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The Influence of Recording Technology on Trumpet Pedagogy

Ken Wendt

To the University Council:

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David W. Spencer, D.M.A.
Major Professor

_____
Jeff W. Cline, M.M

_____
John W. Baur, D.M.A.

_____
John T. Mueller, D.M.A.

_____
Daniel H. Phillips, M.M.

Accepted for the Graduate Council:

_____
Karen D. Weddle-West, Ph.D.
Vice Provost for Graduate Programs

THE INFLUENCE OF MODERN RECORDING TECHNOLOGY ON TRUMPET PEDAGOGY

by

Kenneth Nathan Wendt

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ABSTRACT

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This dissertation considers the influence of modern recording technology on trumpet pedagogy. The research specifically looks at the listening habits of students and the sources they use for concepts of sound. It is hypothesized that students are attending less live performances and using recordings as their fundamental basis for a concept of sound. How much of commercially released recordings have been manipulated by recording technology? Can the listener identify when these edits have taken place? How does this effect student motivation and outcome?

A survey that addresses the listening habits of students was created by the author and sent to four major universities around the United States to collect data. In addition, the author gave personal interviews to leading professionals in the fields of recording, performing, teaching, and composing. The results show that students are attending less live performances and referencing digital, online recordings more and more. The author also

took part in a recording project to demonstrate the influence of digital recording technology on trumpet pedagogy.

This research has led the author to reevaluate his expectations of the necessary curriculum for college music students. Additional suggestions for teachers are included to help address potential negative ramifications of the trends discovered in this research.

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Introduction

Trumpet pedagogy has changed significantly from its embryonic stages. A quick comparison of *The Art of French Horn Playing* by Philip Farkas and *Brass Performance and Pedagogy* by Keith Johnson will show a shift from an over-codified framework of brass pedagogy to a need to address each student individually while focusing on a desired sound rather than specific physiological instructions. The history of brass pedagogy, though its formal structure has only existed for roughly 50 years, has undergone many shifts due to an infinite number of causes including people, places, events and technology. The focus of this research is to discover the significance of modern recording technology and its influence on trumpet pedagogy.

A trend seems to exist in which students are using recorded examples as a basis for pedagogical references more often than live performances. One of the main pedagogical concerns of such a phenomenon is how to establish the integrity and reliability of the recorded material. How much of digitally recorded music was actually produced by musicians and how much of the music was altered or manufactured by means of digital technology? Can students and teachers identify when an aspect of an

original acoustic performance has been manipulated by digital technology?

The research will investigate the most fundamental ways sound engineers use digital technology to manipulate original acoustic performances. The most common edits that take place change aspects of time, pitch, dynamics and timbre. A collection of data regarding listening habits of students will also be presented. It is certainly more convenient and thrifty to download or search *Youtube.com* for a recording than it is to attend a live performance of the same piece. However, this continued behavior may have a large influence on trumpet pedagogy.

It seems many students are primarily experiencing music from online sources. This study will discuss the significance of the delivery system which students use to find and listen to audio samples as it pertains to pedagogy. The study of music greatly changes when the musical experience is brought to the student instead of bringing the student to the music. While modern recording technology allows for a convenient delivery of music to the listener, this easily bypasses taking time to hear live performances which are the only true presentations of a performer's ability and musicianship. Furthermore, continued use of this cheap and sometimes illegal delivery

system may take a harsh toll against the art to which these very students and teachers have invested their future. If downloading and internet browsing is the route that most students choose in acquiring audio recordings, what implications does this hold for both teachers and students?

The research will include surveys from different populations of trumpet students and teachers to compile results from various trumpet studios around the country, interviews with leading professionals in the field, and quantitative data taken from a recording project the author has undergone that will show how modern recording technology may be used to manipulate aspects of time, pitch, dynamics and timbre. The final chapter will include how this research has specifically affected the author's approach to trumpet pedagogy.

1. History of Brass Pedagogy Publications

Apart from early treatises on trumpet playing, the body of literature on trumpet pedagogy is a recent phenomenon. Many of the modern approaches in trumpet pedagogy come from literature published after 1956. Before 1956 there was very little information available about brass pedagogy let alone trumpet pedagogy. Most of the significant books regarded as pillars of modern trumpet pedagogy were published in the last fifty years. Within this short fifty year window exists a significant change and trend in trumpet pedagogy. While Philip Farkas is still held in high regard, modern psychology and pedagogy differ greatly from his first publication.

With this publication of *The Art of French Horn Playing* in 1956, Philip Farkas is largely regarded as one of the first teachers to write about brass pedagogy and playing in the twentieth century. He continued his series with two more books: *The Art of Brass Playing* in 1962 and *The Art of Musicianship* in 1976. In *The Art of French Horn Playing*, much time is spent instructing the reader on specific physiology while playing the horn. For example, in discussing the vibrating embouchure, Farkas writes, "… we control the exact amount of friction by means of the embouchure muscles so that the vibration takes place at the

speed necessary to produce the proper sound and pitch."[1] Farkas suggests that each performer controls the finest of adjustments in the embouchure. By contrast, in *The Art of Musicianship*, the author takes a much broader view suggesting that individuals require unique instruction.

Philip Farkas was only eighteen years old when he played first horn for the Kansas City Philharmonic. He went on to play for the professional orchestras of Cleveland, Chicago, and Boston. He spent most of his time as first horn in the Chicago Symphony. He also was on the faculty of Indiana University, Cleveland Institute of Music, Northwestern University, Roosevelt University and DePaul University. He was one of the most respected and recognized horn players.[2]

> David Hickman, the author of *Trumpet Pedagogy, states*:
>
> Teaching trumpet would be relatively easy if all students possessed the same physical characteristics, musical background, mental capabilities and enthusiasm. However, it is these differences that make trumpet pedagogy important if each student is to become a successful performer.[3]

Clearly, it is his publication provides a more fluid process than material published in *The Art of French Horn Playing.*

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[1] Philip Farkas, *The Art of French Horn Playing,* (Evanston, IL: Summy-Birchard Company, 1956), 27.

[2] Brian Frederikson, *Arnold Jacobs: Song and Wind*, (Wind Song Press, 1996), 54.

[3] David Hickman, *Trumpet Pedagogy: A Compendium of Modern Teaching Techniques* (Chandler, AZ: Hickman Music Editions, 2006), vii

Stephen Chenette, who has been principal trumpet with the Minnesota Orchestra, Boston Pops, St. Paul Chamber Orchestra, and Denver Symphony, considers the approach of Arnold Jacobs to be substantially different than that of Chenette's previous teachers:

> …a comparison between Jacobs' teaching and that which I received as a youngster will illustrate the nature of his contributions. A consensus of the instruction that I had from a number of well-meaning teachers and clinicians follows: expand the stomach when taking a breath, but don't raise the chest because the blowing muscles are down low. Before starting a note, make the stomach muscles very firm, and continue to push them out, or down, while playing. Take in only as much air as is needed to play the passage.[4]

Mr. Chenette goes on to describe how Jacobs' approach was very simple, yet extremely efficient.

In the modern era, Arnold Jacobs is considered one of the most influential pedagogues in brass performance and was the principal tubist of the Chicago Symphony Orchestra from 1944-1988. Contrary to the rigidity of Farkas' first book, Jacobs would often toss a pen to a student who would in turn catch the pen. Jacobs would then ask the student if he was aware of which muscles he used to catch the pen and to what degree each muscle was employed. To which, outside of only the rarest occasions, the student would respond, "No."

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[4] M. Dee Stewart, *Arnold Jacobs: The Legacy of Master* (Northfield, IL: Instrumentalist Publishing, 1987), 3.

This artfully demonstrates Jacobs' fundamental principle: Focus on the desired result and the body will efficiently take care of itself with minimal intervention. For musicians, this starts with a clear concept of the sound to be produced. The more explicit this stimulus is in the mind, the more defined the body's response will be. This Jacobian axiom is at the core of the research presented in this document. Current trumpet students in universities around the country are accessing internet based audio over live performance at a ratio approaching 8:1.[5]

If we accept Jacobs' theory that sound is at the core of teaching musical concepts, then we have to question how the delivery and acquisition of these sounds through digital technology is affecting the current pedagogy of trumpet studios around the world.

Even Philip Farkas, while undergoing difficulty in his own playing commented on the simplicity and efficiency of Jacobs' advice. He recounts being told, "Phil, stop trying to be so analytical! … Your reflexes will take care of your problem… You are trying to correct something by thinking about it. In this case it will only tie you up in knots."[6]

[5] Ken Wendt, Student Listening Habit Survey, March 2010.

[6] Stewart, *The Legacy of Master,* 28.

Farkas goes on to write that his playing improved just two days later.

One of Jacobs' most celebrated students is Keith Johnson who is currently regents professor of trumpet at University of North Texas. His books include *The Art of Trumpet and Brass Performance and Pedagogy.* He is considered one of the leading trumpet pedagogues still teaching today. His career as both a soloist and clinician has taken him around the world. He has performed with the Dallas Symphony, Fort Worth Symphony, Cape Town Philharmonic, Mexico City Symphony, and the Kansas City Symphony.

Johnson reinforces these ideas for trumpet in the *Listening* chapter of *Brass Performance and Pedagogy*. With the exception of "Banal music—on radio and television" which is intended "to mask other sounds" and "influence our mood or behavior," Johnson suggests listeners "…strive not only to be aware of its [art music] presence but also to participate in it, to take it into our sensory memory and to call upon it when we are exercising our own capacity for creating music."[7]

Keith Johnson makes an important point in his above statement. There is no replacement for a strong concept of

[7] Keith Johnson, *Brass Performance and Pedagogy*, (Upper Saddle River, New Jersey: Prentice Hall, 2002), 11.

sound. Furthermore, a strong concept is required to consistently produce satisfactory results in performance. Once a strong concept of sound is established, other variables are free to fall into the most efficient manner of production under the control of the subconscious mind.

At the heart of the pedagogical transition that has taken place since the middle of the 1900's, as evidenced by content of later publications, lies the necessity of the student to develop a strong concept of sound. Without this, nearly every other aspect of musicianship will suffer for students and professionals alike. The great advice of Arnold Jacobs hinges on the assumption that the student can accurately conceive of a beautiful sound. The additional suggestion of Keith Johnson to shower the beginner with beautiful sounds of their instrument is of significant value and will help to ensure these students will be able to adequately utilize the revolutionary pedagogy of Arnold Jacobs.

The core of this research investigates how recording technology affects pedagogy of modern trumpet students. The concept of sound for each musician is very important for mature musical development and the source of these concepts deserves proper attention.

2. Modern Recording Technology

A brief explanation of how digital recording technology functions will also prove useful for the reader as many people including the musicians who use it are often unfamiliar with the process that is responsible for representing their art to an increasingly wider audience.

A key point that is often forgotten or lost in the subliminal thoughts of listeners is that, apart from particular approach to the recording process that uses technology to create sounds that do not naturally otherwise occur[1], a recording is a simulation of a live performance.[2] It is not a live performance in and of itself. Even if the recording is of a live performance, large amounts of sensory information are lost through the recording process. Listening to a recording will never equal the experience of hearing a live performance.

Digital technology allows great freedom with respect to manipulating the audio information once recorded. This is specifically due to the ability of recording technology to convert a recorded sound into a more malleable form. Once sound is converted to a digital signal, it is

[1] William Moylan. *Understanding and crafting the Mix.* (New York: Focal Press, 2007), 261.

[2] Philip, Robert. *Performing Music in the Age of Recording*. (London: Yale University Press, 2004), 26

extremely easy to adjust the many parameters of audio information. Conversely, it is more difficult to manipulate audio information outside of digital information (analog) because inherent limitations exist within analog media.

Analog media include wax cylinders, wire cylinders and magnetic tape. Once the audio is recorded onto tape, for example, the engineer is limited to physical properties of the magnetic tape. Prior to digital editing, engineers would physically cut and splice together different sections of tape to create the desired end result which was meant to simulate a live performance.

When trying to isolate one trumpet note from a tape and attempting to manipulate time, pitch, dynamics and timbre, the engineer has a much greater challenge than when using digital technology. For example, to change the overall tempo, the engineer needs to play the cassette tape back at a different speed. However, changing the speed also changes the pitch in direct proportions. Dynamics can be adjusted most easily but these changes are applied evenly to everything that is captured on the analog device. For example a fade out at the end of a song can be done by gradually decreasing the volume. However if the piano were too loud, and the trumpet too soft, there is significantly

greater difficulty in analog editing for the engineer to increase the volume of just one part.

In contrast, when audio information is represented and expressed digitally, each tiny digital event and expression is subject to its own manipulations in pitch, time, dynamics, etc. The highest quality technology will allow the engineer to capture and manipulate increasingly smaller bits of information well beyond human perception.

A severely oversimplified version of the digital editing process would be represented in the following list:

1. Analog signal is transduced to an electric signal
2. Electric signal is converted to digital information
3. Digital edits take place
4. Digital information is converted back to analog sound which the listener experiences.[3]

The focal point of this process is using technology to capture an analog signal and convert that signal into information represented in a series of two states (binary 1 and 0). Once the signal is represented as information, the most meticulous manipulations can take place. After the engineer achieves the desired result, the technology then converts this manipulated information back to an analog

[3] Jeff Cline, Personal Interview, March 2010.

signal which leaves the speakers and reaches the ears of the listener.

This means that when listeners play a digitally recorded CD they are hearing analog signals as the audio leaves speakers. Digital signals cannot be heard because they are simply discrete amounts of information that can represent sounds. One can only hear the results of using digital technology but cannot hear the digital information itself. When consumers play digital recordings the analog signal results in a specific quality of sound depending on the way the original audio information was able to be digitally manipulated.

The change from analog recording to digital recording began in the mid 1980's. Prior to that time all recordings were captured by analog signals and placed on tape. Editing analog tape is possible but does not offer the engineer even a fraction of the amount of detailed control digital technology provides. Very few engineers maintain an analog studio today. Digital technology dominates the market in all genres.

For example, if a performer records something by analog means and wishes to transpose some recorded material, this is done by increasing the speed of playback to make the pitch ascend and decreasing the speed of play

back to make the pitch descend. However, this also effects the time. To transpose a performance down exactly one octave, the engineer needs to play back the originally recorded audio at exactly half speed. With analog technology it is not possible to change the pitch without also changing the duration of the events. Thus, if a performer wishes to be able to transpose a section of recorded material up from the originally recorded excerpt, the performer must calculate the exact proportional value of speed at which to play the excerpt. The excerpt must be played slower than the desired performance tempo to compensate for the faster playback speed necessary to transpose the excerpt up in pitch. In contrast, digital technology allows the sound engineer to manipulate individual aspects of music without affecting the others.

The easiest and most precise edits conducive to analog recording are those of splicing. Gary Gottlieb defines non-linear splicing as: "the physical action of cutting the tape and reassembling it—sometimes removing tape containing undesirable material in the process, sometimes reordering it."[4] This is also known as using patches of performances from different "takes" to create the desired result.

[4] Gary Gottlieb, *Shaping Sound in the Studio and Beyond: Audio Aesthetics and Technology* (Boston: Thomson Course Technology, 2007), 207.

The degree of precision required to perfect this craft is quite high and requires much practice. The process of "undoing" an action during analog editing carries with it the heavy burdens of physical labor and possible destruction of the musical material subject to manipulation, even during the first attempt. The digital engineer, on the other hand, simply clicks the "undo" key and is free to reattempt the desired maneuver ad infinitum.

One may compare the flexibility and control that digital technology allows, to the degree of increased efficiency of switching from the horse and buggy to the current hybrid automobiles. What once took months to travel can be done in days. What once took hours to edit by analog means can be done digitally in seconds. Corrections that were never even a possibility in the arena of analog editing, the digital engineer executes in seconds.

However, with this upgrade in convenience comes the danger of potential decrease in motivation. Performers can rely on the technology to correct their mistakes, thus resulting in a decrease in motivation of daily practice. Performers' personal expectations may decrease since the technology can (more than) compensate for a lack of control over the instrument. Thus, the value of live performance

increases right alongside the advancements of recording technology. During acoustic performances of the highest artistic caliber, the audience directly experiences the artist's degree of technical control and musical voice without the aid of digital editing. The greatest musicians are capable of consistently playing at an exceptional level in all situations. These players sound great the first time without any technological help.

3. Editing

This chapter will present the most fundamental and commonly used methods to edit recorded material. This research will only focus on ways modern recording technology allows a user to manipulate time, pitch, timbre and dynamics. It is intended to be presented to the reader who may not be familiar with recording technology. All of these editing examples can be done easily and quickly, most of them taking less than ten seconds to correct. Much more complex edits are possible to the advanced engineer which allow for the most precise manipulations among these elements of music. However, the intent is to present these four, most basic ways modern recording technology is used to manipulate audio.

Time

Edits that manipulate the perceived time during which the performance takes place are extremely common. Most recording sessions do not consist of one complete performance that just happened to be recorded. Engineers will often use data from several different recorded takes to create the desired result. In this case, the engineer is manipulating time in the most fundamental of ways. He is organizing two or more events that took place at

different times in such a way that these recorded events create the illusion of one, seamless performance. This application is often referred to as splicing.

In more specific applications of time, engineers can change the tempo of a piece in many different ways. The original tempo can be increased or decreased to very precise degrees. In addition, engineers may select specific sections of a work and gradually increase or decrease, beyond the perception of the human ear, the tempo over these periods of time. Before digital technology, changing the tempo was not possible without also changing the pitch. A simple experiment of playing back a tape at a speed that differs from normal playing speed will demonstrate that as the tape wheels slow down, the pitch will go lower and as the wheels speed up the pitch will go higher. Modern recording technology allows engineers to manipulate pitch, tempo, timbre, rhythm, and dynamics all independent from the other providing a degree of control over musical variables that approaches infinity.

Another application of editing time allows the engineer to change the duration of selected notes. The length of a sounding note may be increased or decreased to extremely precise degrees by altering the beginning, middle, and

ending sections of any sounded note regardless as to how long or short it was originally performed.

Pitch

> The perceived quality of a sound that is chiefly a function of its fundamental frequency – the number of oscillations per second (called Hertz, abbr. Hz) of the sounding object or of the particles of air excited by it. The perception of pitch may, however, be affected by inharmonicity in the waveform, by the amplitude of the waveform, by the physical relationship between auditor and sound source, by the structure of the ear, and by habitual expectations.[1]

Two of the most common edits of pitch that take place are pitch correction processing and transposition. Pitch correction processing will allow only the specified pitches to be heard. For example, if the engineer sets the software parameters to allow A440 and the performer plays A at 447, the software will automatically pull the A from 447 down to 440. A primary use of auto-tuning is to correct subtle discrepancies of intonation.

Transposition allows the engineer to shift all pitch content of selected audio material up or down by the same degree or interval. The further the original material is transposed away from its original pitch, the more noticeable the transposition edit becomes. Shifting

[1] Don Michael Randel, *The New Harvard Dictionary of Music*, (Cambridge: Belknap Press of Harvard University Press, 1986), 638.

passages up or down one or two whole steps can be done and still sound very close to the original quality of performance.

This is frequently done with vocalists who prefer to sing in certain keys. For example, the band will record a piece in F-sharp minor but the singer may prefer to sing it a whole step higher. The engineer then selects all the recorded material from the band and clicks the "transpose" option to one step higher. The band now sounds as if they played in G-sharp minor and the vocalist is more comfortable.

Specifically for trumpet playing, this is more commonly known to take place with notes in the upper register which are often physically taxing to play. The performers will play excerpts in a key which feels comfortable and suits their upper register. Then the engineer will transpose the recorded excerpts up by the desired interval of transposition so the final product sounds higher than the actually recorded material.

Some software even allows the engineer to change the scale of the material that has been recorded. For example, if a soloist plays a scale passage but accidently plays a C-major scale instead of a C-minor scale, the software will

automatically replace all the E-naturals with E-flats, the A-naturals with A-flats, etc.

Dynamics

"The aspect of music relating to degrees of loudness."[2] Changing dynamics is one of the easiest adjustments to make because it is literally the same as turning up the volume on your home stereo. However, the greater degree to which the engineer changes the dynamics, the more unnatural the result will sound. A trumpet has a substantially different timbre when playing pianissimo than when playing fortissimo. It is more common to record passages indicated to be pianissimo louder than the music indicates because most brass players find it more difficult to play extremely softly. Adjusting the original [loud] recorded material to softer dynamics may sound more natural than boosting the volume of softer passages. A whisper that has been amplified so it is technically louder than a full voice scream still maintains the characteristics of a whisper.

Timbre

Timbre of musical instruments is determined by overtones. It is a well documented and researched

[2] Don Michael Randel, *Harvard Dictionary Music,* 247

acoustical phenomenon that brass instruments adhere to a specific series of overtones. When one person produces a sound on a brass instrument, what sounds like one note to the listener is actually a combination of a fundamental pitch as well as overtones. It is this series of overtones and how they function relative to brass instruments that creates their distinct timbre and time relationships.

The timbre of a sound is often manipulated during the editing process with an equalizer:

> Equalizers are frequency-selective amplifiers… an equalizer will allow select parts of the frequency spectrum to be increased or decreased in level, without affecting the pitch. This is because equalizers change the harmonics, while affecting the fundamental frequency minimally in level, if at all…[3]

Anyone who has adjusted bass and treble on their stereo or in their car has done exactly this, only on a less specific scale. The difference is the degree to which the sound engineer can isolate and increase or decrease multiple parts of the frequency spectrum. Manipulating frequencies in this way is one of the most noticeable changes when listening to brass recordings because of the nature of the overtone series. Making adjustments with equalizers, especially to the higher frequency ranges, severely changes

[3] Gary Gottlieb, *Shaping Sound: In the Studio and Beyond,* (Boston: Thomsen Course Technology, 2007), 244.

the overtones and in so doing alters the natural acoustic characteristics of brass instruments.

Timbre is an important aspect of sound because it is responsible for the particular properties and characteristics of each audio source. It allows the listener to distinguish specific differences between sounds.

Another way that timbre can be affected in the editing process is by manipulating what engineers refer to as the sound envelope or duration which is the "volume shape of a sound over time… how much time passes as the sound begins, continues, and ends."[4] The four parts of a sound's envelope include the attack, sustain, decay, and release.[5] Engineers may independently adjust these variables to manipulate aspects of timbre.

[4] Gary Gottlieb, *Shaping Sound*, 35

[5] Ibid.

4. Perceived Benefits and Disadvantages of Modern Recording Technology

The influence of modern recording technology can be viewed from both a positive and negative perspective. For the performer, this can be as simple as the use of the digital metronome or tuner to aid in preparation of mathematically correct rhythm and intonation or as complex as replacing a missed note in a recorded passage of great difficulty.

Recording practice sessions is an excellent way of guiding improvement because it provides the student an objective record that often differs from their perceived expectations. In most cases, hearing one's self away from the instrument accentuates both strengths and weaknesses of a given performer or piece. In *The Brass Performance and Pedagogy,* Keith Johnson writes:

> Using a recording device is also a great stimulus to better listening. It is amazing how intently any player, even a seasoned professional, will listen when a recorder is on. Merely having the machine going will virtually guarantee better listening and concentration.[1]

Another potential benefit of modern recording technology is the ability to capture a much larger dynamic spectrum than magnetic tape was able to. The results of

[1] Keith Johnson, *Brass Performance and Pedagogy*, (Upper Saddle River, New Jersey: Prentice Hall, 2002), 19.

which are a more accurate sonic representation to the human ear, more closely resembling the original musical event. Allen Vizzutti who has played in more than 500 professional recording sessions and performed more than 300 solo performances in the past years comments on this topic, "The accuracy of aural representation may be the most accurate technologically to date but it is different than live vibration hitting you in the chest and ears and heart. I don't know why it is different but it is."[2] Mr. Vizzutti's response reinforces the focal point of this research, that although modern recording technology may allow for the most accurate means of capturing audio, there is a substantial difference when compared to the experience of a live performance.

A student in Germany can bring a New York philharmonic performance to his eyes and ears through the internet and teachers in classrooms across the globe can easily access a performance of a Rossini opera without leaving their schools.

This technology also offers many conveniences that may save much time in certain situations. The student can now

[2] Allen Vizzutti, Electronic Mail Interview, March 2010.

bring the digital representation to himself rather than the reverse.

Modern recording technology allows students to access recordings in seconds without leaving the comforts of home or a practice studio. If a student wants to hear a recording of a Mahler symphony, he can use his computer to download not just one, but several recordings with a few keystrokes. In addition, this student has the advantage of hearing these different interpretations of a particular piece within seconds of each other.

It was possible to do this with tapes and records before modern technology, but one still had to initially travel to buy the hard copy recording or wait for their hard copy order to be delivered. Modern computer users never have to take even one step to obtain a recording while it downloads from online sources in minutes.

To appreciate this type of convenience before recording sound was possible stretches the imagination. To hear Mozart perform, people traveled great distances. Hearing the same piece performed by four different orchestras may have taken years in the past. Today's listeners have the ability to stop and infinitely replay any part of the performance over and over.

Modern recording technology also has many benefits for the artist undergoing the process of recording. For example, the ability to make precise edits allows the engineer to remove or correct one small error from an otherwise flawless passage of music, saving the performer from repeatedly playing the entire section. When in the studio factors such as endurance and time have great influence over the success of the recording process. John Holt, who teaches at The University of North Texas and has recorded many CD's of trumpet works, addresses this, "Practice and record yourself before you begin the actual recording so you can keep your costs down."[3]

In most cases when more time and energy can be saved, the recording experience yields better results. Repeatedly recording a very taxing passage for the sake of one small mistake can quickly deplete the endurance of the performer and adversely affect the remainder of the recording session.

Another positive ramification of modern recording technology is the reinforcement of truly great live performances. At a live, acoustic performance it will be obvious which musicians rely on technology to create a satisfactory product more so than their own musicality and

[3] John Holt, Electronic Mail Interview. March 2010

technical control. To the contrary, when one witnesses a magnificent live performance that approaches a level of artistic flawlessness, it reflects the skill and dedication of the performer(s) and is worthy of great respect. Anthony Plog, who has performed extensively in Los Angeles, is a well respected composer for brass, and now teaches in Germany, speaks upon this subject:

> With the best orchestras and soloists, I think that recordings do represent what the orchestra or soloist is capable of, but in the case of lesser soloists and orchestras the recording quite often presents the performer as better than they really are in concert.[4]

Today, when one hears a truly awesome live performance it frequently stands out in the memory of the listener, going noticeably beyond the mediocrity that is frequently masked by modern recording technology.

Disadvantages

A primary concern of modern recording technology is that performers can use it to make recordings of their playing sound much better than they are capable of playing at a live performance. At some point, the technology may become more responsible for the performance than the musician. Not only does the technology conceal potential weaknesses

[4] Anthony Plog, Electronic Mail Interview, March 2010

of the performer's technical control of the instrument, but it accomplishes this in such a way that is nearly impossible for the listener to identify that any editing took place.

All four professionals interviewed by the author agree that most listeners are unable to tell if a recording has been manipulated by digital technology.[5] This is one of the inherent pedagogical dangers of using commercially released recordings as a basis for establishing concepts of sound and style. When asked if he feels that students receive an accurate aural representation of a performer's ability from recordings, Rick Baptist a professional Hollywood musician who has recorded more than 1500 times in the past five years, replied, "All recordings are tweaked, that is why I love live TV (ala Dancing with the stars, or The academy awards)"[6] Mr. Baptist reinforces the need and enjoyment of preferring to listen to a live performance over recordings. The potential exists for players to increasingly rely on technology to correct aspects of their playing. Howard Snell, former principal trumpet of the London Symphony Orchestra, attacks this dependency on technology:

[5] Allen Vizzutti, Anthony Plog, John Holt, and Rick Baptist, Electronic Mail Interview, March 2010.

[6] Rick Baptist, Electronic Mail Interview, March 2010

> Electronic Tuning Devices – These are not for the serious musician! …They are inaccurate for all but the crudest purposes. They remove from the musician the responsibility for listening, judging and refining his sense of pitch. These machines are a good example of technology's main purpose, which is to de-skill the human race, and reduce it to mindless slavery and dependency![7]

Furthermore, students are hearing recordings more than live performances which reinforces their expectations to be that of perfection as artists will rarely release recordings with errors.[8] This level of perfection can be destructive to the motivation of students when they fail to reproduce the sounds captured on all of their flawless recordings. Allen Vizzutti said,

> …Others who use recordings as their standard might be in for a bout with low self esteem if they listen to great players who make 'perfect' recordings through editing and manipulation and think the artist always plays that way.[9]

Students must keep in mind that recordings cannot equal a live performance. Furthermore, recordings reflect the style and playing of an individual at one point in time. John Holt addresses this idea when asked what advice he has for students as they listen to commercially released recordings in saying, "Just know that a human being made

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[7] Howard Snell, The Art of Practice: A Guide for Music Students, (Brighton: Pen Press, 2006), 57.

[8] Robert Philip, Performing Music in the Age of Recording, (New Haven: Yale University Press, 2004), 25.

[9] Allen Vizzutti, Electronic Mail Interview, March 2010

the recording and you are getting that person's musical ideas of the moment."[10]

Students will often listen to one recording of a particular performer and piece and assume that this musician always plays a certain way. The musicians on these recordings are changing and growing each day while students are incessantly hearing the same recorded performance. Listeners begin to expect the performer to play a particular piece exactly the way it was recorded.

Technology can remove some of the inherent, human elements of performance. People are not perfect and the greatest performers will occasionally make mistakes. Musicians that have great control are able to recover from errors rather quickly. If one section of an ensemble begins to rush, other members become aware of this and begin to make adjustments in their own playing to compensate for the fluctuation in tempo. Using technology to deliver the "perfect" recording eliminates the subtle interaction and nuance in situations like this.

The intent is not to listen for errors in performance but to be aware of the level of artistry required to listen to sixty other musicians and make decisions based on a musical situation that is constantly in flux. There is an element

[10] John Holt, Electronic Mail Interview, March 2010

of excitement and of tension and release of which carefully edited recordings are frequently bereft.

Some professionals take less risks when recording and play things "safe" because time and money are at stake and errors are simply unacceptable.[11] If these recordings that contain the "safe" or reserved performance are what the student is using, consciously or not, as a reference for his own concept of sound, he is again referencing an event that is not at its fullest potential.

Although the convenience of modern technology allows for quick and convenient access to digital representations, this convenience may include an inevitable loss in quality of the recorded sounds. Files containing the best quality audio engineering understandably occupy the most electronic storage space. These large electronic files require more time and bandwidth to transfer than smaller files. As a result, the industry is constantly searching for ways to decrease file sizes without a perceptual loss of audio quality. Society tends to prefer convenience over quality and music students are no exception.[12]

Most music files on mp3 players are of an extremely reduced density. (CD format of 44,100 Hz and 16 bit word

[11] Robert Philip, Performing Music, 43.

[12] Ken Wendt, *Student Listening Habit Survey,* March 2010.

length is equal to 1,411 kbps. MP3 settings decrease this value to only 128 kbps). A once high definition audio file automatically converted to a typical MP3 or similar form, has more than 90% of its the spectrum removed in order to download faster. This is analogous to removing 90% of the pixels from a high definition television. This relates to pedagogy because if students are not attending live performances nearly as much as they are using digital representations they are using misleading examples as their music stimuli. Moreover, the files they choose consist of some of the lowest quality audio available.

Chapter 5. Personal Recording Project

This recording project is organized in two parts. Before reading further please listen to the first recorded example which is the author's recording of the first movement of Johann Nepomuk Hummel's Concerto for Trumpet (E-Flat).

LISTEN TO THE RECORDED EXAMPLE #1 BEFORE READING FURTHER

Part I

The recorded example of J.N. Hummel's Concerto for Trumpet movement I, (audio example 1) is, in and of itself, the entire point of this dissertation. The objective of creating this performance, was to record as little of the actual musical material as possible. The intent is to showcase how modern digital technology may be and often is, used. For example, exact repeated phrases in the concerto were only recorded once, copied, and pasted into the correct locations. If part of a melody returned in a different key, the original recorded melody was copied and transposed into the new key then placed appropriately. In appendix C the reader will see a chart that includes the bar numbers of music that were actually recorded as well as what measures were digitally adapted from previous

material, and what types of edits took place to create the final product.

While this may not be the most effective manner in creating a highly musical performance, the objective here was to example the most common ways digital technology is used today to edit musical recordings. The results adequately showcase the potential applications of the most fundamental edits.

Logistics and Possibilities

The engineers involved could have employed much more sophisticated editing techniques, but the choice was made to remain within the boundaries of the most fundamental processes to achieve an acceptable result. It follows that if these edits in their crudest form can yield a result that is accurate to the composer's notation, more refined and detailed efforts would only improve the outcome.

In an attempt to maintain control and consistency over as many variables as possible, a prerecorded piano accompaniment was used.[1] This allows the listener to focus his attention specifically on the trumpet and how the digital technology changes these characteristics alone.

[1] Sarah, Watkins, Canadian Brass Solo Performing Editions, *Johann Nepomuk Hummel*, (Milwaukee: Hal Leonard, 2003).

Another reason for this choice was the necessity of recording the trumpet in isolation to keep piano sounds from bleeding through into the trumpet microphones. Precise edits are only possible if the recorded source is completely isolated from all other sound sources. A prerecorded piano accompaniment allows the engineer to easily isolate the trumpet recording sounds and simplifies logistical concerns of coordinating two performers.

Many other courses of action were available. A click-track could have been used which would allow the trumpet and piano performers to record their tracks at different times without ever hearing the other performer's contribution. In addition this result would have no potential limitation as to when the recordings were captured. Engineers can combine recordings of piano and trumpet performances that took place five years apart from each other just as easily as they could do this to performances that took place in the same hour. However, performing along with a click track does not easily allow for subtle artistic changes and nuance of acceleration and retardation. The performer must stay accurately with the click track so that when the other part is added the two will metrically align, even if each performer never heard the other.

It was also possible to record both performers at the same time while each played from their own sound proof room. Each performer would use headphones in order to hear the other while they record. Since head phones often cover the entire ear of the performer, this can present a challenge because it drastically changes the way the performer aurally perceives his instrument in the natural acoustic environment. To help correct this phenomenon, engineers will put each performer's own sound into their own head phones as well as sounds from the other performer(s) so they are each free to hear their own recorded sounds as they perform.

However, the sound that reaches the headphones of each performer is still only the electronic representation of what is happening in the acoustical reality and thus will never sound or feel completely natural to the performer who is not familiar with the this process. As a result, the performer may be subconsciously changing aspects of their normal method of performance because the way they experience their own sound is drastically different when wearing headphones that completely surround the ears.

The two options remaining involve recording one part first, which forces the other performer to listen to the first to ensure adequate matching in time, pitch, and

style. Recording the trumpet part first would force the pianist to fit the accompaniment behind a pre-existing solo. Furthermore accounting for all the rest in the trumpet part presents a challenge. How will the trumpet performer decide how much space to leave for the large sections of rest? Will the engineer simply pull the two parts in line with each other after each has been recorded? This assumes that both performers agree on a consistent tempo throughout and must use a click track, presenting similar concerns discussed earlier.

Recording the piano first would result in the same situation as using the prerecorded piano accompaniment, but add more time and performance variables to the process. The process of adding the trumpet solo to accompaniment is more pragmatic than recording the solo first. The piano performance needs only to avoid sudden, uncharacteristic changes and the soloist will easily follow along. As stated earlier, a prerecorded piano accompaniment was used This reinforces the attempts to eliminate as many variables as possible so the attention remains on how the technology affects aspects of trumpet performance and pedagogy.

Another option that was considered was playing the piano part on a MIDI keyboard which would allow for extremely detailed edits to take place as each piano key

stroke becomes an event subject to an infinite number of potential edits to take place. However, this again adds many complex variables to the process and takes attention away from the effects of modern digital technology and the relationship to trumpet pedagogy.

In the end the trumpet track was recorded while listening to the piano accompaniment CD through stock Apple earbuds that come with any iPod. This type of ear bud was chosen because it does not completely cover the ear and thus does not prevent the performer from hearing his natural acoustic sound. One microphone (KSM 44) was used and placed three feet in front, and eight inches above the bell of the trumpet.

The listener will hear the following in this project:

1. The final result of editing a large amount of material to create a complete performance of the entire first movement of the Hummel Trumpet Concerto in E-flat. (The first track the reader was instructed to play at the beginning of this chapter)
2. A track that includes only the original material from which all the edits took place. The listener will hear many gaps where the trumpet would normally play. The music that belongs in these missing sections was

created by manipulating other audio information present on this track.

It was intended for the listener to first hear the final construction of the complete movement. This allows the first hearing to be as objective as possible by preventing the reader from knowing locations of edits before the first hearing. Otherwise the listener may consciously or subconsciously remember specific edits and listen with expectations during the first hearing. A complete list of every edit and how it took place can be found in Appendix C. In addition, relevant screen shots from the *Pro Tools* session are included in Appendix D.

Edit Decisions

Most of the edit decisions that took place involved the transposition of individual notes or short musical cells consisting of two or three notes. For example, the octave from the opening trumpet statement (the second and third bar of the following example) comes back many times in the piece in different keys:

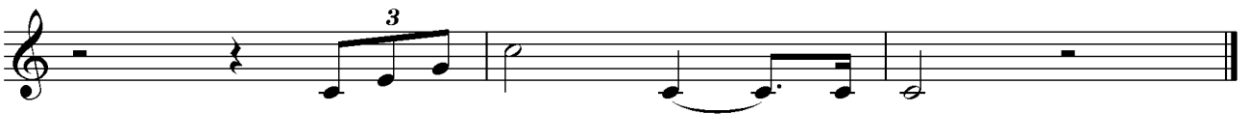

Figure 1

However, this was only recorded one time. Every time the listener hears this theme played after the opening, he is hearing either an exact repeat of the opening statement or a transposed version of the opening statement. Digital technology is also used in this project to replace repeated notes. Even though the second line "G" in figure 2 is repeated fourteen times, only one was recorded.

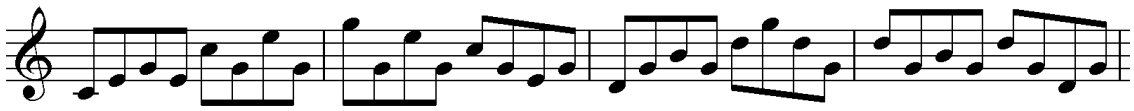

Figure 2

One eighth note "G" was found, copied, and pasted back into the phrase to replace every repeated "G." Every second line "G" the listener hears in this phrase is the same "G." This same type of edit was done for every repeated note in this passage. It was necessary to play one acceptable eighth note of each pitch. Then it was

simply a matter of copying and pasting that eighth note into the correct place. Just as one would copy and paste a passage of text in word processing software. Of the thirty-two notes in this passage, only nine were ever played. Figure 3 shows what was actually recorded to create the illusion of the complete phrase shown in Figure 2.

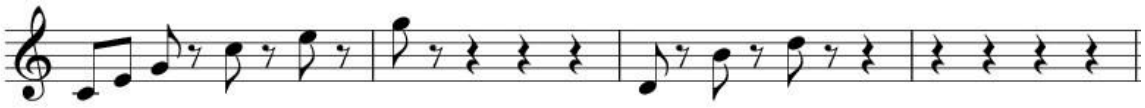

Figure 3

Furthermore, the engineer could have reached the same result by recording even less than the nine different pitches in Figure 3, by transposing other notes. For example it is possible to play one note in the middle of the required register of this passage. The "B" in the staff is almost half way between the "G" above the staff and the "C" below the staff. The engineer could simply take one "B" and transpose it to create the entire passage. However, the greater the distance of transposition, the more distorted or unnatural the original sound becomes.

Part II

The second part of this project will clearly exploit the degree to which a sound engineer is able to manipulate aspects of time, pitch, dynamics, and timbre. After hearing the examples of the edits that took place in the first movement of the Hummel Trumpet Concerto, the reader will now experience a more controlled environment to more easily allow the listener to hear variables of time, pitch, dynamics and timbre as they are individually manipulated by the sound engineer.

A series of brief audio examples follow. Each contains one planned error pertaining to one of these aspects. The listener will be able to hear each short example containing the planned error, immediately followed by what that same passage sounds like after the engineer corrects the error.

Tracks 3 and 5 each contain dynamic errors. The first example is played *forte* throughout followed by track 4 which contains the corrected dynamic manipulation of track 3. The fifth track was played *piano.* Listen to the track 6. to hear how the timbre of sounds differ. This is difficult to mask due to the nature of acoustical principles and overtones that determine how brass instruments create sound.

The next set of examples are played at uncharacteristic tempi. Track 7 is to too slow while track 9 is too fast. Notice the difference in sound that results from slowing down recorded material versus speeding up material.

Track 11 contains an unedited performance of the audio sample. Tracks 12-16 were transposed into different keys. Notice how the sound becomes more distorted as the interval of transposition increases.

Tracks 17 and 18 exhibit manipulations performed by an equalizer(described in chapter three of this document). In the first of these two examples the low end of the frequency spectrum was removed and the high end increased. In track 18, the high end of the frequency spectrum was removed and low end slightly increased.

The final example on track 19 contains wrong notes. The corrected example on track 20 was achieved by transposing only the wrong notes by the necessary interval to create the desired result.

Accompanying CD Track List

1 Movement I of Hummel Trumpet Concerto (Edited)

2 Movement I of Hummel Trumpet Concerto (Original Material)

3 Loud

4 Loud corrected

5 Soft

6 Soft corrected

7 Slow

8 Slow corrected

9 Fast

10 Fast corrected

11 Original Pitch

12 Minor 2nd up

13 Minor 2nd down

14 Minor 3rd up

15 Minor 3rd down

16 Perfect 5th up

17 High EQ

18 Low EQ

19 Wrong Notes

20 Wrong Notes Corrected

6. Importance of Live Performance

Just as a picture represents a limited portion of reality, so does a digital sound representation. However, this may not initially be as noticeable to the listener because people are less familiar with modern recording technology than photography. In addition, more people are experiencing music through recordings than live performance. Robert Philip discusses this trend. "The availability of music today can be taken for granted in the prosperous parts of the world, because it is all accessible on CD."[1] This chapter focuses on the necessity of attending live performances to aid in musical development as well as suggesting some considerations for when recordings must be used as a substitute.

With the exception of the previously mentioned school of thought, recordings will always be a representation of an event. By nature they are meant to simulate a live performance experience. In addition, most students do not take advantage of the technology that allows for the best quality listening experience that is presently possible. Not only is the student absent from live performance, but the substitute avenue of experience has levels of quality within its own structure from which students often choose

[1] Robert Philip, Performing Music in the Age of Recording, (New Haven: Yale University Press, 2004),9

options of minimal qualities. Students are aware of these levels of quality and the majority consciously choose digital representations of low quality.[2] As a result of this choice, students reinforce concepts that maintain the barrier which separates them from the best models of sound. Students do not utilize the best resources available to them by avoiding both live performances and high quality recordings.

When asked about using the highest quality audio equipment to hear recordings John Holt insisted it is "Very important."[3] Anthony Plog's response was:

> If the performance is great, one can get great pleasure from hearing it on a poor to mediocre system. But, of course, the better the system, the closer one is to the real life of the piece being performed.[4]

His response stresses importance of always keeping live performances as the best listening experience while acknowledging the reality that many lower quality formats are often chosen.

Students must attend live performances to hear how other performers truly sound. Live acoustic performances cannot be manipulated. The student is experiencing music

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[2] Ken Wendt, Listening Habits Survey, March 2010

[3] John Holt, Electronic Mail Interview March 2010 (see appendix)

[4] Anthony Plog, Electronic Mail Interview March 2010 (see appendix)

as it happens in real time. The importance of attending live performances is one of the main aspects of musical pedagogy that has and will remain constant as technology changes. Just as a photograph cannot provide the same experience of traveling, recordings are missing large aspects of experience (musical and other) to which those in attendance have access, even if the referenced recordings are of live performances. When using recordings the listener surrender's his own ability to hear and interpret musical sounds, to that of the engineer and available equipment.

The student's concept of sound directly influences the response or outcome. Philip Smith, principal trumpet of the New York Philharmonic says the following on his *Orchestral Excerpts for Trumpet* CD. "Do not be afraid to copy someone's style. It is through this process that we begin to develop our own."[5]

It follows that one who hears many live performances will have a more authentic musical vocabulary to reference than one who rarely attends live performances. There is no equal substitute for experiencing a live performance. Rick Baptist, Allen Vizzutti, John Holt, and Anthony Plog, all agreed that recordings cannot convey the intensity,

[5] Philip Smith, *Orchestral Excerpts for Trumpet*, Summit Records, 1995, B0000038JG.

emotion, and artistry of live performance.[6] These live performances provide the strongest and most reliable sounds from which others can choose to emulate or not. Avoiding live performances limits the student's concept of sound and prevents further musical growth. In addition, a passive attitude towards attending live performances does not help the threatening economic circumstances within which professional musicians currently work.[7]

In focusing on the importance of attending live performances the intent is not dismiss all recordings as irrelevant and useless. Rather, it is to suggest how much more the student can experience from a live performance. When asked if recordings can convey the intensity, emotion, and artistry of live performance, Alan Vizzutti specifically said:

> I do not. I have toured with world class artists and listened to them night after night. I was blown away by how much more intensity and emotion there was live than on recordings I knew. And the same artists have world famous high quality recordings we admire.

If it is clear that attending live performances is the best way to expand and improve one's concept of sound and musical vocabulary, it logically follows that students

[6]Vizzutti, Allen. Written Interview March 2010

[7] Daniel Watkin, "Strike at Cleveland Orchestra Points to Classical Music Woes," *New York Times*, (January 18, 2010), http://www.nytimes.com/2010/01/19/arts/music/19orchestra.html

should be attending as many live performances as possible. However, survey results from this research indicate otherwise.[8] (See Appendix A and B).

In the event that the student must listen to a recording because hearing a live performance is not possible at any given time, there are factors which must be kept close in mind. Robert Philip wrote:

> …anyone who does not know something of the history of recordings as a technology and as a musical and social phenomenon, and who is unaware of the ways in which the sounds that issue from loudspeakers are likely to have got onto the disc, is easily misled when making musical judgments about the performance of them.[9]

This advice is especially true for the student who is developing his concept of sound.

There will obviously be times when hearing a live performance of a specific piece will simply not be possible for many reasons. However, in this situation when the student goes to recordings to enhance his study, he should consider the points given in chapter 4 of this document discussing the perceived disadvantages of modern recording technology.

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[8] Ken Wendt, *Listening Habits Survery*, March 2010 (see appendix)

[9] Philip, Robert. *Performing in the Age of Recording*. Yale University Press: 2004

7. Conclusion

This research is based from the fundamental understanding of the pedagogical importance of a concept of sound. Recent publications in modern brass pedagogy literature approach each student as unique. It follows that teachers should grow well acquainted with the sources from which their students develop concepts of sound.

Today's students are increasingly relying on internet-based recordings rather than live performances as their source for this concept of sound. The results of which may be, at times, both unrealistic and damaging to motivation. Modern digital recordings without question, include some type of manipulation which most commonly include changing aspects of time, pitch, dynamics, and timbre. In addition to the aforementioned editing process of digital technology, the problem is exacerbated by the choice of many students to reference low quality formats of recordings. Online stores and sources such as iTunes and YouTube are simply more popular than other high definition quality audio options.

Serious teachers need to consider these issues to better assess and understand student behavior and psychology. Moreover a fundamental knowledge of digital technology will

assist those aspiring to use this technology. One can save much time and money from such a basic awareness.

Most importantly, and perhaps surprisingly, one gains a stronger appreciation for live, human-driven performance as a result of this research. There is something great to be said for the musicians whose live performances consistently go beyond their flawless recordings, even if not always flawless. The value of such performances and performers should be supported at a time when ubiquitous technology may keep listeners suspect of musical integrity and spirit.

This research has influenced the author's approach to trumpet pedagogy and performance in many ways. Most importantly teachers should surround students with as many opportunities to experience professional live performances as possible. This should take place at local, national and international levels. Each semester faculty should strive to bring qualified guest artists to their institution and institutions must recognize these expenditures not as enhancements to the curriculum that are discretionary, but as a core part of the teaching/learning process. Teachers should remain aware of the schedules of local performing arts venues and announce these concerts to their students.

Teachers should plan experiences that involve travel and interaction with the significant soloists and ensembles on

a regular basis and again, institutions need to recognize the essential role in these experiences and plan accordingly. There is certainly no substitute to hearing live The Chicago Symphony Orchestra, Metropolitan Opera or Dallas Wind Symphony. Furthermore, concepts of style and sound differ around the world and experiencing these sounds will provide a wider sonic palette from which students can form their own concept of sound.

Teachers should consciously try to arrange visits that feature artists from a wide variety of musical genres. These might include performers that specialize in modern unaccompanied literature, baroque, jazz chamber music, lead playing, commercial playing, studio performers, classical chamber musicians and so on.

This research also influences me to reconsider elements of curriculum teachers deem appropriate for performance majors. Most performance majors will depend on the recording process at some point to market themselves whether for an audition, job application, or press package. It follows teachers should provide these students with fundamental knowledge of the current recording technology. The performance major should have access to a basic understanding of the nature of acoustics, microphone placement, data management, and digital audio. Learning

this information and these skills proves to be very beneficial and increases a student's marketability.

This research inspired the author to contemplate a requirement that students submit weekly practice and performance recordings. These objective records encourage students to continue to raise their personal standards by providing an objective source to evaluate progress.

In a performance major's last year, teachers should strongly encourage the student to professionally record a piece of literature suitable for strengths of the student. Simply going through the recording process teaches the student many things including the importance of daily preparation, the benefits of recording individual practice, as well as addresses aspects of performance psychology, and makes the student balance technical and musical aspects of playing within the limitations of a recording session.

Moreover, this project should be done in conjunction with the recording technology students when possible. Upon completion, this collaboration gives each student a product to use for their resumé. Students will also learn from interacting with each other. Each is trained to understand time, pitch, dynamics, and timbre from a different perspective. It is intended that students may begin to

form judgments about the purpose of art music, their role in the art, and what they plan to contribute.

When digital representations must be used as a substitute to live performance teachers should provide the best possible quality audio equipment available. In applied lessons and master-class settings, high definition audio should be used and MP3 and similar reduced quality files should be avoided. Teachers should advocate the use of technology that allows for high definition playback so their students can experience digital representations in their least distorted form.

It is important for teachers to accurately model expected behaviors of their students. Therefore staying active as a performer continues to offer a quality concept of sound for students to experience and emulate. It follows that teachers should continue to record their own practice and performances when their students can observe this. Recording duets in applied lessons or trumpet trios with students is a good way for a teacher to model this behavior. If teachers encourage their students to professionally record a piece, they should also do the same. This allows teachers to stay familiar with the current technology and can increase the teacher's motivation to stay active as a performer.

Teachers also need to closely monitor the habits of their students because many things can influence a student's concept of sound. Teachers should actively reinforce students to reference live performances before any other sources and quickly address student habits destructive to this standard.

When observing the habits of students, teachers ought to note when motivation and self esteem begin to decrease, and quickly address the issue with literature that suits the strengths and comfortably addresses the weaknesses of these students. It is also beneficial to maintain a fundamental awareness of the current technological trends of recording technology. Keeping an active recording schedule will ensure this regardless.

With the current state of recording technology, I believe these ideas and practices will support a realistic and a more defined concept of sound for students, which modern pedagogues stress to be the best foundation for musical success.

Glossary

AIFF. Audio Interchange File Format (AIFF). AIFF files are often used to store digital audio data on Apple computers as opposed to the .wav format for PCs.

Bandwidth. A data transmission rate; the maximum amount of information (bits/second) that can be transmitted along a channel

Kbps. Abbreviation of kilobytes per second

MP3. Acronym for MPEG layer 3, which is a compressed audio format. A compression ratio of up to 12 to 1

Wav. Abbreviation for Waveform Audio File Format. Sometimes referred to as a "WAVE" file is a file format standard for storing audio on personal computers.

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Appendix A

These survey results are representative of both undergraduate and graduate students from Bowling Green State University, The University of North Texas, Illinois State University, and The University of Memphis. All but thirteen of the students surveyed were trumpet students.

The **bold and underlined** numbers after each letter choice indicate the number of students who chose that letter.

Wendt Listening Habits Survey

1. If I am working on music for a lesson/recital/audition, I listen to recordings as part of my regular preparation?

a) **96** Yes
b) **6** No

Stop if you answered "No" to #1.

2. I listen to recordings _____.

a) **17** More than three times a day
b) **14** Once a day
c) **50** Several times a week
d) **10** Once a week
e) **4** About twice a month
f) **1** Less than twice a month

For survey responses 3-6:

Nearly every time estimates 95% of the time
Most of the time estimates 75% of the time
Sometimes estimates 50% of the time
Rarely Estimates 20% of the time

3. I listen to recordings through the ear buds of an Ipod or similar MP3 player_____.

a) **8** Nearly every time
b) **25** Most of the time
c) **36** Some of the time
d) **24** Rarely
e) **6** Never

4. I listen to recordings through laptop speakers _____.

a) **9** Nearly every time
b) **16** Most of the time
c) **35** Some of the time
d) **24** Rarely
e) **15** Never

5. I listen to recordings from hard copy CDs or DVDs (or files comparable to the quality or wav.) through average stereo speakers that support better quality than most small computer speakers but less than high definition or blue ray audio quality _____.

a) **14** Nearly every time
b) **26** Most of the time
c) **23** Some of the time
d) **27** Rarely
e) **12** Never
f) **0** I don't know details of my equipment

6. I listen to recordings through high definition audio (blue ray or equivalent) equipment and speakers that support it _____.

a) **1** Nearly every time
b) **2** Most of the time
c) **8** Some of the time
d) **29** Rarely
e) **55** Never
f) **4** I don't know details of my equipment

7. The following best describes my knowledge of different audio files.

a) **15** I am an audio guru. I know specific details of different file types MP3, wav, AAC, blue ray, etc.
b) **40** I know which files are higher quality than others but not much else.
c) **23** I know which file types I have, but I don't know how they compare to others.
d) **16** I know very little about this.
e) **5** I don't know anything about this, I just listen.

8. If I am working on a trumpet solo/sonata/concerto, to hear recordings I go to _____ first. (choose your normal course of action)

a) **30** Youtube or other free online sources
b) **22** Naxos online music library
c) **33** I-tunes, Rhapsody, or other similar legal downloading software
d) **2** Torrents or other free file sharing software
e) **9** A store (online or not) to purchase a hard copy CD or DVD
f) **0** Live performance
g) **1** This area of playing does not apply to me

9. If I am working on classical orchestral/ensemble literature, to hear recordings I go to _____ first. (choose your normal course of action)

a) **34** Youtube or other free online sources
b) **24** Naxos online music library
c) **27** I-tunes, Rhapsody, or other similar legal downloading software
d) **1** Torrents or other free file sharing software
e) **7** A store (online or not) to purchase a hard copy CD or DVD
f) **2** Live performance
g) **2** This area of playing does not apply to me

10. If I am working on jazz solo or ensemble literature, to hear recordings I go to _____ first. (choose your normal course of action)

a) **44** Youtube or other free online sources
b) **9** Naxos online music library
c) **24** I-tunes, Rhapsody, or other similar legal downloading software
d) **1** Torrents or other free file sharing software
e) **6** A store (online or not) to purchase a hard copy CD or DVD
f) **1** Live performance
g) **12** This area of playing does not apply to me

11. **Not including** required recital attendance courses or popular culture, each year I attend _____ live performances featuring the trumpet.

a) **7** More than 30
b) **12** 20-30
c) **7** 15-20
d) **13** 10-15
e) **25** 5-10
f) **35** Less than 5

12. **Not including** required recital attendance courses or popular culture, each year I attend _____ live performances featuring something other than the trumpet.

a) **13** More than 30
b) **8** 20-30
c) **11** 15-20
d) **19** 10-15
e) **25** 5-10
f) **23** Less than 5

13. **Including** recital attendance courses, each year I attend _____ live performances featuring the trumpet.

a) **25** More than 30
b) **12** 20-30
c) **18** 15-20
d) **25** 10-15
e) **16** 5-10
f) **3** Less than 5

14. **Including** recital attendance courses, each year I attend _____ live performances featuring something other than the trumpet.

a) **29** More than 30
b) **14** 20-30
c) **17** 15-20
d) **16** 10-15
e) **19** 5-10
f) **4** Less than 5

15. Regardless of the type of music (classical, jazz, rock, hip-hop, etc) to hear a recording of something I do not already have, I will first go to _____.

a) **48** Youtube or other free online sources
b) **11** Naxos online music library
c) **28** I-tunes, Rhapsody, or other similar legal downloading software
d) **6** Torrents or other free file sharing software
e) **4** A store (online or not) to purchase a hard copy CD or DVD
f) **1** Live performance

Appendix B

Table 1

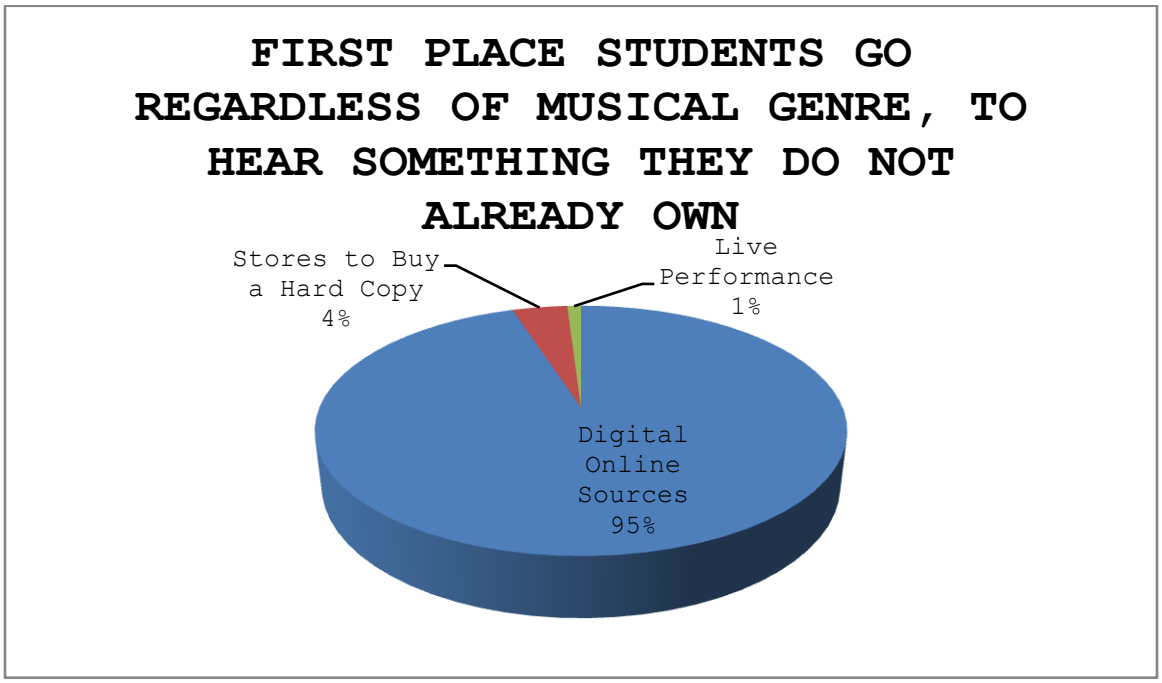


Table 2

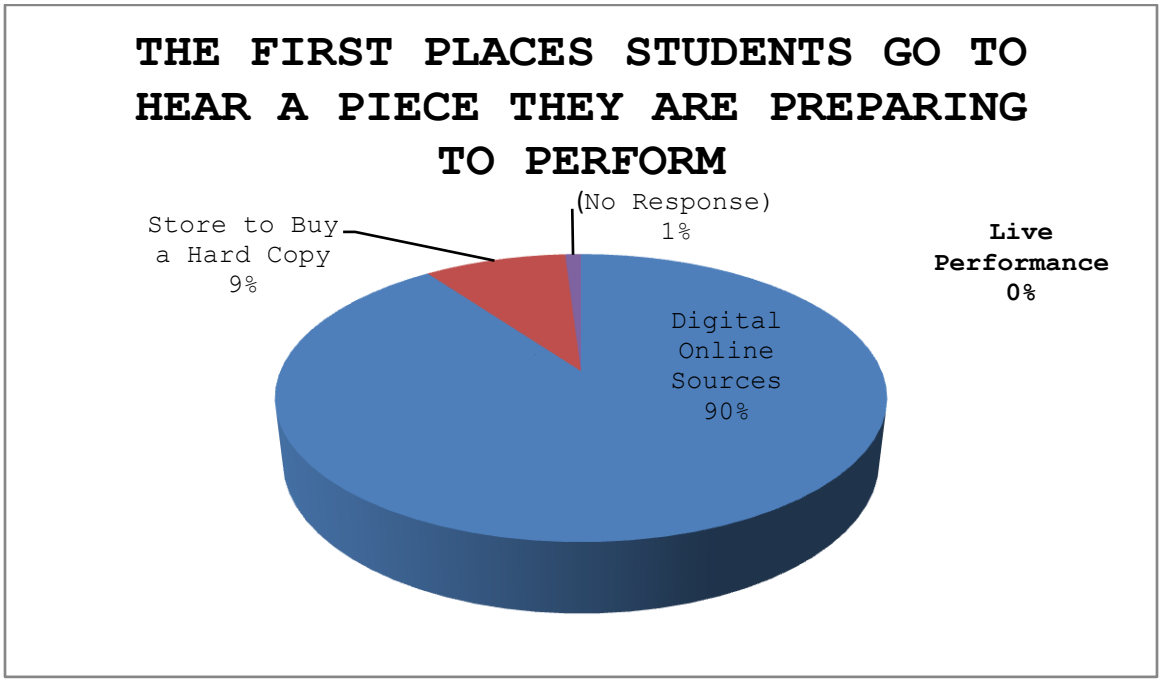


Table 3

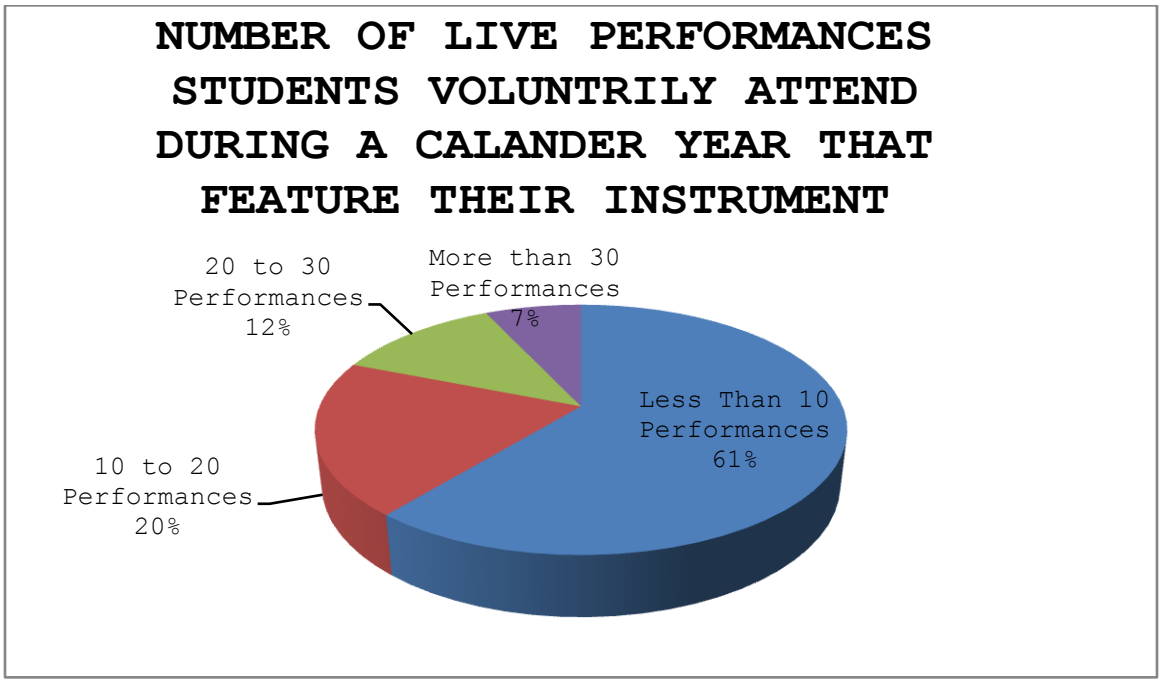


Table 4

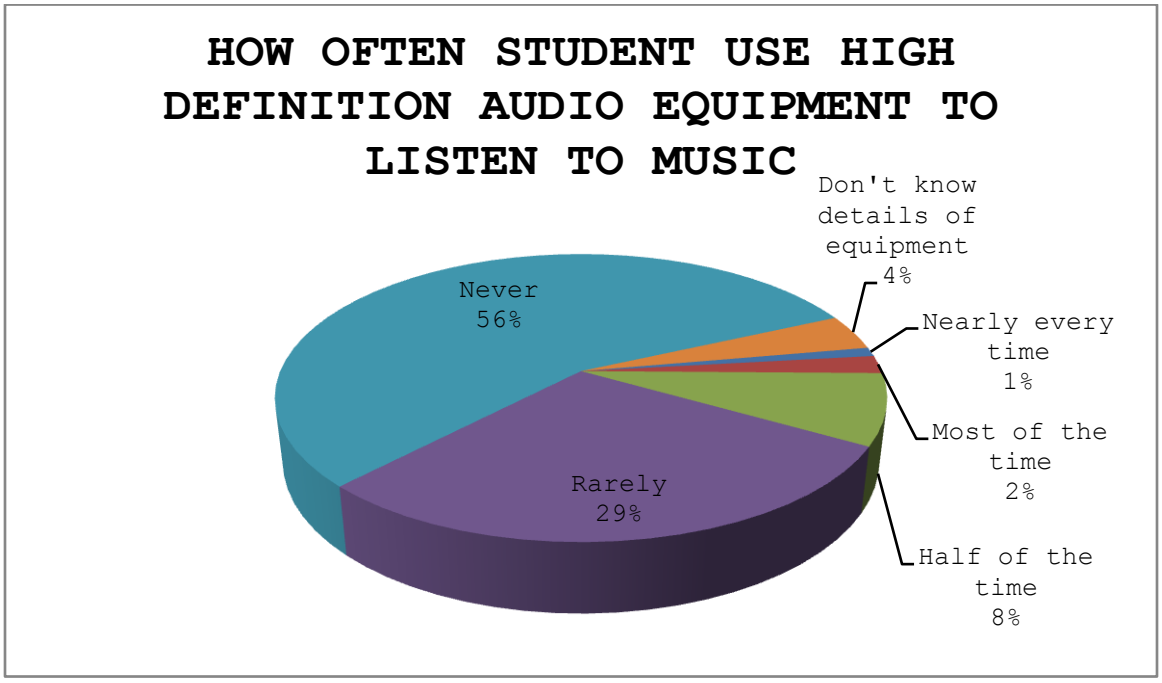
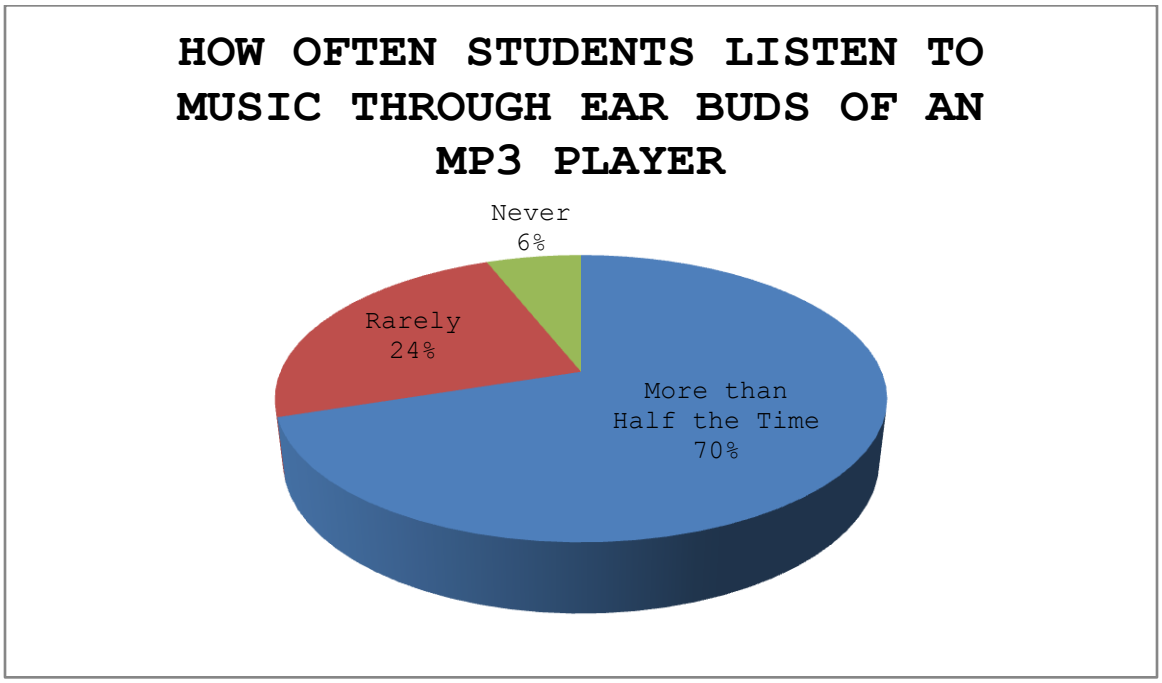


Table 5


HOW OFTEN STUDENTS LISTEN TO MUSIC THROUGH EAR BUDS OF AN MP3 PLAYER
Never 6%
Rarely 24%
More than Half the Time 70%

Appendix C

No editing
65-98
104 beat four - 105 beat 2
112 beat two - 115
118 beat two - 119
122-127
136 beat three - 146
178 - 182 beat one
189-196
222 - 224
229 - 231
234
235 beat four - 238
247 - 248
258 beat four - 261
266 - 269
281 beat four - 282 beat one
283 + of two and three
284 + of 2 and three
287 - 299

Edited Measures	**Means of Editing**
99 G dotted half	copied from 104
105 beats three and four	copied from 101, B nat Transposed down half step
111 beat four - 112 beat one	copied from 112 beats two and three
116	copied from 112
117 beats three and four	copied from 112 beats three and four
118 D half note	copied from 102
119 D half note	copied from 102
130 - 131	any repeated eighth note pitches were copied from the first eighth in the passage
132 - 136	any repeated triplet pitches were copied from the first one in the passage
176-177	67 transposed down a major third
182 beat four - 183	112 transposed up a half step
185 first three eighths	79 (C,B,A) transposed up a half step
185 last three eithths	122 (D, E, F-sharp) transposed down half step
186	195 (G) transposed up half step
189	copied from 179 beat one
193 beats one and two	80 transposed up major third
197 - 198	All except low C and B natural, individually copied from 130-131
199 - 200	All except low A, individually copied from 132 - 134
202	203 transposed up whole step
204	203 first three eighths transposed down whole step
204	203 beat three transposed down half step
210	Copied from 67
218	Copied from 74
221	Copied from 74
227	67 transposed down a minor third
231	67 transposed down a perfect fourth
233	copied from 92
235	copied from 80
239	copied from 115 Beat one
241 beat four	copied from 66
242 beat two	copied a D from 199 repeated it three times and transposed down a whole step
245 beat four	copied from 66 (E natural transp. down half step)
253 beat four - 254	112 transposed up a perfect fourth
255 beat one and two	copied from 115 beat one and two

258	112 transposed up a perfect fourth
265	copied from 256
273 - 276	any repeated eighth note pitches were copied from the first eighth in the passage

Appendix D

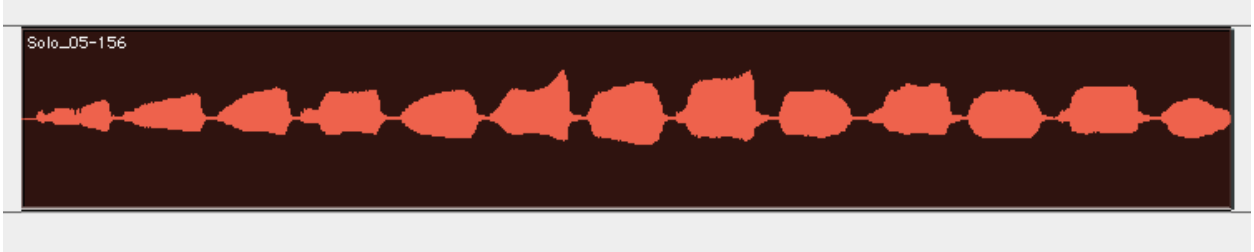


Figure 4 shows a series eighth notes that were played with length before any manipulation.

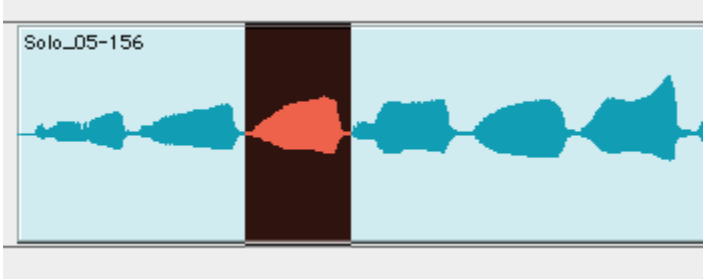


Figure 5 shows the selection of one note from a serious of eighth notes.

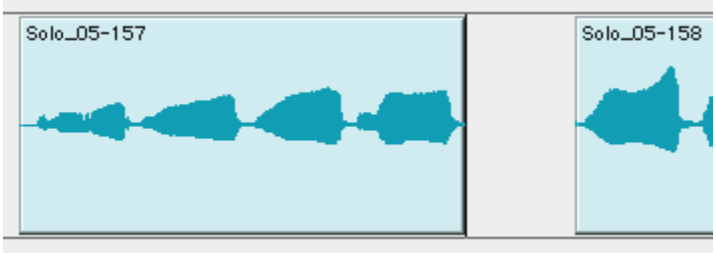


Figure 6 shows the result of removing one eighth note from a series.

Figure 7 shows the result of removing every other eighth note in the series.

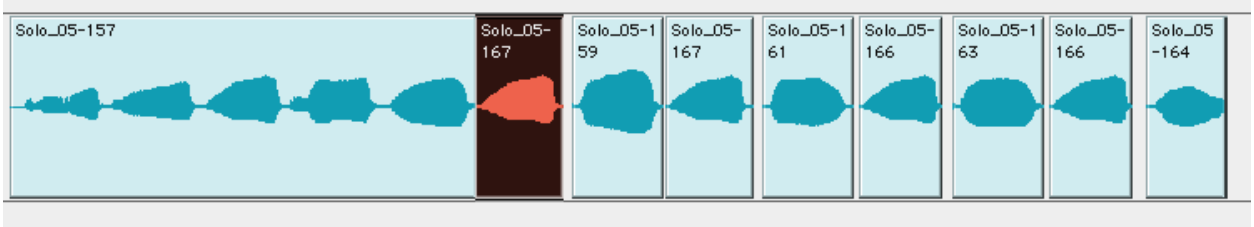


Figure 8 shows the result of copying the selected note and repeatedly pasting this same note into all the spaces shown in figure 7.

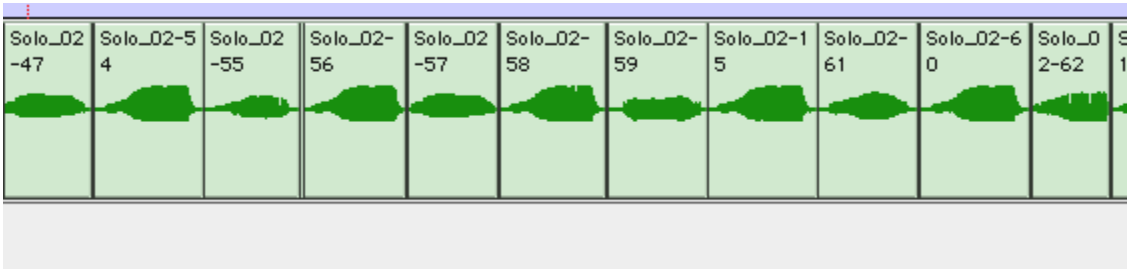
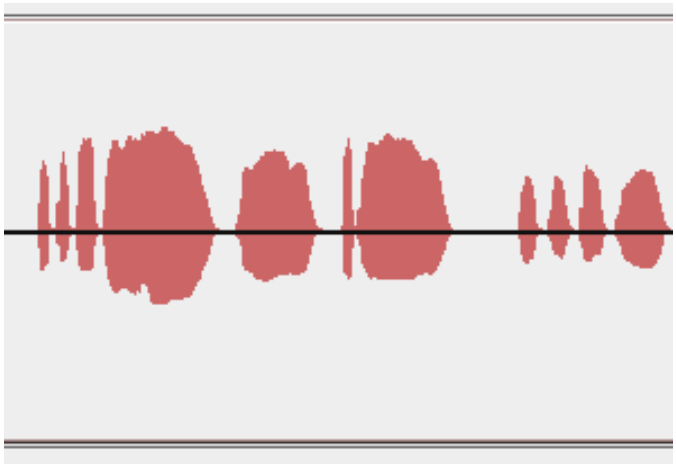


Figure 9 shows a series of eighth notes that have been edited together. Notice how some wave form shapes repeat exactly. Notice the absence of space between vertical lines. Cross fades have been inserter between each note. This is an example of an edit in the final stages.



The horizontal black line in figure 10 represents a pitch transposition tool. When it is perfectly flat (as shown) no effect is taking place.

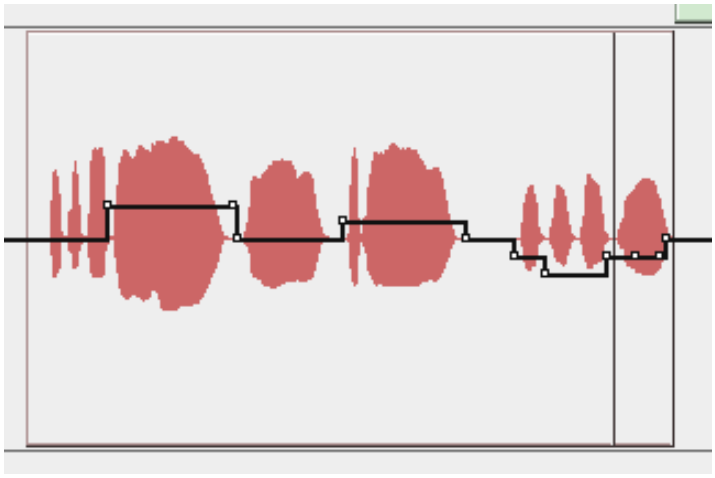


Figure 11 shows what the pitch transposition tool from figure 10 looks like when it is in use. The fourth wave form the left is between two vertical lines. This note has been transposed higher. The four wave forms furthest to the right have all been transposed lower. The second and third wave forms from the right have both been transposed by the furthest interval down.