

RAZOR

Manual



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Document authored by: Errorsmith

Product version: 1.0 (03/2011)

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Special thanks to the Beta Test Team, who were invaluable not just in tracking down bugs, but in making this a better product.

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1 Welcome to RAZOR

Thank you very much for purchasing RAZOR. On behalf of ERRORSMITH and the entire NATIVE INSTRUMENTS team, we hope this product will truly inspire you.

RAZOR is a state of the art additive synthesizer built with the latest REAKTOR technology. It is capable of a wide range of sounds. From 'bread and butter' sounds that are refreshed by new sonic twists to truly new and unheard sounds only possible with RAZOR. All with an outstanding, high sound quality. Despite its vast possibilities RAZOR is easy to use. Its lean and clean Interface in conjunction with the huge and beautiful graphical display makes it easy and fun to edit sounds or build new ones from scratch quickly. Additive synthesis offers the opportunity to design the sound in great detail. RAZOR gives you a simple tool to do so, like a blade to sculpt the sound. RAZOR the cutting edge synthesizer!

Manual Conventions

This manual uses particular formatting to point out special facts and to warn you of potential issues. The icons introducing the following notes let you see what kind of information is to be expected:



Whenever this exclamation mark icon appears, you should read the corresponding note carefully and follow the instructions and hints given there if applicable.



This light bulb icon indicates that a note contains useful extra information. This information may often help you to solve a task more efficiently, but does not necessarily apply to the setup or operating system you are using; however, it's always worth a look.

Furthermore, the following formatting is used:

- Text appearing in (drop-down) menus (such as *Open...*, *Save as...* etc.) and paths to locations on your hard drive or other storage devices is printed in *italics*.
- Text appearing elsewhere on the screen (labels of buttons, controls, text next to checkboxes etc.) is printed in **light blue**. Whenever you see this formatting applied, you will find the same text appearing somewhere on the screen.
- Important names and concepts are printed in **bold faced letters**.
- References to keys on your computer's keyboard you'll find put in square brackets (e.g., "Press [Shift] + [Return]").
- Single instructions are introduced by this play button type arrow.
- Results of actions are introduced by this smaller arrow.

2 What Is RAZOR?

RAZOR is a powerful synthesizer to be used with REAKTOR PLAYER and REAKTOR 5.5. The instrument uses additive synthesis to create state of the art 'synthetic' sounds.

RAZOR simulates features of classic synthesis concepts like subtractive filters, dissonance occurring in Frequency Shifters or certain aspects of physical modeling as a start. These features get improved and extended by means of additive synthesis to achieve a previously unheard of quality. So a resonant lowpass filter for instance sounds very precise and sharp. Filters have new features like variable filter slopes or new resonance shapes that go beyond 'real' filters. In addition to these extended simulations RAZOR brings new highly innovative features like new filter types, new ways to create dissonance, partial panning effects, pitchable reverbs and much more that is only possible with additive synthesis.

RAZOR has a powerful and easy to use modulation scheme. Most parameters can be modulated by an extensive list of modulators. Even stereo effect parameters can be modulated.

RAZOR takes a new approach concerning effects. Instead of inserting a bunch of audio effects behind the synthesizer most effects are instead done inside the synthesizer itself to give them a new sonic twist. Echoes are achieved by echoing envelopes. This feature results in echoes merged with the dry sound in a unique way. Instances of the echo reflections can be modulated. They can be pitched, filtered and made non-harmonic using a new and innovative modulator called 'Echo Steps'. The reverbs are synthesized reverbs using additive synthesis. They have a unique feature: they follow the pitch of the voice, enabling you to play melodies with the reverb tail! Some effects like a flanger and phaser are available as filter types. 'Dissonance effects' make the sound non harmonic in unheard ways. Parameters of all of these 'part of the synthesizer' effects can be modulated to create lively sounds. The only 'real' effects are found in the 'dynamics' section offering compressors and distortion effects to create more punch, warmth and dirt.

RAZOR comes with more than 300 professionally designed presets. Its factory library contains a large variety of basses and lead sounds as well as soundscapes and special effects. Modifying these sounds or creating new ones is an easy task. RAZOR offers familiar parameters to control its powerful additive engine under the hood. Its interface is intuitive and straight forward and has just the right balance of complexity versus usability. All active parts are visible to ease the workflow.

RAZOR features a huge graphical display showing the exact spectrum at certain points in the signal chain of the synthesizer and more. It makes it easy to set up sounds, as the impact of parameter changes can be seen immediately on the display. Besides giving this informative feedback to the sound designer, the display is able to show beautiful animations, especially if set to 3D mode. You might find yourself creating nice 3D animations with RAZOR for hours and totally forget about music making! (Don't miss the hidden tricks for the 3D mode described in the section 'Graphical Display' below)

Additionally, RAZOR REAKTOR features a 34 band vocoder which is a gem by its own. The analyzer part is done using the classic bandpass approach. Imprinting the analyzed band amplitudes on an instrument voice is done in the additive engine of the synthesizer resulting in a high quality vocoder sound.

3 Installation and Activation

3.1 Installing RAZOR

The following section explains how to install and activate RAZOR. Although this process is straightforward, please take a minute to read these instructions, as doing so might prevent some common problems.

► To install RAZOR, double-click the installer application and follow the instructions on the screen. The installer application automatically places the new Ensemble files into a REAKTOR PLAYER directory. Alternatively, during the installation process, choose the directory where you would like to have RAZOR installed.



REAKTOR 5.5 or REAKTOR PLAYER is required to play REAKTOR Instruments and Effects. You can download the free REAKTOR PLAYER from the Native Instruments website.

3.2 Activating RAZOR

When installation is finished, start the Service Center application, which was installed with RAZOR. It will connect your computer to the Internet and activate your RAZOR installation. In order to activate your copy of RAZOR, you have to perform the following steps within the Service Center:

1. **Log in:** Enter your Native Instruments user account name and password on the initial page. This is the same account information you used in the Native Instruments Online Shop, where you bought your REAKTOR Instrument, and for other Native Instruments product activations.
2. **Select products:** The Service Center detects all products that have not yet been activated and lists them. You can activate multiple products at once—for example, several REAKTOR Instruments.
3. **Activate:** After proceeding to the next page, the Service Center connects to the Native Instruments server and activates your products.


4. **Download updates:** When the server has confirmed the activation, the Service Center automatically displays the Update Manager with a list of all available updates for your installed products. Please make sure that you always use the latest version of your Native Instruments products to ensure they function correctly.




Downloading updates is optional. After activation is complete, you can always quit the Service Center.

4 How to Use RAZOR

The following sections will give you a brief overview over some basic operations: you will learn how to open RAZOR, how to explore the factory-set Snapshots and how to load and play RAZOR snapshots from the Main bar and the Sidepane.

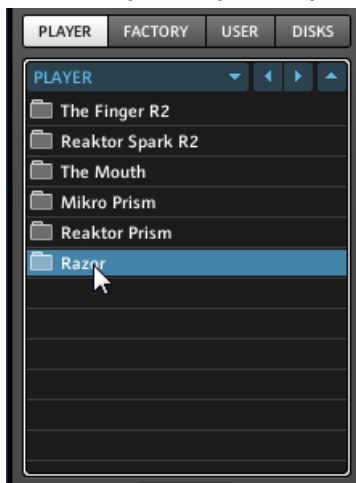
 For latest information on REAKTOR PLAYER files please refer to the REAKTOR 5.5 Getting Started Guide.

 Note that RAZOR generates up to 320 oscillators per voice, and needs more CPU power than other REAKTOR instruments.

4.1 How to Open RAZOR

This is how to open RAZOR in REAKTOR or REAKTOR PLAYER:

1. Start REAKTOR or REAKTOR PLAYER.
2. In the Browser on the left side of the REAKTOR / REAKTOR PLAYER window, click the [Player](#) button to show the REAKTOR PLAYER files (you can open the browser with the F5 key from your keyboard).



3. Click the *Reaktor RAZOR* folder. The folder's content will be displayed in the lower section of the browser.

4. Double-click the *RAZOR.rkplr* file, or drag it into the main screen.
5. RAZOR will be loaded in REAKTOR / REAKTOR PLAYER:



4.2 Exploring Snapshots

If you loaded RAZOR play some notes on your MIDI keyboard to get an idea of how the synthesizer sounds. Then, let's change the sound completely by loading a different Snapshot.



A Snapshot is REAKTOR's notion for a sound, preset, or patch. RAZOR can hold banks of Snapshots, and loading any of these Snapshots will set each control of to a specific value, and re-create a particular sound.

The Snapshots of RAZOR are accessible from the central control in REAKTOR PLAYER's Main Bar or from the Sidepane.



Fig. 4.1 RAZOR interface with Snapshot list in the Sidepane.

- [1] Sidepane Button
- [2] Snapshot drop-down menu
- [3] Snapshot Banks
- [4] Snapshots

4.2.1 Loading a Snapshot from the Sidepane

If not already visible after startup, you need to open the Sidepane. The Sidepane holds a full overview of REAKTOR's Snapshot Banks and Snapshots from the currently selected Snapshot Bank.

1. Click the Sidepane button (1) in the Main Bar to open the Sidepane.
2. Select a Snapshot Bank (3).
3. Select the name of a Snapshot entry (4).

The name of the selected Snapshot will be highlighted in the Sidepane, and the Snapshot loaded and ready in RAZOR.

4.2.2 Loading a Snapshot from the Main Bar

Loading a Snapshot from the REAKTOR PLAYER drop-down menu in the Main Bar is the simplest way to interact with Snapshots.

1. Click the Snapshot drop-down menu control **(2)**. The menu holds all Snapshots and Banks of the instrument.
2. Click an entry to select it.

4.3 Saving a Snapshot

Snapshots can only be saved when using the full version of REAKTOR; however, all your settings will be recalled perfectly in a host if you are using REAKTOR PLAYER, so you can tweak a sound perfectly for your song. All parameter settings made in RAZOR will be saved as part of your DAW project. Please read the REAKTOR documentation for more information on plug-in mode.



For the latest information on REAKTOR PLAYER please refer to the REAKTOR 5.5 Getting Started Guide.

5 Overview of RAZOR Ensemble

This part of the manual gives an overview of RAZORS interface and signal flow and explains all its controls. RAZOR is an extremely graphic synthesizer as you can see the spectrum of oscillator shapes, filter curves and even the frequency depending panning of the signal. To learn the instrument it is highly recommended to turn the graphical display to 'Auto' and switch off '3D'. This will help you to understand what the parameters are actually doing. This is easier than any written explanation. For more information about the display see the paragraph 'graphical display' below.

RAZOR was designed to give its user intuitive control over its powerful additive engine. So you don't have to be a synthesizer specialist to edit and create sounds with it. But it might be helpful to gain some knowledge about the concept of additive synthesis to fully understand some of RAZORS features. It's out of the scope of this manual to explain additive synthesis. Search on the internet for more information. A search for 'Introduction to additive synthesis' and 'Fourier series' might be a good start.

5.1 Overview of RAZOR User Interface

The Interface is divided horizontally in three main parts.

The main synthesizer is located in the middle. There are two oscillators on the left that are mixed together before they get filtered by filter 1 and then by filter 2. The next section to the right of the filters is called 'Dissonance', offering effects to make the sound non-harmonic; followed by the 'Stereo' section with various stereo effects. At the very end of the chain you find the 'Dynamics' section with effects to alter the amplitude dynamics of the sound like saturators and compressors. The Dynamics section is the only part of the RAZOR not using additive synthesis.

Modulators like envelopes and LFOs are located at the bottom. These can be routed to various destinations. Envelope 1 is pre-assigned to the amplitude.

At the top you find a multi-functional display, some global controls like Pitch, 'Voice Mode', a value display and 'Quality'. At the top right there are two sections offering unique features named 'Spectral Clip' and 'Safe Bass'. 'Spectral Clip' takes the filtered signal and limits loud spectral peaks. 'Safe Bass' makes sure that there is always some energy at the fundamental frequency, which is crucial for bass sounds. After 'Safe Bass' the signal enters the 'Stereo' effect section.



Fig. 5.1 Razors User Interface.

- **[1] GLOBAL CONTROLS:** Contains the Mono/Poly switch, the value display, the quality selector and the master volume knob.
- **[2] GRAPHIC DISPLAY:** Multifunctional graphical display showing the frequency spectrum of oscillators and filters, the panning per partial of the stereo effects and more.
- **[3] VOICING:** Controls for the global pitch and the phase of the oscillators.
- **[4] SPECTRAL CLIP:** A tool to limit loud spectral peaks in the output of the filter stage.
- **[5] SAFE BASS:** A tool to assure that there is always some energy at the fundamental frequency.
- **[6] OSCILLATOR 1:** Creates a repetitive signal with a settable wave shape. Both oscillators are mixed and passed on to FILTER 1.
- **[7] OSCILLATOR 2:** Creates a repetitive signal with a settable wave shape. Both oscillators are mixed and passed on to FILTER 1.

- **[8] FILTER 1:** Filters the oscillator mix. Offers several filter types that are capable of damping high frequencies.
- **[9] FILTER 2:** Filters the signal from FILTER 1. Offers several filter types that combine well with FILTER 1.
- **[10] DISSONANCE EFFECTS:** Offers effects to make the sound dissonant.
- **[11] STEREO EFFECTS:** Offers effects to make the sound stereo like panning effects, chorus and reverb.
- **[12] DYNAMIC EFFECTS:** Offers effects to change the dynamics of the output signal from the additive synthesizer including compressors and distortion effects.
- **[13] MODULATORS:** Contains controls for modulators like envelopes, LFOs etc.

5.2 Overview of Signal Flow

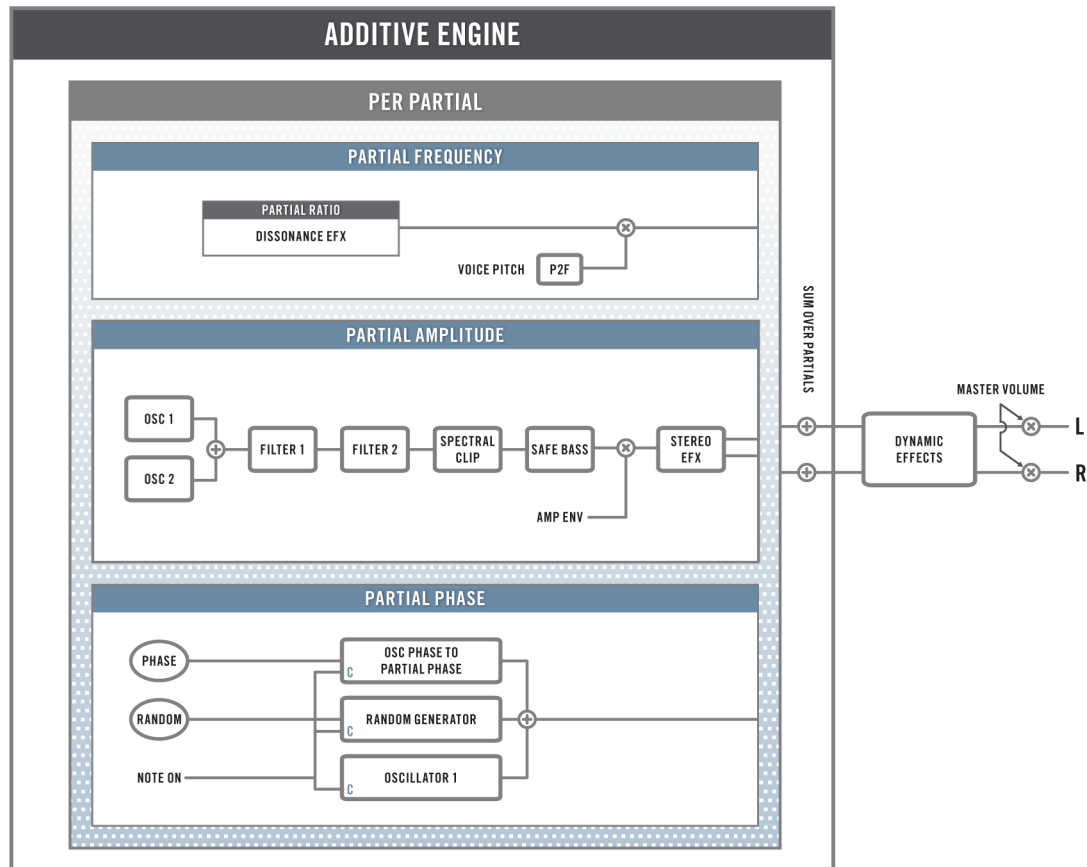


Fig. 5.2 Signal Flow

The synthesizer part of RAZOR consists of the **Additive Engine**, which is one big oscillator: A 'sine bank', a new module in Reaktor 5.5, that is set up to generate up to 320 sinus oscillators called **Partials** and mix them together for one synthesizer voice. The above-men-

tioned oscillators, filters, dissonance effect and even the stereo effects are simulated by this one big oscillator. Their settings are used to calculate the individual frequency, amplitude and phase of each partial.

As you can see in the Signal Flow graphic above, the **second oscillator** doesn't have its own 'sine bank'. It, like all mentioned 'additive' sections, affects the same set of partials. Mixing two oscillators just results in alteration of the partials' amplitudes, it doesn't change the numbers of partials nor their frequencies. This partial sharing means that detuning the oscillators to each other is restricted to certain frequency ratios. Setting the two oscillators to beat to each other is possible, but this is just a simulation. RAZOR simulates the amplitude modulation of each partial that occurs when two oscillators beat to each other. For more on that subject please read the explanation of 'RATIO' in the oscillator section below. The reason not to have an independent second oscillator is to save CPU consumption: the numbers of partials would have to be doubled, which would double the CPU consumption too.

The **Stereo Effects** are part of the additive engine. They alter the partial amplitude for the right and left stereo channel independently. They do not process an audio signal. Some like 'auto-pan' set the partials panning, 'chorus' simulates differently tuned comb filters for each channel. Reverbs are mixing a filtered noisy tail to the dry signal. This mixing is similar to the oscillator mix: the wet signal is not an additional 'sine bank' or the output from a delay network like normal reverbs. It just changes the amplitude of the 'sine bank' partials, the very same that generate the dry signal.

The frequency ratio of the partials in relation to the fundamental frequency is affected only by the **Dissonance Effects**. If they are not active the partials have a harmonic tuning. That means their frequencies are integer multiplies of the fundamental frequency. The position of the dissonance effects in the signal flow of the other sections like Oscillators and Filters cannot be pinned down. It depends on the selected filter types. But in most cases the dissonance effect is applied to the Oscillator mix before it is filtered.

The **phases of the partials** are set at the beginning of the note. They are affected by the Phase Controls in the Voicing section and by waveforms of oscillator 1.

The output of the additive engine is fed into the **Dynamic Effect** section. These are the only 'real' effects as they process an audio signal.

5.3 Common Controls

There are some controls that are used at several positions on the user interface that have the same functionality. They are explained here for Filter 1.

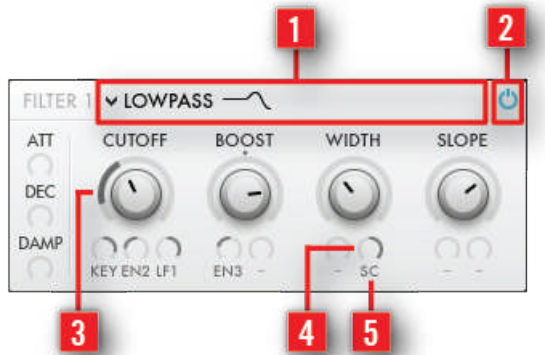


Fig. 5.3 Common Controls.

- **[1] Selector:** The main sections like oscillators, filters, dissonance, stereo and dynamics have a selector in their header to select different types of effects, filter curves and wave shapes. To change a selection, click on the selector icon. A picker page will pop up on the display. Click on an entry to select it or click on the selector again to cancel.



In fact the click area of the selector includes the name field and its icon.

- **[2] On / Off Button:** Most synthesizer sections have on/off buttons in their upper right corner. If 'off' the their controls disappear, so only active controls are shown. Sections that have no effect because of their setting (like 'amount' set to zero), should be turned off in order to save CPU.
- **[3] Modulation Indicator:** The ring around modulatable parameters shows the modulation offset to the parameter.

- **[4] Modulation Amount:** Every parameter that has a modulation amount knob underneath it can be modulated. The modulation amount can be positive and negative. In mid position the modulation amount is zero. In this case the modulation source should be set to 'none'. This helps to save CPU.
- **[5] Modulation Source:** Displays the selected modulation source. Click on this area to select a new one. Then a picker page will pop up on the display. Click on an entry to select it or click on the modulation source area again to cancel.

! Tracking modulators routed to pitch or cutoff frequency related parameters is a special case of modulation: Then A modulation amount of 100 results in a 'linked' behavior. That means that an octave jump in the modulation source results in an octave jump at the modulated parameter. For more information for the tracking modulators see the 'modulator' section below.


5.4 Global Controls


This area contains controls which affects the whole instrument.




Fig. 5.4 Global Controls.

- **MONO / POLY:** MONO activates the monophonic voice mode. Only one voice is generated by the instrument. POLY activates the polyphonic voice mode. The number of voices can be set in the instrument properties (properties are not accessible in REAKTOR PLAYER). RAZOR has 6 voices as default.
- **SINGLE TRIGGER:** Available in MONO mode. If on 'single trigger' mode is active: Note on events that occur while a note is held don't start a new note. The pitch of the held note is updated instead.
- **VOICE LIMIT:** Available in POLY mode. Opens a dialog to set the numbers of voices in the low range. That is below the G1 (note #31) on the MIDI keyboard. Lower notes take more CPU power. If you do not intend to play chords in the lower key range, you can save some CPU by lowering the number of bass voices. 3 bass voices should be enough for most cases. If set to 'max' there is no limitation of polyphony which can result in high CPU consumption.

 Voice limit dynamically reduces the numbers of voices set in the instrument properties (the properties are not accessible in REAKTOR PLAYER). Lets say the number of bass voices is set to 1. If you play a chord in the higher key range and play a G1 or below the chord voices are turned off. This might be a drastic behavior but it keeps the CPU in check: RAZOR will not take more CPU than the set numbers of bass voices by themselves are taking. Set to one, the polyphonic mode will not take more CPU than the monophonic mode!

 Voice limit will also turn off voices if some dissonance effects like CENTROID increase the CPU too much.

- **Value Display:** Every time you turn a knob its value is shown on this display for a short period of time.

 If you just want to readout the value of a knob without changing it you can use this little trick: Click on a knob to select it. Then press the 'arrow up' button on your computer keyboard once. That set the knob to its next position. Now press the 'arrow down' button to undo the change: the initial value is shown.

- **QUALITY:** Selects the audio quality. Lower settings can be used to reduce CPU consumption. The higher the quality, the faster the update rate of the additive synthesizer engine. Fast changing sounds can benefit from a faster update rate. Also usually only partials which are below 16 KHz are calculated. If the pitch stays the same during the time a note is held this doesn't make a big difference. But in case the note starts with a certain pitch and is pitched down afterwards phase artifacts might be heard. These can be interesting though. Only in monophonic mode and **QUALITY** set to high all 320 partials are calculated unconditionally.
- **OUTPUT:** Sets the level of outgoing audio signal of the instrument.

5.5 Voicing

This section contains controls for the instrument pitch and the phase setting of the oscillators.

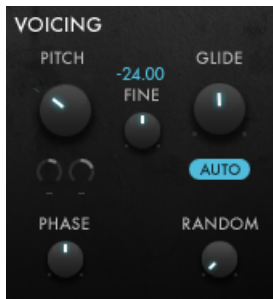


Fig. 5.5 The VOICING section.

- **PITCH:** Sets the pitch (semitones) of the instrument.
- **FINE:** Fine pitch (cents).
- **Pitch Display:** Shows the manual set pitch (semitones). Pitch modulation isn't taken into account.
- **GLIDE:** Sets the glide time from one note to the next. Set to minimum no glide occurs.
- **AUTO:** If on the pitch glide only happens when notes overlap in time.
- **PHASE:** Sets the oscillator phase. Set to the maximum turns on 'free run' mode. Then the oscillators aren't reset at note on, resulting in a more analog always changing attack.



Phase setting helps you to design the attack of the sound. You can set the start of the waveform nearer to transients within the waveform to get more punch and vice versa. If clicks occur with certain phase setting you might want to adjust the attack of envelope 1. Which is the amplitude envelope. Watching the wave on the 'Scope' is helpful to set the phase.

- **RANDOM:** Amount of randomization of the partial phase at note on. This results in a more blurry sound as transients in the waveform are smeared. E.g. a sawtooth with fully randomized phases doesn't have a saw-like shape anymore. Its transient, the jump over the x axis has vanished completely. Watching the wave on the 'Scope' is helpful to set this parameter.

Phase randomization can be used to make dissonant effects sound more consistent. If the amount of dissonance in one of the dissonance effect goes back to zero the partial's frequency are back to their harmonic position but the partial's phase are still messed up. With the next note on the phases are reset, which results in a different sound although no parameter has changed. If this inconsistency is unwanted the phases need to be randomized.

5.6 Graphical Display

Multifunctional display. The content of the graphical display in the upper mid is selected by the radio buttons underneath it. Most of them select a 'partial' display: The level or the panning of each partial along the frequency axis is shown.

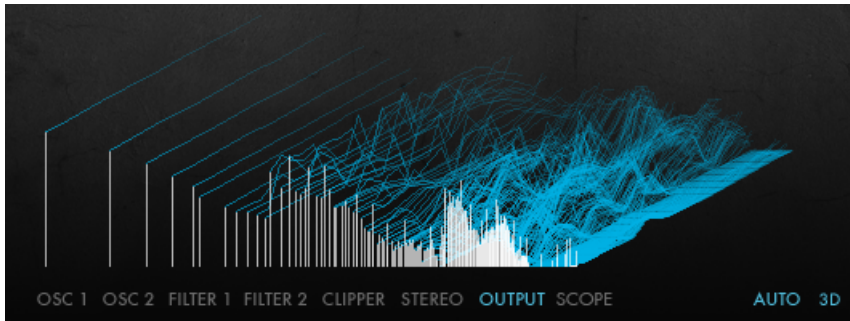


Fig. 5.6 Graphical Display.

- **OSC 1:** Shows the spectrum of oscillator 1.
- **OSC 2:** Shows the spectrum of oscillator 2.
- **FILTER 1:** Shows the filter curve of filter 1.
- **FILTER 2:** Shows the filter curve of filter 2.
- **CLIPPER:** Shows the **SPECTRAL CLIP** threshold curve and its effect on the partial levels. The curve is red in case **SPECTRAL CLIP** is active, grey otherwise.
- **STEREO:** Shows the partial panning resulting from the stereo effects.
- **OUTPUT:** Shows the spectrum of the output of the additive engine. That is after the 'Stereo' effects and prior the 'Dynamics' effects.
- **SCOPE:** Shows the time signal at RAZORs output. That is after the 'Master' volume control. There is one scope for each stereo channel. The length of one wave cycle is made fit to screen.
- **AUTO:** If on the display automatically selects the synthesizer section that is edited. So if you turn a knob in oscillator 1 the display will jump to **OSC 1**. **AUTO** needs to be turned off in case of unwanted jumps caused by parameter automation from the VST host or from a MIDI controller.

- **3D**: Sets the partial display into 3D mode. Hidden tricks: left click and drag on the display sets the perspective, right click and drag sets the amount of decay. Caution: The 3D mode is CPU intensive. Reaktor's CPU display doesn't reflect this cause 3D drains the graphic thread. In case the graphic interface (like knob movement) gets less responsive it is recommended to turn 3D off. Also during music production where you normally don't need 'Eye-Candy' it is recommended to turn 3D off to save CPU for more important tasks. Also for sound design it is recommended to turn 3D off as it makes it more difficult to see what happens to the partials when parameters are changed.



The impact of the 'dissonance' effects can be seen in 'partial' style displays. 'Dissonance' effects alter the frequency of the partials, so the position of the partials along the frequency axis in the display gets altered too.

5.7 Spectral Clip

'Spectral Clip' limits loud spectral peaks in the output signal of the filter stage. It has a spectral curve similar to a lowpass filter that acts as an upper limit to the partial amplitudes. When you turn on 'Clip' in the display you will see a line that shows where the partials are being stopped. This line is red if 'Spectral Clip' is on and grey if it is off. There is no clipping artifact or extra harmonics created. This is very useful for limiting resonance but can also be creatively used to color the voice like a lowpass filter.



Fig. 5.7 Spectral Clip.

- **CLIP**: Overall threshold level (dB) of the clipper curve.
- **PITCH CUT.**: Cutoff frequency (semitones) of the clipper curve. It automatically follows the global pitch.
- **SLOPE**: Slope (dB/Oct) of the curve after the cutoff frequency.



Often a resonant filter with lots of boost will get too 'boomy' when its resonant frequency gets close to the fundamental frequency of the oscillator while sounding great otherwise. Spectral Clip helps in this case: Set SLOPE to zero and set the CLIP LVL to a point where the boost in this band gets enough limiting.



Two resonant filters in series might sound great except when the resonances of both filters lay on top of each other resulting in too much boost in that frequency band. Set SLOPE to zero and set the CLIP LVL so that the spectrum before the band with the overlaying boost is just not touched by the clipper curve. Then set SLOPE to -6 and set P CUT so that the clipping curve hits the boomy band so that it is limited. Try to fine-tune all 3 parameters to get the best result.

5.8 Safe Bass

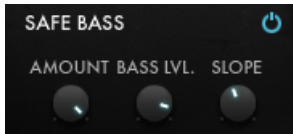


Fig. 5.8 Safe Bass.

'Safe Bass' is a tool to assure that the low partials are always heard regardless of oscillator and filter settings. It processes the signal that comes from the 'Spectral Clip' and is the last stage before the amplitude envelope is applied and the 'stereo' effects. It adds a saw shaped signal to the bottom of the frequency range.

- **AMOUNT:** Defines how much amplitude of the lower partials are taken over by the 'Safe Bass' signal. If set to 1, the amplitude of the first partial is completely independent of the input signal that comes into 'Safe Bass'.
- **BASS LVL:** Sets the level (dB) of the 'Safe Bass' signal.
- **SLOPE:** Sets the spectral slope of the 'Safe Bass'.



Start with full AMOUNT and set BASS LVL and SLOPE to your liking. If you want to bring back some of the partial amplitude changes from prior 'Safe Bass' reduce AMOUNT a bit.



If the oscillators are pitched shifted with the RATIO control, the 'Safe Bass' signal can be used as an additional sub oscillator.

5.9 Oscillators

Oscillators are the signal source of the synthesizer. They usually create a full and bright sound so the filters get a signal they can work on. Their pitch and phase depends on the setting in the VOICING section.

Oscillator 1 and 2 are almost the same. One difference is that oscillator 1 sets the partial phase. As only the 'Formant waves' oscillator type sets the partial phase other than zero (like in a sawtooth) it is this waveform that sounds slightly different in both oscillators. the difference is more obvious with lower notes. For more info on that topic read the description of the 'Formant waves' oscillator type below. The second difference is that oscillator 2 has two decimal digits for **RATIO**. For more info see the description of the **RATIO** control below.

5.9.1 Common controls for all oscillator types

The oscillator sections contain controls that are available for all oscillator types.



Fig. 5.9 Common controls for all oscillator types.

- **AMP**: Amplitude of the oscillator. This is the place for amplitude modulation in RAZOR beside the amplitude envelope. Both oscillators can have their own amplitude modulation allowing interesting crossfades and layers.
 - 💡 For crossfades the same modulator has to be connected to the 'Amp' of oscillator 1 and 2 but using inversed modulation amount (one is positive, the other negative) so while one oscillator is faded in the other gets faded out.
 - 💡 Layers can be used to get more punchy sounds: Only at the beginning of a note the second oscillator with a bright tone is mixed to oscillator 1 for a short time. To realize that set 'Amp' of oscillator 2 to zero and modulate it with envelope 2 or 3 (envelope 1 is used already for the overall amplitude) with a positive modulation amount. Set the envelope times to generate a short click.
- **RATIO**: Frequency ratio of the oscillator in multiples of the fundamental frequency of the synthesizer voice. Octaves correspond to values 2 4 8 16 and 32. In oscillator 2 the decimal digits of **RATIO** set the beating of oscillator 2 against oscillator 1. Beating doesn't change the frequency of oscillator 2. Beating is simulated by amplitude modulation of each partial that occurs when two oscillators beat to each other. If oscillator one is muted beating doesn't have any effect.

- **COLOUR:** One-control equalizer that sets the overall spectral tilt.

5.9.2 Pulse to Saw

Offers the classic pulse and sawtooth oscillator shapes.



Fig. 5.10 Pulse to Saw Oscillator.

PULSE/SAW: Blends between pulse and sawtooth oscillator shape.

5.9.3 Duo Saw

Simulates the mix of two sawtooth waves with a settable frequency ratio and beating.



Fig. 5.11 Duo Saw Oscillator.

- **RATIO 2:** Frequency ratio of the additional sawtooth oscillator.
- **BEATINGS:** Amount of beating between the two saws.

5.9.4 Pulse Width

Pulse oscillator with a settable pulse width. The resulting wave shape is not like a classic pulse oscillator although the sound is almost the same.



Fig. 5.12 Pulse Width Oscillator.

PW: Pulse width. In the middle position a symmetric pulse shape is achieved. In the minimum or maximum position the pulse gets so short that it disappears and no sound is heard.

5.9.5 Hoover

A special pulse width waveform that needs CHORUS as 'stereo' effect to sound similar to the classic 'Hoover' sound.



Fig. 5.13 Hoover Oscillator.

PW: Pulse width of the oscillator.

5.9.6 Sync Classic

Classic oscillator sync sound.



Fig. 5.14 Sync Classic Oscillator.

- **SYNC**: Pitch offset (semitones) of the synced oscillator.
- **PULSE/SAW**: Blends between pulse and sawtooth oscillator shape.

5.9.7 Sync Dissonance

Similar to the classic sync sound but with a dissonant feel although it's not changing the harmonic tuning of the partials.



Fig. 5.15 Sync Dissonance Oscillator.

SYNC: Pitch offset (semitones) of the synced oscillator.

5.9.8 Primes

Creates an oscillator signal that contains all prime or non-prime numbered partials.

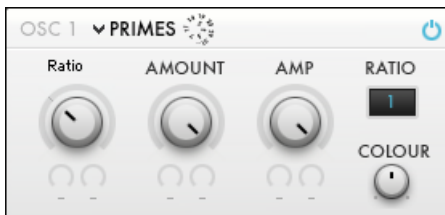


Fig. 5.16 Primes Oscillator.

- **RATIO**: Frequency ratio of the oscillator.
- **AMOUNT**: Blends between non-prime and prime numbered partials. In the middle it results in a sawtooth.

5.9.9 Number Pitchbend

Like all 'Pitchbend' oscillator types 'Number Pitchbend' creates pseudo pitchbended sounds. It's not a real pitchbend. The pitch of the oscillator is not altered at all. The pseudo pitchbend is achieved by special filtering: Partial that are near to partials of a pitch-

bended copy of the oscillator are let thru. Most pseudo pitchbend types create a clean and correct pitchbend for octave intervals as partials of an oscillator pitched up by octaves are shared by the unpitched oscillator.



Fig. 5.17 Number Pitchbend Oscillator.

- **P OFFS**: Pitch offset (semitones).
- The Pitchbend Quantization switch selects different quantization steps of the pitchbend. The order of the entries reflects the perceived dissonance, although the harmonic tuning of the partials isn't altered. **OCT**: Octave steps, **EVEN**: Even numbered partials, **ALL**: All partials, **ODD**: Odd numbered partials.

5.9.10 Mixed Pitchbend

A special comb filter is used on a sawtooth oscillator that sounds like pitch shifting. Other than the other pseudo pitchbend oscillator types not a pitch offset is set but the absolute pitch.



Fig. 5.18 Mixed Pitchbend Oscillator.

- **P**: Pseudo pitch (semitones) of the oscillator.
- **AMOUNT**: Amount of filtering.

5.9.11 Sick Pitchbend

Similar to 'Number Pitchbend' but with a quantization step size set in semitones. Can result in sounds with a dissonant touch although the partial tuning is still harmonic.



Fig. 5.19 Sick Pitchbend Oscillator.

- **P OFFS**: Pitch offset (semitones).
- **STEP SIZE**: Switch selects different quantization steps (Semitones) of the pitchbend.

5.9.12 Octaves to Saw

Creates a waveform that contains only partials at octave intervals of the fundamental frequency.



Fig. 5.20 Octaves to Saw Oscillator.

OCT/SAW: Morphs between 'octaves' waveform and sawtooth.

5.9.13 Pitched Noise

Offers a mix of 'frozen noise' and 'pitched noise'. The noise is created by randomizing the partial amplitudes. For the 'frozen noise' the randomization occurs only when a new random number set is selected with the **SEED** parameter. 'pitched noise' is generated by randomization of the partial amplitudes at a constant rate.

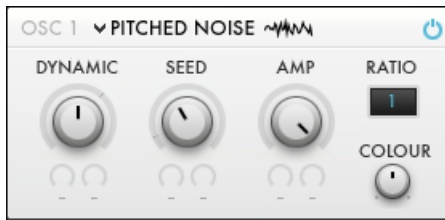


Fig. 5.21 Pitched Noise Oscillator.

- **DYNAMIC:** Blends between 'frozen noise' and 'pitched noise'.
- **SEED:** Sets a different set of random numbers for the 'frozen noise'.

5.9.14 Synced Noise

Offers a mix of 'frozen noise' and 'synced noise'. The noise is created by randomizing the partial amplitudes. For the 'frozen noise' the randomization occurs only when a new random number set is selected with the **SEED** parameter. 'synced noise' is generated by randomization of the partial amplitudes at note on.



Fig. 5.22 Synced Noise Oscillator.

- **DYNAMIC:** Blends between 'frozen noise' and 'synced noise'.
- **SEED:** Sets a different set of random numbers for the 'frozen noise'.

5.9.15 Formant

Offers several wave shape presets. This is the only oscillator type that sets the partial phase different than 0. But only oscillator 1 can alter the phase. So this oscillator type sounds different in oscillator 1 and 2. If 'Formant' is selected in oscillator 1 and oscillator 1 is on it sets the partial phase even if its 'Amp' is zero. That affects the sound of oscillator 2 then. That can be used in a creative way as oscillator 1 imprints its partial phase on

all waveforms selected in oscillator 2. Even a sawtooth in oscillator 2 sounds a bit different then although its amplitude spectrum hasn't changed. The effect of altered partial phases is more audible with lower notes.

The 'Formant' filter type in the filters share the same formant selections as the oscillators. Some wave shape presets have lots of narrow spectral notches. In this case formant shifting can result in fast amplitude jumps for gritty sounds.

This oscillator type is very versatile. It's an oscillator-filter hybrid as formant shifting sounds like filtering a sawtooth oscillator. As the signal of both oscillators are mixed together this filter quality can be used to create parallel filtering in RAZOR.



Fig. 5.23 Formant Oscillator.

- **FORMANT:** Amount of formant shift (semitones) to the spectral curve of the waves. To get the original wave shape set this parameter to 0 (mid) and modulate it with the 'pitch track' modulator using an amount of 100 (fully right).
- **SELECT:** Selects one of 32 wave shapes: 1-3: for subtle coloration and grittiness, 4-11: phasey and peaky 12-19: lowpass 20-23: bandpass & highpass 24-27: notch 28-32: harmonic.

5.10 Filter 1

Filter 1 filters the oscillator mix and passes it on to filter 2. It contains filters which are capable of damping high frequencies. So you find lowpass filters in different varieties but also more unusual filter like 'Vowel', a high quality 'Vocoder' or 'formant' filters.

The Cutoff parameter of filter 1 can be used as a macro control via the FILTER 1 TRACK modulator. See its description in the 'Modulators' section of this manual.

5.10.1 Filter Smoother

On the left hand side of the filter the 3 controls of the 'Filter Smoother' are located. It's active for all filter types. It smoothes fast amplitude changes caused by the filter for each partial. With extreme settings the smoothing results in reverb like effects.



Fig. 5.24 Filter Smoother.

- **ATT:** Attack time of the smoother. Defines the amount of smoothness if the partial amplitude is rising.
- **DEC:** Decay time of the smoother. Defines the amount of smoothness if the partial amplitude is falling.
- **DAMP:** High frequency damping. It reduces the decay time of the smoother for higher frequency partials.

5.10.2 Lowpass

Lowpass filter with extended features to the classic lowpass design.



Fig. 5.25 Lowpass Filter.

- **CUTOFF:** Cutoff frequency (semitones) of the filter.
- **BOOST:** Boost at the cutoff frequency. Negative values create notches.
- **WIDTH:** Bandwidth of the boost.
- **SLOPE:** Filters slope (dB/Oct) in the cut band. If set to maximum, this filter acts as a peak EQ.

5.10.3 Lowpass Ramps

Lowpass filter with an edgy shape.



Fig. 5.26 Lowpass Ramps Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter.
- **BOOST**: Boost at the cutoff frequency. Negative values create notches.
- **WIDTH**: Bandwidth of the boost.
- **SLOPE**: Filters slope (dB/Oct) in the cut band. If set to maximum, this filter acts as a peak EQ.

5.10.4 Lowpass Broad

Lowpass filter with an extra-broad resonance.



Fig. 5.27 Lowpass Broad Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter.
- **BOOST**: Boost (dB) at the cutoff frequency.
- **BANDWIDTH**: Bandwidth (semitones) of the boost.
- **SLOPE**: Filters slope (dB/Oct) in the cut band. If set to maximum, this filter acts as a shelving EQ.

5.10.5 Lowpass Phaser

Lowpass filter with a phasing resonance.

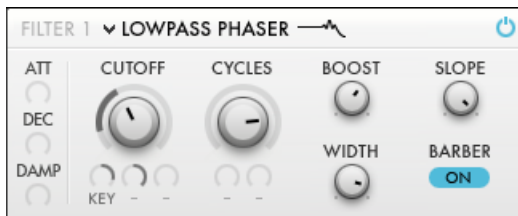


Fig. 5.28 Lowpass Phaser Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter.
- **CYCLES**: Number of phaser ripples in the resonance.
- **BOOST**: Boost (dB) at the cutoff frequency.
- **SLOPE**: Filters slope (dB/Oct) in the cut band.
- **WIDTH**: Bandwidth (semitones) of the boost.
- **BARBER**: Turns on 'Barberpole' mode resulting in ever falling phaser ripples. The movement is hardwired to LFO 2.

5.10.6 Lowpass Dirty

Lowpass filter with a distorted filter shape.



Fig. 5.29 Lowpass Dirty Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter.
- **RES**: Amount of resonance at the cutoff frequency. More resonance results in a more distorted filter curve.
- **STRETCH**: Stretches the filter curve from a thin resonance to wide. It's similar to filter bandwidth.

5.10.7 Bandpass

Bandpass filter consisting of a resonant lowpass and resonant highpass filter in series.



Fig. 5.30 Bandpass Filter.

- **CUTOFF**: Mid cutoff frequency (semitones) between the lowpass and highpass filter.
- **BOOST**: Boost (dB) at the cutoff frequency of both filters. Can be negative to create notches.
- **BANDWIDTH**: Bandwidth (semitones) of the filter combination. It affects the frequency distance between the lowpass and highpass filter.
- **SLOPE**: Filter slope (dB/Oct) of both filters in the cut band.
- **BOOST BW**: Bandwidth of the resonance boosts.

5.10.8 EQ Decay

Five-band graphic equalizer with a unique decaying feature. At note on the EQ is reset to the levels set by the faders. During a note the levels are decaying / rising depending on set 'Decay' and the fader positions. This effect is similar to an EQ that is put inside a feedback delay loop where the audio signal gets EQ'ed again and again.



this filter type can be used to create plugged string kind of sounds.



Fig. 5.31 EQ Decay Filter.

- **P Offs:** Pitch offset (semitones) to the mid frequencies of the five frequency bands.
- **Decay:** Decay time scaling for the five frequency bands. If set to max the bands don't decay at all like in a normal EQ.
- **LO .. HI:** These faders set the boost or attenuation for the five frequency bands. With 'Decay' not set to max the level of the bands are decaying/rising. The decay time depends on the set boost/attenuation. With positive boost values the bands levels rise, with negative boost values they fall. There is an upper limit so the boosts don't rise to unpleasant levels.

5.10.9 Vowel

Vowel filter for simulating human vowel sounds.



Fig. 5.32 Vowel Filter.

- **FORMANT:** Amount of formant shift (semitones) of the filter. Can be used to get a 'mickey mouse' effect.
- **Vowel Selectors:** Select different vowels to be scanned by the Vowel crossfader. 'mid' is an 'in between' vowel that can be used to make smoother transitions from some vowels to others.
- **Vowel Crossfader:** Makes a crossfade between the 3 selected vowels.
- **SINGER:** Morphs between different singer types.
- **SLOPE:** Slope of the used bandpasses. The mid position is the most natural. Higher values result in a brighter sound. Smaller values results in a thinner resonant sound.

5.10.10 Vocoder

A high quality 34 band Vocoder. It uses the audio input of REAKTOR or REAKTOR PLAYER as 'modulator': It analysis the amplitude of 35 frequency bands of the incoming signal and imprints these amplitudes on the oscillator mix. The oscillator mix is the 'carrier' of the vocoder. It's not possible to use an audio signal as 'carrier'. Please read also the paragraph 'How to get RAZORS Vocoder to work' at the end of this manual.



-  Use the COLOR Control of the oscillator to increase the speech intelligibility when using a voice as modulator or to equalize the vocoder sound.
-  Use the Filter Smoother at the left hand side of the filter to alter the vocoding effect.





Fig. 5.33 Vocoder Filter.

- **FORMANT**: Amount of formant shift (semitones) of the filter. Can be used to get a 'mickey mouse' effect if a voice is used as modulator.
- **STRETCH**: Stretches the filter curve of the vocoder along the frequency axis.

5.10.11 Formant

Offers several filter presets. The 'Formant Waves' oscillator type shares the same presets. Some of them have lots of narrow spectral notches. In this case formant shifting can result in fast amplitude jumps for gritty sounds.

-  To smooth these fast amplitude jumps use the ATT, DEC, DAMP controls of the 'Filter Smoother' on the left hand side of the filter.
-  To learn the functionality of the CENTER parameter modulate the STRETCH parameter with an LFO and turn the CENTER knob and see how the filter curve on the spectral display (set to filter 1) is changing.

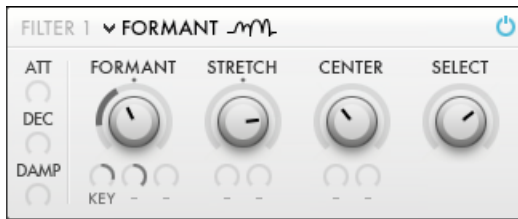


Fig. 5.34 Formant Filter.

- **FORMANT:** Amount of formant shift (semitones) of the filter.
- **STRETCH:** Stretches the filter curve along the frequency axis.
- **CENTER:** Center frequency (semitones) of the stretch. The point on the filter curve at this frequency is unmoved by the stretch while the curve parts below and above this center are stretched away from it.
- **SELECT:** Selects one of 32 wave shapes: 1-3: for subtle coloration and grittiness, 4-11: phasey and peaky 12-19: lowpass 20-23: bandpass & highpass 24-27: notch 28-32: harmonic.

5.10.12 Formant Decay

Similar to 'Formant' filter but with a unique 'Decay' feature. Filter curve affects the decay / rising time of the partial amplitude. This effect is similar to a filter that is put inside a feedback delay loop where the audio signal gets filtered again and again.



Fig. 5.35 Formant Decay Filter.

- **FORMANT:** Amount of formant shift (semitones) of the filter.
- **DECAY:** Master decay / rising time. The actual decay / rising time depends on the filter curve and the 'Thresh' setting.
- **THRESH:** Amplitude threshold. Parts of the filter curve that lie above this threshold are rising in amplitude. Parts below are falling.

- **SELECT**: Selects one of 32 wave shapes: 1-3: for subtle coloration and grittiness, 4-11: phasey and peaky 12-19: lowpass 20-23: bandpass & highpass 24-27: notch 28-32: harmonic.
- **LIMIT**: Upper amplitude limit to prevent unpleasant high amplitudes.

5.11 Filter 2

Filter 2 takes the signal from filter 1 and filters it. It contains filters that combine well with the high frequency damping types of filter 1. That includes a 'Highpass' filter, effect type filters like a 'Phaser' and a 'Comb' filters and innovative new designs like 'Waterbed', 'Gaps' and 'Unisono Noise'.

5.11.1 Filter Smoother

On the left hand side of the filter the 3 controls of the 'Filter Smoother' are located. It's active for all filter types. It smooths fast amplitude changes caused by the filter for each partial. With extreme settings the smoothing results in reverb like effects.



Fig. 5.36 Filter Smoother .

- **ATT**: Attack time of the smoother. Defines the amount of smoothness if the partial amplitude is rising.
- **DEC**: Decay time of the smoother. Defines the amount of smoothness if the partial amplitude is falling.
- **DAMP**: High frequency damping. It reduces the decay time of the smoother for higher frequency partials.

5.11.2 Lowpass

Lowpass filter with extended features to the classic lowpass design.



Fig. 5.37 Lowpass Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter.
- **BOOST**: Boost at the cutoff frequency. Negative values create notches.
- **WIDTH**: Bandwidth of the boost.
- **SLOPE**: Filters slope (dB/Oct) in the cut band. If set to maximum, this filter acts as a peak EQ.

5.11.3 Highpass

Highpass filter with extended features to the classic highpass design.



Fig. 5.38 Highpass Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter.
- **BOOST**: Boost at the cutoff frequency. Negative values create notches.
- **WIDTH**: Bandwidth of the boost.
- **SLOPE**: Filters slope (dB/Oct) in the cut band. If set to maximum, this filter acts as a peak EQ.

5.11.4 Bandpass

Bandpass filter consisting of a resonant lowpass and resonant highpass filter in series.



Fig. 5.39 Bandpass Filter.

- **CUTOFF**: Mid cutoff frequency (semitones) between the lowpass and highpass filter.
- **BOOST**: Boost (dB) at the cutoff frequency of both filters. Can be negative to create notches.
- **BANDWIDTH**: Bandwidth (semitones) of the filter combination. It affects the frequency distance between the lowpass and highpass filter.
- **SLOPE**: Filter slope (dB/Oct) of both filters in the cut band.
- **BOOST BW**: Bandwidth of the resonance boosts.

5.11.5 Bandreject

Bandreject filter consisting of a resonant lowpass and resonant highpass filter in parallel.



Fig. 5.40 Bandreject Filter.

- **CUTOFF**: Mid cutoff frequency (semitones) between the lowpass and highpass filter.
- **BOOST**: Boost (dB) at the cutoff frequency of both filters. Can be negative to create notches.
- **BANDWIDTH**: Bandwidth (semitones) of the filter combination. It affects the frequency distance between the lowpass and highpass filter.
- **SLOPE**: Filter slope (dB/Oct) of both filters in the cut band.
- **BOOST BW**: Bandwidth of the resonance boosts.

5.11.6 Comb Peak

Special filter for flanger and peaky phaser effects.



Modulating the PHASE parameter with a saw shaped LFO results in ever rising or falling comb peaks if the mod amount is set to 50 or -50



Fig. 5.41 Comb Peak Filter .

- **CUTOFF**: Cutoff frequency (semitones) of the filter. If TUNED is off it sets the frequency of the first peak. If TUNED is on it sets the frequency distance of the second peak to the first peak which is tuned to the first partial.
- **BOOST**: Boost at the comb peaks.
- **PHASE**: Phase offset to the recurring comb peaks.
- **STRETCH**: Stretches the filter curve from flanger-like to phaser-like.
- **TUNED**: If on the first peak of the comb is tuned to the first partial (when PHASE set to 0).

5.11.7 Comb Notch

Special filter for chorus and notchy phaser effects.



Modulating the PHASE parameter with a saw shaped LFO results in ever rising or falling comb notches if the mod amount is set to 50 or -50



Fig. 5.42 Comb Notch Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter. If TUNED is off it sets the frequency of the first peak. If TUNED is on it sets the frequency distance of the second peak to the first peak which is tuned to the first partial.
- **SHAPE**: Shape of the notches. Ranges from narrow to broad.
- **PHASE**: Phase offset to the recurring comb peaks.
- **STRETCH**: Stretches the filter curve from flanger-like to phaser-like.
- **TUNED**: If on the first peak of the comb is tuned to the first partial (when PHASE set to 0).

5.11.8 Phaser

Special filter for phaser effects.



Modulating the PHASE parameter with a saw shaped LFO results in ever rising or falling phaser if the mod amount is set to 50 or -50



Fig. 5.43 Phaser effect filter.

- **CYCLES**: Number of phaser cycles.
- **AMOUNT**: Amount of Filtering.
- **PHASE**: Phase offset to the recurring phaser cycles.
- **RAMP**: Amount Ramp. Sets the increase of filtering amount from low partials to higher ones. At minimum the filtering amount is the same for all partials.

- **SHUFFLE**: Selects different phase patterns for recurring phaser cycles.

5.11.9 Waterbed

Special filter that simulates slowly moving waves on a water surface and uses the surface shape as a filter curve. The result sounds like a phaser with an 'organic' character.



Fig. 5.44 Waterbed Filter.

- **FREQ**: Position on the frequency axis (semitones) where the water surface is excited into motion.
- **LEVEL**: Excitation level (dB). Changing it brings the surface in motion.
- **DECAY**: Decay time of the waves due to friction loss.
- **SPEED**: Speed of the waves along the surface.
- **LIMIT**: Upper amplitude limit (dB) for the moving waves to prevent unpleasant loud amplitudes.
- **LO**: Low Reflection. It sets the reflection type of the lower boundary of the water surface. '+' results in a positive reflection keeping the 'sign' of the wave. In other words a wave maxima stays a wave maxima after reflection. '-' results in a negative reflection, toggling the 'sign' of the wave. A wave maxima becomes a wave minima after reflection.
- **HI**: High Reflection. It sets the reflection type of the higher boundary of the water surface. '+' results in a positive reflection keeping the 'sign' of the wave. In other words a wave maxima stays a wave maxima after reflection. '-' results in a negative reflection, toggling the 'sign' of the wave. A wave maxima becomes a wave minima after reflection.

5.11.10 Pseudo Pitchbend

Special combination of a highpass filter and a comb filter that sounds like pitchbent although the pitch of the signal isn't altered. Partial that are near to partials of a pitch-bended copy of the incoming signal are let through.



Fig. 5.45 Pseudo Pitchbend Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter.
- **AMOUNT**: Amount of filtering. Affects the bandwidth of the comb teeth.

5.11.11 Gaps

Special comb filter that cuts hard edged gaps into the signal.



This filter can create fast on/off like amplitude changes to the partial amps. Use the filter smoother to make these amplitude changes less abrupt.



Fig. 5.46 Gaps Filter.

- **CUTOFF**: Cutoff frequency (semitones) of the filter.
- **GAP**: Size of the recurring gaps.
- **INVERSION**: Inverts the spectral curve. All partials that are passed by the filter with inversion set to 0 are cut with inversion set to 1 and vice versa.

5.11.12 Unisono Noise

Special filter that simulates the beatings of several instruments playing the same note simultaneously by applying fast modulation to the partial amplitudes. Can be used to give the sound a noisy character. There is a stereo version of this filter in the stereo effects.

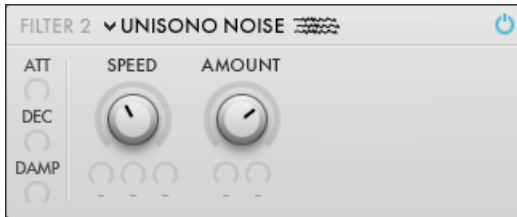


Fig. 5.47 Unisono Noise Filter.

- **SPEED**: Speed of beating. A slow speed sounds like unisono played instruments which have almost the same pitch. With increasing speed it sounds like the unisono played instruments get more and more detuned to each other.
- **AMOUNT**: Amount of filtering.

5.12 Dissonance Effects

These effects alter the tuning of the partials to each other to create unique dissonant sounds. If off the partials have a harmonic tuning. That means that frequency of a partial is a multiple of the fundamental frequency.



Phase randomization set with the RND control in the 'Pitch Phase' section can be used to make dissonant effects sound more consistent: If the amount of dissonance in one of the dissonance effect goes back to zero the partial's frequency are back to their harmonic position but the partial's phase are still messed up. With the next note on the phases are reset which results in a different sound although no parameter has changed. If this inconsistency is unwanted the phases need to be randomized.

5.12.1 Beating

Detunes every xth partial.

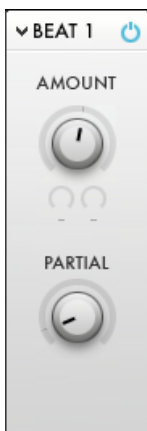


Fig. 5.48 Beating Dissonance Effect.

- **AMOUNT:** Amount of detuning.
- **PARTIAL:** Selects the partials to be detuned.

5.12.2 Beating Tuned

Takes every xth partial, shift its frequency down to the previous partial and detunes it.

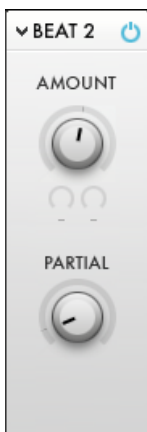


Fig. 5.49 Beating Tuned Dissonance Effect.

- **AMOUNT:** Amount of detuning.
- **PARTIAL:** Selects the partials to be detuned.

5.12.3 Stiff String

Simulates the dissonance of stiff strings.

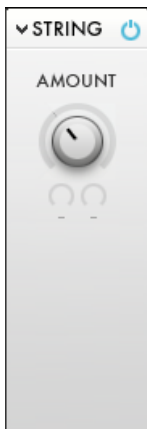


Fig. 5.50 Stiff String Dissonance Effect.

AMOUNT: Amount of dissonance.

5.12.4 Stretcher

Stretches the frequency distance between partials.



If a sawtooth is detuned by this effect an amount of +12 results in a pulse like wave. -12 results in a sawtooth wave detuned by one octave but missing the first partial.

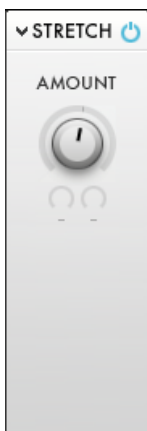


Fig. 5.51 Stretcher Dissonance Effect.

AMOUNT: Amount of stretching (semitones).

5.12.5 Frequency Shifter

Shifts the frequency of all partials by the same amount.

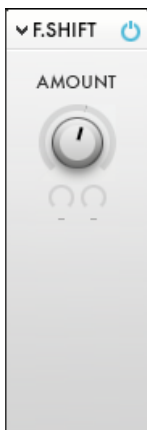


Fig. 5.52 Frequency Shifter Dissonance Effect.

AMOUNT: Amount of frequency shift (semitones).

5.12.6 Centroid

Detunes all partials so they meet at one frequency.



This dissonance effect can create nice percussive and metallic sounds.



Fig. 5.53 Centroid Dissonance Effect.

- **AMOUNT:** Amount of detuning.
- **PITCH:** Sets the frequency (semitones) that all partials are tuned to if 'Amount' is set to full.

5.13 Stereo Effects

Stereo Effects are part of the additive engine. They alter the amplitude of the partials for the left and right stereo channel. They do not process an audio signal. They are polyphonic. That means every voice of RAZOR has its own copy of the set stereo effect. This allows the stereo effect parameters to be modulated by polyphonic modulators like envelopes. So the stereo effects can be used for creative sound design.



Modulation of 'Amount' (or 'Dry Wet') can be used to achieve a mono (or dry) attack phase while having it stereo (or wet) afterwards. Set the 'Amount' to full and modulate in with an envelope using a negative modulation amount. Then set the envelope so it has an instant attack and decays to 0.



The stereo effects are designed to be useful also for bass sounds. Even 'Reverb' effects work great on bass sounds because of their unique 'pitched' feature. For more see the description of the reverb effects.

5.13.1 Auto Pan

Modulates the partial pan with a barberpole style spectral LFO



This stereo effect can be used to make a sound stereo without changing its character.



Fig. 5.54 Auto Pan Stereo Effect.

- **AMOUNT:** Amount of stereo.
- **RAMP:** Sets the increase of stereo amount from low partials to higher ones. Can be used to prevent the low partials to be stereo as they usually have an high amplitude and would dominate the stereo field. Partial in the bass range are never stereo regardless of the RAMP setting.
- **RATE:** Rate of the barberpole LFO. Can be zero for static panning set by CYCLES.
- **CYCLES:** Numbers of cycles of the barberpole LFO along the frequency axis.

5.13.2 Stereo Spread

Similar to 'Auto Pan' but the stereo channel is flipped for every second partial.



This stereo effect can be used to make a sound stereo without changing its character.



Fig. 5.55 Stereo Spread Stereo Effect.

- **AMOUNT:** Amount of stereo.
- **RAMP:** Sets the increase of stereo amount from low partials to higher ones. Can be used to prevent the low partials to be stereo as they usually have an high amplitude and would dominate the stereo field. Partial in the bass range are never stereo regardless of the RAMP setting.
- **RATE:** Rate of the barberpole LFO. Can be zero for static panning set by CYCLES.
- **CYCLES:** Numbers of cycles of the barberpole LFO along the frequency axis.

5.13.3 Chorus

Special stereo comb filter that simulates a chorus effect.



Fig. 5.56 Chorus Stereo Effect.

- **AMOUNT:** Amount of chorus effect.
- **OFFSET:** Delay offset of the simulated chorus. Affects how high the dedicated LFO is rising on the frequency axis.
- **RATE:** Rate of the dedicated LFO that modulates the delay time of the chorus.
- **DEPTH:** Amount of delay time modulation from the LFO.

5.13.4 Reverb

Unique reverb like effect. It's not a usual reverb algorithm consisting of delay networks to simulate reflections of real rooms. The reverb is part of the additive engine and it affects the amplitude of the partials. So one specialty is that the reverb signal is pitched. It follows the pitch of the voice. RAZORs reverb effects sound quite different in monophonic and polyphonic mode as every voice has its own copy of the stereo effect. In polyphonic mode the reverb is polyphonic too. That means with a new note the reverb tails in the other synth voices continue to decay with their own pitch. In monophonic mode the reverb tail is monophonic too. So with a new note the pitch of the reverb tail from previous notes is taken over by the new note. Which is very musical because the played melody 'gets thru' even with very long reverb tails. So the reverb is not just an external effect to add some 'room' but it is an integral part of the synthesizer. Also the reverb tails is completely devoid of metallic ringing or audible delay pattern found in some reverb plug-ins even with very short decay times. They reverb tail consists of filtered noise. So it never repeats itself giving it an unheard lively quality.



Fig. 5.57 Reverb Stereo Effect.

- **WET LVL:** Level of the reverb tail.
- **DECAY:** Decay time of the reverb tail.
- **ATTACK:** Attack time of the reverb tail.
- **HI DAMP:** Damping of the high frequencies resulting in a shorter decay time in this frequency band.

5.13.5 Reverb Synced

Unique reverb like effect. At note on the reverb tail from the previous note is nulled. This feature is more obvious in monophonic mode. In polyphonic mode this reset of the tail happen for each voice separately. It's also more obvious with long reverb tails.

This effect not an usual reverb algorithm consisting of delay networks to simulate reflections of real rooms. The reverb is part of the additive engine and it affects the amplitude of the partials. So one specialty is that the reverb signal is pitched. It follows the pitch of the voice. RAZORs reverb effects sound quite different in monophonic and polyphonic mode as every voice has its own copy of the stereo effect. In polyphonic mode the reverb is polyphonic too. That means with a new note the reverb tails in the other synth voices continue to decay. In monophonic mode the reverb tail is monophonic too. Since 'reverb synced' nulls the current reverb tail with each note on there is no overlapping of reverb tails like in polyphonic mode. Which is very musical because the played melody 'gets thru' even with very long reverb tails. So the reverb is not just an external effect to add some 'room' but it is an integral part of the synthesizer. Also the reverb tails is completely devoid

of metallic ringing or audible delay pattern found in some reverb plug-ins even with very short decay times. They reverb tail consists of filtered noise. So it never repeats itself giving it an unheard lively quality.



Fig. Reverb Synced Stereo Effect

- **DRY / WET:** Blends between the unprocessed signal and the reverb tail.
- **DECAY:** Decay time of the reverb tail.
- **SMEAR:** Smooths fast amplitude changes in the reverb tail.
- **HI DAMP:** Damping of the high frequencies resulting in a shorter decay time in this frequency band.

5.13.6 Unisono Noise

Special filter that simulates the beatings of several instruments playing the same note simultaneously by applying fast modulation to the partial amplitudes. Can be used to give the sound a noisy character. There is a mono version of this effect in filter 1.



Fig. 5.58 Unisono Noise Stereo Effect.

- **AMOUNT:** Amount of noisy amplitude modulation.
- **RAMP:** Defines the increase of amplitude modulation from low partials to higher ones. Can be used to prevent the low partials to be stereo. Partial in the bass range are never stereo regardless of the RAMP setting.
- **SPEED:** Speed of beating. A slow speed sounds like unisono played instruments which have almost the same pitch. With increasing speed it sounds like the unisono played instruments get more and more detuned to each other.

5.13.7 Simple Pan

Simple stereo panning with unique 'amount ramp' feature.



Fig. Simple Pan Stereo Effect

- **PAN:** Panning. Sets the position in the stereo field.
- **RAMP:** Sets the increase of stereo amount from low partials to higher ones. Can be used to prevent the low partials to be stereo as they usually have an high amplitude and would dominate the stereo field. Partial in the bass range are never stereo regardless of the RAMP setting.

5.14 Dynamics Effects

Contains effects altering the dynamics like compressor and saturator. It's the only 'real' effect section of RAZOR as these effect process the audio output of the synthesizer. 'Dissonance' and 'Stereo' effects are part of the additive synthesizer engine. The meter at the bottom of the section shows the gain reduction caused by the dynamics effects.



Dissonance effects have great impact on distortion. Try different 'Dissonance' effects and change their parameters to alter the distortion character.

5.14.1 Compressor

Clean Compressor.



In polyphonic mode the level of single notes are less than the level of several notes are played at once like in chords. The compressor can be used to reduce these level differences.



Fig. 5.59 Compressor Dynamic Effect.

- **DRIVE**: Increases the level (dB) of the incoming signal forcing it to exceed the fixed threshold of the compressor.
- **RELEASE**: Sets the recovery time of the compressor if the signal's amplitude falls under the threshold.

5.14.2 Dirty Limiter

Distorting Limiter.



Fig. 5.60 Dirty Limiter Dynamic Effect.

- **DRIVE**: Increases the level (dB) of the incoming signal forcing it to exceed the fixed threshold of the compressor.
- **DIRT**: Amount of distortion. Blends between limiter mode in which the amplitude of the incoming signal is smoothly altered and shaper-like distortion.

5.14.3 Clipped Compressor

Compressor followed by a soft clipper.

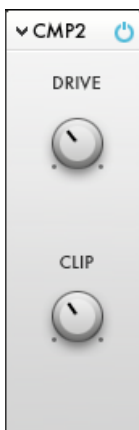


Fig. 5.61 Clipped Compressor Dynamic Effect.

- **DRIVE**: Increases the level (dB) of the incoming signal forcing it to exceed the fixed threshold of the compressor.
- **CLIP**: Increases the level of the signal coming from the compressor to drive the soft clipper.

5.14.4 Saturator

Versatile distortion effect.

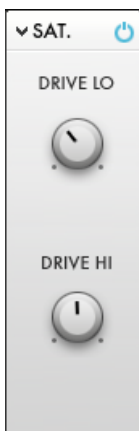


Fig. 5.62 Saturator Dynamic Effect.

- **DRIVE LO:** Sets the drive (dB) for low frequencies. More drive results in more distortion in this frequency band.
- **DRIVE HI:** Sets the drive (dB) for hi frequencies. More drive results in more distortion in this frequency band.

5.14.5 Clipper

Clipper with 'foldover' feature for 'nasty' distortion.



Fig. 5.63 Clipper Dynamic Effect.

- **DRIVE**: Increases the level (dB) of the incoming signal forcing it to exceed the fixed threshold of the clipper.
- **FOLDOVER**: Sets the slope for signal levels exceeding the clipping threshold. Set to minimum a normal clipping is achieved.

5.15 Modulators

5.15.1 Envelopes

There are 3 ADSR style envelopes. Envelope 1 is the amplitude envelope.



Fig. 5.64 Envelope.

- **A**: Attack time of the envelope.
- **D**: Decay time of the envelope.
- **S**: Sustain level of the envelope.
- **R**: Release time of the envelope.
- **VEL**: Velocity sensitivity of the envelope.
- **ECHO**: Activates a feedback delays for the envelope. The delay time and feedback amount is set with the **ECHO STEPS** controls.



Having echoes on envelopes can result in unusual effects, as echoes are still dependent on the synthesizer settings: They can be pitched, filtered and made non-harmonic etc. In monophonic mode these echoes - even with lots of feedback - will not blur the pitch as normal echoes would do. There is always only the current synthesizer pitch. There are no echoes of previous notes with different pitches like with normal echoes. Also there is no flanging that normally happens when delayed signals are mixed together. These are the reasons why echoed envelopes sound great in bass sounds too. They keep their dry bassy character.

5.15.2 Echo Steps

Echo Steps provides the controls for the envelope echoes. But it is a modulation source by itself that can be used even if no envelope has echo. It is triggered by a note on and creates steps at each occurrence of an echo. The following picture illustrates the relation between echo steps and echoed envelopes:

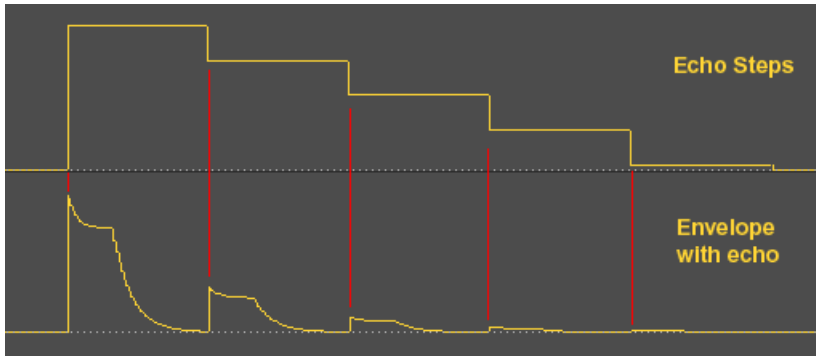


Fig. 5.65 Echo Steps Illustration.



Fig. 5.66 Echo Steps Controls.

- **DELAY**: Delay time (16th notes). The marks around the knob represent 16th notes.
- **FB**: Amount of feedback. Influences the step height of the **ECHO STEPS** modulator.
- **VEL**: Velocity sensitivity of the **ECHO STEPS** modulator.



Echo steps can be used to pan each echo of an envelope to a different stereo position or make the sound get more dissonant with each echo.

5.15.3 LFOs

Low frequency oscillator.

LFO 1



Fig. 5.67 LFO 1.

- **SPEED:** LFO speed.
- **SHAPE:** LFO shape. Available shapes are sine, triangle, saw down, saw up, pulse, random, smooth random.
- **Mode Toggle:** In **HERZ** mode the LFO speed is set in Hz. LFO isn't restarted at note on. It's always monophonic. In **BEAT** mode the LFO speed is set in 16th notes. Speed control snaps to musically interesting time intervals. LFO is restarted at note on.

LFO 2



Fig. 5.68 LFO 2.

- **SPEED/PHASE:** LFO speed in **HERZ** and **BEAT** mode. Phase offset to LFO 1 in **LF01** mode.
- **SHAPE:** LFO shape. Available shapes are sine, triangle, saw down, saw up, pulse, random, smooth random.
- **Mode Toggle:** In **HERZ** mode the LFO speed is set in Hz. LFO isn't restarted at note on. It's always monophonic. In **BEAT** mode the LFO speed is set in 16th notes. Speed control snaps to musically interesting time intervals. LFO is restarted at note on. In **LF01** mode LFO 2 synchronizes to LFO 1 with a settable phase offset.



Beat Mode with LFO2 synced to LFO1 is the preferred mode to make powerful 'wobbling' sounds which come to life when the 'Speed' control gets automated.

5.15.4 Sidechain

The 'Sidechain' signal is the result of the upper modulator scaling the lower modulator. A classic example is an envelope that scales an LFO, so the LFO can be faded in and out.

- 💡 The upper modulator is always unipolar. That means its value is always positive in the range 0..1. Bipolar Modulators like LFOs which normally goes from -1 to 1 are shifted and scaled to fit in the range 0..1. So scaling an LFO with an envelope is different than to scale an envelope with an LFO. In the first case the result will be bipolar in the second unipolar.
- 💡 Little sidechain trick: If both modulators are set to 'none' the 'Amount' value is send out so it can be used as a macro control. That is a control that is modulating several targets at once to realize morphing like effects for instance. It can be used to integrate a midi controller that is not part of the modulation source list of RAZOR. In that case the 'Amount' knob must be midi-learned to that controller.

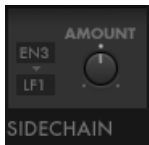


Fig. 5.69 Sidechain.

- **Upper Modulator Selector:** Selects a modulator that scales the lower modulator.
- **Lower Modulator Selector:** Selects a modulator that is scaled by the upper modulator.
- **AMOUNT:** Sets the amount of scaling. Set to 0 leaves the lower modulator like it is. Set to 1 the lower modulator is multiplied by upper modulator. Set to -1 the lower modulator is multiplied by the inverted upper modulator. The inversion will change the value range 0 ..1 into 1 .. 0.
- 💡 Classic examples: For a LFO with attack & decay, select an envelope with zero sustain level as upper modulator and a LFO as lower modulator. Set the amount: to 100. For a unipolar Pulse LFO with attack & decay select a LFO with pulse shape as upper modulator and an envelope with zero sustain level as lower modulator. Set the amount to 100.

5.15.5 MIDI related modulators

- **VELOCITY:** Note-on velocity from the MIDI keyboard.
- **MODULATION WHEEL:** Controller signal sent from the MIDI modulation wheel.
- **PITCH BEND:** Controller signal send from the MIDI pitch bend wheel.

- **AFTERTOUC**H: Controller signal sent from MIDI Aftertouch. Not all keyboards send this controller.

5.15.6 Tracking Modulators

These are special kind of modulators tracking pitch or cutoff frequency related sources.



If these modulators are used to modulate pitch or cutoff frequency related parameters like 'cut off' or 'formant shift' the modulation amount characteristic changes. A modulation amount of 100 results in a 'linked' behavior. That means that an octave jump in the modulation source results in an octave jump at the modulated parameter.

- **KEY TRACK**: Tracks the keys of the incoming MIDI notes. Including the glide and the manual set pitch.
- **PITCH TRACK**: Like KEY TRACK but inclusive pitch modulation. The main reason to have 'pitch track' extra to 'key track' is that the formant oscillator type needs 'pitch track' in order to get the original waveform regardless of pitch modulation.
- **FILTER 1 TRACK**: Tracks the cutoff of filter 1. It includes modulation. The main purpose is to link cutoff parameters in filter 2 or in the oscillators to the cutoff of filter 1 but can be used to modulate other parameters too. If mod amount is set to max the cutoff frequencies always have the same distance.

6 How to get RAZORS Vocoder to work

In the filter 1 section a Vocoder can be selected as filter type. In the following paragraph we explain how to feed an audio signal into the Vocoder and how to include RAZOR in a DAW in order to use its Vocoder.



For more information on the vocoder please read its description in the filter 1 section of this manual.

6.1 Using REAKTORS internal sample player

A simple way to feed audio in the Vocoder is to play back audio files with the built in sample player of REAKTOR or REAKTOR PLAYER. It can be found on the left hand side of the 'Player Recorder' bar located below the Instrument panel. In case it is hidden *View > Show Player Recorder* needs to be checked.



For more info on the sample player please refer to the REAKTOR and REAKTOR PLAYER manual.

6.2 Using the audio input of a soundcard in REAKTOR standalone

In REAKTOR or REAKTOR PLAYER standalone version the audio input from a sound card is routed into the vocoder. Please make sure the right sound card and the right audio input of that soundcard is selected in *File > Audio MIDI Settings... > Audio and File > Audio MIDI Settings... > Routing > Input*.



For more info on the soundcard settings please refer to the REAKTOR and REAKTOR PLAYER manual.

6.3 Using RAZORS Vocoder in a DAW

When using the Vocoder in a Digital Audio Workstation (DAW) an audio signal needs to be sent to RAZOR as well as MIDI notes to play the 'vocoded' synth. To set this up is different in each DAW software and is not always straight forward. So please read the sections below for a little help.

Ableton Live

In Ableton Live, insert the RAZOR as an effect. Chose or create another MIDI track. Click on the *MIDI To* menu on the MIDI track and select the track where the effect was inserted. If there are more than one MIDI-enabled effects on the original track, you must select the specific plug-in you want the MIDI to go to from the drop-down menu below the *MIDI To* selection. Make sure you are recording enabled on the new MIDI track, or are using Monitor *In*, to send the MIDI to RAZOR.



Please refer to the documentation provided with Ableton Live for more information on setting up MIDI for virtual instruments and effects. You may also find more support and information specific to your scenario on the Native Instruments REAKTOR website forum.

Logic

In Logic, first insert the plug-in as an audio instrument from the track sub-menu called *AU MIDI-controlled Effects*. Use the side-chain menu in the plug-in window to choose an audio track to route into RAZOR. The MIDI will come from the sequences on the audio instrument track (or live MIDI input if that track is selected in the Arrange window) and the audio to be processed will come from the side-chain track.



Please refer to the documentation provided with Logic for more information on setting up MIDI for virtual instruments and effects. You may also find more support and information specific to your scenario on the Native Instruments REAKTOR website forum.

Cubase SX / Nuendo

In Steinberg products, first insert RAZOR as an effect and *activate* the RAZOR. Select the RAZOR as the output device for one of your MIDI tracks from the output device menu. The MIDI track will now send MIDI to RAZOR. To send MIDI, make sure the MIDI track is active, playing a clip or monitoring MIDI in.



Please refer to the documentation provided with Cubase SX / Nuendo for more information on setting up MIDI for virtual instruments and effects. You may also find more support and information specific to your scenario on the Native Instruments REAKTOR website forum.

FL Studio

In FL Studio, add RAZOR as an insert to the channel you want to process. In the plug-in window, on the arrow next to the folder icon on the left in the header, select *Show MIDI Port* from the drop-down. A new green area appears on the right of the plug-in wrapper's header. Drag on this area to select a specific port number. From FL's main menu select *Channels > Add one > MIDI Out*. On the MIDI Out instrument, select the same port you used for the plug-in. You can now send MIDI on from the MIDI out instrument's track to the plug-in.



Please refer to the documentation provided with FL Studio for more information on setting up MIDI for virtual instruments and effects. You may also find more support and information specific to your scenario on the Native Instruments REAKTOR website forum.

ProTools 8

Create one MIDI or audio channel with the RAZOR used as an insert. Create a second track for the incoming MIDI. In the new MIDI track's Input/output section on the mixer, select RAZOR. Now make sure you are recording on the new MIDI track (or use monitor to send MIDI always).



Please refer to the documentation provided with ProTools 8 for more information on setting up MIDI for virtual instruments and effects. You may also find more support and information specific to your scenario on the Native Instruments REAKTOR website forum.

NI MASCHINE

Just put RAZOR as an effect on a pad in a group, then route either the sound or group output to your RAZOR pad. Make sure RAZOR is on the first slot as an FX.

7 Credits

Instrument by: Errorsmith

Product Design: Matt Jackson

GUI Design: Philipp Granzin, Efflam Le Bivic, Gösta Wellmer

GUI Production: Dietrich Pank

Sound Design: Robert Linke, Adam Hanley, Julian Laping, Tobias Menguser, Matt Jackson, Tasmodia, Summa, Andre Goc, Ema Jolly, Jeremiah Savage, Peter Prestel, Uwe G. Hönig, Andrew Hyde, Colin Fraser, Klaus Baetz, Simon Stockhausen, Richard Devine, Todd Krupa, Krikor Couchian, Antonio Blanca, Errorsmith

Documentation: Errorsmith and Patryk Korman