EQ (Equalization)

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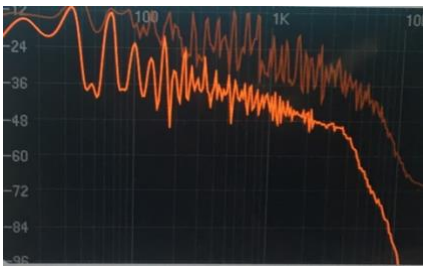
If you've ever tried to make a beat on GarageBand, record yourself playing an instrument, or even just record your voice, you probably noticed that the audio quality of your sample was not even close to that of the songs on the radio or from your favorite artists. This is because of the effects that audio engineers use during the mixing and mastering stages of music production. One of the most basic (and effective) audio effects that can elevate a mix from amateur to professional sounding is EQ (or Equalization), which is the act of boosting or reducing the levels of different frequencies in a signal [1].

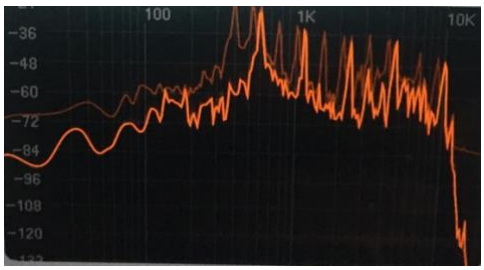
In order to understand what EQ is and how it works, it is first necessary to understand the concept of frequencies. If you have taken Physics, you probably understand that the frequency of a wave (measured in Hertz) depends on the number of oscillations (cycles) on a given period of time. In relation to sound waves, changes in frequency directly affect their pitch; higher frequencies correspond to high pitches (like a whistle) and lower frequencies correspond to low pitches (like a gong) [1]. However, if you were to listen closely to a gong, in addition to the low bass frequencies that are easily heard (and felt), you would also hear some high frequencies. This is because each instrument does not just have one frequency, but covers a range of frequencies, with each individual frequency coming in at a different volume. Consider the examples below. Each instrument is known for a specific frequency, yet their frequency distribution charts clearly show a broad range of frequencies.

2020 Bass



This frequency distribution chart for a bass has frequencies reaching 10K Hertz, even though it is an instrument primarily for lower frequencies.

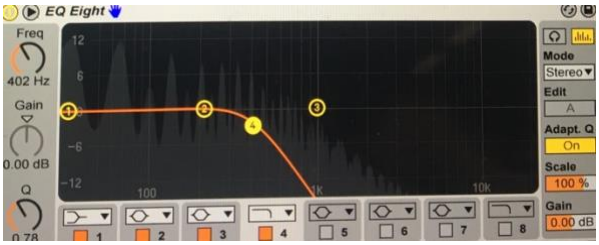
Balafon Bell



This frequency distribution chart for a bell has low frequencies approaching 0 Hertz, even though it is an instrument primarily used to fill in high frequencies.

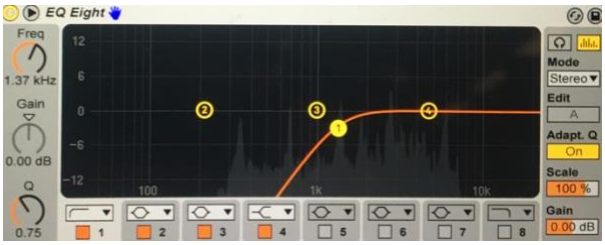
Now, imagine that you just produced a song with multiple elements. It probably incorporates a bass, hopefully some drums, maybe some guitar and keys, possibly a synth, and then probably some other subtle sounds and instruments acting as ear candy. Considering that each of these instruments are covering a broad range of frequencies, there is bound to be some overlap. Even if you were just trying to mix the two instruments above, the higher frequencies from the bass would interfere with the high bell sound you are going for, and the lower frequencies from the bell would interfere with the full sounding bass. Competing frequencies take away from the mix as a whole, and can lead to the mix sounding muddy and distorted [2]. Although it seems counterintuitive, we can improve the quality of the mix by simply cutting out the frequencies that are interfering with other instruments, which is in essence what EQ is [3]. Consider the same two instruments from before, but this time with an EQ Filter on them.

2020 Bass



Only the frequencies under the Orange border will play. Now, the bass will sound fuller and the higher frequencies won't interfere with the bell.

Balafon Bell



Like the bass, the Orange border dictates which frequencies are let through. The lower frequencies won't interfere with the bass anymore, contributing to a fuller sound.

Each instrument should have some sort of EQ Filter on it, even if it is just cutting out a couple frequencies. That way only the frequencies that are meant to stand out are heard. Unfortunately (and fortunately), there is no formula on where to set the filter for specific instruments. Every song and instrument is completely unique, meaning that the only way to find the sweet spot is to fool around with the filter. Therefore, it can take hours for an audio engineer to get an instrument exactly how they want it to sound (keep in mind that EQ is just one in a multitude of audio effects). However, even if EQ was the only audio effect used, the difference that it makes can be heard clearly, and it is the first step in elevating your mix to a professional level.

References

[1] M. College, "Audio Equalization," [Online]. Available: https://www.mediacollege.com/audio/eq/. [Accessed 18 Feb 2019].

[2] E. Tarr, "How to Deal with Destructive Interference," 8 Dec 2014. [Online]. Available: https://theproaudiofiles.com/destructive-interference-polarity-timing-phase-issues/. [Accessed 12 Feb 2019].

[3] P. White, "How to Use EQ - Music Production," [Online]. Available: http://www.roland.co.uk/blog/how-to-use-eq/. [Accessed 12 Feb 2019].