

## Mastering: Mathematics or Art?

Mastering is a mix of art and maths, it has as much to do with understanding equipment and frequencies than it has to do with listening, or does it? This essay will be focussing on this question and many others surrounding mastering such as how, when and why mastering came about?, What Equipment is used and why?, What Is considered good and bad?, Who are the masters of mastering and why?, What techniques are used throughout mastering? , and finally where is mastering going. Will it just be one click through a computer or will the art of listening still be relevant in an ever-changing music industry.

### History

The question of whether music mastering has changed with the advances of computer music has many critical aspects the first of these being the history behind mastering. Mastering has a long history which has changed over the past century and one must look at these changes to establish their effect on music mastering being mathematical or an art form.

There are three main changes in the music industry which have had an effect on mastering the first of these being the release of tape in 1948 which saw mastering becoming a separate job to the recording process. The use of tape in recording studios meant that someone had to take the final 2 stereo and produce a master, which could be used to press the track to vinyl and not much has changed in the aims of mastering as you can see from appendices 1, the chain of mastering seems to have stayed the same and its just the machines in between that have changed with technology. The role of the mastering engineer was widely different then as well “In those days mastering was an entry level position” (Stubblebine, P. 2010) with interns working their way up the chain getting the job of mastering. Studios at this time were mainly owned by record labels themselves and they used the mastering process as a way of teaching new engineers to use their ears. “mastering wasn’t considered a creative art” (Stubblebine, P. 2010) just more of a chore that had to be done.

The second big change that affected mastering was the creation of independent recording studio in the 60’s. This now meant that people wanted their mixes fixed and changed in the mastering change thus expanding the need for them and their role. The first stand alone mastering studio was “Master Lab” set up in 1967 by its owner “Doug Sax” who was a well known mastering engineer at the time. With the opening of this studio and the expansion of the role, mastering gained a great deal more respect in the music industry.

The final big change to affect the mastering industry was of course the invention and use of the CD in 1982 which meant there was no more limitation of using vinyl such as have to adapt low and high frequencies to get a good sound without the needle getting “settled in grooves”. It not surprising that the role exploded in the 80’s with “the billboard studio directory in 1978 listed the mastering engineers in the US at around 150” (Stubblebine, P. 2010). Many people thought that the invention of the CD would bring about the end of mastering, “CD in 1982, far from causing the decline of the mastering studio- since there was no “cutting” to do instead led to its development”(Bassal, D. 2005). This quote shows how big a change CD was with more people now needing edits at the mastering end of the process. However the main reason that mastering has remained in the picture is simple because it’s “an obligatory step between the mixing studio and the manufactory of a CD” (Bassal, D. 2005). This means that their has always been and always will be a need for a middle man to smooth out the gaps between the studio and the final audio format.

### Equipment

Arguably the most influential and most important part of mastering is the equipment that is widely used in mastering. However is there a particular outboard or program that is used throughout the industry? This is something I intend to find out and hopefully the equipment people are using or have used in the past will give me a good insight into the mathematics behind it.

There is a wide range of equipment that is used in the mastering process, some of it outboard and some of it in the box. However I have found that modern mastering engineers seem to use a fine balance of the two, using tube compressors and EQ alongside the cost effective and precise EQ of Pro tools.

There are a few units which have been featured in high end mastering studios, however this is like many other areas of music where peoples preferences are completely different. The first outboard I have found was the Avalon 2077 which has been described as “truly a Roles Royce product”(Grant, B. 1997) giving the ability to cut and shelf frequencies with precision and adding that sound that only a Class A circuit can produce. With a pretty large price tag of over £10,000 it might not be in everyone’s budget but it seems to have become a standard in the high end mastering studios.

Another high end mastering tool is Manley Massive Passive EQ and again it uses tubes to give a good sound to the mix, with more of a modest price tag this EQ seems to appear more in mastering studios. One review said “there are some “mastering” boxes that belong in the hands of every mix engineer. One of them is Manley’s

Massive Passive.” (Haines, G. 2011) there is also a digital copy of this plugin available and it would be interesting if they have managed to emulate the sound of tubes. The reviewer of this product also did an A/B test of the hardware and software versions of this outboard and said that “I chose the hardware 75% of the time” (Haines, G. 2011) this perhaps shows that software is catching up to the standard of hardware and that you cant always tell the difference between the two.

There are also a few well known pro tools plugins that seem to be used quite a lot by mastering engineers. These are the waves master plugins which have been seen as the future for mixing and mastering in some peoples eyes. However, this pack only contains two EQ and one limiter which some would say shows that even Waves admit you cant compete with outboard tube equipment when it comes to mastering by offering just what the computer does best EQ and limitation.

However with the incorporation of computers into mastering circles the process seems to have been made cheaper and a hybrid of digital and analogue seems to have become the norm. The future seems to be a use of a mix with some engineers saying “the wires and analogue equipment as a signal enhancer are something I use on every project” (Calbi, G. 2006). This quote shows that as much as computers have offered a new dynamic simply putting the signal through some decent cabling gives the sound a natural feeling which has yet to be matched by computers.

The final area equipment plays is a key roll in the listening back to mixes, there are two main references that are used at this stage and they are headphones, which are typically “Bayerdynamic DT770” headphones because of their frequencies response. As far as speakers are concerned it doesn’t seem that you can go wrong with the classic Yamaha “NS-10” monitor speakers. These speakers offer a good reflection of every poor quality speaker out there giving you a good idea of what the mastering session might sound like when it leaves the studio.

### Bad examples

There are obviously good and bad examples of tracks being mastered. I have decided to look at one really poor example which I believe needs highlighting as a “When things go wrong” session. The name of the album is “Death Magnetic” (Hetfield, J. Ulrich, L. Hammett, K. Trujillo R. 2008) by Metallica and is a prime example of being over processed and not carefully listened to.

This album was even remastered for a video game called guitar hero with many fans saying the original was “not as good as the guitar hero version” (Van Buskirk, E. 2008). This quote is an example that the general public can hear the difference

between good and bad mixing and mastering. So how and why did the band decide it sounded good? Well there isn't much reading available on the technical side of the album however the mixing engineer on the project disowned the project after it was released and slated. In my opinion I believe that the band were trying to get more out of their mix, thinking that using more tubes and pushing it into distortion might make it sound better and the mix obviously cant have been checked on a wide range of reference speakers. "The band were going for ultimate power, impact, presumably, at the expense of clean results- were the results a success? No." (Sheppard, I. 2008) this quote enforces my opinion of the end result of this album and shows that there is an art to mastering a track correctly, being able to produce something that sounds so powerful and complete without breaking "the loudness barrier".

### Key Engineers in mastering circles

To get a good insight into mastering as an art form there a few engineers I have decided to investigate these are Bob Katz and Greg Calbi. Looking into their work and backgrounds I have decided they are experienced and brilliant mastering engineers simply because they have either written books on the subject, their work is considered across the board to be brilliant and they have worked their entire careers perfecting a mastering sound in their chosen genres.

The first and main engineer I am looking at is Bob Katz because he has had a long history in the mastering field and has also written a few books on the subject, which gives a good insight into the techniques he uses. He first started Mastering audio in 1990 but was into music all his life, without taking the conventional way in through working up in a studio environment it was Bobs attention to detail that got him the job in something he loved doing. Bob has been on both sides of the fence where digital and analogue are concerned and is a big fan of both using outboard equipment and the good old waves plugins. Bob says he "works well with rock and roll and heavy metal" (Owsinski, B. 2009) this is because he loves the range of sounds involved and the natural sounds that are produced. He also believes that a great mastering engineer has "Great attention to detail and extreme persnicketyness" (Owsinski, B. 2009) which gives you a good idea that he believes the role of a person cant be replaced by a computer. He also believes that you have to know how far you can take something and that you can only learn this through experience, taking good and bad examples of tracks and seeing how good you can make them after all he does say you cant "Make a silk purse out of a sow's ear" (Owsinski, B. 2009). Overall though Bob Katz hates the use of normalising saying "Normalise is a dangerous term. I think it should be destroyed as a word" (Owsinski, B. 2009). He has written a few papers and blogs on this subject saying that the human ear responses to normal volumes not peaks and it

takes away from the dynamics and makes it sound flat something which I might be inclined to agree with.

The next mastering engineer I am looking at is Greg Calbi who is well renowned in the field and is still currently working. Greg has been in the music industry for over 40 years and like many others he searched for something he enjoyed doing and that was mastering. After watching an interview with him I learnt a lot about the way he works and his opinion on mastering. He believes that in the digital age there has been advantages and disadvantages, one advantage being that there is no longer tape which means you say about 2 hours on scrolling the tape back and forth. However the disadvantage is people want more done quicker and at the lowest cost possible meaning there isn't much time for experimentation. This does lead to the approach that the mastering engineer is "never really satisfied" (Calbi, G. 2010) which he sees as a good thing meaning you are always striving for more. Also Greg believes the best mastering tool is the room and person you are working with, if you always work in the same great sounding room you will know what to do if something is wrong and also how good the mix will sound outside the room. He also uses a lot of software as well as hardware equipment but he likes hardware especially. "Each one of them sound completely different" (Calbi, G. 2010) is how he describes his outboard equipment and he loves using and updating every piece of equipment he can because you don't know what is going to sound better till you try.

### Techniques

Possibly the most important aspect of mastering is the techniques that are used in the process. Not too long ago the techniques of the mastering engineers were closely guarded secrets but thanks to the work of Bob Katz and other authors anyone can read up on the subject and have a good knowledge. Although there are no right or wrongs in mastering just like mixing music there is techniques that if applied and altered work most of the time. However a major problem with track can't be altered perfectly at the mastering process stage.

The first technique I found was an internet based technique which caught my eye. This method is the mastering in 20 minutes and basically covers the maths behind mastering and how to create a good sound right from the off. The method is all in logic with plugins and the articles tell you what settings to set for each style of music, this seems to be a method a lot of mastering companies are employing that claim to master tracks for £20. After looking at the samples they provided I must admit that it did sound better than the original however comparing these to some I listened to from professional mastering studios I found the mix a bit dull and lifeless. In my opinion

this method is a good place to get used to the settings of your equipment but isn't a good way to get the best results.

After looking at a few other articles I have picked up a few ways of working which might save time and be a great place to start. The first great tip is to dither the level below the ceiling of the session which allows space for the frequencies and makes it sound wider. Mazen says "The difference was unbelievable" (Marad, M. 2012) showing that a professional in the industry uses this method. Mazen also says for people to apply the dithering at the end of the mastering chain, always add a good sized gap at the end of your tracks so that if they are going on an album it doesn't feel like a rushed sound and that always watch the vocal level during the compression and EQ stage as it has a habit of jumping out.

There are a few overall rules and techniques that all mastering engineers apply in all genres. These are always know the room you are working with, this will always help mastering the low frequencies and thus ensuring a good sound. The second major rule for mastering I have found is simply to listen, "work fast, be bold" (shepard, I. 2008) and "don't be afraid to go back to the drawing board" (Marad, M. 2012) and this is a rule that is adopted by all the mastering engineers I have researched.

In my opinion all these methods have their own merits, however there seems to be a need for someone to implement them. I am yet to find a method that involves all mathematics and no listening to the audio, leaving it all in the computers hands.

### Where to now?

We now come to the last question and possibly the most important one of all for future mastering engineer practitioners where do we go from here? Is there any future for mastering engineers against the rise of the computer? In my opinion yes there is. Computers have advanced knowledge and capability's far beyond what could have been imagined just 10 years ago but I still feel that computers are and should be used as creative tools and shouldn't be left to their own devices as it were.

The search for the perfect sound in music has been around for thousands of years from the placing of strings in an orchestra to graphics EQs that can be picked out and alter single frequencies. However there is one thing that cant be changed in this search and that is the human ear, this is after all what people are aiming to please and the

computer can merely be used as a tool to please the ear because it doesn't have its own perception or thinking pattern of how we hear.

In contrast I do however believe that music is moving into the box, as it were in its creation and alteration and this would mean mastering as well with engineers becoming masters of the mouse as well as their ears.

## Conclusion

I started this essay with a few questions in mind I wanted to answer and I believe I have successfully come to a conclusion on these questions. Throughout my research I have looked into the history of mastering, the equipment that is being used, the pioneers of mastering and the future of mastering all in the effort of answering the key questions of whether sampling has more to do with maths than it does with art.

All aspects of mastering I have investigated in this essay have been relevant to my final question, the history has shown me that mastering has been a strong industry and has changed with the times over the years. The equipment has shown me that there is a lot out there offering different genres and a wide range of sounds. The equipment has also shown me that high end tubes give great and quicker results and that the room and engineer which are mastering the tracks are the most important part. Both the examples of mastering engineers have shown me a mix of analogue and digital equipment is the way forward and this is evidenced by the amount of work they get and the high quality work they produce. The techniques I have researched have shown me that research, listening and time are key to producing good sounding session and that taking it too fast or pushing it too far can end up going horribly wrong.

Returning to my overall question I believe that mastering audio is more of an art form because it will always need someone there to listen while mastering and there are so many techniques for so many different genres an inquisitive brain will always be needed. Computers will aid the future of mastering as they do now but as long as the creative music keeps moving creative mastering will be along side it all the way.

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