexy at huge sizes with font size adjustment set to small values such as the minimum of negative 100%. We are fully prepared for 4K, 5K, 6K, and even 8K or higher display resolutions and are big advocates of high-resolution displays. We advise users to use at least 4K displays whenever possible. The software experience as a whole, not just for 2CAudio products, is much better on high-resolution displays, in our opinion. As of 2019, 4K displays are also already very economical.

*Tip: 720*720 is the default GUI size for sake of compatibility with smaller legacy displays, but we strongly recommend to use a larger GUI size such as 1440*1440, particularly when working with Multi-Instance Edit Groups, where one GUI can be used to change parameter values for many instances, eliminating the need to open multiple GUI editors simultaneously.*

Show Values

The Show Values preference allows you to control how and when the numerical values of each knob are displayed. Changes to this preference take place immediately. This preference has three options:

- **Always:** Numerical values are displayed on all large knobs at all times—the default behavior
- **Never:** Numerical values are never displayed on any knob unless the knob is in Text Entry mode. This mode is designed to force users to use their ears when adjusting parameters instead of relying on using their eyes, mind, and numerical affinity.
- **While Tracking:** Numerical values are displayed only on the knob that is actively being changed by the user. This mode provides a minimalist GUI aesthetic while still communicating the relevant numerical feedback when it is needed.

Show Trackers

Trackers are pop-up displays that show numerical values and other parameter data for GUI elements that may not show numerical values themselves. Sliders are a good example. This preference has three options:

- **Never:** Tracker values are never displayed. Like above, this mode is designed to force users to use their ears when adjusting parameters instead of relying on using their eyes, mind, and numerical affinity.
- **When Changed:** Trackers are shown when the associated parameter is being changed.
- **On Mouseover:** Trackers are shown when the mouse cursor is held over the control for more than 1 second.
- **Both:** Both When Changed, and also On Mouseover – the default behavior

Show Labels

Labels are used for the circle node(s) in the Position Display to identify which instance a particular circle represents when using Precedence's Multi-Instance Edit Group functionality. Labels are automatically off if not using Multi-Instance Edit Groups. This preference has three options.

- **Never:** Labels are never displayed
- **On Mouseover:** Labels are shown when the mouse cursor moves over a circle node
- **Always:** Labels are always displayed -- default

Load Last

The Load Last Preference determines what preset settings are loaded each time a new instance of the plug-in is loaded.

- **Yes:** The last settings used by the plug-in are remembered and recalled when loading the new instance.
- **No:** The internal default values for all settings are loaded each time a new instance is loaded.

Load last can be especially useful when using audio editor applications such as Magix Sound Forge, or Steinberg Wavelab where the normal workflow is to load the plug-in and apply it to a single stereo audio file and then close the plug-in automatically.

Mod

The Mod Preference allows you to optionally disable the "Mod Cloud" animation from the position display to save CPU resources if you are working with limited CPU resources or simply find the animation distracting.

- **Hide Animation**
- **Show Animation**

Color Tab

The Color Tab holds controls that allow users to customize the color of the GUI and achieve fairly drastic modifications to the general look and feel of the GUI. Approximately 300 pre-made Color Preference Presets are already supplied with the shipping product that demonstrate the extreme variety of looks that are obtainable with 2CAudio's GUI Color system. Color Preference Presets are comprised of all of the settings found here on the Color Tab on the INFO page. The large collection of factory-supplied Color Preference Presets may be enough for most users, but the Info Page Color Tab exposes these parameters to users to allow you to adjust color settings as desired to create an infinite variety of personalized GUI themes, which can be saved as User Color Preference Presets.

Tip: Changes to any of the Color Preference parameters are reflected in the GUI instantaneously. The effect of each parameter will be visible and intuitive as it is changed. Users are encouraged to experiment as desired, and the descriptions below are likely redundant. Control/Apple Click on any parameter will reset it to its default value.

Object & Panel Colors

The GUI design makes use of multiple colors. Some GUI objects such as Knobs, Sliders, and Data Displays use intense colors to communicate parameter values and differentiate similar GUI objects. We call these Object Colors. Object Colors generally communicate parameter data in some way. It is also possible to colorize non-functional aspects of the GUI, such as the general backgrounds. We call these Panel Colors. The left column of sliders affect Object Colors, and the right column of sliders affect Panel Color. The double-wide Hue slider is global and effects all colors.

Hue

Hue is controlled in two ways:

- **Global Hue Slider:** controls the absolute hue of everything on the GUI, by applying an equal hue rotation to each and every Color Harmony Value. Musically you could think of this as like a reference tuning value such as A = 440hz. Hue is measured in degrees from 0 to 360 degrees and is cyclical like notes in a musical scale. 360 degrees gives the same value as 0 degrees.
- **Hue Color Harmony Values:** color targets can have relative offsets from the absolute Global Hue Slider value, achieving color harmonies. In the musical metaphor, you can think of these values as similar to notes in a chord. There are 12 evenly spaced values for each target just as there are 12 notes in a musical octave. They are spaced 30 degrees apart. This system makes it very easy to create various common color harmonies such as Complementary, Analogous, Triad, Square, Split-Complementary, etc. An Internet search for “Color Harmony” will provide more info if you are interested in this topic. There are multiple color targets:
 - **Primary Object**
 - **Secondary Object**
 - **Tertiary Object** (if available)
 - **Accent** (middle button in the Saturation row)
 - **Panel** (right button in the Saturation row))

Saturation

The Saturation controls affect color saturation, i.e. how distinct, far-from-gray-scale, colors are. The controls are:

- **Accent Saturation Switch:** determines if saturation tint is applied to GUI elements such as buttons and fonts
- **Object Saturation Slider:** controls the intensity of saturation for object colors
- **Panel Saturation Slider:** controls the intensity of saturation for Panel and Accent colors. This parameter is bipolar. Negative values give a different variation of the process.

Brightness

The Brightness controls affect color brightness, i.e. how far-from-black colors are. The controls are:

- **Brightness Mode:** switches the entire GUI between a Light theme, and a Dark theme
 - **Dark Theme:** a dark gray to black theme with light text to minimize eye strain (default)
 - **Light Theme:** a light gray to white theme with dark text to improve readability in high light environments (maybe you are checking your mix on a laptop at the beach, or just like to be generally cheerful?)

- **Accent Brightness Switch:** determines if the Panel Brightness slider effects accent colors such as buttons, fonts, etc. or just the background panels
- **Object Brightness:** controls the brightness of Object Colors
- **Panel Brightness:** controls the brightness of Panel and Accent colors

Contrast

The Contrast controls affect the general range or deviation of brightness values found in the GUI. The controls are:

- **Contrast Mode:** switches the entire GUI between a Standard and Duality theme variations
 - **Standard:** as described above in the Brightness Mode section (default)
 - **Duality:** a more adventurous design where dark objects are put on a light background or light objects are put on a dark background. This option is an exercise in pure aesthetics. It simply looks cool, fresh, and modern in some contexts with careful settings of the other parameter values.
- **Object Vibrance Mode Switch:** a subtle control that deals with the exact mapping of the human perception of color to computer display numeric RGB values. It is somewhat related to the concept of contrast, but at applied to a color space.
 - **Naive Mode:** a rigid mathematical mapping to RGB, that can provide very intense colors
 - **Vibrance Mode:** a more organic mapping that provides results that look closer to nature in most cases
- **Object Vibrance Slider:** controls the specific mapping used by Vibrance Mode (disabled if using Naive mode)
- **Panel Contrast Slider:** controls the range or deviation of brightness values used in background panels

Spectral

The Spectral controls are normally somewhat subtle and serve to create color variations within object and panel colors so that all pixels for a particular perceptual color actually have some variation as would happen in the real world with natural lighting and variable material properties. Extreme spectral values can create gradient effects. There are two controls:

- **Object Color Spectral Direction Switches:** changes the direction of the spectral effect for each object color
- **Object Spectral Slider:** controls the intensity of the spectral effect for object colors
- **Panel Spectral Slider:** controls the intensity of the spectral effect for panel colors

Color Preference Presets

The collection of all of the Color Preference controls can be saved and recalled as a Color Preference Preset. Precedence ships with many different factory Color Preference Presets which can be accessed from the Color Preference Preset Menu ▼ as well as decremented ◀ and incremented ▶ from the supplied GUI buttons to allow fast Color Preference browsing. The Navigation Bar may also be switched to Color Preference Mode, to allow browsing Color Preference Presets from the Main page of the GUI so that users may see the result instantly as a matter of convenience while choosing one to use.

Note: the Color Preference Preset controls are disabled when using Multi-Instance Editing if the Selected Instance is not equal to the Host Instance.

Lower Info Area

Version Display

The Version Display communicates the version number of Precedence that is installed on your computer, as well as which CPU instruction set it is currently using.

Authorization Status

The Authorization Status text field is here repeated here for convenience. It can display several text strings:

- **Enter Serial:** This is displayed before the product has been authorized
- **Authorized:** This is displayed when the product has been properly authorized and the plug-in is functioning correctly.

Additional text strings are possible, but only occur when something is wrong. If encountered, please contact tech support.

Host Instance Name

The Host Instance Name communicates the name/ID of the instance that was opened in your DAW (i.e. the Host Instance). This is mostly for reference purposes as users get accustomed to Multi-Instance Editing workflows. If you are not using Multi-Instance Edit Groups, the Selected Instance will always be equal to the Host Instance.

When using Multi-Instance Edit Groups, a limited number of operations such as changing plug-in preferences including color presets must be done when the Selected Instance is equal to the Host Instance.

In Precedence, it should already be clear on the Main page of the GUI in the Position Display which instance is the Host Instance. The Host Instance has a different color than all other instances. The Host Instance may be less obvious in other products such as Breeze 2, which do not have explicit Multi Instance display objects such as the Precedence Position Display. Therefore, as additional insurance against confusion the Host Instance name/ID is also explicitly provided on the Info page as a reference. This is included in Precedence as well for sake of consistency.

***Tip:** As a reminder, closing and reopening any GUI editor will always reset the Selected Instance to the Host Instance. This is another way to be certain what the selection is in the unlikely event of confusion.*

Preset Info

Overview

The Precedence Factory Preset bank contains the following sub-directories:

- 00 Multi Instance Templates
- 01 Repositioning
- 02 Image Manipulation
- 03 Instruments
- 04 Synths
- 05 Special FX

00 Multi Instance Templates

The Multi Instance Templates directory contains presets that are designed to be used with Multi-Instance Editing. The Angle and Distance value for all presets in this group are set to the default values and it is expected that the user will change them as needed.

***Tip:** When using Multi-Instance Edit Groups it is expected that the user will establish the desired custom position values for each instance. Angle and Distance parameter values do not change when presets are loaded in this context.*

Tip:** Do to the fact that position will not change when loading presets in this context, it is possible to browse this preset directory while using Global Broadcast. This can change the entire set of “spatialization rules” used for the group, while maintaining each member’s relative position. This allows users to quickly audition different degrees of separation, depth, width, and “spatial contrast” across the entire group. **This is a very powerful macro feature!

01 Repositioning

This folder demonstrates how to use the Input Modes to handle the varying needs of the input signal.

02-05 Preset Folders

These folders contain presets that are meant for specific use on single instances more so than in the Multi-Instance context. i.e. we would not expect them to be used with Global Broadcast.

Concept Refresher and General Knowledge

Overview

This section of the manual repeats the information available on the product website. It can be helpful to understand the history of these topics to understand the full value of Precedence, particularly in context with Precedence Link, Multi-Instance Editing, and Global Broadcast. If you have read the web material, there is no need to reread it here. It is repeated here for convenience.

Spatial Evolution In Azimuth Positioning

ZERO SUM GAIN

Most existing methods of stereo imaging and positioning suffer from unfortunate weaknesses. Gain panning is of course the most simple to implement and is ubiquitous throughout the last 100 year history of recording arts and sciences. Unlike some of the more modern methods, it is generally free from any nasty unwanted side effects. There remains one rather large issue however: it generally does not occur in real-world acoustic environments -- at least not to the degrees and intensity offered and commonly used by mix desks and modern DAWs. A hard-panned signal is not particularly natural especially on headphones for example. Drastic level differences between ears, or stereo microphones simply almost never occur in the real world. In the real world the only equivalent would be something like a young lover whispering directly into only one of your ears, and while this may seem nostalgic indeed, it simply does not really translate to the experience of musical instrument performance in acoustic environments. There is almost no desirable circumstance in which someone could hear a violin, trumpet, piano, drums, or vocal in only one ear. Of course play-back of gain-panned signals in-air over loudspeakers results in sound reaching both ears even if sound is emitted from only one of the loudspeakers. Some mixing in-air certainly occurs, but not necessarily in physically accurate ratios relative to the original sound field. More problematically this method completely ignores other important interaural differences that occur in nature. Gain panning is used widely because it is mostly safe to use, not necessarily because it is the best choice aesthetically or provides the most accurate directional cues. Differentiating a large number of instruments in a mix based solely on gain panning is extremely difficult and often results in poor separation between instruments.

HAAS (THE PRECEDENCE EFFECT)

In the real physical world a sound coming from a source that is closer to one ear or microphone will arrive at this ear or microphone before the other more distant one. In technical terms this is called an Interaural Time Difference and in human perception this cue has a significantly stronger perceptual impact than Interaural Level Differences (i.e. gain panning). In psychoacoustics this phenomenon is called the Precedence Effect or the Haas Effect as named after one of the first scientists to explore it in the 1950s. It is also known as the Law of the First Wavefront, which attempts to convey the salient point that the first wavefront to reach either ear will take precedence over the one arriving slightly later in the second ear, and the sound will be perceived to be coming from the direction from which it first arrived. Haas showed that this effect was so strong that it would even beat significantly conflicting Interaural Level Difference cues. In other words, even if the later-arriving signal was significantly louder than the first-arriving signal, the listener would still perceive the sound to be coming from the direction where the sound arrived first. Time-Delay based panning therefore is often significantly more powerful and effective than gain panning.

MODERN ATTEMPTS (HRTF)

Binaural panning techniques incorporate both Interaural Level Differences and Interaural Time Differences as well as other psychoacoustic effects such as Interaural Spectral Differences in effort to attempt to model human hearing as exactly as possible. Head Related Transfer Functions can be used to create filters that change the frequency response independently in each ear based on the real-world physical size, geometry and materials of human heads and ears. The head can create a shadowing effect on some frequencies at certain azimuths, and the pinna of the ear also creates very complex filtering effects in each ear depending on the source sound positions. These techniques can be extremely convincing under some circumstances and have great application for fields such as Virtual Reality.

CHALLENGES

Unfortunately the circumstances in which HRTFs really work well are very restrictive. Namely these techniques really require headphones for the best result, and even then, HRTFs do not always translate well from one person to another due to quite large variation in human pinna size and shapes. A unique custom set of HRTFs for each user is the ideal solution but is obviously very impractical. Furthermore, interaural filter effects are extremely sensitive to head position, and indeed this is likely part of their evolutionary design. If humans are forced to keep their head perfectly still their spectral-filtering based localization abilities are decreased significantly. The ear is basically designed to take multiple snap-shots of a source sound from different angles and then effectively triangulate a position based on how the filter effects in the spectrum of the source sound change depending on head angle. If you have ever observed predator animals in nature or those who were trying to avoid them, and wondered why they move their head rapidly in a jerky start-stop manner, you now know why. They are attempting to better locate a respective meal or avoid becoming one. Some form of head tracking and dynamic filter computation would be required to get really convincing results with HRTFs. Again this may find application in Virtual Reality, where head tracking may be incorporated into VR headsets, but it is generally way too cumbersome for professional music applications and simply does not work over loudspeakers.

Image Both pure Time-Delay based panning and Spectral based techniques also create other potential issues such as concerns over mono-compatibility and introduction of potentially strong coloration of reverb tails if such techniques find their way into the signal sent to a reverb device. Both techniques introduce a form of comb-filtering and if such filtering is altered downstream either by collapse to mono or by recirculating through feedback in an algorithmic reverb the result can be unpleasantly obvious. In general these type of strong comb filtering effects are highly undesirable and often cited by music engineers as a reason for avoiding simple Haas panning and anything based on HRTFs. This is in large part why pure gain panning persists today.

THE SOLUTION

Precedence utilizes some variation of all of the above techniques, but does so in a novel manner that largely avoids the issues associated with more advanced time and spectral methods. It uses a proprietary mix of the perceptual cues humans use to locate sounds in 3D space that has been optimized specifically to work within the needs of music and professional audio production. The relative strength of these cues can even be adjusted to suite the needs of a wide variety of musical styles.

Precedence's lateral azimuth positioning ability is extremely convincing over both loudspeakers as well as headphones. It is largely mono-sum compatible even at extreme settings, and if exactly perfect mono-sum compatibility is required it can be guaranteed as needed to avoid bass cancelation in club systems for example. Precedence also offers three input modes to maximize compatibility with the needs of user's audio tracks and sample instrument libraries to avoid this additional potential source of unwanted coloration from spatial information contained within the source sound.

Precedence is designed to be used as an insert directly on individual tracks, and therefore its output will inevitably find its way into reverbs whether placed directly after Precedence on track inserts, or on sends. Unlike other techniques such as HRTFs, Precedence will cause absolutely zero negative consequences when used this way, and the reverb tail will not be undesirably colored as an unwanted side effect. Indeed 2CAudio reverbs such as Breeze 2, have been designed to be used specifically with Precedence in mind. Both are extremely efficient and mid-level recent CPUs can run hundreds or

even thousands of instances of both simultaneously to allow users to perfectly spatialize and position every single performer in an symphony orchestra performance simultaneously if desired, all with independent and dynamically modulating settings.

Getting Deep With Distance/Depth Positioning

HISTORICALLY SPEAKING

The world's best algorithmic reverbs such as our own Aether, B2, and Breeze 2 have quite masterfully perfected the art of diffuse field late reflections for some time now. Our tails have been silky smooth since 2009 and have only gotten better with each generation of our products. Our ray-tracing-based Early Reflections Engine in Aether, and more abstract approach to Early Reflections in B2 and Breeze likewise do a good job of creating strong spatial impression complimenting the envelopment offered by our tails. In short we create very convincing spatial impression and sense of envelopment with somewhat abstract yet infinitely variable spatial models.

For solo instruments this is a very convincing illusion. For use in multi-track sessions there is historically something of a complication. In the hardware days of yesteryears, the hardware devices where so expensive that most studios had only one or two that were shared by all instruments via using them on send buses. More recently in DAWs the same practice was typically continued do to limited CPU power a few years ago, and the relatively high CPU usage of full extreme algorithms such as Aether and B2. Many engineers also advocated using shared reverbs on sends to do the convenience of being able to change the reverb settings globally as well, which is admittedly convenient we agree.

SHARING AIN'T ALWAYS CARING

Using a shared reverb instance or two may be a reasonably acceptable compromise for diffuse late reflections, but it is a quite incorrect from the physical perspective for Early Reflections as it is the physical equivalent of having all source sounds occupying exactly the same position within the virtual acoustic space. Even if Aether or B2 supplies an immaculately sublime spatial model, if we send 20 instruments into the model and have them all coming from exactly the same point in space within this model, the result will still be less than perfect. In the real world the 20 performers would be occupying different locations within the shared space. We can of course apply gain panning to the tracks pre-send, but as explained above this is somewhat artificial and does not really properly position them within the space. It does nothing to change the time delay lengths that happen in the real world depending relative source, listener and boundary positions.

We could instead use separate Early Reflections engines directly on each individual tracks and reserve a few instances on sends to supply shared diffuse late reflections. This works relatively well, and we have advocated it back as far as 2009 with Aether. One complication here is that sending early reflections into tails usually results in some degree of coloration of the tail, which may or may not be an issue. Secondly there is no easy way to correctly control left-right positioning. If you insert Aether on a track, and then pan the track in the DAW, the entire track will be shifted including it's reflections and this is not physically accurate. Furthermore you are still relying only on gain panning which is not the most physically accurate. Finally, you have no easy way to independently control the delay between the direct sound and early reflections and the tail for each instrument, which is a critical perceptual cue for depth and distance positioning.

MOVING FORWARD (AND BACK)

Beginning with Breeze 2.0 in early 2018, we solved several of these issues by creating a reverb that is so efficient that you can easily load 100 (or 1000 or even more) different instances directly on each track. Each new instance will automatically produce a variation of itself so that instruments will feel part of the same space, but occupying different locations within that space. Early Reflections patterns and even the diffuse tail for each instance will be different as would happen in the real world. An infinite variety of more drastic mutations of each preset are a click away as well, and allow you to find a magic sweet spot for each instrument. This is already a great step forward.

The next step is to offer purposeful control. Breeze 2 allowed you to create multiple instruments that all occupy a different location within a unified space, but it did not allow you be specific about where they are within this space. If you are trying to recreate an orchestral stage for scoring work for example you will have to utilize some other tools together with Breeze 2 to achieve this. Most likely this would have previously involved the track panner, but once again this is generally post insert, and now you are panning your direct sound, your early reflections and your tail. To be blunt, shaking your tail is one thing, but panning it is something else entirely! It is physically incorrect and will not sound authentic and is still only using gain panning.

Even more importantly, to achieve authentic front to back distance positioning other psychoacoustic cues should change between instrument instance such as the wet/dry balance as well as the pre-delay amount. These can be set by ear or via using precise calculations for those knowledgeable and diligent enough to do so, but the process is tedious. Furthermore, the direct sound itself should also change some depending on its position following very sophisticated processes.

This is what Precedence achieves for you. Precedence precedes all of your other spatial tools. Precedence comes first in your spatial processing chain. Precedence will impeccably position your source sound laterally left-to-right controlling its azimuth angle using techniques that will work perfectly with all reverbs that follow it without creating unwanted side effects. Precedence will also pre-condition the direct sound to give it an instant sense of audio source width and spatial impression, similar to what early reflections are typically used for and will do so in a variable manner that embeds distance cues into the direct sound itself.

HIGHER DIMENSIONS

Precedence can then be followed by a Precedence-aware reverb such as Breeze 2.5, which can be set to link its internal settings to Precedence. The entire Breeze 2.5 engine will now sync to Precedence's position parameters to create the correct psychoacoustic cues to position the source within the virtual acoustic environment. Many instances can share the same preset, defining the general virtual acoustic space, while each instance will occupy its own position within this space.

Using Precedence directly on track inserts together with shared reverbs such as Aether, B2, or even Breeze on sends will also still be a dramatic improvement over standard methods if you prefer not to manage many instances of reverb directly on track inserts. When used this way Precedence will still correctly laterally position each instrument, add some distance cues, and also add some modulation that will have the effect of slightly randomizing the Early Reflections independently for each instrument that is sent to a shared reverb on a send. This alone is a huge step in the right direction and can work very well for small ensembles.