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THE SACRIFICE OF ARTISTRY FOR

A CONVENIENT SOCIETY

A Thesis Submitted

in Partial Fulfillment

of the Requirements for the Designation

University Honors

Riley Jermier

University of Northern Iowa

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This Study by: Riley Jermier

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Approved by:

Professor Chris Merz, Honors Thesis Advisor

Dr. Jessica Moon Asa, Director, University Honors Program

The Sacrifice of Artistry for a Convenient Society

Abstract

Over the past hundred or so years, the music industry has seen lots of change in the

way that music is made, played, and displayed. With the advancement of recording technology,

societal influence, and musicianship we see a plethora of different genres, as well as mediums

of listening in today's world. This thesis discusses the different modes of recording, from LP to

streaming services, and comments on the sonic characteristics of numerous recordings from

different genres and eras. This thesis also compares and contrasts certain aspects of

professional level audio and consumer level audio, as well as sonic biases in them both. The

central theme of this thesis, however, is the reduction of audio quality throughout the industry

process when the original master recordings are encoded into a digital format. This process

pulls away from the brilliance of an original recording, and displays the importance of respecting

the craftsmanship of the artist as well as the engineers.

Introduction

From a surface level perspective, a movie theater has both a visual and an auditory

aspect. You see the movie on a large screen, and you hear the slightest footsteps and breaths

through some sort of Surround Sound configuration. Yet, why is it that when a horror movie

plays, we feel tense, feel scared, and get anxious? Why do some sounds seem more spread

out than others? In short, the answers to these questions- and so many others- lie in the field of

psychoacoustics.

Psychoacoustics might be easier to understand by splitting up the two words. Psycho

has to do with the brain and thinking, and acoustics has to do with sound. Between the two, we

are able to articulate some of the underlying influences and relationships between people and

the natural and artificial sounds around us. In commercial music, this relates specifically to both

the musician, and the audio engineer. It is the musician's role to bring to life music to evoke feeling, and the engineer's role to make the recording of that music force a greater sonic impact on the listener.

Moving back to the theater example, there are a number of ways that psychoacoustics can cause bodily responses, trigger emotions, or in the case of surround sound, put you into the three dimensional box of sounds. However, one might not expect that the same level of detail goes into every record made. Yet, with the introduction of streaming services and ease of listening to digital music, we see a drop in quality.

Before diving too far into consumer listening, we must understand the logistics behind creating records. Major popular artists spend thousands of dollars- sometimes even in the tens or even hundreds of thousands to pay their musicians, record, mix, master, promote, and perform their music. The monetary return on the recordings is also far worse than what you would expect. In Spotify's case, the current model in place pays the artist $0.004 per stream. If this model is enough of an ego check, many major artists sign deals with record labels only to receive a portion of these royalties, usually totaling 50%. For example, if an artist had one million streams on Spotify, the artist would make $4000 before their royalty cut, $2000 before taxes, and even less after taxes. Also, if the label pays the studio expenses, those expenses are recouped at the royalty rate, and royalties are only paid out after expenses are recouped.

Now one might wonder- if an artist doesn't make that much money from streaming, where do they make their money? There are two major avenues for capital for artists in today's music business, but note that they are both very closely tied together. The first way is merchandise, and selling apparel and artist "bling" to fans. The second income stream is through concerts- tickets, specifically.

The quality of sound makes a big difference in the realm of concerts as compared to recorded music. The phrase, "You had to just hear it live", or "Live music is better" both hold merit in regards to this concept. Many artists view a concert at a professional level venue as the

closest thing sonically to their intended listening experience. Because of the greater experience of a concert, artists charge more for live performances than they do for their recordings, even if it is a one-time experience. Only the few with high end stereo systems can experience the kick drum hitting their chest, or the clarity of the lead vocal over the ensemble. However, it is impractical to attend a concert every time you want to listen to a song- so instead many consumers rely on poorly developed audio systems.

The notion that the recording industry has favored convenience over quality is proven through many reasons, but two in particular seem to encompass the greater argument. The first and most important reason is that a cell phone speaker or headphones can't reproduce the full spectrum of sound captured or manipulated during the engineering process. Speakers are unable to truly recreate low frequencies unless you have a large enough speaker cone, and a low frequency driver (LFD). The same goes for higher frequencies with a high frequency driver, or tweeter. Another reason lies in the streaming companies' conditions to normalize (make the recording quieter or louder, depending on the initial volume compared to the standard), or compress audio (make quiet sounds louder and loud sounds quieter) without any regard to the original audio. Most streaming services now have a number of options to adjust the audio to be compressed, equalized, and normalized. This is extremely counterintuitive, as it lacks respect for the original mix that the artist released.

Why would an artist spend so much time and money to craft a record to sound perfect to their taste, only to have it falsified through the few centimeters of speaker we carry in our pockets? The artist, producers, and engineers all have to compare the value and integrity of their work to the convenience of listening in today's world. Although there isn't a short answer to this question, it is worth examining, and finding a common ground between the artist and the consumer. Besides concerts, there are a number of ways that consumer audio has developed to make good speakers more affordable, at least attempting to bridge the divide between studio

monitors and consumer audio gear. In today's economy, many high-level speakers are available for under one or two hundred dollars and can be found even cheaper on second hand markets.

Another aspect of home listening is to examine what engineers have done to combat this problem of budget audio gear. The sounds of records have been completely reimagined, and sometimes even optimized for phone listening in the hopes of having your recording stand out against the others. However, it tends to be a very thin line to walk. For example, if you optimize the bass response for a phone, you are bound to plug into a larger speaker that can reproduce bass frequencies at an appropriate level, and receive way too much low-end response (typically, and bass instruments, or kick drum make up what is known as low-end signals). Similarly, phones add built-in compressors to their speakers, so they do not translate the original audio from its lossless state.

Although it isn't desirable or practical for everyone to own a state-of-the-art stereo set of speakers, it is important to understand how you listen to any music, and the effort that a team puts into the music you listen to. Between the artist, the engineers and the record label there are many hours and dollars sunk into the creativity of the project, and it deserves the respect and understanding of anyone who listens to it. Due to the increase in convenience in society, how have the quality or sonic properties of records changed over time? Throughout the course of this thesis, I plan to study the relationship between the quality of recording and human preferences of what to listen to music on; specifically, with the introduction of the cell phone, streaming services, and earbud and smartphone listening.

General Literature Analysis

Now we turn to how to address the sonic qualities of record making from the last hundred years. There are a number of ways to approach this, both from a scientific standpoint, as well as from a more general or observational standpoint. Each record contains a plethora of

information for the listener to observe and interpret, including the musical content, the sonic characteristics, and the cultural and societal influences reflected into the sound.

It is important to understand how to analyze music from the perspective of an audiophile, but also vice versa, as a consumer. However, there is the notion that when analyzing music that the playback of a song is an exact reproduction of the original song. This is impractical, because every speaker has different sonic characteristics, and every listener perceives sound slightly differently. In Floyd E. Toole's, "Sound Reproduction," the author makes reference to the relationship between loudspeakers, recordings, and microphones. He uses a satirical image describing the circular reasoning behind psychoacoustics, quoting that "Loudspeakers that are evaluated by listening to recordings made with microphones that are evaluated by listening through loudspeakers…" [1]. In the center of the words there is a picture of a clock labeled psychoacoustics with a bomb labeled measurements, meaning that the catch-22 can only be broken through the use of measurements to advance psychoacoustics. Additionally, the sonic patterns of many speakers change depending on the SPL, or Sonic Pressure Level, used during playback.[2] Setting aside differences in speaker choices and SPL, humans often experience hearing loss, impairing their ability to receive sonic signals the same way as they are reproduced [3].

These challenges clearly not only pose a barrier to testing loudspeakers and playback systems, but also make it impossible to reproduce sound the same way over two sources, or even to two different people. Yet, it is necessary to attempt to create the most unbiased sonic test and capture possible, in order to achieve results as close to truly accurate as possible. One such study was in the listening room at the National Research Council of Canada (NRCC), which set up listeners in the middle of the room. On the other side of an acoustically transparent screen, one would find four loudspeakers. Both the speakers and people were placed at

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[1] Toole, "Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms", 9
[2] Toole, "Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms", 48
[3] Corey, "Audio Production and Critical Listening", 21

random, to eliminate any standing waves or phase issues[4]. The clear dilemma in this case study is the inconsistent control variables. If all speakers are placed randomly, there is no central basepoint data. Nonetheless, Toole continues and says that "the results were good enough to provide a solid foundation for the research that followed"[5]. This provides a direct contradiction to the test given, as if it were going for true accuracy, it would have been properly isolated in some sort of Anechoic chamber or room, to properly isolate the sounds of the speakers and listener. However, the other dilemma that arises in this case study is that an everyday music consumer wouldn't listen in such an isolated space, so why would one test something there? For one, it is the only place that could provide consistency among tests. Sound isolation becomes especially important when reviewers review new gear, as they tend to pass over good isolation due to convenience and test in their everyday space. At a glance, there isn't a problem with it, since the reviewer is likely accustomed to the sound of their own space. Also, they only switch out the piece of gear they are reviewing at the time. However, there is no point to create a perfect test, as a variety of factors play a role that are far out of the reviewer's control. For example, the placement of the speakers in relation to a wall or a corner could drastically influence the sound of the playback system, or the amount of soundproofing and isolation (foam pads, diffusers, and similar devices to suppress reflections of sound off of walls) also play a role into the review. In a room with little sound treatment a system could seem unpleasant due to lingering soundwaves, but in actuality be a very functional piece of gear. Floyd Toole mentions this thought as well, that consumers "seeking excellence in sound reproduction are frequently advised by journalists and reviewers who have little or no awareness of the research that has been done", even though they may not be aware of what they are always doing[6].

Analyzing Recordings

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[4] Toole, "Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms", 44
[5] Toole, "Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms", 45
[6] Toole, "Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms", 7

In a collectively written book titled *Analyzing Recorded Music*, various authors analyze a number of tracks throughout history. William Moylan, one of the three editors for the book, touches on the notion of what to analyze in a recording. The "framework for the elements of a recording offers many listening pathways through a recorded popular song" [7]. He splits up his framework five ways: space, timbre, pitch/frequency, loudness and rhythm/time. Space refers to the depth and positioning of a stereo image. Space, which refers to the ambience, echo and reverberation which are three of the most common effects that are used with this dimension of a recording. Next, Moylan touches on the timbre of a recording. He touches on the "timbral balance", the "pitch density", or the "performance intensity, expression, and performance techniques" [8]. He moves onto the pitch and frequency of a recording, which is closely related to the timbre, but hones in more on the frequency placement/array. Moylan then mentions loudness, which refers to the contour and balance of a record. Lastly, he introduces rhythm and time, referring to the tempo, meter, as well as the durations of all recording elements.

The first track analyzed in the text is Robert Johnson's, "Preachin' Blues (Up Jumped the Devil)," off of his album titled *King of the Delta Blues Singers*. This track is not only valued in its cultural influence, but also sonically. The legend surrounding Robert Johnson was that he had "sold his soul to the devil at a rural crossroads in return for his prodigious talent, a fact supported in myth by his death at the age of 27 through poisoning"[9]. This record was the birth of some of the modern-day recordings that we listen to, especially in the case of emphasizing the importance of recording music in general. The album was recorded in a hotel room, which also displays that the recording doesn't need to be flawless, especially this early on in recorded history.

One common name in the world of recording that comes to mind is The Beatles, specifically their album *Abbey Road*. The track off of this record I will examine is a medley

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[7] Moylan, "Analyzing Recording Music", 2
[8] Moylan, "Analyzing Recording Music", 3
[9] Moylan, "Analyzing Recording Music", 24

beginning with "You Never Give Me Your Money" (1969). One particular review, written by Albin Zak, covers the advances that the group made for this recording, as well as some of the insight into the music and influence of the album.[10] Gear-wise, the group utilizes a plethora of new toys and gadgets to take this album further into the future than any other album of the time period. It uses a SSL TG12345 mixing console, paired with a REDD 5.1 desk, as well as an extensive outboard collection of EQs, compressors, reverbs, channel strips, and others bits of gear[11]. These bits of gear create a much clearer and warmer sound than most previous records, as you can hear the tape saturation and distortion- but it doesn't sound unpleasant. As Alexander Case describes it, "all audio devices, including mixing consoles…possess an output voltage limit. It must be understood what happens when that limit is reached"[12]. Although Case makes it sound like it has a negative connotation, it actually adds a warmth to a record. The peak of the sound hits a threshold where it cannot get any louder, and instead of clipping (when sound is 'chopped' off and distorted in a harsh way), it saturates, which means the sound fattens out a bit, and instead rounds off the peak. Many modern sound engineers still utilize this sound, running signals through more vintage gear, such as tape machines, older consoles, or tube preamps and compressors.

Perhaps, though, the most innovative part of the recording is the new application of stereo mixing- something we take for granted in today's world. Zak goes on to talk about this idea of stereo mixing theory later in his analysis, which he references in a figure the stereo framing of foundational rhythmic elements. He shows the progression of the instrumentation in relationship to the song, and to the stereo placement (left right or center) in each respective track[13]. The Beatles are notorious for their stereo mixing, as they only mixed their records typically in the far right, far left, or center. Most engineers put the drums and bass in the center,

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[10] Moylan, "Analyzing Recording Music", 203
[11] Moylan, "Analyzing Recording Music", 203-205
[12] Case, "Sound FX: Unlocking the Creative Potential of Recording Studio Effects", 92
[13] Moylan, "Analyzing Recording Music", 213

and rather put other layered instruments into the far sides, but the Beatles seem to have flipped that concept entirely. The bass stays center for most of the tracks, but the drums favor one side heavily, and some of the other instruments are doubled in many places (placed in various places). When listening to the track, it is possible to even hear the phase cancellation in the doublings of the instrumentation- which means that certain sound waves have reversed polarity on top of one another, causing the audio phenomenon to cancel each other out (think of the simple equation, $1+(-1) = 0$), the ones being the soundwaves, and the zero being the resulting dB of the two. The extensive use of stereo in this track serves as one of the initial starting points for the study of psychoacoustics, and something to keep in mind while working through some other major recordings.

The most notable thing that happens for me, however, is the continuous motion from track to track. Zak organizes the tracks onto a chart, in which he notes the flow of the tracks between "Sun King" to "Bathroom Window," and then from "Golden Slumbers" to "The End"[14]. Each song is a normal length, but the catch is you are never quite certain that the track has switched. Also, the tracks tend to progress in sound towards "The End" of the medley (pun intended). If you listen to the drums, they remain on the left side for "Carry That Weight," while moving back to the right for "The End," yet the toms separate from the kit[15]. The panning opens up the stereo field drastically, and displays a sense of new-found space in the record.

After the Beatles split in the 70s, we see a major shift in genre. All of the new recording techniques and technologies seemed to open the door for all sorts of artists. To this note, the era of disco reigned supreme in the 70s, and Barry White among others, found himself in the spotlight. His 1975 single "Let the Music Play" served as one of recordings finest intersections with soul since Marvin Gaye eight years prior[16]. These mixes were very commercialized, as he released four versions of the track: The "single mix," the "instrument mix," the "extended mix,"

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[14] Moylan, "Analyzing Recording Music", 205
[15] Moylan, "Analyzing Recording Music", 214
[16] Moylan, "Analyzing Recording Music", 71

and the original multitrack master[17]. They all sound great, as they are mostly the same mixes

(only the levels have changed slightly for the lack of vocals, or the presence of vocals).

However, musically, they are varied, as they all serve different purposes. The single was cut for

radio use (a three minute and twenty-five second mix, "primed for radio"), the instrumental mix

for dancing and DJing, the extended mix for the album, and the multitrack master to serve as

the premiere version of the tracks[18].

As far as the quality of the mix, it sounds incredible. But why does it sound incredible? In

Jason Corey's text, "Audio Production and Critical Listening," he mentions a few things for

reviewing a recording. He mentions overall bandwidth, spectral or tonal balance, auditory

image, spatial impression, reverberation, time-based effects, dynamic ranges, changes in level,

noise, distortion, edits, and balance of the components in a mix[19]. The few that I feel are very

important to relate throughout our more recent recorded history are spectral or tonal balance,

auditory image, and edits. Although a great engineer could really prove himself in every one of

the aspects, I feel that these three in particular are extremely important in checking off when

mixing anything. For example, the spectral or tonal balance makes some recordings bearable to

listen to for extended periods of time (many also refer to this listening as "non-fatiguing"), as well

as sound more natural (or less natural, depending on the kind of sound). Auditory imaging is a

bit trickier, as it is the event of the listener creating an image in their mind based off of the

sounds that they have heard (similar to visual imaging, or mental imaging). Lastly, the edits tend

to go less noticed, unless they are poor, and they identify themselves in very unpleasant ways-

in this time period one had to cut and reconnect tape reels to make edits, rather than relying on

software as we do now.

Returning to Barry White's "Let the Music Play," we can begin to discuss some of the

perceivable things in the recording, since a lot of the gear and techniques used then are also

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[17] Moylan, "Analyzing Recording Music", 73
[18] Moylan, "Analyzing Recording Music", 73
[19] Corey, "Audio Production and Critical Listening", 121-122

used today in many studios. What is most notably important for this recording was the extensive

use of overdubbing, as well as the application of twenty-four tracks in the session[20]. The world

of close-miking with such abundance was very young until this point, and few had come out with

recordings that utilized this technology. Close-miking was a technique that involved limiting

space between the sound-source and the microphone. The technique captured a 'larger' sound

that was punchier and more accurate, since the gain level could remain lower when recording.

Even on the released multitrack, it is clear to hear some of the instruments miked in stereo,

which was generally unheard of for the time period. The track listing shows the piano in

particular miked as stereo, which is clearly heard in the record, and has much more clarity within

the record. Similarly, engineers begin to get a better handle at capturing the sounds of the band,

so we hear a bump in all instruments. For example, the bass has a very warm sound, and there

is so much more control over the low-end of the frequency in all of White's recordings of "Let the

Music Play"- especially in the vocals. We hear a new depth in a vocal that hadn't presented itself

prior to this era of recording. The vocal can be described as thicker, richer, and a bit warmer

than previous recordings. Also in this era, we hear for the first time hints at modern panning

techniques, expanded upon what the Beatles showed us what was possible.

The 1980s

As we inch closer to the present day, we pass through the 80s, which is commonly

referred to as one of the most unique sounding eras in the history of recorded music. The use of

reverb, but specifically gated reverb, was the pinnacle of outboard effect discoveries- specifically

first used in Phil Collins' "In the Air Tonight" (1979) during the drum fill. Many people even today

refer to some mixing techniques as "making it sound like the 80s". The reverb is the favorite

child of the time period, but also the audio world developed numerous new microphones, as well

as extensive upgrades to mixing consoles and outboard gear. The sounds of the 80s were

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[20] Moylan, "Analyzing Recording Music", 81

revolutionary, and one might argue that they even sounded too extreme. However, one must push past the boundary to discover where it really is.

The next piece to analyze is Prince's "Purple Rain". Released in 1984, it was his second major hit, after his first notable recording titled, "Little Red Corvette" (1983). This piece was recorded a bit differently, as the foundation for the recording was done live at First Avenue (music venue) in Minneapolis in 1983, and overdubbed later in the studio[21]. Live recordings were very uncommon for the time, especially for a record of that caliber to be recorded live and then overdubbed. The other side of the coin, however, could argue that there is no performance like a live performance. First Avenue, in particular, is a small enough venue that one could expect the energy to be very high, and the music to be full and present. They have upgraded gear and renovated since 1983, but it is still a very energetic place, not to mention it is in Prince's hometown of Minneapolis.

One of the most important aspects of the 80s, however, is the extreme fluctuation of reverb sounds in this record, as well as the sound of the decade altogether. Reverb has always been an integral part of the sound of any record, but it was truly the 80s that changed the way we think about including this effect into society's favorite hit records. But what specifically changed? There are a few common terms in the audio world relating to reverb, that are crucial to understanding what shaped the big sound of the 80s. These include reverb time (RT_{60}), bass ratio (BR), and predelay[22]. Reverb time is the most self-explanatory, as it is simply the measure of the "perceived liveness of a hall," and also "perhaps the most noticeable quality of a room's acoustics"[23]. Bass ratio is a bit more complicated, but also directly relates to reverb time. Bass ratio is a result of the difference between the low frequencies reverb time, and the middle frequencies reverb times, written as the formula $\frac{RT_{125}+RT_{250}}{RT_{500}+RT_{1000}}$.[24] What the ratio compares is the

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[21] Moylan, "Analyzing Recording Music", 91
[22] Case, "Sound FX: Unlocking the Creative Potential of Recording Studio Effects", 265
[23] Case, "Sound FX: Unlocking the Creative Potential of Recording Studio Effects", 265
[24] Case, "Sound FX: Unlocking the Creative Potential of Recording Studio Effects", 266

"perceived warmth and low-frequency richness" of a space. Bass ratio is crucial to the development of the 80s sound, as they dove into recording chambers with different spaces, and relied on utilizing these spaces to create a richer sounding record. Lastly, predelay is the gap of time in between the "arrival of the direct sound straight from the sound source to the listener and the arrival of any sound reflections or the reverberant wash of energy that follows".[25] This parameter sets the size of the space, and the feeling of a low ceiling or smaller room versus a high ceiling or a larger room.

Now, how would these three reverb parameters apply to the sounds of the 1980s? For starters, the reverb time becomes a crucial part of the mix, versus merely serving as an addition. In "Purple Rain", it is extremely evident that Susan Rodgers (mixing engineer) strived to include a huge snare decay, as well as spend a lot of time working with the reverb frequency bands. Similarly, if you listen to the frequency response of the snare reverb, it is clear that the bass ratio is above one, as you can hear the low end of the snare last far longer than the top end. In this particular case, I believe that it aids in the sound of the record, and results in a bigger and more full sounding track. At various points in the guitar solo, you can hear the extensive use of the reverb, both in the depth of the frequencies, and the length of the frequencies. Another aspect of the reverb in this track is found in the vocals, but specifically on the delay in the vocal. It sounds like there is a reverb track that was placed on the delay track, which was not something that had really come up in any major recordings until this time period. This technique brings a new meaning to predelay, and changes the 'nearness' of the lead vocal completely.

Another major revolution of the 80s was the introduction of channel strip compressors on mixing consoles. Prior to this decade, compressors were only found in outboard gear collections, and were only available to a few tracks. However, in the 1980s we saw the development of compressors on each channel, and it raised the "loudness wars" to the next level. In a fast commotion, we see engineers include compressors on all recorded sounds,

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[25] Case, "Sound FX: Unlocking the Creative Potential of Recording Studio Effects", 267

raising the volume of records, and creating a new kind of sound altogether. One great example of multiple compressors is the evolution of the group, "ACDC". Comparing their two tracks titled *Hells Bells* (1980) and *Thunderstruck* (1990), it is evident to an inexperienced listener that there is clearly something different in the later recording. The overall loudness of the record increases greatly, and we hear a shift in the presence of each track. The bass begins to sound far punchier, the drums bigger, and the mix as a whole gains a new depth that was previously unattainable.

<div align="center">Digital Audio Workstations</div>

As we reach this point in recording history, we hit upon arguably one of the most important changes to music recording and production. Audio recording introduces the concept and ability to record and playback music digitally, as compared to analog recording. Digital audio is a massive step towards a brand-new direction of recording, as now engineers have so much more capability to manipulate audio. It sums up to something called "Non-Destructive Editing," but there are a few different aspects to this concept. In prior analog years, tracks were recorded on tape, and if the engineer wanted to edit the audio, they would either have to rerecord the track, or physically cut and reattach the tape to itself. Working with tape recordings was known as destructive editing, as there was no way to retain the original audio once tampered with. With the digital age, destructive editing could be completely removed from the equation, as engineers could edit from their computer, and merely undo the procedure with little hassle. The little change in operation opened the door for extreme editing capability, and precise mixing techniques. The introduction of the Digital Audio Workstation (DAW) opens the door for the next generation of engineers and producers. It allows "for sound to be recorded, processed and edited on relatively low-cost desktop computer equipment," which is "a trend likely to continue".[26]

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[26] Rumsey, "Sound and Recording", ed 6. 203

One of the most prominent artists to benefit from the introduction of DAW's was Eminem, who was brought to the spotlight through Dr. Dre. Dre was initially with Death Row Records, but in 1996, he left and created Aftermath Records, which he used to continue to produce his own music as well as discover new talent, including Eminem.[27] "Most notable on this label were his much-anticipated second solo album, *Chronic 2001* (1999), and Eminem's debut album *The Slim Shady LP* (1999)".[28] On "Chronic 2001" specifically, Dre pioneered the way that hip hop makes music, from the perspectives of both the artist and the engineer/producer. He was one of the first individuals to sample music, but rather than record samples directly from records, "he hired live musicians to re-record portions of songs that he wanted to use".[29] The effect of re-recording samples does not go unnoticed, as the sonic qualities of the record are phenomenal. The bass frequencies are far more controlled for the style than any other track, and also are much louder in the mix, striving for his "window-rattling low-end frequencies".[30] The idea of sampling is also shown in Conway's "Biscotti Biscuit," released in 2018, which features some 1980s samples in a hip hop context.[31] Unlike Dre, who re-recorded samples, Conway recorded his samples from LP while he was in Athens, Greece. He used a traveling Akai MPC1000 to chop up a 1980s recording, and ended up landing with the sounds for the track.[32]

However, when the world of audio engineering opened the door to accessible software and recording technology, inexperienced engineers also took advantage of this software. At this point in the history of music production there is a split into two categories. The first is major-label releases created by established engineers. The second category is the common household studio. The split isn't something that we have seen up until this point in history. For the first time ever, the average working adult can purchase gear at a low enough cost to reproduce their own

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[27] Williams, "Dr. Dre"
[28] Williams, "Dr. Dre"
[29] Williams, "Dr. Dre"
[30] Williams, "Dr. Dre"
[31] Moylan, "Analyzing Recording Music", 231
[32] Moylan, "Analyzing Recording Music", 231

music and create records without the use of an engineer. We also see a rise in the independent artist, due to the biggest invention since bread, iTunes.

Streaming Services

iTunes is full of ups and downs, and we see this repeatedly throughout history. Before iTunes, however, there was a precursor program that took American college students by storm, called "Napster", which allowed users to share MP3 files between devices for no charge.[33] Napster clearly posed a problem for copyright law, and the company was forced to shut down in 2001, but not before gaining the attention of over twenty one million users.[34] Many companies caught wind of the concept of streaming service, and saw the potential in exploring a more legal and copyright protected path. Leading the charge was Apple, who launched iTunes in 2003.[35] This business decision was a near checkmate for Apple, as they simultaneously launched their iPod, which was a revolutionary MP3 player that worked in conjunction with the newly founded streaming service. On top of the launch, users now had the ability to purchase a single song for 99 cents, rather than a whole album, which turned out to be the deciding factor in proving Apple to be a very viable business model.[36]

Yet, iTunes is also the first time we really see a drop in sonic quality. iTunes streams records at 44.1 kHz, which typically sits lower than the master recordings sample rate.[37] Also known as Mastered for iTunes (MfiT), this service's aim was to reduce file size for consumers, without dropping a significant amount of sonic quality.[38] While it does accomplish this goal, it also takes away from the listening experience as an 'audiophile'. If one were to seek out the highest quality of recording, they still would need to purchase a CD- which is still far more than

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[33] Brewster, "The History of Music Streaming"
[34] Brewster, "The History of Music Streaming"
[35] Brewster, "The History of Music Streaming"
[36] Brewster, "The History of Music Streaming"
[37] Rumsey, "Sound and Recording: Applications and Theory", ed 8. 316
[38] Rumsey, "Sound and Recording: Applications and Theory", ed 8. 316

purchasing the downloadable version- and thus begins the dilemma between down-sampling records for the next 20 years, and paying a fortune to hear everything in its intended glory.

To fully understand this two-sided coin, it's best to move ahead to 2005, when Pandora launched its streaming capabilities.[39] Pandora was able to track consumers' listening trends, and in turn recommend songs that were similar to what they were listening to. "While it certainly took a while to gain traction, Pandora influenced several modern streaming services including Spotify, and by 2013, the website had over 200 million users, demonstrating its influence to the modern world of streaming".[40]

Now it's best to uncover the darker side of streaming services, and the home producers who unintentionally ruined sonic quality and profitability for many artists. There are thousands of independent artists, and many different mixing engineers that provide a vast array of different qualities of records. With so many artists, there seems to arise a question, how does one analyze such a wide net of music without generalizing?

For the sake of choosing one to study, we will discuss the analytics of Spotify, as that is the most common in the world. As of February 1, 2023, there were 500 million songs available to stream on Spotify, 5 million podcasts, and 433 million listeners, which is six times the number of listeners the service had in 2015.[41] What's even more surprising is the number of total subscribers that Spotify has gained, which reached 205 million in Q4 of 2022. This is over eleven times the amount of subscribers they had in 2015.[42] This statistic clearly shows that the trend is very strong to switch to a streaming service, and besides the LP connoisseurs physical music is quickly becoming a piece of history.

Now what does Spotify mean to the industry, its artists, and the future of music listening? As previously stated, artists do not make nearly the same capital that they did selling albums on

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[39] Brewster, "The History of Music Streaming"
[40] Brewster, "The History of Music Streaming"
[41] Iqbal, "Spotify Revenue and Usage Statistics (2023)"
[42] Iqbal, "Spotify Revenue and Usage Statistics (2023)"

CD, cassette, vinyl, or any other physical form. Artists in today's day and age typically make anywhere "from $0.006-0.0084 to as low as $0.00318 per stream" and have paid 21 billion dollars to rights holders (owners of copyright, which is typically the label or the artist).[43] Even with the benefit of $0.0084 per stream, it would take almost 12,000 streams to make your first $100 back- assuming you've released the song without the help of a record label, who will eat into these earnings even more. On the other hand, without the use of streaming service the artist would have to rely on consumers to purchase the full album, which severely limits the target audience. Streaming is available to all persons, and casts a far wider net that allows everyone to take part in the album. However, the price of streaming still falls very short in comparison to traditional physical sales.

Yet, the money that people spend on streaming subscriptions still has to end up somewhere. In 2022, Spotify almost made 12 billion dollars, which is just over half of what they paid back in royalties to rights holders.[44] This causes all of the music business logistics to go for a stumble. From an artist's perspective, not only is Spotify holding a third of all profits, but an artist's record label also withholds its 50% if they have one (typical for a performance royalty). In short, it means that an artist is only making a sixth of their total streaming revenue. In the defense of record labels and Spotify, they do end up with far more promotional work for the artist than the artist would ever know, but it is a hard argument to deem it worth 83% of total revenue for a song.

There is a second demise of streaming services as well, which, as previously stated, has to do with sample rate. Spotify in particular offers two types of subscriptions: a paid subscription for high-fidelity audio, and a free subscription which reduces audio quality.[45] But what does Spotify deem as high quality streaming? It is common knowledge in the music industry that Spotify reduces all of their files to an MP3, which seems silly, considering Spotify also

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[43] Iqbal, "Spotify Revenue and Usage Statistics (2023)"
[44] Iqbal, "Spotify Revenue and Usage Statistics (2023)"
[45] Iqbal, "Spotify Revenue and Usage Statistics (2023)"

encourages artists to send in extremely high quality PCM files. However, MP3 encoding has taken large leaps forward in the past decade, making it only possible for a very experienced listener to notice any digital artifacts or distortion from any encoded audio. Better encoding "is part of the reason for the massive success of the MP3 and other perceptually encoded audio formats found on Internet audio".[46] Another way that consumers add firewood to the music streaming housefire is through their means of listening to these records.

<center>Alternate Study in Listening</center>

Another way to analyze the changes in records over the last 50 years is to listen to and analyze remasters of popular songs. One track in particular is "Jump" from Van Halen, from the record *Jump*, recorded in 1984 and remastered in 2015. To control as many variables as possible, both the digital 45 (original 1984 vinyl mixdown) and the 2015 remaster are available on Spotify, so there is no difference between different services, or formats of the recordings. The playback system I used to analyze the two recordings was through a Focusrite Scarlett 18i20 interface, a 2020 Mac Mini M1 desktop computer, and both Presonus Eris 3.5" stereo monitors, as well as Audio Technica ATH-M50x headphones. The most obvious difference when first listening to the two tracks is the equalization differences, as well as the overall volume of the two tracks. The original 45 has a significantly lower amount of top end and tends to sound less punchy, whereas the remaster pushes the sound of the synthesizer and adds a lot of top end to the recording. However, the remastered recording seems to have a significantly higher amount of compression to the drums, almost pushing them past an appropriate amount. Many of the fills throughout the piece come off as aggressive to the listener, and break away from the original sound drastically. It is hard to tell what the original mix engineer was intending for the record to sound like, especially since there is no way to really replicate the playback system used for the session, but it is clear that the two sound drastically different.

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[46] Corey, "Audio Production and Critical Listening", 14, 104

What might have caused such drastic changes in the remastered version of *Jump*?
Floyd Toole describes this very occurrence well; "Loudspeakers with lower preference ratings
were described as having either insufficient bass or excessive treble, or both".[47] Bass-favoring
consumers also explains why perhaps consumers loved the sound of Dr. Dre's take on the hip
hop genre. The use of extensive bass seeps into the minds of consumers, and creates a false
sense of high fidelity recordings when listening to a record. During Toole's "Olive Experiments"
he asked each of the individuals participating in the study to draw out what they believed the
frequency band was for the given speakers, as well as the original Harmon (speaker company)
to participate blindly as well. The most interesting part was the treatment of below 200 hz, as
well as above 5 khz. The subjects typically labeled the high end as less than was present, and
always labeled the kick as much more prominent than it actually was. The participating
individuals all showed that they preferred the lowest-rated speaker by Harmon, and didn't prefer
one of the highest-rated speakers.[48] This case study brings up a peculiar point, in which the
consumers attributed their preferences almost exclusively to either the lack of bass, or the
presence of bass. The logic is extremely ironic considering that most music lives in the
midrange, and not many instruments "live in the basement," referring to the extreme low-end
frequencies found in recordings.

Another concept that disrupts one's ability to properly judge a recording is labeled as
bias. The three categories of bias, as defined by Tom Nousaine in his 1997 article titled "Can
You Trust Your Ears?" are sensory bias, expectation bias, and social bias.[49] Sensory bias is a
broader subject, but in audio it has to do with the accustomization of playback speakers or
headphones.[50] Expectation bias has more to do with seeing versus believing. Corey even

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[47] Toole, "Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms", ed 3.
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[48] Toole, "Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms", ed 3.
141
[49] Corey, "Audio Production and Critical Listening: Technical Ear Training", ed 1. 143
[50] Corey, "Audio Production and Critical Listening: Technical Ear Training", ed 1. 143

quotes Toole on this excerpt for his study in the Olive tests, when subjects were asked to

identify speakers' qualities blindly, removing confirmation bias from the test.[51] Lastly, social bias

only applies to group listening sessions, when someone points out something to listen to,

altering the way you were going to hear the record prior to their comment.[52]

Conclusions and Recommendations

And alas, we have returned to our initial question. Has sound quality been altered by the

creation of more convenient listening? It's really difficult to answer this question in short, as it

would seem that one did not influence the other, but rather both streaming services and

convenient means of listening aided each other in their rapid development throughout the last

few decades. Spotify and Apple Music have taken the world by storm, but so has the iPhone

and the development of portable earbuds, many with the previously alluded "Dr. Dre-ism"

increased bass. Dr. Dre is even known today for his partnership with Apple, where he

collaborated in designing and producing a headphone called "Beats by Dre," which features the

increased bass response previously mentioned.

Sonic properties of records are not something that could change overnight, but rather

through years of subconscious consumer feedback, displayed through popular music trends,

proving what consumers like to listen to, and what they don't. Early on, we see the introduction

of stereo in *Abbey Road*, as well as the well-furnished production of *Let the Music Play*, followed

by the 80s sound of reverb and outboard effects. We move into the era of sampling as shown

with Dr. Dre, as well as the beginning of music streaming. With the introduction of streaming

services, we see an extreme boom in song availability, as well as total songs, ultimately causing

this trend to slow down dramatically. Although the studies of Toole and Olive show us that

listeners still clearly have different taste in sonic properties than audio manufacturers, they

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[51] Corey, "Audio Production and Critical Listening: Technical Ear Training", ed 1. 143-144
[52] Corey, "Audio Production and Critical Listening: Technical Ear Training", ed 1. 144

correlate strongly with random pools of listeners. This trend shows us that perhaps the questions that were posed regarding the influence of convenience were all inverted of their true structure. Instead, the question is whether or not consumers themselves have influenced the way that audio manufacturers and designers have created the playback systems that we listen on, and influenced the way that engineers blend records together. This question, proven by the studies of many, leads us to conclude that the sonic characteristics of the music industry is solely consumer-led. It has to do with sound and its relationship with the consumer, and its ability to break down the key roles of determining sonic quality throughout time.[53] In future years, it will be extremely important to monitor the use of streaming services, as well as the demographics of artists utilizing the services, and perhaps see yet another shift in frequency preferences among consumers. I would also recommend continuing studying the interactions between the sounds of records and consumer preferences, as well as the relationships between the sonic qualities of music and the world's top songs. By reforming the original question, we arrive at a new perspective on the music industry, shifting the focus from the artist to the listener. The relationship between a consumer's preferences in music and sonic properties greatly outweighs the artistry of an artist or engineer. It is the consumer that influences the hit records throughout history through a sense of Darwinism, weeding out records that don't serve the taste of the listener, whether for good, or for bad.

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[53] Toole, "Sound Reproduction: The Acoustics and Psychoacoustics of Loudspeakers and Rooms", ed 3. 9

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