ARCADA

Loudness War

Introduction and Aftermath of Hypercompression in Modern Music

Miika Elmgren

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EXAMENSARBETE	
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Sammandrag:
Denna examensarbete är en introduktion till ett fenomen som kallas för Loudness War och en reflektion till dess följd. Fenomenet är bekant kring ljud/musikproffs-kretsen, men inte kring vanliga musik-konsumerare.

Fenomenet har styrt i ljud- och musik-industrin fr.o.m. 1970-talet när inspelningar blivit ökande högljudda i nivån. Fenomenet började redan på 1940-talet när artisterna märkte att radion spelar musik hårdare när inspelningen har högre ljudnivå. Artisterna började konkurera mot varandra i ljudnivå. Även skivbolag påstod att högljudd musik säljer bättre.
Efter uppfinning av digitala ljudformat, bl.a. CD, har det varit möjligt att höja på ljudnivån lättare än på vinyl som har sina tekniska begränsningar. Vinyl-spelarens nål vanligtvis börjar hoppa bort ur sin plats när inspelningen har hög ljudnivå. CD:n har ett tak på ljudnivå av -0dBFS, som är gränsen även idag.

Jag kommer att introducera verktyg för ljud-processering som används för att skapa ljudstilen som används i fenomenet. Högre ljudnivå skapas med kompressorer och kraftigare kompressorer som kallas för limiter. Kompression jämnar ut ljudnivån genom att reducera transienter (peak), och därmed ökar på sakta delar i inspelningen. När kraftig kompression används överdrivet kallas processen för hyperkompression. Hyperkompression kan skapa distorsion som lyssnaren kan uppleva obehagligt och tungt att lyssna på i långa siktet. Många som kritiserat fenomenet påstår att hyperkompression tar livet av musiken eftersom allt låter lika jämnt och trögt på inspelningen. Det sägs att transienter skapar spänning och ger liv till musiken.

För att få förståelse till grunden av fenomenet går jag igenom historien bakom ljud-inspelning: när Loudness War började, varför det utövas och möjliga orsaker varför den fortsätter idag.
Nuförtiden kontrolleras ljud på stora medier, t.ex. Spotify, YouTube och på TV med normaliseringsregler, som gör att allt spelas upp på samma ljudnivå. Orsaken som fick många artister att konkurera i ljudnivå finns inte kvar längre. Fenomenet började av konkurenta orsaker men digitala taket är nått länge sedan. Ljudstilen fortsätter trots

detta idag p.g.a. olika orsaker som kan spekuleras över. Även myten som skivbolag och producenter uppehåller om att högljudd musik säljer bättre har bevisats felaktig.

Det finns kraftig debatt kring fenomenet och den kritiseras av ljud-proffessionella – frågan är att är det ett problem eller inte. Med klarhet kan man säga att kriget är poänglös. Jag kommer att reflektera kring idén att artisterna utnyttjer den hyperkompresserade ljudstilen för artistiska- och inte konkurerande orsaker.
Unga och moderna artister skapar även mer högljudda inspelningar idag med hjälp av teknologin. Musikteknologin har skapat effektiva kompressorer och limiter som gör hyperkompression lättare och bi-produkter som distorsion osynligare än förr.

Den mesta informationen hittar man på ljud-relaterade webbsidor som jag syftar till. Mastraren Ian Shepherd har en egen blogg där ämnet behandlas noggrannt och grundligt.
Shepherd tar ställning till ämnet med att organisera ett evenemang som heter Dynamic Range Day. Evemanget hålls årligen, och dynamiska inspelningar firas - bästa publikationen vinner pris.
Dynamic Range Day har som mål att allmänbilda vanliga konsumerare att bli medveten om fenomenet. Många vanliga lyssnare har reagerat på inspelningar med överdrivet ljudnivå, t.ex. Death Magnetic av Metallica och Californication av Red Hot Chili Peppers. Fenomenet har blivit synligare med åren men vanliga lyssnare sällan reagerar eller bryr om det hela.

Grundkunskap om saken hittas i boken Mastering Audio av mastraren Bob Katz. Jag presenterar grundtermer och processen kring kompression av denna bok.

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Abstract:
This thesis is an introduction to the a phenomenon called the Loudness War and reflections to its' aftermath. The phenomenon has reigned in the audio- and music industry since the 1970's when audio recordings have become increasingly louder in level.
I will introduce the technical audio processing tools on how to achieve the sound that the Loudness War is known for – the sound is called hypercompression.
To understand the root of the phenomenon I will review the loudness history in audio recording: when the Loudness War began, why it is practised and the possible reasons why it continues today.
The phenomenon is highly debated on and critised by audio professionals whether it is a problem or not, but it is clear that the war is pointless. I will be reflecting on the idea that artists utilize the hypercompressed sound for artistic and not competitive reasons.
The most information about the subject is found on audio related web-sites which I will be refering to. I will also present the basic knowledge on the subject found from the book Mastering Audio by mastering engineer Bob Katz.

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OPINNÄYTE	
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Tiivistelmä:
Tämä opinnäyte-työ on johdanto ilmiöön jota kutsutaan nimellä Loudness War, ja pohdinta sen jälkiseurauksiin. Ilmiö on vallinnut ääni- ja musiikkiteollisuudessa 1970-luvulta asti, kun äänitallenteista on tullut kasvavasti äänekkäämpiä äänentasoltaan.
Esittelen tekniset äänenprosessointi-välineet joilla saavutetaan äänityyli mistä ilmiö on tunnettu – tyyli on nimeltään hyperkompressointi.
Jotta voi ymmärtää ilmiön ydintä, käyn läpi äänekkyyden historiaa äänitallenteissa: milloin Loudness War alkoi, miksi sitä harjoitetaan ja mahdolliset syyt miksi se jatkuu tänä päivänä.
Ilmiö on herättänyt kritiikkiä ääniammattilaisten keskuudessa ja asiasta kiistellään, että onko ilmiö ongelma vai ei – selvää on vain se, että se on hyödyntöntä. Aion pohtia teoriaa siitä että artistit hyödyntävät hyperkompressoitua äänityyliä taiteellisiin- eikä niinkään kilpailullisiin tarkoitusperiin.
Suurin tieto asiasta löytyy ääneen liittyvistä verkkosivuista, joihin aion viitata. Esittelen myös perustiedot asiasta masteroija Bob Katzin kirjasta: Mastering Audio.

Avainsanat:	Loudness War Kompressointi Nykyajan Musiikki Ääni Tuotanto
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FOREWORD

Since the 1970's audio recordings have become increasingly louder, hence the name "Loudness War". The Loudness War holds its' roots in the 1940's when radio broadcasters started to broadcast in a competitive manner, which gave birth to a gradual loudness race in the music industry.

Increasing audio level loudness is achieved with the help of an audio process called Dynamic Range Compression. Audio processing tools such as Compressors and Limiters are used to compress the audio and bring it up in level, making the recording sound louder by increasing the apparent loudness.

The phenomenon has been widely discussed in the audio community but the phenomenon is not globally known among average listeners. A debate concentrates on the topic whether it is a problem or not, but mainly it is a source of complaint in the audio community.

The mastering engineer Ian Shepherd, founder of Dynamic Range Day, an event for raising awareness of the ongoing Loudness War, manifests the phenomenon as a pointless one – even as damaging factor in modern audio recording.

With the maximum value of loudness reached since the 2000's and strict online and TV-broadcasting level-normalization -regulations, audio recordings remain heavily compressed as modern music artists continue to mix and master their music with heavy compression.

Miika Elmgren

1 DYNAMIC RANGE COMPRESSION

1.1 Audio Processing Devices

To raise audio level or perceived loudness of a recording tools used for the job are audio processing devices called Compressors and Limiters. These devices compress the dynamic range and boost the overall gain of a recording.

1.2 Compressor

A compressor is a dynamic processor used for gain reduction. Once the audio signal goes above a certain threshold, measured in dBs, the compressor starts to reduce the gain at a certain ratio 1:1-9:1).

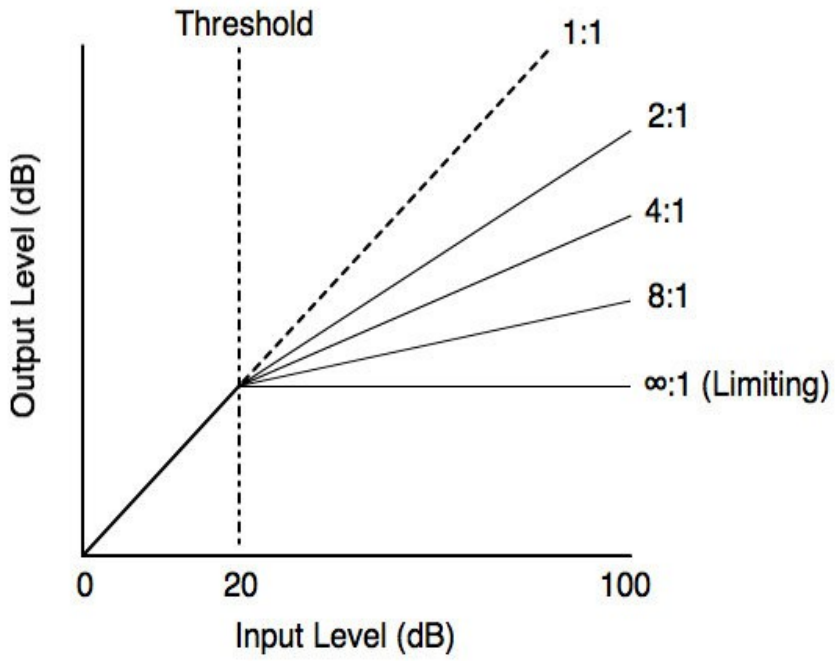

Figure 1: Image of a simple compressor displaying compression ratio & threshold values . http://www.practical-music-production.com/audio-compressor.html

This process is called downward compression. This type of compression brings down loud sounds, thus bringing up softer sounds of the signal. Loud sounds are usually transients (eg. drums/percussive instruments) that are spikes (peaks) in the audio signal waveform.

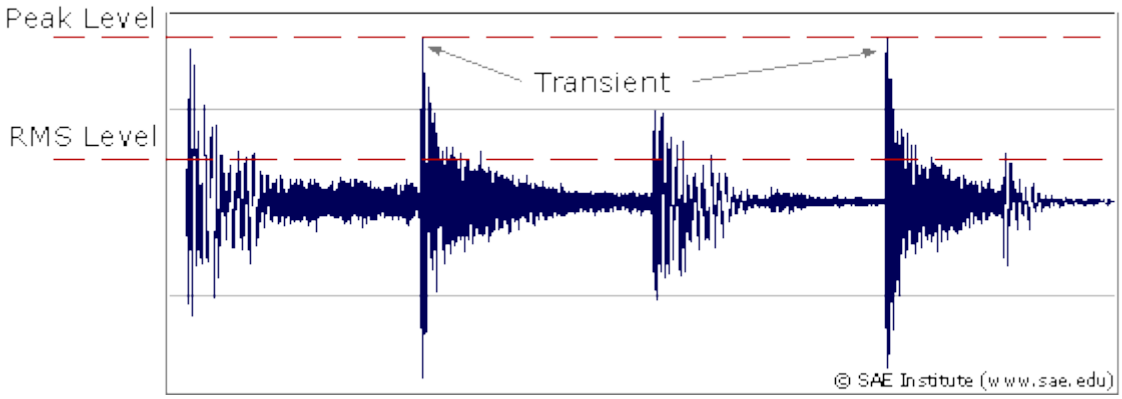

Figure 2: Image of an audio waveform displaying sharp transients within peak and RMS -level. (https://mudstompinmunkee.files.wordpress.com/2013/11/transient2.gif

The peaks are reduced and the overall RMS level of the waveform is more constant. After that the overall level can be brought up with makeup-gain and thus the overall RMS level is brought up.This is compression in its' simplest form.

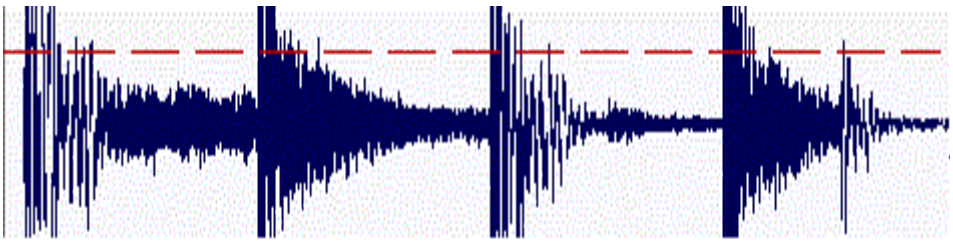

Figure 3: A zoomed and cropped view of Figure 2

A compressor also has other functions, such as the **attack**, **release** and **knee** -options.

Figure 4: Screencaptured image of a digital compressor in Avid Pro Tools (http://www.homestudiocenter.com/wp-content/uploads/2015/10/comp21.jpg

These options provide finetuning of the compression. **Attack** is the time when the signal is above the threshold and full gain reduction takes place. **Release** is the "recovery" time the signal drops below the threshold and when the gain returns to unity (0dB). The time can be measured in micro- or milliseconds or seconds. Generally the terms used for attack and release times are short / fast, or slow / long. The **knee** is the transition between unity and compression at the threshold. The shape of the transition can be soft or hard (gentle / heavy).

The compressor can radically change the dynamics of the sound: soft, punchy, warm, smooth, bouncy etc. When compression exceeds the ratio 9:1, the proper term used for the process is **limiting**. (Katz ss. 117-120)

1.3 Limiter

Where as a compressor's function is to change the sound intentionally, the purpose of a limiter is to change the sound as little as possible, only affecting the overall loudness of the audio signal. Though the limiter is a type of a compressor, it does affect the sound to some extent, when used more heavily. (Katz ss.121-122)

Figure 5: Screencaptured image of an iZotope Ozone 5: Maximizer -digital limiter (http://help.izotope.com/docs/ozone/pages/images/5_maximizer_1.png

A limiter has the same functions as a compressor: it performs gain reduction of the signal when it exceeds a certain **threshold**. A ceiling (**margin)** can be set to a value measured in dBFS which the signal will not exceed (the maximal value is 0dBFS in digital recording). Limiters can also have **attack/release** and other functions to finetune limiting.

1.4 Clipping

As the limiter's main role is to raise the apparent loudness of the recording, some limiters have an efficient tool for the task: **clipping**. Clippers cut out momentary peaks of the sound waveform, which produces a **square wave**. This is an extreme way of attempting to raise the level above 0dBFS, which produces **distortion** as a bi-product. (Katz s.127)

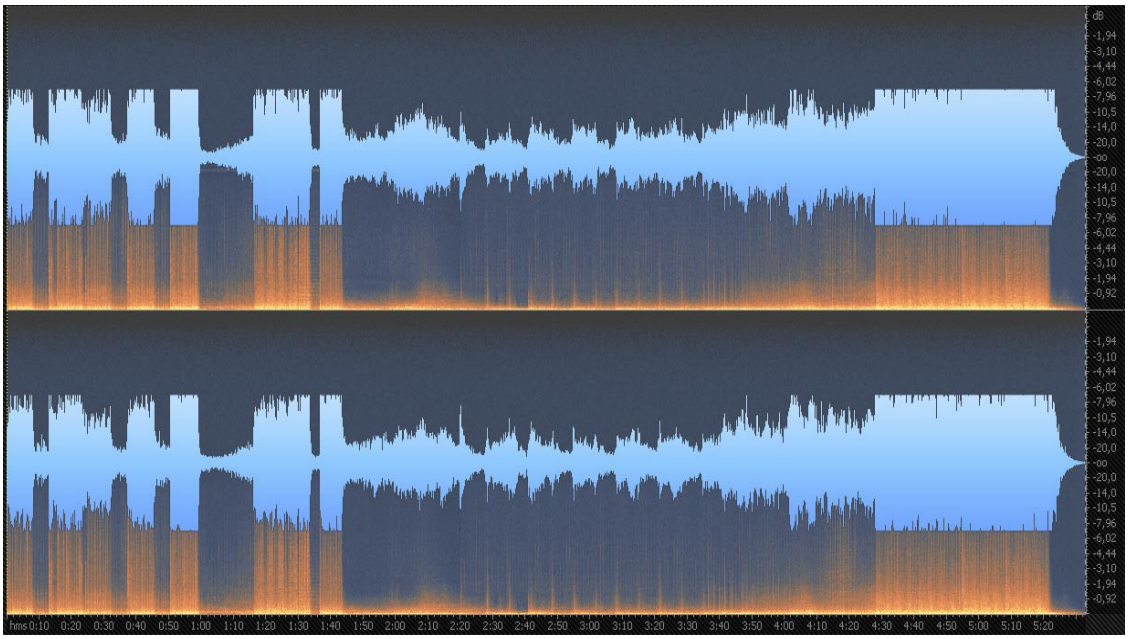

Figure 6: Image of a waveform that has been affected by clipping (http://1.bp.blogspot.com/-cPItxm2i0TQ/UEZQYSKIhGI/AAAAAAAAAsY/I2tn2AcMxtE/s1600/tdkrloud.jpg

When sound recording is heavily clipped, or sound is heavily "squashed" by the compressor/limiter the proper term used is **hypercompression**. Hypercompression leads to lost defition, lost transients and a distorted sound. (Katz s.128)

1.5 Equalisation (EQ)

An Equalizer is a device that reduces or boosts the levels of different frequencies in an audio signal.

The most common EQ types are simple bass/treble -functions on a home playback system. A more advanced EQ can affect low-, mid- and high frequencies of a signal.

The perfect example of a more advanced EQ is a parametric EQ, which can be used to affect the whole audio spectrum between 0Hz and 20kHz. (MediaCollege.com, 2016a)

Figure 7: Screencaptured image of a digital parametric EQ in iZotope Ozone 5
http://help.izotope.com/docs/ozone/pages/images/5_eq_4.png

Whereas using compressors is a way to achieve apparent loudness (high absolute loudness) (Katz s. 137), an EQ is a powerful tool to boost the perceived loudness by emphasizing certain frequencies, utilizing the Fletcher-Munson curve.

2 LOUDNESS

2.1 Fletcher-Munson Curve

The Fletcher-Munson curve describes how a human ear perceives loudness. When the actual loudness changes, the human ear will perceive it differently – this is based on the perception of different frequencies.

When listening to music at low volumes, we perceive the mid-range (middle frequencies) more prominent than high and low frequencies. When listening at high volumes, we perceive high and low frequencies more prominent than the mid-range, although the EQ balance stays the same throughout. (E-Home Recording Studio, 2016)

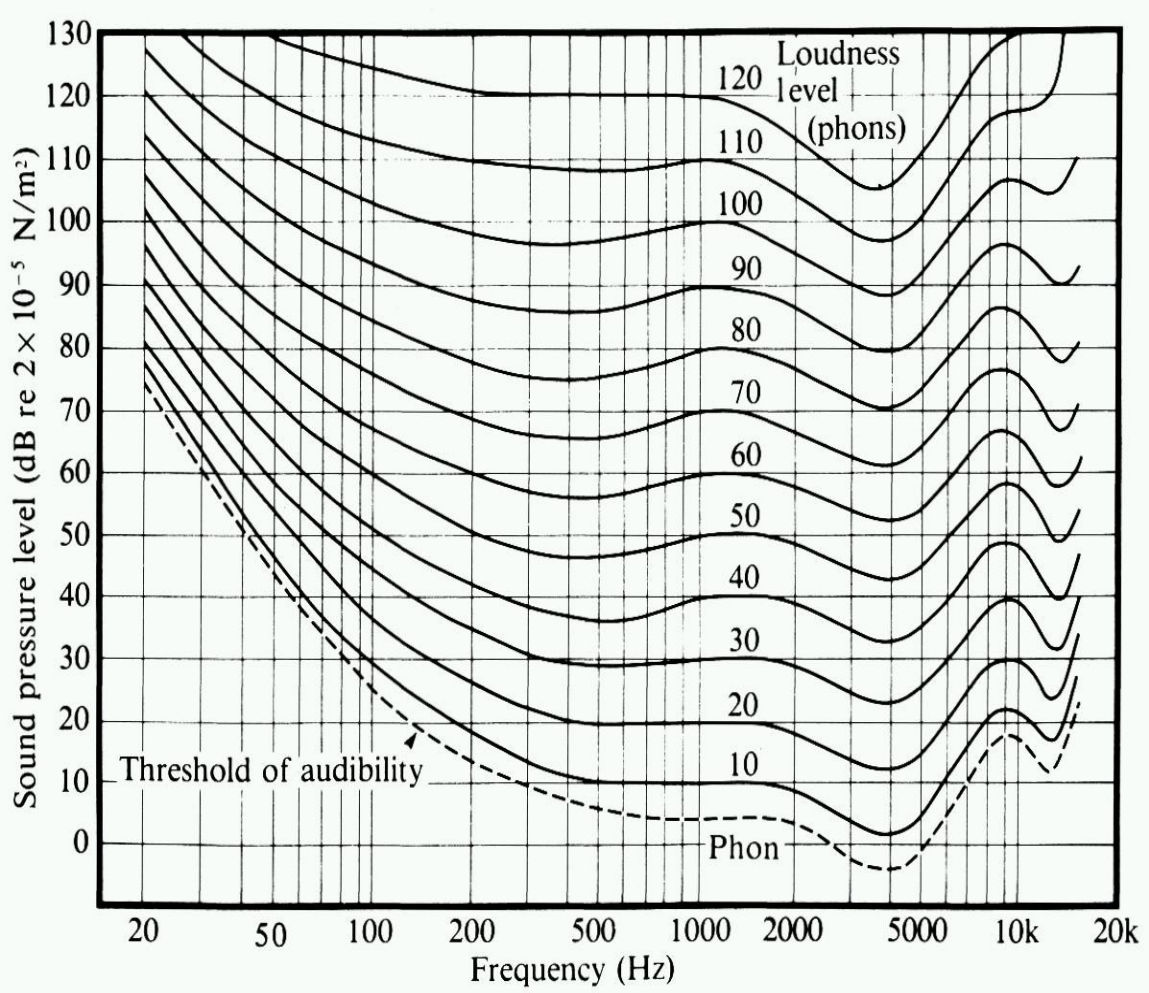

Figure 8: Image of theThe Fletcher Munson -curve
http://tuvalu.santafe.edu/projects/musicplusmath/index.php?id=24

The Fletcher-Munson -curve is a noteworthy phenomenon to grasp on when mixing/mastering music and making it loud. Loud music should be perceived loud even when it is played at a low volume.

2.2 Measuring Levels

Audio levels can be measured by RMS, when a listener wants to know how loud something is. RMS (Root Mean Square) measures the average level of the voltage of an

electric signal. RMS meters are used to approximate the way a human ear perceives sound levels. The average level gives a more realistic perception of the audio level than a sharp peak, which often seems more low in level to the human ear. That is why the RMS meter is more practical for this purpose than a Peak meter, which measures only the peaks of an audio signal. (Biamp, 2016)

2.3 VU-Meter

One of the oldest and most reliable meters to measure loudness is the VU-meter. It was developed in the late 1930's to help standardise transimission over telephone lines. It has been used in audio industry and has been a helpful tool ever since. In comparison to a peak meter which only measures peaks of an audio signal (Meterplugs, 2016a), the VU-meter measures the average level of the signal and thus represents the human ear and how it perceives volume. Working with continuous sounds can get the best out of the VU-meter, however with fast transient sounds things can get problematic, and that is when one can rely on a peak meter to see if the signal is clipping (exceeds -0dBFS). (MediaCollege, 2016b)

Figure 9: Screencaptured image of Peak Meters in Avid Pro Tools (https://theproaudiofiles.com/wp-content/uploads/2013/08/parallel-compression-daw.png

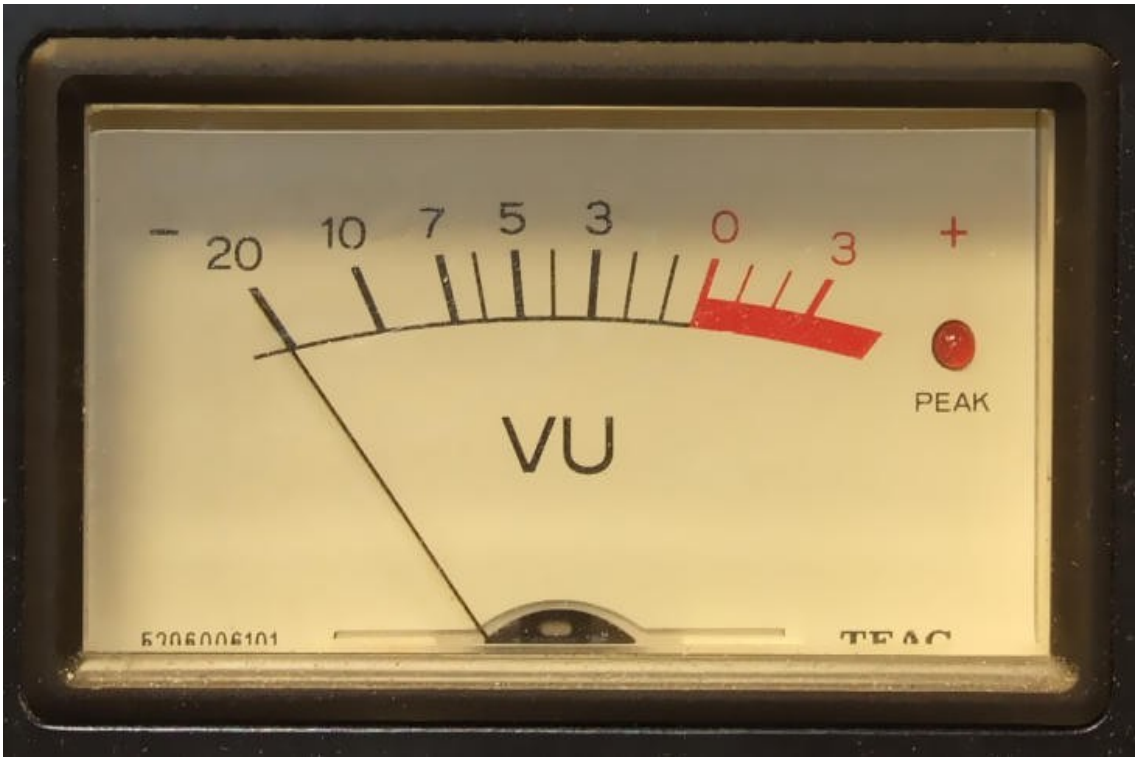

Figure 10: Image of A VU-meter (https://upload.wikimedia.org/wikipedia/commons/f/f2/VU_Meter.jpg

2.4 TT Dynamic Range Meter

The TT Dynamic Range Meter was released in 2009 by Pleasurize Music Foundation for the purpose of ending the Loudness Wars. Listeners would be able to measure the Dynamic Range of audio recordings and share DR (dynamic range) -values for all to see.
The dedicated website for public DR-values is: http://dr.loudness-war.info/ where over 96000 album infos have been posted.

The TT DR Meter measures the dynamic range of the audio based on the RMS level. It reads the audio waveform and its' lowest and the highest value (peak). The difference between lowest and highest value is the DR (dynamic range) value. Thus the DR value is equivalent to RMS level.

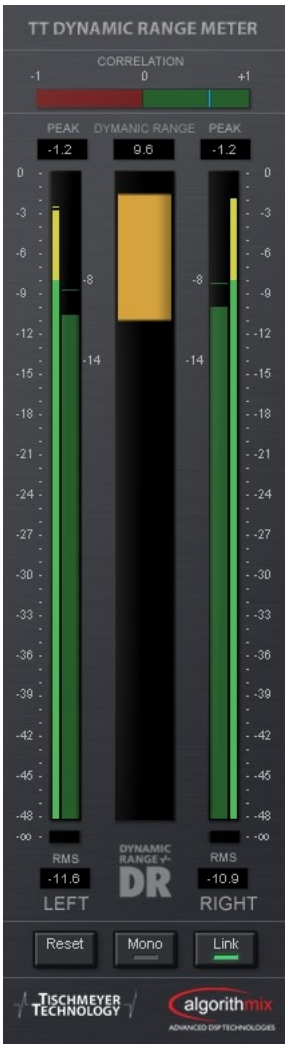

Figure 11: Screencaptured picture of TT Dynamic Range Meter (https://www.kvraudio.com/product/tt_dynamic_range_meter_by_pleasurize_music_foundation

The meter displays the dBFS -value for both left and right channels, peak, RMS and dynamic range.

The lower the DR value is (eg. DR4), the less dynamic range it will have. For example a classical music recording might have a high DR value (eg. DR14). (KVR, 2016)

2.5 LUFS Meter

In 2011 when the EBU R128 loudness normalization standard was regulated alongside a new way to measure loudness in LUFS (Loudness Unit Full Scale) (R128Audio, 2012), new digital meters were created for the purpose.

The LUFS loudness meter displays integrated loudness and short-term loudness, which gives a more accurate way to measure loudness.

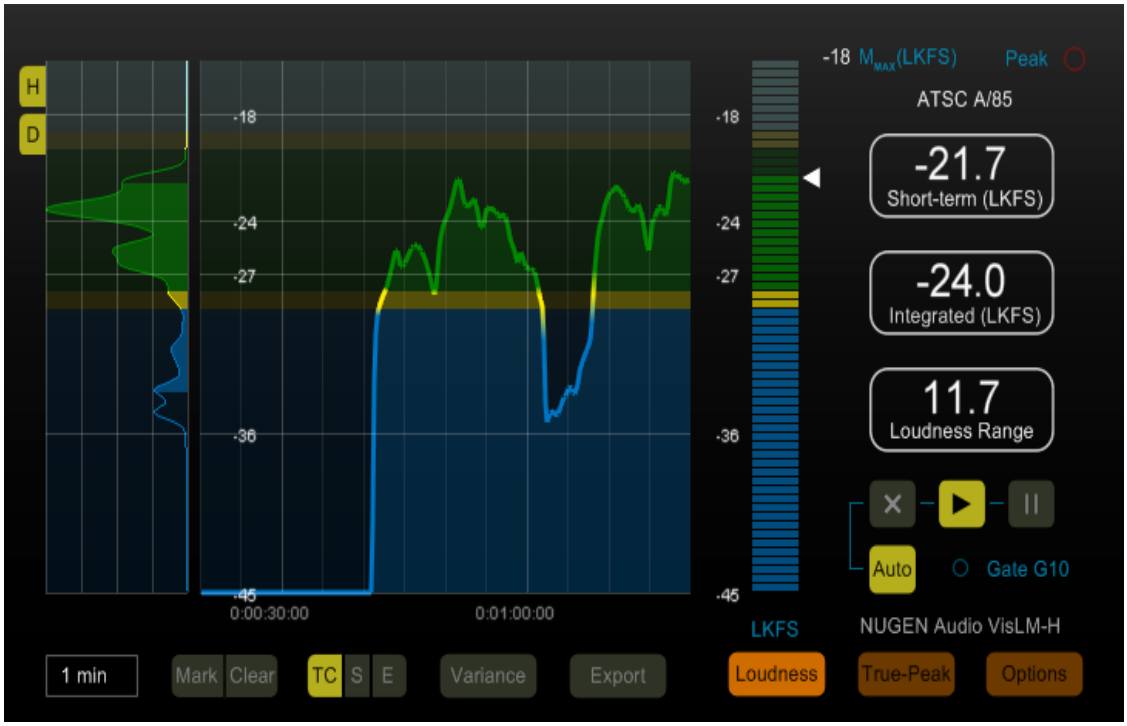

Figure 12: Screencaptured image of Nugen Audio VisLM Loudness Meter (http://www.nugenaudio.com/images/screen_shot_vislm-h.png

The Integrated Loudness stands for RMS level and Short-Term Loudness displays the momentary peaks within the audio signal. There is also a True Peak meter which displays accurate true peaks in dBTP which a normal dBFS meter will not display. (Production Advice, 2013)

2.6 EBU R128

In 2011 a new set of rules for loudness normalization were regulated. The EBU R128 or European Broadcasting Union Recommendation R128 is a standard which TV-program broadcasters have to follow worldwide. The standard was created because broadcasters failed to meet equal volume normalizations for all programs, resulting in big variations between programs, movies, advertisements and trailers. Complaints were coming from viewers. The variation between volume was also apparent when switching between channels.

Before the EBU R128 loudness normalization was monitored with a Peak Limiter usually with a limit of -10dB. The volume was not to be exceeded this limit. Because

programs have high dynamic range, the advertisers saw this as a chance for exploitation and started to compress their ads to the maximum level with a constant peak, thus achieving a higher volume than the previous program.

EBU R128 normalization standard is -23 LUFS and -1dBTP. If the audio is heavily compressed as in the case of advertisements, the level will be turned down to the same level as everything else. (R128Audio, 2012)

2.7 Audio Normalization Online

EBU R128 does not restrict itself only on television broadcast. It is being implemented gradually also on some radio stations. (EBU, 2016)

The following Online Music services manage loudness: **Spotify**, **AppleMusic** and **YouTube**. All three use different tools and algorithms, but the basic principle is the same: quiet music is turned up and loud music is turned down. (Shepherd, 2015). Spotify uses limiting to match target loudness, which the EBU R128 does not encourage to do.

3 HISTORY

Well-known mastering engineer Bob Ludwig states that exceptionally loud records have existed since the 1940's, when radio stations realised the concept of raising audio level intentionally to stand out from everything else on the radio. It was clear that an increase in level was done for competitive reasons. (NPR Music, 2009). Motown Records, known for their famous soul and pop records since the 1950's, managed to use loudness to their advantage and reached the peak for loud recordings during the vinyl -era. (Fernandez, 2015)

The only restriction for raising audio levels was the vinyl until the inception of compact discs (CDs). Since vinyl has a dynamic range of approximately 75dBs and CD has 90dBs, the CD enabled a wider dynamic range. Because of this the 1980's was the golden era of the CD with Hi-Fi sounding dynamic records utilized by bands such as

Dire Straits. The 90dB dynamic range encouraged mastering engineers to master recordings with full dynamic range until the beginning of the 1990's, when technology was overtaken by commerial concerns. (Southall, 2006)

During the end of the 1980's the pressure of "standing out" in the market came into view once more, and mastering engineers started to utilize the potential of the CD in a reversed manner: mastering CDs louder than ever before (Southall, 2006). The dynamic range of the CD allowed audio levels to be raised higher than on vinyl, mainly because the technical limitations of the vinyl would make the vinyl player-needle jump out of place and make the medium unplayable (Henshall, 2012).

In the mid-1990's exceptionally loud records started to rule the market and mastering engineers were no longer restricted by technical limitations of the CD - the only rule-of-thumb was to not exceed the maximum rate of -0dBFS, which caused audible digital distortion. Digital processing allowed complex mastering processes with multiple compressors and brickwall limiting to be applied to recordings, which was not possible in the analogue vinyl era.

A peak in loudness was achieved around 1997 when a remastered release of Raw Power by Iggy and the Stooges was released. By this time records started to average around -5dBs, when audio level meter moves constantly near the maximum rate of -0dBFS. (Southall, 2006)
This gave birth to remastered releases from famous artists such as Michael Jackson, Abba, Madonna and many more. When measuring loudness of original releases and remastered releases, a noticable raise in audio level can be noticed.

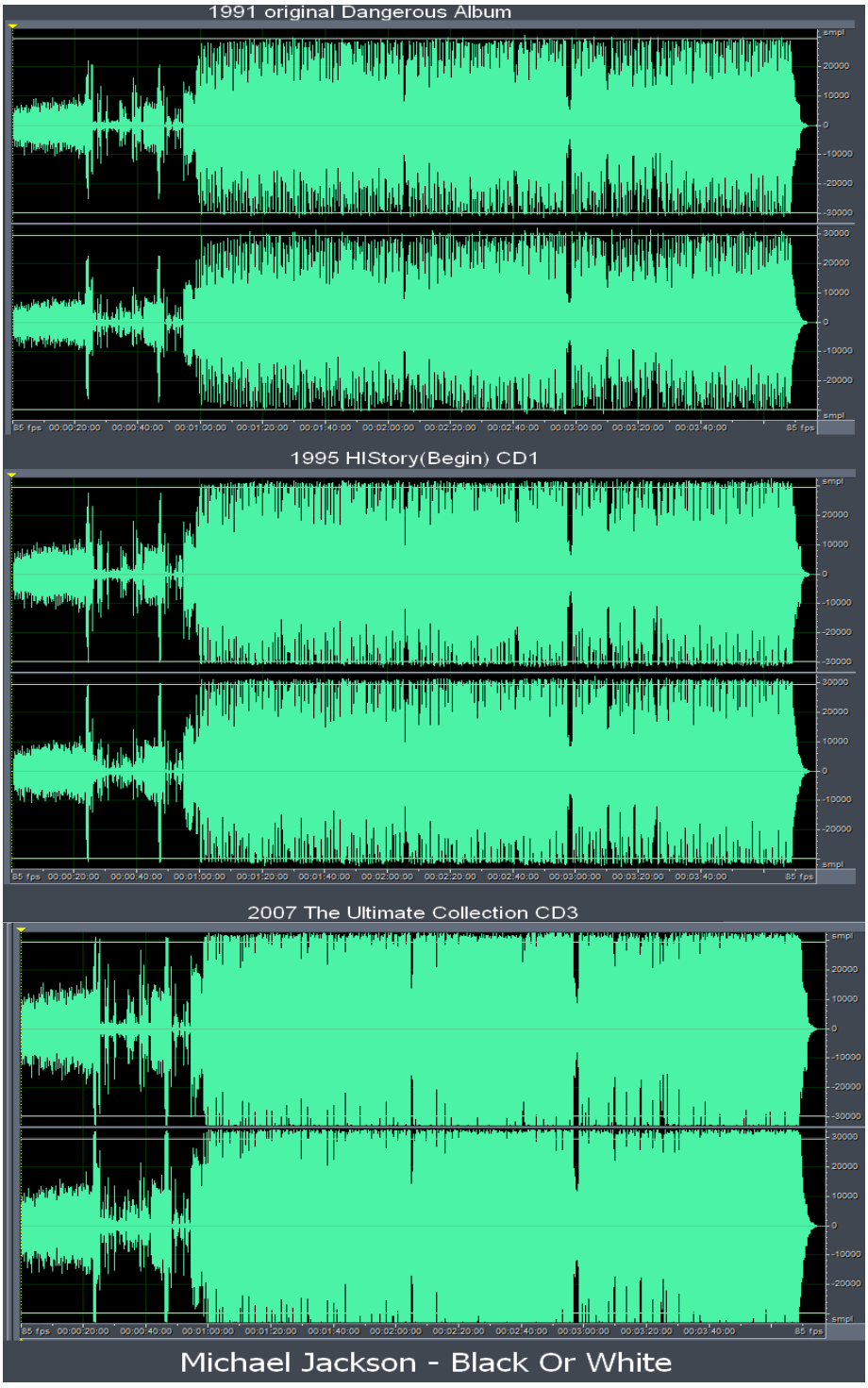

Figure 13: Image of audio waveforms in different releases of Michael Jackson's song "Black or White" that show increasing loudness over time: 1991–1995–2007
(https://upload.wikimedia.org/wikipedia/commons/thumb/4/4d/Michael_Jackson-Black_or_White_Loudness.png/800px-Michael_Jackson-Black_or_White_Loudness.png

By the end of 1990's releases such as Californication by Red Hot Chili Peppers paved the way for loud recordings. Digital processing came the golden standard: to push levels as high as possible without significant or noticable digital distorsion. With the release of

Californication even some non-audiophile listeners started to notice the audible distortion.

Ever since the beginning of 2000 recordings have reached the maximum loudness because the maximum value of -0dBFS cannot be exceeded without unpleasant digital distorsion. On average every major release since year 2000 has been hypercompressed, beside few exceptions. (Southal, 2006)

Studies show that an average loudness reached its' peak around 2005 and has stopped increasing after that. (Collins,2013)

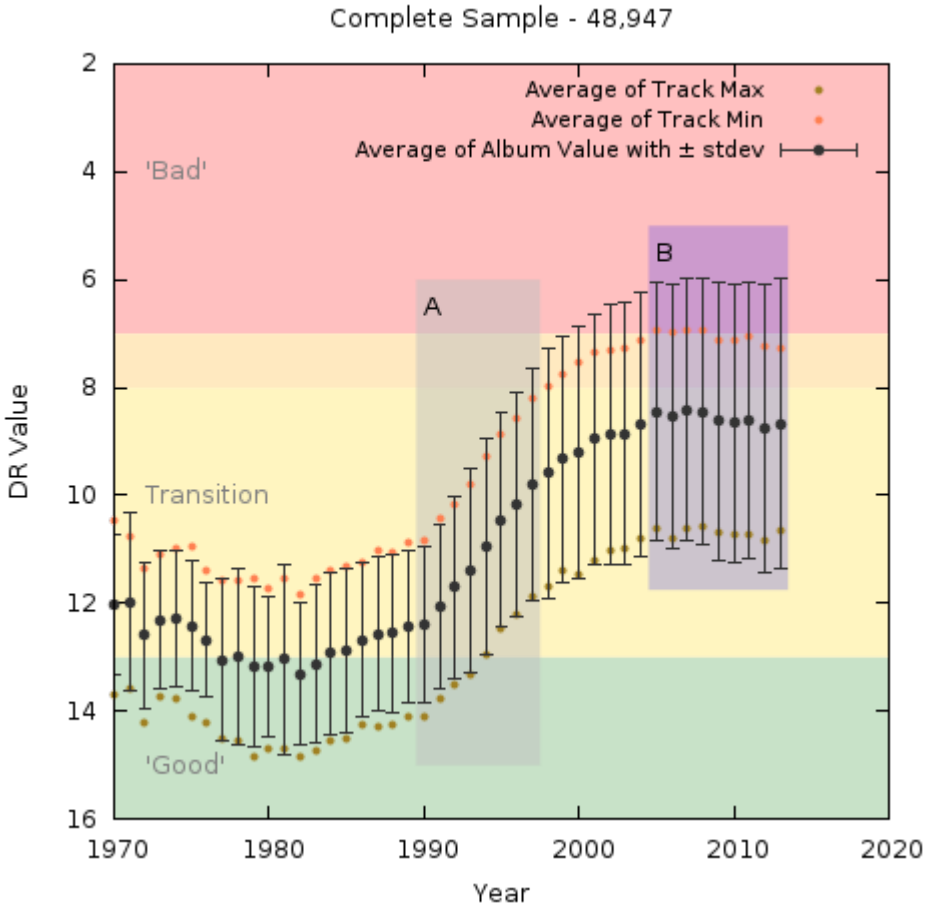

Figure 14: Image of a table showng the increasing loudness by DR (dynamic range) -value since the 1970's. (http://www.tristancollins.me/wp-content/uploads/2013/11/DRcomplete.png

A notable peak in loudness wars was reached in 2008 with the release of the album "Death Magnetic" by Metallica. Both fans and casual listeners had a negative reaction towards the album, stating the music was simply too loud. More than 10,000 fans signed

an online petition for the band to get the album remixed or remastered. Death Magnetic is one the most loudest records produced to date and it lead to a widespread phenomenon for ordinary people to address the problem in the music industry. (NPR Music, 2009)

In 2008 there was backlash against the ongoing trend of using heavy compression on records, when the rock band Guns 'n' Roses decided to make their album Chinese Democracy dynamic. The frontman of the band Axl Rose was given a choice by the mastering engineer Bob Ludwig, to either use a dynamic or a compressed version for the release. Rose chose the dynamic version, which was a small victory of raising awareness against the Loudness Wars. (Shepherd, 2008b).

In 2010 mastering engineer Ian Shepherd founded Dynamic Range Day, an online movement to raise awareness of the Loudness Wars. (Shepherd, 2016b) An annual reward is given to a major release that has utilized great dynamics, therefore celebrating dynamic music overall in 2010's. (Dynamic Range Day, (2016). The event is celebrated annually via live stream online where the annual winner is announced and overall information is given on the issue.

In 2013 another small victory against the still ongoing wars was Daft Punk's album “Random Access Memories”. The album was praised and widely regarded for its' great sound and dynamics (Tingen, 2013).
Mastering engineer Bob Katz writes a press release that states: "The battle of the Loudness War has been won", when Apple enables iTunes Radio to normalise all audio tracks to the same level by default. Katz believes that this creates an opportunity for artists and bands to use more dynamics in music. This way dynamic music becomes more powerful alongside compressed music when every track is brought to the same level. (Digital Domain, 2013)

In 2016 the war is still ongoing and although dynamic music is released on monthly basis, the average dynamic range is farly low for new releases. (Dynamic Range Database, 2016a)

4 CRITISISM & DEBATE

Loudness Wars have been condemned by music industry professionals, mastering engineers and fans alike (Masterson, 2008), but there is also debate whether it is a problem or not (Deruty, 2011). Rock musician Bob Dylan states: "You listen to these modern records, they're atrocious, they have sound all over them. There's no definition of nothing, no vocal, no nothing, just like — static." (Curnyn, 2009). Mastering engineer Bob Katz states: "There's a happy medium, and CDs have gone much too far. Music that is digitally altered to be louder isn't as enjoyable to listen to. It's relentlessly, fatiguingly loud. The punch is gone, the impact is gone." (Masterson, 2008).

Emmanuel Deruty questioned in an article for Sound on Sound about the misconceptions of measuring loudness, and the uncomparability between vinyl and CD. Deruty stated that the problematique of dynamic range gives a slight misleading view on the whole issue of Loudness Wars, and is more about the sound and purpose of the music itself. (Deruty, 2011)

Chris Emery claims that listening to heavily compressed music can have a ear fatiguing impact on the listener and increases the chance of suffering of hearing loss. (Emery, 2007)

Mastering engineer Ian Shepherd clears the debate by saying that even though loudness measurement can be problematical and music is a subjective matter, the problem remains the same. It is a fact that modern music suffers from a crushed and distorted sound, which is quite apparent even for an average listener (Shepherd, 2011c). Shepherd also states that even if over-compressing music does not have a negative impact on recordings, the Loudness War is still pointless because it can make music more harm than good when taken to the extreme (Dynamic Range Day, 2013c)

5 DESCRIBING COMPRESSION & SOUND

5.1 Desribing Compression

It is easy to demonstrate visually what a compressor does to a sound. The question is though how does the sound change after it has been compressed.

An audio track where audio compression hasn't been applied to usually has dynamics. When the track has variation in different sections or increments the term used is Macrodynamics. When the track has small instantenous peaks (transients) eg. percussive hits, such as a snare drum hit, the term used is Microdynamics. (Katz s.109)

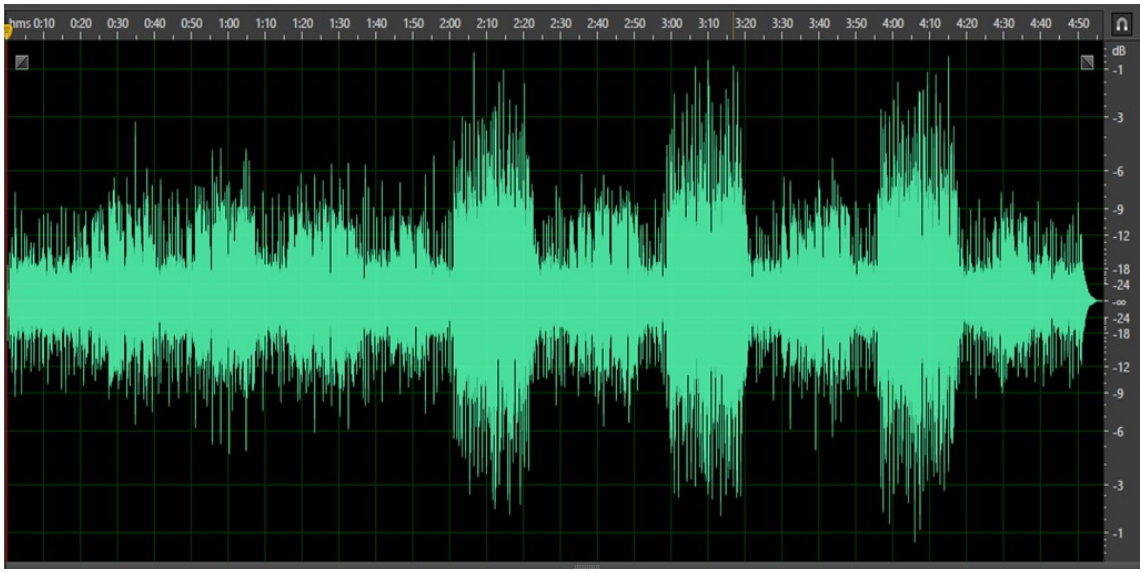

Figure 15: Image of an audio waveform with macro- and microdynamics

(*http://gadgets.itwriting.com/wp-content/uploads/2013/09/image12.png*

Raising the average loudness of an audio track can be achieved efficiently when microdynamics are manipulated and that is when compressors come in. Peaks are attenuated and the attack of the peaks are modified, and the overall audio track is brought up in level.

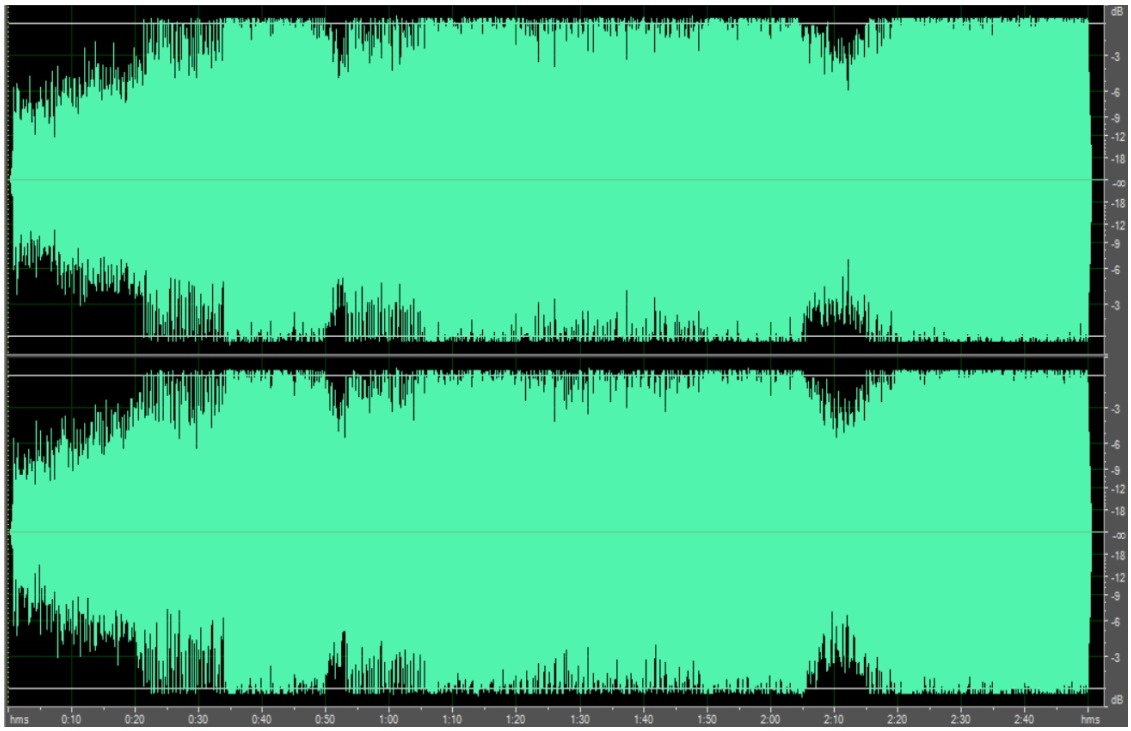

Figure 16: Image of an audio waveform with decreased macro- and microdynamics (http://3.bp.blogspot.com/-LZkplxxBPD0/VpfNXOEC_dI/AAAAAAAAGnQ/DOa6F_N-U8E/s1600/Eight_Easy_Steps_-_Waveform_CD.png

It is said that dynamics bring more life to an audio mix. Compression can be used moderately to compliment certain elements of the mix, or to add more punch, warmth and power to the mix. The attack of the peaks can be emphasized with compression, making the impact of the peaks more powerful. (Shepherd, 2010)

Compression reduces dynamic range of the mix which can add "more beef to the bones" or "fattness" thus making the mix sound more "thicker", strengthening the musical message of the song. (Katz s.121)

When compression is over-used (hypercompression), it can make have a downgrading effect on the impact of the music when transients are lost which leads to reduced definition. Katz descibes this sound as a "boring, lifeless mush".

In skillfull hands compression can add punch to the mix and make the overall mix sound more consistent and even. Transients can actually sound thinner when they are overly emphasized. The main purpose of the compressor is to affect the loudness of the mix in a beneficial way, which hypercompression rarely does. (Shepherd, 2010)

5.2 Describing the Sound

Sound is a subjective matter and it is hard to define what sounds better than the other. That is why we can make a musical comparison of the difference between a compressed mix and a dynamic mix.

To make the comparison fair and more accurate one must have two audio tracks that are level-matched. The Fletcher-Munson curve reminds us of how we experience sound at different volumes and that is why a comparison can only be made when two tracks play at the same volume. (Shepherd, 2011a)

When comparing two tracks with one another and after they have been level-matched by RMS-level, the listener can be deceived by differencies in EQ and more. That is why audio professionals have developed tools like Perception plugin by Meterplugs for making accurate audio comparisons (Meterplugs, 2016b)

The comparison can be made even more fair if the the two mixes are of the same track. One mix is more dynamic and the other is heavily compressed.

In 2008 by the time Metallica had released their album "Death Magnetic" an other version of the album was released via the video game Guitar Hero which was more dynamic than the CD version.

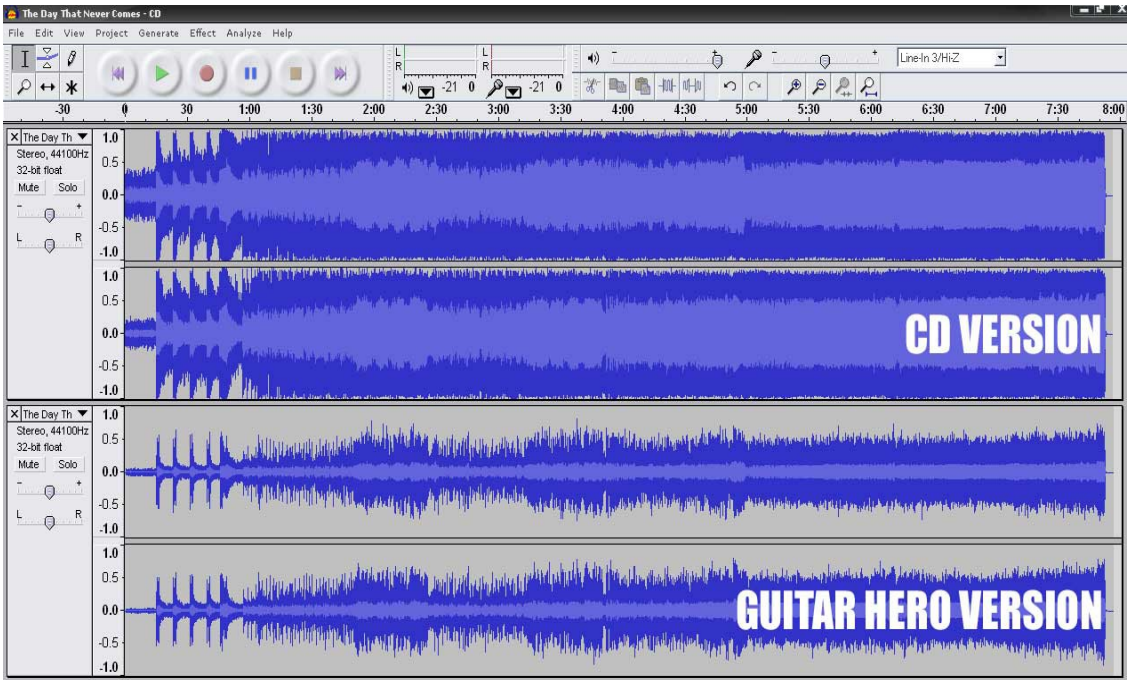

Figure 17: Screencaptured image of audio waveforms displaying two different versions of the Metallica song "The Day That Never Comes"

(http://www.hdphonic.com/img/a/metallica.jpg

When comparing the two versions of the same Metallica song a comparison can be made. The Guitar Hero dynamic version has more definition, the kick and snare have more punch and overall the track sounds less distorted than the compressed CD version. (Michaels, 2008)

Lars Ulrich, the drummer of Metallica, commented on the criticism of Death Magnetic and stated that to him the album sounds loud and exciting, and "it jumps out of the speaker". Ulrich also stated that he is not concerned if the audio clips or not and the sound of the album is how exactly how the band wanted it to be.
(Blabbermouth.net, 2008)

The first thing a listener notices, as Lars Ulrich stated, that a loud track certainly does jump out the speaker if the previously heard track was more quiet than the current track. The listener's need to use the volume knob for increasing the volume decreases since the track is already playing loud.
When the track is mastered loud there is less room to play with the volume knob since the track is loud and compressed so it will sound more even when it is played quiet out of the speakers.

Producer Kevin Killen states that compressed music can be taxing to the ears and can become tiring to listen to on the long run. Killen claims that by the end of the day listeners end up fatigued as a result of the loud music that "assaults" the ears. (Masterson, 2008)

Ian Shepherd found one positive note on the CD version: it has a better EQ-setting, it sounds fuller and the balance between guitars is better than on the Guitar Hero -version. (Shepherd, 2008a)

Bob Katz describes a heavily compressed sound as "grainy" because there is less definition between different elements of the mix. (Katz s.128) Therefore heavy compression can be an artifact that is either wanted or not wanted in a mix.

Audio engineer Geoff Emerick used a compressor for the Beatles to add character to a sound instead of using it for technical purposes. Using a compressor in an artistic way creates a certain sound in itself. (SOS, 2009)

Compression is mainly a tool for balancing different elements, making sounds even by gluing them together. Because it makes the internal levels of the track more even it makes the the track more consistent. (Haas, 2008) This can be an advantage since a compressed track offers no suprises in level variation. It can be listened to on a constant level for the purpose of eg. background music because peaks, heavy transients, are not jumping out of the mix.

As in the case of “Death Magnetic” by Metallica, hypercompression is a distorted, grainy and squashed sound that Metallica was after. Beside competitive loudness, hypercompression is a style and a sound itself.

6 COMPETITION & THE MYTH

It is clear that the music industry's main purpose for producing loud records is based on a common belief that the louder the record, the better it will sell. If not, then the probability is that a loud recording will catch the attention of the listener more easily.

In 2010 Earl Vickers presented evidence that there is no clear connection between loudness and sales. Vickers stated that sales and loudness do not correlate with each other and listeners hardly prefer loud music over less loud music. Vicker claims that listeners even tend to dislike the the side-effects of hypercompression applied to music. (Shepherd 2011b)

A test performed by Sound on Sound magazine also shows that test subjects did not prefer louder music. Some listeners did not notice a difference and even if they did, they did not prefer higher levels in a song.
(Inglis, 2011)

Ian Shepherd claims that the phenomenon still continues because of fear. A common assumption is that record labels have found a working recipe and they will not change it. Because labels and listeners have become accustomed to loud music, there is no need to change recordings to have more dynamics. (Dynamic Range Day, 2013a)

A recommendation for Loudness of Audio Streaming and Network File Playback -petition has been handed in that online streaming services will most probably follow in the future, alike the EBU R128 -regulations for radio and TV.
When online streaming services have normalization that brings every audio track to the same level, loud tracks will not stand out as being louder than the other. Ian Shepherd, Bob Katz and many others believe that this will make loudness war obsolete in the near future. (Shepherd 2016b)

7 PRESENT & FUTURE

7.1 The Present

In 2013 Bob Katz announced that the main battle of Loudness War has been won. Apple's iTunes Radio enabled loudness-normalization for all tracks to play at the same level and soon YouTube and Spotify followed the same path. Although there is still

finetuning involved and some medias are not following the regulations as strictly than others, the principle is the same - all audio tracks will play at the same level on radio and online, thus making loudness war a thing in the past.

Ian Shepherd is raising awareness of the phenomenon and advices artists to use more dynamics for their benefit to stand out, and end the pointless competitive war which removes all contrast, light, shade and depth from music. (Dynamic Range Day, 2013b)

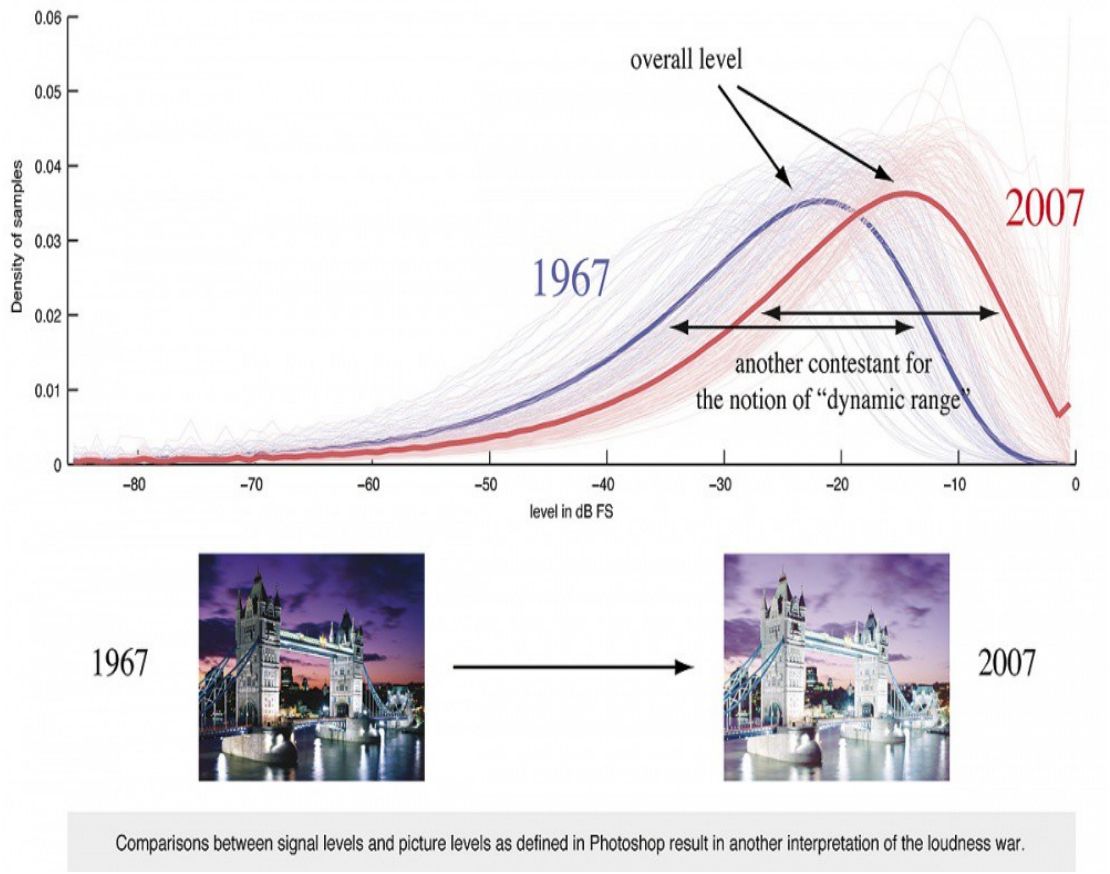

Figure 18: Image of an interpretation of the Loudness War http://dt7v1i9vyp3mf.cloudfront.net/styles/news_large/s3/imagelibrary/D/DR_10.jpg?VwxxURVTGfKaZwcvX764PybPdW5QatH5=&itok=v2mo1Mo9)

A clear shift towards greater dynamics has not yet been made by 2016. EDM (Electronic Dance Music) is one the most popular music genres today with its multi-billion revenue per year. (Peoples, 2015)

As a music genre EDM is one of the prime examples that continue to make music louder than ever.

7.2 Modern Audio Production

All-digital production has increased the possibilities to raise loudness level near the maximun without unpleasant audible distortion. The digital audio production market offers great tools for the purpose, eg. advanced digital limiters such as the iZotope Ozone 7 which makes it possible to compress and limit heavily without unwanted bi-products (Hepworth, 2015). Digital music production pushes the extreme because music producers have better control on digital soucen than on analogue sources (BalanceMastering).

Loud music serves as a starting point and purpose for music. The popular swedish EDM-producer Avicii uses a brickwall-limiter in mixing phase, which makes the mix sound loud right from the start (Future Music Magazine, 2012). Also the well-known American DJ Skrillex states that his mastering consists of mainly limiting with the use of iZotope Ozone Maximizer, which is known for its capabilities to provide heavy limiting without audible distortion (Music Radar, 2011).

Successful Canadian DJ Deadmau5 states that the modern hypercompressed sound is the result of a lack of skillful audio engineering, because the new generation of music artists have little knowledge of audio engineering in general. (FM, 2012)

8 REFLECTION & CONCLUSION

The legacy of the Loudness War has created a common hypercompressed sound which young musicians and artists have been listening to for over two decades to which they have grown accustomed to. The present situation shows that even though audio professionals encourage not to squash the life out of music with over-compression the artists and music labels etc. still choose to do so.

The need to hypercompress recordings for competitive reasons is no longer valid since audio playback platforms normalise every track to the same level, where dynamic tracks will probably stand out with more punch than compressed tracks that will sound flat. The LUFS-metering platform will be applied to every broadcasting- and streaming

channels globally in the near future. The LUFS-metering will ensure that loud hypercompressed tracks will no longer have the benefit of sounding louder than tracks with more dynamics. On the contrary dynamic tracks will most likely have the benefit of standing out of hypercompressed tracks.

Whether the purpose to raise apparent loudness in recordings is of competitive or artistical reasons or both or neither, is quite speculative in the present day. The aftermath of hypercompression has lead to an evolution in sound, where every modern artist wants that familiar certain compressed sound on their recording.

As the competition in loudness will decrease in the future, music labels and artists still have the choice to use hypercompression if they choose to, and that can be purely an artistic choice.

Changing habits and mindsets can be challeging, and that is why the experienced audio professionals still have a big task ahead if they want to decrease the habit of using hypercompression in modern audio production. Whether the hypercompressed sound is destructive or artistical, is a subjective matter.

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Figures