The Influence of Recording Technology on Music Performance and

Production

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Introduction

Music is an aural art. From its prehistoric beginnings around campfires, through its evolution into complex musical styles such as jazz and electronica, to the current multi-billion dollar recording industry, music has enabled humanity to express its collective thoughts, feelings, and emotions through melody and rhythm. Historian Josh H. McDermott states that, "Music is universal, a significant feature of every known culture, and a major investment of resources, and yet it does not serve an obvious, uncontroversial function for those who create or listen to it" (McDermott 164). Humans across the world experience and create music; it is something that is integral to society and culture. It has fascinated people and spawned intense discussions about its genesis. Some scholars state that it is an "accidental byproduct of traits that evolved for other purposes, but also various proposals for potential adaptive functions, ranging from the promotion of social cohesion to the facilitation of infant–parent interactions" (McDermott 164). Other historians assert that "music has always been a powerful means to act out publicly one's resistance to the dominant culture and to express and preserve, often more privately, one's identity as different" (Applegate 334). Whatever its purpose, music has endured the test of time, becoming a shared experience for

humanity. Music transcends life and death, and humans embrace it for moral, spiritual, and personal reasons.

It is unlikely that society viewed music as a commodity in its earliest forms. The wholesale commercialization of music occurred after Thomas Edison's invention of the phonograph in 1877 provided the first opportunity for people to record and play back audio. From there, new advances in technology allowed the music industry to blossom and evolve. Products like the wax cylinder, gramophone, and wire recorder enabled music aficionados to listen to music in a portable and accessible fashion. Before such technologies, music did not exist as a casual, on demand form of entertainment. Instead, it was performed by live musicians in specific locations at scheduled times. These inventions allowed music to transition from performance to product, initiating the beginnings of the recording industry as we know it today.

The phonograph was not intended to spark this change in music consumption. In fact, Edison expected that it would be utilized for purposes other than the reproduction of music. He suggested "the 'Family Record'--a registry of sayings, reminiscences, etc…the preservations of languages by exact reproduction of the manner of pronouncing…clocks that should announce in articulate speech the time for going home," and more (Butler 8). These speculations came to pass in some form. Modern day audiobooks, digital alarm clocks, and recorded speeches and lectures embrace Edison's

original intentions, but in the end, music reproduction became its main function.

The debut of the first recording technologies spurred the ubiquity of music in society. For the first time, people who did not posses the ability to play or own an instrument could enjoy music in the comfort of their own homes. Music was now accessible to the majority of humanity, regardless of skill or wealth. Mark Katz asserts that the portability of the phonograph gave anyone with sufficient financial resources to experience music. He states:

> Portability meant that potentially every American could hear the classics, for phonographs and recordings could travel where professional musicians never ventured. 'Good music' could therefore be heard at home more easily than ever, available to people of all classes and means. (Katz 51)

People who did not live near professional music venues could experience a world-class orchestra, John Philip Sousa's marching band, and much more. Like the printing press before it, the mass production of phonographs and recordings facilitated the spread of knowledge across the world. In this instance, however, it was musical knowledge and appreciation.

As time progressed, recording engineers implemented new recording techniques and innovated upon existing ones. Acoustic methods led to electrical innovations after the implementation of microphones, amplifiers (devices designed to increase the volume of electrical audio signals), and pre-amplifiers (devices designed to increase the volume of the signal coming from the microphone in order for the recording apparatus to better capture the

sound). One microphone became two. Two became four, and eventually, engineers began using a whole suite of microphones for the optimal recording experience. The advent of multi-tracking (recording multiple tracks of audio from different sources and playing them back simultaneously) and overdubbing (where "recordings made at different times are combined, not sequentially, as in splicing, but synchronically" [Katz 42]) opened up new recording possibilities for music performers and producers. These advances allowed longer, bigger, and more creative musical works to be recorded for the first time in history.

Artists, producers, and engineers used these innovations to shatter the temporal and spatial constraints of prior recording formats. Performances could be assembled and recorded asynchronously, eliminating instrumental leakage between tracks (where one instrument can be heard in the microphone of another) and allowing for higher quality recordings. Rather than working on microphone placement with large ensembles, studio professionals split the ensemble up and recorded musicians separately. Isolation and separation gave the producers and engineers greater control over the sound. Records produced with multi-tracking sounded crisper, cleaner, and more uniform. In addition to volume control, producers gained the ability to use the same performer multiple times in a single recording. Artists sang their own backup vocals, replaced mistakes, and performed multiple instruments on the same song. Now that the prior limitations of earlier

formats were lifted, artists, producers, and engineers alike created music that was much more complex than early phonograph recordings.

In today's society, music is perhaps the most ubiquitous form of entertainment. It surrounds us daily, whether it's the background noise in a television sitcom, an ad played on the radio, or muffled sounds emanating from earbuds worn by the millions of people with iPods. Musical tastes, like the technologies that assisted in their development, have also changed over time. Instead of big band swing, jazz, or orchestral suites, artists such as One Direction, Lady Gaga, and Justin Bieber rule the Billboard charts. Their electronic and over-processed sound bears little to no resemblance to songs from the early 1900s, due in part to the technological innovations used in the recording and production process. Many believe that most current music is sonically unnatural and over-produced. As Ronan Chris Murphy, producer for King Crimson states, "The term 'over production' as it is commonly used, describes a record that is perceived as having an over abundant use of processing (reverbs, delays, etc.) or has performances that appear to be fine tuned to death" (Murphy). Innumerable songs played on the radio or streamed online are "victims" of such of over-production. The electronic processing that defines these tracks causes them to feel fabricated or unrealistic. Many modern pop hits could not be performed in a live setting without the aid of plug-ins, samples, or electronic equipment.

This raises the question: should recordings feel like they are live and cohesive performances, or something that could only be produced with the aid of digital technologies? My thesis aims to study the conflict between production techniques and musical expression to determine whether recording technologies benefit or inhibit the performance music in studio recordings.

Research Questions

How has recording technology influenced performances in the music studio? How has recording technology affected the post-production of music? Are these post-production techniques homogenizing modern music? Are artists embracing or rejecting the influence of digital processing on their music?

History of Recording Technology

The Phonautograph

Before the first reproduction of sound, man could only listen to sounds as they passed through the air. In attempt to capture these sound waves, Leon Scott de Martinville invented the phonautograph. This device transferred sound from the air to a piece of paper or other material, but it was incapable of playing back what it recorded. This is how it worked: "Now, what that means is just that someone is standing in front some kind of a funnel and speaking, shouting, singing - we don't know doing what - into that funnel. It

vibrates a little membrane, and that wiggles a stylus that scratches this wavy line on a sheet of paper." (Flatow). The lines on the paper became the first permanent record of sound. This laid the groundwork for every subsequent recording invention (it's modern equivalent is the waveform monitor). It was not intended to play back the audio thus captured, but over 100 years later, modern technology was able to do just that. A ten second version of "Au Claire de la lune" that was recorded in 1860 was played back by researchers at the University of Berkley using a scanned copy of the paper and a virtual stylus. Even over 150 years later, this primitive form of recording technology served its purpose: it captured a sound image.

The Phonograph Cylinder

The first method for reproducing sounds was invented by Thomas Edison in 1877. The original machine engraved sounds captured by an acoustical horn on tin foil or wax cylinders. As the recording stylus passed over the cylinder, it oscillated back and forth and carved a record of the sound waves in the material's surface. The audio could then be played back by running the stylus through the newly recorded grooves. This first invention, however, was plagued with numerous problems. The needle tended to wear away the wax after repeated uses, affecting the longevity of the sound quality. The soft, malleable material tended to produce very low quality sounds, and with the constantly degrading sound quality, the results tended to be of low

fidelity. To the general public though, it didn't seem to matter. People marveled that sound could be reproduced at all by a mechanical device.

The production and replication process of wax cylinders improved with time and innovation. By the end of the 1890s, "Edison's engineers had perfected a method whereby each performance of a title was recorded onto five master cylinders. In turn, each of these could produce twenty-five duplicates before it was then worn out" (Laing 2). The drop in audio quality after repeat duplications was an issue that these early audio engineers had to address. This duplication degradation meant only a finite amount of copies of a song could be made. In order to accommodate consumer's demand for phonograph cylinders, musical and spoken performances needed to be repeated to create multiple masters. This created a slightly precarious situation: two recordings of the same performer would never sound exactly the same. This variability paralleling what was seen in live performances. In a live situation, artist tend to have slight variations of their song from performance to performance. The tempo might be slightly faster, or the vocal pacing may be slightly different. The early phonograph recording process captured all of these slight variations. Unlike modern music where every MP3 or CD sounds exactly the same (excluding live versions, acoustic versions, etc.), early recording technologies required artists to perfect their takes in order to create a similar sounding product. Still, the consumer tended not to mind, as they were most likely unaware to these subtle variations.

The Phonographic Disc

In 1892, Emile Berliner developed the process or recording sounds onto two sided circular discs instead of the tin foil and wax cylinders Edison had been using for the prior decade. These new discs had numerous benefits over the existing cylinders. One of the main frustrations and difficulties with Edison's invention was the degradation in quality from the master source, but discs removed a lot of factors that caused this. The flat surface of the disc allowed for an even and more consistent recording and replication process, which in turn allowed the quality to sustain after multiple duplications. The shape of the cylinders also mad it harder to press and mass produce, while the compact and flat discs could be made quicker and easier. In addition, discs were made of a shellac compound, allowing them to be much more durable after multiple plays.

When the phonograph was first introduced, its purposes and functions were not completely defined. Though intended for a wide variety of uses, culture and society mainly accepted it as a means to play back music on demand. Families found this device that reproduced music to be a desirable addition to their living room. Mark Katz illustrates this scene:

> The gentleman of the house takes a heavy black disc, grooved on one side and smooth on the other, and places it over the spindle with the label facing up. He turns the crank several times, gingerly sets the needle on the outermost groove, and hurries back to the chair. Everyone stares at the phonograph in eager anticipation. The disc

spins quickly and above the whooshing and crackling the machine begins to sing. It sounds to them like actual voices and instruments, albeit in miniature. It is hard to believe that little more than a needle and a record can bring the performers to life, just as if they were right in the parlor. (Katz 8)

This was a new and magical experience for people. Before this, sheet music was the only tangible musical product. It was something that could be owned, but without the necessary skill, it could not be enjoyed as entertainment. Through the phonograph, music became a commodity, like other media forms such as books, toys, and newspapers. This switch changed how people perceived music. They now owned entertainment on demand in the living room that required little to no audience participation. Books and toys require a form of constant interaction to entertain the user, while listening to music became one of the first passively entertaining experiences in the household. Music, prior to this, was a fleeting experience, something that could not be stored and recalled for later enjoyment. With the invention of the record, people could possess a product that contained a musical performance. Katz writes, "This tangibility has allowed extraordinary changes in the way music can be experienced" (Katz 9-10). Now, people could hear any song they wanted, provided it was available on record. The only barrier between an average person and a musical performance was the turn of a crank on the phonograph.

Electrical Recording and the Microphone

The next innovation in recording technology was the implementation of electrical recording techniques, which changes how the master disc is recorded. Rather than using the acousitc horn to capture the sound and record it directly to the disc, electrical recording uses microphones and electrical signal paths. In this new recording method, a microphone captures a sound and converts it into an analogous electric signal, which is then transmitted down wiring to an amplifier, where the signal is intensified. It is then used to manipulate and move the recording stylus directly with electrical impulses. This direct and clean signal allowed engineers to capture the sound with greater fidelity and nuance.

The transition from an entirely mechanical process to a mostly electrical one changed the recording process. With many old songs, the acoustical horn tended to capture the sound of the room in addition to the performance itself. Reverb was present in many tracks, making songs sound muddy and washed out. Also, most instruments and vocal tracks tended to blend into one block of sound, which caused some instruments and sounds to get lost in the recording. It was hard to isolate each instrument's sound because there was only one recording apparatus. In order to compensate for this limitation, recording supervisors sometimes developed drastic solutions. Trombonists usually had to play far away from the horn, as their sound was too loud and direct. Singers sometimes stuck their head inside for their

pianissimo singing to be heard. Towels and other dampening material were placed on the drums to minimize their volume. However, the invention of the microphone allowed producers to implement new recording techniques and eliminate their previous compensations. Rather than having to arrange every instrument in the room around a single acoustical recording horn, ensembles could sit in a more natural fashion with individual microphones in front of each instrument. If a particular instrument bled into another track, the engineer could isolate them in a different room, while still capturing everybody's performance.

For the first time, engineers had the ability to work with multiple recording sources. In the past, they were limited to the basic mechanical structure: one sound source writes to one medium. Now, they could wire multiple microphones to one disc recorder, allowing them to simultaneously capture clear and accurate sounds from many musicians. Each instrument's volume could also be individually manipulated, which in turn made recordings much more consistent and clear. The subtleties of instrumental and vocal techniques could be better captured. Electrical recording eventually led to an entire new area for audio engineers: signal processing. Before this, producers only had one way of changing the sound: manipulating the placement of the musicians within the recording space. Now, they had the option of direcly manipulating the sound's signal, and it was only possible by converting sound waves to electrical impulses.

Magnetic Tape

Magnetic tape followed electrical techniques as the next major innovation in recording technology. Developed in pre-WWII Germany, it provided the first opportunity for direct manipulation of a recorded performance after it had occurred. Prior to this, all recordings were cut directly to the master disc. If a performer made a mistake, the engineer was compelled to discard the old master and start over. If the band played too loud, the needle could jump out of the groove, rendering the recording useless. Producers and engineers advised musicians to counteract these difficulties. Katz talks about some of this advice:

> The demands [cutting directly to the master disc] placed on performers were tremendous. Soft and loud notes, for instance, demanded drastically different techniques. A vocalist might literally stick her head inside the horn to ensure that her pianissimo would be heard, but then, with the timing of a lion tamer, quickly withdraw for her fortissimo, so as to avoid "blasting" the engraving needle out of its groove. (Katz 37-8)

Even though modern techniques have compensated for these shortcomings, many musicians still follow some of these pieces of advice. Vocalists still use the distance between their mouths and the microphone to adjust dynamic range. For example, a singer can sing closely off to the side of the microphone in order to sound soft or distant. They can also pull the microphone away from their mouth when he or she wants to "belt" a note. The processes that were implemented decades ago are still being used today, and in turn, have affected how vocalists perform in the recording studio.

Magnetic tape provided numerous benefits to engineers and producers. Master discs were single-use only, while magnetic tape was reusable. It was also the first recording medium that could be cut, allowing studio professionals to manipulate the audio after the initial recording. Its capacity for editing and splicing was perhaps more important than its reusability. Katz mentions, "with the ability to manipulate sound through such technology, musicians have been able to transcend time, space, and human limitations, and in the process have created wholly new sounds, works, genres, and performance traditions" (Katz 41). Before tape, recordings were a snapshot of a single performance at a specific time. Now, recordings could be a compilation of multiple performances from different times. The arrival of tape enabled producers to edit anything in a performance opening up new possibilities for recorded music.

Multi-tracking gave artists the ability to create songs that were impossible, or at least difficult, to perform live. Singers could now sing their own backup vocals. Guitarists could perform multiple simultaneous solos in one song. Producers could add instrumentation after the basic tracks were finished. Asynchronous recording and editing allowed artists to experiment in new ways. Katz writes, "In 1946 Jascha Heifetz released a disc on which he is heard simultaneously playing both solo parts of Bach's Concerto in D Minor for two violins" (Katz 42). Recording a song in parts made it practical to produce tracks that were not constrained by the one-time use of a master

disc. Engineers could also manipulate the playback itself, speeding it up or slowing it down where they deemed fit. Adventurous singer/songwriters could even play and sing every part of a song. The ramifications of magnetic tape are still seen in the industry today, as many modern artists, engineers, and producers still abide by these practices.

Digital Audio

Magnetic tape created a convenient and manageable method for producers and engineers to store recordings. Eventually, technology progressed, and now computers and digital audio have become a mainstay in the music industry. The ability to encode audio files as data onto a hard drive provided a quantum leap in music storage and portability. Digital files take up significantly less space than a reel of magnetic tape; digital files are only as big as the physical hard drive on which they reside. In addition to their smaller size, hard drives also can be re-written and reused almost indefinitely. Tape, on the other hand, wears out eventually. Digital audio has also affected the production budgets of making records. Hard drives and other digital audio gear are possibly the most cost-efficient form of recording medium ever devised. Thanks to this cost-efficiency, artists can put more money towards other uses, such as extra studio time, instruments, or even purchasing their own recording gear. These digital files also allow musicians and engineers to easily back up, store, and transport their recording sessions. With the removal

of the physical limitations of tape, digital audio has emerged as the standard for most studio professionals.

This new production standard introduced new techniques and tools that gave producers more control over the recording process, such as non-destructive editing. During the analog era, any edit to the recording was performed by cutting tape with a razor blade. Edits were made carefully and deliberately, so as to not destroy an otherwise good recording. It was also harder to undo an edit when dealing with tape. Digital audio changed the entire editing process. Now, songs can be spliced on the fly, allowing for quick and easy changes and test edits. Any change can be reversed with the stroke of a keyboard. By removing the finality of tape editing, many producers and artists feel more comfortable experimenting with their works. It is now extremely easy to composite multiple takes of a song into one cohesive track, without the fear of destroying a good take. In almost every conceivable way, digital audio has assisted producers in the studio, allowing for easier edits, more economic storage, and more freedom to experiment.

Digital audio also allows for digital processing and manipulation of music. The impact of digital signal processing, or DSP, is just as important as non-destructive editing. DSP allows for techniques that "far transcend the limitations and possibilities of magnetic tape. With rhythm quantization, for example, a performance with an unsteady tempo becomes metronomically precise as all notes are forced to fall on the closest beat" (Katz 43). Producers

can repair bad performances, create reverberation effects, easily accelerate a part of a song, synchronize drum and bass parts that don't line up, and much more. It provides producers with some of the most powerful sound manipulation tools ever known, but these tools can sometimes bend musical performances beyond recognition. Many listeners are unaware that many "good" sounding artists are fabricating their skills using DSP. Richard Marx, a singer and producer, tells Katz that "You have a guy or girl who literally can't sing one phrase in tune to save their lives, and I can make them sound like they can" (Katz 43). Plug-ins such as Auto-Tune and Beat Detective relieve artists of the pressures of delivering "perfect" performances, but it also allows artificial perfection to be concocted from sloppy execution. However, one could argue that some "imperfect" performances are better untouched. Some of the most evocative recordings have imperfections throughout them. Whether it's the over-distortion of Johnny Cash's vocals in "Hurt" (Reznor), or Paul McCartney's missed high note in "If I Fell" (Lennon-McCartney), performance mistakes can often enhance a musical work. The removal of imperfections can be seen as a removal of these songs' authenticity. DSP equips the producer with a seemingly infinite amount of control over the performance of an artist, and finding that balance between an unaltered and perfected performance is something that many producers struggle with.

Recording technology, over the past 125 years, has equipped record producers with the tools to control the sound of the finished product. This

technology started off with humble beginnings, allowing producers to just record and play back low quality spoken words and songs. As the public demand for recorded audio grew, manufacturing and technological processes evolved in order to satiate the audience's desires. Hard to produce cylinders evolved into easy to manufacture discs, providing for easier duplication and recording processes. The widespread distribution of these records allowed new forms of music, like jazz, to proliferate and popularize. With the invention of the microphone, individual musicians and vocalists could be mixed and captured with more clarity and accuracy, providing for better sounding records. The development of multi-tracking allowed producers to break the temporal limitations of cutting to a single master disc, enabling musicians to create new musical masterpieces and experiments by recording multiple parts and combining them through editing. Digital audio further improved the control of asynchronous recording, allowing producers to fine-tune a performance after it had already been captured.

All of this technology has revolutionized the recording process, but it has also affected the way that many musicians perform music. Many people believe that these devices over compensate for lackluster talent, thinking that modern music is more about equipment than performance. These tools, however, are not inherently good or bad; it is how they are used in the studio and how they affect musical performances that is the crux of the matter. The foreign nature and learning curve of using modern DSP tools causes

musicians to adapt the way they record. As we continue, it will become clear

that how one chooses to record something affects not only how one performs

in the recording session, but how society and future musicians consume and

interpret music.

Technology's Influence on Music Genres

Jazz

Recording technology has changed the way that many forms and

genres of music are performed, perceived, and consumed. One of the most

non-structured types of music, Jazz, has had to drastically adapt to limitations

inherent in these early tools. The same devices that enabled producers to

capture music also defined and shaped a genre for many generations.

Jessica E. Teague discusses this in her piece about liveness in Ma Rainey's

Black Bottom. She states:

> Of the many theoretical debates surrounding jazz and blues music, it is
> an endemic irony that although improvisation is one of the defining
> qualities of jazz, so much of what we think of as jazz stems from
> "definitive" recordings— that is, frozen versions of a music that moves.
> A record may capture a particular performance of an improvised solo,
> but the act of recording transforms the nature of the performance from
> one that was temporally bound—or *live*—to one that can be repeated.
> (Teague 556)

The intrinsic elements that make jazz unique contradict the purpose of

capturing a performance. A jazz solo is meant to express the thoughts,

emotions, and mental state of the player in a particular moment in time, and

by capturing it, engineers are immortalizing a player's emotional state of mind

into a musical artifact. Rather than becoming just one player's interpretation

of a solo, these recorded performances set the precedent for all future solos in the same piece. Teague elaborates on this, stating "Recording tends to reify improvisation, converting the extemporaneous into scripture leading to the cult of the recording" (Teague 556). Many early recordings, such as those performed by Glenn Miller and Benny Goodman, have become the standard solos for many of these songs. Budding jazz musicians tend to model their improvisation after the ones heard on such early recordings. This emulation, while helpful for new musicians, can sometimes become routinized and prevent them from branching out and making a solo that is unique.

Many jazz players find this sense of permanency in the tracks troubling. In fact, these performers tend to play different solos when re-recording the same piece.

> For example, in 1957 Louis Armstrong recorded a four-LP box set titled *Satchmo: A Musical Autobiography* in which he rerecords many of his most famous recordings, informing the listener about the history behind the recordings in the interceding tracks. Many of the songs are in a similar spirit to the original recordings, or re-create the improvised solos he would have played, but he also takes many liberties in creating new versions of the tunes. Which is to say, of course, that even in the most definitive of recordings, one can make room to play in the margins and to version again. (Teague 569)

Louis Armstrong, one of the most influential jazz musicians of all time, resisted this definitive nature of the recording process by re-interpreting and expanding upon his previous works. He regularly changed his solos, reflecting the original intent of jazz, in which solos are improvisational and spontaneous. This relationship between existing works and live performances creates an

expectation between audience and player in a live situation. When a performer plays a song live, many people anticipate a version that's similar to the recording. The songs captured on phonographs provide familiarity to the listener, and the consumer hopes that the live performance will reward the audience's sense of familiarity and satisfy expectations. While some musicians choose to cater to this, many of them choose to continue performing jazz in the standard way: spontaneous improvisational solos where no two breaks are alike.

One of the most important elements of a jazz solo is known as the break. Teague defines the break as, "the moment within the music when the ensemble stops playing momentarily while the soloist improvises. This suspension of time and disruption to the rhythmic flow of the music enables moments of musical freedom" (Teague 558). The solos in the other sections of the song are still constrained by the pacing, rhythm, and chords of the rhythm section (piano, bass, guitar, and drums), but in the break, the performer has complete and total freedom.

When it comes to recording breaks, new factors had to be considered. Teague explains:

> The break almost always carries a temporal valence and is sometimes called *stop-time*, for it creates the effect of time stopping even as the music moves forward. Although the break does not literally *stop* the time of the song, it conveys this effect by rupturing the flow of the tempo as the rhythm section drops out. (Teague 558)

When a break is recorded, the engineer sets a sonic precedent for that section. After the first recording of a jazz song, other artists may emulate the length and style of their breaks based on this original recording, taking away the spontaneity and originality in these subsequent performances. Katz further expands on this idea:

> In jazz, the repeatability of sound recording has had many and varied consequences. For one, it has aided the close study of the repertoire. It has has also had a complex effect on jazz improvisation. While recording may foster improvisatory skills by allowing musicians to analyze and extrapolate from solos, it can also inhibit experimentation and encourage the reproduction of once-improvised solos in live performance. (Katz 81)

Many inexperienced jazz musicians tend to emulate recorded solos rather than experimenting on their own, but this trend, while eliminating some sense of originality, provides some benefits. Through emulation, these players can learn the basics of jazz. Once they feel comfortable with the fundamentals, they can deviate from those prerecorded solos to experiment with their own style. Still, some musicians will musically mature through a constant sense of emulation rather than experimentation. However, not all jazz musicians fall into this trap. In some live performances, the integrity and original intention of the break is carefully preserved. Many musicians tend to use the opportunity of a live performance to really stretch out the breaks of songs, and in some cases, the actual improvisation is longer than the rest of the song.

The recording equipment used during the acoustic era affected the sonic quality of jazz records. The recording horn, the large cone used to

capture the sound to record to the master disc, tended to favor certain audio frequencies over others. Engineers adjusted the placement of the musicians in the room in order to compensate for the horn's frequency and volume response. In the 1920s, "some performers had to play right into the horn, some were put up on risers, and others had to face away from the machine or even play in an adjoining room". (Katz 82) The techniques Katz describes helped control the volume, but the timbre and clarity of many of the instruments were sacrificed to make these compromises.

Jazz was one of the first musical forms to utilize a wide range of instruments and sounds in a recorded medium. The limitations of early recording technology, however, made it hard for engineers to accurately capture each instrument's sound. "While some instruments recorded well, the range of sounds that acoustic and early electrical equipment could capture was much narrower than the range of sound that jazz bands produced" (Katz 81). The inherent tonal limitations of the recording equipment drastically altered the way that instruments sounded. Many instruments sounded washed out or indistinguishable because of these issues. Some instruments were more troublesome than others, particularly the piano: "The piano, particularly when part of a larger ensemble, was difficult to record in the acoustic era. Banjos often substituted for keyboards, and many ragtime and early jazz pianists chose to make piano rolls instead. Drums also fared poorly" (Katz 81). These are just some examples of how early jazz recordings

failed to capture the true essence of the performances. In order to compensate for the lack of acoustic sensitivity, studio professionals changed up the instrumentation of many songs. Bass drums from the drum kits were sometimes foregone completely, and drummers sometimes played sets consisting of only cowbells, woodblocks, and drum shells (Katz 81). This changed the way that many drummers thought of dixieland and jazz. With the lack of these instruments in the original recordings, many players assumed that these types of drums were not intrinsic to those styles of music. Entire generations of drummers who listened to these songs used snare and bass significantly less when playing this style of music.

Jazz, along with many other genres, benefited from the widespread distribution of phonographic discs. Initially, many areas around the country were devoid of jazz musicians, which limited its overall reach. Jazz eventually spread and flourished throughout the nation because of the portability and ubiquity of turntables and records. Audiences that never heard this style of music could now experienced it from the comfort of their living rooms. Many young players hoped to emulate the jazz musicians they heard on these recordings. As Mark Katz states:

> Phonographic dissemination made jazz accessible not only to the listening public, but to aspiring jazz performer-composers as well. The career of cornetist Bix Beiderbecke is nearly inconceivable without the phonograph. Growing up in Davenport, Iowa, Beiderbecke had little chance to hear live jazz. His first encounter with the music was in fact courtesy of his family's wind-up talking machine. (Katz 73)

These recordings became a model that future musicians attempted to follow. The first jazz records inspired many young people to pick up an instrument and learn new styles of music, and as new musicians learned and played, the genre grew in popularity. Jazz evolved and survived due to its pervasive reach, and it only accomplished that feat through record distribution. This dissemination of recorded media exposed a previously unheard musical genre to the masses. The jazz expansion through phonographs is comparable to YouTube in today's film industry. Many YouTube videos motivate novice filmmakers to create their own content, and the publishing platform provided enables them to reach as large of an audience as possible. Knowledge and education in niche fields and activities tend to only disperse throughout society when people have access to a means of observation. By listening to jazz, people could observe it, and eventually, learn how to perform and understand it better.

Jazz is an art form that is based on learning by example. Many of the early jazz musicians did not use printed sheet music, and even if they did, they took many liberties with composition and structure. Katz describes jazz as "ear music" (Katz 78), or music in which the primary form of learning is based on hearing the music rather than studying the printed works. The recorded examples of jazz provided a learning opportunity for those who would not have learned it before. Just like folk music before it, jazz was learned and passed down orally, leaving additional room for interpretation.

Through recordings of famous artists, anyone across the country had the ability to learn jazz from the great players of that era.

These records allowed musicians on-demand access to songs on which they could model their playing. With the distribution of jazz albums, musicians were able to sit in their living room and theoretically hear a song hundreds of times a week if desired. Some musicians can learn music through repeated and constant exposure, and the repeatability of these records allowed an entire new generation of players to develop their skills. A young person could sit next to the family turntable, trumpet in hand, and attempt to play along with his favorite song. If he made a mistake, he could simply get up and restart the record, providing for countless opportunities to perfect a practice performance.

Even though records introduced jazz to the masses, in the early days they often negatively affected its composition, performance, and development. The physical limitations of early records truncated many jazz songs and solos in order to fit the entire song on one side. Katz describes "… the limited playing time of the 78 [record] forced musicians to trim their performances, but even more, it discouraged improvisation as well. It turns out that early jazz musicians did not improvise in the studio as much as is commonly thought" (Katz 75). (These problems are not present in today's music industry. Digital audio and hard disk drives provide nearly limitless space for recordings.) The master discs and magnetic tape during jazz's

development limited how long a song could be. Many musicians limited their improvisation to accommodate the time restrictions, and that affected the flow and feel of the performance. Jazz is heavily rooted in improvisation, and through its limitation, early recordings failed to accurately replicate the live experience. Choruses and verses were sometimes removed from recordings, and solos were severely abridged. This influenced the way future composers and performers interpreted jazz. Many implemented this limited style in their live performances. Katz recalls:

> With few exceptions, the length of recordings and the brevity of solos remained constant for the thirty-one years between the first jazz recording and the introduction of the long-playing record in 1948. This was hardly a temporary situation, and it affected jazz performance and composition alike. Concision became a virtue, if not a defining trait, of the music. How early jazz is understood, therefore, is often a function of its phonographic preservation, which in turn was for more than three decades subject to a severe and arbitrary time limitation. (Katz 77)

Jazz musicians and performances adapted to the temporal recording limitations of their day, causing entire generations of musicians to shorten their songs while performing live. It's early history is defined by the short recordings that existed, but now, technological advances have since allowed jazz to evolve in structure and length. Now, modern jazz recordings can last as long as the performers want, thanks to increases in recording and playback space.

Even with the truncated recording times, the development of electrical recording enabled engineers to better capture the sounds of the ensembles.

With individual microphone placement, instruments like the piano, drums,

bass, and guitar could finally be captured with more clarity. The microphone,

however, was not the definitive solution, as early designs introduced new

problems. Faulty equipment could influence how a song was recorded. Katz

tells the story about Duke Ellington and his experience with the microphone:

> Duke Ellington stated a number of times that the sound of "Mood
> Indigo" (1930) was influenced by the nature of electrical recording. In
> 1933 he remarked that it was "the first tune I ever wrote specifically for
> microphone transmission." He explained further in 1935 that when he
> first tried to record the piece, the playing created an unpleasant
> resonance with the microphone: There was a funny sound in the first
> record we made, and we busted eight more recordings before we
> found the trouble. There was a loose plunger in the 'mike', and we
> couldn't get rid of it nohow, so what did we do but transpose the piece
> to another key so the goofy mike sound fitted and it made a swell
> effect." (Katz 83)

In this case, the microphone affected the song in a way that was unintended.

After the engineers were unable to fix the problem, Ellington adapted his

performance to better accommodate for the situation. Before the development

of these technologies, it is unlikely that Ellington would have change the key

that he performed in. The recording horn didn't have any mechanical parts

that would force Ellington to alter his performance, other than modulating the

ensemble's blend and volume. For one of the first documented times, a

musician had to drastically alter his part to accommodate for the microphone's

technological failure.

Orchestral Recordings

In addition to jazz, orchestral recordings adapted and evolved with

shifts in technology. One such example of this is the increased frequency of

vibrato in modern violin performance. Prior to the early twentieth century, "it

was not vibrato that violinists considered the most important agent of musical

expression, but the box–often called the 'soul' of the violin" (Katz 86). Vibrato

was seldom used prior to recorded music; it was reserved for special

moments in a composition. Though no definitive link between increased

vibrato usage and musical recordings exists, many observers, such as Mark

Katz, believe that the correlation between increased vibrato usage and the

start of the recording industry is evidence of such a link. His argument is

based on the sonic limitations of the acoustic horn. Katz writes, "when

recording for the megaphone-shaped acoustic horn, the violinist faced a set of

unwelcome alternatives: play as close as possible to the horn and risk hitting

it–thus ruining the take–or play at a comfortable distance and risk being

inaudible" (Katz 93). Katz further elaborates:

> Vibrato helped violinists resolve both dilemmas. For those recording
> acoustically, a strong vibrato helped project their playing to the none-
> too-sensitive machines, thanks to the periodic fluctuations in intensity–
> variations in pressure resulting from the contraction and expansion of
> air–that mark the technique. By using more vibrato, the recording artist
> could increase the effective loudness of a note without overplaying and
> without coming into contact with the horn. (Katz 93-4)

Violinists, after hundreds of years of accepted performance techniques,

adapted their playing style to accommodate the technological limitations of

the acoustic horn. Vibrato was implemented out of necessity rather than style,

but as more recordings of violins populated people's record collections, it became part of the instrument's standard repertoire of sounds. These recordings influenced new violinists, who learned to replicate what they heard. Like jazz, aspiring performers learned this technique orally, and future performances, in which they implemented the vibrato techniques that they learned from the recordings, further perpetuated this new playing style.

Many classical musicians found the permanency of recordings to be both a blessing and a curse. One such musician, Camille Saint-Saëns, found that he was not satisfied with his performance upon playback noting he "at once saw, or rather heard two grave mistakes upon listening" (Smith). Many of the recordings of this era were filled with flourishes and interpretations that composers and performers would categorize as mistakes, but these very imperfections soon became standard for the genre. These mistakes were accepted as correct in these pieces, and future generations emulated the playing style of the original recordings with most, if not all, mistakes intact. Like jazz, classical music's recorded sound affected the way that many future musicians performed these works.

The temporal limitations of records also affected the production of orchestral pieces. Due to the short playing time of 78s, marches and other shorter pieces became more popular than longer symphonies. In the initial stages of record distribution, many of the shorter works were confined to records while longer symphonies and pieces were reserved for concert halls

and live performances (Smith). As Smith puts it, "concert audiences began to demand what they had been listening to on record at home" (Smith). This demand, and other technological advancements, would soon spur the development of a longer recording format.

In the mean time, many phonograph and record companies used these restrictions to their advantage. For example, they commissioned many composers to write pieces that were specifically tailored to the limited amount of playback time given on any phonographic disc. Some composers, such as Stravinsky, appreciated the benefits of the recorded format, believing that it allowed more people to experience these pieces, thanks to the distribution of records to areas not near professional orchestras (Smith). However, other composers, such as Aaron Copeland, felt that the "unpredictable element, so essential in keeping music alive...dies with the second playing of a record" (Smith). This regret and loss of unpredictability eventually faded away, as most modern musicians and composers benefitted from the exposure and quality of recorded pieces.

In the first decades of recorded music, the goal of the recording process was to accurately capture the live sound (Smith). Over time, technology and practice have allowed producers and engineers to craft performances in the music studio that sound arguably clearer and of higher quality than live recordings (depending on perspective and distance to the performance). Now, after about a century of practice and advancement, we

expect the live performances to sound just like the album versions. Smith

documents this change:

> The recording now comes first; it's the ideal, the reference, the
> prototype. Live music is just a subsequent interpretation. Touring
> bands hire extra musicians so they can make their live performances
> sound as full and fleshed-out as they do on record. But when
> performers feel the need to adhere too closely to note-perfect
> recordings, Katz says, something suffers. One critic blasted the
> Chicago Symphony for playing this way, saying that they were
> "machine-like" and that "they sounded like a phonograph record".
> (Smith)

The idea that the live performances of these recorded pieces sound machine-

like exemplifies how recording technology affects the way that performers

play. The crispness, tightness, and cleanness of recorded music creates a

demand in the audience's mind. Crowds expect classical music to sound

cohesive and unified, with little deviation in style from the recording. The

musicians are adapting to this expectation, and in turn, are affecting the way

that they perform them in a live situation. This unspoken expectation between

live performance and actual recording gives producers an immense amount

of control over how classical music sounds. Rather than affecting the way that

musicians record in the studio, this technology has caused live performances

outside of the studio to change in order to satisfy consumer demand. With

classical recordings, technology has caused orchestras to adapt their playing

style, not matter where or how they perform.

Garageband and Amateur Producers

More than any other time in the history of music production and recording, the the 21st century has allowed musical works to emerge from people who are professionals outside of the standard studio environment, aka the "prosumer". Thanks to the wide-spread distribution of basic audio manipulation software, such as Garageband (free with every new Apple computer purchase) and Audacity (a free open-source piece of software available online), prosumers have the opportunity to create and produce music without the budget or resources that many studio professionals rely on. These mass-market tools have enabled an entirely different demographic of people to produce records, in a variety of different ways.

One is sampling, the process of taking a previously recorded song, or section of a song and reusing it in a new composition. There are many famous examples in history of sampled audio, but Lauri Väkevä points out one of the most popular ones of all time:

> Have you heard the story of the Amen break? This is the 5.2-second drum groove that livens up 'Amen, Brother', the B-side of The Winstons' 1969 single 'Color Him Father'. I must confess it is a piece of music I never paid attention to, nor learned about in my music education studies. Yet I must have heard it a number of times, for it has been the backbone of numerous hip-hop, jungle and breakbeat tracks produced in the last decades (Harrison, 2004; Snoman, 2008).
>
> It is unlikely that G. C. Coleman, the original drummer on the track, could have anticipated that his solo would spawn entire subcultures by being transformed to countless loops that drive today's digitally produced popular music. Arguably the most sampled record of all time, the Amen break thus offers an interesting case of subjecting artistic authorship to cultural dynamics. (Väkevä 59)

The choice of which song to sample is left up to the artist, but in this case many artists have sampled this same groove over time. This repeated use can lead to developments of entire sub-genres. Similar to the discussion of vibrato mentioned earlier in this paper, these sub-genres are fed through consumption and replication by the audience. As new listeners emulate the sound in the recordings, more music is created in this new sub-genre. These new styles of music would not exist without sampling.

The expansion of sampling can be correlated with the increase in digital audio and ease of production. As people have become accustomed to hearing samples in songs, they have attempted to replicate these methods themselves. Thanks to Garageband, it's as easy as clicking your mouse to sample and create your own works. The process and use of sampling proliferated during the early days of digital audio, providing new life and a new audience for older pieces of music. Väkevä describes it best:

> All around, musical bits and pieces that were destined to the cultural dustbin find a second life in the digital domain as memes: that is, as cultural replicators that pup up in new contexts, mutating into new forms and serving new functions, out of the reach of their original authors. (Väkevä 60)

These artifacts of previously recorded songs are being reused and re-interpreted in new contexts through sampling, and many artists' work finds a new life in this digital age, turning what was typically a permanent and concrete art form into something that is malleable and manipulative. Music itself is always evolving, but the definitive finality of a given recording is slowly

fading away. Through this technology, prosumers can breathe new life into long dormant songs and sounds, exposing them to a new generation of listeners. In a way, the art of sampling is in itself a performance, and the audience can now become the performer.

The relationship between audience, producer, and artist has fundamentally changed with the digitalization of music. With the barriers between the creation tools and consumption tools almost entirely dissolved, consumers see these two elements, not as separate functions or responsibilities, but as one process that anyone can partake in. Väkevä states:

> Importantly, the digitalisation and digital distribution of pre-existing music has not only confused the line between what can be counted as an original artwork and what cannot; it has also mixed up the roles of the artist-producer and the audience-consumer, influencing our ways to judge what can be counted as artistic expression (Väkevä 61).

Users can easily import any song from their CD collection to iTunes or other music player, and from there, it's a simple process to open the same track in Audacity, Garageband, or any other free audio editor. It becomes very easy for a user to utilize someone else's work, make tweaks to it, and republish it as their own mix, version, or track. Consumers today are creating digital audio content, whether as free ringtones, mash-ups, or entirely new works based around samples. Take one look on YouTube, SoundCloud, or any other media streaming site, and you will be inundated with numerous examples of user created audio works based on reappropriated materials

The tools given to us by companies like Apple, Microsoft, Google, and many others allow users to broadcast directly to the world and has made it even easier to share music with friends or anonymous people on the internet. This combination spawns and sparks creativity in many individuals. Väkevä continues by explaining that:

> Today, anyone with loop-based music software on her computer can make music from ready-mades: entry-level software like GarageBand® has brought loop-based musicking to the reach of almost everyone; countless new mash-ups are created from previous patterns and relayed online on a daily basis. These patterns are constantly mixed and remixed to new forms; during this process they are transformed so many times that the question of the original fades out, overwhelmed by the aesthetic challenge to keep up the listeners' interest with endless new configurations. (Väkevä 61)

So, are users of GarageBand and similar DAWs really composing and creating music, or are they just assembling and creating variations on preexisting compositions? One could make the argument either way, but it's apparent that using GarageBand as an editing platform and composing and recording original music are two different things. It's very unlikely that the next great symphony or rock record will be composed entirely of pre-made loops, as true musical creativity requires some compositional knowledge and recording resources. There is a greater issue at hand, though, when examining the impact of loops and digital production of music.

There is a trend on YouTube that has garnered a lot of attention called "The Four Chord Song". A famous video, produced by The Axis of Awesome, titled "4 Chords", raises an interesting observation about common musical

motifs in music. The musicians in the video take the same four chords and

perform countless songs and variations over the background music. The

background music does not change, and the similarities and modular

structure of these song pieces speaks volumes about the structure of music.

Väkevä elaborates,

> From the standpoint of music education, the line between creative
> appropriation and plagiarising should not be the most critical issue
> related to digital musicking. What really should grasp our attention is
> the way in which the latter unveils a deeply ingrained taboo, revealing
> how many artworks, in every realm that interests a number of people,
> are compounds: mixes that at least partly (and surprisingly often
> wholly) draw from communal sources. (Väkevä 62)

The musical work performed by The Axis of Awesome in conjunction with

Väkevä's analysis shows a trend in the music industry. The majority of

modern popular songs are built around the same chord structure and

progression. Even though instrumentation, speed, dynamics, and vocals vary

between tracks, the fact that many songs, at their core, are the same is

troubling. The self-produced songs in GarageBand do nothing but further

perpetuate this pattern in the industry, albeit not necessarily in the same

capacity. Even though GarageBand songs aren't necessarily built around the

same four chords, it reinforces the notion that at its core, modular music can

be composed and performed by plugging together different patterns, ideas,

and progressions.

Now, is this user generated content a legitimate threat to the creators

in the music industry? Not necessarily. Many consumers view the ability to

edit audio as nothing more than a passing distraction or a fun thing to do. The

majority of consumers will simply upload these creations to YouTube and

hope to get a couple of hundred views and some positive comments. In

purely economic terms, a good majority of people will not make any

significant amount of money from these videos and songs. The most

important outcome of these user experiences comes from the ability to utilize

audio editing tools and become accustomed to them, while at the same time

transforming the consumer into a producer, inspiring them to create music

and participate in the industry in a significant and contributory way.

The Proof Is In The Recording

Getting Back To Basics: Rejecting Recording Technology

Most modern records are produced the same way: musicians play to a

click track in order to maintain a consistent tempo across each individual

song. The room in which the sessions are recorded is usually well treated to

minimize echoes, reverberation, and other audio anomalies, and it is expertly

designed in an extremely controllable location, allowing engineers to isolate

the audio from external sounds. Most importantly, these albums use digital

audio workstations, such as Pro Tools or Logic, to record onto the hard drive

of a computer. These modern records are reliant on many types of

technology, to the point that many bands would shudder at the thought of

recording their next album without them. On their most recent album, the Foo

Fighters, however, wanted to move as far away from these paradigms as possible.

After touring with a wide variety of artists in the late 2000s, lead vocalist/guitarist David Grohl decided to take the most recent Foo Fighters album in a different direction and attempt to replicate their earlier edgy and more natural sound (Wood 112). When looking at most modern rock records, he observed how Pro Tools and other digital audio techniques changed their sound. In an interview with LA Weekly, he states, "When I listen to music these days, and I hear Pro Tools and drums that sound like a machine–it kinda sucks the life out of music" (Turner). Many producers rely on these pieces of software to perfect the sound of the record. Pro Tools and other audio programs have the ability to remove drum tracks and replace them with samples, or perfectly align existing drum tracks, allowing producers to make them sound radically different in sound or rhythm. Grohl's frustrations with these mechanical techniques led him to make a radical decision.

Rather than producing another modern studio rock album that would sound very similar to their last release, "Echoes, Silence, Patience & Grace", he decided to craft the album in a style that harkened back to Foo Fighters' roots. Producer Butch Vig recounts his early conversations with Grohl in an issue of Nylon Guys:

> I get to [Dave Grohl's] house and the first thing he says is, 'I really wanna do this in my garage.' So we went downstairs and set up a snare drum. I said, 'Well, it sounds really loud and trashy, but I don't

see why we can't do it.' Then he said he wanted to record on tape with no computers. That threw me for a loop; I've made lots of records that way, just not for the last 10 years. But Dave really wanted it to be about the sound and the performance. They'd just played some shows at Wembley Stadium, and he told me, 'We've gotten so huge, what's left to do? We could go back to 606 and make a big, slick, super-tight record just like the last one. Or we could try to capture the essence of the first couple of Foo Fighters records. (Wood 112)

Immediately, Grohl set strict limitations. Foregoing the use of computers, Grohl approached "Wasting Light"'s production style in a similar fashion to some of the all-time famous records, such as "Abbey Road" and "Pet Sounds". The inability to non-destructively edit or use DSP drastically limits the producer's ability to clean up small mistakes, but at the same time, it frees the production team to focus less on the individual notes and more on the the overall cohesiveness of the material. Vig commented early on about the standard that analog tape would enforce upon the band. He said, "You guys have to play really well, because nothing is gonna be fixed" (Back and Forth). Most producers tend to use digital audio to correct any performance errors, but without using Pro Tools and its editing power, these mistakes would still remain in the final master recordings.

The members of the band believed the move to analog recording would benefit their sound. Grohl commented that, "I want the record to sound rawer and somewhat imperfect. As good as we play, that's how good the record will sound" (Montgomery). Nate Mendell, the bassist, echoed Grohl's notions. He realized that working with tape presented limitations, but the

patience required to overcome these barriers would inspire the band to enhance the integrity of their work (Back and Forth). The drummer, Taylor Hawkins, considers most modern rock and roll to sound inauthentic. He says, "they kinda played it and then how someone else manipulated it in a computer, to make them sound a certain way" (Back and Forth). To an extent, all of these band members are correct. Most modern records tend to be manipulated after the musicians have stopped performing, and one could argue that these changes remove some of the original work's authenticity. With the Foo Fighters, however, the decision to record using strictly analog gear removed that possibility, encouraging them to perform to the best of their abilities. The end result is an album that is purely Foo Fighters, with no production or drastic editing.

The production of "Wasting Light" was not done on a small budget; it was merely done without the assistance of computers. As shown by Back and Forth, minor sound treatment over the garage doors and near the drum set allowed Vig to control the bombastic and bright sounds of the kit in this reflective recording environment. The room adjacent to the garage was turned into a vocal recording booth, and the control room was moved to the backyard in order to distance Vig and the other engineers from the sound source. Vig set up a camera surveillance system between the tent and the garage to observe the band members while the tracking occurred (Back and Forth). This system compensated for the lack of visual feedback in the studio. With this

studio set up, the producers weren't on the other side of a glass window; they

had no direct eye line to the band. Artists and engineers both rely on this

visual feedback to communicate in the studio, such as cutting takes, giving

subtle cues while the performance occurs, and much more. With the

surveillance system installed, Vig could monitor the band, alleviating some of

this disconnection.

The production of the album took place over 11 weeks, with each song

receiving about a week of production time. At the start, takes and parts

weren't necessarily falling into place. Grohl recounts this experience in an

interview with Sound on Sound:

> "Butch said," Grohl remembers, "'If we run into any real trouble we can
> always dump it into Pro Tools.' I said, 'No no no no, dude. No fucking
> computers. Not one computer. None.' Personally, I've always preferred
> using tape, because I like the sound of human performance. I don't like
> the mechanical, perfectionist attitude to making music. He said,
> 'Y'know, I'm gonna have to get out my razor blade for editing.' I said,
> 'I've seen you do it before, I know you can do it.'" (Doyle)

Foregoing the use of Pro Tools, editing needed to be taken more seriously.

Vig recounts his process on editing with tape in an article published by

Electronic Musician:

> Initially on a couple songs, I did old-school razor blade edits.
> Rosemary is one. It had a lot of edits. Then we realized that drum
> editing is very time consuming, it's a better way to go, I would love the
> verse on one take, the chorus on another take, or a fill. There'd be ten
> edits in a song. All tape edits, just cutting the two inch tape. It takes a
> couple times. But after a couple songs we said f**k it, this is too time
> consuming. So we started punching in little things. Arm the machine
> and punch in the take til we got one we were happy with and one
> where you didn't hear the drop out. I can still hear a bad punch out

after the first chorus in White Limo. There's a chunk drop thing in the drums. (Micallef)

By punching in, rather than editing, the musicians had to be more consistent to make the songs fit together. The heightened performance and practice shows in the final product, as the album sounds cohesive and powerful. Songs like "Rope" harken back to their earlier work on *Everlong*, with a strong drum beat and changing time signature. The lack of grid based editing usually employed by Pro Tools allows subtle variations and changes to occur. The new album feels convincing and cohesive, while seeming playful with its tempo and intensity at times.

Vig also recounts the process of visualizing and listening to the audio without a computer. He states:

I really had to force my brain to fire different synapses. For one thing, everyone is used to looking at a computer screen, so you can look at the music, what the timing is, what the waves are like. There was no computer screen so I would look at the meters, which is how I initially learned how to record. (Micallef)

This adaptation forced Vig to use different techniques to make sure the sound was well balanced and recorded. By monitoring the meters, Vig could make sure that the overall levels weren't peaking in order to not waste a good take.

When it came mixing, the recording environment and lack of technology influenced the way that Vig and his colleagues worked on the album. Vig comments on their first attempts at mixing "Wasting Light":

We went to Chalice to mix with Alan Moulder, locked the drums, 48 tracks, we did a few songs, but Dave wasn't feeling it; "doesn't sound

like the garage anymore," he said. So we decided to go back to the garage and mix manually, with no automation; the room we recorded in had no acoustic baffle or treatment (Micallef).

By mixing in the space that the record was produced, Vig essentially reasserted his notion that this open and booming space would benefit the album's overall tone and feeling. The mixing process posed many problems, such as a muddled low-end of the audio spectrum. With careful listening and adjustments, each of the band members were extremely satisfied with the final result.

Does this approach produce an album that's better and more pure than their past records in their discography? Though musical interpretation is subjective, it can be argued that the quality of the mix, sound, and mastering rivals, and in some cases bests their previous work. When comparing *Everlong* to *Wasting Light,* the newer album hits the same notes as older one: consistent vocals that don't overpower the guitars, drums that keep time steadily without sounding robotic, and guitars that sound like they were captured from a real amp and not some plug-in simulation. The experiment undertaken by The Foo Fighters shows that recording technology, though beneficial in many ways, is a tool that can enhance existing performances on records. Through its absence, however, music can be produced just as well. It is a stylistic choice more than a necessity.

Without the benefit of a click track or isolation, the members adapted their performance to best fit the situation. Drums needed to be tuned in a

particular fashion as to not resonate in the room too much. Guitar amps and speakers were arranged to best suit the environment. In a way, the lack of recording technology changed the band's sound more than tweaking the recorded tracks in a digital audio environment. Modern technology sometimes removes the blemishes of recordings and over-produces the end result, but "Wasting Light" shows that these mistakes can often create an album that is just as good, if not better than digitally produced albums.

Post-Production Gone Awry: The Nickelback Effect

In stark contrast to the The Foo Fighter's most recent album, Nickelback relies heavily on post-production techniques. Nickelback, a rock band based from Alberta, Canada, is infamously known for its over-produced sound; the guitars are hyper clean, the drums' tempo is metronomic, and vocals are heavily processed. Many critics and music listeners attribute modern rock and roll's decline to the over produced and highly digitized sound of this band.

Nickelback's musical success can be attributed to the machine-like efficiency of Kroeger's songwriting capabilities. It sometimes appears that many songs produced by the band have no emotion or feeling behind them; they merely exist to fill out a record around the singles. Many of their songs from the past decade arguably sound similar in lyric, harmonic, and melodic structure. Heavily Auto-Tuned vocals soar over the rest of the band, and the guitars and bass push out a constant, loud wall of sound. Lyrics are bland and

easy to memorize, while the drums keep time with simple patterns and fills.

"Nickelback's music is direct and immediate: There are no extended preludes

or codas to be found in their repertoire. They eschew lengthy solos or overt

displays of virtuosity, preferring heavy, detuned guitars for power" (Reesman).

By eliminating what they deem unnecessary, the band focuses on power

rather than creative flourishes. Kroeger's song writing process is almost a

science, stated by Chris Daughtry:

> 'I've always called him a song scientist. He's got it down, and I respect
> that,' says Chris Daughtry, the American Idol runner-up who played No
> Surprise, a song the two co-wrote together, during a 2009 victory lap
> on the TV show. 'People want to hear songs they can remember after
> just one listen. That's what I love about Chad's songwriting'. (Paynter)

Even fellow rock star Daughtry, who some critics compare to Nickelback,

acknowledges Kroeger's simple and formulaic song-writing approach.

However, the songwriting is only one facet of their production process. With

Nickelback, the post-production process enables them to create songs that

are powerful and full, but at the same time, less musical and interesting.

The advancements in digital recording technologies have allowed

Nickelback's albums to attain a level of polish that completely overpowers

many rock records. . Every drum hit, guitar stroke, bass pluck, and lyric line

up in perfect unison. Set a metronome to many of their songs, and it becomes

apparent that their songs don't deviate in tempo. Kroeger's vocals are also in

tune for almost every song. When compared to the The Foo Fighter's most

recent album, these perfected performances showcase the engineer and

producer's manipulation of the recordings to create perfect takes. The Foo

Fighters, with all of their skill and playing history, did not aspire to record

perfect takes; Nickelback, though skilled on their own, could not easily

achieve their final product without heavy editing and processing.

One example from the band's 2003 album, *The Long Road*,

exemplifies the level of post-production on their songs. Rather than allowing

every instrument in the mix of "Someday" to speak clearly, Kroeger decided to

add as many instruments as possible in order to create a full sound. He

explains in this interview:

> Lots of layers and textures, and recording tons and tons of stuff. We
> would record everything and listen to it all. There's a mandolin on
> 'Someday,' but you'll never hear it. But it's sitting there. I love it when
> you can feel something, and you're not sure what it is you're feeling but
> you can't hear it. You can't pick it up and know exactly what it is.
> (Reesman)

Nickelback's production of "Someday" congeals every part together to create

a monolithic wall of sound rather than a mix of discrete instruments. Guitars

and bass parts bleed together, masking the mandolin and many subtle parts

on the drum set. The over 100 tracks tracks in "Someday" makes it difficult to

distinguish instruments.

Rather than arrive at the studio with finished song parts, Kroeger and

crew started with jam sessions that eventually led to overdubs and song

recordings. Their producer outlines their studio set up:

> "We set it up so they had a full P.A.," says Moi (whose last name
> rhymes with his first). "We made it like they were onstage: They all had

monitors and good headphone mixes. They would just go in there and jam, and I would sit in here and have tape rolling [figuratively] the whole time that they were rehearsing and coming up with ideas. That's how we would start: Get a good performance of the song that way, and then if the guys play the song well enough — there's a good tempo and a good vibe — we'd start overdubbing drums on top of that." (Reesman)

Rather than removing unnecessary elements from the recordings, Nickelback decided to embrace their arena rock style; the PAs and monitors bled into the recorded tracks. Instead preparing tuned parts and performing them, the band treated the sessions as if they were warming up before a show; they started jamming. While these parts would eventually lead to the machine-like song production that Kroeger is famous for, his cavalier attitude towards sound levels, sound leakage, and performance shows a heavy reliance on post production processes.This is subliminally expressed when Moi talks about the drum tracking process:

"When the guys play downstairs, it's all bleeding and really loud," confirms Moi. "But when we record it up here, we use a program called Amp Farm from Line 6. We just take a split off of their guitar amps so we can have everything modeled as though they're playing live, but we just sneak an extra cable in there that comes up to the computer. We have the amp-simulator program and record a direct, clean guitar tone — the same with the bass — with no leakage, DI'd into the mixing board and then into the computer, which then processes it. You create the amp sound in the computer and it records it. You can simulate any amp you want [with Amp Farm]. It sounds good. When the drummer re-tracks the drums, he plays to the clean guitar tracks, which don't have any leakage in them, and a click." (Reesman)

While Nickelback isn't the only band to employ this technique, they are certainly a prime practitioner. With the right plug-in, it becomes virtually

impossible to tell whether the guitarist performed on a real amp. This process does end up benefitting the drummer, but with more time, preparation, and resources, the same sound, if not a better one, could be achieved with using real amps rather than virtual ones.

Another song off of the album showcases how Nickelback fabricates songs from sessions that didn't occur simultaneously. On their cover of "Saturday Night's Alright for Dancing" none of the three parties were in the recording studio at the same time:

> One song that did not include the entire band playing together is their testosterone-fueled interpretation of the Elton John/Bernie Taupin hit, "Saturday Night's Alright for Fighting," which includes vocal contributions from Kid Rock and guitar work from Pantera guitarist "Dimebag" Darrell. Due to time constraints and schedule conflicts, Nickelback sent music files to each of those guests, and they added their parts in studios in Michigan and Texas, respectively. (Reesman)

In the days of analog tape, this process would be much riskier. Sending away tapes would cost significantly more money, and mixing the subsequent tapes and extraneous parts would be difficult. In today's digital music production world, sending the files to someone across the world takes merely seconds instead of days, and it's also much easier to archive backups and combine separate recordings. This track over-relies on digital music production to create the final product.

Nickelback aims to produce an album that prioritizes sound levels over ingenuity. Kroeger and bandmates pride themselves on having powerful, simple, and catchy songs that are easy to produce. The lead vocalist sums it

up best himself, "Every cake we bake has the same ingredients, it's just how much stuff we decide to throw into the icing" (Reesman). Rather than branch out and try new things musically, Nickelback is content to stick with the same formula. It's a formulaic approach that may crank out hits, but in the end, it provides society with music that relies heavily on post-production rather than cohesive performance between band members.

Gotye: Some Instruments that We Used to Know

Famous for his breakout hit, "Somebody That I Used to Know," Gotye relies entirely on digital audio and post production. The majority of his three albums have been composed of sampled instruments, provided both in the software he uses and samples he has created himself. His most recent album, *Making Mirrors,* could not exist without the aid of technology.

The recording process for *Making Mirrors* started in the makeshift studio in his family's barn that consisted of various instruments, a MacBook Pro, and a quarter inch tape machine (Gotye - Making Making Mirrors). He wanted to use this opportunity to blend both acoustic performance and samples to create sounds that could not exist in a conventional performance. He elaborates by talking about the recording of an autoharp:

> Along the way, I got really into-multi sampling the acoustic instruments that I collected, and making sort of virtual version of them. One of the most interesting was an autoharp, so I recorded it one note at a time. I stored each individual note in a sampler on my laptop. Then I could play all of these notes back from a MIDI keyboard. Something interesting that came about from this process was that it wouldn't sound the way you expect an autoharp to sound. 'Cause generally

you'd either strum that instrument or at the very least, you could only play single notes very slowly. I like the fact that in virtualizing an instrument this way it would become something unique. (Gotye - Making Making Mirrors)

By sampling the Autoharp, he was able to strum entire chords, play quicker patterns, and perform in a style not possible on the physical instrument. This specific track exists because of sampling and digital production of music, showing that in the right hands, samples and digital production can make entirely innovative sounds rather than derivative ones.

These new technologies also allowed Gotye to combine his love for vinyl with his sampling practices. He describes his composition process in regards to one song:

> The way I've come up with ideas for songs is very reactive. I think I've always got an ear out for any sound that elicits an immediate response from me. In the case of the song "State of The Art" a horn break from a one-off recording of a Taiwanese traditional song was the starting point. I sampled it, sped it up, edited it into a sparser rift, and added some echo [on my MacBook Pro]. The same day, I'd sampled a Turkish drum song that seemed to work as a response. It's this sort of fortuitous meeting of sounds that I find a really exciting way to start recordings. It means you get combinations you might not have thought of before, and when you're really in a flow of sampling, you get these meldings of sounds that sound like they're somehow always meant for each other. (Gotye - Making Making Mirrors)

Instead of purely using canned samples included with his software, or samples of well known recordings, Gotye combined two very different schools of thought when composing his album. Like many before him, he scoured the local record store for old albums, seeking out inspiration. Rather than simply listening and writing a track based off of the song, Gotye digitized and

manipulated the old recordings in the software, breathing new life into the existing work. From there, he combined many different samples, providing a foundation for him to compose the rest of the song. Before modern music software, it was harder to splice and process these samples and make them a part of the track. Now, he is able to take a classic music discovery approach and fuse it with a modern production techniques to allow his creative vision to manifest itself in his recordings.

Gotye, like many other experimental artists, uses these techniques on vocals just as well. He explains his vocal recording on "State of The Art":

> I thought the vocals should be heavily warped, like this character was speaking to you from another dimension where the cotillion is still this zenith of technological achievement. I sang the whole thing in a monotone, and then electronically shifted each note to make the melody. It meant that the further away from my first note the pitching got, the more warped the vocal became. I also added Vocoder and Talk Box underneath. (Gotye - Making Making Mirrors)

Thanks to the plug-ins bundled with Pro Tools, he was able to take a monotone performance and transform it into something stylized specifically for the song. This shows how an artist can take an acoustic performance, in this case his monotone voice, and manipulate it into a sound that could not exist in the real world.

Before this recent wave of digital music production, the majority of albums were recorded at a professional music studio. These establishments, with their funding from the record labels, were selective and prestigious, only allowing those with enough money or talent to use the facilities. Music

production was an elite industry; not everyone could participate. Thanks to the dissemination of recording technology to the masses, anyone can produce a high quality album from their own bedroom.

Prior to *Making Mirrors,* Gotye's music was composed of samples and small acoustical recordings. With *Making Mirrors,* Gotye had more space in the barn to record drums and other larger instruments. Without the space and financial restrictions of a normal recording studio, Gotye was able to record and produce in his own living space. More and more, musicians are taking this grass-roots approach when producing their albums. They use digital audio workstations to record songs, layering instruments one at a time until the song is built from individual performances and samples. This saves money and time, and it also avoids the pressures and constraints of working in a recording studio. Many successful musicians started their careers through these advancements in digital production tools. Recording technology can enable amateur musicians and producers to create works that are fantastical and imaginative, allowing the music scene to blossom and expand. In some cases, a record produced with nothing more than a MacBook Pro can succeed just as much as one produced in a multi-million dollar recording studio. The new wave of artists has arrived thanks to Pro Tools and other digital audio software.

Sometimes Less is More: Let it Be.... Naked

The Beatles, perhaps the most famous rock and roll group of all time, released twelve albums in their career. No other album released by the band garnered more controversy than *Let It Be.* Fraught with recording issues, production quarrels, and constant delays, the record released after its intended release date to mixed reviews and lackluster fanfare. By the time it was on store shelves, the album sounded nothing like what the band intended. Produced by music industry veteran Phil Spector, *Let It Be* failed to truly represent the band's vision, but what exactly caused this?

After the recording of what was known as *The White Album*, Paul McCartney, bassist, felt that the members of the band were drifting apart. McCartney believed that the recording techniques implemented for the recording of *The White Album*, *Magical Mystery Tour,* and *Sgt. Pepper's Lonely Hearts Club Band* caused tension between band members*.* During the production of those albums, the band had all but ceased touring, focusing their efforts on creating musical masterpieces not suitable for live performances. Many of the tracks on those albums were recorded asynchronously; the band members rarely played their parts in the studio at the same time. McCartney believed recording an album where the members all played the songs together would heal relationships between band members, something rarely felt since the passing of their manager Brien Epstein in 1967. As expected, John Lennon hesitated when he heard the idea, "In a nutshell, Paul wanted to make - it was time for another Beatle

movie or something, and Paul wanted us to go on the road or do something.

As usual, George and I were going, 'Oh, we don't want to do it, fuck,' and all

that" (Wenner 100).When all was said and done, *Let It Be*, or at that time

known as *Get Back*, would be the band's problem child; nothing went

according to plan once post-production started.

Almost immediately after the completion of the recordings, McCartney

and the other band members had second thoughts. They believed that many

of the tracks recorded were not up to par. Glyn Johns, producer of the album

during the sessions, attempted to salvage an album from this pool of material.

Johns mixed this album in solitude, rarely receiving any input from the band.

When the final product was presented to them, The Beatles rejected it,

dissatisfied with the job Johns had done. Lennon made his thoughts clear:

> We let Glyn Johns remix it and we didn't want to know, we just left it to
> him and said, 'Here, do it.' It's the first time since the first album we
> didn't have anything to... we just said, 'Do it.' Glyn Johns did it, none of
> us could be bothered going in and Paul... nobody called each other
> about it. The tapes were left there, and we got an acetate each, and
> we'd call each other and say, 'Well, what do you think? Oh, let it out.'
> We were going to let it out with a really shitty condition, disgusted. And
> I wanted... I didn't care, I thought it was good to go out to show people
> what had happened to us. Like this is where we're at now, we couldn't
> get - we can't get it together and don't play together anymore. Leave
> us alone. Glyn Johns did a terrible job on it, 'cause he's got no idea,
> etc. Never mind. But he hasn't, really. And so the bootleg version is
> what it was like. Paul was probably thinking, 'Well, I'm not going to
> fucking work on it.' It was twenty-nine hours of tape, it was like a
> movie. I mean just so much tape. Ten, twenty takes of everything,
> because we're rehearsing and taking everything. Nobody could face
> looking at it. (Wenner 101)

The hands-off approach taken by the band led to their eventual dissatisfaction with their product. Eventually, they decided to shelve the sessions and work on what would become *Abbey Road*. Eventually, *Let It Be* would see the light of day again, with the dubious help of industry veteran Phil Spector.

Spector's influence permeated many of the tracks on *Let It Be* when he, without permission from all members of the band, decided to add orchestral instrumentation to many tracks, such as "Across the Universe", "The Long and Winding Road", and "I Me Mine". Many of these changes upset Johns:

> I cannot bring myself to listen to the Phil Spector version of the album - I heard a few bars of it once, and was totally disgusted, and I think it's an absolute load of garbage. Obviously I'm biased, because they didn't use my version, which upset me, but I wouldn't have minded so much if things hadn't happened in the way they did. ... I think Spector did the most atrocious job, just utter puke. (Tolber and Grundy 157-8)

Spector's orchestral additions drastically changed the sound of *Let It Be*. He believed that a record should feel like a cohesive and powerful wave of sound that envelops the listener, and many of the tracks, such as the previously piano-focused ballad of "The Long and Winding Road", did not fit that vision. Paul McCartney's was extremely dissatisfied with Spector's work. He eventually sent Spector this letter with his thoughts:

> Dear Sir,
>
> In future no one will be allowed to add to or subtract from a recording of one of my songs without my permission.
> I had considered orchestrating The Long And Winding Road but I had decided against it. I therefore want it altered to these specifications:

1. Strings, horns, voices and all added noises to be reduced in volume.
2. Vocal and Beatle instrumentation to be brought up in volume.
3. Harp to be removed completely at the end of the song and original piano notes to be substituted.
4. Don't ever do it again.

Signed
Paul McCartney
c.c. Phil Spector
John Eastman (The Beatles Anthology 350)

Spector's mixing and McCartney's subsequent response show that the producer doesn't always have the band's best interests when mixng an album. *Let It Be* is a prime example of the negative impact a producer can have on a piece of work.

Before Spector, *Let It Be* was intended to be a departure and deviation from the band's recent work; it was meant to be live, uncut, and raw. The original Johns mixes, though unacceptable to the band members, captured the essence portrayed in the recording studio. Johns was present at many of the sessions; his knowledge of the songs' evolution gave him a more authentic perspective of the works. Spector's outside view left him detached from the experiences in the studio. He immediately rejected Johns' work and mixes as unworthy, and proceeded to use the power of post-production to create his vision: an over-produced and un-Beatle like album that contradicted the McCartney's vision and intention. Spector's work on *Let It Be* exemplifies how the producer can alter and control the sound of a record, with little to no regard for the original source material.

Recording technology has the power to alter songs beyond recognition. Though instrumental in lining up takes and parts, these editing tools can transform songs into works that are barely represent the original recordings. Luckily, *Let It Be* would get a second chance to shine, thanks again to post-production, in the 2003 re-release of *Let It Be... Naked.*

Spawned from a 2002 discussion between Paul McCartney and the director of the *Let It Be* film, Michael Lindsay-Hogg, *Let It Be... Naked* differed from the band's other remastering projects. Rather than merely touch up the existing recordings, the surviving members of the band wanted *Let It Be... Naked* to be an accurate representation of their original vision before Spector's involvement. Allan Rouse produced the album, an Abbey Road studios veteran and engineer responsible for the re-releases of *The Beatles Anthology, Yellow Submarine Songtrack,* and John Lennon's *Imagine* (Hurwitz). Rouse and the other members on the project had a simple goal:

> "This was not an attempt to remaster an existing album," Rouse says. "We were asked to make it sound the way the band had believed the finished album was going to sound." This meant, for the most part, producing mixes that reflected only what the four bandmembers (or five, including Preston) could play live: no overdubbed guitars or vocals, and certainly no orchestras. (Hurwitz)

Let It Be... Naked would represent the band's early days; songs would consist of material that the band performed in live-tracking sessions. They would strip out the orchestra, choirs, and any other parts unnecessary parts to create a

pure Beatles experience. In order for this to be achieved, it was clear that some major musical surgery needed to be performed.

Rouse decided to stay away from both Johns and Spector's mixing styles. He eliminated the inter-personal chatter between bandmates during the songs. He stated, "They just didn't really fit in with an album of 11 songs and neither did the dialog. Those little bits were fine for a soundtrack album, which Glyn's was, but they didn't fit comfortably with the concept of a straight album" (Hurwitz). In many conceptual and soundtrack albums (works that believe that they are more than a collection of songs) bits of dialogue and anti-musical elements can be inserted or left in to create a certain atmosphere in the record. Some modern concept albums blur the separation of tracks, indicate a band member's instrument change, or tell stories that transcend across tracks. By eliminating these extraneous pieces from *Let It Be... Naked*, Rouse could focus on the content of the songs themselves.

Rouse transferred the original tapes to a digital audio workstation to make the editing and mastering process much smoother. He used Pro Tools 5.2 to edit these priceless and historical works in a non-destructive environment, ensuring that anything could easily be undone. These editing powers enabled the engineers to combine different takes in order to create the best version possible. Though this would have been possible in the analog world, Pro Tools provided precise control to splice tracks with little to no noticeable audible indication. Hurwitz recounts their experience:

And, as part of the improvement process, once the recordings were in the digital world, the engineers began researching which takes were the best performances, and, if more than one take of a song had strong attributes, trial edits were made to see what combination would make the best overall performance. "Once we had the building blocks in the digital domain," says Massey, "we'd delve into a bit more detail. If there were fluffed lines or pops, etc., if there was another take without the errors, we'd try inserting that part from the other take." (Hurwitz)

Rouse could mix many different takes while still maintaining the live-tracked sound. While analog editing could provide similar results, the Pro Tools, with it's highly sophisticated processing, allows for an easier editing experience.

Hicks, an assistant to Rouse, further talks about their approach, "Sometimes we did the tiniest little things. If something wasn't quite right — if there was a bend in a note or something — we did actually replace it with a slightly better one. Again, our main theme was to make it as strong as possible" (Hurwitz). Rouse and Hicks intended to produce nearly perfected takes through editing, rather than processing existing full takes. They manipulated singular notes and tones, stopping to fix even the most minute mistakes. Modern digital editing allows the producers to perfect songs when the ability to re-record material is not an option. Takes that are inherently flawed can be combined with others to create performances that never existed. They only exist in the post-production process. *Let It Be... Naked*, while more true to its original vision than *Let It Be*, exemplifies the benefits of digital manipulation; it makes existing material more refined without turning it into something that sounds unnatural.

One of the biggest changes on the record was "The Long and Winding Road". On the original album, Spector's orchestra drowns out McCartney's piano melodies. The strings, however, lack dynamics, creating a track that feels stale and extremely un-Beatle like. On the *Let It Be... Naked* version, the song allows the guitar and bass to breathe, and the now-exposed piano melodies provide a subtle, yet flowing motion to the song. While the Spector produced song sounds thematic and pulls at the listener's heartstrings, the Rouse produced version, with its subtlety and careful mixing, is a far more intimate ballad. The song reprises many qualities from the band's previous ballads, such as "Blackbird", and in turn, is much more memorable.

Unlike other songs on the record, the re-mastering of "The Long and Winding Road" contains nothing from Spector's version. Rouse explains his choice for this take:

> Spector had used one take recorded five days earlier." "This version, recorded on January 31, we felt was a stronger basic performance," says Hicks. "There's also a slight lyric change," adds Rouse, who suggests that, this being the later recording, it represents McCartney's final lyric choice. (Hurwitz)

By taking a track with more lyrical refinements, Rouse believed that this version of "The Long and Winding Road" would be a more accurate representation of the song. Regardless of personal opinion of the two versions, it's clear that the Rouse version is closer to McCartney's "no overdubs" vision for recording the album. In many cases, less is more, and

the re-mastered version of "The Long and Winding Road" is a sparser, yet more refined version of the original song.

The *Let it Be... Naked* version of "I've Got a Feeling" was taken from the Apple Corps. rooftop recording sessions in January of 1969. These rooftop recordings provided production and mixing challenges. These tracks were captured on a blustery January day, so wind noise was a significant issue. Luckily, the original microphones had panty-hose wind screens, isolating the vocals from much of the environmental noise. However, many hard consonants and pops still existed in the recording, due to the live tracking method employed with these tracks. Overdubbing tracks to eliminate these imperfections was not possible in this rooftop setting, but modern editing techniques allowed Rouse and crew to eliminate most, if not all of the problems. Hurwitz elaborates on the difficulties of working with these tracks:

> "The wind noise was actually quite manageable," says Hicks. "It was really only when they weren't singing that you could hear it." For the inevitable hard consonants and mic pops, "We mainly handled that with a combination of filtering and EQ," notes Hicks. A small amount of de-noising was done using an analog Behringer dynamic filter. (Hurwitz)

These slight adjustments allowed the original sound quality to stay intact, making the audio issues almost invisible to the casual listener. The production techniques recreated the pristine studio atmosphere decades after the tracks were produced. The subtle filtering and EQ adjustments on this track show how modern processing can perfect and shape a song, without destroying the quality of the original recording. Many of the songs on *Let It Be... Naked* may

not carry the same wall of sound quality that Spector imparted to his mixes, but in the end, they accurately represent McCartney's original vision.

When looking at the albums from a pure production standpoint, some stark differences emerge. Spector's vision for the album, though powerful and thematically cohesive, doesn't congeal with later Beatles albums. The additions of strings and choirs may remind some listeners of *The White Album* and *Sgt. Pepper's Lonely Hearts Club Band*, but when compared to *Abbey Road*, *Let it Be* doesn't musically fit. The 2003 version seems to fit better with the band's later discography.

The production techniques employed by Rouse changed the album's tone. Rather than aspiring to emulate Spector's wall of sound, Rouse's methods allowed the music to be more subtle, yet pronounced. His engineering created more cohesive, perfected, and genuine songs. Though fabricated, these meta-takes composed of multiple recordings, note fixes, and other techniques better represent the original vision. The recording situation at the time–rooftop tracking and rushed sessions in the Apple Corps basement–prevented the band from recording tracks that were without imperfections. Thanks to Pro Tools, Rouse and associates created cleaner tracks from the original sessions. A listener would be hard pressed to tell the difference between an actual take and a digitally altered one.

Let It Be... Naked is a prime example of how digital processing can enhance an album. Many modern rock albums take the "kitchen sink" method;

the producers over manipulate songs and create something that sounds radically different than the original track. In The Beatles' case, the restraint shown by Rouse highlights the original sessions in a more refined and perfected way. Rather than creating tracks with bombastic guitars, perfectly in sync instruments, and vocals that never deviate from pitch, the processing used on *Let It Be... Naked* creates a listening experience that's raw and more accurate. Major performance errors were fixed, and small deviations were fine-tuned. Other than that, Rouse made no major additions or subtractions to the original takes. The end result is an album that sounds distinctly Beatle-like, but more refined and cohesive than its previous release. *Let It Be... Naked* provides a rare glimpse into the editing and producing process. No other high profile rock band has released two drastically different versions of the same album, and in this case, it shows that sometimes, less alteration and production can produce a more meaningful and genuine album.

Folk Music: A Messenger from The Goat Rodeo

Many musical genres have now become more popular thanks to the proliferation of digital music distribution. Albums that would normally not warrant a spot in Walmart or Target now have the opportunity to reach their audience due to the limitless shelf space of digital marketplaces, such as iTunes and Amazon. Folk music, in particular, has seen a drastic resurgence, with bands like Mumford and Sons dominating the Billboard charts. This style of music, however, seems to be at odds with modern recording techniques.

Many musicians in these folk bands thrive off of subtle cues from the other band-mates in order to adjust tempo, dynamics, and individual parts. Despite these struggles, many phenomenal folk albums have been created over the past decade. One in particular, *The Goat Rodeo Sessions*, has been recognized as the best engineered album and the best folk album at the 2013 Grammys. This album shows that all styles of music, even those that rely on band member interaction, can still use modern production techniques to enhance their sound.

The album is a collaboration between renowned musicians Yo-Yo Ma, Stuart Duncan, Edgar Meyer, and Chris Thile, consisting of instruments associated with many classic folk songs. The album originated over a decade ago when Thile and Meyer began working together on various projects (Graff). Eventually, Thile and Meyer collaborated with Ma for his 2008 album *Songs of Joy and Peace*, and after that, the trio added Duncan to complete the quartet for *The Goat Rodeo Sessions*. Rehearsals began soon there after at Ma's house in Cambridge, Massachusetts (Graff). Right away, the band members found a synergy:

> "You look at it on paper and it's like, 'Gee, how come these people are getting together?!" Yo-Yo Ma recalls. "But we clicked immediately -- and partly because we basically share the same values. We're all interested in the world around us and in all different kinds of music. So when we got together it was such an excitement of, 'Gee, tell me more stories about Bill Monroe or the Stanley Brothers...' It's a typically American phenomenon that you can have a group of people who didn't grow up together or go to school together, but because they like one

another and have certain values, they find a way to work together." (Graff)

The common musical knowledge shared by the musicians made it easy for them to work together. The album was intended to be collaborative at its heart, drawing inspiration from all the players and giving them each a chance to shine:

"Everybody could be a leader or everybody could be a follower at various times," Ma says. "And I think the vast amounts of fun that we have — which is, for me, that's the goat rodeo part: How can we ever get any work done when we're laughing all of the time? That's actually the part that we love the most. It's a great balance between the two." (NPR)

As stated earlier, folk albums thrive when musicians can play off of the subtle cues given by the other band members. By giving each musician a chance to lead, every member was able to play at his peak and follow each other instinctively.

Unlike other modern records that stress isolation and overdubbing, *The Goat Rodeo Sessions* was recorded in a natural performance setting. All four members of the band sat in a circle in the middle of a barn-based studio in Massachusetts. The ensemble was recorded using overhead microphones, in addition to spot mics placed near individual instruments, in order to evenly capture the performance. The mandolin, however, posed a problem. Duncan elaborates on the situation:

"Because we were using the overhead microphones, for a balance, we were talking about maybe the mandolin being on up risers so that it was equal with the violin as far as how close it was to the overheads,"

Duncan says. "Upon hearing this, James Taylor goes down in his shop and builds a five-by-five riser for Chris [Thile] to sit on." (NPR)

In order for all of the instruments to be heard equally, the distance between the overhead microphones and the mandolin was shortened. This distance manipulation allowed the producer to control the volume of that specific instrument without having to isolate or affect the other musicians. Similar to the techniques employed with the acoustic horn, the distance, and not the performances themselves, had to be altered in order to compensate for inequalities between instrument volumes and timbres. This naturalistic style of producing lessens the need for post-production. The producer strives to achieve the final tone and sound in the live recording session, rather than relying on post-production techniques to clean up the sound.

The conscious decision to record the group as they sit in a circle provided the best sound:

"We all like to go to the edge," Ma adds. "And we like to take calculated risks to go to the edge. And all of us, in some weird way, are also perfectionist[s], so the tension between the two is what we play off of each other. Therefore, the visual cues. Therefore, the tight quarters. So when somebody does something that you know is special to them or going in a different direction, we almost intuitively will follow. It's like a school of fish, you know; suddenly they will turn direction. And that's part of the thing that makes a performance or music come alive." (NPR)

As Ma stated, the interpersonal dynamic that exists between musicians in tight playing spaces allowed them to perform very naturally. Rather than approaching the sessions with concrete parts and arrangements, the band

opted to use the circle as a mechanism for composing the music. By using

visual cues, band members followed each other's spontaneous tracks and

parts, shaping the way that the final song would sound. This tight-knit bond

between the players was essential to recording an album based heavily in

structured improvisation.

Most of the parts on the album were written by Edgar, Stuart, and

Thile. Thile talks about the process:

> We would go to Edgar's house in Nashville and sometimes we'd have starts we'd come up with individually, and sometimes we would literally start from nothing. We'd actually just kind of improvise together and all the sudden someone might be onto something that the other two guys liked. You'd stop and go, What was that? Sometimes they'd remember and sometimes they wouldn't. That's some of my favorite instances. Or when Stuart, who is just a consummate improviser, he'd be playing and he'd play something that Edgar and I would just freak out over and have no idea what he just did, have like no idea. So then it was up to Edgar and I not only to remember what happened and start reconstructing it, but to actually teach it to Stuart.
>
> We would write parts for Yo-Yo with Yo-Yo's incredible voice in mind. Again, it was so fun. You know, improvising isn't the meat and potatoes of Yo-Yo's game, and reading isn't the meat and potatoes of Stuart's game. Stuart's parts needed to be kind of frameworks, just sort of direction, and Yo-Yo's parts needed to be written out. Every guy had something that he was able to sort of help the other guy with. (Brown)

Playing with a musician who builds his albums in a very structural manner

provides for some interesting challenges. As Thile expressed, many of his

and Edgar's parts are based around loose structures, much like traditional

folk music. In this style, parts can be altered between performances, adding

an element of spontaneity. When Ma is added, parts needed to become more structured, without loosing that improvisational spark.

The end result is an album that is beautifully composed, arranged, and engineered. On every single track, each instrument speaks clearly, fully showcasing the breadth and depth of the musicians talents. Violin parts provide strong melodies, while Ma's cello sits in the background, driving yet present. The natural volume balance that exists between all of the instruments is pleasing and clear, presenting an album that stands as an excellent example of how modern recording techniques, such as compression, EQ, and time-alignment, can sometimes be abandoned all together for the betterment of the music.

I also had the opportunity to also produce a folk album using modern recording equipment. During my junior year at Ohio University, I worked with Messenger, a local christian folk band. Over the course of the year, we recorded an eight song album, and I found myself using some of the very same techniques and styles used on *The Goat Rodeo Sessions*. Rather than isolating and separating the band members from each other, I decided to simultaneously track the band members in order to cater to their playing style. When I first discovered the band, they were playing a live show for a local christian worship service. Right away, I noticed the give and take between the band members; head nods, eye contact, and body movement cued the other

players when to change tempos, melodies, and harmonies. By playing in the same room, they were able to emulate their live performance style.

Rather than worry about post production to balance the band's overall sound, I used a pair of stereo room microphones and arranged the band around those. I still used individual instrument microphones for fine tuning volumes, but the majority of the sound came from the room microphones. Little to no post production editing or DSP was was utilized, in order to capture the essence of a live performance. With folk music, less tends to be more. Between *The Goat Rodeo Sessions* and my time working with Messenger, it is evident that with some genres of music, in this case folk, modern recording techniques should be used sparingly in order to maintain the purity of the original songs.

Conclusion

Throughout time,humanity has always adapted to new technology, and the music industry is no different. What was once thought of as foreign objects soon became a natural part of the recording process. Along the way, users of the equipment altered their performance to compensate for the technology's shortcomings. In order for spoken text to be captured by wax cylinders, the speaker adjusted the volume of his or her speech, sometimes raising his or her voice to almost a shouting level for it to be captured by the recording apparatus. When the first violinists attempted to record in an acoustical horn, they employed vibrato in order to increase the duration of

their notes on the recordings. Singers had to re-adjust their style when performing into microphones, and entire ensembles had to rethink their performances once isolation and overdubbing were implemented.

In addition, the limitations of each recording medium affected the composition and distribution of music as well. The limited recording time of the original wax cylinders and phonograph discs urged composers to write short songs that would fit on one side of a disc or one cylinder. As newer technologies emerged, such as the LP and MP3, these limitations were lessened, allowing producers to record longer works.

These new advancements in recording technology also allowed producers and engineers to control the sound in new and powerful ways. The invention of microphones and electrical signals allowed individual instruments to be isolated, enabling more control over instrument volume. An instrument that was soft in comparison to the rest of the ensemble could be made louder in order to blend better. Instruments that produced shrill or thumping frequencies could be smoothed out in order to make the listening experience easier and smoother to the listener.

The invention of digital audio changed the way that the editing process was handled. Rather than dealing with permanent edits using a razor, digital files could be easily manipulated: the editing could be undone and redone at will. The portability of hard disk drives and laptops enabled artists to collaborate with anyone at any time. The falling costs of this technology

opened up producing and editing to entirely new demographics. This created the self-producers, able to record, edit, master, and publish their works on various platforms for the whole world to enjoy.

All of this innovation in recording technology has left the music industry at somewhat of a crossroads. At this juncture, modern producers and engineers seem to head down one of three paths. One group of people sees technology as an instrument just as much as a tool. These individuals like to use technology to create recordings, sounds, tones, and instruments that don't exist in the real world. In essence, they believe the mixing and production of the record is the performance. Another group aims to use these production techniques to make albums that are hyper-perfect. They Auto-Tune every instrument, line up every rhythm, and maximize the volume of every song, creaitng a record without any flaws. The final group uses these recording technologies sparingly, making them invisible to the naked ear. Rather than making it apparent that the recordings have been processed, these producers and engineers use technology to perfect performances in a naturalistic way, making microscopic changes in order to tighten up the songs and tracks. These three ideologies, while contradictory in nature, peacefully coexist in the current industry.

The first group consists of artists like Gotye, who perceive technology as a performance enhancer rather than a crutch for fixing mistakes. Rather than fretting over creating an album that lacks random variation, they see

technology as the means to compose, record, and edit their artistic visions.

These artists could not make their product without the aid of technology, and

in many cases, their end work sounds nothing like acoustic music. They

embrace the unique styles and sounds that can be only achieved through

digital audio, and their work stands out among others in the industry.

On another side of the spectrum, some music producers elect to use

post-production techniques as frequently as possible. As examined through

Nickelback's ultra precise rhythm, over production makes these tracks sound

almost robotic. They are performances that cannot be simply achieved

through raw instrumental tracks; they require the aid of production to exist.

Nickelback's hyper-realistic approach to post-production turns what

would sound like an average rock and roll band into a sound that is larger

than life, yet at the same time lifeless. Its guitars, bass, and drums may be

present and mixed expertly at a high level, but the level of perfection

executed in these mixes take away from what makes music compelling: the

human elements--voice inflection, slight variations in tempos, vocals that may

be slightly out of pitch, and many other minute things. By editing these

imperfections out, Nickelback sets a dubious standard that has affected the

entire industry. Because of their success, many other rock groups have

emulated them, creating albums that are perfect, full, and hyper-realistic. As a

result, the general public becomes more accustomed to this style of

production, and gravitates to similar music.

Spector chose to add grandioise instrumentation to enhance The

Beatles' lackluster performances on *Let It Be*, creating an album that sounds

nothing like the original sessions. He alters the pacing of the album, the

fullness of the sound, the direction and length of individual songs, and much

more to produce his vision: an album that does not resemble the band's

original intentions. In this case, where is the line drawn between the band's

contribution to the sound and Spector's own? Spector shows that producers

have as much power over the final sound as the band, which can have mixed

results. Though this could have occurred prior to many of the advancements

around that era (synthesizers, multi-tracking with tape, etc), these

developments allowed Spector to easily and quickly make changes in scoring

and instrumentation. Nowadays, it's even easier to do so. Almost every

Macintosh computer comes preinstalled with MIDI instruments, orchestras,

and instrumental loops, allowing almost anyone to manipulate the scoring and

arrangement of any song. These DAWs provide the producer with ample

opportunities to overhaul the entire band's sound, creating an album that

might differ dramatically from the artists' original vision.

On another part of the spectrum, some producers try to eliminate

technology's influence in their recordings in order to create a pure and

untouched listening experience. These producers use technology to their

advantage, merely accessing it when necessary to fix small performance

issues, instrument levels, or adjusting the overall consistency of the album. In

many cases, these techniques will almost appear invisible to the consumer, lending an increased sense of purity and liveness to these recordings.

In contrast to Spector's work on *Let It Be*, the post-production on *Let It Be... Naked* employs modern techniques in a way that minimizes interference with the original tracks. Rather than adding orchestration, choirs, or other miscellaneous instrumentation, the producers used Pro Tools to make only small adjustments. It was used to account for missed drum hits, vocal takes that were slightly out of pitch, and other guitar and bass mistakes. Rather than take the existing tracks and heavily alter them, the producers of *Let It Be... Naked* chose to combine multiple tracks in a way that is almost indistinguishable to the naked ear. Instead of fabricating a perfect take, a close to perfect take was assembled from existing material, making the overall product more genuine and more solid sounding.

The Foo Fighters chose to eschew technology completely when approaching their most recent project. Rather than try to minimize the influence of digital post-production techniques, the band chose to forego many modern conventions and use tools popular in the 1970s, taking the extra time to perfect their performance in the studio. This decision creates a more imperfect, yet more genuine product than many other current rock bands produce. The minute flaws, unprocessed guitars and vocals, and slight variations in performance give the album character, allowing it to stand out

and be recognized as a fantastically authentic sounding part of the band's discography.

What makes one of these crossroad options better than the other in the end? To be frank, it's all dependent on the situation. Now, many consumers are beginning to desire and demand music that is different and unique. Many artists that follow the first branch tend to cater to these consumers. The over-production and fabrication practiced by the second branch tends to better cater to the mass consumer base by homogenizing music and making it easy to transfer from one song to another.

At the same time, however, this homogenization is nothing new to the music industry. Like the boy band craze of the late 90s and the metal craze of the 80s, homogenization is a natural occurrence in the industry. As newer technologies and production styles occur, there is a mass rush to this proverbial gold mine of new demand as many producers try to cash in on the newest popular genre. Certain labels and producers will always try to follow the demands of consumers. It's important to note that even though new technologies emerge, the same trends still exist in the industry. Homogenization will always exist in the industry; it merely shifts from style to style as one genre becomes disliked as another gains popularity.

Why though, are people embracing digital processing and production? Regardless of cost and efficiency, there are other reasons why people seem to alter and edit tracks on such a broad level. If cost and efficiency were the

only reasons to transition to a digital workflow, many of today's records would sound similar to ones produced decades ago. There is a simple answer to this: the audience is always looking for something new.

Music has reached somewhat of a brick wall in the physical space. Within the past hundred or so years, few analog instruments have truly been invented (the Moog synthesizer, theremin, and mellotron are exceptions). From time to time, instruments that have been lost in time may reappear and gain traction in the recording community, but for the majority of the commercial music industry, we have been stuck with the same instruments. Digital technologies, however, have allowed producers to push through that wall, creating a seemingly infinite amount of new instruments and sounds. I posit that producers and musicians are not necessarily using digital technology just for the sake of convenience; hese new sounds gained from the production process cause their music to stand out among the thousands of years of recorded music. Music, in the physical world, has all but plateaued. Most genres and instruments have been well established, so people turn to digital production to break out of these pre-existing musical molds, in the eternal search for novelty.

Technology has always pushed music to evolve and change, and musicians have had to adapt to changes introduce by these technologies, for better and for worse. It is clear that the relationship between music and technology is symbiotic. As new technology is introduced, performers and

engineers adapt their styles to compensate for any idiosyncracies of the technologies. As these vagaries are noticed, innovators and visionaries create new technologies to fix these problems, while simultaneously creating new issues.. As new technology is invented and developed, some producers will inevitably use it to create music that is even more exotic than existing pieces, while others will use its subtleties to better perfect the existing performances. In the end, it's all about the choices that the crew working on the album makes. Some may think over-production and fabrication of songs enhances music beyond conventional means and elevates it to an entire different level. Others assume that recordings should accurately reflect the live performance of a song, believeing that these technologies should be used as as invisibly as possible to create works of art that are as close to perfect, yet still human as possible. One thing is certain though: music will continue to grow and evolve. As newer technologies emerge and new artists begin creating music, new blends and combinations of performance, mixing, and processing will produce music that is entirely unique, yet still reminiscent of existing works. At the end of the day, whether you're listening to a sampled Gotye song or one of Yo Yo Ma's cello concertos, music is an experience that everyone, no matter what their background, can enjoy and revel in. What we hear and how we make it is, at the end of the day, determined by whether or not the producer believes that technology, and not music, should be the defining factor of a song.

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