

The "art" of EQ

by Aaron Trumm

EQ can be used in a variety of situations, from live sound to recording to tape to mixing down. Mainly, it should be used to enhance signals that have some problem. The golden rule of EQ is less is more. If something seems fine without it, I avoid EQing it at all. Then, if I do use it, I try to remain subtle. My personal golden rule is nearly never EQ signals going to tape (as in a multitracking situation). I always try to get the original sound on tape, then I can mess with it later. Putting EQ (or any other effect) on tape usually just leads to trouble. The other rule (the silver rule :)) is cutting is almost always better than boosting, especially when fixing problems. For example if a guitar sounds too thin, first try cutting high frequencies and boosting the gain a bit, instead of boosting the lows. The more clutter you can remove from a mix, the better. A better example is I very often cut a bit of high away from hats. Another example is, many times you may not hear something well in a mix...You might try cutting some frequencies in a different track that seems to be interfering, rather than boosting in the track you want to bring out. With these basic rules in mind, I'll tell you my rules when I enter a mixdown session:

1. Rule Of Opposites: Usually, tracks with high sounds, (a high guitar, hats) need cutting in high frequencies and boosting in lower, and vice-versa. This is really only a starting guide, not a rule. Also, sounds that interfere with eachother can be separated in a mix by EQing them in opposite directions.
2. Bass usually needs a boost in the mid range somewhere and sometimes the high. This way it can cut through and be heard on smaller speakers.
3. Kick drums usually need that same mid and/or high boost on a subtle level so they too can cut through on smaller speakers. For hip-hop, kick needs a low end boost, but NOT TOO MUCH.
4. Snare drums always sound warmer with a boost in the low-mid range and some cut of the highs. An annoying CRACK can be softened with this high cut. Sometimes I boost the lows in snares to make them even fatter. But it really depends on the snare sound. The rule of opposites usually applies here. Snare sounds that were thin to begin with I usually warm up a bit, and hefty snare sounds I might thin out a bit.
5. Hats almost never need any EQ if they're recorded clean. Usually an EQing for my hat tracks is to cut highs to get rid of an annoying hiss.
6. Guitars are simaler to snares for me. A thin original guitar might need boosting in mids and lows (depending on what the desired sound is, and what else is present in the mix) or a hefty guitar might need to be thinned out a little by cutting lows and low-mids.
7. Vocals usually like to have a boost in the mids or high-mids, but it depends on the voice. Vocals nearly always get lost amongst guitars...a good way to deal with this is the rule of opposites. Boost mids in the vocals and cut them in the guitar, or something similar. Vocals can also have annoying hiss or sibilance, and sometimes cutting high frequencies can help that.
8. Strings, and more specifically good string patches from a synth, usually need little EQ. If they are merely a support player, I may thin them out a tiny bit, or if they are meant to be

present, I may thicken them in the mids a little (or sometimes the opposite...this stuff is highly subjective). But they usually work well left alone. Really clean piano or keyboard synth patches are the same way.

9. I like to leave reverb returns alone, but if the reverb becomes annoying and noisy, cutting some high can soften it up a bit...same with strings.
10. Extreme EQ settings create sounds of their own. Experiment. But for a non-novel track, be subtle.
11. AC hum from a track can almost always be fixed by cutting 60 Hz all the way off. (Sometimes this can take away from bass or kick sounds, but I believe that most frequencies audible in a song are above 60 Hz).
12. Play with EQ settings thoroughly to find appropriate settings.
13. I don't mix horns too often, but when I do, I like to leave them alone. Clean horn tracks usually seem fine to me.
14. NEVER EVER EVER force yourself to EQ a track that sounds fine, just because you think you should use the full capabilities of the studio. NEVER NEVER NEVER!
15. If anyone out there has rules they use for their mixes, especially for instruments I don't mention or use much, send 'em along. :)

A Basic Guide for EQing

by Devin Devore

Some History

Dating as far back as the 1930's, the equaliser is the oldest and probably the most extensively used signal processing device available to the recording or sound reinforcement engineer. Today there are many types of equalisers available, and these vary greatly in sophistication, from the simple bass and treble tone control of the fifties to advanced equipment like the modern multi-band graphic equaliser and the more complex parametric types. Basically, an equaliser consists of a number of electronic filters which allow frequency response of a sound system or signal chain to be altered. Over the past half century, equalisers design has grown increasingly sophisticated. Designs began with the basic 'shelving filter', but have since evolved to meet the requirements of today's audio industry.

Understanding EQ and its Effects on Signals

There are two areas of equalisation that I want to cover. Those two areas are vocals and music. I'd like to discuss the different effects of frequencies within audio signals. What do certain frequencies do for sound and how we understand those sounds. Why are some sound harsh? Why do things sound muddy? Why can't I understand the vocals? I'll try and answer all of these question and hopefully bring some light to the voo-doo world of EQ.

Vocals

Roughly speaking, the speech spectrum may be divided into three main frequency bands corresponding to the speech components known as fundamentals, vowels, and consonants.

Speech fundamentals occur over a fairly limited range between about 125Hz and 250Hz. The fundamental region is important in that it allows us to tell who is speaking, and its clear transmission is therefore essential as far as voice quality is concerned.

Vowels essentially contain the maximum energy and power of the voice, occurring over the range of 350Hz to 2000Hz. Consonants occurring over the range of 1500Hz to 4000Hz contain little energy but are essential to intelligibility.

For example, the frequency range from 63 to 500Hz carries 60% of the power of the voice and yet contributes only 5% to the intelligibility. The 500Hz to 1KHz region produces 35% of the intelligibility, while the range from 1 to 8KHz produces just 5% of the power but 60% of the intelligibility.

By rolling off the low frequencies and accentuating the range from 1 to 5KHz, the intelligibility and clarity can be improved.

Here are some of the effect EQ can have in regards to intelligibility. Boosting the low frequencies from 100 to 250Hz makes a vocal boomy or chesty. A cut in the 150 to 500Hz

area will make it boxy, hollow, or tubelike. Dips around 500 to 1Khz produce hardness, while peaks about 1 and 3Khz produce a hard metallic nasal quality. Dips around 2 to 5KHz reduce intelligibility and make vocals woolly and lifeless. Peaks in the 4 to 10KHz produce sibilance and a gritty quality.

Effects of Equalisation on Vocals

For the best control over any audio signal, fully parametric EQ's are the best way to go.

80 to 125 160 to 250 315 to 500	Sense of power in some outstanding bass singers. Voice fundamentals Important to voice quality
630 to 1K	Important for a natural sound. Too much boost in the 315 to 1K range produces a honky, telephone-like quality.
1.25 to 4K 5 to 8K	Accentuation of vocals Important to vocal intelligibility. Too much boost between 2 and 4KHz can mask certain vocal sounds such as 'm', 'b', 'v'. Too much boost between 1 and 4KHz can produce 'listening fatigue'. Vocals can be highlighted at the 3KHz area and at the same time dipping the instruments at the same frequency. Accentuation of vocals.
	The range from 1.25 to 8K governs the clarity of vocals.
5 to 16K	Too much in this area can cause sibilance.

31Hz to 50Hz	These frequencies give music a sense of power. If over emphasised they can make things muddy and dull. Will also cloudy up some harmonic content.
80Hz to 125Hz	Too much in this area produces excessive 'boom'.
160Hz to 250Hz	This is the problem area of a lot of mixes. Too much of this area can take away from the power of a mix but is still needed for warmth. 160Hz is a pet-peeve frequency of mine. Also, the fundamental of bass guitar and other bass instruments sit here.
300Hz to 500Hz	Fundamentals of string and percussion instruments.
400Hz to 1K	Fundamentals and harmonics of strings, keyboards and percussion. This is probably the most important area when trying to control or shape to a natural sound. The 'voice' of an instrument is in the mids. To much in this area can make instruments sound horn-like.
800Hz to 4K	This is a good range to accentuate instruments or warm them up. Too much in this area can produce 'listening fatigue'. Boosts in the 1K to 2K range can make instruments sound tinny.
4K to 10K	Accentuation of percussion, cymbals, and snare drum. Playing with 5K makes the overall sound more distant or transparent.
8K to 20K	This area is often what defines the quality of a recording or mix. This area can also help define depth and 'air' to mix. Too much can take away from the natural sense of a mix by becoming shrill and brittle.

Instruments

Miking instruments is an art ... and equalisers can often times be used to help an engineer get the sound he is looking for. Many instruments have complex sounds with radiating patterns that make it almost impossible to capture when close miking. An equaliser can compensate for these imbalances by accenting some frequencies and rolling off others. The goal is to capture the sounds as natural as possible and use equalisers to strighten out any non-linear qualities to the tones.

Clarity of many instruments can be improved by boosting their harmonics. In fact, the ear in many cases actually fills in hard-to-hear fundamental notes of sounds, provided the harmonics are clear. Drums are one instrument that can be effectively lifted and cleaned up simply by rolling off the bass giving way to more harmonic tones.

Here are a few ideas on what different frequencies do to sounds and their effects on our ears.

Here are a few other pin point frequencies to start with for different instruments. In a live sound situation, I might event pre set the console's eq to these frequencies to help save time once the sound check is under way. These aren't the answers to everything... just a place to start at.

Kick Drum:

Besides the usual cuts in the 200Hz to 400 area, some tighter Q cuts at 160Hz, 800Hz and 1.3k may help. The point of these cuts makes for space for the fundamental tones of a bass guitar or stand up. I have also found a high pass filter at 50Hz will help tighten up the kick along with giving your compressor a signal it can deal with musically. 5K to 7K for snap.

Snare Drum:

The snare drum is an instrument that can really be clouded by having too much low end. Frequencies under about 150Hz are really un-usable for modern mixing styles. I would suggest a high pass filter in this case. Most snares are out front enough so a few cuts might be all that is needed. I like to start with 400Hz, 800Hz, and some 1.3K. This are just frequencies to play with. Doesn't mean you will use all. If the snare is too transparent in the mix but I like the level it is at, a cut at 5K can give it a little more distance and that might mean a little boost at 10K to brighten it up.

High Hats:

High hats have very little low end information. I high pass at 200Hz can clean up a lot of un-usable mud in regards to mic bleed. The mid tones are the most important to a high hat. This will mean the 400Hz to 1K area but I've found the 600Hz to 800Hz area to be the most effective. To brighten up high hats, a shelving filter at 12.5K does nicely.

Toms and Floor Toms:

Again, the focus here is control. Most toms could use a cut in the 300Hz to 800Hz area. And there is nothing real usable under 100Hz for a tom... unless you are going for a special effect. Too much low end cloud up harmonics and the natural tones of the instrument. Think color not big low end.

Over Heads:

In my opinion, drum over heads are the most important mics on a drum kit. They are the ones that really define the sound of the drums. That also give the kit some ambience and space. These mics usually need a cut in the 400Hz area and can use a good rolling off at about 150Hz. Again, they are not used for power.... these mics 'are' the color of your drum sound. Roll off anything that will mask harmonic content or make your drums sound dull. Cuts at 800Hz can bring more focus to these mics and a little boost of a shelving filter at 12.5K can bring some air to the tones as well.

Bass Guitar:

Bass guitar puts out all the frequencies that you really don't want on every other instrument. The clarity of bass is defined a lot at 800Hz. Too much low end can mask the clarity of a bass line. I've heard other say that the best way to shape the bass tone is to roll off everything below 150Hz, mold the mids into the tone you are looking for, then slowly roll

the low end back in until the power and body is there you are looking for. If the bass isn't defined enough, there is probably too much low end and not enough mid range clarity. Think of sounds in a linear fashion, like on a graph. If there is too much bass and no clarity, you would see a bump in the low end masking the top end. The use of EQ can fix those abnormalities.

Guitar/piano/ etc.:

These instruments all have fundamentals in the mid range. Rolling off low end that is not needed or usable is a good idea. Even if you feel you can't really hear the low end, it still is doing something to the mix. Low end on these instruments give what I call support. The tone is in the mids. 400Hz and 800Hz are usually a point of interest as are the upper mids or 1K to 5K. Anything above that just adds brightness. Remember to look at perspective though. Is a kick brighter than a vocal? Is a piano bright than a vocal? Is a cymbal brighter than a vocal?

In Closing

Equalisers are one of the most over looked and mis-used pieces of gear in the audio industry. By understanding equalisers better, an engineer can control and get the results he or she is looking for. The key to EQ'ing is knowing how to get the results you are looking for. Also, knowing if its a mic character or mic placement problem. EQ can't fix everything. It can only change what signal its working with. Equalisers are also a lot more effective taking away things in the signal than replacing what was never there.