



Software-Assisted Composition Instruction For Non-Music Students

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The Interactive Music Technology Curriculum Project (IMTCP) was a research endeavor that sought to use interactive software to teach composition and performance to middle-school students including those with little or no musical experience. The software used in this study allows individuals to use the number keys on a computer keyboard to play diatonic scale degrees and chords in a specified key.

In 2010, IMTCP was conducted at Rowan University with a group of middle-school and early high school students in a one-week music camp setting during the summer. Early activities involved brief explanations of music terminology like pitch, harmony, and timbre. A collection of free open-source software apps (eamir.org/imtcp) was used exclusively to demonstrate these musical concepts. These apps were used as the instruments by which students composed and performed throughout the week.

Instructional Activities

After a brief crash course in harmony, students were asked to go to YouTube® and copy the links to 10 songs that they liked. The instructors listened to these songs and created a single sheet of paper containing the form and chord progressions containing just the numeric diatonic chord functions. Each student then had a folder containing a Word document for each song they identified. Each document displayed the artist name, tempo, key, and the chord progression (typically a 4 bar phrase) used for each section of the song's form.

Artist: Train		Song: Hey, Soul Sister		Key: E		Tempo: 98 bpm	
Intro:							
1	5	6	4				
Verse: 2x							
1	5	6	4				
1	5	6	4	5			
Chorus:							
4	5	1	5	4	5	1	5
4	5	1	5	4	5		

Figure 1: Excerpt of sheet music made for student playback showing diatonic chord functions

The software used in this project all hinged around one central idea: since scales consist of seven unique notes, and chords are built up from scales, if we map these seven scale degrees or chords to simple control interface, like the numbers 1-7 on a standard ASCII computer keyboard, we would enable the students to control diatonic harmony with an accessible control interface that they are already familiar with. With a list of chord functions of their favorite music and the ability to play such chords just by pressing a number key on the computer keyboard, students played through their favorite songs and composed original compositions. The chords generated by the software could utilize internal software timbres or could be routed to a third party DAW like GarageBand® where the timbres could be changed and the data could be recorded and layered.

As the week progressed and the students' understanding of triggering diatonic notes and chords became clearer, a MIDI keyboard was introduced by which a seven-note major scale would be used to trigger the diatonic scale degrees instead of the number keys on a computer keyboard. When the student played a single note of the scale, the software added the remaining chord tones to complete the diatonic chord for that scale degree. If a student played the note D, scale degree 2 in the key of C major, the software would add the third and fifth (F and A) to complete the chord. The MIDI keyboard would in essence be functioning as a trigger just like the computer keyboard was being used earlier. Electric guitars or acoustic instruments could be harmonized in the same way since the software can detect pitch from a microphone. Eventually, the software was removed completely and students played chords on their MIDI keyboard.

Each day, students were asked to identify progressions that they liked, either from the popular music they were playing or others, and devise a form as pictured above with progressions allocated to each section. Students would then perform and record their original compositions (and the works of others in the class) using the IMTCP software to perform and GarageBand® to record. Students were permitted to use drum loops if desired, but all other harmonic or melodic content had to be original. Instructors were able to make comments about their compositions.

In addition to composing and performing diatonic chord functions, students soon became comfortable with identifying progressions and chord functions by ear. A number of pop songs were played in which the students were able to successfully identify the chord progression by ear using the IMTCP software as an aid. This opened the door to allow the students to perform other music that they liked without the need for the instructors to create sheet music for them.

The Software

There were 6 IMTCP software titles used in the 2010 version of this study, labeled E000 - E005, each with a specific purpose. Each program was introduced to the students with an explanation of the musical concept it highlighted before they were invited to use it to help them compose.

E000

E000 is a basic demonstration app for showing the numerical relationships between scale degrees and how chords can be built in tertian harmony. It uses the numerical keys from a computer keyboard to trigger diatonic scale degrees or chord functions. The tonic

and mode can be determined by selecting from the two pull-down menus. Chord tones can be added or taken away by checking the chord tones boxes. The chord voicings and octave doublings can be adjusted from the chord voicing menu.

The software has the option to enable auto sustain in which notes will sustain until a new note is received or the space bar is pressed. This allows notes to sustain while the user is preparing to play the next note. With manual sustain enabled, notes will sustain only as long as the number key is held down allowing rhythmic patterns to be performed with greater accuracy than in auto sustain mode. A mode using an automatic playback style can also be turned on and set in beats per minute in which sustained chords will instead be played back with a specified rhythmic pattern.

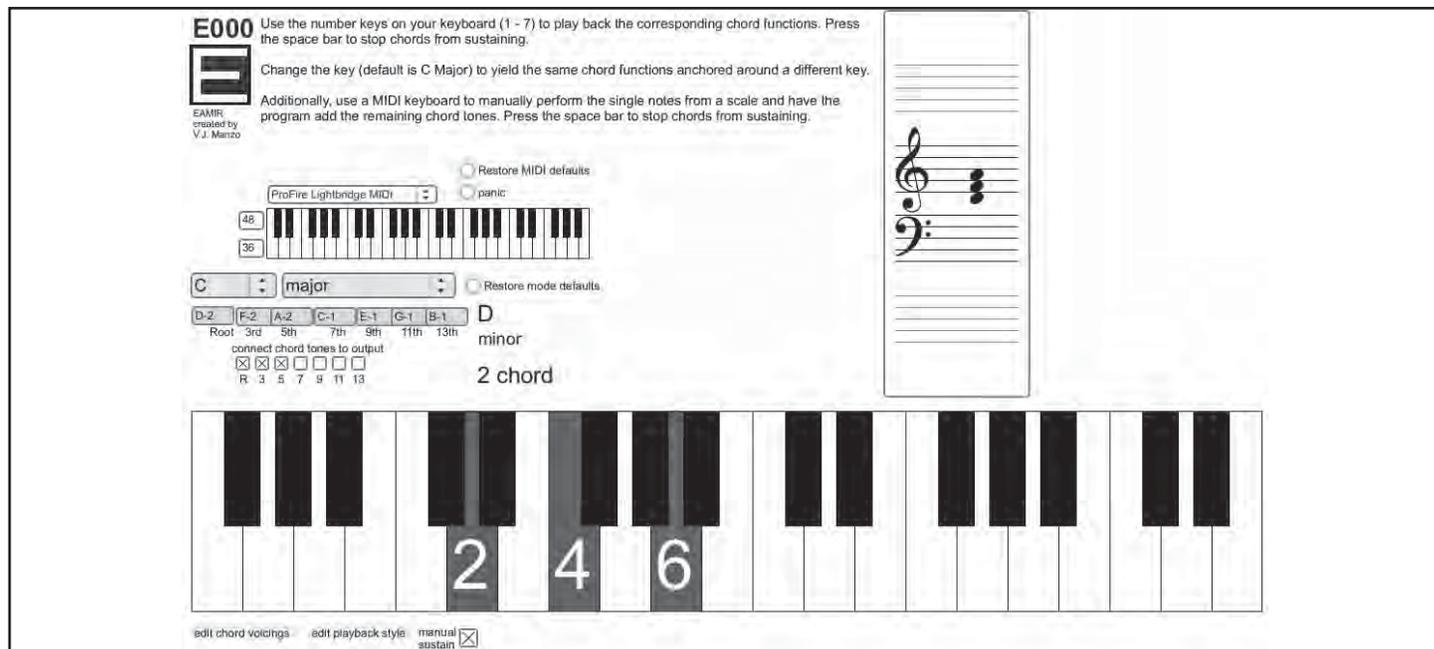


Figure 2: Screenshot of chords played to demonstrate tertian harmony

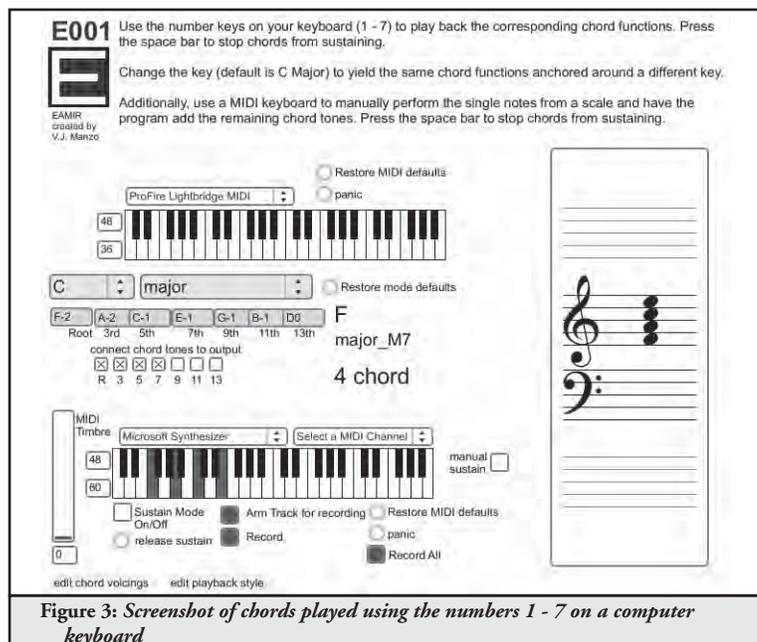
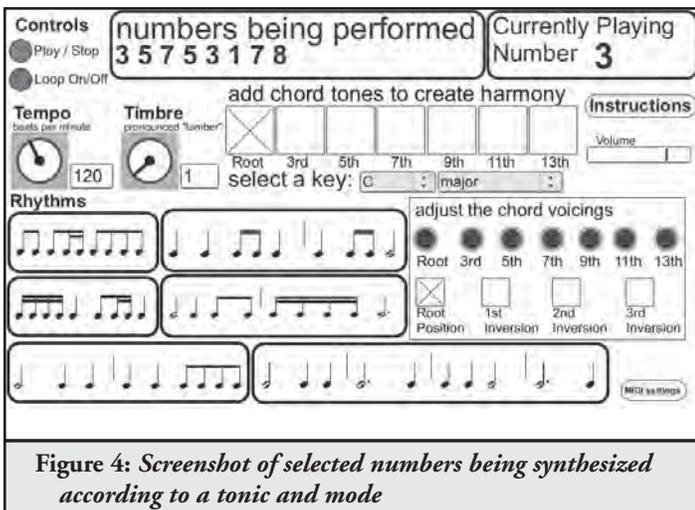


Figure 3: Screenshot of chords played using the numbers 1 - 7 on a computer keyboard

E001

E001 is similar to E000 in almost every functional aspect. It does, however have added functionality for recording MIDI data as a performance. It also has the option to route the MIDI data from the software to another audio program like GarageBand® or Mixcraft®. From within those programs, the performance can be recorded in real-time. This also allows the user to change the timbre to something other than the default internal timbres of the E001 software.

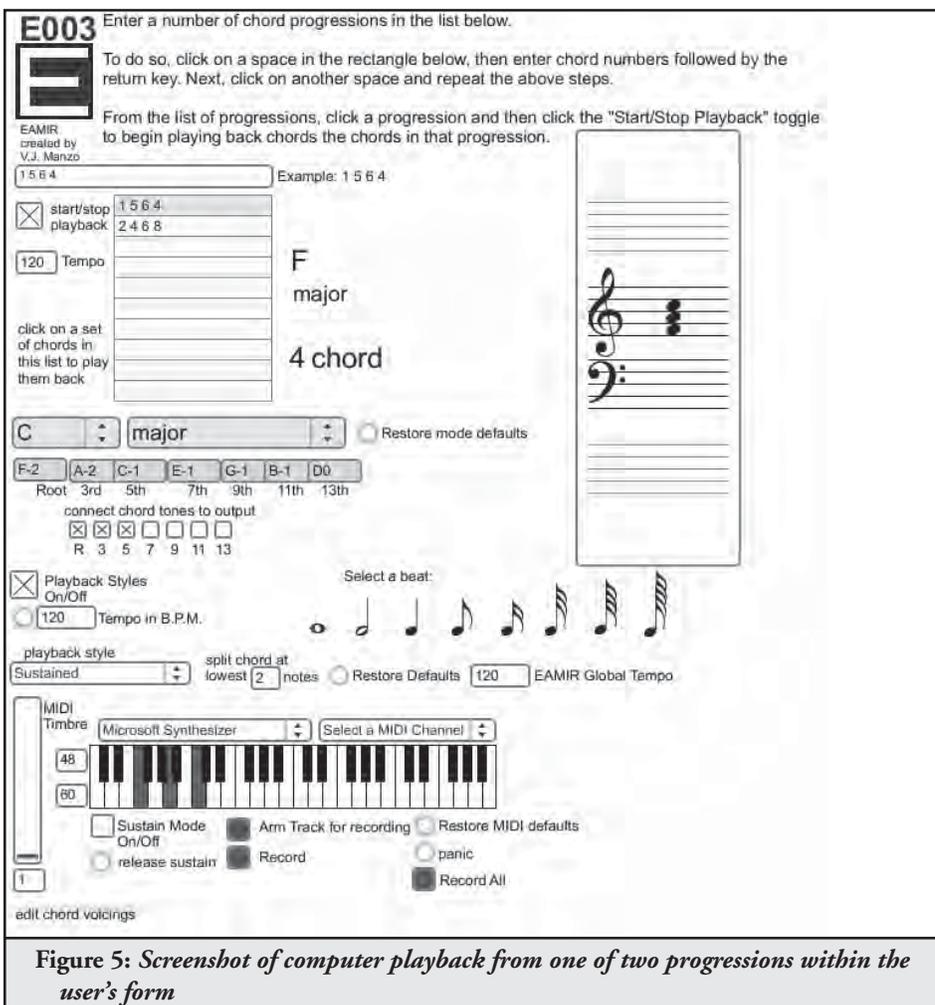
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E002

E002 incorporates the same functionality and concept as the aforementioned software: provide a bunch numbers using the onscreen buttons, and then manipulate those numbers to create music. The numbers can be played back in a user-controlled rhythm and tempo, while their timbre, chord voicing, and dynamics can be changed. The tonic, mode and overall chordal harmony can also be changed. Students can use up to 4 number-based patterns simultaneously which can be linked to the same tempo if desired. Like E001, this software can also be recorded internally or routed out to another audio program for recording and timbre changes.

Figure 4: Screenshot of selected numbers being synthesized according to a tonic and mode



E003

E003 allows a user to organize a collection of progressions into a form. The software will then perform through each chord in the progression as the user dictates the overall form by selecting from the different progressions. Like E001 and other software, the user can control the playback style, tempo, timbre, key and more. The data can be recorded internally or routed to another audio program.

E004

E004 is a modified version of the existing EAMIR Smart IWB software created for use on a large interactive white board such as a Smart Board®. This software shows suggestions for composing chord progressions based on the ways that chords tend to resolve in western music which includes popular music. If a user clicks on the 5 chord, they will hear the chord played back in either a sustained mode or in one of the playback styles as seen in other IMTCP software. Additionally, the 6 chord and the 1 chord will begin blinking showing the user that these chords tend to follow the one they just played. Of course, the user is not

Figure 5: Screenshot of computer playback from one of two progressions within the user's form

forced to play one of these chords, but the suggestions are still there when the user triggers diatonic chords or any of the secondary dominant or leading-tone chords, augmented sixth chords, or other tonicizing chords available in the other rows of the program or through the pull down menu.

The blinking chord suggestions are stored in a simple text document and can be modified to allow instructors to create customized chord suggestions for a given chord.

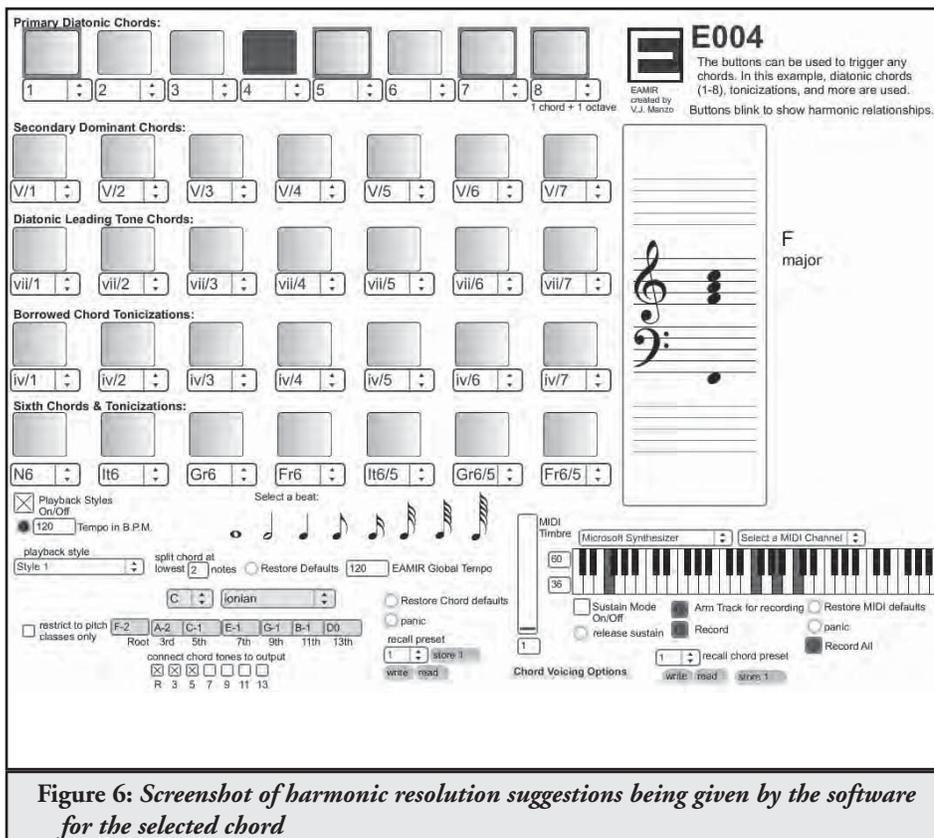


Figure 6: Screenshot of harmonic resolution suggestions being given by the software for the selected chord

Implications

The software applications used in this study were simple programs created for a specific intended purpose tied to our teaching objectives. In the context of a typical music classroom situation that meets regularly throughout the year, a teacher could easily incorporate these lessons and methods to discuss composition and musical concepts in classes where little or no formal musical training is evident.

One of the main thrusts of this project was to get the students performing music that was culturally familiar to them with timbres that they liked. By using a simple control interface for playing back diatonic chords, students were able to play along with these songs and compose original music. This allowed the students to function in a more self-directed learning paradigm while the instructors functioned as facilitators for the musical discovery, able to discuss the harmonic implications in Green Day, draw comparisons to extant music, and apply the concepts to the student's work.

At the end of the week of IMTCP, students were given a CD of all of the software as well as a CD of all of the MP3's they made of their compositions. The benefits for students having a CD of their work go without saying, but, as an educator, it is helpful to be able to see the advancement in compositional sophistication as time goes by.

IMTCP was conducted by V.J. Manzo and Rick Dammers in August 2010. For more information about IMTCP and to download the software, visit www.imtcp.org or www.eamir.org/imtcp.

V.J. Manzo is a composer and guitarist with research interests in theory and composition, artificial intelligence, interactive music systems, and music learning. He is the Oxford University Press author of *Max/MSP/Jitter for Music* on developing interactive music systems for composition, performance, instruction and more. He directs music technology studies at Montclair State University where he teaches courses in traditional and electronic music and composition, and is a PhD candidate at Temple University. For more information about V.J., visit his website at www.vjmanzo.com/cv.

E005

E005 is almost identical to E001 with a few added features. The main difference is the addition for MIDI input support that will take a single note from a scale played on a MIDI keyboard and add the remaining chord tones to complete the triad or taller chord. A user can then play through chords in progressions using the MIDI keyboard to trigger scale degrees 1 through 7. There is also a mode so that when the key is changed in the software, the user can still play the diatonic scale degrees in C major in order to trigger the diatonic chords of another key, like F# Major. This allows the user to play through a wide range of repertoire even if they only know one scale.

An added feature of E005 is the option to use a microphone on an acoustic instrument or a line-level instrument such as an electric guitar to perform in a similar way. A user could play a single note on their guitar and have the software harmonize the single diatonic notes just as it did with the MIDI keyboard as just described.

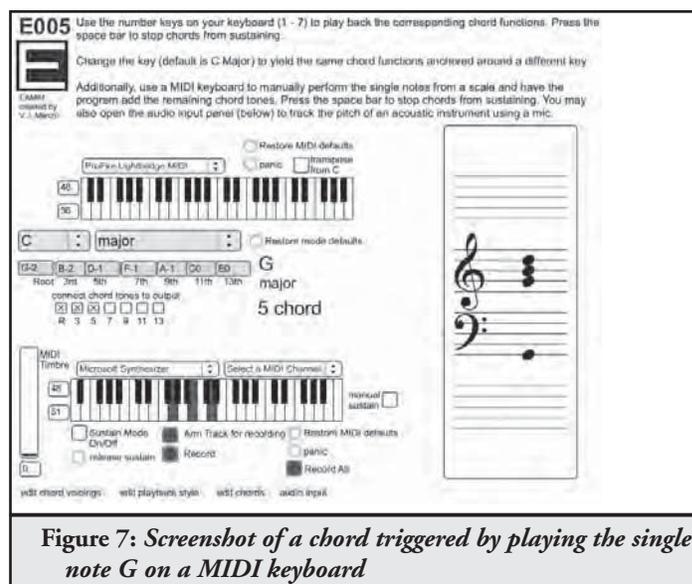


Figure 7: Screenshot of a chord triggered by playing the single note G on a MIDI keyboard