



JAX [JUST AN EXTENSION] SERIES

JAX : UNISONIC [AUDIO UNIT]

MANUAL

Version 1.3

JAX Unisonic

Multi Pitch Shifter / Octa Voice Multiplier

JAX Unisonic is a special Audio Unit, able to produce up to 8 additional voices from any audio input (also polyphonic audio) by multiplying and shifting them in pitch and other parameters. Audio Units require a host application for operation.

The concept of JAX Unisonic is loosely derived from 'Unison' which was adopted from the ancient analog synthesizer world, where manufacturers and sound designers intended to fatten the sound by multiplying and stacking available voices together. Also digital synthesizers did adopt this technique to fatten sound sources.

Due to the instability of analog oscillators and components and some willful detuning, an interesting sonic effect is achieved, giving the produced tones significantly more presence and life. Unison voices are still excessively used in modern music styles today. (In classical music compositions 'unisono' basically means a performance, where multiple instruments or voices play exactly the same parts inside an ensemble.)

Technical

Now JAX Unisonic can simulate this sonic effect with any audio source by incorporating a bank of independent time domain pitch shifters, that are optimized to detune and spread artificially multiplied voices in panorama. It can be understood as a kind of super chorus generator or an ensemble like effect with variable, realtime controlled intensity and pitch relation. But it is clearly something more.

With JAX Unisonic you can create up to 8 additional voices, that will be passed thru a chain of pitching and positioning, creating massively fattened sounds with any kind of voice input. Additionally you may transpose each voice individually per semitone to max. +/- 1 octave / +/- 12 semitones, something that cannot be achieved with usual choruses, unison or ensemble effects and moves the results slightly in the direction of the category “harmonizer” effects. Although the harmonic results can be programmed (automated) freely and are not auto generated in any way, as on some available other harmonizers.

Version 1.3 extended the tone generation with 8 tempo synced delays.

The used pitch shifters in our JAX Unisonic are NOT based on the phase vocoder paradigm (FFT) and do not introduce the static latencies, which are unavoidable by the latter. A time domain pitch shifter in contradiction, uses very small delay buffers, where the latency is dynamically adjusted (depending on the used pitch shifting amount) and much smaller and nearly latency-free. Such pitch shifters are better situated for live usage therefore. Although, such pitch shifters sound slightly more raw and tend to produce disharmonies with more extreme values.

Usage

JAX Unisonic may be used as a massive unison effect generator or more decently for creating various, more subtile effects for improving sonic qualities of parts in a composition. For instance controlled voice detuning, manual pitch correction, doubling of vocals or solo instruments or just to give some boring voices more interest and static sound some special movement. It is even usable with drums, adding subtile or even massive new frequency components.

A note to the user controls in our JAX series: Our controls are made for usage with touch screens. This is often misunderstood. You just need to hit a control of your choice and move your fingers to ANY direction. This will effectively increase or decrease the value behind. Some users are conditioned by the mouse move paradigm of the desktop computer, so that those expect the controls to behave like there. But our controls are much more intuitive to use due to this “just touch and move” technique. We did not change this behavior with the macOS versions of our Audio units, so that the usage remains consistent on both systems. On iOS, the screen can be zoomed in and out freely to get a closer look into details of the interface.

Parameters

There are few and very easy to use parameters in JAX Unisonic.

- **Detune:** will uniformly detune the selected set of voices in per(cents) up to a maximum of 1 semitone around the centre pitch. This effectively controls the percentage of the relative detuning between multiple voices, regardless how much of them are used. If only one voice is selected, it can be detuned this way too by increasing the pitch up to one semitone (100 cents) unidirectional.

- **Stereo Spread:** distributes the current selected set of voices uniformly into the stereo panorama field from mono to wide stereo. Monophonic recordings are not so much affected by this. Extra positioning was added with version 1.3.

- **Additional Voices:** will adjust the desired number of voices by multiplying / cloning the input signal. Default is one additional voice, adding to the input. The order and activity state of additional voices will be visualized with the 8 color circles on bottom of the screen. This parameter is not intended to be realtime automated (see notes for Voice Mute below).

- **Voice Transpose** 1-8: can transpose each voice individually in semitones up to +/-12, creating freely user definable harmonies. The detuning parameter remains effective and adds to this, when using individual semitone transpositions this way. The transpose parameter can be automated in realtime and create varying harmonies dynamically this way.

- **Voice Volume** 1-8: can dynamically adjust the volume of each of the voices independently to equalize the sonic results and to achieve i.e. individual crescendo effects. Also lower tones tend to become quieter and higher notes appear to be much louder by nature. This can be freely adjusted and automated with the volumes of the single voices.

- **Voice Mute** 1-8: Each of the voices can be muted temporarily while audition for better control of it. Note: Adding dynamically more notes may cause clicks in the audio processing signal. We recommend to use the Voice Mutes therefore. Voice mute will slightly fade the tones in and out, preventing such audio clicks. A muted tone will not use any processor cycles, so you can safely switch all required voices on and work with the Voice Mute controls.

Version 1.3 added several fundamentally widening extensions to JAX Unisonic.

- **Voice Pan** 1-8: You can now assign individual pan positions to each voice. The global spread parameter is affected by this

too. Stereo spread is implemented into the pitch shifter bank and panorama positioning is an extra parameter at the final mixer stage.

- **Voice Delay** 1-8: There are now 8 additional tempo delays, one for each of the voices. These delays do not have a feedback parameter and basically are delaying the tone by a certain selectable tempo division ones. This enables to design melody alike sequences. We did implement this on user request, although it is conceptually quite different to the initial release.

There are several predefined divisions for selection available. A division is based on BEATS (quarter notes). So 4/1 means a 4/4 bar (whole note) while 1/32 for instance means a 32th of a quarter note based on the current tempo and so forth. Very short delays are thought for effectively emulating pitched strumming effects.

- **Tempo and tempo sync:** The implementation of the delay units required a tempo adjustment to be musically useful. JAX Unisonic can receive the hosts tempo (if this is supported by the host) and alternatively adjust the tempo for the delay units freely. In sync mode the tempo slider cannot be adjusted, as it will be locked by the reported host tempo.

~~Please note, that JAX Unisonic is also able to receive MIDI Clock realtime messages. If MC is actively being received, it will override / ignore the hosts reported tempo because it may conflict. So the clock source can be an external signal.~~

A Word About Phasing

The sonic result of unison voicing comes mainly due to periodic phase shifting and phase cancellation side effects because of slightly differing pitches. Two voices with basically

the same tone, that are detuned, will produce continuously shifting phase cancellations that create a kind of 'living' effect which is dependent only from their base pitches. As more voices are adding to this with slightly differing pitches, as more massive (fat) this sonic effect can become. Very low detuning values may produce clearly audible strong phasing effects. Another side effect is uncontrolled loudness sweeping. When the voices waveforms periodically overlap perfectly, the volume is temporary multiplied (spiking) this way, when phase cancellation occurs the volume will drop periodically vice versa. JAX series effects have therefore a brick-wall limiter inbuilt to equalize this effect and to save the output against really bogus loudness levels caused by phasing.

In contradiction to a usual chorus effect, where the pitch shift is mostly performed and controlled by an additional LFO (low frequency oscillator), the phase shift with unison is generated merely by the micro pitch relation between the used voices and thus, relatively uncontrollable and kind of chaotic.

For the reason, that phase cancelation side effects easily went out of control, we added a visual realtime correlograph to the user interface, which also can be switched off for saving performance. The detuning parameter should be re-adjusted slightly, to correct strong phasing problems fast and effectively. The spread parameter can adjust the stereo wide additionally.

JAX Unisonic is registered as a MIDI controllable effect. The usage of the direct MIDI features is optional. Some hosts may allow you to assign MIDI controllers to AU parameters, so you may ignore the direct MIDI controls completely and use the exposed Audio Unit parameters for all automation.

MIDI Implementation

Direct MIDI support was added with version 1.3

JAX Unisonic is able to receive MIDI messages on MIDI channels 1 to 8. The following common MIDI messages are supported:

MIDI Notes

- Note On - channel 1-8 - adjusts the transpose parameter, while note number 60 is the zero point of the mapping. You can switch the transposition of the corresponding voice (MIDI channel) up and down 12 semitones. Note number 72 on MIDI channel 1 means +12 semitones for the first voice this way. Keys outside the mapping are ignored.
- Note Off - these MIDI messages are ignored

MIDI Controllers

- Volume (CCO-007) - channel 1-8: corresponds to the voice volume parameter for the voice on the specified channel.
- Pan (CCO-010) - channel 1-8: corresponds to the voice pan parameter for the voice on the specified channel.
- Expression (CC-011) - channel 1-8: corresponds to the voice tempo division parameter for the voice on the specified channel.
- Sustain (CO-064) - will switch voices on and off (voice mute), based on the value for the selected channel. Please note, that per default all voices are switched on. A sustain value of 127 means ON, all other values mean OFF.

Other MIDI Messages

- Channel Aftertouch - channel 1-8: will damp the voice volume while playing for easily creating controllable crescendo effects.

Modulation Wheel - adjusts the uniform stereo spread for all voices.

Pitch Bend - adjusts the uniform detuning of all voices.

~~**MIDI Clock** - Tempo information can be extracted from continuous MIDI Clock signals. However, this will overwrite/ignore the reported host tempo.~~

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