MUSIC TECHNOLOGY AS A TOOL FOR EXPLORING
THE CREATIVE ASPECTS OF MUSIC

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Abstract:
This project describes several music technology web pages that are interactive and educational. The web site, "Exploring MIDI", is an introduction to understanding basic concepts in MIDI and is designed as an educational tool for those who would like to explore its application to the world of music. The interactive music theory web site, "Score Scan," provides practice in reading the "tonal profile" of a music selection. "Gregorian Chant, Christmas Mass," showcases the use of technology in support of music history instruction.

1 Introduction
The primary purpose of music education is to develop the aesthetic experience of every student to its highest potential. The imaginative qualities engendered in music technology make it an ideal tool for demonstrating the intrinsic values of music during a student's educational formation. There is no denying that technology has become an important and intricate component of music. As the phonograph caused a radical change in how we listen to music, the computer chip is changing the manner in which we learn about music. In the midst of this revolution, it is crucial to remember that music technology can be a tool for exploring the inner workings of music and should not get in the way of music.

This paper will describe three web sites at Northwestern University that are interactive, educational, and demonstrate the use of web technology in music education. "Exploring MIDI", is an introduction to understanding basic concepts in Musical Instrument Digital Interface (MIDI). This site is designed as an educational tool for those who would like to learn more about basic concepts in MIDI and its application to the world of music. With the addition of Java applets, the playback of MIDI files, Maxplay documents, and the use of hyperlinks, this site is interactive as well as educational. The target populations are music students from junior high through college, music teachers who want to know more about MIDI and music technology, or anyone with a personal interest in MIDI. Information contained in this site also makes it a valuable supplemental resource for an introductory MIDI class.

"Score Scan", is an interactive web site based on the 1989 HyperCard document created by Northwestern music theory professor John Buccheri, with assistance from programmer Roland Telleyan. The current version is a Java applet and Java application that was created by the collaborative efforts of Michael Overman and Peter Raschke. The "Score Scan" Java applet allows the user to analyze the "tonal profile" of a selected music score. The user assigns analytical symbols to the score and then compares his or her analysis to the instructor's interpretation. Additionally, the score may be heard through the playback of the score MIDI file. The Java application enables an instructor to add new scores, analytical symbols, comments and clarifications, which when saved as html documents, may be accessed by students.

A third web site, "Gregorian Chant, Christmas Mass," was created to showcase the use of technology in support of music history or music theory classes. Using Voyager CD Link, the web site utilizes control files to send commands to the computer CD-ROM. This program is an invaluable tool in that it allows an instructor to create a learning environment built on the foundation of a musical performance, providing access to dynamic and interactive contexts for presenting the musical experience. Students can listen to a recording of selections from the compact disc while simultaneously interacting with the notation, graphics, text, and hyperlinks of the web site.
2 Features of “Exploring MIDI”
The initial motivation for creating the MIDI web site was to demonstrate web technology as a teaching tool in music. The author plans to utilize this site in his own classroom teaching, as well as sharing the site with all those educators and students with web access. This site was also created as an educational tool to provide an understanding of the basic concepts of MIDI. It is important for an educational web site to be interactive, instead of relying on text from a computer screen. An interactive web site creates a context where the user is active in the learning process.

One of the interactive features of this site occurs on the page "MIDI Connections" which includes a hands on demonstration of connecting a MIDI studio. It begins with an explanation of MIDI In’s, Out’s and Thru’s, as well as the concept of the daisy chain, the MIDI Thru box, and MIDI echo. The user then has the option, supported by Java applets, of connecting cables in several imaginary studios. The MIDI site becomes interactive, combining fun with learning as the user tries to connect cables from one synthesizer to another.

The page "Understanding Decimal/Binary/Hexadecimal" reviews the three counting systems and demonstrates the importance of numerical systems to the MIDI language. Included are diagrams to help the student visualize the process involved in translating among the decimal, binary, and hexadecimal counting systems. The user may download a document, "Conversion of Numbers," that was created with the program "Max". This document further reveals the similarities of the decimal, binary and hexadecimal counting systems with the use of sliders, giving the user a visual way to understand the interrelation of the three different number systems.

Once the user has an understanding of the various number systems, "The MIDI Language" page explains how MIDI signals are passed through a MIDI cable. The user is able to test his or her understanding of binary and hexadecimal by creating mock MIDI events. There are additional "Max" documents which enable the user to visualize the generation of MIDI events when a note on a music keyboard is activated. (Figure 1)

![Figure 1](image_url)

Internet design is constantly evolving to meet the changes in modern technology. The use of MIDI over the Internet has gone through a metamorphosis in recent years, and most likely will incorporate new standards in the near future. One useful aspect of MIDI files is that they consume little memory space in the computer and that they download quickly as compared to digital sound files. This is an attractive feature for web users who are dealing with speed and flexibility issues. There are limitations to the sound quality of these files, depending upon the individual computer serving up the MIDI file. Currently, the best way to play standard MIDI files over the Internet is through the use of secondary programs, "plug-ins," that work with a web browser. The purpose of the page "Using MIDI on a Web Site" is to demonstrate the options for using MIDI files on a web page. The user can play MIDI files from this page and gain a better understanding of the transfer of MIDI files over the Internet and their use in different music applications.
The "Exploring MIDI" web site has maintained an average of a thousand hits per week since it was brought online in June of 1997. There are colleges that use this site in conjunction with MIDI classes, but the majority of users are everyday Internet users that utilize this site to gain a better understanding of the uses of MIDI in music applications.

3 Features of "Score Scan"
"Score Scan", is an interactive web site that enables the user to analyze a music score by assigning "tonal profiles," decorative accidentals, various chord symbols, and an extensive chord palette of Roman numerals. Professor John Buccheri has used a HyperCard document to reinforce the concept of "tonal profiles" for his music theory score analysis skills class, and his desire to expand on the program and make it more flexible for the student and the instructor provided the basis for the "Score Scan" web site. Michael Overman and Peter Raschke decided to create an interactive score analysis web site through the creation of a Java applet. With the click of a button, the user may compare his or her analysis to the instructor’s interpretation. Included with the instructor’s interpretation are comments and explanations for the particular analysis. The flexibility of this program also allows instructors to use this Java applet for developing students’ chord analysis skills.

Available on request is a Java application for instructors that includes not only all of the features of the students’ Java applet, but the ability to add more analyzed scores. (Figure 2) The instructors’ application was created in an easy to use format that allows the instructor to create an analysis which is then saved as an html document. All marks and comments that are added to the score are saved as parameters using the html <PARAM> tag. The parameter tags are then passed on to the Java applet when the student opens the new score. An instructor does not need to understand the Java language to use this application and only needs to learn simple html commands to link the new score to the score index page.
4 Features of “Gregorian Chant, Christmas Mass”

The web site, "Gregorian Chant Christmas Mass," was designed to demonstrate the use of web technology in support of musicology. Before CD link the only way to work with sound on the Internet was with sound files or MIDI files. CD link enables the user to insert a compact disc into his or her computer which is linked to the web site. Control files send commands to the compact disc player, using technology similar to that used by the links established between HyperCard and audio compact discs. An important feature of this technology is its ability to enhance music appreciation, giving a music instructor access to dynamic and varied contexts for presenting the musical performance. A program, such as CD link, enables professors to author web sites at their schools that may be accessed by students in their classes who have a compact disc being used for the course. Students at other colleges across the country may use the same page provided they also have the disc. CD Link demonstrates that the learning environment reaches beyond classroom lectures.

This particular project fosters an understanding of Gregorian Chant by listening to recorded selections from the Proper and Ordinary of a Roman Catholic Mass. Manuscript from the Liber Usualis is provided during the playing of the compact disc selections. A primary goal is to create an atmosphere conducive to a positive learning experience, one in which the student can integrate sounds, pictures, text and related resources.

Conclusion

The innumerable possibilities for using web technology in a music learning environment goes beyond the scope of this project. The goal of a good music program is to provide an opportunity to explore the musical experience with research, listening, composing, and performing music. Technology is a vital aid in helping the student to discover the subjective qualities of music. A closer analysis of the web site "Exploring MIDI," "Score Scan," and "Gregorian Chant, Christmas Mass" reveals how technology may be used in a musical learning environment.

This project, "Music Technology as a Tool for Exploring the Creative aspects of Music," was created to demonstrate how academic music education can benefit from the use of web technology. Future work within the field of music education will be greatly influenced by the use of technology. The appropriate use of this technology must be a prime concern, because the main focus should remain on the subjective qualities of musical expression and not on the technology itself. Music technology is a powerful tool for exploring the creative aspects in music.

References