

Reverb, chorus, pitch shift, and other effects

Reverb

“Reverberation is the persistence of sound in a particular space after the original sound is removed.”
(from Wikipedia).

It is often desirable to “add reverb” to recorded or live music but most people don’t have an understanding about this process. The old adage- “if in doubt, add reverb” is one of the biggest misconceptions in the recording process. Singers in particular often want to add reverb to cover up flaws or other undesirable qualities in their performances. It has ruined countless recordings and probably led to more frustrated engineers than anything else in the world. So, let’s unravel the mystery of “adding reverb”. First, let’s take a look at the different devices that have been developed over the last 50 years or so.

Chamber reverberators (Echo Chambers)

The first reverb effects created for recordings used a real physical space as a natural echo chamber. A loudspeaker would play the sound, and then a microphone would pick it up again, including the effects of reverb. This technique requires a dedicated soundproofed room, and varying the reverb time is difficult. One of the most famous echo chambers is in the Capitol Records building in Hollywood, CA. Here in Door County, old grain silos could make great echo chambers. Echo chambers are used for special effects

Plate reverberators

A plate reverb system uses an electromechanical transducer, similar to the driver in a loudspeaker, to create vibration in a large plate of sheet metal. A pickup captures the vibrations as they bounce across the plate, and the result is output as an audio signal.

Spring reverberators

A spring reverb system uses a transducer at one end of a spring and a pickup at the other, similar to those used in plate reverbs, to create and capture vibrations within a metal spring. Guitar amplifiers frequently incorporate spring reverbs due to their compact construction and low cost. Spring reverberators were once widely used in semi-professional recording due to their modest cost and small size. Many musicians have made use of spring reverb units by rocking them back and forth, creating a thundering, crashing sound caused by the springs colliding with each other. The Hammond Organ included a built-in spring reverberator, making this a popular effect when used in a rock band.

Digital reverberators

Digital reverberators use various signal processing algorithms in order to create the reverb effect. Since reverberation is essentially caused by a very large number of echoes, simple DSPs use multiple feedback delay circuits to create a large, decaying series of echoes that die out over time. More advanced digital reverb generators can simulate the time and frequency domain responses of real rooms (based upon room dimensions, absorption and other properties). In real music halls, the direct sound always arrives at the listeners ear first because it follows the shortest path. Shortly after the direct sound, the reverberant sound arrives. The time between the two is called the 'arrival time gap'. This gap is important in recorded music because it is the cue that gives the ear information on

the size of the hall, better digital reverbs can incorporate this arrival time gap and hence sound more realistic.

Over the last few decades, Reverb has played an important role in defining various musical styles- who doesn't remember Simon&Garfunkel's bombastic reverb on "Bridge over troubled Waters"; or how about Pink Floyd's music where reverb was often used to paint a whole other musical layer? And how about Paul Horn's "Inside" recording at the Taj Mahal?

Most reverb programs have several parameters, such as size, pre-delay, Hi Cut, and so on, that allow the user to tailor the reverb exactly to their needs.

Modulation-related effects

Rotary speaker

Rotary speaker effects are accomplished by amplifying a sound through spinning speakers or horns and/or by placing a rotating baffle in front of a speaker. This creates a doppler effect, and depending on the speed of the rotation, translates into phasing, flanging, chorus, vibrato, or even tremolo. In addition to the basic rotating speaker sound, other effects created with these cabinets included changing the speed, turning the motor on and off (causing a pitch "wobble" effect), and using two rotating speakers at once, a rich, chorusing sound.

Leslie speakers: The wooden cabinet has rotating baffle near the bass speaker, and a horn speaker that rotates like a siren. Originally designed for Hammond organs, they are also used by some guitarists. Some Leslie enthusiasts claim that that no electronic effects or software modelling devices can duplicate the complex doppler effects that the speaker creates.

Rotary speaker simulator

Electronic Leslie-style effects duplicate the sound of a rotating speaker, but they offer different simulations of the effects of the rotation speed, volume, and pitch modulation. Some Leslie-style pedals can provide two or more modulation effects at the same time. Despite the numerous different analog devices, it is very rare for them to be able to duplicate all aspect of a Leslie speaker. Thus, rotary speaker simulators are always going to be digital, utilizing modeling algorithms to model the relations between the rotating horns and bass baffle, and how the sound bounce around the cabinet. As Leslies also have a tube amplifier, most of these pedals have an overdrive circuit. Some of these pedals can even accept an 11-pin Hammond organ keyboard input.

Vibrato

A Vibe or vibrato pedal reproduces the sound of a rotating speaker by synchronizing volume oscillation, frequency-specific volume oscillation, vibrato (pitch wavering), phase shifting, and chorusing in relation to a non-rotating speaker. The modulation speed can be ramped up or down, with separate speeds for the bass and treble frequencies, to simulate the sound of a rotating bass speaker and a rotating horn. This effect is simultaneously a volume-oriented effect, an equalization-oriented effect, and a time-based effect. Furthermore, this effect is typically related to chorus. Some vibe pedals also include an overdrive effect, which allows the performer to add "tube"-style distortion.

Phase shifter

A phase shifter creates a complex frequency response containing many regularly-spaced "notches" in an incoming signal by combining it with a copy of itself out of phase, and shifting the phase relationship cyclically. The phasing effect creates a "whooshing" sound that is reminiscent of the sound of a flying jet. Phase shifters were popular in the 1970s, particularly used with electric piano and funk bass guitar. The number of stages in a phase shifter is the number of moving dips in the frequency response curve. From a sonic perspective, this effect is equalization-oriented. However, it may be derived through moderate time-based processing.

Flanger

A flanger simulates the sound effect originally created by momentarily slowing the tape during recording by holding something against the flange, or edge of the tape reel, and then allowing it to speed up again. This effect was used to simulate passing into "warp speed" in sci-fi films, and also in psychedelic rock music of the 1960s.

Flanging has a sound similar to a phaser, but more intense, cutting, and metallic, and is closely related to the production of chorus (both involve delaying a copy of the signal by a short, varying amount, and re-combining it with the original signal). Spectrally, the main difference between the flanger and the phaser is that in the flanger, the notches in the spectrum are spaced at equal frequency intervals (similar to harmonic overtone intervals), while in the phaser, the spacing is approximately logarithmic (similar to pitch intervals).

Chorus

An electronic chorus effect splits a guitar signal in two, modulating the second signal's pitch and mixing back in with the "dry" original signal. The effect sounds like several guitarists playing the same thing at the same time, resulting in a wide, shimmering or swelling sound.

Pitch-related effects

Octaver

An octaver mixes the input signal with a synthesised signal whose musical pitch is an octave lower or higher than the original. Effects that synthesize intervals besides octaves are referred to as harmonizers or pitch shifters, shown below. Octave up pedals are often used by lead guitarists to add additional edge and clarity to their solo sound. Octave down pedals are used by guitarists in bands without a bassist who want to add a lower-end sound, or by bassists who want an extended low range without having to buy a 5-string or 6-string bass.

Pitch shifter

A pitch shifter is a device that alters the pitch of the instruments. They are generally used with an expression pedal to give a smooth bend-like effect. Pitch shifters can also be used to electronically "detune" the instrument. The company Eventide were the first company to experiment with a harmonizer. Companies including Digitech followed in their footsteps.

Distortion effects

These type of effects do what the name suggests- they simulate various types of distortion- tube, solid state, and various amp simulations.