A Long Time Ago, In a Galaxy Far, Far Away...

By now I'm sure you're familiar with the catchy, almost Lucas Films-like phrase "Loudness Wars"- it's everywhere, from magazine articles and topics on message boards where everyone has an opinion on it and everyone knows how it started, yet for some reason, albums at the time of this writing are still being released at levels so loud that you wonder if it's something we'll ever be able to back away from.

There are many articles already dedicated to loudness levels in commercial music today, so why another article on this you ask?

One of the things I've noticed from articles and message board postings related to the "Loudness Wars" is that there's always someone to point the finger at. It's always somebody's fault that we're in this mess, nobody's claiming their portion of the blame, so a lot of people have taken an "I don't care" position about it and simply make their music as loud as they can just because everyone's doing it, and while everyone just points the finger at either the mix engineers, or the producers, or the record labels, they're not focusing on telling people *how* to fix the problem, or *why* it would be a good idea to not maximize audio as much as it's currently acceptable. Independent artists don't feel it's their problem to fix, because publications and mastering professionals who post on message boards usually exclude them from their articles and discussions, so everyone who is independently putting out records feels that they have to do the same to be able to compete with records being put out commercially, otherwise they won't be considered "up to par" with the industry.

Bullshit. I think it's time people re-think their position in the world of music today. The Independent Artist is in the unprecedented position to change all aspects of how music is distributed. You no longer need to try and fit into what the recording industry is doing; It's no longer debatable whether it's fully possible to produce high quality recordings in your own home. You do need the proper (often times expensive) gear, room and skills to do so, but you definitely don't have to sacrifice the quality of your recordings thinking that's the only way you'll get put on. These days, if you do land a deal with a label, they tend to prefer to have the artists hand in a mastered project and the better your project sounds, the better it is for you and the label even.

Back when I started learning how to improve a mix - to take a recorded (mixed down) song and give it that "polished" sound quality that is obtainable during the mixing and mastering phases of audio production, things were not at all the same as they are today.

Before I was able to take mixes and get them to "Industry levels", I had for years been bouncing down songs since the late 80s and early 90s on 4-track recorders and eventually an 8-track but in the back of my mind, I knew I was not at a "real pro" level and that if I needed to take a mix to that serious "pro" level status, I would need to get into a "real" studio and at one point, that seemed like a faraway dream. This is years before computers had powerful enough processors to be able to mix with them; if you had a computer in your studio, it was only handling MIDI sequencing tasks so when it came down to processors, most of what was available was hardware, and unless you had a professional facility, most of the processors musicians had in their home studios were not in the serious "pro" category (this is back when "home studio" truly meant "not professional").

Mixing and Mastering in the Old Galactic Republic

Ages ago, a group of friends and I ended up buying studio time to get some of our songs mixed at a studio and it cost us a small fortune. It took us about three days and several hundred dollars to get 8 songs recorded and mixed at this studio and I can recall the feeling I had at the end of it, when we were sitting in the studio, talking to the engineer listening to the tracks while at the same time, making reference tapes from the DAT, which was the mixdown deck we used and the only thing that was digital in the studio as far as I remember. It felt like we were now getting to that "pro" level, the quality was eons above what we were doing with our cassette multitrack in my then home studio.

Each of us went home with a tape; we all needed our own time to listen to the finished product. I popped the cassette in my car and immediately noticed that the sound was not at all the same as the tape I was playing before. It wasn't as loud and it sounded a little muddy, the mixes didn't sound as "clean" as I had expected them to. All the way home I was wondering why this could be, maybe the tape deck wasn't hooked up to the DAT correctly back at the studio. I got home and pretty soon started getting calls from everyone in the group who had similar opinions, so I called up the engineer and told him something was wrong; the songs don't sound as loud and as crisp as anything we're comparing it to. He said "Okay, well now you need to get the tracks mastered!"

The engineer assumed we knew the difference between a mix and a master. After I told him that I had no idea what mastering was, he explained over the phone that there's this

separate stage of audio processing where they take your tracks and *"match them to sound as the songs you hear on other albums and the radio."* I said *"Can you do this?"* and he said *"Oh no, I record and mix only, a mastering engineer uses specialized gear for that, in a room designed for mastering!"*

So began my personal mission to learn what mastering is and how it's done. This happened around '93 and for those of you not yet working with audio at the time, imagine a world without the Internet (to be specific, a world without Google where you can get thousands of responses to any question and message boards where perfect strangers try to answer your questions faster than everyone else because that's how they earn "cool" points on the forums). If you wanted to learn something, you had to know someone who knew what it was that you needed to know, or go to the library and check out a book on it and read it, and trust me, back then there were no books on Mastering Audio at the library (I looked for them), or if you were extremely lucky, you grew up with people in the audio industry (which I did not). The reason why I'm telling you this is not to be on that *"when I was your age, we used to walk for miles to get to school"* tip, it's because when you have to dig up and research things on your own, without anyone's help, you tend to develop your own theories; you think for hours about one specific aspect of what it is you want to learn about and then start using your common sense. These days, too many people simply repeat what they've read on message boards without putting much thought into it, or worse, don't try something different to get the same or better outcome. Another good reason for giving you an example of what independent musicians like myself at the time went through is to point out that mixing and mastering were two completely separate stages, done by different people at different studios each with a different set of tools. As I had said earlier in this series, it is possible to mix and master your recordings, but one should separate themselves from both stages as much as possible. Using different tools for mixing and mastering and different speakers (nearfields for mixing, full range for mastering) in my opinion, is essential.

I remember calling up a few places to find out how much it would cost for someone without a record deal and on a budget to get 8 songs mastered. Let's just say that the prices were astronomical in comparison to today's rates with a mastering pro, so in addition to not knowing anyone, not having resources to pick up and read, and not having a relative that worked in the audio industry, I was also broke. We decided to skip the expense of getting the project mastered. A lot of the artists that broke around that time did so with non-mastered demos anyway; it was common back then for a label to pay to re-record a project. This brings up another good point about mastering today – these days, getting a project mastered professionally is much more affordable than it was back in the day; supply and demand baby. If you spend about $150 on sneakers 4 or 5 times a year, you can afford to get your project mastered by a pro.

The albums being released at that time were not nearly as loud as most of the material that gets released today. It's not like you couldn't maximize the levels back then the same way you can today, that's been possible in the digital domain since day one, but it's probably because back then, there was only so much you could do at the mix stage with regards to making mixes loud. Mastering processors back around that time were mostly hardware, so if you wanted for example a compressor and limiter that had mastering features, you were going to have to spend a small fortune in some hardware.

It was not common to find something like a TC Finalizer in a mixing studio back in those days, so the dynamics processors that were used in most of the recording and mixing studios would not be able to increase the loudness of mixes the same way mastering compressors do (transparently, as is desired in mastering), so when the mixes went out for mastering, there was a lot of headroom, and so much of this headroom was retained by the mastering engineer, otherwise the mixes would really change from what the artists, producers and record label execs had already heard and liked. Loudness was used to make softer mixes more consistent with those which were louder, and the average loudness of albums back then was not as high as it is today, so nobody was really out to squeeze every last dB of dynamic range.

Eventually, as digital effects processors became cheaper and more accessible, mixes began to get louder, and mastering engineers had no choice but to work with what they received from the mix engineers. It's not uncommon today to hear of a mastering engineer who asked the mixing engineer for a mix with more headroom (dynamic range), only to be told *"well, the artist, producer and record label have already approved the mixes so you need to work your magic on what you already have."* It's not like how it was for me back in 1993, when a mix engineer knew how far he could go and where a mastering engineer would take over, and it's mostly because nowadays, a mix engineer has access to a bunch of effects, most of them plugins that allow them to increase the levels as loud as it makes sense to them and everyone else approving the mixes in the studio. Nobody is saying *"Wait, hold on a sec, isn't this starting to sound a little harsh?"* or *"Hey, I know you just used that ____ plugin to increase the loudness, but we're going to get the album mastered by someone else next week, so we'll need the headroom."*

Long gone are the days when A&Rs were driving around town, checking out your shows, ready to give you a demo deal and develop you as an artist, and that your demo (or "mixtape") has to sound as loud as the latest album by so-and-so because otherwise you won't get a record contract. Again, you are responsible for changing the outcome of the "Loudness Wars". The moment you separate yourself from what the industry is doing, that'll be the moment you'll start to think about what loudness levels are best for your

music, and there are psychological effects that you should know about to back that up too, which we'll get to in a second.

If you're a recording/mixing engineer and your clients expect you to push the levels so that their mixes are as loud as anything they're going to compare it to outside of your studio, by all means, squash the mixes as much as they like, but please give your clients a "master-ready" mix that they can send to a mastering engineer should they decide to get their mixes done by a pro. There's nothing wrong with saying *"Look, I don't do mastering; I'll push this mix for loudness, but I'm going to give you a mix that isn't as maximized in case you want to get this mastered later."* Unless you're really confident that you can also master properly through the same system that you're using to record and mix (i.e., can you hear 45Hz on those?), I would at least give your clients that little bit of warning, after all, they shouldn't expect you to give them a mastered mix if all they're paying you for is to record and mix the audio.

If you're on the client side and you're working with a studio that is recording and mixing your tracks and they offer to do the mastering on the same system for a little bit extra, at the very least, take it upon yourself to get "master-ready" mixes. I would honestly be a little cautious when dealing with someone who claims they can do it all on the same system, so proceed with caution here. All you need to say is that you're going to get the project professionally mastered elsewhere and that you want suitable mixes for mastering. If they are half the professionals they claim to be, they'll be able to provide you with proper mixes with enough room to master.

Sensory Overload

Okay, so now that you're no longer making music to please people who care more about quarterly sales figures than music, you can focus on something that marketing and advertising agencies have known for years: Loudness gets peoples' attention. But is it good for music?

Fortunately, I'm hearing more and more Hip Hop releases being put out that are not as smashed as they were in recent years, this is a good thing. It seems the artists doing this know that there's a threshold that shouldn't be passed to keep the music energetic without fatiguing the listener.

Have you ever gone to a bar where it's impossible to have a conversation with the person next to you because the music is really loud? This is done so that you spend less time talking and more time buying drinks. Most people that "bar hop" probably have no idea

that subconsciously, bars are getting you in and out so they can free up the tables and booths for other paying clients.

There are certain clothing stores who have been in the news for their overuse of loud music. Apparently, in the retail clothing industry, the practice serves two purposes, to attract passersby and once they're in, they'll find what they need, pay and get out quickly, avoiding prolonged exposure to loudness. You typically see teenagers hanging around stores like this, not people who are older, this is because as we get older, our tolerance for loudness diminishes; we put up with loudness for shorter periods of time. In one interview, a student employee told the news reporter that management didn't allow them to turn the music down.

Have you ever been annoyed at a TV commercial that comes on and is so loud that you find yourself scrambling to find the remote to turn down the volume? I know I do (I actually have a cheap compressor/limiter hooked up to my TV's audio outs). The idea behind this is that since commercials are about 30 seconds long, you won't mind the loudness that much and your attention will be captured so at the very least, you will remember what product the commercial was about because it startled you; you probably won't remember the commercial that came before or after it.

This is all done on purpose; loudness grabs your attention. This is how albums have gotten progressively louder over the years. Someone at a record company meeting said *"Hey guys, you know, we could get our album to sound louder than so-and-so's; when people hear it on the radio, it'll capture the attention of the listeners more than the last song that was played!"* Great idea, until everyone else caught on and they started to do the same thing!

The thing these geniuses didn't take into consideration is that in the world of music, this may not be the best thing in the long run, especially if you expect your listeners to keep coming back to listen to your music. The effect of loudness in the above examples is for short term purposes, prolonged exposure to loudness can also fatigue the listener; so a simple question for you is:

Do you want to make your listeners tired while they listen to your music?

No, right? Okay then, let's talk about why people get tired when they listen to loud music for prolonged periods of time.

Crest Factor

If listening to music at loud levels all the time is not the most desirable thing to do, then wouldn't turning down the volume take care of the problem when listening to music that's overcompressed and maximized? Another side effect to consider when maximizing audio is the reduction of the Crest Factor, or PAR (Peak-to-Average Ratio) of the material; in other words, you're not letting the music "breathe".

Let's get a little technical; what exactly does Crest Factor mean? When speaking about audio, it is the difference between (ratio of) the peak and average levels in the music. You have more Crest Factor in a mix that isn't compressed because when compressing audio, you bring down the peaks, which in turn brings down the output level and then you compensate for the volume reduction by turning up the makeup gain; doing this gives you a reduction in peak volume, with an increase in average levels so the effect that you get is the sense that the material is louder, and it is, because you raised the average levels of the mix; your brain is processing sound waves that have a higher amplitude.

One frequent question I see posted on message boards is one that goes something like: *"How can I get my drums to bang like they used to on stuff from the 90s?"* Typical replies by the "experts" include things like *"they tracked to tape"* or *"they used hardware samplers"* and even *"they sampled from wax and not CDs"*. I think a huge part of the reason why drums sound as big as they did on stuff from back in the "Golden Era" of Hip Hop is because the joints had room to breathe, or in technical terms, a big "Crest Factor", a lot of "dynamic range."

What effect does a small dynamic range have on you? Imagine if this article was presented to you in all capital letters, with no paragraph breaks – would you read it?

Our senses don't like to be overwhelmed, that's the best explanation I can give you. I'm sure there's a better (more boring) scientific explanation, but for now let's stick to real world examples. Our sense of hearing doesn't like abuse; just like you wouldn't read this article if it was all typed in caps, just like you wouldn't bathe in cologne, just like you wouldn't pour a cup of salt on your steak, and just like you wouldn't hit everything you want to touch with a bat, your hearing does not really appreciate music that doesn't have a dynamic "ladder" to it.

There have been studies that show that loud music gives people a boost of energy. Music is loud at concerts for a reason and they even recommend that you turn up the radio if you're feeling tired while driving, but this isn't how people live 24/7. If your goal is to make people "feel" something and get some kind of an emotion while listening to your

music, you better give them some dynamic range. Last I checked, they still make potentiometers (volume knobs) and people can turn up the volume to their desired level, which brings us to our next topic, brought to you by two engineers back in the 1930s.

Equal Loudness Contours

In 1933, two engineers at Bell Telephone Labs named Harvey Fletcher and W.A. Munson published an article in the Journal of the Acoustical Society of America (Vol. 5, #1) named "Loudness, Its Definition, Measurement and Calculation". They found that our hearing is most sensitive in the middle frequencies and that in order to "match" lower and upper frequencies to be perceived as loud as middle frequencies, we must turn up the volume so that we are able to hear those frequencies more, making things sound more "even". The most important finding in their research is that this phenomenon varies from person to person, as stated in the first paragraph of their article:

"Loudness is a psychological term used to describe the magnitude of an auditory sensation. Although we use the terms "very loud," "loud," "moderately loud," "soft" and "very soft," to define the magnitude, it is evident that these terms are not at all precise and depend upon the experience, the auditory acuity, and the customs of the persons using them."

In my opinion, if there ever was a case for backing off the loudness race, that is it. When maximizing the levels in a mix, you minimize the dynamic range with the use of compression. This may seem like a good idea (so that all frequencies sound "even" to the listener), but as you increase the amplitude of these lower (in output) frequencies, it can distort your mixes, while decreasing the headroom. This also can be perceived as an unnatural effect, how much so depends on the listener.

What the so-called "Fletcher Munson Effect" means to those of us who mix audio is that we should listen to mixes at different volumes as we work, to ensure that we are placing the low and high frequency elements of the mix at levels that can be made out in relation to the middle frequencies, because people will listen to the mixes at various levels.

However, this doesn't mean that if you turn the volume down to for example 40dbSPL, that you should be able to hear all of the elements of your mix; if you can barely make out the bass line but can hear the vocals clearly, that's alright! The vocals and other things in the mix that live mostly in the mid range frequencies should stick out to you more than anything else.

Listening to mixes at lower SPLs can also give you an idea of how dynamic your mix is. A quick example of this is would be to take a song that has been maximized to the point where there is very little dynamic range and compare it to the song's mix before it was put through all of the maximizing processes. You would first listen to the maximized master and set a reference level in your SPL meter, at around 40dbSPL for this example. Make a note of where your volume control is at that level. Next, load the mix before the maximizing processes were applied and bring up the volume until your SPL meter displays 40dbSPL and make another note of where your volume control is at for that level as well, and compare the two at their respective 40dbSPL levels, which version has more punch?

Another thing you'll notice while listening to both the maximized master and the original mixdown is more dynamic range in the mix and some degree of distortion in the master that was not in the original mixdown. You should be able to hear more middle frequency content even at this lower volume level, a less technical meaning for this would be that you'll hear things closer together than farther apart. By the way, if you don't have access to something like this, you can compare something that has been "remastered" and made louder for the purpose of competing for loudness versus the original version from vinyl or even the first generation CD release from 10 years ago or so. You'll also notice that even at this lower volume level, you still need to raise the volume to be able to hear the lower frequencies as much as you're hearing the mids, so maximizing audio does not mean that you'll hear everything more evenly at lower volume levels exactly, in fact, you may actually notice more "punch" in the low end on a less-maximized mix, due to the increased crest factor (more room for that low end to breathe). Because your ears will still hear the middle frequencies more than others, this area of frequencies will be more obvious to your ears after maximizing the audio and when listening to a maximized mix at lower volume levels, it's easier to make out the distortion around the middle frequencies more than in the low frequency range.

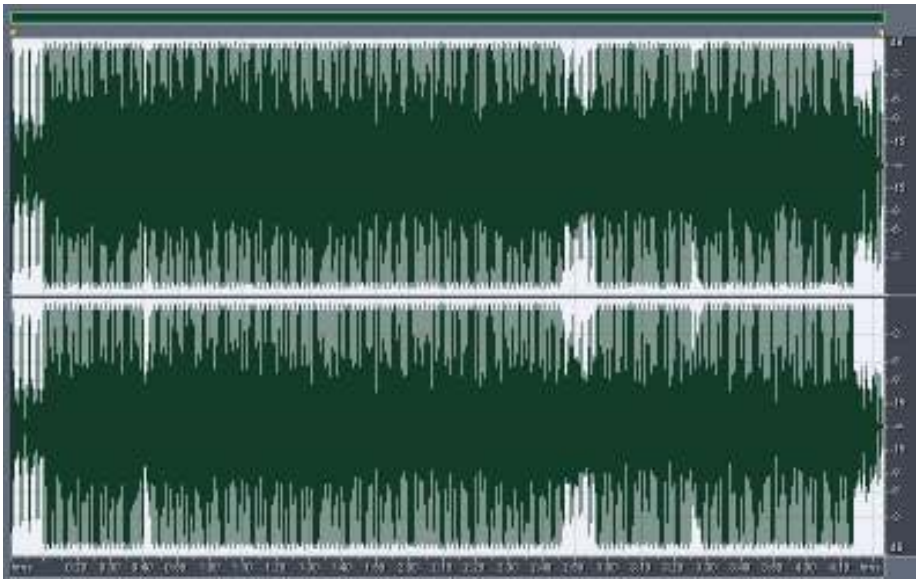
Examples of Loudness Increase in Hip Hop

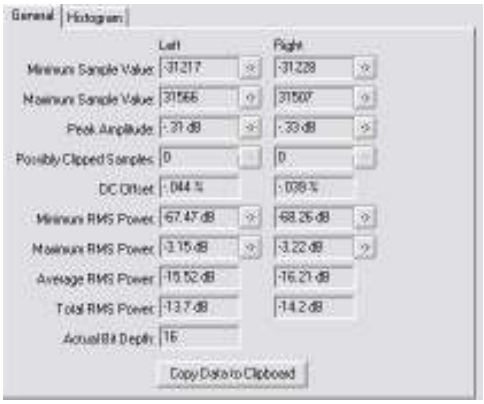
In the last 20 years and change, Hip Hop albums have generally gotten louder. The following page has screenshots of tracks I analyzed for loudness. Think of the white space as headroom, and check how much and how little there is in each of the examples.

NWA – Straight Outta Compton
(File extracted & analyzed from original 1988 CD)

I don't remember ever thinking: "this song sounds too soft, I can't make my stereo go louder." Interesting observation of this classic is that it never even peaks at 0db. The maximum peak happens on the Right channel at –0.96dB. The average levels are around –18dB.

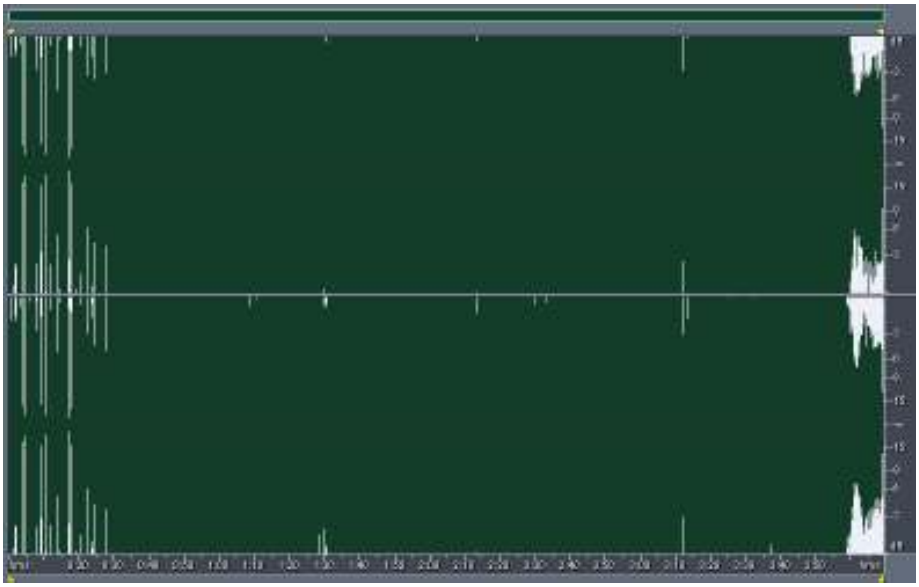
Xzibit – Los Angeles Times
(File extracted & analyzed from original 1998 CD)





For me, when it comes to loudness levels, the 90's were the Apex. At these average levels (around –15dB, which some listeners might already consider loud) you can listen to an album from beginning to end without much ear fatigue. I recall around this time, people would talk about the individual sound that some albums had in comparison to others. I remember you could tell when someone was using a good reverb on their drums, or one that sounded weak. I think this is in part because at these loudness levels, you are very unlikely to hear digital saturation. These days, once you've learned what digital saturation/distortion sounds like, you can hear it on almost every album and it all sounds very much the same.

Ghostface Killah – The Champ
(File extracted and analyzed from original 2006 CD)



As much as I like this album, it's one that I can honestly say I've only listened to from beginning to end about twice. Whenever I pick up this CD and play it on my system, I jump around from track to track and play a few of my favorite tracks. I do this regularly with this CD, sometimes I play different songs, but never the whole thing. I think this is in large part due to the insanely loud levels. Now, Ironman from '96? I play that one from beginning to end at least twice a year.

So then, how loud?

The main discussion most audio engineers are having these days when it comes to the "loudness wars" is one that baffles me. The majority of audio professionals and the recording industry in general, seem to be calling for some kind of volume standard, one that will set limits of how much something can be maximized before it gets commercially-

released. This idea is ridiculous in my opinion, because as we just discussed, everyone has their own limit as to how loud something can be before it starts being annoying to them. Sure, there are average volume (RMS) ranges that can work but they should only serve as a ballpark range because even in a specific style of music, the average levels change.

What makes most sense to me is to release various versions of songs, each with levels suitable for their destination. There should be a version that best utilizes the dynamic range of a CD, a version that is lower in average levels output for pressing to vinyl, one that is a bit louder for the web and so on. You might even want a version that has a dip in the 10k range and above to minimize that garbled sound you get when some websites' audio players upload your audio. In order to have this kind of flexibility, you need to print mixes that have enough dynamic range to push them higher, as we've learned, once you squash the material, there's no way to undo it.

The various processors that maximize audio have different characteristics that they impart on the material, so the best thing you can do is learn how far you can push them before they start to "break up" and make your mixes sound harsh. This is the reason why you don't want to maximize your mixes if you intend to send them out for mastering; a mastering engineer probably has better gear than you do for this, and most importantly, a lot more experience than you to be able to do it in a musical way without it sounding like shit.

I hope that at least, this article has inspired you to proceed with caution when using processors that maximize audio levels. In part six, I will wrap up this series of articles on Mastering with new platforms that the audio industry is looking into for the future of audio distribution as well as ideas for you as an artist to help get your music out there with the best possible quality.