

THE PENNSYLVANIA STATE UNIVERSITY
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SCHOOL OF MUSIC

EXPLORING MIDI SEQUENCING SOFTWARE AS A SCORE STUDY TOOL FOR
ENSEMBLE CONDUCTORS

JARED S. JUDGE
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Reviewed and approved* by the following:

Dr. O. Richard Bundy
Professor of Music Education
Thesis Supervisor

Dr. Joanne Rutkowski
Professor of Music Education
Honors Adviser

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

The purpose of this study was to explore the potential inclusion of MIDI Sequencing Software in a conductor's score study toolbox. Based on prior experience and a review of relevant literature, I proposed that MIDI Sequencing Software could enable conductors to more efficiently internalize a score than is possible with traditional score study tools. This study contains an evaluation of the traditional score study tools to determine their capabilities, limitations, and perceived efficiency. It also contains an introduction to MIDI Sequencing Software as a score study tool in the form of an Initial Guide for Conductors. The Initial Guide was implemented with a high school orchestra during my student teaching experience. Based on its implementation, MIDI Sequencing Software was evaluated for its capabilities, limitations and perceived efficiency. Lastly, the Initial Guide was revised based on its evaluation creating the Conductor Guide to Digital Score Study. Through this study, I determined that MIDI Sequencing Software is an extremely powerful tool that can be used to study scores, but should be supplemented by the conductor's primary instrument, voice and inner ear to provide a complete score study experience. I also discovered MIDI Sequencing Software's pedagogical offerings, and made further recommendations for study in that realm of possibility.

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EXPLORING MIDI SEQUENCING SOFTWARE AS A SCORE STUDY TOOL FOR ENSEMBLE CONDUCTORS

Chapter I: Introduction

Score study is an essential component of the preparations to rehearse and conduct a musical ensemble. Distinguished wind band conductors Frank Battisti and Robert Garofalo summarized the benefits of score study in the introduction to their *Guide to Score Study for the Wind Band Conductor*: “To communicate the expressive potential of a musical composition to an ensemble in an effective and efficient manner, a conductor must first acquire an understanding of the score. Interpretive decisions are based on insight and knowledge gained through thoughtful and imaginative study of the score. Hence the conductor’s first task is score study” (Battisti & Garofolo, 1990, p. 1). This process has no definitive beginning or end as score study is an ongoing process that informs many decisions an ensemble conductor must make. These decisions include, but are not limited to repertoire selection (with attention to technical considerations), style and interpretation, and gestural needs.

Much literature has been devoted to the topic of score study, particularly suggesting score study processes that have worked well for certain conductors. Inherent in each of these processes are suggestions for sound-creation tools (i.e. those that either physically create sound or manifest sound in the conductor’s inner-ear) to use in the score study process. The tools suggested by most of these guides include: a piano, a

metronome, the conductor's primary instrument, the conductor's voice, recordings and live performances, and the conductor's inner ear (audiation).

Most of these guides were written in the 20th Century when music technology was fairly inaccessible to the technological novice. Since then, developments in hardware and software have made music technology readily accessible and easy to use. Current music technology is able to fulfill a diverse set of musical needs. The specific technology examined in this study is MIDI Sequencing Software. MIDI Sequencing Software enables the input and playback of musical data (including but not limited to tempos, pitches, durations, and dynamics).

The purpose of this study was to explore the potential inclusion of MIDI Sequencing Software in a conductor's score study toolbox in order for the conductor to more efficiently internalize a score than through traditional score study tools. This study contains an evaluation of the aforementioned traditional score study tools for their capabilities, limitations, and perceived efficiency. It also contains an introduction to MIDI Sequencing Software as a score study tool and a similar evaluation of its capabilities, limitations and perceived efficiency.

In order to evaluate MIDI Sequencing Software as a score study tool, I needed to determine how to use it as a score study tool. The first problem of this study was to develop an Initial Guide containing instructions on how to set up and utilize MIDI software as a score study tool. The second problem was to implement the Initial Guide in my score study process with the intention of rehearsing a specific piece with an ensemble. Based on this implementation, the Initial Guide was evaluated for clarity,

logical sequencing and ease-of-use, and the software itself was then evaluated as a score study tool. Therefore, the third problem of this study was to revise the Initial Guide based on its implementation. The last problem of this study was to evaluate MIDI Sequencing Software as a score study tool in comparison to the traditional score study tools.

Chapter II: Evaluation of Score Study Tools and Literature Reviews

Overview

This section aims to evaluate the capabilities and limitations of the six traditional tools used for score study: a keyboard instrument (most often a piano), a metronome, the conductor's primary instrument (piano excluded), the conductor's voice, recordings or a live performance of the given musical work, and the conductor's inner ear (audiation). For each tool, a brief description is followed by an analysis of what specific musical benefits are offered to conductors by its use, followed by an analysis of the specific limitations that it possesses. Furthermore, this section reviews relevant literature in the fields of score study processes, score study tools, and music technology I found to be applicable to the realm of score study.

Score Study Tools

Keyboard instrument. A keyboard instrument (most often a piano) is used by a conductor to gain an aural image of the score being studied. This process encompasses several smaller-scale processes, including playing individual lines from a full score on the keyboard, playing several lines of the full score at the same time, playing the harmonies of a full score by vertical analysis (either prepared or at-sight), playing a combination of single or multiple lines from the score in combination with the harmonies, and playing a reduction (most-often at-sight) of the full score.

Playing an orchestral score at the keyboard is an effective score study tool. It provides a kinesthetic interaction with the notation that enables a conductor to literally feel the score's range, melodic contours, rhythmic tendencies, textures, etc. It gives

instant and fairly detailed aural feedback as to the pitch and rhythmic content in the score. It also aurally approximates the dynamics and articulations contained within the score. Additionally, as a polyphonic instrument, it demonstrates multiple musical lines simultaneously and the resultant harmonies contained within the score. This provides opportunity to explore the balance between different lines. It also provides an understanding of the large-scale structure of a piece by playing larger sections of the work.

Additional benefits to a conductor's overall musicianship include the facilitation of learning the wide variety of transpositions used in orchestral scores, improvement of the conductor's keyboard skills, and aural exposure to a variety of musical concepts and orchestral works.

The limitations of using a keyboard as a score study tool are plentiful. The first limitation is the skill-level of the conductor as a keyboardist because orchestral literature is not necessarily easy to play on a keyboard. Additionally, many orchestral works contain ranges that are simply unplayable by two hands on a keyboard. The next limitation is the lack of timbres offered by the keyboard instrument. An orchestra is capable of a near-infinite variety of timbres and colors, and these are simply impossible to achieve on a keyboard instrument.

Additionally, the keyboard offers no means to sustain a pitch other than clever manipulation of a piano's pedals or keeping a key depressed, but even these solutions are inadequate: The pitches immediately decay after the hammer or plectrum strikes or plucks the string. In the same vein, notes are unable to be dynamically shaped after they

are played, causing dynamics to only be affected by the attacks of notes. An additional limitation of the keyboard is its temperament. Most keyboards (except perhaps period instruments) are tempered with equal-temperament that allows for intervals to sound equal in every key, but the overall effect is a sacrifice in intonation. Lastly, it is impractical to transport a keyboard wherever a conductor wishes to study scores.

Metronome. A metronome is a simple but extremely useful tool in score study in that it provides a model of the pulse's speed in a given work, provided the composer indicated the precise metronome marking in the composition. For scores with metronome markings, some conductors take the written marking as the only tempo for the piece while others use it as a guideline for making their own creative decision for the tempo. For scores without metronome markings, it is necessary for conductors to translate the text that suggests a certain speed in order to inform their decisions about tempo.

The benefit of using a metronome in score study is that it helps the conductor determine the tempo of a piece which informs all other aspects of score study. Without the use of a metronome, the conductor's interpretation of the tempo will be a guess at best, or an imitation of another's interpretation at worst. Additionally, it provides an extremely steady pulse that conductors can constantly use as a reference and to check for their personal tendencies to speed up or slow down.

The limits of a metronome are its inflexibility for variations in tempo: Once it is set at a tempo, it will remain at that tempo despite the conductor or composer's desire otherwise. To change the tempo, the conductor must reset the metronome, thereby interrupting the score study process. Additionally, it provides no other musical

information than the tempo itself, which is completely useless without the rest of the musical information.

Primary instrument. The conductor's primary instrument is very useful as a score study tool. The process of studying a score using the primary instrument involves playing lines directly from the full score. The act of playing a score on the conductor's primary instrument provides the conductor with an aural image of these lines individually, and offers a much more accurate representation of the way the lines will actually be played. Assuming the primary instrument is not a keyboard instrument, the primary instrument offers a variety of expression devices that more closely represents the capabilities of orchestral instruments. Included in these expression devices are vibrato, a variety of attacks and releases, the capability to sustain and musically shape individual notes and specific techniques unique to certain instruments (e.g. flutter-tonguing for certain woodwind and brass instruments, etc.).

Additionally, for most instruments, temperament is not rigid so the conductor may adjust the intonation of certain notes for harmonic and melodic accuracy. Another benefit of playing the score on the conductor's primary instrument is that it provides insight into the performance challenges associated with a given passage.

Some limitations of studying a score using the conductor's primary instrument is that it is only possible to play one line of a score at a time. This leaves the issues of harmony and balance to be dealt with by other score study tools. As with a keyboard instrument, the timbre palate of the primary instrument is limited. Another limitation is that the range of the instrument most likely does not cover the full range of an orchestra,

causing the conductor to use octave displacements to fit the lines within a playable range (which, depending on the instrument and passage, might still be impractical).

Additionally, certain passages may prove completely impossible to play on certain instruments because they were written with the technical capabilities of a different instrument in mind (e.g. playing quick widely-spaced arpeggios is possible on stringed instruments, but fairly impractical on brass instruments).

Voice. Singing from an orchestral score is a commonly used tool for score study. The process for its implementation is singing individual lines from an orchestral score.

Singing individual lines is an efficient way to gain an aural image of the score in the same way that playing individual lines on the conductor's primary instrument is efficient. In many cases, it is technically easier to sing a line than to play it on an instrument because transposition is not an issue and awkward fingerings are eliminated. It also may be slightly easier to explore the phrasing of a melody because of the elimination of technical issues.

On the other hand, singing has similar limitations to playing on a primary instrument, with the added technical limitations present in the voice.

Recordings and live performances. Recordings and live performances of the work being studied are very valuable tools in the score study process. They offer a snapshot-in-time of what another conductor has done with a piece in addition to what artistic decisions the individual performers made within the performance.

The benefits of listening to recordings and hearing live performances include hearing a full-fledged aural manifestation of the score. Recordings contain all elements

that were unable to be addressed due to the design flaws inherent in the previously mentioned score study tools. Additional benefits include hearing every part performed simultaneously with the correct timbres and in the correct range, hearing what the piece sounds like with actual reverb, and in the case of a live performance, seeing what goes into a successful performance of the piece (including the conductor's gestures, the layout of the orchestra, the spacial, instrumental and mallet considerations of the percussion section, and the way the ensemble breathes and moves together).

The biggest limitation with using recordings and live performances as a score study tool is that it is extremely easy to let the artists' decisions in the recordings/ performance influence the conductor's own decisions to the point of artistic plagiarism, especially if it is not clear from the score why certain decisions were made. Additionally, the skill level and intangible factors that went into the performance must be considered because the ensemble playing most likely played a few mistakes during the performance.

Another limitation with recordings and live performances is that the conductor studying the score has no way to physically interact with the music other than just listening and perhaps conducting along, but this act is only valuable for determining gestures and is also governed by the decisions of the performers.

Inner ear (audiation). The conductor's inner ear is an absolutely essential score study tool. In fact, all of the other score study tools evaluated in this section serve to inform the inner ear. It is within the inner ear that the fully-formed aural image of the score is formed and manipulated through thorough and constant study. The processes of assimilating a score into the inner ear without the use of other tools involves using

previously acquired aural skills to look at the score and hear the music. This can be done line-by-line or several lines at once.

Advantages to studying through the inner-ear is that if the conductor's inner ear is trained extremely well, it is possible to hear an entire score accurately without using other score study tools. Every detail in the score can be imagined instantly, and incorporated into the aural image of the score. This aural image can be replayed in the conductor's mind, and adjustments can be made to this aural image based on musical intuition and discoveries made during further study. Additionally, the conductor's gestures are readily determined by the aural image of the score, and having a fully-formed aural image is paramount to being able to rehearse and conduct an ensemble.

The limitations of the inner-ear as a score study tool are dependent on the musicianship, skill level and experience level of the individual conductor. Young conductors will undoubtedly have a more difficult time assimilating the score and manipulating their aural image of it than seasoned professionals will. Additionally, it is easy for the inner ear to become accustomed to the way a passage sounds, and then it becomes difficult to change that if new information demands its change.

Summary of traditional score study tools. The score study tools traditionally used by conductors include: a keyboard instrument, a metronome, the conductor's primary instrument, the conductor's voice, recordings or a live performance of the given musical work, and the conductor's inner ear (audiation). Each tool provides unique features that help a conductor internalize a full score, and are most often used in some combination with each other.

Literature Reviews

This section reviews areas of literature pertaining to traditional score study processes, the sound-generating tools traditionally used during these score study processes, and different music technology that could be used for score study. Every ensemble director utilizes a unique score study process that uses certain sound-generation tools in specific ways. This section explores a few of the suggestions of experts in this field.

Score study processes. In their *Guide to Score Study for the Wind Band Conductor*, renowned wind band conductors Frank Battisti and Robert Garofalo recommend a four-step score study process that includes score orientation, score reading, score analysis and score interpretation. Score orientation encompasses the initial steps in looking at a score including reading all of the front matter, becoming familiar with the format of the score (including transpositions, etc.) and leafing through the rest of the score to glean visual information about the score. Score reading, by their definition, exclusively relies on the inner ear to gain an aural image of the score. In fact, the authors discourage the use of a piano as it “diminishes the challenge of developing inner hearing ability” (Battisti & Garofalo, 1990, p. 23). Score analysis encompasses dissecting each musical component of the score. Score interpretation involves combining the results of the three prior steps into making informed interpretive decisions about the music.

Elizabeth Green and Nicolai Malko present a method of score study in their book, *The Conductor and His Score*. Their method begins with mentally reading the music, thinking it over, studying the score, then coming to audible sound. They suggest starting

with a study of the instrumentation of a score, including the musical content and character as well as technical considerations for each performer. Next they propose a process they call “rationalization of the score” that they define as “the mental approach to it [the score] before it turns into live sound” (Green & Malko, 1975, 14). After this, they recommend completing an analysis to study phrase groupings, dynamics, expression, style and tradition. Their final suggestion is to apply interpretative imagination to the score (using the inner ear) as well as memorize the score.

In *Conducting with Feeling*, Frederick Harris documents interviews he conducted with 12 ensemble directors from various facets of the conducting field. These interviews focus on “how a conductor develops feelings for a piece of music and communicates those feelings to an ensemble” (Harris, 2001, p. vi). Interspersed in these interviews are various tips on score study. Gunther Schuller, a prolific composer and conductor, stated that a good score study process involves “understanding, hearing, and feeling the entire score” (Harris, 2001, p. 34). Aside from these general recommendations for the score study process, these interviews do not provide specific suggestions.

Daniel Kohut and Joe Grant propose a different score study process in their *Learning to Conduct and Rehearse*. Their process includes four steps: an initial overview, a detailed score study, making manual technique decisions, and anticipating performance problems. The initial overview includes researching background, formal/structural, melodic, and harmonic information from the score, as well as singing and playing through parts from the score on a keyboard instrument. They also recommend listening to recordings and attending live performances. Their detailed score study involves

establishing the correct tempo, conducting phrasal, harmonic and rhythmic analysis, marking the score, determining the correct pronunciation and meaning of any text as well as marking bowings and articulations. The manual technique decisions process is fairly straightforward, including such aspects as which parts to conduct and how to decide the division of beats. Their last step of anticipating performance problems includes being able to sing the correct starting pitch for any instrument, knowing where to cue the percussion, intonation, balance, etc.

Lewis Strouse, in his article *Knowing the Score* published in the October 2009 issue of *Teaching Music*, recommends a six-step score study process that is geared towards conducting and rehearsing a K-12 ensemble. These steps consist of researching introductory information, obtaining an overview of the score, marking the score, interpreting the score, anticipating performance issues, and exploring comprehensive musicianship topics that can be taught in a standards-aligned music classroom. Strouse recommends singing and playing the piano to gain an understanding of melody and harmony within the score.

In summary, ensemble directors use a variety of score study processes. Battisti and Garofolo propose a process that includes score orientation, score reading, score analysis and score interpretation. Green and Malko suggest mentally reading the music, thinking it over, studying the score, then coming to audible sound. Harris presents several general score study suggestions including Gunther Schuller's understanding, hearing, and feeling the entire score. Kohut and Grant propose a score study process that includes an initial overview of the score, a detailed score study, making manual technique decisions,

and anticipating performance problems. Finally, Strouse recommend a process that consists of researching introductory information, obtaining an overview of the score, marking the score, interpreting the score, anticipating performance issues, and exploring comprehensive musicianship topics.

Score study tools. Eric Taylor, in his book *Playing from Orchestral Score*, provided a fairly detailed guide on how to play a full orchestral score on a keyboard. The guide covers topics such as transpositions, doublings, omissions for practicality, and other issues to consider when undertaking this process. Taylor stated that, “the main reason for playing from an orchestral score ... is to deepen one’s understanding of the score” (Taylor, 1967, p. 16). In the preface to the guide, Taylor describes the shortcomings of playing orchestral scores on piano: “a pianist cannot do justice to a work which was conceived for the orchestra. He cannot reproduce the timbres of the different instruments. He cannot sustain notes as wind and string players can, let alone shape them with a crescendo. Much of the time he cannot even play all the notes...” (Taylor, 1967, p. 3). Taylor believes that playing from an orchestral score is valuable as rehearsal preparation. The later part of the guide contains musical examples from orchestral works to be played at the piano.

R. O. Morris and Howard Ferguson’s *Preparatory Exercises in Score Reading* is also a guide to playing a full orchestral score on a keyboard. They distinguished between score-reading and playing from score: Score-reading relies on inner hearing while score-playing relies on finger and keyboard facility. They then redefined score-reading as “a synthesis of the following distinct capacities: to take in the content of many staves at

once, to see where the principal melody or melodies are at any given moment, to perceive instantaneously the essential harmonies and modulations, to omit, adjust, or transpose the details of spacing, figuration, etc., as may be necessary to get the music under the fingers, to read the C-clefs without hesitation, to make the necessary transpositions of key” (Morris & Ferguson, 1931, p. iii). The rest of the guide contains exercises in both clef-reading and orchestral score playing at the keyboard.

In summary, Taylor suggested using a keyboard as a score study tool to “deepen one’s understanding of the score” (Taylor, 1967, p. 16). He described the advantages and shortcomings of a keyboard as a score study tool, as well as provided examples of how to use it as such. Morris and Ferguson also described how to use a keyboard as a score study tool, but made sure to distinguish between score-reading and score-playing. Score-reading only uses the inner-ear while score-playing relies on a keyboard in addition to the inner-ear.

Music technology. Kathleen Riley (2005) examined students’ ability to assess different piano performances of the same piece on a Yamaha Disklavier© piano. They were asked to visually analyze the performances by looking at the MIDI data on an earlier version of the MIDI sequencing software Logic© (at this time produced by Emagic), and aurally analyze the performances by listening to the MIDI playback as well as imitating the performances. Students were able to visually analyze performances by answering specific questions about the performance, and were able to aurally analyze the performances by imitation. The researchers concluded that MIDI sequencing software is

a viable tool for performance analysis, as well as a tool to inform interpretive decisions within performance practice.

David Stech (1994) explored the applications of MIDI Sequencing devices to the non-performance activities of musical dictation, harmonic error dictation, and aural comparisons of historical tuning systems. He argued the feasibility of these tasks, and described several of the advantages that MIDI Sequencing Software has over traditional approaches to these tasks such as using a recording or a live performance. These advantages include tempo flexibility, easily locating a passage for instant playback, and repeated listenings through looping.

Jerry Gerber and Michael Prager (2004) discussed several ways to make a MIDI sequenced orchestra sound more realistic. Prager first discussed several options for placing the virtual instruments in the stereo field, the first option being a replication of standard orchestral seating, the second option embracing the limitations of stereophonic audio by panning instruments to the extremes of the stereo field. Gerber discussed making MIDI tracks expressive through careful attention to the ADSR envelope and velocity of each note, as well as through reverberation effects.

In summary, Riley examined MIDI Sequencing Software from a performance analysis perspective. This examination concluded that MIDI Sequencing Software is a viable tool for students to analyze performances and make interpretive decisions. Stech explored the applications of MIDI Sequencing Software to non-performance musical tasks and determined that the technology is a powerful and flexible tool that can be used in various capacities. Finally, Gerber and Prager focused on making MIDI-based virtual

orchestras sound more realistic. They provided several suggestions as to how to accomplish this including but not limited to adjusting the pan position of the instruments as well as applying reverb effects to each track.

Chapter Summary

The traditional score study tools have been preparing conductors to conduct and rehearse ensembles through the methods describe in each tool's evaluation and relevant literature. The literature on music technology indicates that music technology is becoming much more accessible and efficient. These technologies may provide more efficient and effective means of score study that combine several traditional score study tools. My project investigated MIDI Sequencing Software as a score study tool, and evaluated its efficiency and effectiveness through the lens of improving upon the traditional tools and methods.

Chapter III: Methodology and Development of Guide

Methodology

The Initial Guide was created using information from a variety of sources as well as a variety of personal experiences. The sources provided information in order for me to prepare to knowledgeably interact with music sequencing software and to study scores in preparation to conduct an ensemble. The personal experiences helped me analyze the process of inputting full scores into music sequencing software, as well as analyze my personal interaction with the score study process. My exposure to this information and experience led to initial experiments in their combination. The Initial Conductor Guide (Appendix A) was created based on these initial experiments. Its sequence was developed by taking the musical score of work for symphonic orchestra and going through the process of inputting every imagined detail of the score into the music sequencing software while documenting each step and anticipating common errors and pitfalls.

The suggestions of the Initial Conductor Guide were evaluated through implementation involving digitally studying a score in preparation to rehearse and conduct an ensemble. This experience was facilitated by my student-teaching situation in Altoona Area High School in Altoona, Pennsylvania. I chose a score to study using MIDI Sequencing Software from the repertoire that the Symphonic Orchestra would be performing. The particular score I chose was Charles Gounod's *Funeral March of a Marionette*. This piece was programmed for the ensemble by the ensemble director, Mrs. Detwiler and was one of the pieces assigned to me to study and rehearse. I specifically

chose this score to study with MIDI Sequencing Software because of its relatively large instrumentation that contained woodwinds, brass, percussion and strings.

The suggestions and sequence of the Initial Conductor Guide were evaluated through my implementation of the suggested score study process using MIDI Sequencing Software in preparation to rehearse the Symphonic Orchestra. During the implementation of the guide, I reflected on my experiences by writing in a journal (see Appendix B). This journal documented my experience of following its sequence while reflecting on the clarity and ease of each step as well as how efficiently I felt I was absorbing the score. This process began my third week of student teaching and ended one month later when the ensemble performed the work being studied.

Finally, the Initial Conductor Guide was revised based on my reflections on its implementation. These reflections as well as technical considerations within the software used were incorporated into the revisions. These revisions were applied to the Initial Conductor Guide. This revised guide constitutes the Conductor Guide to Digital Score Study (see Appendix C).

Development of Conductor Guide

The Initial Conductor Guide was developed through the synthesis of a variety of personal experiences and literature sources (see Chapter II). Both contributed to my decisions when compiling the Initial Guide.

Personal experiences. The experiences that proved invaluable to my personal competency with MIDI Sequencing Software include INART 258, a course taught at Penn State by Dr. Mark Ballora. Through projects assigned in this class, I developed a

familiarity with Apple's Garageband© (Apple Inc., 2010) and Apple's Logic Pro© 7 (Apple Inc., 2004). I also developed a personal sequence for entering musical data into their interfaces. For personal enjoyment, I continued to explore the capabilities of these programs after the course concluded, and purchased Apple's Symphony Orchestra Jampack© (Apple Inc., 2006) that contained virtual instruments that represented real-life orchestral instruments.

When taking an intermediate conducting class (MUSIC 366), taught by Dr. O. Richard Bundy at Penn State, I conceived the idea to study the score for *Chester Overture* by William Schuman using Apple's Garageband©. I used my personal sequence for entering musical data into the software to enter the score for *Chester Overture* into Garageband©. Upon reflection on the efficiency of the sequence and the effectiveness of Garageband© as a score study tool, I modified my personal sequence to more closely resemble the sequence contained within the Initial Guide. I also concluded that Garageband was not powerful enough to be effective for larger-scale works. This prompted me to decide to switch to Logic Pro©, which by this time had been upgraded to version 9 (Apple Inc., 2010).

I also evaluated the hardware that was necessary to perform this kind of score study, and determined that in addition to a computer, a MIDI keyboard was necessary to play the score into the computer. The model I purchased was an M-Audio Keystation© 49e, which had proven effective during my study of *Chester Overture*. Additionally, I needed a way to hear the sounds generated by the computer, so I needed to add speakers or headphones to the list of required hardware.

The next experiences I had with this type of score study was in preparation for my senior recital which contained five orchestral works that I wished to conduct. One of these works was the *Marche Royale* from Igor Stravinsky's *Histoire du Soldat*. I wanted to study this work using Logic Pro© 9 to determine if this software would be helpful in studying a work of such metric complexity. The Initial Guide for Conductors is based on this specific experience of entering the score into Logic Pro© 9. It began with setting up the Logic interface for use with an orchestral score, proceeded to setting up time signatures and tempo changes, continued to note entry, and finished with revising the sketch I created in Logic.

Chapter Summary

This study was conceived based on my initial experiences with MIDI Sequencing Software and score study facilitated by Penn State courses. These experiences were supplemented by a review of literature concerned with score study processes, score study tools, as well as music technology involving MIDI Sequencing. These experiences, combined with information gathered from the literature sources, led to the development of an Initial Conductor Guide to studying scores using MIDI Sequencing Software. This Guide was implemented during my student teaching. I kept an implementation journal to examine the overall quality and clarity of the Guide. After the Guide's implementation, I consulted my journal and revised the Guide to compensate for its shortcomings. Additionally, I evaluated MIDI Sequencing technology as a score study tool based on my experience with its implementation.

Chapter IV: Implementation, Evaluation and Revision of Guide

Implementation

After the development of the Initial Guide, it was necessary to implement the sequence presented in the Guide for the purposes of evaluation and revision of the guide, as well as for the evaluation of MIDI Sequencing Software as a score study tool. The way in which this was accomplished was through my personal student teaching experience in the Altoona Area School District. During this experience, I was assigned to conduct and rehearse several pieces with the high school orchestra. With the permission of my cooperating teacher, I selected Charles Gounod's *Funeral March of a Marionette* with which to implement the Initial Guide.

The first step of implementing the Guide was to ensure that I had the requisite materials for this score study. I did indeed have the requisite materials as I already had all of the software and electronic equipment, and I had acquired the score to *Funeral March* from IMSLP.org as it was under public domain.

The second step of implementation was setting up the digital audio workspace and instrumentation. The Guide contained clear and straightforward steps on how to do this with an orchestral score in mind. Following the instructions to create new tracks in the Logic Pro© 9 interface for each instrument in the score was simple. The Guide also mentioned that I should have an understanding of the instrumentation of the piece, which I did.

The third step of implementation was setting up time signatures and tempo changes. *Funeral March of a Marionette* contained the time signature 6/8 for the entire duration of the piece, so setting that up was quite simple. Several sudden tempo changes were fairly simple to address.

The fourth step of implementation was entering the pitches and rhythms from the score into Logic Pro 9. This step involved using the MIDI keyboard to record passages from the score. I found I needed to slow the tempo quite a bit in order to play the passages with accuracy and musicality. By the time step four was completed, I had played quite a bit of music on the MIDI keyboard and heard fairly accurate representations of the melodies and harmonies with representative timbres. I had developed fairly specific ideas about the phrasing of each line that I incorporated in my mental image of the piece so far.

The fifth step of implementation was to review and modify the sketch created in Logic Pro© 9. This involved listening to the sketch and re-recording sections to better suite my musical intuition about phrasing, dynamics, etc. Each of these revisions were justified by further study of the score and were fairly simple to implement given the clear instructions in the Initial Guide.

During implementation, I kept a journal along the way to document my experience of studying the score in this fashion. In this journal, I also made note of the imperfections within the guide that would be addressed during the evaluation and revision of the Guide.

Evaluation and Revision

After implementing the Initial Guide, it was necessary to evaluate the guide as a whole based on my personal interaction with it. This evaluation was partly based on my experiences with the Guide, on the implementation journal (Appendix B) and on further review of the Guide for logical sequencing, flow and organization.

On the whole, the sequencing of items in the Initial Guide made logical sense and was very easy to follow. It did take me through the process of entering a score into Logic Pro© 9 from start to finish, and broke steps down far enough to be understood. By heeding the recommendations of the Initial Guide, I was able to formulate an aural image of the score that prepared me to rehearse and conduct an ensemble. That being said, I do not feel this particular evaluation was completely unbiased because I am very experienced in this sort of activity and most-likely filled any gaps in the Guide's instructions with my personal expertise. Despite this, several areas in the Guide came up short, even for me.

Through implementation, as documented in the implementation journal, I encountered 19 individual items that required revision. These fell in the categories of inefficient sequencing, incomplete information, and inefficient wording. These revisions were all simple fixes that immediately improved the quality of the guide. Further review of the guide revealed three more items that required revision. These included adding Roman numerals to each section of the guide for clearer formatting, adding several figures to demonstrate how to access certain features in Logic Pro© 9, and general revisions for clarity.

An additional revision that needed to be made was the addition of instructions on how to place virtual instruments in the stereo field and how to add reverb to instruments to more accurately represent the location and timbre of a live orchestra in a rehearsal space or concert hall. This particular revision was inspired by an article in *Keyboard Magazine* that was geared toward composers using MIDI Sequencing Software to make more realistic mock-ups of their compositions (Gerber & Prager, 2004, p. 26).

These revisions were applied to the Initial Guide to create the Conductor Guide to Digital Score Study (see Appendix C). This revised guide was intended to be clearer and easier to follow than the Initial Guide. The additional diagrams and text revisions in the Conductor Guide to Digital Score Study serve these purposes and increased the overall quality of the Guide.

Chapter V: Summary, Evaluation, Conclusions and Recommendations

Summary

The purpose of this study was to explore the inclusion of MIDI Sequencing Software in a conductor's score study toolbox. The initial problems of this study were to determine what sound-generating tools are traditionally used in score study, exactly what each tool provides the conductor during score study, and evaluate their efficiency and limitations. An additional problem was to determine how MIDI Sequencing Software can be used as a score study tool by developing, evaluating and revising a guide for conductors on how to include MIDI Sequencing Software in their score study process. The final problem of this study was to evaluate the capabilities and limitations of MIDI Sequencing Software as a score study tool.

Traditionally, conductors have used a keyboard instrument, a metronome, their primary instrument, their voice, recordings and live performances of other conductors, and their inner ear to study scores. Each of these tools offers unique benefits for its use in score study. Some tools offer a physical and aural interaction with the score while others offer only an aural interaction with the score. Others provide only an internal aural interaction with the score.

Evaluation of MIDI Sequencing Software as a Score Study Tool

MIDI Sequencing Software, the subject of this study, is an extremely useful and efficient tool for studying scores. The process of studying scores using this tool is detailed in the Conductor Guide for Score Study Using MIDI Sequencing Software (Appendix C), but is summarized as creating a digital representation of the score in a

MIDI sequencer by establishing formal elements in the software then recording each line of the score by playing on a MIDI keyboard.

The benefits of MIDI Sequencing Software as a score study tool are manifold. The first benefit is that it provides a visual representation of the form of the score being studied. The following benefits are offered by this score study tool because it involves playing on a keyboard: It provides a kinesthetic interaction with the notation that enables a conductor to literally feel the score's range, melodic contours, rhythmic tendencies, textures, etc. It provides instant and fairly detailed aural feedback as to the pitch and rhythmic material contained within the score. It also provides aural feedback as to the dynamics and articulations contained within the score.

Additionally, as a polyphonic instrument, it provides the capability of hearing multiple lines at once as well as the harmonies contained within the score. This provides opportunity to explore the balance and interplay between different lines. Along those lines, the software is capable of playing representations of the many different timbres found in an orchestral score. It also provides an understanding of the large-scale structure of a piece by having the user define the form of the piece in the sequencer, and by playing back larger sections of the work. Because the MIDI sequencer retains all data previously entered, it will always provide a consistent model of the score that is available for review at any time. Additionally, MIDI Sequencing Software provides the capability to play back any combination of instruments simultaneously, which assists with the learning of rhythmically complicated and interlocking passages.

In contrast to a keyboard instrument, MIDI Sequencing Software is capable of sustaining pitch and of shaping individual notes through the use of automation data. The acoustic properties of the virtual instruments can be edited allowing the conductor to experiment with a larger sonic palate. An additional benefit of MIDI Sequencing Software is that it contains and requires the use of a built-in metronome. This allows the conductor to experiment and determine appropriate tempos for each passage. A unique feature of the built-in metronome is that it can be set to automatically change tempos, allowing for a more seamless score study experience.

A further benefit to MIDI Sequencing Software is its ability to simulate the reverb and placement of instruments in the stereo field that a conductor is likely to experience in actual rehearsal and concert settings. The conductor can get a better sense of where specific instruments will be heard in the orchestra, which will lead to more efficient gestures.

Despite this multitude of benefits, there are several limitations to using MIDI Sequencing Software as a score study tool. The largest limitation is the psychological implication of creating and editing an audio product, which runs the risk of the conductor focusing on the end product and not on the process itself as the learning medium. This also impacts the musical development of conductors; if they allow the MIDI Sequencing Software to do all the imagining for them, they will miss out on the experience of developing their inner ear.

An additional limitation is the approximation of timbre possessed by virtual instruments which by nature can not replicate the actual timbre of a real instrument being

performed by a live player. In the same vein, score study with MIDI Sequencing Software cannot immediately inform the conductor of performance issues related to specific passages. It is also difficult to replicate the subtle nuances within a musical performance using a MIDI keyboard, yielding a model that lacks expression. Further, it is fairly difficult and involved to adjust intonation within the software. The default settings for every instrument is equal temperament which sounds acceptable, but intervals and chords will sound slightly out of tune compared to a skilled orchestra that is capable of tuning each interval and chord to just intonation.

Conclusions and Recommendations

Based on the development and implementation of the Conductor Guide to Score Study with MIDI Sequencing Software, it is clear that MIDI Sequencing Software is an effective tool for score study. During its implementation, I was able to use it to gain an aural image of Charles Gounod's *Funeral March of a Marionette*, and was able to effectively conduct and rehearse a high school symphonic orchestra using that aural image of the score. The score study process with MIDI Sequencing Software was very helpful with internalizing the form (including cuing information), pitch, rhythm, timbre and dynamic content of the score. The areas in which it was not helpful were musical expression and phrasing, and discovering performance issues. I compensated for these issues by relying on other score study tools. I mainly supplemented MIDI Sequencing Software with my violin (which, despite being a secondary instrument, may be considered my primary instrument for the purpose of this study), my voice and my inner ear.

Based on the success of this lesson, further inquiry in the pedagogical possibilities and effectiveness of MIDI Sequencing Software in an ensemble setting is necessary. Other possibilities of its use in the rehearsal setting include using the synthesized playback as a model for specific sections, having the students play along with the model, creating and distributing practice files that contain single parts and single parts combined with the rest of the ensemble at a lower dynamic level, and even having students create an arrangement of the piece in a technology lab (if available).

Chapter Summary

This study demonstrated the efficiency and effectiveness of MIDI Sequencing Technology as a score study tool. Through the study, I developed and improved a sequence for its implementation. Based on its implementation, I evaluated the benefits and limitations it provides to ensemble conductors, and discovered that an effective score study process combines MIDI Sequencing Technology with other score study tools.

I also discovered MIDI Sequencing Software's pedagogical offerings through sharing the end product of its implementation with my students using a project and speakers. I did not fully explore the pedagogical potential of MIDI Sequencing Software, and I expect that there are many more pedagogical uses that I have not discovered. Additionally, I expect that as technology advances, there will be even more pedagogical uses for music technology and MIDI Sequencing Software in particular.

This project has made me a better conductor and teacher. It has enhanced my score study process by increasing its efficiency and effectiveness. It has also provided me

with a robust set of tools to incorporate in rehearsals which helps me teach the music more effectively, which in turn makes me a better conductor.

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Appendix A

Initial Conductor Guide to Digital Score Study

This Initial Guide assumes that the conductor has already selected repertoire and is at this point concerned only with the internalization of the score for the purpose of being able to conduct and rehearse the selected repertoire with an ensemble. This guide assumes a basic understanding of MIDI Sequencing Software such as Logic Pro 9. Those who are not quite comfortable using MIDI Sequencing Software would benefit from watching basic tutorials that can be easily located on YouTube. This guide is intended to be followed from beginning to end, but recognizes that not every step can be done in this exact order.

Requisite Materials

1. An Apple Computer capable of running Logic Pro 9 software.
2. Logic Pro 9 software installed on computer.
3. Symphonic sound samples installed on computer (Apple's Symphony Orchestra Jampack or equivalent)
4. A MIDI Keyboard (M-Audio Keystation 49e or equivalent) and USB cable.
5. Speakers or headphones
6. Full score of piece to be studied (with measure numbers added)

Setting up the Digital Audio Workspace and Instrumentation

1. Open Logic Pro, and create a new empty project.

2. When prompted to create New Tracks, enter the number of *independent woodwind, brass and string voices* present in the selected score. For example, even if the score has two or more flute parts on one staff, each part should be added to the number of New Tracks to be created. *Tutti* string sections should be counted as one track each, and each soloist should be counted as one additional track.
 - If your score has percussion, add one track to the total for each percussion instrument used (this is important for later flexibility).
3. Make sure that *Software Instruments* is selected as the type, and that *Output 1-2* is selected as the output. Click *Create* to continue.
4. For each track in the Arrange Window (the main program window), double click on the track number to edit the name, and label each instrument as it appears on the score, maintaining strict score order.

Now go through each track and choose the appropriate instrument from the *Jam Pack Symphony Orchestra* folder in the Library window on the right-hand side of the screen.

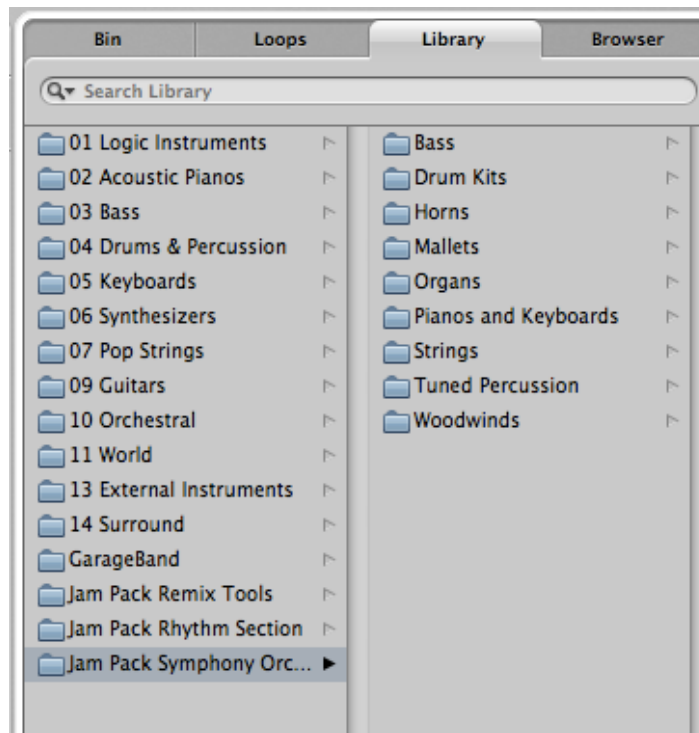


Figure A-1, the Library in Logic Pro 9

5. The order of percussion instruments is up to personal discretion as most of the time there are several percussion instruments on a single staff in the score. After making sure each percussion track is labeled, select the appropriate instrument for each tuned percussion instrument (located under the *Tuned Percussion* subfolder). For each remaining battery and accessory percussion instrument, choose the *Orchestra Percussion Kit* located under the *Drum Kits* subfolder.
6. After all instruments have been labeled and assigned a software instrument, you should now have an understanding of the instrumentation of the piece.

Setting up Time Signatures and Tempo Changes

1. Click on the arrow next to *Global Tracks* in the main Arrange window to reveal the *Signature* and *Tempo* tracks.
2. Change the first time signature of the piece by double clicking on 4/4 (the program's default signature) and entering the correct time signature.
3. Change the cursor to Pencil Tool by clicking on the left cursor icon at the top right corner of the main window pane and clicking on the pencil icon.
4. In your score, locate each measure where a time signature change occurs and note the measure number.
5. In Logic Pro, horizontally scroll to each of those measure numbers and click on the time signature track at the beginning of each measure to set the correct time signature.
6. In your score, locate each tempo marking. This step requires you to convert any marking to an exact beats-per-minute (BPM) measurement. There are a number of resources available to execute this conversion. It is important to note that these initial BPM conversions will most likely not be your final decision, but rather serve as markers to guide the score study process.
7. In Logic Pro, horizontally scroll to the measure numbers where these changes occur and use the pencil tool to enter the BPM into the Tempo track.

Note Entry

This process is perhaps the most tedious and time-consuming, but is also one of the most important. Have patience, and most importantly, incorporate what you are playing into your aural concept of the entire piece. The purpose of note entry in this context is not just

note entry, but to also to provide an approximation of what each instrumentalist plays in the score.

1. Choose an instrument with which to begin. The easiest place to start is most likely the instrument that plays the most often throughout the score. Select the instrument's track in Logic Pro's arrange area.
2. Choose a place in the score to begin your note entry, and practice playing the part on your MIDI keyboard at concert pitch (accounting for the instrument's transposition). It is **extremely** important to play each pitch, rhythm and dynamics accurate as possible in this step. It is also important to play as *musically* as possible because the tendency of MIDI technology is to sound as unmusical as possible. Additionally, this is your first opportunity to experiment with phrasing, so be creative!
 - a. It is important to resist the urge to play the part at the instrument's written pitch and then to adjust the transposition in the software because this will compromise your understanding of the composition. This also has the added benefit of providing practice reading transposed lines.
3. Scroll to the measure number in Logic Pro where you will be starting, and click below the measure number to move the playhead to this location. Click the record button in the transport to begin recording, playing as accurately as possible. If this proves to be too difficult, you may slow down the passage by dragging the tempo to a lower BPM, but be sure to return it to its original setting after recording. Record as much as possible without making too many mistakes. Some good spots to break up the recording process are at cadences, section divisions and before measures of rest.

- a. By default, the built-in metronome is set to play, but can be switched off.
 - b. When recording a track, it is possible to turn off all other tracks so you only hear the track being recorded. This is accomplished by toggling the solo button next to the instrument's track, or on the instrument's mixer.
4. Repeat this process with the same instrument to finish the section, phrase, etc., and work on the rest of the instruments as well. Working on small passages has the benefit of understanding the interplay between instruments, however working on large portions has the benefit of gleaning a more holistic impression of the composition.
 5. There will be a lot of rhythmic imprecision due to the inadequacies of the technology, as well as performance errors during note entry. To correct this, go through the piano roll for each instrument and use the quantize tool to align the beginnings of notes with the actual beats and divisions. Additionally, correct note endings by dragging the note length in the piano roll.

Reviewing and Modifying the Sketch

At this point, your Logic Pro file should contain a rough sketch of the entire composition. It will not sound very musical, but the pitches and rhythms will all be present with a vaguely representative timbre. There are several ways to enhance the musical quality of the sketch. This includes adjusting sound levels using automation and specifying articulations within each instrument. These more advanced concepts will not be discussed here, but can be explored by reading the Logic Pro manual and reading literature on the subject.

One major aspect to revisit is tempo. To establish more concrete ideas about what the tempo should be, listen to the sketch several ways using your musical intuition to determine what tempo sounds appropriate for the musical material. Additionally, go through and add more BPM adjustments to provide finer control over the tempo. This is particularly important for written accelerandos and rallentandos, but is also useful for creating phrases that develop in an organic fashion.

Learning from the Sketch

As your Logic Pro sketch of the composition becomes more representative of the work, it can be used to assist in the learning process. It will provide a consistent model of the work that can be played and replayed to help internalize the score. To hear only one or several specific instruments at once, make liberal use of the solo and mute buttons next to each track. This provides for hearing a wide variety of instrumental combinations that informs your mental image of the score.

The creation and review of the Logic Pro sketch should not be the first or the last step in your personal score study process. It contains many limitations that can be overcome using other score study tools. The sketch can be incorporated in your score study process as a learning aid for pitch, rhythm, dynamics, form, meter, harmony, timbre, and tempo. Each of these aspects is limited by the fact that the sketch is created by a computer. Other elements of music such as tone color, phrasing and shaping – as well as emotion – cannot adequately be represented by this sketch, and must thus be augmented by other score study tools.

Appendix B

Implementation Journal

January 17th, 2012

Today I followed the instructions in the Setting up the Digital Audio Workspace and Instrumentation section of the Initial Guide. I opened Logic Pro 9 and was prompted to create a new project or open an existing project. I selected Create New Empty Project and was prompted to create New Tracks. I referenced my score for *Funeral March of a Marionette* and counted the number of independent woodwind, brass and string voices which totaled twenty (seven woodwind voices, eight brass voices, and five string voices). I entered this number, and realized that it would be simpler if I added the number of percussion instruments to this total before creating the new tracks. I counted the percussion instruments, totaling three, and added this to the initial twenty to make twenty-three. I made sure that Software Instrument was the selected type, and that Output 1-2 was selected and clicked *Create*.

I followed the next step and double-clicked each track number to enter the instrument name as it appeared on my score. Here, I found it necessary to change instrument names from the plural to the singular, as well as add part designations (e.g. *Clarinetti* to *Clarinetto I* and *Clarinetto II*) to keep track of the parts accurately. In this process, I discovered an oversight in my initial instrument count because the bass drum and cymbal parts are located on the same staff and labeled only as *Gran Cassa* (bass drum) at the beginning of the score. I decided to leave this as is because the player is

expected to play both instruments at the same time, and the virtual instrument is capable of playing both at the same time.

I then selected the appropriate virtual instrument for each track from the Library. The first issue I encountered was that the *Jam Pack Symphony Orchestra* did not contain a solo trumpet (as required by the score), but instead offered a trumpet section. I decided to make this compromise as I had no other choice with the instruments provided by the software. The same situation occurred with the trombones, and the same compromise was made. For each non-tuned percussion instrument, I chose the *Orchestra Percussion Kit*.

Once I assigned virtual instruments to each of the string sections, I had completed this section of the instructions. Upon reflection, step seven in the sequence somewhat accurately described my situation: “you should now have an understanding of the instrumentation of the piece.” This statement will be revised, because I have an understanding of the overall instrumentation of the piece, not of specific orchestrations.

January 18th, 2012

Today I followed the Setting up Time Signatures and Tempo Changes sequence. I changed the first time signature of *Funeral March for a Marionette* from 4/4 to 6/8. There were no later time signature changes, so steps 3-5 were unnecessary. I will revise this section to state that these steps are optional if there is only one time signature throughout the entire piece.

I located the first tempo marking of *allegro* at the beginning of the score. I converted *allegro* to 120 beats per minute to be generous. Being that 120 beats per minute is Logic Pro 9’s default tempo marking, I didn’t need to change this. I located the

next tempo marking of *adagio* and converted this to 66 beats per minute, again to keep on the slow-side of the tempo. I wasn't very clear in the Initial Guide on how to obtain the Pencil Tool, so I will include a figure to demonstrate its location. I then added 116 bpm to the *allegretto* section in the score. This section was fairly clear and allowed for a smooth entry. However, I can imagine scores where tempo changes are not as immediate (e.g. *stringendo* and other fluid tempo changes), thus I will revise this section to include how to create tempo gradients in Logic Pro 9.

I also began the Note Entry process. The wording of the introductory paragraph was slightly awkward, and thus will be revised for clarity and flow. Step one will need to be revised to state that there are a variety of approaches to this process including following score order. I chose to begin with the Violin I part because it seems to play the most often in the score. I followed step two and practiced the part. I was immediately presented with the issue of articulation as the score calls for a variety of articulations. Each virtual instrument possesses different capabilities for articulation. The way to access these articulations varies by instrument, so I will revise this section to mention these articulation possibilities without describing how to access them for each instrument.

I proceeded to step three and recorded the first phrase of music. This immediately proved to be too fast for my non-pianist hands (and my MIDI keyboard), so I was forced to follow the suggestion of slowing down the tempo, deleting the previous take and starting over. The Initial Guide does not mention deleting the previous take, and will need to be revised to do so. When I listened to my recording, I was immediately aware of the

rhythmic inaccuracies of my playing, and made step five the logical next step to follow. I will revise the Guide to include this step earlier in the process.

Entering the woodwind parts tested my ability to play from transposed score, but my previous training in score transpositions from conducting and score-reading classes at Penn State enabled me to play these without making too many transposition errors.

I followed step five to correct my rhythmic inadequacies, but realized that step five only names the tools to use to do this and not how to use the tools. This section will be revised to include a more thorough explanation on how to use the tools.

I went back to step four to complete the rest of the note entry for this phrase, and realized that since this phrase consisted entirely of octave doublings, it was possible to copy-paste entire sections of music from one instrument to the other. Taking this short-cut may compromise my understanding of the score, so I elected not to do so, but it seems worth mentioning in the Guide for anyone who is short on time. I finished the string section without further issues, then proceeded to the woodwind section, the brass section and finally the percussion section (one cymbal crash). Note entry and quantization for these sections was straightforward as described in the Guide, and the first full phrase of music was entered into Logic Pro 9.

At this point, I did feel like this portion of the score was memorized (especially considering this phrase only contained octave doublings with staggered entrances). I also felt that the virtual instruments were doing an adequate job of representing their real-world counterparts.

January 19th, 2012

I began entering the notes for the *Adagio*. The strings have an articulation change from *arco* to *pizzicato*, and the string virtual instruments provide access to a *pizzicato* sound (as well as trills and tremolos) through the modulation wheel foot controller. I decided that I need to revise the Guide to include how to access these string-specific articulations because they will occur quite frequently in pieces that include stringed instruments and will have an immediate impact on the effectiveness of electronic score study of these pieces. I entered the string parts including the change from *arco* to *pizzicato* using the modulation wheel and the Events List and will revise the Guide based on this.

I entered the horn and clarinet parts and copied these sections to double them as indicated in the score, however the dynamics as indicated in the score were impossible to approximate using the MIDI keyboard as there is no way to indicate a crescendo nor a diminuendo. I will need to address this later in the process.

January 22, 2012

I began note entry for the *Allegretto* section. Entering the bassoon parts was quite simple, but when I began entering the string parts, I had to deal with the grace notes. I practiced these parts several times before entering the notes, and decided that the grace notes should occur before the beat (especially considering the bassoon parts double this melody without grace notes and I wanted to avoid the dissonance of having the grace notes on the beat). I recorded the string parts including the grace notes, but when I quantized the rhythms, the grace notes snapped to the beat. To fix this error, I undid the

quantization and selected all of the notes except for the grace notes and quantized them.

This left the grace notes in place before the beat.

After finishing that page of the score, I chose to assign letter names to specific sections of the score for ease of reference when rehearsing. I placed them in the most logical sections that I could, following the form of the piece (assigning each repeated section its own letter, and following texture and melodic changes). I then went into Logic Pro 9 and labeled these letters using the Markers feature. I did not include this really useful tool in the Guide, and I will need to revise it to include it. I also need to include that in order to label these sections, I needed to write measure numbers into the score to keep track as this directly affects where they are placed in Logic. I also needed to decide how I would handle repeated sections (e.g. do I include the material once or twice in Logic, and how do I address first and second endings). I decided to include the material only once, and place first and second endings next to each other so that the layout in Logic mirrors that of the printed score.

I skipped all the way to rehearsal letter I so I could study the end of the piece. I entered the string parts first, then the woodwinds, brass and percussion. By the end of the session, I felt extremely familiar with the music in letter I to the end. I did not encounter any issues that were not previously addressed by the Guide and proposed revisions thus far.

January 31, 2012

I entered the notes for the section beginning at rehearsal letter G. This is the first section that all the instruments of the orchestra are used, so I made sure that there was an

adequate balance by playing each instrument softer than normal. I also made sure to play a distinguishable difference between notes that were marked staccato and those that were not marked. This was very effective at modeling the articulation appropriate for this section.

The dynamics of this section were problematic because there are three notes played at *ff* with the rest played *p*. No matter how soft I played, the overall effect of the virtual orchestra playing was too loud. I solved this problem by opening the piano roll for one instrument (command+3) and double clicking in the blank space which opened the piano roll for every instrument that plays at that time. I selected all the notes that were not supposed to be loud, and used the velocity tool to decrease their volume until there was a large enough differentiation between the two dynamic levels. I will revise the guide to include this feature as it was quite useful for this section.

I also entered the notes for rehearsal letter D. This section is canonic, and thus I wanted each entrance to stand out. I accomplished this by playing the beginning of each canonic entrance slightly louder, and played the rest of the line softer. This canonic effect was quite easy to see as the entrance of each track of the recording combined looked like a staircase which illustrated the staggered entrances visually.

February 3, 2012

Today I entered the notes for the rehearsal letters C and E. Only rehearsal letter E presented a challenge not addressed in the Initial Guide. The viola section plays a divisi passage ten bars into the section. I solved this problem by recording the upper divisi first, quantizing the passage, then recording the lower divisi on top of the upper one,

quantizing and then using the Glue Tool to merge these two tracks together. The other possible solution would be to create a second track (or as many division parts the score contains) and only use it when the part is divided. I need to revise the Guide to include this challenge, and present the aforementioned solutions.

February 5, 2012

I entered the notes from rehearsal letter H into Logic. This was a rather tedious section because it included every voice playing at once. Because of this, I was forced to listen to the parts over and over to enter each individual voice, thus increasing my exposure to those lines. I feel very comfortable with the pitches, rhythms and harmonies of this section due to this exposure. In this session, I also discovered the keyboard shortcut “R” which acts as the recording button on the Transport. I will revise the guide to include this option.

I also entered the notes from rehearsal letter F into Logic. This section was very similar to rehearsal letter B, but differed enough that I could not copy and paste any sections from one to the other. Besides, this would have detracted from the experience of playing every phrase from the score.

At this point, I completed the Note Entry section of the Initial Guide. In general this section was very clear and easy to follow, but would benefit from some strategically placed diagrams to demonstrate the process. The areas that need revision have been addressed throughout the previous journals.

Upon reflection of my completion of this section, I do feel extremely familiar with the melodies, accompaniments, harmonies, dynamics and articulations of the score.

The areas in which this process comes up short are in the details and subtle nuances. I was able to recreate different articulations, but my options came from a very limited pallet. I was unable to approximate the effects that different bowings and fingerings had on passages, an issue that was becoming relevant during rehearsals of this piece. For that matter, it was impossible to use Logic to anticipate performance issues for any instrument. It is worth revising the Initial Guide to mention this issue, as it is critical to understand that digital score study is not enough.

I continued to the Reviewing and Modifying the Sketch phase of the guide and listened to my current sketch and edited the note durations and velocities to follow the score more closely. This particular task was quite tedious as there were many places where my mental conception of note lengths and dynamics were different than Logic's representation of them. In fact, this part of the process seemed almost more trouble than it was worth because I had an image of the score in my head that I could manipulate faster than the digital representation. The aspect of this phase that I did find beneficial was the ability to play around with tempi and hear immediate aural feedback on the effects of the tempo adjustments. I wound up revising my initial tempos to be faster because it felt like they needed more motion.

Appendix C

Conductor Guide to Digital Score Study

This Guide assumes that the conductor has already selected repertoire and is at this point concerned only with the internalization of the score for the purpose of being able to conduct and rehearse the selected literature with an ensemble. This guide assumes a basic understanding of MIDI Sequencing Software such as Logic Pro 9. Those who are not quite comfortable using MIDI Sequencing Software would benefit from watching basic tutorials that can be easily located on YouTube. This guide is intended to be followed from beginning to end, but recognizes that not every step can be done in this exact order.

I. Requisite Materials

1. An Apple computer capable of running Logic Pro© 9 software, including keyboard and mouse.
2. Logic Pro© 9 software installed on computer.
3. Symphonic sound samples installed on computer (Apple's Symphony Orchestra Jampack© or equivalent)
4. A MIDI Keyboard (M-Audio Keystation 49e or equivalent) and USB cable.
5. Speakers or headphones
6. Full score of piece to be studied (with measure numbers added)

II. Setting up the Digital Audio Workspace and Instrumentation

1. Open Logic Pro©, and create a new empty project.

2. When prompted to create New Tracks, total the number of *independent woodwind, brass and string voices* present in the selected score. For example, even if the score has two or more flute parts on one staff, each *divisi* part should be added to the number of New Tracks to be created. *Tutti* string sections should be counted as one track each, and each soloist should be counted as one additional track.

If your score has percussion, add one track to the total for each percussion instrument used.

Enter this total in the New Tracks text box.
3. Make sure that *Software Instruments* is selected as the instrument type, and that *Output 1-2* is selected as the output. Click *Create* to continue.
4. For each track in the Arrange Window (the main program window), double click on the track number to edit the name, and label each instrument as it appears on the score, maintaining strict score order. Be sure to numerically distinguish *divisi* parts (e.g. Flute 1, Flute 2, etc.).
5. Now go through each track and choose the appropriate instrument from the *Jam Pack Symphony Orchestra* folder in the Library window on the right-hand side of the screen.

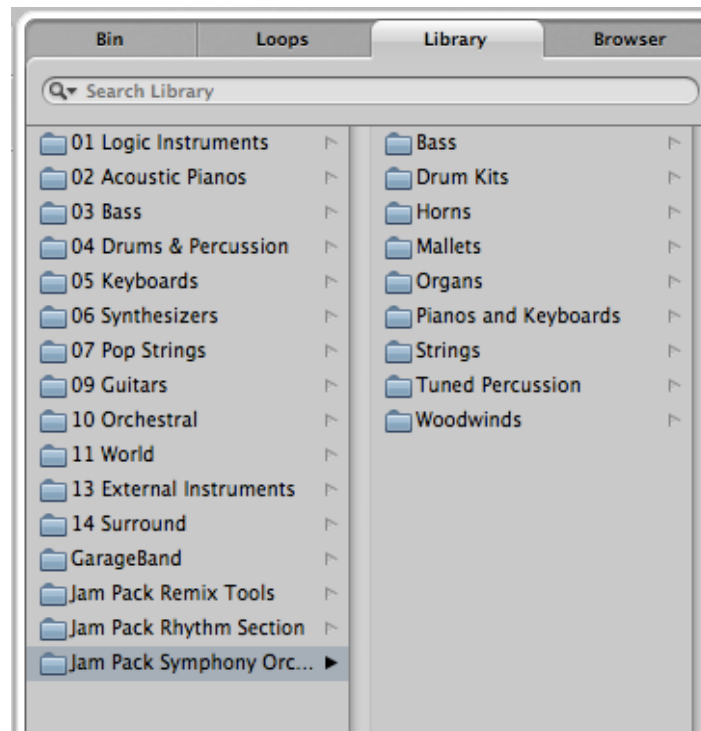


Figure C-1, the Library in Logic Pro 9

6. The order of percussion instruments is up to personal preference as most of the time there are several percussion instruments on a single staff in the score. After making sure each percussion track is labeled, select the appropriate instrument for each tuned percussion instrument (located under the *Tuned Percussion* subfolder). For each remaining battery and accessory percussion instrument, choose the *Orchestra Percussion Kit* located under the *Drum Kits* subfolder.
7. After all instruments have been labeled and assigned a software instrument, you should now have an understanding of the overall instrumentation of the piece.
8. To make the virtual instruments sound more realistic and accurately located in the stereo field, adjust the location of each instrument in the Mixer Window using the pan control. The placement should mirror that of your actual ensemble.



Figure C-2. Suggested Pan Positions for the String Section

9. It is also suggested that you add some reverb to the Output Track (located to the right of the Mixer) to mimic the acoustics of a rehearsal or concert space. This can be done by adding the Space Designer Reverb Engine as an Insert (click and hold the pill), and selecting an appropriate reverb model.

III. Setting up Time Signatures, Tempo Changes and Section Divisions

1. Click on the arrow next to *Global Tracks* in the main Arrange window to reveal the *Signature* and *Tempo* tracks.
2. Change the first time signature of the piece by double clicking on 4/4 (the program's default signature) and entering the correct time signature. The following steps may be unnecessary if the piece being studied does not change time signatures or tempos.
3. Change the cursor to Pencil Tool by clicking on the left cursor icon at the top right corner of the arrange window and clicking on the pencil icon.

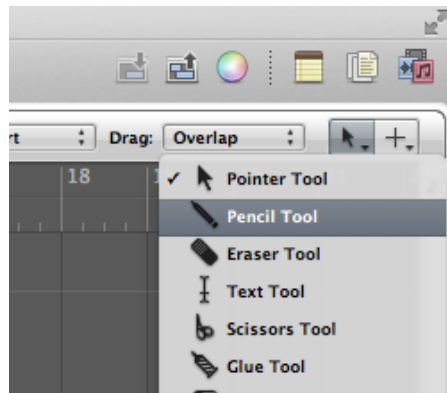


Figure C-3. Accessing the Pencil Tool.

4. In your score, locate each measure where a time signature change occurs and note the measure number.
5. In Logic Pro, horizontally scroll to each of those measure numbers and click on the time signature track at the beginning of each measure to set the correct time signature.
6. In your score, locate each tempo marking. This step requires you to convert any marking to an exact beats-per-minute (BPM) measurement. There are a number of resources available to execute this conversion. It is important to note that these initial BPM conversions will most likely not be your final decision, but rather serve as markers to guide the score study process.
7. In Logic Pro, horizontally scroll to the measure numbers where these changes occur and use the pencil tool to enter the BPM into the Tempo track.
8. If the piece being studied contains tempo-based effects such as *stringendos*, *ritardandos*, etc., it will be necessary to insert many tempo adjustments as intermediary stages using the pencil tool to simulate each of these effects.

9. Indicate section divisions (such as rehearsal letters, etc.) by utilizing Logic Pro 9's Markers feature. To access this, return to the Arrange Window's Global Tracks and display the Markers track. Use the pencil tool to insert section divisions where appropriate in the score, and label them appropriately.

IV. Note Entry

This process is perhaps the most tedious and time-consuming, but is also one of the most important. The purpose of note entry in this context is not just to enter the notes into Logic, but to also to provide an approximation of what each instrumentalist plays in the score in order for that to be incorporated into your mental image of the score. For some instruments including strings and woodwinds, a variety of articulations are offered through the modulation wheel of the MIDI keyboard, or through the Event List in Logic Pro 9. Consult the user manuals for the hardware and software on how to incorporate these effects into your score study.

1. Choose an instrument with which to begin. The easiest place to start is most likely the instrument that plays the most often throughout the score, but a wide variety of options are available. Select the instrument's track in Logic Pro's arrange area.
2. Choose a place in the score to begin your note entry, and practice playing the part on your MIDI keyboard at concert pitch (accounting for the instrument's transposition). It is **extremely** important to play each pitch, rhythm and dynamics accurate as possible in this step. It is also important to play as *musically* as possible because the tendency of MIDI technology is to sound as unmusical as possible. Additionally, this is your first opportunity to experiment with phrasing, so be creative!

- a. It is important to resist the urge to play the part at the instrument's written pitch and then to adjust the transposition in the software because this will compromise your understanding of the composition. This also has the added benefit of providing practice reading transposed lines.
3. Scroll to the measure number in Logic Pro where you will be starting, and click below the measure number to move the playhead to this location. Click the record button in the transport (or press the letter "R" on your keyboard) to begin recording, playing as accurately as possible. If this proves to be too difficult, delete the previous take and slow down the passage by dragging the tempo to a lower BPM, but be sure to return it to its original setting after recording. Record as much as possible without making too many mistakes. Some good spots to break up the recording process are at cadences, section divisions and before measures of rest.
 - a. By default, the built-in metronome is set to play, but can be switched off by clicking on the metronome button in the Transport.

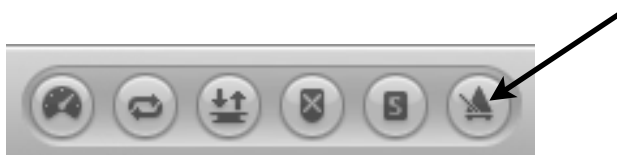


Figure C-4, the Metronome Button in the Transport.

- b. When recording a track, it is possible to turn off all other tracks so you only hear the track being recorded. This is accomplished by toggling the solo button next to the instrument's track, or on the instrument's mixer.
4. There will be some rhythmic imprecision due to the inadequacies of the technology, as well as performance errors during note entry. To correct this, go through the piano

roll for each instrument, select the passages with rhythmic inaccuracies, and use the quantize tool to align the beginnings of notes with the actual beats and divisions. Additionally, correct note endings by dragging the note length in the piano roll. Keep in mind that when working with grace notes, quantization should not be applied to them as they are intentionally shifted off of the beat.

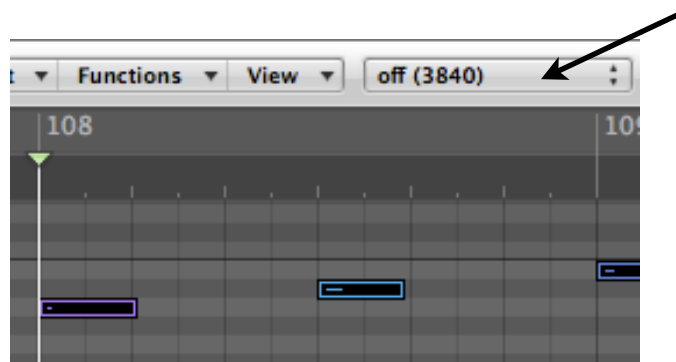


Figure C-5, The Quantize Tool within the Piano Roll.

5. Repeat this process with the same instrument to finish the section, phrase, etc., and work on the rest of the instruments as well. To save time, unison and octave doublings can be copy-pasted, but may take away from your overall understanding of the piece. Working on small passages has the benefit of understanding the interplay between instruments, however working on large portions has the benefit of gleaning a more holistic impression of the composition.

V. Reviewing and Modifying the Sketch

At this point, your Logic Pro file should contain a rough sketch of the entire composition. It will not sound very musical, but the pitches and rhythms will all be present with a vaguely representative timbre. There are several ways to enhance the musical quality of the sketch. This includes adjusting sound levels using automation and

specifying articulations within each instrument. These more advanced concepts will not be discussed here, but can be explored by reading the Logic Pro manual and reading literature on the subject.

One major aspect to revisit is tempo. To establish more concrete ideas about what the tempo should be, listen to the sketch several ways using your musical intuition to determine what tempo sounds appropriate for the musical material. Additionally, go through and add more BPM adjustments to provide finer control over the tempo. This is particularly important for written accelerandos and rallentandos, but is also useful for creating phrases that develop in an organic fashion.

VI. Learning from the Sketch

As your Logic Pro sketch of the composition becomes more representative of the work, it can be used to assist in the learning process. It will provide a consistent model of the work that can be played and replayed to help internalize the score. To hear only one or several specific instruments at once, make liberal use of the solo and mute buttons next to each track. This provides for hearing a wide variety of instrumental combinations that informs your mental image of the score.

The creation and review of the Logic Pro sketch should not be the first or the last step in your personal score study process. It contains many limitations that can be overcome using other score study tools. The sketch can be incorporated in your score study process as a learning aid for pitch, rhythm, dynamics, form, meter, harmony, timbre, and tempo. Each of these aspects is limited by the fact that the sketch is created by a computer. Other elements of music such as tone color, phrasing, shaping and the

intangible aspects of music cannot adequately be represented by this sketch, and must thus be augmented by other score study tools.

Academic Vitae

JARED JUDGE

Conductor, Educator, Percussionist, Violinist

jaredjudge@gmail.com
<http://www.jaredjudge.info>

EDUCATION

The Pennsylvania State University; University Park, PA — Bachelor of Music Education
Schreyer Honors Scholar
Graduation Date: May, 2012.
School of Music Marshal at May 2012 Commencement
Honors Thesis Title: "Exploring MIDI Sequencing Software as a Score Study Tool"
Thesis Supervisor: Dr. O. Richard Bundy, Professor of Music Education

Student Teaching Experience, Spring 2012 - Altoona Area School District.
Conducted and rehearsed Junior High School and High School Orchestra. Led AP Theory class and K-6 Elementary General Music. Coached two string quartets and provided private instruction in Bassoon, French Horn, Trumpet, Percussion, Violin, Viola, Cello, and Double Bass. Designed lesson plans around use of technology.

EMPLOYMENT HISTORY

Undergraduate Music Theory Paper Grader, Penn State, University Park, PA - Fall 2011
Collaborated with Music Theory faculty to assess student performance on homework assignments.

Music Director, Into the Woods, Princeton Summer Theatre — Summer 2011
Directed all musical aspects of Into the Woods. Established warm-up and rehearsal routine with company. Contracted pit of ten local instrumentalists. Rehearsed vocalists and pit separately and together, and conducted all eleven public performances.

Camp Counselor, Westminster Conservatory; Princeton, NJ — 2009 - Present
Worked with students and camp administrators to foster a positive learning environment. Encouraged individual growth through private instruction. Ensured student safety by leading recreational activities and monitoring meals.

Resident Assistant, The Pennsylvania State University, University Park, PA — 2009 - 2010
Worked directly with sixty students and parents to foster a living-learning community through educational programming and social outreach.

AWARDS

School of Music Marshal, Commencement, May 2012

Penn State College of Arts and Architecture Creative Achievement Award, Spring 2012

PMEA/SMTE Award for Outstanding Scholarship in Music Education, Spring 2012

Phi Kappa Phi National Honors Society

Pi Kappa Lambda National Music Honors Society

AFFILIATIONS

Phi Mu Alpha Sinfonia Fraternity of America

Pennsylvania State Education Association, 2011 - 2012

Pennsylvania Collegiate Music Educators Association, 2009 - 2012

Penn State Percussion Club, *treasurer* 2010 - 2011

CONDUCTING EXPERIENCE

Altoona Area School District, January 2012 - May 2012. Conducted two high school and three junior high school orchestras as part of student teaching experience. Coached and arranged music for two string quartets.

Penn State Philharmonic Orchestra, December, 2011. Rehearsed Beethoven's *Symphony No. 5*, Allegro con brio.

Penn State Percussion Ensemble I, October - December, 2011. Rehearsed and conducted movements from Rosauero's *Concerto for Vibraphone*.

State College School District Elementary Orchestra Project, October - December, 2011. Rehearsed and conducted Can-Can by Offenbach, arr. Meyer.

Jared Judge's Senior Recital, Mixed Ensemble and String Orchestra, October - November, 2011, performed November 4th, 2011 - Contracted musicians, rehearsed and performed a variety of literature with two ensembles consisting of Penn State School of Music students.

Unitarian Universalist Fellowship of Centre County, PA, October 2011 - Conducted choir of community members for two rehearsals and service.

State College Area High School Orchestra, September - October, 2011 - Rehearsed Schumann *Symphony #4* and Corelli's *Concerto Grosso Op. 6, No. 8*.

Altoona Area High School Select Strings Ensemble, September, 2011 - Rehearsed Vivaldi's Gloria, mvmt. II.

"Into the Woods," Princeton Summer Theatre, Summer 2011 - Directed all musical aspects of "Into the Woods." Established warm-up and rehearsal routine with company of seventeen cast members. Contracted pit of ten local instrumentalists. Rehearsed vocalists and pit separately and together, and conducted eleven public performances.

Westminster Conservatory's "Keep It Going Strings" Camp Orchestra, Summer 2010 and 2011 - Assistant conductor.

Sinfonietta, Campus Orchestra, Penn State University, Spring 2011 - Rehearsed Schubert's Unfinished Symphony.

PARTICIPATION IN PERFORMING ENSEMBLES

Nittany Valley Symphony Orchestra, directed by Michael Jinbo. Percussionist in Spring 2010 - Spring 2012.

Penn State Philharmonic Orchestra, directed by Gerardo Edelstein. Violinist in Spring 2010 - Fall 2011.

Penn State Symphonic Wind Ensemble, directed by Dennis Glocke. Percussionist in Fall 2010 - Fall 2011. Percussion section leader in Fall 2011.

Mallet Ensemble, directed by Dan C. Armstrong. Marimbist and vibraphonist in Spring 2011 - Fall 2011.

Percussion Ensemble I, directed by Dan C. Armstrong. Percussionist in Fall 2008 - Fall 2011.

Altoona Symphony Orchestra, directed by Teresa Cheung. Percussionist in Spring 2011.

Penn State Blue Band, directed by O. Richard Bundy. Percussionist in Fall 2008 - Fall 2010.