Mirror EQ

Hello everyone. I am Michael Matson from Baltimore, MD in the USA. For Week 5 of Introduction to Music Production at Coursera.org, I will share a common usage of mirror equalization (EQ), specific to fitting a kick drum and bass guitar together in a mix.

Due to issues with getting a good screen capture while working with my DAW, I decided to choose a text-based presentation so that the presentation is easier to follow. My goals for this presentation are to:

1. Introduce the concept of frequency masking.
2. Explain the use of a parametric EQ as an audio microscope.
3. Demonstrate how to use mirror EQ to give the kick drum its own frequency space in the mix.
4. Provide general guidelines for this procedure.

I hope that this information provides insight into how mirror EQ can be used as an effective tool for mixing.

Frequency Masking

Frequency masking is a psychoacoustic effect where two sounds at the same frequency will compete, and the louder of the two will be heard much more clearly. Because "stereo width" often resembles a reverse pyramid, frequency masking at higher frequencies can often be resolved by stereo separation; but at lower frequencies mirror EQ is commonly used to achieve frequency separation of two competing sounds. This is very often done to make a kick drum fit well with the bass track of a mix.

For this demonstration, I used audio stem files from a re-mix contest for Tears for Fears "Pale Shelter." The drum track included all drums, which added to the complexity of fitting it with other tracks in the mix, but for this demonstration I focused on the bass track and drum track only.

The Problem

To demonstrate the problem, I opened the mix in SONAR X3 and inserted Alloy 2 on the drum track and bass track. By superimposing screen captures of these EQs during playback, it is easy to see that the fundamental frequency of the bass is perfectly on top of the kick drum, but is 2dB louder.
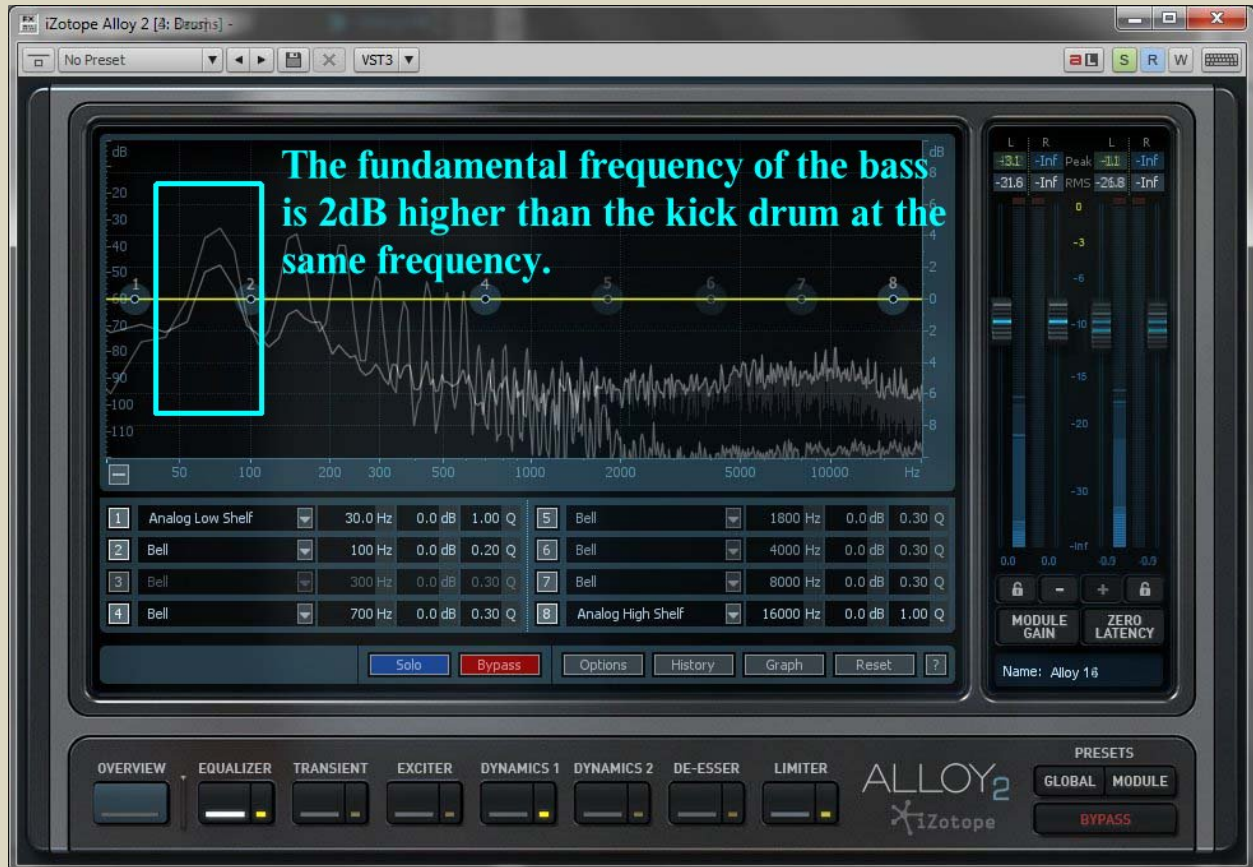
Mirror EQ concepts

While mixing, it is a good rule of thumb to only boost a signal by ~3dB max without making it sound unnatural, but cuts in signals can be done to higher levels (~6dB or so) before they become audible. Because of this, it is common to do a **slight boost** at the "sweet spot" on one track, and then make a **complementary notch** in other tracks to give the main instrument its own frequency space. Since the kick drum is only prevalent at one frequency and the bass fills two octaves, it is typical to boost the kick drum and notch the bass.

Finding the kick drum's "sweet spot"

Using Alloy 2, I used band 2 as an *audio microscope* by using it as a bell (parametric) EQ and maximizing the Q (to 12) and boost (to +15dB). This allowed me to adjust the center frequency to find the portion of the kick drum that gave the best timbre for the context of the song.

Adding the slight boost

For this application, I liked the warm "thump" sound I got at 55Hz. Next I reduced the boost to a more appropriate level. By looping a portion of the song where the kick drum was prevalent, it was easier to tailor the sound to the settings below.

Adding the complementary notch

The complementary notch can be more aggressive without adversely affecting the sound, so while listening to a looping portion of the bass track I adjusted a notch at the same frequency on the bass track.
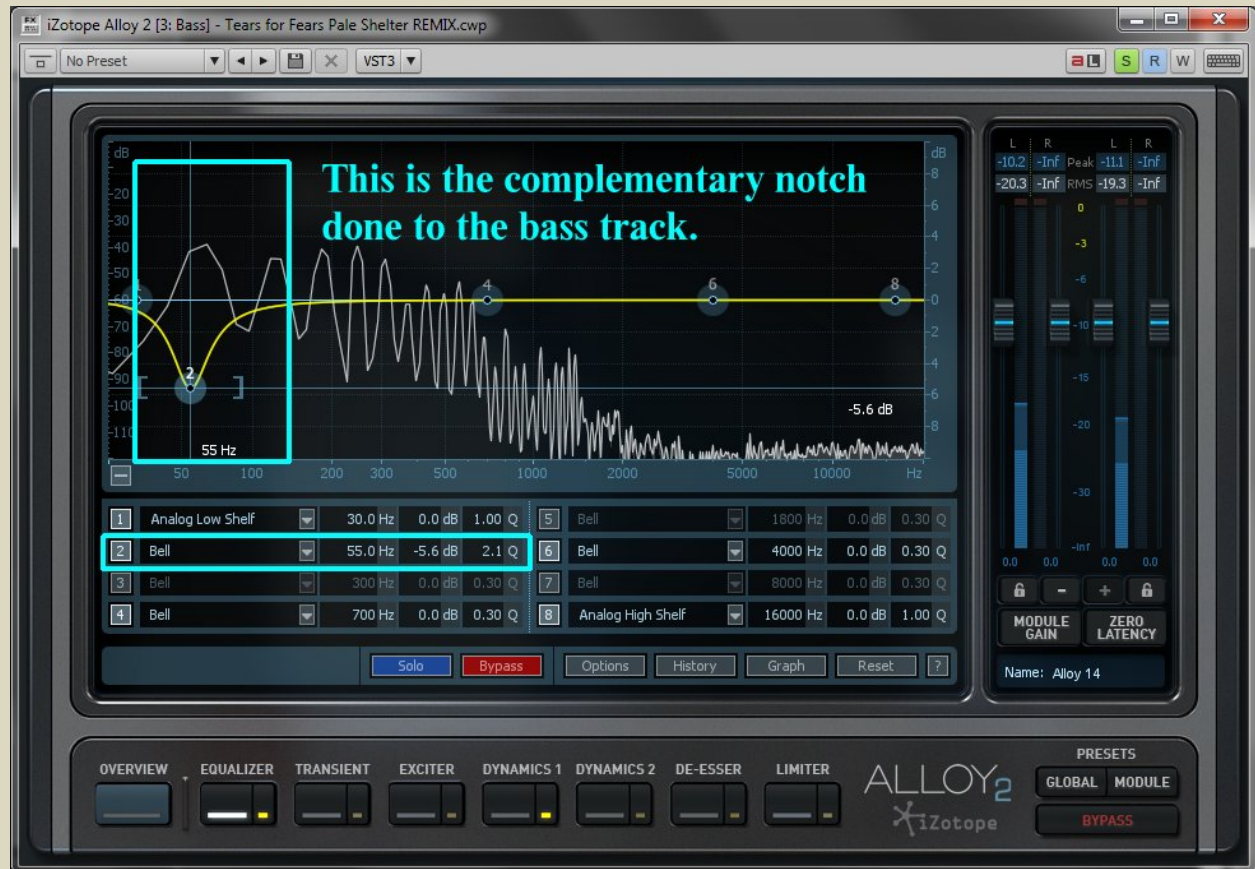
As you can see, I removed a healthy notch from the bass fundamental frequency, but also took advantage of another psychoacoustic effect called *missing fundamental*, which is where the mind *perceives* the fundamental frequency based on the harmonics we hear even if the fundamental was not present! Harmonics (or partials) are spaced by the fundamental frequency, and our minds can perceive this.

The Result

By performing a slight boost on the kick drum with a complementary notch on the bass, I was able to give the kick drum its own ***frequency space*** in the mix, especially since both the kick drum and bass are centered in the stereo image. Because the drum track included all drums, I was not able to use fader or panning methods to separate only the kick drum without it making the rest of the mix sound awkward. However, even if I had a track for just the kick drum, using mirror EQ is most common regardless, as both the kick drum and bass are center-panned and competing in most mixes.

This concept can be applied to all elements of a mix similarly, but is a complex discussion. I included a video link in the references section below to a very nice demonstration of this concept in a real-life mixing situation.

In summary

I hope that this article provided some insight on using mirror EQ as an effective tool to give musical elements their own frequency space in a mix. Specifically,

1. Understanding the concept of frequency masking and why it is an issue.
2. Understanding the use of a parametric EQ as an audio microscope to analyze frequencies and find those ideal for the element being examined.
3. Seeing how to use mirror EQ to provide a gentle boost to key mix elements while notching other elements to give each component its own frequency space in the mix.

Thank you for your time!

References

Frequency Masking - http://en.wikipedia.org/wiki/Auditory_masking

Missing Fundamental - http://en.wikipedia.org/wiki/Missing_fundamental

Dan Worrall's video (this is a brilliant video demonstrating the topics covered in this presentation, but in more detail) - http://www.youtube.com/watch?v=kSNYBbPAvKE