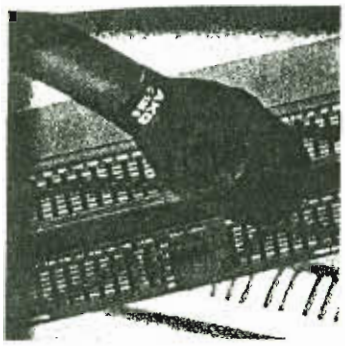
All Things Being EQualized



Equalization can be a powerful ally, but it can also be a veritable Pandora's Box if misused.

By Paul White

Regular *H&SR* readers will probably be aware that I tend to steer clear of equalization unless it is really necessary. My reasoning is simply that a nicely recorded, natural sound loses something when more than the barest hint of EQ is applied. Although I don't pretend to have all the answers, the way in which EQ disturbs the phase relationships between all the harmonics that make up a sound must play a large part.

Nevertheless, there are occasions where EQ is not only desirable, it is essential. The classic case is close-miked drums, where the sound we're after bears little resemblance to the natural sound of the drum kit or the un-EQ'd sound picked up by a mic a couple of inches away from the head. In this case, we are using the EQ creatively to produce the drum sound we want, rather than attempting to capture the way the drum kit really sounds.

Read the interviews with various engineers and producers, and you'll find that nearly all have different views on how and when to use equalization. The real truth is that it doesn't matter what you do, so long as it gets the job done. But when you're still learning and eager for advice, that doesn't help much. Hence, this article will set out to provide a few pointers, though nothing is set in stone and further experimentation is most definitely encouraged.

Real World

When it comes to analyzing any aspect of sound, I like to look at what happens in real life before moving into the rather unreal world of the studio because it seems easier to put things into perspective. So, what happens in nature to cause EQ changes?

You might think that a real sound heard outdoors will always sound the same and just get quieter as it gets further away. This isn't entirely true because the air itself absorbs sound and it absorbs high frequencies more effectively than low ones. In other words, the further you are from a sound, the less top end you hear. Already that gives you something to try in the studio—if you want to position a sound back in the mix, turn down the top end as well as the level, and the effect will be more convincing.

EQ also has a bearing on stereo placement because the way that we perceive a sound depends on the direction from which the sound is coming. Most people already know that the relative level of sound arriving at their two ears differs depending on the source position, and many will also appreciate that the ear nearest the source also hears the sound a fraction of a second before the further ear. But stereo perception is far more complex than that.

Because of the shape of our ears, sounds directly to the side of us are likely to be heard most accurately because our ears are working "on-axis," giving the best possible top-end response. Move the sound source so that it is directly in front of us, and it is perceived differently because the ear is now receiving off-axis sound plus some reflections from the pinnae, which is bound to affect the frequency response of the auditory system to some extent. The same is true if the sound source is moved up or down, and it's now widely believed that the human hearing system obtains directional information by analyzing the time and level differences of the sounds arriving at each ear, and also the way that the incoming sound is filtered by the ear's own directional characteristics and the masking effect of the head. In fact, it is this theory that has been exploited in the Roland RSS 3D sound system, which attempts to recreate the illusion of three-dimensional sound from a two-speaker source. The main stumbling block in recreating the effect precisely seems to be that everyone's ears are slightly different, so a system designed using data derived from one listener will not necessarily work properly for another person with physically different ears. Nevertheless, the system can be very effective with certain material.

Separation

After that little digression into stereo perception, what about EQ in the studio? One of my earliest experiences with EQ was using it to separate sounds that shared the same tape track—this was back in my four-track days. You learn a lot when you only have four tracks to play with, and I feel those who dive straight into 8- or 16-track without spending a year or so on four-track are really missing out on valuable experience.

With only four tracks to go at, the luxury of putting one instrument onto one track was rare indeed, and so I'd try to mix instruments occupying opposite ends of the audio spectrum so I could use EQ to adjust the balance when I came to mix. For example, one track might be used to record bass guitar and glockenspiel. If the bass is

too loud in the final mix, rolling off a little bass will bring it down without affecting the glockenspiel in any significant way, and though this isn't really the right reason to use EQ, needs must when the devil drives your overdraft!

There is a limit to the rebalancing that can be achieved here, though, because the vast majority of musical instruments refuse to be confined to one convenient frequency band and instead spread themselves across a large part of the audio spectrum. Even an instrument like the flute, which produces an almost perfect sine wave, has harmonics in the breath noise that extend right to the upper limit of human hearing. Turning down the top end may not effect the basic pitched sound of the flute too much, but it will alter the character of the breath part of the sound significantly.

To help get a feel for what instruments occupy what part of the frequency range, I've included a chart, Figure 1, that was originally intended to help, but on second thought serves better as an illustration of just how much of the spectrum most instruments actually occupy. The lower end of the range of an instrument is usually quite easy to find as it generally coincides with the fundamental pitch of the lowest note that the instrument can play, but the top end is less easy to define. You can't just take the highest note the instrument is capable of producing because, often, the harmonics of that note extend beyond 20kHz. Take the human voice, which we've got down as extending from somewhere around 100Hz to a little over 1kHz; in reality, the upper harmonics spread across the entire audio spectrum. Furthermore, because singers vary so much, the lower limit is not easy to define as a bass voice can go as low as 80Hz while a soprano might be pushed to get down to 250Hz!

This would seem to contradict the theory that level balancing can be achieved using EQ, but if your levels aren't too far out to begin with, a little EQ either boosting or cutting at that part of the spectrum where an instrument produces most power, can make all the difference without compromising the timbre too much.

Creative EQ

To get you off on the right footing, I've compiled a short list of instruments and sounds commonly used on pop recordings, with a few comments on how they might be equalized. If you have a mixing console with at least one sweep mid control (and preferably two), then you should be able to try most of these out for yourself, but if you have a system with only bass and treble controls, then try to get hold of a basic graphic equalizer, as that will give you a lot more control.

Bass Guitar. Because bass styles, instruments and amplifiers are so varied, it is possible to create a huge range of sounds from this instrument, and EQ plays no small part. That old standby frequency of 80Hz can be used to enhance the sense of low bass, while a raspy character can be imparted by adding a little boost between 500Hz and 800Hz. Boosting between 1kHz and 2kHz tends to give a rather thin sound with a lot of finger noise, and if you are after a bright sound, it is essential to get a bright sound at source since, it's virtually impossible to add top to a dull-sounding bass. A little lower mid cut at around 200-250Hz can sometimes be effective in combination with a little low-end boost for warming up the bass-end without allowing the sound to become unduly boomy.

Vocals. Always work with a pop shield, since no amount of EQ will remove popping once it's on tape. Any top boost should be applied quite high up at 6-12kHz, but watch out for sibilance creeping in. Boosting lower down at 1-2kHz gives a rather honky, cheap sound to the vocals and is not recommended. I try to keep vocals as flat as possible and tend to use the shelving high control to add just a

hint of top rather than anything more drastic. Presence can be added by using just a little boost at 3-4kHz, but be moderate or the sound quality will suffer.

If you're mixing several backing vocals, rolling off a touch of bass might help the vocal to sit better in the mix without sounding muddy.

Electric Guitar. There's no point adding boost much below 100Hz on a conventional electric guitar, as the fundamental of the lowest note is in the order of 80Hz—all you'll do is bring up the boom of the cabinet or the room resonances, which is not what you want. If you need to warm the sound up, concentrate on the area between 125Hz and 200Hz. To add bite to the sound, go for the 3-4kHz section of the spectrum. Remember that the electric guitar isn't a natural instrument, so the only rule is to get the sound you want. Don't add any really high-end boost unless the guitar is DI'd—there's not much comes out of a guitar speaker above 4kHz, so you'll just be bringing up the background noise for no reason. Two similar-sounding electric guitars can be separated by adding bite at different frequencies, say one guitar at 3kHz and one at 3.5 or 4kHz.

Bass Drum. For a rounded bass sound, a little boost at 80Hz will certainly do the trick, but to get a more weighty sound without too much boom, try adding 10dB or so of boost with your shelving bass control, and then 10dB or so of cut at around 220Hz with your lower mid control. This combination of low boost and low-mid cut keeps the bass boost well under control and can be very effective. Add click to the beater impact by boosting at 3.5 to 6kHz, and if the drum doesn't sound bright enough in the first place, try sticking a credit card to the head where the beater hits!

The same EQ tricks apply to toms, though you may want to increase the area of bass boost from 80 to 120Hz or so, depending on the size and type of tom.

Snare Drums. Snare drums can either be a dream to record or a real pig, and I've had my share of the latter. The sound can be fattened by boosting the 100-120Hz band, while the crispness can be enhanced by pushing the 3-6kHz region. Boosting around 1kHz gives a rather nasty zonking sound, but this can be overemphasized to create a techno sound from a standard snare. My trick is to apply full boost and then tune for the appropriate pitch. Driving the mixer channel and a gated reverb unit in serious overload with this EQ setting can really perk up the sound—but don't tell anyone I told you to do it! The end result is not unlike a popping champagne cork.

Acoustic Guitar. I like to record acoustic guitars as flat as possible, but players and producers always seem to want more top end added. If the guitar is part of a pop mix, then I'd also advocate rolling off some bass to avoid muddiness, and if the sound is boomy (usually due to miking too close to the sound hole), then try some cut around 200Hz. To add jangle, boost between 4 and 6kHz, and if this isn't enough, get out your enhancer! Seriously though, by paying attention to mic positions, you should avoid having to EQ very much at all.

Cymbals. If you're working with four-track, cymbals can be recorded onto a track alongside a bass instrument and then EQ'd with little effect on the bass sound. Little happens below 1kHz and the best sounds occur in the 5-10kHz band, so if you need boost, apply it here. To make the sound less clanky, apply a mild cut at between 1 and 2kHz. Always record cymbals at a low level to prevent tape overload, and keep in mind that they always cut through more loudly than you expect.

Brass and Strings. Though brass and string instruments are mechanically quite different, they do respond to equalization in similar ways. The danger area is between 1kHz and 3.5kHz, where the sound

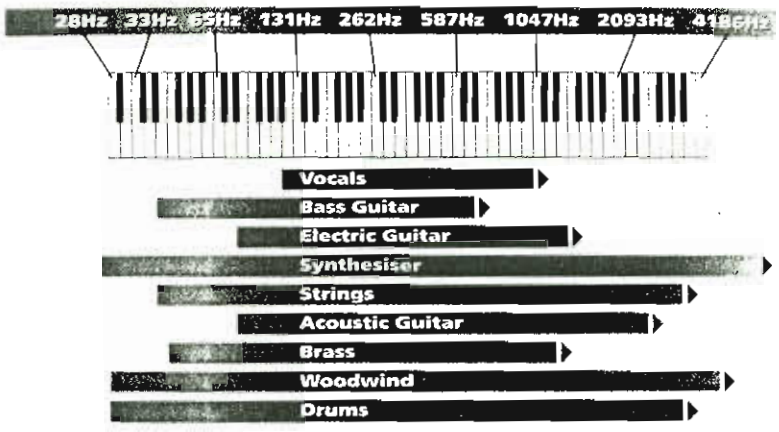


Figure 1: Frequency ranges of musical instruments.

can become harsh or honky, so to add high-end sizzle, move up to the 6-10kHz band and try a little boost there. To fatten up a string or brass pad sound, roll off a little top and add a touch of boost between 300 and 400Hz.

Piano. Most pop recordings are now done using sampled piano sounds, so you can usually pick one that's right with little or no EQ. If you want to mic a real piano, then you'll need good mics and ideally two of them. The bass can be fattened up by boosting at 100-145Hz, while the attack detail can be brought out by bringing up the 4-6kHz area of the spectrum. If the sound is boomy, look for the offending area between 250 and 350Hz and apply just enough cut to tame it.

Summary

Equalization is a personal thing, and to compound the difficulty, different equalizers produce a different subjective effect, even though their paper specifications may be similar. That's why top engineers have certain favorite, and often wildly expensive, outboard equalizers at their disposal while mixing. Whether cutting or boosting, if you're using a sweep equalizer, it's always easiest if you first set it to full boost and then sweep through its range until you locate the area of the specturm you're interested in. Once you've found it, you can either moderate the boost or apply cut as required.

I can't tell you whether it's right to use just a little EQ or to use a lot, as it is a subjective matter. But I would ask you to try to get the sound as near correct at source as possible rather than relying on EQ to save the day in the mix. If you look upon EQ as a fine-tuning process rather than as a major factor in reshaping an unsatisfactory sound, then you won't go too far wrong.

Applying cut to correct a problem is likely to have less of a detrimental effect on the sound than applying boost, as the human hearing system seems less susceptible to frequency notches than it does to peaks. Never forget either that every dB of top-end boost is also another dB of high-end noise in the mix!

Hopefully this article gives you something to think about, and if you haven't had much recording experience, you should find the guidelines useful. Just bear in mind that they are only guidelines, and if you get a better result by ignoring everything I've said, then go for it!