



# MIXING

— with iZotope —

*PRINCIPLES, TIPS  
and TECHNIQUES*



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# 1: INTRODUCTION

## INTENDED AUDIENCE FOR THIS GUIDE

If you don't know anything about mixing or mixing software, this Guide is a great place to start. Sure, we think you should use iZotope mixing tools, such as Neutron, Trash® 2 and Nectar® 2 ([www.izotope.com](http://www.izotope.com)) to mix your audio... you certainly could. But we've learned so much from the audio community over the past 10+ years that we're happy to give something back in return: a Guide that's useful for everyone who wants to learn more about mixing. As a result, this Guide can be freely copied or distributed for non-commercial purposes.

**If you don't fully understand mixing, but already have some iZotope mixing software,** this Guide can help you better understand the powerful sound-shaping tools at your disposal. Each chapter demonstrates many useful concepts that you can apply to your next mixing project. You can also follow along with the free trials of [Neutron](#), [Trash 2](#) and [Nectar 2](#) available at [www.izotope.com](http://www.izotope.com).

**If you already have any of the products mentioned above and already know the basics of mixing,** this guide can show you new tricks or techniques that are possible. Just read through and say "Yeah, I knew that" when appropriate for the other parts.

## ABOUT THE THIS EDITION

This edition of this Guide has been written by Sean McLaughlin, and updated by the iZotope team. Originally from Boston, Sean McLaughlin got his start in the music industry at an early age. He moved to Los Angeles, teamed up with fellow producers Jimbo Barton, Carmen Rizzo, Tim Palmer, and Scott Storch, and lent a hand in honing the sounds of Elliott Smith, Rush, Stone Sour, Seal, Dwight Yoakam and Dark New Day. By 2004, McLaughlin moved back to Boston with a mission of "Helping local artists create major label caliber records". McLaughlin opened the doors of 37' Productions in 2006. Within the studio's first six months, he produced two albums, both charting: Static of the Gods' *Cycles Follow Signs* (Recordhead/Revolver Records) and Oddway's *Away From The Everyday* (OurStage Artist of 2007). Since then, McLaughlin has been fortunate to work with many different artists both locally (Sarah Blacker, Vary Lumar, Girls Guns and Glory, OldJack) and nationally (Queensryche, Matchbox Twenty). In 2013, Sean had the honor of being named Producer of the Year by the New England Music Awards.

iZotope is delighted to have Sean bring his respected perspectives and practical experience to this edition of this Guide.

## ADDITIONAL RESOURCES

If you're interested in exploring more audio topics, iZotope offers additional guides and educational resources that you can download for free:

[www.izotope.com/support/guides](http://www.izotope.com/support/guides)

Ultimately, practice makes perfect—but a firm platform of knowledge to stand on while practicing your art is invaluable.

## ABOUT iZOTOPE

iZotope makes innovative products that inspire and enable people to be creative. Based in Cambridge, Massachusetts, iZotope has spent over a decade developing award-winning products and audio technologies for professionals and hobbyists alike. Used by millions of people in over 50 countries, iZotope products are a core component of GRAMMY-winning music studios, Oscar and Emmy-winning film and TV post production studios, and prominent radio studios, as well as basement and bedroom studios across the globe. Through a robust licensing program, iZotope also powers products made by industry partners such as Adobe, Avid, Microsoft, and Sony. iZotope was recently honored with an Emmy® Award for Outstanding Achievement in Engineering Development for its flagship audio repair suite, RX®.

Learn more at [www.izotope.com](http://www.izotope.com).

## 2: WHAT IS MIXING?

Mixing is the craft of taking multiple audio tracks and combining them together onto a final master track—be it a 2-channel stereo master, or 6+ channels in the case of surround mixing. The way we combine tracks is equal parts art and science, and involves utilizing a variety of tools to bring out the most emotional impact from the song.

Mixing can be as simple as presenting great-sounding tracks in a more impactful way. Other times, mixing may require repairing tracks that sound sub-par. Each mix presents its own problems and challenges—it's your job as the mixer to not only solve these problems, but to present the song the way it sounds in the client's imagination.

This guide will demonstrate how to utilize these tools to achieve the best possible mixes. So what are we waiting for? Let's get started!

## 3: THE FOUR ELEMENTS OF MIXING

Think of a mix as a sonic “soundstage”. There are four essential elements that we use to control that image:

1. Level
2. EQ
3. Panning
4. Time-Based Effects

### LEVEL

Level seems pretty simple—when we want to hear something louder, we turn up a fader. And the louder components of the mix grab the listener’s attention more than the quieter components.

### EQ

EQ can be thought of as a more detailed level control that lets us boost and cut levels at specific frequencies. EQ is the easiest way to shape the tracks in your mix so they fit together—and provides a powerful way to add personality and character to the individual tracks.

### PANNING

Panning refers to the horizontal (left/right) placement of sounds within a mix. Panning can be helpful on instruments that sit in the same frequency range. By panning one to the left and the other to the right, you can separate the two instruments and reduce the chance of one instrument masking the other, and making it harder to hear.

### TIME-BASED EFFECTS

Time-based effects can help form the sensations of depth and space. Time-based effects such as reverb and delay can make an instrument seem further away, or sometimes bigger than a dry instrument.

The elements discussed above allow us to build a creative sonic image, but there’s also another dimension available to us - time. Time is the key way that music differs from static art forms like paintings and sculptures. You can stare at the Mona Lisa all day long and she’ll never change—she’s had that wry smile on her face hundreds of years. Conversely, a song can change within 30 seconds of listening to it and can go through multiple changes throughout the length of the song.



So utilizing the four elements we have control over and changing them throughout a song's structure can result in a vibrant and dynamic mix. Mixing involves a fair amount of sleight of hand—you're deciding what instruments the listener is focusing on and you can change their focus within the mix at any point. A good example of this is going from a vocal melody to another instrument soloing. You've now seamlessly taken the attention of the listener from the vocal to the solo.

## 4: EQUALIZATION (EQ)

Equalization is the process of adjusting the levels of particular frequencies.

### WHAT IS EQ FOR?

We use equalization primarily to shape the tracks in our mix to fit well together. A mix engineer might for example reduce the low frequencies of a bass guitar to allow the kick drum to cut through the mix a little more clearly. But EQ can also enhance individual tracks, perhaps by boosting certain frequencies that make a snare sound punchy (150 Hz – 300 Hz), or a voice sound airy (15 kHz – 18k Hz).

### PRINCIPLES OF EQ

There are many different types of equalizers, and they all perform boosts and cuts in specific frequency ranges. The frequency range can be divided into several bands, such as a low band, a high band, and so on. This allows for unique adjustments to be made in certain areas. Equalizers usually consist of several bands: each band of an EQ is a single filter.

To understand the basics of how equalizers work we will first discuss the parameters in detail:

Parametric equalizers provide the greatest level of control for each band. The instantly recognizable ‘bell’ shape is the most commonly used of all EQ types, allowing independent control of the three most common variables: amplitude, center frequency and bandwidth.

The picture below shows the equalizer in Neutron, but the principles apply for most parametric EQs. One band has been selected and has been dragged down to cut the frequencies centered around 185 Hz by -2.7 dB.



Each band of a parametric EQ typically has three controls:

**Frequency:** The center frequency of where the EQ band is placed within the frequency spectrum. In the picture below, the center frequency is 4900 Hz, or 4.9 kHz

**Gain:** How much we are boosting or cutting. In the picture below, the gain is being boosted by 2 dB

**Q (Bandwidth):** This represents the range of frequencies that are being adjusted by the Gain control. A frequency with a high Q will affect a narrow range and a frequency with a low Q will affect a wider range. In the picture below, the Q of 1.4 is fairly wide, and you can see which surrounding frequencies are also being affected.



While these are the controls for a parametric EQ's bell filter, there are other types of EQ filters that are useful when mixing:

**Low/High-pass Filter:** This is a “one-sided” filter. By choosing a cutoff frequency, we are attenuating (turning down) all frequencies below (high-pass filter) or above (low-pass filter) that frequency. You can determine how steeply the frequencies are attenuated by adjusting the slope setting, which is often configured in multiples of 6 dB per octave, such as 6 dB, 12 dB, 18 dB, 24 dB, 48 dB etc. In the picture below, we are using a high-pass filter with a Q/slope of 48 dB to remove rumble.



**Low/High Shelf:** These EQ types are also “one-sided” and are called shelves because they resemble a shelf on a graph. This manifests sonically as well. A shelving EQ levels off for an overall cut or boost, whereas a bell shape is for more precise adjustments. The gain (boost/cut) affects all of the frequencies below our center frequency (low shelf) or above our center frequency (high shelf). In the picture below, a high shelf is adding 1.7 dB of boost above a turnover frequency of 2378 Hz. Note how it ‘shelves off’ above the center frequency.

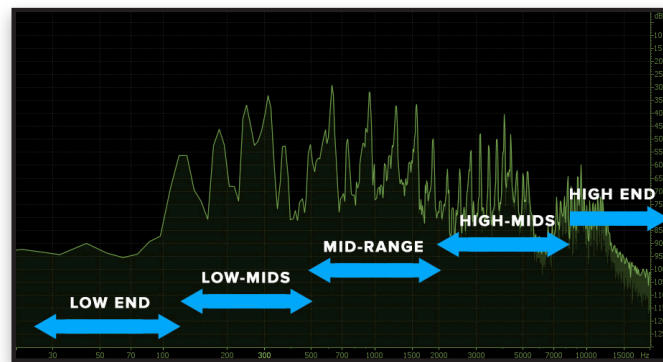


# THE FREQUENCY SPECTRUM

Before we begin EQ'ing, we should understand the frequencies we are about to adjust. Frequencies are measured in 'Hertz', or 'Hz'. This can be easily understood as the number of cycles per second of any given wave. A 200 Hz tone has 200 cycles per second, which ultimately provides us with a recognizable pitch.

Human hearing is commonly understood to cover a range from as low as 20 Hz to as high as 20 kHz (20,000 Hz). We refer to this range as the frequency spectrum. Different instruments within a mix tend to be focused in different areas of the frequency spectrum.

How do we know where each instrument lies? We can certainly use our ears and our eyes, but let's break this range down into five specific ranges using common terminology.



1. **Low End (125 Hz and below):** This is where all sub-bass and bass instruments reside. Be careful, this frequency range is generally better “felt” than heard.
2. **Low-Mids (125 Hz – 500 Hz):** This range has the fundamental frequencies of a lot of lower range instruments and can be a tricky one to master. Too much in this range could be described as “muddy”, while too little will have your mix lacking power.
3. **Mid-Range (500 Hz – 2 kHz):** Almost every instrument sits somewhere in this range (vocals, snare, guitars, piano, horns, etc.). This is where you will spend most of your time getting your instruments to fit together.
4. **High-Mids (2k Hz – 8 kHz):** This range is where a lot of upper harmonics live (vocal breaths, cymbals, etc.). This range is where you will find the “snap” in a kick drum and the “pluck” of an acoustic guitar.
5. **High End (8 kHz and above):** This is where the “air” and “sizzle” resides. Too much energy in this range can be fatiguing and will make the mix sound thin, while too little will make the mix dull.

## THE ART OF EQ

Now that we understand where our frequencies are and the sorts of adjustments possible with EQ, let's take a look at some general EQ tips.

- Every instrument has a fundamental (lowest) frequency for each note that it plays. Try to listen and learn the basic frequency ranges for each instrument you're working with. This can help you decide when and where you cut and boost.
- Knowing where the fundamentals and harmonics (frequencies that are a multiple of the fundamental, i.e.: a 100 Hz fundamental has harmonics of 200 Hz, 400 Hz, etc.) are for each instrument can help eliminate some guesswork you may be doing while EQ'ing tracks in your mix. To illustrate, let's use the example of trying to create space for a lead vocal when you feel something is crowding it. Try adjusting the EQ of other instruments with a similar frequency range as the vocal (like piano, guitar, snare, etc.); if that doesn't help relieve the crowding, try something else. Maybe it's the kick drum? A typical kick drum can have a fundamental frequency of 80-100 Hz and have a harmonic near the vocal register. If this is the case, removing EQ from the kick drum between 2-3 kHz can make the vocal sit loud and clear atop the mix. So, if changing the obvious culprits doesn't fix the problem, investigate further to find the issue. A quality mix is worth the effort.

### NEUTRON TIP

In Neutron's EQ, if you hold down the Alt/Option key and click on the spectrum, you reveal an "audio magnifying glass" that lets you hear only the frequencies that are under the mouse cursor, without affecting your actual EQ settings. This is useful for pinpointing the location of a frequency in the mix without messing up your actual EQ bands. Releasing the mouse button returns the sound to the actual EQ. You can set the width of this filter in the Options dialog by adjusting the "Alt-solo filter Q", or by scrolling the mouse wheel. Double-click in the spectrum area to add an EQ band.



To find and fix a problem frequency using “alt-solo”, double click exactly where the mouse is and add a new EQ band at that frequency. Then you can hold shift to drag that band down and cut those frequencies (see next section).

- The relationship between a kick drum and a bass guitar is paramount to maintaining a solid and strong low end. Listen for the fundamental on each and do your best to not overload any particular frequency on both. If a kick drum’s fundamental is 90 Hz and the bass’s fundamental is 50 Hz use those frequencies as a guide for separating the two instruments while still maintaining a solid low end. One way to achieve this is to “wrap” one instrument around the other. For example, find the fundamental frequency of the bass, then notch that frequency out of the kick. Then, boost the frequencies above and below that (if needed). In addition to this, another technique often used is called side-chaining, which we will discuss in [Dynamics Chapter](#).
- If your mix feels “muddy”, try reducing frequencies between 125 Hz and 500 Hz. If certain instruments, such as heavy electric guitars, piano and certain keys and pads, feel as though they are carrying too much “weight” in the mix, start with those instruments.
- Too much between 500 Hz and 1 kHz can sound “woody” or “boxy” and give a false sense of power in a mix. Certain instruments, such as acoustic guitar, hand percussion (such as congas), electric pianos and other instruments that have a wide midrange tend to fall into this category.
- Watch your step with 2 kHz and above. This is an area where a little EQ can help a lot, while a little too much can start to make a mix sound brash or tinny. A lot of instruments have a “tackiness” between 4-8 kHz, but this range also adds some “snap” to the attack of instruments. Be aware of how much or how little work you’re doing in this range; you want to make sure your mix stands up to repeated listening without feeling too harsh.



- To continue the thought above, our ears tend to get fatigued when overworked, particularly in the high end—yet another reminder that breaks are as important as listening!
- Realize that our ears adjust to EQ changes very quickly and can be easily convinced a change is a positive one purely because it sounds different (especially if it sounds louder), so remember to reference back to the original sound of the instrument if you feel like you're straying too far from the desired effect. The bypass button can be your greatest ally.

## TIP

In Neutron, Nectar and Trash, you can use the unlimited undo history within the plug-in to easily audition different EQ settings to find the best sounding one without having to keep changing the settings back and forth manually.

- Remember that cutting can be just as effective as boosting—and often times even more effective. Cutting certain frequencies allows the surrounding frequencies to feel more prominent, and has the added benefit of ensuring there are no overloaded frequency ranges.

## TIP

This principle applies to many aspects of the mixing process. If you can get a great result by reducing an ingredient instead of adding more unwanted salt into the soup, your mix is often better for it!

- Try using a high-pass filter (HPF) on every instrument except for kick and bass. In a lot of cases this will create more clarity in the low end. The reason for this is that many instruments (such as vocals) have little to no useful information in this range, and other instruments (electric guitars for example) may have low end added through EQ on an amplifier. If you're listening and feel that you hear the low end to be "crowded", try this technique. Start by soloing the drums, bass and any instrument (I usually do a vocal first). Set the HPF to 60 Hz, and slowly move the frequency higher. As soon as you feel you're losing tone from the instrument, bring the HPF lower to where it sits best in relation to the track. The bass and kick drum will usually fill in all the low end you need.



- Many mix engineers talk about 'Pultec' equalizers as one of the holy grails of studio gear. Of course, this is entirely subjective, but there are certain characteristics of a Pultec filter curve that people respond well to. Boosting frequencies with a Pultec EQ causes a complimentary dip to occur elsewhere in the frequency spectrum, as seen in this image.



- So, adding some low-end boost with a Pultec EQ is often effective, as a side effect is a slight reduction of the frequencies above the area to be boosted helping the track to sound fuller and clearer at once.

## 5: DYNAMICS

Dynamics processing isn't just about making things 'louder'. In the context of mixing, dynamics processing can be used to control the dynamic range of an audio signal in order to achieve a variety of musical effects. You can think of dynamics processing as having two major 'families': Downward Compression/Limiting and Expansion/Gating. Using both of these two major types of processing to adjust dynamic range is often essential to creating the illusion of a perfect performance—or at least the polished sound of one!

### WHAT ARE DYNAMICS FOR?

Using these processors is a way to control, reduce or expand the dynamic range or overall volume level of a track.

In the case of compression and limiting, the goal is usually to “even out” the dynamic range of a track by attenuating loud transient peaks, such as a singer that suddenly belts out a high note in the middle of a gentle ballad, which can be a little jarring to the ear.

In the case of expansion and gating, the goal is to lessen or remove unwanted signal on a track. Removing the sound of high hat bleed in a snare drum recording would be one example. Reducing the volume of unwanted breaths in a vocal recording would be another.

#### TIP

iZotope's Nectar 2 Production Suite includes a Breath Control module, which automatically detects and attenuates breaths in a vocal recording more transparently than a traditional gate.



## PRINCIPLES OF DYNAMICS

The ability of a good mixing engineer to use dynamics processing effectively is truly a life-long learning process. So let's start with the four basic parameters common to almost all dynamics tools, namely, threshold, ratio, attack and release.

### Threshold

The threshold is the level at which dynamics processing begins. For compressors and limiters, any signal rising above the threshold would be affected (see Fig. 1) For expanders and gates, any signal falling below the threshold would be affected (see Fig. 2).



Figure 1

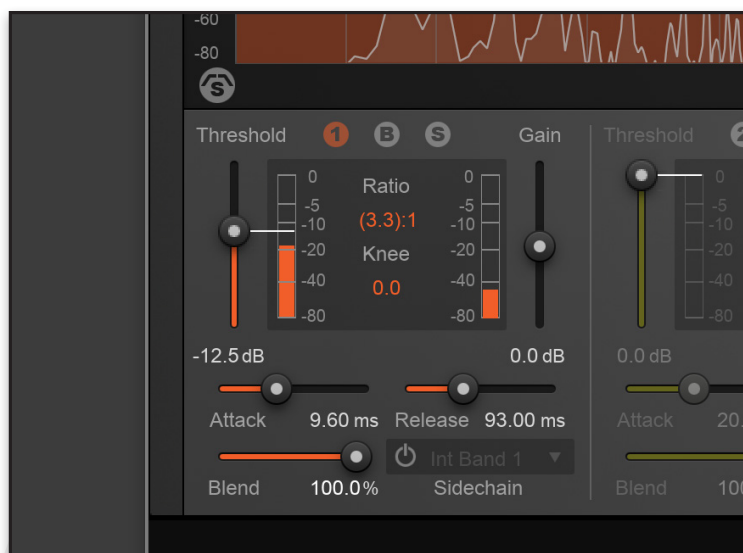


Figure 2

## Ratio

The ratio determines the amount of dynamics processing that happens to the signal. For example, a 4:1 ratio (see Fig. 3) on a downward compressor means that for every 4dB the signal in question rises above the threshold only 1dB will be heard above the threshold, a reduction of 3dB. A limiter is a compressor with a ratio of 10:1 or greater—often as high as 20:1 or 30:1—and generally a fast attack time (see below). In the case of a gate, the ratio is  $\infty$ :1, meaning that any signal below the threshold will be muted.

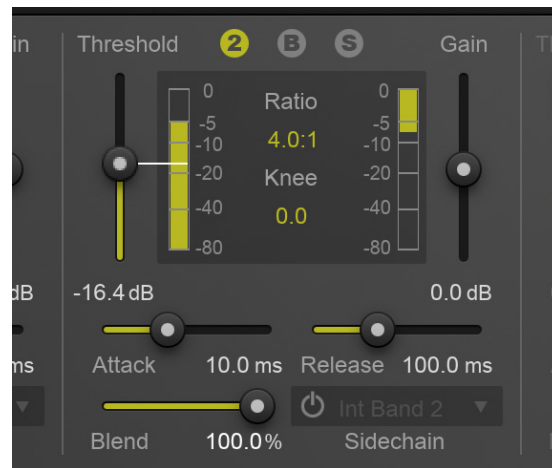


Figure 3

## Attack

The Attack parameter defines how fast the dynamics processor works once the signal has passed the threshold, usually measured in milliseconds.

## Release

The Release parameter determines how fast or slow the dynamics processor stops processing or “lets go” once the signal has passed the threshold, also measured in milliseconds.



Compression essentially distorts a signal, in that it changes the original sound of the signal through its processing. It's our job to make that compression feel transparent and to use our dynamics to create the best-sounding performance we can. One way to avoid adding more distortion is to be careful with our attack and release times—too fast an attack time can “choke” the performance and too fast a release time can cause the instrument to “pump”. Try setting these parameters and listen for yourself to hear the effect so you never do this again! In the picture below, the release time is too slow, and the compressor is squashing the signal before it has time to recover.



See, that was easy! Now that we know our parameters, how do we use them effectively? We don't necessarily want our track to be constantly compressed or squashed, so we should set our compressor to achieve the desired effect. But how do we know what the desired effect is?

There is no hard and fast rule since much is determined by instrument type, style of music, performance, etc. We'll go into more detail in [Chapter 10: Mixing An Action Verb](#). For now, let's go over a few guidelines.

## THE ART OF DYNAMICS PROCESSING

- Use lower ratios (2:1–5:1) for “leveling out” performances, particularly ones that have a few notes that “jump out” in a particular performance.



Sometimes, using two more gentle compressors in series (one compressor followed by another compressor) is a more transparent way of leveling out an audio track. Rather than one harsh pass of compression that could sound squashed, you achieve the same result with more finesse. In the picture below, we are compressing the same note as the previous picture, but both Compressors are engaged in series.



- Try using faster releases when compressing drums and other percussion instruments. This helps tame the transients (the initial burst of sound) but maintain the decay of the original sound.
- On that note, be careful to not crush the transients of a particularly percussive or choppy transient audio signal with an attack time that's too quick.
- When compressing acoustic guitars, try a faster attack for a picked or plucked acoustic, and a slower attack for a strummed acoustic. Picked or plucked acoustics tend to have more individual transients that are louder than the sustain of the note. A faster attack will help to even out the attack and sustain. Strummed acoustics are generally more even dynamically, so a slower attack will help it "shine" a little more.
- Distorted guitars already have some natural compression from overdriving the amplifier. For best results, use little to no compression unless there are spots in the performance that are popping out of context.
- Try this on a lead vocal: first, set a limiter with a high ratio to grab the extremely hard notes and then follow it with a compressor using a gentler ratio (for example, 3:1) to do the overall processing. This will allow the compressor to not work as hard on those peaks, and the vocal will sound less "pumping" and more natural.



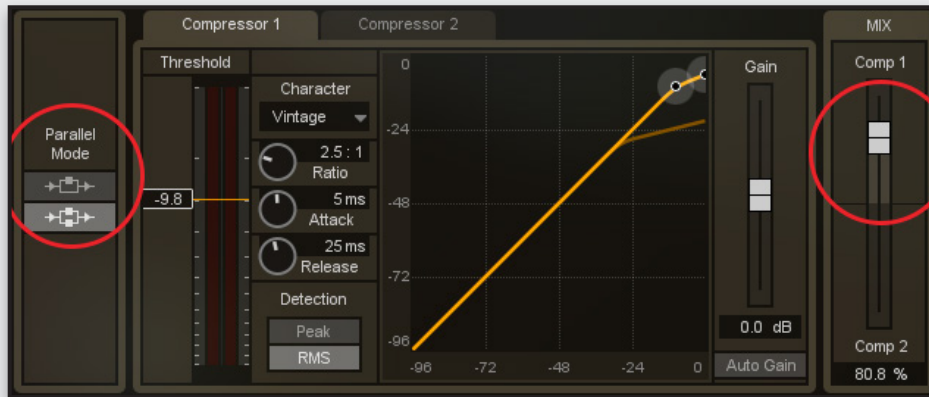
- Parallel Compression is a technique that involves mixing a lightly compressed signal with a heavily compressed (and sometimes high-pass filtered) version of the same signal. This allows for a smoother result, with crisp and level sound in the high end without any loud peaks or squashed transients. A typical ratio might be 50% of each signal.



It's easy to achieve Parallel Compression with Neutron. Adjust the Blend slider in each band, or the global parallel amount slider.



In Nectar 2, simply click on this button, and the two compressors are now in parallel. The ratio can be adjusted with the mix slider, and the second compressor can be filtered up above.



- Experiment with matching the release time on a compressor to the tempo of your song. Having the release synchronize with, say, a driving 8th note rhythm on a bass or guitar can add life to the performance. An easy way to figure this out is to set the compressor on your track with a very low threshold, then adjust the release time until the signal sounds natural (i.e.: not pumping).
- Try using a limiter on your bass with a heavy (6-12dB) gain reduction in a dense mix. This will maintain a solid low end throughout the mix.



- For staccato horns, start with a fast attack, but make sure the attack doesn't smother the 'hits' of the horns. Parallel compression on a horn section, similar to a drum group, can also be a lot of fun!
- Don't be afraid to experiment with extreme compression. Limiting ambient microphones on drums can give a sense that the drums were recorded in a much larger room than they actually were. But be careful: When not set properly, this can completely smother the sound of your drums, and, in extreme cases, you can lose the energy and intensity of the rhythm and your whole mix can end up sounding flat.
- Above all, keep listening, and reference your original sound. The more you use compression, the better you'll understand the parameters and how to use them to achieve the desired effect. One day you will rule the compression world!

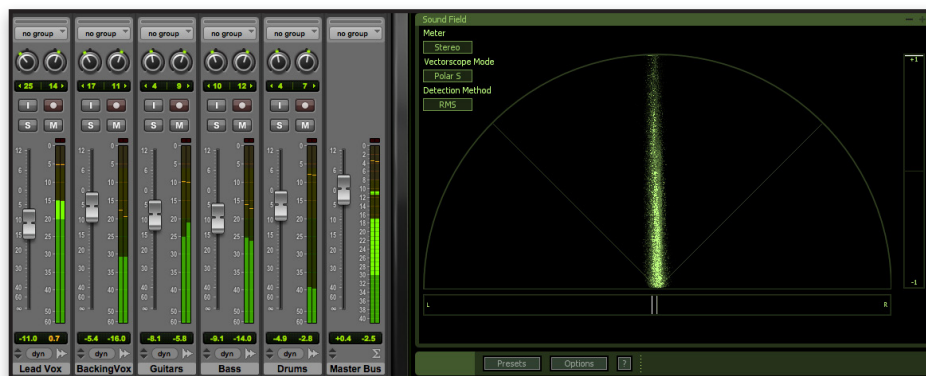
## 6: PANNING / STEREO IMAGING

Music is typically mixed and listened to in stereo. Panning a single audio element within a mix is the process of weighting the element more heavily in favor of either the left or right speaker.

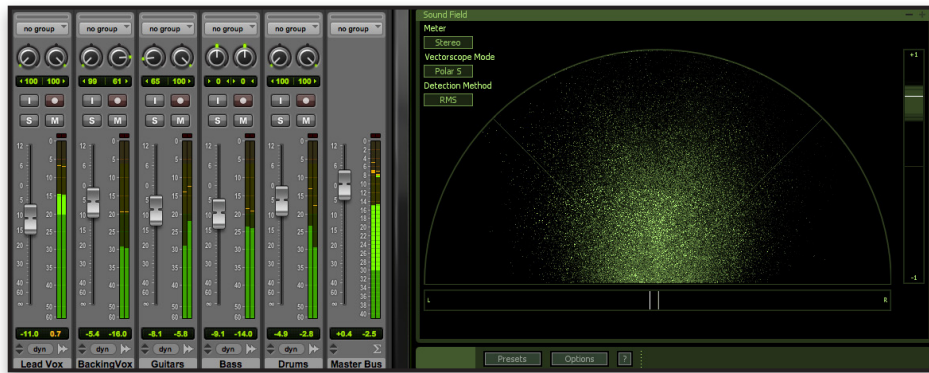


### WHAT IS PANNING FOR?

Panning in large part determines how wide our mix ends up sounding to the listener. It can be used to create space in a mix, enhance existing space, and create a more immersive musical experience for the audience.



In Fig. 4, the mix is panned very narrowly, and the Stereo Vectorscope tells us the listener will not hear much spatialization, or width.



In Fig. 5, the mix is panned widely, and you can see the result. A much wider mix without any processing required beyond panning!

There are a couple of easy effects and tricks we can use to create different stereo images, which we'll discuss later in this chapter.

## PRINCIPLES OF PANNING

How do we know what to pan, and where? A general rule in much of today's popular music is that the backbeat and lead vocal are the focal points of the mix. Because of this, the kick, snare, bass and lead vocal are usually panned center, often referred to as 'C' or '0' by most DAWs. The other elements of the mix are what the mix engineer typically uses to create a stereo image of your song. Our ears tend to focus on the signals in a mix that are panned center or panned extreme left or right.

### TIP

When recording acoustic guitars, 'double-tracking' (recording the same part twice), and panning one recording extreme left, and the other extreme right can create a much fuller sounding mix without overloading the instrumentation of the arrangement.

This doesn't mean that the space in between Center (Left and Right) is to be ignored. Understanding these common approaches will help you determine what you want the listener to hear and experience by where you pan that particular instrument.

### TIP

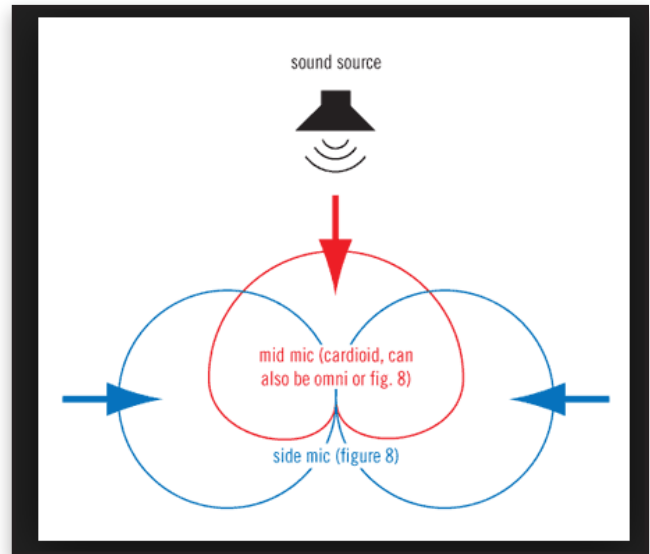
Panning a snare dead center can immediately make it sound punchier, panning it slightly to one side might cause the listener to focus slightly more on the lead vocal or kick drum, and so on.

## MID / SIDE PROCESSING

Any discussion of panning and stereo imaging techniques in general would be incomplete without mentioning Mid/Side processing, so let's take a look at that before we dive into the art of panning.

The concept of Mid/Side Processing comes from a mic technique patented by Alan Bluemlein in 1934. The original idea was to recreate how a pair of human ears hears a stereo image. It came to be used effectively as a recording technique to enhance 'space' before stereo playback existed. The basic setup is: One cardioid microphone (mid) and one bi-directional (figure eight) microphone (sides).

Either during or after recording, the process includes copying the side mic signal and reversing the phase. This would leave you with three audio signals, one called 'mid', and the other two, 'sides'. The two 'side' channels get panned hard left and hard right respectively.



Listen to the mid microphone signal—you'll hear a mono image. When you add the side signal, the stereo image changes. The louder the side channel is, the wider the audio is perceived. This is due to the phase correlation between the two mics. It's an interesting sounding recording technique, particularly for capturing drum sounds in a room. But how is this used in the mixing process?

Simply put, Mid/Side processing in the mixing or mastering stages separates an ordinary stereo recording into its separate areas of your soundstage, independently. Mid/Side Processing lets you work independently with the center of the stereo image or the sides. The mid channel, (the sum of Left and Right, or everything common to both the left and right speakers) can be isolated from the side channel, (which is everything different between the left and right speakers) for separate processing.

For instance, if you have a stereo drum bus, applying some high-end boost to the side channel makes the 'wider' elements sound brighter. Also, adding some mid-range boost to the mid channel can add punch to a snare drum without muddying up your reverb, which is often more noticeable in the side channel.

To process audio in Mid/Side, you must have either recorded it in Mid/Side to begin with, or encoded the signal for processing, then decoded the signal after processing back into the conventional L+R format for playback. If you don't have a recorded Mid/Side instrument in your mix, there are a few plug-ins that do Mid/Side encoding (including iZotope Ozone, seen below EQ'ing in mid/side mode).



## THE ART OF PANNING / STEREO IMAGING

Let's step back for a second. Remember the idea here is that we're creating an audio picture for our audience to experience. In some cases this will mean that, if you close your eyes and hear your mix, you can picture all of the musicians playing their instruments as if they were positioned on a stage. In other cases, it just means that you're trying to create movement and excitement by having newer instruments pop up in your stereo field for the ear to focus on. There are no hard and fast rules for this; just guidelines, but here are a few tips:

- If there are two instruments in your mix that occupy a similar frequency range, try panning them opposite of one another. You don't have to pan them to the extreme. For instance, a guitar panned slightly to the left will complement a keyboard panned slightly to the right. This will create a better balance throughout your mix, as the listener won't perceive all the instruments to be coming at their ear from exactly the same position—which can be fatiguing and make it hard to know what the ear should focus on.
- Try keeping a narrower image across your whole mix during the verses of your songs and then widening that image by panning the elements that appear in the choruses further away from center. Having certain elements pop out like this, or even just move temporarily to a more extreme pan setting will create excitement.

- Every once in awhile, listen to your mix in mono to ensure you aren't losing too much in the translation. It's possible to spend a long time panning everything, only to go too far and realize your mix sounded more impactful before you even began!
- Every once in awhile, listen to your mix in headphones to make sure it doesn't sound too disjointed or off balance. Your monitor speakers might be excellent, but since headphones lack the 'crosstalk' (audio information from the right speaker reaching the left ear and vice versa), the experience can sound different.
- Make sure that the elements you pan don't make the left or right side too rhythmically busy. For example, when mixing two instruments that occupy a similar higher-end frequency range, such as an acoustic guitar and a hi-hat, you can pan each instrument opposite sides. Since these two instruments are usually playing a similar rhythm (8th or 16th notes), keeping them opposite of each other maintains a similar timbre and rhythmic feel in both speakers. Panning a lot of rhythmic elements to one side could be quite distracting.
- With that said, sometimes older recordings, or modern recordings mixed with nostalgic, vintage methods, might pan the drums almost all the way to the right, and the bass opposite on the left. Doing this can result in interesting textures.
- As mentioned above, when recording an instrument, particularly one that's quite transient and tonal (anything plucked or strummed), recording that instrument's part twice and panning one recording 'extreme left', and the other 'extreme right' can create a much fuller sounding mix.

## 7: TIME-BASED EFFECTS

So far we've covered 3 of the 4 elements we mentioned in [Chapter 3](#), Level, EQ and Panning. Now we get to our fourth element—time-based effects. Time-based effects are responsible for the perceived 'space' in our mix.

### WHAT ARE TIME-BASED EFFECTS FOR?

Using certain time-based effects can give instruments the sense of being larger or further away in the mix. A good mix engineer might make use of a few different reverbs to give each element a shared or unique acoustic space, or perhaps use a delay to inflate the presence and impact of a lead vocal. Overall, you might say time-based effects are for enhancing the depth, and spatial characteristics adding the final finishing touches, or providing the final sparkle to a mix.

### PRINCIPLES OF TIME-BASED EFFECTS

There are many different types of time-based effects, and they each work differently and achieve different results:

#### *Reverb*

Reverberation is a naturally occurring phenomenon caused by sound reflecting (or 'bouncing') off walls in any given room or space. Room size and materials play a big role in the sound of any given space. For example, music in a wooden barn, a stone cathedral and a bedroom would all sound very different.



Reverb in the mixing process creates the sense of space that a room would provide and is an aesthetic tool the mix engineer can use to great advantage. Reverberant effects can be achieved via digital technology, such as convolution—the algorithmic modeling of a room behavior—or in the analogue domain with objects such as springs or plates.

The distinct character and coloration of spring (often found in guitar amps) and plate reverbs is now something modeled and replicated in the digital domain.

## TIP

Nectar 2 contains a model of the renowned EMT-140 plate reverb (a large metal plate with a unique sonic signature) that's graced classic recordings for decades. With it, you can change the size of the room and other parameters to dial in the wanted effect.

There are many great reverb options out there, and the reverb plate in iZotope Nectar is one of them. We'll also discuss a few different options later in this chapter. Be careful, too much reverb can drown out the actual elements of your mix.

## Delay



A delay stores a signal for a period of time and then releases it. Controlling multiple delay lines allows a mix engineer to create 'echo-style' effects. Releasing the delayed signal with some sort of volume decay enhances the presence of a human voice rather than replacing it, which would make it appear out of time.

Delay comes in many forms, from a simple slap back sound a la Elvis Presley's "Heartbreak Hotel" rockabilly style, to a synchronized rhythmic style along the lines of the Edge's guitar part in U2's "Where the Streets Have No Name." Each of these delays creates a different effect in how you perceive what you are hearing.



There are many different types of equipment that can create delays (analog, digital, etc.). You can blend them into your mix subtly or drastically to make them stand out. The important thing is to understand why you are using the delay: Is it there to make the listener feel something rather than ‘hear’ it, or are you using it to actually change the tone of the instrument? A variety of delay-centric tips are offered later in this chapter.

### *Chorus/Flange/Phase*



These three effects are modulated versions of delays. A general rule of delay is that the human ear doesn't hear a delayed signal as separate from the original signal until it's timing exceeds approximately 50 milliseconds (ms). These three types of modulated delays occur before the delay signal reaches 50ms. The timings are approximately:

Phase: None

Flange: 1-5 milliseconds

Chorus: 5-40 milliseconds

These effects are created by adjusting the depth and rate of the delay. The depth, usually measured in percentage (%), is how far the set delay time moves earlier or later within that time.

For example, a delay time of 40 milliseconds with a depth at 25% means the delay time will vary between 30-50 milliseconds. The rate determines how fast that change happens. So, in our above example, a faster rate would move the delay time faster between 30-50 milliseconds.

Now let's discuss the rate and depth of the three modulation effects. A phaser effect cancels out different frequencies at different times, with the frequency notches evenly spaced. Flangers usually have the widest depth with varying rates from slow to fast, depending on how extreme you want it. Chorus has a more subtle rate and depth; the settings on a chorus should be used to create a wider and thicker sound, and, in some cases, widen the stereo image of the instrument you are affecting.

Be aware that the type and amount of time-based effects you use tend to date a mix more than any other element. A good example of this is the gated reverb used on snare drums in the 80's (this is as much a mix 'fashion statement' as shoulder pads and leg warmers). Be aware of this while you are mixing, and understand that someday someone might say "that mix was so 2014."

## THE ART OF TIME-BASED EFFECTS

Some time-based effects tips:

- Experiment with a mono reverb on a lead vocal and add a stereo delay in a chorus. This will keep the lead vocal focused in the center, and the delay (if timed with the tempo of the song) will act as a wider reverb in the chorus.
- Add a chorus effect to a lead vocal mixed in at around 5-8% wet. This introduces some subtle movement to the lead vocal that is hard to detect, but will keep a lead vocal interesting.



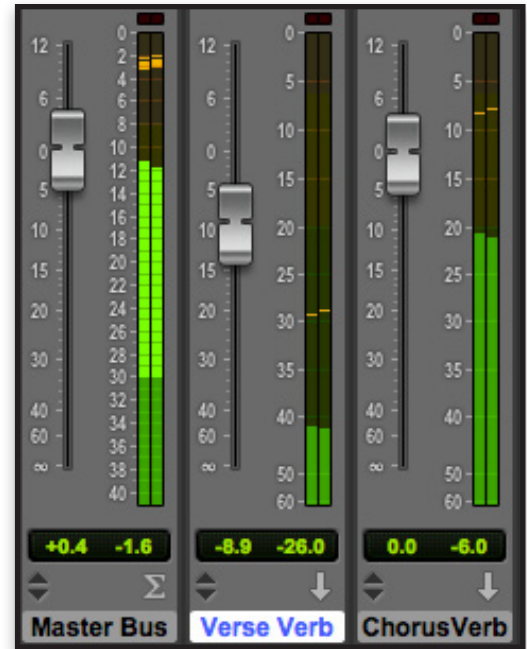
- Try different reverbs between a chorus and a verse. This helps to differentiate various musical sections sonically. In the picture below, the chorus reverb is taking over from the verse reverb in our mix, as the musical transition happens.

- If you would like your delay to be more noticeable, or you want to create some rhythmic push and pull, try setting the delay time slightly earlier or later than the tempo of the song (+/- 10 ms). This anticipation or 'laying back' of the delay can heighten a listener's interest.

- Experiment with using delays on particularly close mic drums (snare, hi hat); this can create a shuffle or a 'swung' feel if mixed in at the right level. Listen to it as low as you can possibly hear it, then bring the level up until you feel a rhythmic change.

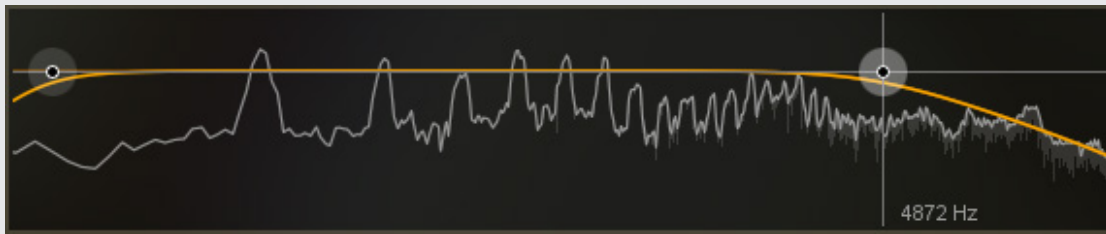
- Try using a chorus effect on your bass track. Start with the chorus fader all the way down, then bring it up until you can feel the low end start to surround the sides of your kick drum rather than center. Don't go too far! The low frequencies should never be mixed too wide.

- Try rolling off both high and low frequencies of the wet reverberant signal. Gentle differences in the mid range are often more effective at creating space and depth. It's easy to overload the high end with special effects.



**TIP**

When adding reverb to a lead vocal, put a low-pass filter on the wet signal with a center frequency below 5 kHz. This helps avoid the sibilance of the wet signal overloading the vocal and making it sound harsh.



## 8: DISTORTION

Some of you may think of distortion as a bad thing, but distortion—from subtle to extreme—can be a powerful tool in your arsenal.

Long before digital mixing, distortion was inherent in every project. From pushing the preamps on an analog console to tape saturation or tube amplification, distortion was on **every** track in **every** mix.



Many musicians throughout modern popular music history have used distortion creatively to define signature sounds. Because of this, our ears have not only gotten used to the sound of distortion, but find it harmonically pleasing. This is one of the elements that, until recent years, have been missing from the inherent, clean precision of digital mixing. These days however, many different harmonic distortion tools are available to help mix engineers produce this phenomenon.

### TIP

You'll find models of analog or vintage gear with great distortion characteristics in various iZotope plug-ins, such as Neutron, Trash 2 and Nectar 2, as well as other tools you may have in your toolbox.

### WHAT IS DISTORTION FOR?

A mix engineer typically uses distortion to enhance the presence of an audio signal. Whether it's by adding something punchy, such as a tube based distortion on a kick drum, or something bright, like a tape based distortion on drum overheads or vocals, adding harmonic distortion can make a signal sound fuller and more exciting.

Many guitar players prefer to record with their overdrive or distortion active because it enhances the way they play their instrument and can inspire a great performance that an otherwise plain guitar tone simply cannot.

## PRINCIPLES OF DISTORTION

Perhaps the most basic form of distortion is over-modulating a sine wave to the point that certain harmonics approximate the sound of a square wave. Distortion is the result of this overmodulation.

Any form of harmonic saturation is technically distortion. Some common types of distortion a mix engineer might use are:

- **Tube:** This simulates the distortion heard from tube equipment which emphasizes transients (or the attack of an instrument) which is why people tend to describe it as punchy. Often, tube distortion is more easily noticed in the low end, which is why it is described as 'warm.' "



- **Tape:** This emphasizes the odd order harmonics normally found during tape saturation. Though it also affects the low mid range, the effect of tape saturation is often more noticeable in the high end, and tape machines themselves have a high noise floor (read: hiss). Because of this, tape saturation is often described as ‘bright’ sounding, as well as ‘warm’.

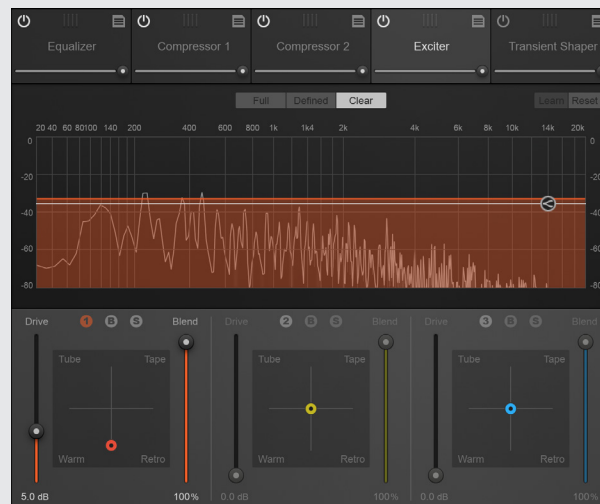


**TIP**

You may have noticed that subjective terms in audio are often interchangeable and mean something different to everyone. The golden rule, above all else, is that if it sounds good, it sounds good—however you describe it!

**NEUTRON TIP**

Neutron also has ‘Retro’ and ‘Warm’ settings. ‘Retro’ is based on transistor characteristics that have odd order harmonics which slowly decay over time. ‘Warm’ is similar to the tube setting but generates quickly decaying even order harmonics, and can sound gentler than tube saturation.



These settings can be used subtly or drastically depending on your taste. There are also more extreme forms of distortion possible in other plug-ins, such as iZotope's Trash 2. These range from amplifier simulation, to extreme fuzz, to combinations that you may have never imagined.

## TIP

Waveshaping distortion, such as that in Trash 2, goes back to the idea of over-modulating a waveform to introduce additional harmonics, and can be used to create entirely unique distortion signatures.



An added bonus of using distortion or 'harmonic excitement' is that the effect itself can help shape the timbre of a track as well as act as a dynamic control. Overdriven signals coming from a guitar amp, for instance, have an inherent compression that lessens or negates the need for extra dynamics processing. As a result, little to no compression is needed for distorted electric guitars (as mentioned in [Chapter 5: Dynamics](#)).

## THE ART OF DISTORTION

Think of distortion as the garlic in your tomato sauce—just the right amount gives the perfect nuance. Too much of it could make your breath (or mix) smell unpleasant. Here are some tips for using distortion in a mix:



- In mixes with a lot of guitars or keyboards, try distorting your bass track to help the transients cut through in the mix. Since the bass is holding down the low end and may be covered by other instruments higher up in the frequency spectrum, you might be surprised at how much distortion you can get away with.
- Try sending your drums to a stereo bus and applying distortion to that drum bus. This can provide some of the 'glue' that people sometimes rely on compressors for.



- Using subtle distortion on a lead vocal, with heavier distortion on a backing vocal bus that's mixed lower in volume can help enhance the fullness of the backup vocal track.
- Experiment with distorting any signal that you'd like to cut through but which seems 'too clean' to allow that to happen (this includes the snare drum.) Remember, a little can go a long way! Automating the distortion levels across different instruments can help create an interesting contrast.
- Duplicate your vocal track, then heavily distort the second vocal. Slowly introduce the distorted vocal in choruses to add a little harmonic excitement. This will also help the vocal sit further forward in a thick chorus.
- In some cases, a subtle (under 30%) distortion mix on almost any audio signal can act as a harmonic boost to the song as a whole, particularly drums (kick and snare, as well as ambient mics) and acoustic guitars.
- Above all, there are so many different flavors, from subtle to intense, that can be used to great effect in a mix. The best way to use distortion is to experiment with the different types at your disposal, and find a way to make it your own. Just have fun with it!

## 9: BEFORE STARTING YOUR MIX

### DISCUSSING GOALS WITH THE CLIENT

Assuming you've received files from a client, it's important to have an initial discussion with them about their expectations for the end result. Try to get a list of reference mixes to have as a baseline from which to work (i.e. drum sounds, reverb on vocals, overall level of instruments in relation to each other, etc.). The next step would be listening to a rough mix. While you may eventually go in a different direction, it's important to have an idea of what the artist and producer intended while they were working on the project. For example, there may be plug-ins or effects on certain instruments in your mix; these plug-ins could be the vague direction the artist/producer would like to move in, or they could be the exact sound they would like to keep in the mix. Do you hear any conflicts between the discussions you initially had with the artist and the tracks that you are hearing (i.e. the artist is looking for a dance mix but has an acoustic rock drum set on the track)? If you have any questions on your mix, keep an open line of communication with your client. The more information you have before you begin, the closer you will be to reaching your artist's goal.

An important distinction needs to be made between the sound the artist is looking for and the vibe the artist is looking for. Remember, we make things fit sonically to achieve an end result that conveys the emotion of the song.

### LISTENING TO THE ROUGH

The first thing you should do when you open your mix is listen to it as a whole. During your second pass, you should start examining the tracks in the mix. Remember, when you are baking a cake, you need to know what ingredients are in front of you.

### WHERE TO BEGIN?

There are a few different ways to approach your mix when you begin. Some mixers begin with the lead vocal, and some begin with drums. The reason for beginning with a lead vocal is that the lead vocal is the 'star' of the track. In most western music, all of the elements of a song exist to serve the lead vocal. The reason for starting with drums is that the drums are the foundation of the song, and the other elements of a mix are built on the drum track. When listening to music, most people either want to sing along or dance—therefore, the two most important elements of a mix should be the lead vocal and the backbeat (drums).

For example, when working on a pop song it's good to start with the lead vocal since pop music is primarily based around a melody, but when working on a rock song, which is usually based around a band performance, you may want to start with the drums because of the way the songs are structured.

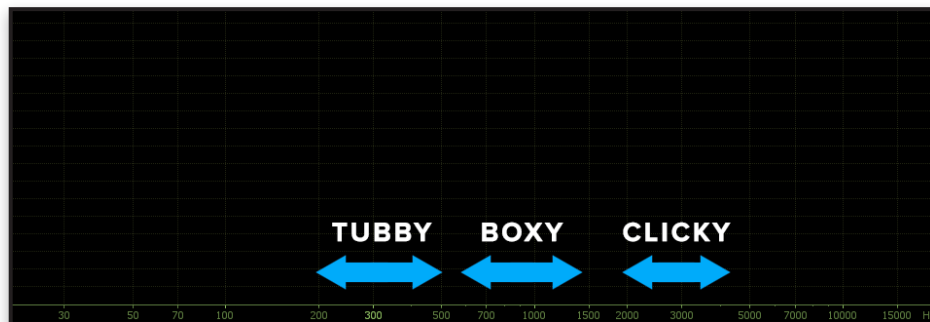
## 10: MIXING: AN ACTION VERB

It's finally time to mix! Let's start by taking a look at your mix and deciding which instrument to mix first. Even if you begin with drums, always make sure that the vocal is present while mixing, so that the drums don't ultimately overwhelm the vocal in a war of ever-increasing levels. It's good practice to think of your vocal track in rock or pop music as your compass. As long as you understand that it's typically the most important—and therefore should be the loudest—thing in your mix, you'll find it easy to maintain the other instruments around the vocal in a way where everything is complimented.

### MIXING DRUMS

#### *Kick Drum*

Start by EQ'ing your Kick. There are usually a couple of trouble spots: Between 200 Hz – 500 Hz (which can sound “tubby”), 600 Hz – 1 kHz (“boxy”) and 2 kHz – 4 kHz (“pointy” or “clicky”). There isn't a hard and fast rule for this (or any of these for that matter), but these are frequencies worth examining first to see if you hear any issues.



#### TIP

Remember the 'Alt+left click to solo' shortcut in Neutron, Ozone 7, Nectar 2 and Trash 2 EQ's. You can use this to locate problem frequencies

#### NEUTRON TIP

Neutron's Vintage Low Shelf curve, as mentioned in [Chapter 4: Equalization](#), is a great way to add some low end boost—particularly to kick drums—as it also simultaneously cuts some of the more 'boxy' frequencies that can make a kick drum sound weak.

Although you do want a solid low end, even a kick drum can have too much of a good thing, so to speak. Using a high-pass filter to cut some low end rumble out of the kick drum, particularly below 30 Hz, can help clean up the overall bass sound of your mix.

Next, you might want to compress your kick. A gentle ratio can help tame the initial click and allow you to increase the overall volume, resulting in a louder, smoother kick drum. Since this is reducing the dynamic range, the net result is that quieter kick hits (particularly in a passage where the drummer is using the kick heavily) will sound 'louder', and the kick will become more even.



Try using Neutron's unique Transient Shaper to adjust the volume level of the 'Attack' (initial hit) and 'Sustain' (fade-away) of the Kick Drum. For a 'boomier' kick, increase the amount of sustain (see Fig. 6). The body and ring of the kick will become fuller and more apparent. For a tighter kick, reduce the sustain (see Fig. 7), and add some attack.



Figure 6



Figure 7

## Snare and Toms

Suggested EQ settings can vary wildly depending on the tone of the snare and toms. For example, some snares have a fantastic ‘round’ tone around 200–250 Hz, while other snare drums can sound muddy in this range.

### TIP

Routing your drum tracks to a stereo drum bus that sits ahead of the master channel can help here, as you can use Neutron’s EQ on the drum bus to locate and hear problems before fixing the issues on the individual drum tracks.

A lot is going to be determined by listening to your drum kit as a whole and hearing what needs to be emphasized or deemphasized.

Oftentimes, the ‘snap’ of the snare that sounds great and crisp competes with the sibilance of the lead vocal around 3–5 kHz, which can cause problems. This is another good reason to leave your vocal track audible while working on your drums. Listening to the overtones of your snare as you EQ will help you determine what harmonics might be masking your lead vocal, and what EQ points will help emphasize the snare while staying out the vocal’s way.

### NEUTRON TIP

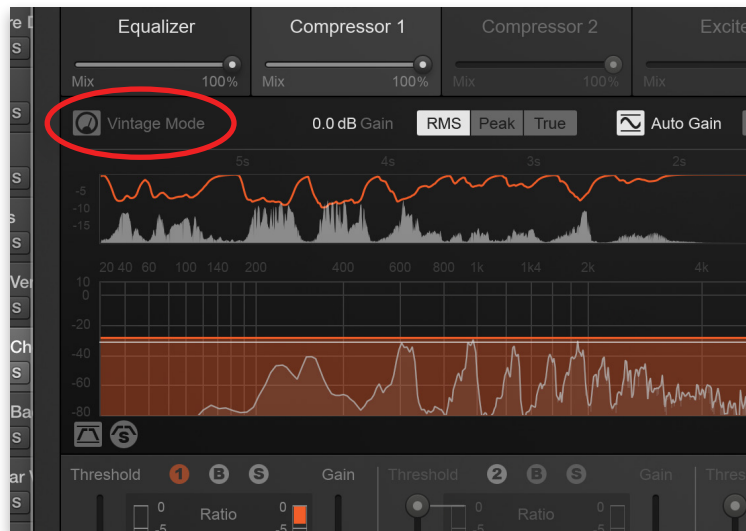
The Masking Meter in Neutron can help identify these frequencies for you. Just add Neutron to both your snare and lead vocal tracks. Open the lead vocal instance of Neutron, and click the ‘Masking’ button inside the EQ module. Choose your snare track from the menu, and now you can identify the frequencies where the snare harmonics could be masking the vocal, and use complimentary EQ to mitigate the issue.

As for compression, a lot of the same rules apply to the snare as they do to the way you might treat ambient drum microphones (read on). As with the kick, you can tame the initial transient with some gentle compression to achieve a smoother sound.

### TIP

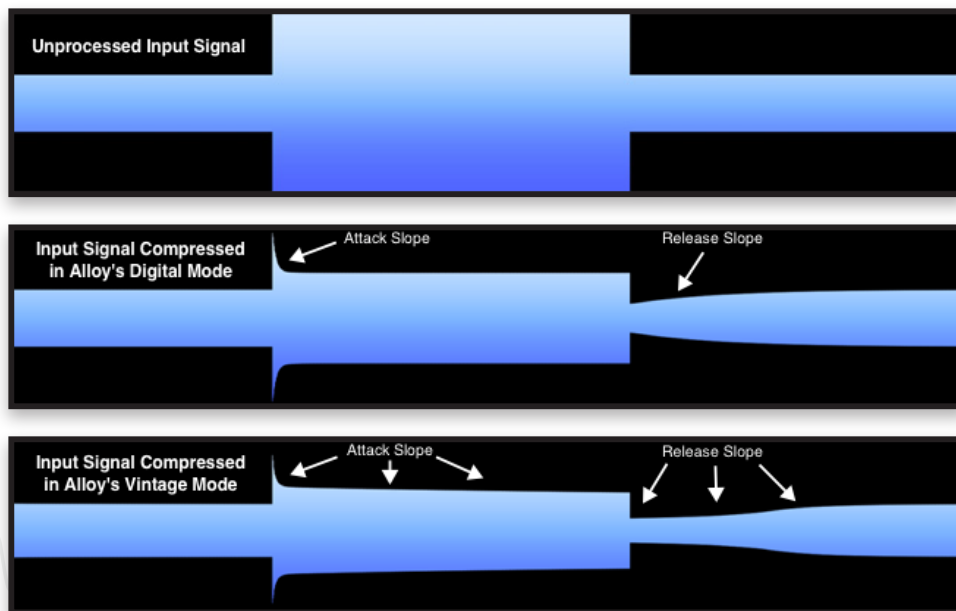
Be careful not to over-compress the snare. A hyper-compressed snare can be much more lifeless and squashed sounding than a kick drum can.

There are many different types of compressors, and iZotope's Neutron has two algorithms, 'Digital' and 'Vintage'.



Whereas 'Digital' is clean, transparent and precise (great for a clean snare on a pop production), 'Vintage' mimics the character of some analog compressors. 'Vintage' reacts more quickly to transients, but then eases in and out in the release phase. This behavior is a little 'grabby', and can sound smoother and punchier. This is often the way to go for a good sounding snare drum with lots of character.

In the three images below, the top image shows unprocessed input signal, the middle image shows input signal compressed in Neutron's Digital mode, and the bottom image shows input signal compressed in Neutron's Vintage mode.



## Overheads/Ambient Drum Microphones

When mixing drums, some engineers start with the overhead mics as they provide a picture of the entire drum kit. Depending on how many ambient mics you have—whether it be a mono or stereo overhead or multiple room mics—you can either use these mics to shape a bigger room sound or merely emphasize certain aspects (i.e. cymbals / hi-hats). Remember, because the sounds of rooms vary, the way the room mics will be EQ'd will also vary.

### TIP

Drastic cuts to the low end on ambient mics can sometimes clean up 'rumble' in the room tone, and tighten up drum sounds. Although this can sometimes sound very unnatural in isolation, it works in the context of the mix. Try it out!

With compression, the choices can range from subtle, for maintaining cymbals, to an extreme limiting ratio of 20:1 or higher for turning your drummer into John Bonham. Later in this chapter, we'll discuss creative uses for multiple ambient mic set-ups.

### NEUTRON TIP

Using a De-Esser on cymbals can help tame any harsh metallic tones if a cymbal sounds a little brash for the mix. While De-Essers were originally designed for vocals, the De-Esser works the same when used in suppressing high-frequency bursts from any instrument. Simply tune the 'ess' frequencies to the area of the frequency spectrum in which the cymbals sound particularly harsh, and set the threshold accordingly.



Remember what we covered earlier about mid/side processing? Using a mid/side EQ on your drum overheads to add some lift in the high end on the side channel, while adding more precise cuts and boosts centered around the kick and snare can make a drum recording sound much wider, if that's something that makes sense for your mix.



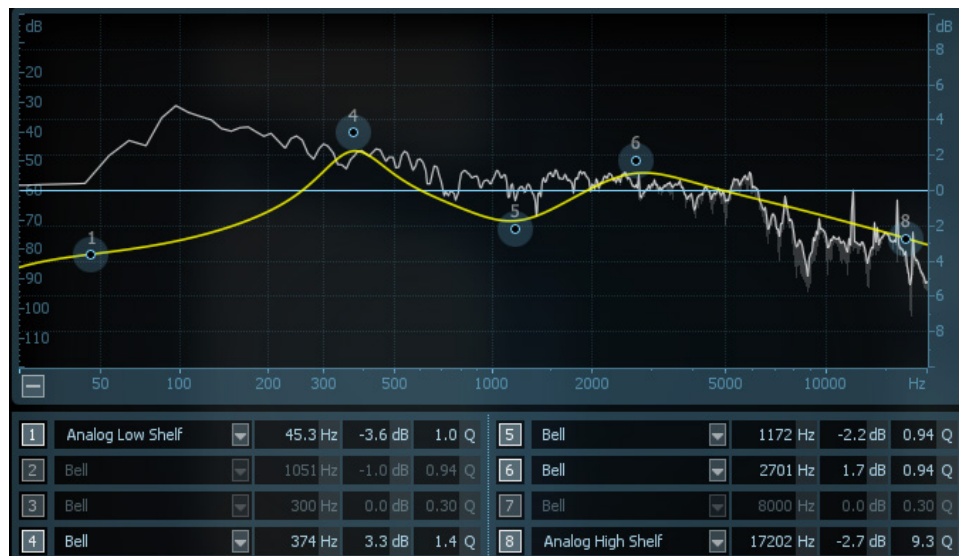
Using a transient shaper, like the one in Neutron, is a great way to enhance the presence of overheads and hi-hats. Adding more attack (particularly to the high end if in multiband mode) helps these metronomic—yet expressive—elements cut right through a mix for just the briefest transient moment (pun intended). Automating the Attack parameter to increase in a chorus, where there is likely more going on, would help it cut through, and keep the rhythmic drive going, despite the extra parts.



## Percussion

This can be anything from shakers and tambourine, to congas and timpani, to electronic percussion and anything in between.

As these instruments vary in tone, and often take up smaller areas of the frequency spectrum, EQ adjustments are often drastic, in order to make the percussion fit into or cut through a mix.



Neutron has some great presets to help get you started mixing all sorts of percussion instruments, including drums.

Compressing percussion requires much higher ratios, as well as quicker attack and release times. Ratios between 5:1–8:1, though heavy, are recommended. When a percussion sound is too short, smoothing out the transient peaks allow us to hear the decay and character of the sound a little more clearly. You might use a release time as low as 20ms.



The compressor in Neutron has a Gain Trace meter which illustrates gain reduction over time. Use this display to set your release time accurately. If the compressor is taking too long to return to 0, reduce the release time until you see it snapping back quickly.

Percussion can be used to add rhythmic excitement, but bear in mind that too much can distract the listener from the fundamental core of your mix. Use percussion sparingly. Consider turning the level way down during the verse, while always making sure to balance the panning so that you don't have all of your percussion centered around just the left, or just the right channels.

# MIXING BASS

## Bass

As we discussed in the previous chapter, the low-end relationship between the bass guitar and the kick drum is one of the most fundamentally important relationships in your mix. The goal is to have the low end feel both powerful and moving without crowding either instrument or forcing one out of the way of the other. A rule of thumb for EQ'ing the bass/kick combo is to decide which one wins the low end battle. Is your bassist rounding out that bottom end with a rich tone and some serious low notes while the kick drum is more 'snappy' and 'clicky?' Or is it your kick drum that rules the roost with deep, sustained sound? Perhaps it was even recorded through a sub kick. The choice is stylistic, and it's really up to you.

Whichever instrument you decide is going to drive the low-end, 'wrap' the other instrument around it with its EQ. For example, if your kick is emphasized at 80 Hz, make sure your bass is not emphasized at 80 Hz, but rather at 40 Hz and 120 Hz. You may well decide to change this relationship as you start to introduce other elements in your mix, but don't be discouraged by that. Revisions are a normal and expected part of the process!



Use the Masking Meter in Neutron's EQ to help carve out space for the bass and kick drum in your mixes.

Between 2–5 kHz is a good mid-range area to boost in order to help a bass poke through a dense mix. This 2–5 kHz area is where the upper harmonics that more easily identify the bass tone and pitch are located.

Some harmonic distortion can also help enhance frequencies in this area. As a general rule, adding tube-style distortions will thicken up the low end of a bass guitar, while adding tape-style distortions will introduce harmonic distortion that will be more noticeable in the mid to higher ends. So tape-style distortion is advised for brightening up the 2–5 kHz area.



Neutron's Exciter offers both Tape and Tube style distortions. You can also blend between different modes on an XY grid. With the Exciter in multiband mode, you can apply warm, tube distortion to the low-end and tape saturation to the high mids, as discussed above.



Whatever EQ and distortion you add, keep bypassing and un-bypassing your settings to make sure you're able to really hear—not just see—the changes you make. Our eyes can often fool us into thinking we hear the change occurring, so it's important to listen carefully.

Bass compression can vary depending on how the instrument is played. If it's an upright bass, then subtle to moderate compression with a moderate attack and release time is best.

If an electric bass is played with a pick or “funk style” with a thumb, faster attack and release times may be necessary to tame the transients.

For fingerstyle electric, those attack and release times can go back to moderate. These ratios often vary between 3:1 to 6:1 but can go as high as 10:1. The important thing here is to note how much gain reduction is occurring. Subtle gain reduction would result in the peaks being attenuated by approximately 2-3dB, where moderate reduction would be close to 6dB. Make sure to apply makeup gain, or auto-gain, if your tool has such a feature. Otherwise, your bass will be getting smoother, but also quieter, which can cause it to get lost in a mix.



The Compressor module in Neutron contains a make up gain stage you can either set manually, or use auto-gain to intelligently make up for any loss in volume due to compression.

Another useful tool for separating kick and bass is side-chain compression. This form of compression uses one instrument's level over a threshold to activate the gain reduction (compression) on another instrument. For example, inserting a compressor on a bass track that reacts to the kick drum will compress the bass every time the kick drum is hit. This method will 'tame' the bass track and 'duck' it out of the way each time the kick is hit, while still maintaining its overall level in the mix.



Neutron can serve as a powerful and flexible sidechained compressor. You can use one of the compressors to compress your bass as its own instrument, and then use the second compressor to side-chain the now-polished bass according to the kick drum signal. You can also use the Masking Meter and a sidechained Dynamic EQ node to help ensure the bass and kick aren't masking each other.



Of course, while looking at meters can be important, it's equally as important to trust your ears. Until you do, know you can always reference your meters. Don't be discouraged if it takes a while to get your low end to sit right—bass can be the most difficult instrument to manage in a mix. Unlike drums, bass is both a heavily rhythmic and harmonic instrument. While every kick drum hit is largely the same tone, the fundamental note on a bass changes for every note the bass player strikes, which makes nailing the low end on bass akin to hitting a moving target. If the bass part has a lot of movement, you may have to make adjustments using automation rides. Many mix engineers prefer to do this manually, but there are also plugins that automatically ride the gain or EQ of a performance within certain thresholds in order to smooth out a performance.

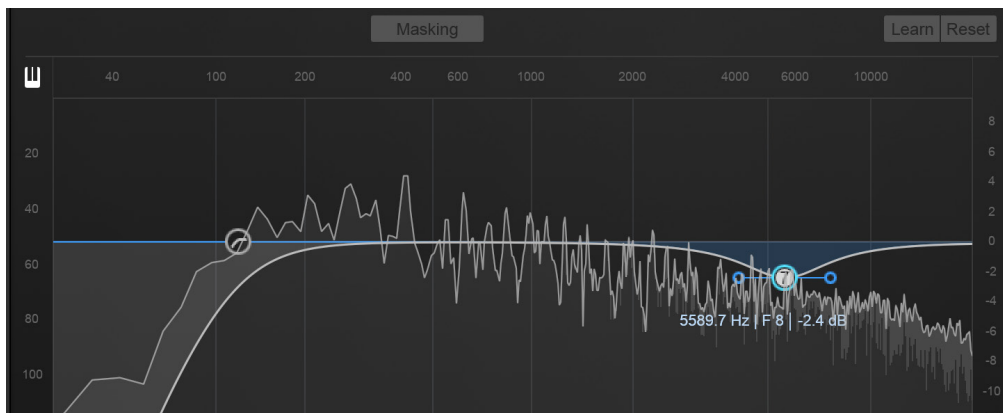
Once the rhythm section has been established, it's time to bring in the harmonic instruments. The overall harmonic ranges and tones of these instruments can vary massively, from an ultra-clean and wide piano sound, to a screechy high-end guitar solo. Each presents their own unique challenges and characteristics.

# MIXING GUITARS

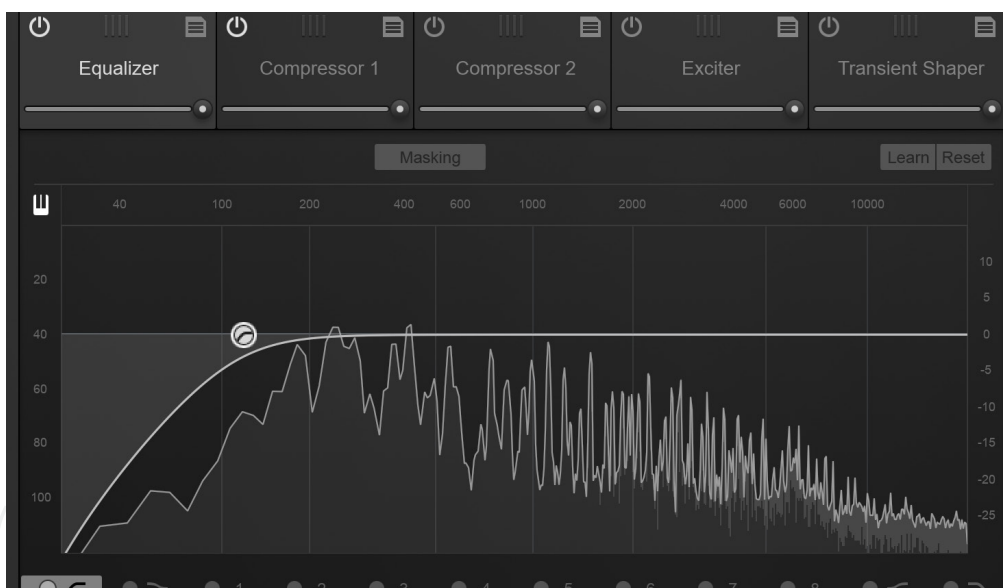
## Acoustic Guitar

Acoustic guitars can take on different roles in different tracks, either up front in a more shallow, stripped down mix, or as a support track in a dense mix. It's important to note before you begin whether the instrument will be a feature or not. If it's intended to be a support track, then consider that the instrument covers a lot of space harmonically, and that 'landscape' needs to be trimmed. It's essential to make sure that the acoustic guitar doesn't cause the drums to sound smaller.

This is a good use for a high-pass filter set between 100–200 Hz with moderate compression.



You may also want to make some larger EQ cuts in the 4–6 kHz range, as this helps an acoustic guitar move slightly away from a vocal, which it could otherwise interfere with.



Remember, thinning out these instruments will be noticeable if you solo them, so you may doubt yourself, but such changes will be more of a compliment if you listen to how the acoustic guitar fits into the overall mix.

Lastly, stereo mic'd acoustic guitars can be very difficult to blend in a large mix. Try panning these to the same point to create a much narrower or even mono acoustic track. This allows for the instrument to take up much less space overall which can help.

## ***Electric Guitars***

This instrument, along with certain vocals, has the widest variation of tone possibilities of anything you will likely find in a mix. As we stated before in the dynamics section of this guide, compression can be much more effective on cleaner electric guitars than on distorted ones, since distorted guitars will have some inherent compression.

People usually record electric guitars with amp and pedal effects active, or if they recorded it dry, they might include a plug-in on their tracks as a guide. Both of these can be helpful since the players are able to capture the sound they want to hear from the instrument. This will help you, as the mix engineer, understand either the exact sound the players are looking for, or an approximation of the tone that they would like you to refine.



Using Neutron's Harmonic Exciter to start adding a slight amount of harmonic distortion, then automating the width control up or down in the choruses is a simple yet effective enhancement to electric guitars.

You'll find that panning will be the most effective way to separate numerous electric guitars in a dense mix. Finally, if there are any double tracked guitars (the same part performed twice), panning them hard left and right helps to widen the stereo image of the track.

## **MIXING KEYBOARDS**

### ***Keyboards***

These can be the most troublesome instruments in a mix to deal with because they take up the most space in the stereo and harmonic fields.

Many pianos are mic'd in stereo to capture performances that can vary wildly from extremely low in the register to extremely high. It's therefore crucial to know whether the piano is a feature instrument (meaning guitars are there to support it) or if the piano is merely a support instrument itself.

Sometimes drastic EQ can be needed just to make a piano fit in an ensemble. Often, mix engineers will pan keyboards more to one side rather than having them encompass the entire stereo field. This comes back to the idea of closing your eyes and picturing the band on stage. Do you see a piano player in the middle of the stage with his left hand all the way to the left side and right hand to the right? Chances are, probably not. Because of this, try and place the player where you would picture him/her onstage.

Be careful using Dynamics processing on a piano or keyboard sound, as it's extremely easy to over-compress and cause audible 'pumping' on these instruments. A ratio between 1:4–2:1 as well as some parallel compression is usually all that's needed. Parallel compression, as mentioned in [Chapter 5](#), is an effective way of achieving compression more transparently.

## MIXING VOCALS

### *Lead Vocal*

Now we get to the star! Unless you're mixing the next great instrumental jazz record, the lead vocal is usually the single most important track in your entire mix. This is what everybody will focus on when they hear the song. A well-tracked and well-performed vocal may need little processing. On the other hand, a vocal that's poorly performed or recorded may require the audio equivalent of serious open-heart surgery.

Here's an extensive list of processors commonly used in complex vocal chains:

- High-pass Filter: To remove any unwanted low end signal.
- Dynamic EQ/De-Esser: To remove any distracting sibilance.
- "Surgical" EQ: This is an EQ that's useful in removing unwanted frequencies. For example, between 400–800 Hz there may be a frequency that could make the singer sound like they are singing into a cheap microphone, and between 2–4 kHz there is usually a frequency that emphasizes a nasal sound. These are some to look out for
- Compress: This is usually set to hit the highest peaks of a vocal performance at 2–3dB of gain reduction.



When using a compressor to catch the highest peaks of a vocal, you'd likely want to use a gentle analog-style leveler. Instead of acting like a brick-wall, it performs softer attenuation with a 'some shall pass' philosophy. The vintage mode in Neutron's compressor, set to RMS detection with a high ratio (4:1 or higher) and threshold (just catching the peaks) can do this quite effectively!



- Shaping EQ: Use this EQ to emphasize and compliment the best qualities of the singer's voice. If needed, use a shelving EQ on the top end to add "air" to the voice.
- Compression: This is where you can shape the overall dynamic range of the voice. This can go from subtle to extreme depending on the genre of music or the sections within a song. For compression, a medium attack and fast release would be a good starting point. You'll have to adjust your threshold for an uneven performance and deal with other issues with automation.



If you find yourself using a higher ratio with lots of compression on a vocal, take a step back. Sometimes, using two more gentle compressors in series (one after the other) can yield a smoother result, as opposed to one compressor working harder.

- Saturation: Top your vocal processing with a light form of tape saturation to add a nice character to the voice.
- Reverb/Delay: Whether it be a nice plate reverb, some dirty analog-style delay, or some clean digital echoes, reverb and delay are the key to making a vocal really stand out and shine.

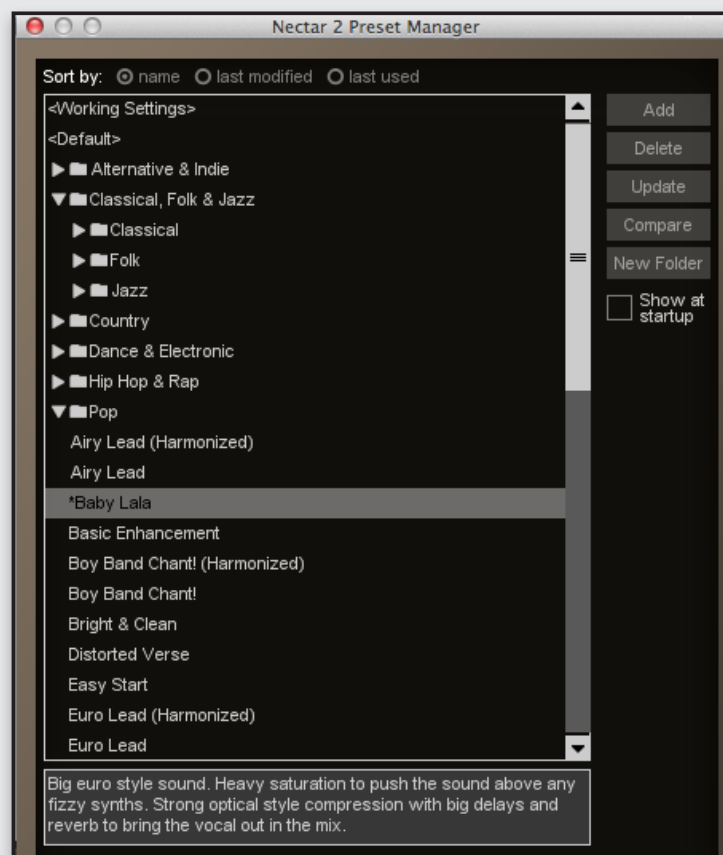


**TIP**

When adding reverb to a vocal, many good reverbs offer the ability to filter the 'wet' or reverberant signal. Try rolling of the high end of the wet signal until the 'shiny' reflections sit just underneath the vocal sibilance. Otherwise, adding a lot of reverb in the high end can create a new space that, in fact, competes with the dry vocal.

**TIP**

This signal flow is one approach, but there are many. Nectar 2 contains many genre-specific vocal presets that use different signal flows. Try experimenting and tweaking with a few to find the sound that inspires you.

**TIP**

As a bonus, sometimes a lead vocal benefits from a slight (8% wet or less) chorus effect. A good voice is never boring, but utilizing a chorus effect mixed in at a low level can add just enough movement around center to make the lead vocal even more interesting.

## ***Background Vocals***

These can also vary wildly, but there are usually two types of background vocals: Vocals that harmonize and share lyrical content with the lead vocal line, and vocals that act as pads (oohs and ahhs for example).

For the harmony lines, you should discuss with the client how loud they think the harmonies should be. Are they acting almost as a dual lead vocal, or should they be lower in the mix as a support for the lead?

For pad vocals, try compressing them slightly more, using a more extreme high-pass filter, and drenching them in reverb for added dramatic effect. These types of vocals can vary in how widely they are panned. Sometimes if they are double tracked, they can be panned hard left and right. Although, in recent years, these types of vocals have had a much tighter panning in mixes which leaves more room for guitars and keyboard pads to be panned wider.

## **MIXING WITHIN THE SONG STRUCTURE**

Now that you've created the basic framework and shape of your mix, it's time to create some motion within the mix to complement the arrangement.

When listening to a song, you'll notice changes in energy from section to section. For example, have you ever noticed how the energy changes when a song transitions from a verse to a chorus?

Part of what you're noticing (especially in a good mix) is how the mix compliments that transition. The most important thing is to create a forward motion that best compliments and presents the song. One of the

most important elements that we have available to us in music is that, unlike a painting or a sculpture, a song develops over time. It isn't static, it is dynamic, and our mix should reflect this. There are a few ways to do this:

- First, have fewer tracks in verses than there are in choruses and try to introduce something new in each section as the song progresses. It isn't unusual for an artist to present a mix engineer with a full complement of tracks and instrumentation, and for the mix engineer to make some decisions about where to cut, mute or otherwise change parts and arrangements.
- Pan tracks and verses narrowly and chorus tracks wider. Perhaps a verse will have a mono acoustic guitar panned halfway to one side, and a chorus will have double tracked guitars panned hard left and right.
- Have tracks and verses carry less low- and high-end information and choruses be full range—this will create harmonic excitement in your mix.
- Use either mono effects or effects with a shorter decay time in verses and stereo effects with

longer decay time in choruses. This will help the depth of your mix move as the song progresses.

- Use distortion sparingly (or not at all) in verses and enter it in gradually for each chorus. This aids in creating even more harmonic excitement than you can with EQ alone. Distortion doesn't need to be extreme—just a little can change the sound immensely. You don't want to overwhelm it, just give it a little kick.
- With drums, automate your ambient microphones to change between verses and choruses. There are two schools of thought with this: Bringing up your overhead and room mics in choruses will widen the stereo image of your drums and make the overall kit sound larger, while bringing those ambient mics down in choruses will leave a lot more room for guitars and other harmonic instruments that will be coming in. Try experimenting with both approaches to see what style best meets the needs of your mix.

The objective to all of these points and tips is to change the three-dimensional image of our mix along with the song. We're trying to make the song "breathe" by adding width, depth and harmonic excitement as the song itself gets more exciting, and having those elements contract as the song becomes sparser and changes lyrically and dynamically.

Another way to think of it is that the song is telling a story. Every story has its ups, its downs and its transitional periods, and the mixer uses tools to frame that story.

## **Automation**

We use automation to achieve the same effect as all of the elements above. We want to both "even out" uneven performances dynamically, and emphasize particular points of excitement within a mix.

Many mixes utilize automation. For instance, automation on a lead vocal can keep the vocal on top of the mix and emphasize particular words and phrases within the song to achieve the best emotional impact. Another good use of automation is to emphasize a 'build' on a particular instrument to make the section feel more dramatic. Automation is also helpful for changing the level of tracks from section to section within a song (as we stated with ambient drum mics). This is the type of device that you can use as sparingly or as liberally as you wish. There are no rules for automation—some mixers despise it and others adore it. So use it to your heart's content, provided it makes your mix better.

Believe it or not, there will be a point where you feel your mix is ready or close to ready! This could also be the point where you've lost all perspective and need another set of ears to listen to it. This will be the time you're ready to send your mix to the client. However, there are a few practical tips you should know before that all-important email goes out:

- Be sure to take frequent breaks, since ears get tired from overuse. A few general rules of thumb are to take a 10-minute break every hour (therapists do it, so why shouldn't we?). Another option

is what is known as 90/20 rule: A 20 minute break every 90 minutes. Sometimes it's important to spend as much time not listening to the mix as it listening, that way your ears will be refreshed when you start working again

- A mix is a series of logic riddles, similar to building a house of cards. In many cases, one action will affect something else in your mix. Listen to subtle changes carefully to understand the effect they have on other tracks.
- Remember, the solo button is your enemy! When listening to a track soloed, you have no point of reference for how it sits in the mix. It's fine to solo an instrument to find out if there's a trouble spot in the performance or how you've processed it, but you should then immediately take it out of solo and listen to it in the context of the full mix. A better option is to bring the fader for that particular track up in your mix to hear what the issues are. It doesn't give a perfect sense of context, but it's a lot better than just hearing it by itself.
- Listen to your mix on different speakers and in different environments, particularly environments where you normally listen to music. If you have any questions about how a certain instrument may be sitting in your mix, you'll have better information if you know you're speakers aren't tricking you. Also, your client is likely to perform the 'car test,' or 'ear-bud test' listening to it in as many environments that are as far removed from a treated, acoustically good mix room as possible!
- Have a list of songs to reference that you are familiar with. Create a playlist of numerous songs that you know intimately. Listen to how the vocals sit in the mix, how the reverbs and delays sound in context to the instruments, where the drums sit in relation to the bass and guitars, how tight or how loose the low end is, and so on. Comparing your mix to familiar material can give you a point of reference for everything that you're doing. Having the client suggest reference mixes that they admire can help in this regard.
- At some point, or multiple points during your mix, turn off the computer screen and just listen to the mix. You'll be surprised at what you can hear when you remove the visual component from your work.
- If at all possible, when you finish your mix, put it away for the night and listen to it when you first get to the studio the next day. This will give you the freshest perspective you can possibly have and will give you a psychological and physical rest before sending the mix off to the client.

# 11: FINISHING THE MIX

After the mix is largely finished, creatively speaking, the final steps are no less important. First, the mix needs to be delivered to the client for their approval. Then, any required revisions should be made and approved. And lastly, the mix should be delivered to the mastering engineer. Let's look into specifics of these processes.

## PRINTING YOUR MIX

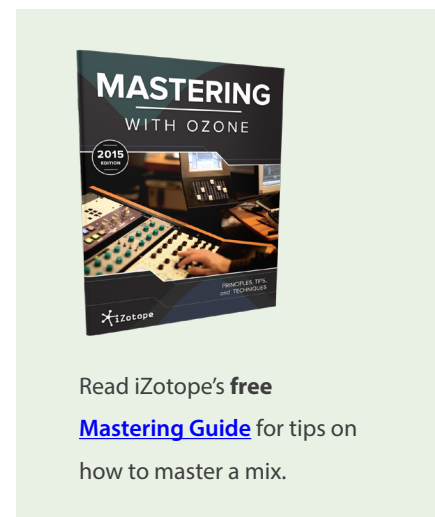
Now that you feel that your mix is ready to present to the client, how are you going to send it to them? There are several ways to do this:

1. **Bouncing / Exporting:** Your DAW should have a feature to internally record a stereo file of your mix. It might be called 'Bounce to disk', 'Export', or some such term. We'll discuss export formats later in this chapter.
2. **Internal Foldback:** If you're recording "out of the box", either through an analog summing device or a console, you can create a stereo track within your DAW and record your mix to that track. This offers the added benefit of saving a copy of your mix within your session. Once you've recorded your mix, you can then export the file into whatever format you would like.
3. **External Print:** This is also useful when recording "out of the box." With this method, you're recording to an external device (a 2-track tape, a CD burner, etc.).

## YOUR MASTER BUS

A lot of time and energy has been spent by mix engineers arguing over whether or not to use certain processing on their master bus.

There isn't a right answer for this. If you plan on sending your mix for mastering (which is highly recommend), it's usually better to not use any processing on your master bus. Even if you plan on mastering your own mix, it will be worth your time to not process your master bus, and, instead, master your mix at a later date.



Some professionals use a little compression and EQ on the master. So if you do decide to use processing—whether that be EQ, compression or so on—make sure to also print a mix without any processing. Also, don't ever think "the mastering engineer will fix that." You should deliver the best mix possible so the mastering engineers can do what they do best..

## TIP

Some great mixing engineers start with a compressor on the master bus and 'mix into it'. This isn't always best practice, as great mixes often come from careful attention to each individual mix element, instead of broad sweeping changes to a stereo master mix bus. If some 'gluey' compression or saturation sounds nice on your master bus, ask yourself if you could achieve that result by adjusting individual track settings, but always trust your ear, and don't just use master bus processing because someone else does.

## REVISIONS

In some cases, your client will be present for your mix. But in other cases (such as when you have to send your mix to your client remotely) you'll have to await feedback. In both cases, it's likely that the client will request changes or revisions. This isn't to say that you've done a bad mix. There's always a chance the client will hear certain things differently than you. They could demand larger changes, such as bringing the vocal level down throughout the mix, or they could request smaller changes, such as hearing a particular overdub in the left speaker as opposed to the right. In any case, the client's vision of the mix may differ from yours in some ways.

Remember that your client is the person paying you, and quite often—unless there is a label involved—the client is also the songwriter. As such, their vision of the sound and feel is more important than your interpretation of their song, and yes, we feel your pain when this represents a problem. When this happens, remember the days of vinyl. When records were the primary listening format, the artist's name would be really large on the front cover, and the mixer's name would be really small on the back. Try to remind yourself of this whenever you feel strongly about an interpretation of a client's song. Coming to this realization will leave you with happier clients and a few new referrals!

## AUDIO FILE FORMATS

When ready to bounce or print your mix, you need to decide what format, bit depth, and sample rate you'll print. If you're going to send your mix to get mastered, I recommend keeping all of the parameters the same as the audio files in your mix. By doing this, you are also maintaining the audio quality of your file and allowing the mastering engineer the possibility to do bit depth or sample rate conversion at the final stage with higher-quality conversion tools.

**TIP**

Bouncing or exporting your mix at a higher bit depth or sample rate doesn't add fidelity or resolution to your file. For example, if the session uses a sample rate of 44.1 kHz, you cannot simply add more samples to your final mix, you're just creating empty data. Good audio processors can do internal oversampling and 64-bit processing when required, so the argument that up-sampling yourself helps the audio processors do a better job without aliasing is rarely valid, unless the tools are outdated.

When bouncing your mix to a lower bit depth, you'll need to add dither to your master bus. Again, it's best to leave this to mastering engineers if possible.

**TIP**

Both the iZotope [Mastering Guide](#) and the [Dithering Guide](#) can help explain the dithering process if you are interested.

## PRINTING ALTERNATE MIXES/STEMS

After you've printed your final mix, you may choose to print alternate mixes. Some common alternate mixes that provide interesting choices for the client are:

- Vocal Up 1 dB
- Vocal Up 2 dB
- Bass Up 1 dB
- Instrumental
- A capella
- Show Mix (Mix with no lead vocal)

You may also choose to print stems. Stems are individual instruments or groups of instruments with all of their processing enabled. To print stems, simply solo the instrument or group before recording. Common stems are:

- Drums
- Bass
- Guitars
- Keys
- Synths

- Percussion
- Lead Vocal
- Background Vocals
- Horns
- Strings

You'll find that printing these stems may be helpful later should you need to go back and do any remixing. Oftentimes, it's easier to pull stereo mixes of instruments than try to recall an entire mix.



## 12: SUMMARY

We hope this guide continues to be a reference for you as you expand your mixing skills. Remember that our goal is to be “the invisible eye”—the lens through which our client sees the final vision of their song. It’s also our job to serve the song as best we can by using whatever tools we have at our disposal.

In the end, nothing in this guide represents a hard and fast rule, merely a guideline. Everyone may own the same EQ or compressor, but, in the end, how we choose to use our tools helps us find our own unique voice as a mixer.

Lastly, remember the two most important things: Mix the song to the best of your ability, and have fun doing it!

# 13: TIPS FROM THE PROS

## [Joel Hamilton](#)

Credits include: Elvis Costello, Pretty Lights, Matisyahu

“Sometimes having a mono, parallel compressor that has a weird phase offset can be amazing. Try running something like that on the drums and then listen to it with the phase flipped. See if you can get some seriously crazed comb filtering going on. It can make the kick sound like it dropped an octave, and still not swamp the mix bus. Enjoy!”

## [Jimbo Barton](#)

Credits include: Rush, Queensryche, Matchbox Twenty

“I usually get the drums, bass and lead vocal in perspective and build the other instruments into that framework. Equalizing instruments in solo will not always give the desired perspective in the mix. Get the basic sound in solo, then if you still can't hear it, EQ to suit your mix. Don't be afraid if you re-solo it again and it sounds like crap. If it sounds good in the track, it's Good! When using delay on vocals, heavily de-ess the send to the delay, so as to remove hard syllables from the delay.”

## [Craig Schumacher](#)

Credits include: Neko Case, KT Tunstall, Caexico

“Know when the mix is done! Too many times we can tinker and nitpick at a mix. If you have to level a shelf, you know when the shelf is level. Attention to detail is good, but know when you've finished, or passed the point of diminishing returns.”

## [Ted Paduck](#)

Credits include: Nine Inch Nails, Aerosmith, Run DMC, Busta Rhymes

“EQ isn't always about boosting. Try cutting unwanted frequencies that can mask the fundamentals of other instruments. For example a high-pass filter at 80 Hz on the overheads can open up the low end for kick drums and bass.”

# APPENDIX A: GETTING SET UP FOR MIXING

## SOFTWARE AND SOUND CARD

To mix on a computer, you will need some type of editing software and an audio interface or sound card. There are plenty of reviews and articles on software, sound cards, and audio interfaces, etc. that can help you find the equipment that will work best for you. One word of warning: you need to exercise caution when relying on the audio playback that is built into a computer, whether desktop or laptop. They are usually not designed for high fidelity and in some case will run the audio you hear through hidden signal processing. This will alter what you hear making it difficult to make good decisions during mixing. This is why we recommend acquiring the additional equipment mentioned above.

## MONITORS

It's important that you monitor on decent equipment when mixing. If your playback system is giving you an inaccurate or incomplete playback of the sound, you can't possibly know what's the sound of the mix and what is coloration that's caused by your playback system. That doesn't mean you can't get decent results with relatively inexpensive equipment. The key is knowing the limitations of what you're monitoring on and learning to adjust for it in your listening.

For near field studio monitors, the most common problem is lack of bass, specifically below 40–50 Hz or so. These monitors just don't have the size or mass to move that much air at that low a frequency. One solution is to complement a pair of studio monitors with a subwoofer to cover the low end. However, it takes time and care to set up a sub-woofer so that it fixes more problems than it causes.

How do you do this? If you have a mic that's flat down to 20 Hz, here's a quick and dirty way to do it with iZotope's Ozone (this tip works in the demo version too).

1. Take a song with a good range of frequencies in it. As long as there's a broad spectrum, it doesn't matter which song (we did say this was the quick and dirty method).
2. Put Ozone's spectrum in average mode and loop a section of the song. Open the EQ module and save it as a snapshot (open the Snapshots tab, click "Start Capture" and you'll see a frozen line that's a different color than the active spectrum).
3. Place the mic in the spot where you would be listening from, and play the loop through the monitor/subwoofer combination.
4. Adjust the subwoofer level until the sound picked up by the microphone (the yellow line) is close to the spectrum of the source (the purple snapshot).

It's not exact, and there are several variables here (the response and location of the microphone being the most significant), but it can get you close.

In the end, your monitoring environment is made up of more than your monitors. Probably the most influential part of the system (aside from your ear-brain connection) is the room. You'll never get a perfect listening environment, and you can never predict how what you're listening to will translate to all the systems out there that other people will use to playback your song.

With that in mind, here are some tips we've picked up over the years for learning to mix on studio monitors:

1. Listen to music that you know well and have listened to on many systems. Spend some time “getting to know” your monitors. Play your favorite CDs through them. You probably know how these CDs sound on a home system, a car radio, etc. and this will help you learn to adjust your listening for your monitors.
2. The bass will typically be under-represented on small studio monitors. That doesn't mean you should add bass however. You should simply understand their shortcomings and look for ways to get a good perspective on how much bass there is in your mix and mix.

## HEADPHONES

Headphones are another option for monitoring. There are entire sites and forums dedicated to headphones (such as <http://www.headphone.com>) so again we'll leave our hardware recommendations out of it and just advise you to do your own research. When working with headphones, here are a few things to keep in mind:

1. Imaging on headphones is very different than imaging on speakers. Usually music produced on a well-imaged speaker system will work well on headphones. The opposite is not as reliable, so use headphones as an alternate perspective, but not as your main monitoring system if you can avoid it.
2. Frequency response can be different on headphones compared to loudspeakers. The listening room, your head and even your outer ear have filtering properties that alter the frequency response of the music. This “natural equalization” is bypassed when you listen on headphones. If you're interested in learning more about this phenomenon, look into “diffuse field” headphones.

## APPENDIX B: IZOTOPE TOOLS



### NEUTRON: REVOLUTIONARY MIXING PLUG-IN

Achieve unprecedented focus and clarity in your mixes with Neutron. This new mixing plug-in combines the latest innovations in analysis and metering with award-winning audio processing. [www.izotope.com/neutron](http://www.izotope.com/neutron)



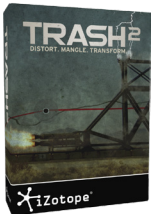
### NECTAR 2: TREAT YOUR VOICE

Bring your vocals to life with Nectar 2's powerful vocal production effects. The Production Suite includes Nectar 2, plus Pitch Editor and Breath Control plug-ins. [www.izotope.com/nectar](http://www.izotope.com/nectar)



### OZONE 7: ESSENTIAL MASTERING TOOLS

Glue a mix together, control dynamic range, and add rich character with the critically acclaimed music production tools in Ozone Advanced, including the new Vintage EQ, Vintage Compressor, and Vintage Tape modules. [www.izotope.com/ozone](http://www.izotope.com/ozone)



### TRASH 2: DISTORT. MANGLE. TRANSFORM.

Trash 2 is primed for a powerful new era of audio mangling, distortion, and experimentation. Let sonic mayhem ensue. [www.izotope.com/trash](http://www.izotope.com/trash)

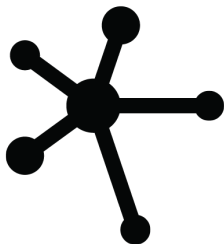
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