How to Create Realistic Room Sounds Using Reverb

(Excerpt from WAVES Software Co) Apr 17, 2019 by Charles Hoffman

A reverb is an audio device that allows you to simulate the physical characteristics of a room and generate the reflections that would occur if you were to play a sound within that room. The specific properties of the room can be tweaked using the reverb's parameters.

Hardware and software developers have figured out how to re-create the sound produced by various real and imaginary rooms. We won't deal here with the technology behind different types of reverbs but rather, how you're able to use them practically to create different room characteristics appropriate to your song.

Room Characteristics and Reverb Parameters

When attempting to simulate a room using reverb, you need to take characteristics like room size, shape and material into consideration. It's equally important to determine where the sound source is stationed within that room. Where the listener is positioned? Are there other objects in the room? These are some of the crucial questions that you need to ask yourself.

Much like other audio devices, there are a core set of parameters that will allow you to sculpt the sound produced by your reverb. These parameters usually include shape, decay time *(the larger the space the more decay time, and the harder the surfaces the longer the decay time)*, size, density, pre-delay *(the time it takes the first sound to travel from the source to the listener - usually longer in a larger room)*, a dry/wet knob and a filter section (for EQ). For simple reverb units with a limited number of controls, some of these parameters will be pre-determined for you.

Manipulating Room Shape and Size

A room's shape and size play a tremendous role in dictating how the elements of your song are going to sound within the space. Large untreated rooms typically result in sounds with long decay times, while small untreated rooms usually result in sounds with lesser decay times; this is actually a bit presumptuous because a room's material plays a significant role in how reflective a room is, but we'll look at this in more detail in the next section.

If your reverb has a **shape** control, it affects the pattern and spacing of early reflections. Early reflections are copies of the direct sound that you hear after they've bounced off your desk, walls, ceiling or floor, no more than once or twice. There is usually some overlap between early reflections and the diffused sound *(sometimes known as the reverberant field)*, and the shape control allows you to manipulate the decay time of early reflections, dictating how much overlap occurs.

Decay time adjusts the amount of time it takes for the tail of a reverb to die out. *(Actually this is how long it takes the reverb to drop 60 "decibels" - practically speaking, to completely quiet.)* If you're unfamiliar with a reverb, look for the decay time knob because it's going to allow you to get the unit under control.

Shorter decay times will keep sounds upfront and present in your mix, while longer decay times will push elements to the back of your mix, making them seem further away.

Size determines how big the room is that a reverb is meant to model. Larger rooms, like concert halls, tend to produce longer decay times and darker sounds, while smaller rooms, like drum booths or Jazz clubs, often result in brighter sounds with shorter decay times. Some convolution reverbs will generate new impulse responses by resampling when you modify their size.

Manipulating Room Material

Most materials can be broken down into two categories: **porous materials** and **non-porous materials**. Insulation is an excellent example of a porous material. It contains tiny spaces that sound can leak into and get trapped in. Porous materials tend to be good at absorbing sound and the thicker the material, the more adequately it will be able to absorb low frequencies. *(Porous materials shorten reverb time. Thin porous materials like curtains and carpet reduce or "dampen" high frequencies more.)*

Non-porous materials like tile or metal tend to have poor absorption properties. They reflect sound across most of the frequency spectrum and can make a room sound “bright.” *(Reverb controls often have some kind of equalization or "EQ" controls, such as high-pass and low-pass filters. Such a room, for instance a tiled bathroom, would need a bit longer reverb time with boosted high frequencies)* Natural materials like wood are somewhat neutral in the way they reflect sound. Wood is semi-porous, which allows it to absorb high-frequency content but also remain lively. The next time you walk into a wooden sauna, listen to how your voice interacts with the space; it should sound energetic, but not in the same way as it would in a tile bathroom.

A reverb’s **density** controls how thick the echoes are as your sound diffuses throughout the room. Higher density values can help make your input signal sound more aggressive, while lower density values can help separate the effect of the reverb from your original sound. *(Is the reverb seem "intense"?)*

The **filter** section of your reverb plays an essential role in creating space between your dry and wet signal. I’ll usually apply a high-pass filter at 200Hz and a low-pass filter at 2000-3500Hz; this prevents my reverb from creating phase issues in my low-end and also cuts off the high-end that would otherwise make my reverb too bright. However, if I’m trying to model a “dark” space, I’ll cut away more of my top end (treble frequencies) and add back low end (bass frequencies). On the other end of the spectrum, if I’m trying to emulate a room made of a non-porous material, I’ll refrain from cutting away my top end, and I may even boost it with a high-shelf filter. *(In contrast, a "damping" control lowers the treble part of the reverb sound more quickly than the lower frequencies. A little damping would be good to use if your virtual room was full of people.)*

Manipulating Distance from the Sound Source to the Microphone

The further away from the sound source your listening position is, the more of the room you’re going to record (or hear). As well, moving your sound source around the room is going to affect how its reflections interact with the environment.

Pre-delay controls the delay time before your microphone or ear picks up early reflections. Early reflections are sounds that reach the microphone or ear after reflecting once or twice off the surrounding walls and/or ceiling. Pre-delay adjustment plays a considerable role in determining the apparent size of the room, although other factors like the shape and decay time come into play as well. *For instance, we*

assume sound travels about 1 foot per millisecond or ms. Therefore if the sound of a person speaking must travel 20 ft to meed the closest wall, and then travel 20 ft back to the listener, the pre-delay would be about 40 ms.

The **dry/wet** parameter controls the mix between the unprocessed input signal (with no reverb) and the processed output signal (pure reverb) of your reverb. If the effect of the reverb sounds the way you like but it's overpowering your original sounds, dialing back the dry/wet parameter will resolve the issue.

How to Approach Creating a Realistic Room Sound

If you're trying to model a specific room with a reverb, you need to think about all the physical properties of that room and how they're going to affect the reflections the room generates. Modifying a single parameter on a reverb can change multiple characteristics of the room it's meant to model. Revising parameters a number of times is usually required if you're trying to model a specific space accurately.

Modeling a room using reverb requires attention to detail. If you try to do too much at once, you risk throwing off the careful balance between parameters, and consequently, the characteristics of the room.

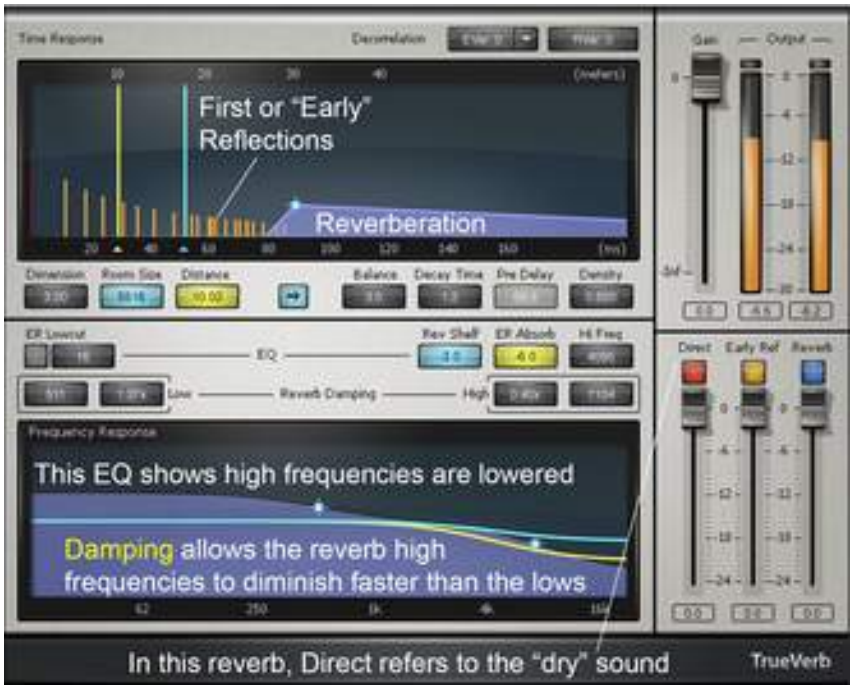
Sometimes making your reverb wetter than is necessary can be useful for this step; it makes hearing the effect of the reverb significantly easier. Once you've done this, turn down the wetness of your reverb to an appropriate level and tweak your reverb's settings further until you achieve the room sound you're after.

(In a music mix) Making Instruments Sound Like They're in the Same Space

It's important to note that if you use too many different reverbs in the same project *(operating at the same time)*, the perceived space you're trying to create will become less believable. If you're trying to make it sound like your orchestral piece is being played in an extravagant concert hall, it doesn't make much sense to use 5 different reverbs across various tracks, each modeling vastly different rooms.

Reverb software designers are not obliged to use the same terminology as every one else. So they make up terms that describe what their tools do. In Audacity's reverb, "Reverberance %" is somewhat like decay time. In WAVES TrueVerb, "Direct" is the same as dry.

Right: WAVES TrueVerb



Below: Audacity's Reverb