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Computer-Assisted Instruction and Sequencing Within the Studio: a Focus on Halsey Stevens' "Sonata for Trumpet and Piano"

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COMPUTER ASSISTED INSTRUCTION AND SEQUENCING WITHIN THE STUDIO:
A FOCUS ON HALSEY STEVENS' SONATA FOR TRUMPET AND PIANO

A Written Document

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Musical Arts

in

The School of Music

by

Timothy J. Zifer
M. Mus., Louisiana State University School of Music, 1993

August, 2000
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I wish to thank my parents for their relentless support during the quest of my degree. The moral, financial, and parental guidance provided has satiated my pursuit of this substantial goal. I would be remiss if I failed to thank James West, my trumpet instructor, friend, and colleague. His motivational influence with regard to performance, instruction, and the implementation of music technology has inspired me beyond the confines of the private studio. The members that comprise my committee are commended for their positive support and suggestions during my studies. As a testament to the commitment and instructional technique instilled by my instructors, I must applaud the willingness of my own students receptivity in allowing me to introduce music technology in their studio lessons.
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ABSTRACT

The teaching of solo literature in the context of studio trumpet instruction has always presented personal challenges, especially when that literature includes a variety of mixed meter, subito tempo, and dynamic changes. Consistent aid from a metronome and tuner has for generations facilitated the dedicated musician, yet these devices are obviously limited by the student's dedication, receptivity, and innate talent. I conversely propose that by introducing computer assisted instruction within the confines of the private studio, the students' musical ability will be enhanced as will the pupils' consistent practice regiment.

The introductory segment of Chapter 1 provides an extremely truncated synopsis regarding the history of MIDI, examples of current MIDI applications within the studio, and the justification thereof. Chapter 2 encompasses the specific procedures used to accomplish computer assisted accompaniment in the studio, while relevant topics such as equipment, analysis of the Stevens' Sonata For Trumpet and Piano, and programming/editing procedures are comparatively addressed. The processes of programming and editing comprise much of this chapter, since these components form an integral function within the electronic music studio. The third chapter exists as a compendium of contemporary practices regarding CIA (computer assisted instruction), with the remaining passages comprising a conclusion.

It is my intent that production of this document will inform other studio instructors of the value of introducing technology to students, their quest furthered with the
inclusion of a relevant guide needed to compile and construct a successful computer assisted studio.
CHAPTER 1: INTRODUCTION

Introduction to MIDI

Throughout the history of Western music there have been numerous technological advancements which have furthered the progress of musical development. Jeff Pressing reveals in his book, *Synthesizer Performance and Real-Time Techniques*, a chronological outline of these developments in the field of music technology. This outline illustrates the steady development of music technology beginning with Jon La Borde's 1759 invention of the electric harpsichord (an early static electricity driven instrument) through present day technologies and applications.¹

One of the most innovative accomplishments of recent merit is the coupling of synthesizers and computers. This union was made possible through a technological protocol breakthrough called MIDI, or Musical Instrument Digital Interface. One of the most practical applications of MIDI is the use of computer assisted accompaniment, allowing a computer to perform an accompaniment without any need for human input.

Computer assisted accompaniment can enhance the student's sense of pulse, intonation, and increase the awareness of the accompaniment and its role in ensemble rehearsal and performance.² Aside from the obvious

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² Shan-Mei Amy Tseng, "Solo Accompaniments in Instrumental Music Education: The Impact of the Computer-Controlled Vivace on Flute Student Practice", (PhD. Dissertation, University of Illinois, Urbana-Champaign, IL, 1995), 121, 92.
advantages of rehearsing with accompaniment, the pupil becomes more aware of the current trends in computer technology as it relates to music performance and education.

As a demonstrative concept, I selected the Halsey Stevens' *Sonata for Trumpet and Piano* as an example to substantiate the versatility of computer assisted instruction, applicable to all musical eras; twentieth century music inclusive. Stevens is quoted as having said, "The over-all character of the work is one of contrasts, primarily in rhythm and melodic line." The aforementioned parameters will satisfy the following conditions: a justification for using this technology, the history of MIDI, the equipment needed for the compilation of a MIDI accompaniment studio, a metric/dynamic/tempo analysis of the Stevens' *Sonata for Trumpet and Piano*, basic programming and editing aspects, and contemporary trends in computer music technology.

**Justification of MIDI**

MIDI has become a valuable teaching tool in the private studio, assisting students with a bevy of musical problems. The adjoining of a computer, synthesizer(s), and a sequencing program enables the instructor to produce high quality accompaniments. Once the accompaniment is recorded into the computer with a MIDI keyboard via a sequencer, previously recorded pieces can then be edited to satisfy personal specifications. The editing process can involve rubato,
rhythmic alterations, transposition, tempo alterations, and the addition of other instrumental voices. The identical MIDI accompaniment can be personally tailored to fit the needs of a variety of performers, thus introducing a nearly endless collection of musical options.

Opponents to MIDI accompaniment argue that preprogrammed accompaniment cannot be interactive with the musician during real time performance, thereby denying them of a positive musical experience. The objective of implementative MIDI accompaniment is not one of replacing the collaborative efforts pervasive of the soloist and accompanist, rather sequenced accompaniment alleviates the distressing and frustrating problem of locating suitable accompanists.

The Idea Bank found in the *Music Educators Journal* notes that "CAI (Computer Assisted Instruction) is not a substitute for creative and interactive musical experience; rather, it can be a new source for the acquisition of many fundamental skills that are intrinsic to musicianship." This truth has proven itself in my own studio instruction, as students who prepared with CAI not only responded admirably during lesson time (having experienced practice accompaniment other than a metronome), but also have realized that rehearsing with a "live" piano accompanist is an easier task when the need presents itself (i.e., recital and/or workshop). "In the field of private teaching, most solo musicians study only the solo line and treat the

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accompaniment as background music. They rehearse with their
accompanists only a short time before a real performance.
The absence of the accompanying harmony in rehearsals makes
the student rarely notice the consonance and dissonance,
tension and release which are deeply embedded in the music.
As a result, most instrumental students feel uneasy when they
first rehearse a piece with an accompanist.”

History of MIDI

In the late 1970’s and early 1980’s there was a large
impetus in the electronic music world to increase the sound
quality of synthesizers and to develop a device that would
link synthesizers together, thus allowing an augmentation of
sound depth. The result was USI (Universal Synthesizer
Interface), invented by Chet Wood and Dave Smith of
Sequential Circuits.* In 1981, USI was modified to MIDI,
which allowed the standardization of protocol among various
manufacturers’ electronic musical instruments. By the late
1980’s, the final result was the ready availability of
inexpensive and versatile synthesizers that could be coupled
with any computer or synthesized instrument with a MIDI port.

There must be a sequencing program available for the
computer and synthesizers to communicate with each other. The
sequencing program allows the synthesizer (keyboard and other

*Shan-Mei Amy Tseng, “Solo Accompaniments in Instrumental Music
Education: The Impact of the Computer-Controlled Vivace on Flute Student
Practice”, (PhD. Dissertation, University of Illinois, Urbana-Champaign,
IL, 1995), 20.

*David Miles Huber, The MIDI Manual (Carmel, Indiana: Sams; A
MIDI instruments) to input information into the computer so the performer/programmer can edit and/or perform with the accompaniment. There are numerous inexpensive sequencing programs currently on the market as a result of MIDI, many of which are standardized much the same as word processing programs. The terms related to computer hardware and software will be more appropriately discussed in Chapter 2.
CHAPTER 2: PROCEDURES

Equipment

There are numerous options available today for constructing a MIDI accompaniment setup. The equipment I selected was the result of information gained through my own studio instruction as well as reading through various journals and consulting catalogs offering music technology components. I have recently updated both computer and keyboard due to the ever-improving technological advances in this field.

There are several general equipment definitions which must be identified before discussing specific name brand equipment. The basic MIDI accompaniment setup (for computer assisted instruction) requires the following: a computer, a sequencing program, a synthesizer and/or tone generator, a monitor speaker, MIDI interface, MIDI cables, SCSI cable, patch cord(s), and an ear piece. The computer used for this project was a Macintosh PowerBook 1400c. The specifications for the PowerBook 1400c include 16 megabytes of RAM (Random Access Memory), 1,000 megabytes (1 gigabyte) of memory on the hard drive, and a 166 megahertz processor. These specifications (16/1000/166) are more than adequate to run many of the sequencing programs that are commercially available.

A sequencer is a computer software program which is purchased separately and must be installed on the computer's hard drive. This program enables the computer to function as a recording device much like that of a tape recorder but...
with digital recording and editing capabilities. The sequencer I used was Metro™, a relatively inexpensive and user friendly program.

The recording of musical data (sound) onto the sequencer and computer necessitates a synthesizer. Synthesizers are produced in many forms, the most recognizable being a keyboard. There are many electronic keyboards on the market today but not all of them are MIDI capable, a mandatory asset for the completion of the basic MIDI setup. Most MIDI keyboards have the term MIDI printed on them but verification can be obtained by checking the back of the keyboard to see if there are three MIDI ports labeled MIDI IN, MIDI OUT, and MIDI THRU. The Yamaha PSR 420 proved to be quite sufficient for my needs. I looked for cost effectiveness, portability, full size keys, the number of sounds available, and expandability (i.e., is the keyboard able to add new sounds through the use of cartridges?). The university where I currently teach acquired a Yamaha Clavinova for my studio. This keyboard is a far more powerful synthesizer than my PSR 420. This upgrade has not substantially affected my MIDI setup, but I will make mention of the differences in setup between the two keyboards as I currently use both (see page 9).

The next piece of equipment required is a MIDI interface or translator. This piece of hardware allows the computer and synthesizer to communicate with each other. The MIDI

interface I purchased is *Translator Pro* by Opcode Systems, Inc. Some keyboard synthesizers have internal interfaces, an option that can be verified by simply looking at the back of the synthesizer or consulting the owner's manual.

The networking of the above equipment calls for the purchase and implementation of certain cords/cables for a MIDI setup. Each end of a *MIDI cable* has a five pin jack or din. Two cables are needed (MIDI out and MIDI in) to connect the synthesizer to the interface. A *SCSI cord* is needed to connect the interface to the computer. The *patch cord* connects the synthesizer to a speaker. An ear piece, similar to that of a transistor radio ear piece, is plugged into the audio port of the computer. The ear piece is required to hear the metronome or click track during practice and/or performance. After the mechanisms have been installed and connected, the basic MIDI accompaniment setup is complete (refer to Figure 1).

![Diagram of MIDI setup](image)

**Figure 1: Basic MIDI accompaniment setup**

* Some keyboard synthesizers have built in speakers but may have a limited volume, therefore the *monitor speaker* enhances sound depth.

* Note: When using the Yamaha Clavinova there is not a need for the interface, MIDI cables, speaker, or patch cord as the Clavinova has a built in interface and sufficient speaker volume.
Analysis of the Stevens' Sonata

The Stevens trumpet sonata was chosen to exemplify the application of electronic accompaniment to an acoustically conceived work for three reasons. First, the outer movements contain many alternations between various meters (e.g., 5/8, 2/4, 6/8, 7/8, etc.). Second, there are several tempo changes, particularly in the first movement. Third, the technical demands on the accompanist with regard to tempo and technique, especially in the outer movements, establish this as an ideal example of how CAI can benefit studio instruction. Elliston best describes these technical demands by stating, "The odd rhythms and meters in movements 1 and 3 tend to make the music feel awkward to the performers until well-rehearsed. Stevens' piano parts are pianistic, but counting can be a problem. He explores various colors to a greater extent than Kennan, with pedal indications of S.P. (sostenuto pedal) and tre corde, and the use of glissandi in the bass line at the beginning of movement 2."

A preliminary analysis of the sonata reveals that the first movement contains six different meters, ten different tempo changes, and thirty-four dynamic changes. The second movement, while having only one meter and no tempo changes, contains twenty-three dynamic fluctuations. The third movement has nine meters, two tempi changes, and thirty-one dynamic fluctuations (see Appendices B, C, and D).

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Once a preliminary analysis has been completed and the studio teacher is comfortable with a sequencing program, programming can begin. All of the previously mentioned aspects (tempo, meter, dynamics) can be addressed through the use of computer assisted accompaniment.

**Programming and Editing**

The basic programming and editing processes are covered extensively in the manuals of the respective sequencing programs. My purpose in discussing basic programming and editing is to introduce the reader to basic concepts needed to understand the processes being discussed and demonstrated. I have gleaned from working with several different sequencing programs that many of the editing features are similar among the various marketed sequencing programs. Familiarity with basic computer language will enhance the reader's understanding while perusing this document. A glossary of terms is provided in Appendix A. In addition, I have included editing terms which relate to the particular sequencing program with which I am currently working. Many of these editing terms are universal among the various sequencing programs available today.

As stated earlier, the sequencing program allows the computer to act as a recording device, similar to a tape recorder. The monitor displays a virtual recording panel with such button icons as play, record, stop, return, cue, and fast forward (F.F.). In addition to recording features the screen displays various editing icons: a keyboard,
pertinent MIDI information, and a note editor window (see Figure 2).

The data contained on the note editor window resembles that of a roll on a player piano. Each line, dash, or dot represents a particular note, duration, articulation, and velocity. The process I used to enter the Stevens' Sonata into the sequencer is as follows: I created a meter map by referring to the score and listing all of the mixed meters and their respective measures (see Appendix B). The process of entering the different meters was a time consuming task, but the resulting meter map greatly aids in future editing processes.

Once a new program or file has been opened it will provide a similar screen to that of Figure 2 but will not contain information (lines/dashes) in the note editor window.

Figure 2: Tranport and note editor windows

Before entering the various meters the process of numbering the measures should be completed for each respective movement.

![Sections Window](image)

**Figure 3: Sections Window**

The above window, Figure 3, Sect 1:Untitled, is made available in the upper left hand corner of the screen at the beginning of a new sequence. Click on the box under Bars and enter the number of measures for the first movement.

The various meters are entered by clicking on the treble clef/staff/meter icon (Figure 2, upper left hand corner) in the transport window and the Time & Key Signatures window will appear (see Figure 4).

![Time & Key Signatures](image)

**Figure 4: Time & key signatures window**

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13 Ibid.
As shown in Figure 4, the movement is currently set to 4/4 time for the entire movement (which is the only metric requirement for movement 2). The meter may be altered by entering the appropriate information and clicking OK. For example, the process for entering measures 1 through 4 is: enter From Bar [1] to Bar [4], set the time signature to 2/4 by clicking on the top meter number and changing it to a 2, click the box on the left side of Set Time Signature to and press return or click OK. This process needs to be repeated for the entire movement using the meter map created to expedite this process (see Appendix B).

The next step required (before entering the accompaniment) is that of programming all tempo fluctuations (e.g., accelerandi, ritardandi, or subito tempi changes). The protocol for altering the tempo is satisfied by clicking on the Tempo icon in the lower right corner of the Transport Window (see Figure 5).

![Figure 5: Tempo window](image)

The easiest method for altering/entering the various tempi is performed by clicking and dragging (highlighting) over the desired measures, using the above window for programming purposes (see Figure 5).

![Note Editor]

In Figure 6, measures 1 through 3 have been "clicked and dragged" (highlighted). Once performed, the Tempo window is selected, the appropriate data is entered, and OK is clicked to store the information. Movement one is comprised of no less than ten tempi fluctuations, which necessitates the drafting of a "tempo map" (see Appendix D) while entering data.

After the aforementioned process has been completed for movement one, the next step required is the completion of the same data entry process for the ensuing movements. Click on Windows in the top most menu and select Sections (see Figure 7). Double click on number 1) (under Sections) and a window will appear (Enter Section Name...). Enter the appropriate information for each section. Throughout the data entry

"Metro 2.5, Twelve Tone Systems, Inc., Cambridge, Mass."
process it is advantageous to systematically save the information entered. When the document is saved, the Sections window will display the document's name (Stevens Son...). Inputting this data serves two purposes: First, a "programmed" metronome is created with which the soloist or accompanist may practice. I typically require that the pianist practice with a click track to become familiar with the tempi and metric fluctuations; second, the programmed metronome serves as a click track for the accompanist while entering the keyboard accompaniment. One distinct advantage of using a sequencing program is that the accompaniment may be programmed at a substantially slower tempo than the performance tempo. Once the accompaniment has been recorded, the tempo may be altered without affecting pitch. The tempo may be altered by clicking on the left or right arrows in the Tempo box (see Figure 8). Performing this function will

"Metro 2.5, Twelve Tone Systems, Inc., Cambridge, Mass."
affect all tempo changes in relation to the beginning tempo.

Figure 8: Tempo icon

For example, if the starting tempo is 120 bpm (beats per minute) and is reduced to 100 bpm, the ensuing accelerandi, ritardandi, and subito tempi will be reduced proportionately.

When the pianist is ready to record, the program is designed to allow recording directly into the sequencer. This technique, called real-time recording, is far more efficient than step-time recording, a process in which each note is entered one at a time. Several "count off" measures are needed to supply the accompanist/programmer with an idea of the beginning tempo. Select Count Off in the transport window (the option will currently display No Count Off). Select Record Play Set Up from the Setup menu. The default setting will contain one bar of count off before recording. I usually enter a minimum of 3 bars to provide the accompanist with a steady tempo. The three measures of count off will be in the tempo and meter of the first measure (i.e., movement I begins in 3/8 at 116 bpm, thus three measures of 3/8 at 116 bpm will sound). Note, the click track tones will indicate the "pulse" of each bar and meter by sounding a high pitched tone on beat one and a lower pitched tone thereafter. Once the recording process is under way, I encourage the pianist to play the movement in its entirety. If errors occur they may be edited at a later time.

time. If the pianist must stop while programming there is not a need to begin anew. The **Punch In** option allows the programmer to resume where he/she left off, or as an editing feature, replace inaccurate section(s) within the sequence. Clicking on the **Punch In** icon, located in the Transport window next to the metronome icon, will prompt the window: (see Figure 9).

![Punch In/Out options window](image)

**Figure 9: Punch in/out options window**

For example, to replace the portion of the sequence from bar 25 to bar 50 (from beat 1 of bar 25 to beat 4 of bar 50) one would select the information contained in Diagram 9, making sure that the **Punch In** option is selected. The **Overdub** option will add to the existing information while **Punch In** replaces existing information. After executing the **Punch In** process and clicking **OK**, rerecording will begin on beat 1 of bar 25 and progress to beat 4 of bar 50.

The editing of a sequence can involve many processes; **Scrubbing**, **Overdub**, **Punch In**, and **Quantizing** are just a few.

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processes which are often employed. Sequencing programs allow the programmer(s) to perform many other tasks in addition to recording piano sequences. These programs are also designed to allocate large MIDI studio set-ups and synchronize Quick Time movies with music. For the sake of not rewriting the manual, I will discuss those processes which are directly related to computer assisted accompaniment.

The obtaining of a competent keyboardist to enter the sequence will greatly reduce the number of errors. Fewer mistakes made during the recording process will diminish the editing required to achieve a useful accompaniment.

One of the first steps required for the editing process is to listen to the sequence at a reduced tempo while following the score. While listening, I make notes in the score where errors have occurred. The individual numbering of measures will assist in the editing process, as the Note Editor window displays the measure numbers after the click track has been completed. Once errors have been identified, I employ the Scrubbing feature located under the Switches menu. This feature enables the user to click and drag (thus highlighting) on any measure(s) from the Note Editor window, allowing the pitches to sound (see Figure 10). Scrubbing may be executed as fast or slow as needed depending on the rate at which the mouse is manipulated. In addition, Scrubbing allows the user to repeat the process with the option of listening to the suspect section(s) as many times as needed. In addition to the Scrubbing feature, the Forcep is activated...
by clicking on the icon located in the top portion of the Note Editor window (see Figure 2). The Forcep tool allows one to click and drag, selecting only portions of the measure(s) in case the listener wanted to hear only the upper octave notes of a particular section (see Figure 11).

Figure 10: Scrubbing example

Figure 11: Forcep and scrubbing example

Figure 11 exemplifies that only the notes highlighted will be affected by the ensuing editing features. Use of the Scrubbing option in conjunction with the Forcep will allow the pinpointing of problem areas which can be further addressed with various other editing features.

One of the most common errors incurred while programming sequences is wrong notes. Wrong notes may be extra notes, which can be deleted by double clicking and deleting, or

" Ibid.
highlighting and deleting. Double clicking on a note (line/dash in the note editor window) will prompt the window shown in Figure 12. Note Event Edit presents several different parameters which can be altered pertaining to the single pitch that was selected. The Note box, Velocity on box, and the Delete box are the only features that are efficient for my personal editing needs. Velocity refers to the loudness or softness of a note, with the number 127 being the maximum. The remaining features contained in the Note Event Editor are more efficiently put to use by employing the mouse (i.e. clicking and dragging). For example, if the note in question is on the wrong pitch, it may be selected by clicking, holding, and then dragging the note to the desired pitch. Moving the cursor across the screen will display (in the upper right corner) the exact pitch and octave of the note in question (refer to Diagram 13).

![Figure 12: Note event edit window](image)

If the note in question is too long or too short, use the Forceps to select the note and then select Duration under the

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* Ibid.
Options menu. This act will open a window allowing the variation of note lengths (see Figure 14). Selecting the up or down arrow will alter the duration. The desired note duration is best accomplished via the process of experimentation.

Once the notes are in order, the next problem addressed is that of precision. Most problems regarding precision occur between the accompanist and the click track during programming, for the computer records all imperfections with great precision. This particular error is very evident while listening to the sequence and click track simultaneously. On first listening one may notice that the click track does not always aurally align with the accompaniment. A process called Quantizing is used to correct this problem. The command for this is found under the Options menu. To correct imprecision, highlight the misaligned section and select Quantize, thus opening the following window (see Figure 15).

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Figure 14: Duration window

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Attacks and Releases may be adjusted by clicking the respective boxes. The Quantize value refers to the note values being affected and can be changed by using the arrows. Experimentation is required to achieve the most desirable result.

Quantizing will align an entire sequence if the sequence consists of similar note values throughout. This feature is advantageous when programming sequenced accompaniments for beginning trumpet students, as most note values are similar throughout. Possessing knowledgeable experience with respect to Quantizing saves many hours of tedious editing time. However, if Quantizing does not function in a particular setting, adjusting the precision of attacks and releases visually will remedy the problem.

Quantizing can change the selected portion of accompaniment to something completely unrecognizable. If this occurs, it is due to the selection of a portion of sequence that may contain many different note values. If

*Metro 2.5, Twelve Tone Systems, Inc., Cambridge, Mass.*
this is the case, the Quantizing process has recognized all of the selected (variable) note values as the same value. The use of Forceps allows the selection of those notes that are of the same value, thus allowing a more exclusive method of editing.

Visually increasing the size of the Note Editor window will help to expedite the manual alignment of notes (the magnifying glass icon contains a "+" and "-" symbol that will enlarge/decrease the size of the Note Event window). The enlargement of the Note Editor window will clearly display the out-of-line attacks/releases and can be adjusted by clicking and dragging until the targeted notes are aligned with their respective beats (see Figure 16).

Figure 16: Magnifying glass icon

The Human Feel option, located beneath the Option menu, is designed to make the sequence (once it is programmed and fully edited) sound less mechanical. The use of real-time recording (the recording of an actual performance of the accompaniment) as opposed to step time recording (the process of entering each note separately) provides the desired "human feel." The engagement of the Human Feel option will remedy

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those areas of the sequence which have been edited to the point of sounding too mechanical. As with any editing feature the programmer must highlight a section; I recommend selecting a section and not the entire sequence. After following this procedure, selecting Human Feel located under the Options menu will provide the desired effect (see Figure 17). The randomization of velocities (dynamics) and/or tempi is not suggested as this option is designed to function in relation to the editing of Quick Time movies. The process of experimentation reapplied to the start times (percentage only) and durations will illuminate the beneficial possibilities of this feature.

Figure 17: Human feel window

Most of the editing features discussed thus far have involved either preparation (click track) or correcting errors. One of the most unique editing aspects is that of making adjustments within the sequences (accompaniment) to suit the needs of individual students. The involvement of students in the process of editing the accompaniment not only helps them understand music technology, but also requires them to make informed musical decisions with respect to tempi, dynamics, and other expressive musical elements.

The editing of tempi to conform to the needs of a particular student is a very simple task. In fact, this is the same process used to enter the programmed metronome (see Figure 5). The alteration of tempi is accomplished by highlighting the appropriate measures and following the process discussed in reference to the program metronome (see pages 16-18). If the need arises to reduce or increase the tempo for the entire movement or work - inclusive of ritardandi, accelerandi, and subito tempi changes -, the arrows in the Tempo box can be used (see Figure 8). This feature, without affecting pitch, will reduce all of the preprogrammed tempi proportionately.

Sequencing programs do not use the term, "dynamics", to refer to the loudness or softness of sound; instead these programs use the term, "velocity". Even though the keyboardist who entered the accompaniment may have been extremely expressive with regard to dynamics, the soloist may have a different opinion concerning dynamics. If so, students can make their own informed decisions regarding
dynamics, thus becoming more involved in the craft of music performance. If a section of the accompaniment is too soft and the performer wants it to be louder, highlighting those measures and selecting Velocity under the Options menu will achieve the desired effect (see Figure 18).

![Velocity window](image)

Figure 18: Velocity window

Much like the Tempo feature, the Velocity window will allow the performance of subito or gradual dynamic changes. As with tempi, a controlled amount of experimentation is necessary to attain the desired dynamics.

The Transpose feature has proven to be an invaluable teaching tool within the studio. For example, when I assign a student the Haydn Trumpet Concerto and the tessitura is too high, I require that they practice the E-flat trumpet part on a B-flat trumpet without transposing. In doing so, the student is sounding the interval of a fourth lower, which aids in overcoming the temporary tessitura limitation while practicing the correct fingerings, rhythms, and the avoidance

"Metro 2.5, Twelve Tone Systems, Inc., Cambridge, Mass."
of tessitura stress placed on the student’s embouchure while performing in a high tessitura. I then graduate the student to the Eb trumpet by having them play the part on a C trumpet (not transposing), then D trumpet, and finally on an Eb trumpet. The transposition can be performed by highlighting the entire sequence and/or movement and then selecting Transpose from the Options menu (see Figure 19).

Once the desired editing has been completed, rehearsing with the sequenced accompaniment may begin. There are a few aspects which need to be addressed before simply pressing “play”: first, plug the ear piece into the audio port of the computer; second, click on the metronome icon located in the lower right corner of the Transport window (refer to Figure 20). The click track will be activated by selecting the metronome icon, which in turn will transmit the sound through the ear piece. The first beat will sound at a higher

![Transpose window](image)

**Figure 19: Transpose window**

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"Metro 2.5, Twelve Tone Systems, Inc., Cambridge, Mass."
pitch than the remaining beats of a bar, supplying the performer with necessary aural information. A **Countoff** is helpful if the accompaniment begins with the soloist entering on the first beat as in Stevens' first movement. A **Countoff** can be selected by clicking and changing the preset **No Countoff** bar and selecting **Countoff** (see Figure 20).

![Metronome icon](image)

**Figure 20:** Metronome icon

The final step is to select **Record and Play Setup** from the **Options** menu (see Figure 21). Figure 21 demonstrates that three bars of **Count off** have been selected, thus allowing

![Record and Play Setup](image)

**Figure 21:** Record and play setup window

the performer to activate the sequence by clicking the **Play** button in the Transport window. Clicking the **Return** button

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* Ibid.
(located on the Transport window) will ensure that the sequence starts from the beginning and not from the last edit performed.

Sequenced accompaniment can address many problems between the soloist and the accompaniment. For example, a common problematic section in the Stevens Sonata is located in measures 120 through 130 of the first movement. To practice this section repeatedly, move the cursor or set the measure (bar) number in the Transport window to measure 120 and allow the accompaniment to play through measure 130. The next time the cue button (located between the Return and F.F. buttons) is selected, the sequencer will play only measures 120 through 130. The cuing feature allows for the reduction of tempo and its gradual increase for rehearsal purposes. Second, assisted accompaniment provides rehearsal flexibility and patience to the soloist with regard to accompaniment availability. Third, sequences prepare the performer for rehearsal with a "live" accompanist. When the edits for the accompaniment have been tailored to the individual's needs, I often make a practice cassette tape and/or have the "live" accompanist listen to the edited sequence so they can know the musical desires of the performer.

Metro's functions can be applied to other educational aspects in addition to solo accompanying. In difficult brass quintet music (and in the genre of wind ensemble literature), I have constructed click tracks which can be amplified and used during rehearsals. Click tracks are an excellent teaching tool as well and can save valuable rehearsal time.
In summary, there are many educational benefits that computer assisted instruction provides. Below is a list of these benefits and a brief explanation of each.

**Availability:** The student may rehearse with the accompaniment at any given time.

**Technology:** The student becomes more aware of technology and how it relates to the field of music education. This in turn may peak an interest in the field of music technology.

**Metronome:** A programmed metronome or click track serves as a wonderful learning aid when working on metrically challenging music such as the Stevens Sonata.

**Preparation:** Rehearsing with sequenced accompaniment better prepares the student for rehearsing with a "live" accompanist. The student has a better understanding of the accompaniment, thus making the first rehearsal with a "live" accompanist more efficient.

**Rehearsing:** Not only is availability a valuable asset, but the rehearsal techniques of cuing, dynamics, tempi alterations, and transposition make sequences and sequencers a valuable rehearsal tool.

**Intonation:** Rehearsing with the sequenced accompaniment heightens the student's
awareness of intonation. Rehearsing solely with a metronome may not reveal to the performer that the top space G becomes very sharp as they tire or that the fourth line D becomes very flat.

The final sequences tailored to the needs of each individual allows the student to contribute informed musical decisions with regard to their solo.
CHAPTER 3: CONTEMPORARY TRENDS

Current Products

The computer field in general provides commercially available products which tend to be outdated soon after they are introduced to the public. However, certain products have the possibility of becoming mainstays in the market. One such device/program is SmartMusic Studio™ (formerly Vivace® Practice Studio™) by Coda Music Technology, Inc. This program offers computer assisted accompaniment, but is limited in its interactive capabilities with respect to tempi and dynamics. The accompaniments must be purchased through Coda Music. The editing of these accompaniments is limited when compared to the editing capabilities of sequenced accompaniment. Another limitation pertaining to the interactive capabilities is the existence of a slight inaccuracy following the performers every rubato. 

However with the recently large decrease in price, SmartMusic Studio™ has become a valuable and affordable tool for developing musical skills that otherwise would not be available without an accompanist.

Band-In-A-Box™ is a supplemental sequencing program I incorporate in the studio. This program is virtually what the title implies. It is an accompanying ensemble contained within a MIDI program. I use Band-In-A-Box™ when teaching students jazz as the program will assemble a band (keyboard, bass, and drums) based on the entered chords. There are

"Shan-Mei Amy Tseng, "Solo Accompaniments in Instrumental Music Education: The Impact of the Computer-Controlled Vivace on Flute Student Practice", (PhD. Dissertation, University of Illinois, Urbana-Champaign, IL, 1995), 84.

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numerous styles to choose from, and like Metro, this program will allow tempi alterations. This virtual band is an outstanding means of training beginning jazz students enabling them to be more uninhibited and adventurous with regard to improvising, as might not be the case with live performers.

One of the most valuable sources I have encountered while researching new trends in music and technology is the magazine entitled, *Music and Computers*. Besides providing reviews of the latest software and hardware, there are informative columns in each issue pertaining to MIDI, downloading, and educational applications. Ken Johnson, one of the columnists for *Music and Computers*, provides the monthly column entitled "Computers in Education." His columns provide helpful ideas for the integration of computers and technology within the music curriculum. If one approaches the teaching of music courses by first knowing the students' interests, then the instructor may make an otherwise dull music assignment more appealing." Most of my students spend an exorbitant amount of time surfing the internet, therefore the incorporation of this technology within the studio can enhance their private lessons. A future studio assignment will be one of having my students locate, download, and import a standard MIDI file of a trumpet solo accompaniment while searching the internet. This investigative project will not only aid the student in

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locating sites that offer free MIDI files but will make them aware of the virtually limitless educational possibilities available to them via the internet.

Conclusion

The perusal of numerous sources consulted during the pursuit of this document revealed a mutual underlying theme: music technology must be integrated inclusively in the music education curriculum, encompassing the basic rudiments taught in grade school general music classes to the most advanced graduate music degrees. In describing the topic of my document to fellow musicians I received mixed reactions. I admit that some were interested, but most were not. "The adherence to traditional methods, and the fear of computers and electronics, or 'technophobia,' continues to prevail throughout many of our educational programs." The integration of new technologies within the current curriculum is key to successfully preparing musicians for the future. Each music faculty member at the university where I currently teach has a computer in their studio/office. In fact, our department has no need for paper memos; e-mail has prevailed. Music departments/schools are increasingly obtaining keyboard synthesizers for studios and labs (composition, education, piano, theory), but the coupling of computers with synthesizers is not being used to its greatest potential. The use of sequences to accompany students in the studio is but a small portion of what can be integrated within the

curriculum. Theory classes could apply the technology to dictation (harmonic and melodic) and other written assignments. History and literature courses could take advantage of the ever growing educational CD ROM collections. Music education courses could make use of notational programs, marching band drill design programs, and databases which could be used for inventory and budgetary needs. The expansion of an already saturated program by the addition of degree requirements is not in the student’s best interest unless the addition incorporates technology classes into the curriculum. The National Association of Schools of Music (NASM) is requiring that all students pursuing a professional baccalaureate degree should be “made familiar with the capabilities of technology as they relate to composition, performance, analysis, teaching, and research.” Other professional music affiliations such as Music Educators National Conference (MENC) and the Manhattan Music Curriculum Project (MMCP) are taking active roles in identifying the need to incorporate said technologies in the field of music.”

My desire is this document will serve as a “how to get started” guide for students, performers, and teachers alike by focusing on the discussion of my personal justification for using CAI, investigation into the equipment used, programming and editing capabilities of MIDI based systems, and a performance demonstration of Halsey Stevens’ Sonata for

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Trumpet and Piano. As a teacher and performer I believe that creating such a document will help fellow teachers/performers with studio instruction and aid their students in keeping abreast of the emerging and ever-improving computer technology and its function in music education. Music technology, especially the interactive aspect, rather it will enhance the education of ourselves and our students.
BIBLIOGRAPHY


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APPENDIX A: GLOSSARY OF BASIC COMPUTER TERMS

Mouse - This device allows the cursor to move anywhere on the screen by rolling the mouse over a flat surface. The cursor responds to direction in conjunction with the motion of the mouse. The mouse is also equipped with a button(s) allowing the user to select and/or open information contained on the screen. Similar devices include the track pad and track roller.

Click - Refers directly to the button(s) on the mouse. "Clicking" will highlight and/or select different options available. The act of clicking and holding is needed when viewing menu items. The act of clicking and dragging allows the selection of larger portions of information. Double clicking will open programs, documents, and certain other features.

Menu - The menu is always located at the top most portion of the screen. To access any item, click and hold on the menu term (printed word), thus prompting a list of options. To select a menu option, move the cursor down (while depressing the button), highlight the option needed, and then release the button.

Edit Menu Terms

Undo - Allows the "undoing" of the last edit performed.

Redo - Allows the "redoing" of what has been undone.

Cut - Removes a highlighted section. This "cut" is stored in the memory until the cut or copy command is used again.

Copy - Is similar in all respects to cut but does not remove the selection when the process is performed.

Paste - May be performed only after a selection has been either cut or copied. This feature may be repeated more than once.

Clear - Removes all selected data and may be retrieved only by implementing the undo option.

Paste And... - This allows for the pasting of numerous copies of the data that was cut or copied. The number of times that the selection is to be pasted may be specified.

Select All - This function allows for the selection of all data contained within a sequence. Editing features performed will effect the entire sequence.
Options Menu Terms

Quantize - Used to align imprecise attacks by shifting the attacks to specified beats. Variables such as percentages and types of notes may be altered.

Duration - Refers to note duration (i.e. quarter, half, eighth, etc...). Following the selecting of a note or group of notes, one may alter the durations either by percentage or note values.

Transpose - This option can alter the pitch of the selected notes. The dialog box will allow three options of transposition: chromatic, scalar, or pitch.

Human Feel - This option is made available to rid the selection of sounding too mechanical due to quantizing and other performed edits. Timing and/or velocity (dynamics) may be altered. Step Time sequences may receive the most benefit from this feature.

Velocity (also known as Dynamics) - The selection of this option enables the manipulation of the attack and release velocities (loudness/softness of notes). This feature is used when the accompanist/programmer may not have implemented expressive dynamics (crescendi, diminuendi, accents, et al.) during recording.

Tempo - Allows the selection of: a specified tempo, gradual change from one tempo to another (accel. or rit.), or the scaling of the selection to fit a specific amount of time using hours, minutes, and seconds.

Switches Menu Terms

Playback Scrolling - This feature prompts a window (Note Editor) showing the data entered. During play the data will scroll across the screen. This window resembles the roll on a player piano and allows one to perform editing features.

Scrubbing - This feature allows the cursor to move and sound the data contained in the Note Editor window. The entire range of measure(s) or a portion thereof may be selected by using the Forceps (located directly above the Note editor window). The speed at which data is played is determined by the rate at which one drags the mouse. This feature is helpful in locating wrong notes, especially in thick harmonic sections of the sequence.
Transport Window Term (Icon)

Punch In - Once programmed, this feature will allow recording to begin where the programmer has previously ended, or replace a specified number of bars/beats within the sequence once recording commences.

Overdub - This feature functions much like Punch In but adds information to previous data instead of replacing the existing data.
# APPENDIX B: METRIC ANALYSIS

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<td>3/8</td>
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## APPENDIX C: DYNAMIC ANALYSIS

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<td>$p$</td>
</tr>
<tr>
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<td>$&lt;$</td>
</tr>
<tr>
<td>$mf$</td>
<td>$f$</td>
</tr>
<tr>
<td>$p$</td>
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<tr>
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<td>cresc.</td>
</tr>
<tr>
<td>$f$</td>
<td>$f$</td>
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<tr>
<td>dim.</td>
<td>dim.</td>
</tr>
<tr>
<td>$p$</td>
<td>$p$</td>
</tr>
<tr>
<td>$&lt;$</td>
<td>$&gt;$</td>
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<tr>
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<td>$&gt;$</td>
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<td>mp</td>
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<td>dim.</td>
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<td>$f$</td>
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<tr>
<td>$&lt;$</td>
<td>$ff$</td>
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Movement III

Dynamic | mm
---|---
mf | 1-4
f | 5-6
mf | 6
f | 7-17
p | 17-19
f | 20-24
ff | 25-28
f | 28-42
< | 43
> | 44
f | 45-47
mp | 48-49
f | 49-50
> | 51-53
p | 54-58
f | 59-79
p | 80-92
< | 92-93
> | 94-95
f | 90-105
fz | 106
p | 107-117
f | 117 (beat 3)-123
< | 124-126
ff | 127-144
f | 145-147
p | 148-154
f | 155-163
cresc. | 164
ff | 165-166
f cresc. | 167-170
**APPENDIX D: TEMPO ANALYSIS**

**Movement I**

<table>
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<tr>
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<th>Tempo</th>
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<td>1-50</td>
<td>116-120</td>
</tr>
<tr>
<td>51-66</td>
<td>48</td>
</tr>
<tr>
<td>67-68</td>
<td>116-120</td>
</tr>
<tr>
<td>69</td>
<td>48</td>
</tr>
<tr>
<td>70</td>
<td>116-120</td>
</tr>
<tr>
<td>71</td>
<td>48</td>
</tr>
<tr>
<td>72-19</td>
<td>116-120</td>
</tr>
<tr>
<td>192-214</td>
<td>48</td>
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<tr>
<td>215-246</td>
<td>116-120</td>
</tr>
<tr>
<td>247-249</td>
<td>allargando</td>
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**Movement II**

<table>
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<tr>
<th>mm</th>
<th>Tempo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-89</td>
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**Movement III**

<table>
<thead>
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<th>mm</th>
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</thead>
<tbody>
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<td>1-168</td>
<td>128</td>
</tr>
<tr>
<td>169-170</td>
<td>poco allargando</td>
</tr>
</tbody>
</table>
APPENDIX E: CONSENT FORM

Date Sent: Monday, May 01, 2000 8:24 AM
From: MichaelHoover@Cakewalk.com
To: tz3
Subject: RE: Letter

Urgent New Tim,

Sorry about that. Here you go...

May 1, 2000
Tim Zifer, University of Evansville, Music Dept.
1800 Lincoln Ave, Evansville, IN, 47722

Dear Mr. Zifer

Please accept this letter as written permission to include multiple screen captures and icons from Cakewalk Metro in "Computer Assisted Instruction and Sequencing within the Studio: A Focus on Halsey Stevens' Sonata for Trumpet and Piano."

If Possible, we would like to receive a copy of this work for our records.

Sincerely,

Michael Hoover
Product Manager
Cakewalk
VITA

Trumpeter Timothy Zifer holds degrees from Ohio University School of Music (Bachelor of Music Education, summa cum laude), and Louisiana State University School of Music (Master of Music and Doctorate of Musical Arts). His teachers have included Ernest Bastine, William Scarlett, Charlie Butler, and James West. Professional performing obligations have included Evansville Philharmonic Orchestra, Baton Rouge Symphony Orchestra, Owensboro Symphony Orchestra, Acadiana Symphony Orchestra, LSU Faculty Brass Quintet, UE Faculty Brass Quintet and The Brass Company. Recent international appearances have included performances in China (Beijing, Shanghai), Hong Kong, and England. Professor Zifer frequently presents lectures on computer assisted instruction and its application in the studio setting. A conductor also, Timothy has studied conducting with Frank Wickes and Ronald Socciarelli.

In 1996 Timothy was appointed assistant professor of music at the University of Evansville where he currently serves as Professor of Trumpet and Director of Bands. His teaching duties include Studio Trumpet, Wind Ensemble, Symphonic Winds, Brass Ensemble, and Athletic Pep Band.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Timothy J. Zifer

Major Field: Music

Title of Dissertation: Computer Assisted Instruction and Sequencing within the Studio: A Focus on Halsey Stevens' Sonata for Trumpet and Piano

Approved: 

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

May 1, 2000