

## Mastering In a Computer-Based Home Studio, For Novices, by Pete Ayscough (a Novice)

I decided to write this article following my first experience mastering an album. For most of us mere mortal musicians, audio mastering is such a fearsome path to tread, and I learned so much from the experience that I felt it would be good karma to pass on some of what I'd learned to others who may also be fearfully contemplating the journey.

As I approached my mastering project I needed to learn a few basics to kick off the process and provide some direction, so I started Googling articles on mastering, printing them off and reading them on the train on my way home from work. These articles invariably started off with the disclaimer that although it is possible to achieve acceptable results taking the DIY approach, it is always far preferable to have a professional do the job for you. The pro has the right gear, the experience and the ears for the task.

If you're like me, the DIY route to mastering your audio project has been forced on you by economic circumstances. Given the choice you'd probably like nothing better than to send your mix off to a mastering studio and have it all taken care of, but in one important respect there is actually an advantage in doing it yourself:

When you go through the process of intently scrutinizing a recording with a view to perfecting it, the vast majority of improvements you'll find are actually needed in the *original mix*, rather than by shaping the mixed-down file. If, for example, your hi-hats are too prominent, it is far more effective to reduce them in the original mix than try and equalise them down in the master. The process of mastering a release yourself will focus your attention on the mix of the material far more (probably) than ever before, which will result in a much-improved mix, which is *by far* the best way to optimise your material for release. A mastering professional with no access to your original mix can only apply a "band-aid" fix to any problems that might exist in the mixdown file.

This article assumes you are using a computer to mix and master your material. It also assumes you will be prepared to undertake further research on some of the more extensive topics introduced. The web is an excellent source of information.

### What You'll Need:

There are a few things you'll need as you approach your mastering project:

1. A reasonable pair of monitor speakers. You cannot master using headphones and you will find it difficult to obtain a reasonable result using standard cheap computer speakers. Having said that, you probably can't afford to shell out a thousand bucks for a pair of nice quality nearfield monitors (otherwise you could probably afford to send your project to a professional for mastering), so just get your hands on the best quality small speakers you are able to and optimise your listening set-up by placing the speakers at the same level as your head, and so that the 2 speakers and your head form the corners of an equilateral triangle. You can also place a piece of soft foam beneath the speakers to reduce the transference of energy to the surface they are sitting on. Room damping may improve things too; plenty more on this is available on the web.

If your speakers have tone controls you should set them at neutral, and while you are mastering I recommend you listen at a level that is neither very loud nor very soft. Your brain changes the way high and low frequencies are perceived at very high and very low volumes, so tempting as it may be to blast your mix (yes - most music does sound better loud) keep the volume at a moderate level.

2. Mixdown files. These are the files of your mixed-down songs. Use a distinct and consistent naming convention so you don't confuse them with some other version of the song that may be lying around your computer; like "mysongMixdown" or similar.

You need to ensure the output level of your mixdown is correct. I used Apple's Logic for my mixing, and when you bounce a mix in Logic, the "bounce" dialog box contains a "Normalise" tickbox. Ensure your mixdowns are NOT normalised, similarly the mixdown should not be compressed, or have any other processing applied (it's fine

to use whatever processing you like on the individual tracks, but make sure there is no compression, limiting, EQ or any other form of processing applied to the output channel). You also need to look at the volume of your mixdown and ensure it does not peak above -0.3dB. This will give the mastering processors some room to play with in shaping the sound. Don't worry if this makes the song sound quieter than you are used to hearing it. When you master, the various processors will bring it up to your desired optimum volume. How do you determine the peak volume of a song? Play it and watch the output meters. The meters in Logic have a little window above them that displays the loudest peak encountered since you last hit the play button.

3. Mastering software. I'm not going to recommend anything in particular here - because I haven't used anything other than Waveburner, which conveniently comes bundled with Logic. But what you need ideally is an application that allows you to place songs in a particular running order, apply fades to them, apply mastering processors (EQ, Compression, Limiting etc) to each song individually, enter text information about the disc and the songs on it, and burn to "Red Book" standard (the accepted international standard for CD's). Waveburner does all these things.

Read the documentation for your mastering software to see if it will accept 3rd party plug in processors. If it does, I heartily recommend spending some time perusing forums and getting an idea of which ones people like and recommend as there are very probably 3<sup>rd</sup> party plug-ins that are superior to the ones bundled with your mastering software. I found a 3rd party equaliser and limiter that I preferred to the ones that come with Waveburner. For the record I used the MasterQ plug-in from PSP for equalisation, and the Voxengo Elephant mastering limiter. For Compression I stuck with Waveburner's inbuilt "Multipressor" multiband compressor.

4. CD-R disks, and a CD drive that can burn disks: I burned something like 18 separate disks in this process. You need a burner that can reliably send your audio to disk exactly the way you shaped it. Many modern computers have a built-in burner. Ensure your mastering software can write to the burner you've got installed.

5. Time. You are attempting to speed-learn what it has taken a mastering engineer years to learn. I originally allocated two nights for my mastering project. It ended up taking me three and a half weeks!

## **The Process:**

An experienced mastering engineer might be able to listen to a mixdown and turn it into audio gold on their first try. You're not an experienced mastering engineer - so you need a process. My process involved patiently completing a number of cycles until I eventually had the outcome I was looking for. First I would create a master and burn it. I would then listen on a variety of different stereos/speakers, make detailed notes about what needed to be changed, then apply those changes to a new master and repeat the process. I went through this cycle approximately 15 times during my project.

Your monitor speakers only sound like *your monitor speakers* - every other listening environment is vastly different and will introduce huge differences to the way the songs sound. I listened to every mix on the studio monitors, my car stereo and my living room stereo. When I wasn't sure about my judgment I listened to a commercially released CD immediately before listening to my project. This gives you a frame of reference and is highly recommended.

If you are mastering an album, try and listen to it in its entirety. An important part of mastering is making the songs "gel", or sound as though they all belong on the same CD. One thing to listen for is flow - or the way the songs are placed on the record. This can make an enormous difference to the way the record is perceived. Be prepared to change the flow, even though you may have started off with an ideal flow in mind (I did). In determining the best flow for the album, the advice of others is invaluable. Play the CD to friends and open yourself up to their opinion. After all, this recording isn't just for your own ears - otherwise you wouldn't be putting all this effort into it.

You also need to listen for the transitions between songs. Your mastering software should enable you to vary the gaps between songs (a 2 second gap is quite common and sounds ok in most circumstances), as well as the types of fades applied to each song. Most of my songs ended with an "S" type fade, but for songs that come to a sudden stop you might like to use a short "Convex" type fade. In just about every case, the track should end with the fader set at -infinite (the bottom). There was only one song on our album that broke this rule, and that was one where we wanted to have electric guitar feedback shrieking right up to the start of the next track.

As discussed above, most (though not all) of the notes I made while listening to my master candidates, were about changes required to the *mix*, rather than about shaping the general sonic quality of the songs. I found it useful to only note one or two changes for each song on each cycle, rather than try and fix everything at once. The reason for this is that any change you make will affect every other part of the song. You may for example feel that the bass guitar needs to come up and the lead vocal needs to come down, when simply raising the bass may have the effect of "balancing" the vocal part, so that it doesn't need to be changed.

When determining what needs to be changed, try and isolate the instrument that needs adjusting, rather than generalising about the mix. For example, removing sibilance on the vocal track and applying some equalisation to the cymbals might be the best fix for a mix that sounds "too topky". Don't forget, when adjusting individual tracks, that equalisation is sometimes a more effective tool than volume. A vocal track that sounds too thin won't sound any thicker with more gain; it'll just be a more *prominent* thin vocal track.

### Getting Started:

So you've opened your mastering software, imported all the songs and placed them in the right order. What's next? One of the scariest parts of mastering for the novice is knowing which processors to use, and how to use them. Here's a brief guide.

Every track should have its own separate chain of processors. Logic enables you to apply the same chain across the whole album, but you should resist this because you will find, as you progress, that each song will require *different* processing in order to make it fit properly into the sonic footprint of the album.

As a general rule, the last processor in any chain should be the limiter. The kind of limiter to use is called a "brick wall limiter". This will optimise the volume of each song, without allowing it to reach 0dB and clip. The limiter will be adjustable, and most contain a handy set of presets, which the pro's scoff at, but which are quite useful as a starting point. I suggest "auditioning" a few different settings while listening and finding something that sounds reasonable to start off with.

Before the limiter in the chain there is usually a compressor of some kind. Most mastering processor chains I've seen (and I haven't seen that many) utilise a multiband compressor, which basically splits the frequency spectrum into a number of sections (usually 3 or 4), each of which can be compressed separately. Again I suggest auditioning some of the presets in your compressor and getting an idea of which works best for your music. Bear in mind that the more compression you apply, the less dynamic range (distance between the softest and loudest sounds) the music will have. Any compression you apply will change the character of your music, so if the mix itself is good, you should probably use compression sparingly (if at all). Compression is a complex issue and I recommend Googling if you want to learn more.

Somewhere near the top of the processor chain (often first) there will usually be an equaliser. In comparison to the compressor, this is relatively easy to understand. There are a number of bands, from low frequency to high. You can adjust the gain on each band, as well as the Q (the width of the band you are adjusting) and usually the frequency at the mid-point of the band. Again, if your original mix is good you won't need to do much EQing. Most of my songs ended up with variations on a gentle curve with the bottom end boosted somewhere between 1dB and 2dB, and the top end around -.5dB to -1.5dB. This was basically to fix errors introduced into my mixes by bad studio monitors (since my monitors were bass-heavy and top-light, I had compensated in the mixes by reducing the bass and boosting the top end. The mastering equalisation allowed me to correct this so the mix

sounds good on other systems). Your EQ settings will typically vary a little from song to song in order to bring them together and make them sound as though they belong on the same CD.

With equalisation, you need to be aware that whatever elements originally caused you to produce a badly equalised mix might still exist at the mastering stage. For example, you may generally "feel" that you love punchy bottom end in your music, so you usually boost the bottom end when listening to CD's on your car stereo. The same psychology may have caused you to boost the bass and drums in your original mix, and now, the same psychology may be causing you to boost the bottom in your master EQ. If this is the case the master EQ boost may in fact have *compounded* an existing issue in the mix and made the track unlistenable for most people. For this reason, you need to try and be as objective as possible when listening to your master, as well as listening on a wide number of different stereo systems.

Aside from these 3 basic processing units, there are a large number of processors which will do things like introduce subtle harmonics into the top end to make it sound more spacious, introduce more analogue "warmth" to the sound, apply gentle reverb to "glue" the different parts of the sound together, etc. These processors can be useful, but again, if your mix is good, you hopefully won't need to use them much. Having said that, I *did* use the PSP Vintage Warmer on a few tracks (inserted just before the limiter). An important point to keep in mind with all these processors is whether they need to be applied to the whole mixdown, or just to a particular instrument. If for example, you want to use a processor to make the drums sound more "spacious", then add it to the drum track in the mix, rather than to the whole mixdown.

## Finishing It Off

At some point, after a number of cycles, you're going to produce a master that sounds the way you want it to, on every stereo you can find, and in reference to your favourite commercially-released CD. When this finally happened to me it came as a surprise. I was so used to the cycle of listening and adjusting that I really wasn't expecting a master that didn't need any more changes. Now (after consuming a large glass of whatever you like to consume when celebrating a big achievement) is the time to finish the project.

Your mastering software may allow you to add text to the CD (Waveburner does). If you take advantage of this, the names of your songs will be displayed on CD players that have this function. Your mastering software may also allow you to burn ISRC Codes onto the disc for each song. These are useful as they allow your disc to be listed on Gracenote, so that any compatible software your fans play it on will automatically pick up its details. ISRC codes are probably essential if you think your album is going to be played on radio, and you'd like to receive royalties. If you want to find out about obtaining ISRC codes for your songs (they're free) I suggest Googling.

Ensure there are a few seconds lead-time on the disc before the first song starts. My car CD player would cut half a second off the first track whenever it came to the end of the disc and restarted (until I fixed the CD). You don't want this happening to your release.

Consider the brand of CD-R you're going to burn your master onto. Not all CD-Rs are created equal. You want your master to be durable and to last as long as possible without degrading. A CD enthusiast's forum I found recommended Taiyo Yuden as the brand to buy.

Be careful not to put finger marks on the master disc. I have read stories of finger marks being inscribed on glass masters and going out on thousands of discs. Also, do not write on the disc with a pen as this can interfere with and degrade the digital information on the other side.

Back up all the mixdowns, and the master file on your computer back-up system. You have dedicated a lot of time to this project. What if the cat pees on your master disc? You need to be able to bring it back into your computer and recreate it. Also, when you burn your final master, burn a second identical disc, and put it somewhere no one (except you) will ever be able to find it.

Well, that's about everything I know about mastering an audio CD at this point. I hope your own project goes well and that this article has helped you in some way.

If you want to hear our CD [per ardua ad astra], you can go to our website and have a poke around;  
[www.cartoonphysics.net](http://www.cartoonphysics.net)