

Pedagogical Tools for a Digital Music Library
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Comment: SLIDE 1: Title

Introduction

Digital libraries—that is, large collections of recorded, printed, and encoded media—will transform the way we teach music theory, much as digital technology has transformed commerce, communication, entertainment, and scientific research. In fact, that transformation has already begun. For example, many schools now support the use of electronic reserves of journal articles and the posting of MP3 files for course listening assignments. These resources provide students with ready access to course materials from the comfort of their home. When these are integrated with course management systems such as WebCT or Indiana University's On course, some courses can be managed almost entirely without paper. This improved access to course materials certainly increases convenience for the student, and sometimes even for the instructor. On the other hand, it only scratches the surface of what technology can provide. We feel that a digital *music* library should also improve *how* students learn.

Comment: SLIDE 2: Ereserves

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Seven years ago, Indiana University established the first major digital music library with the launch of Variations. Variations provides online access to over 9000 hours of CD-quality audio to computers within this building. It is used for the vast majority of student listening in the school, both for course reserves and for personal study, and it is also used in technology equipped classrooms such as this one in face-to-face teaching. Although access to Variations has been limited to the buildings in the School of Music for both copyright and networking reasons, it has nevertheless improved access to the library's audio holdings by eliminating our former reliance on cassette duplicates that there were never enough copies of at exam time and would deteriorate quickly. Yet as in the scenario I described above, Variations provides only improved

Comment: SLIDE 4: Variations player

access. It has not materially changed the way students learn or study music, beyond the fact that they can now listen while simultaneously doing their email, browsing the web, or working on a paper.

Development of Variations2 is now underway. The Variations2 Digital Music Library takes a significant next step toward actually transforming how our students learn by changing the nature of their engagement with the library's content. This is a multi-disciplinary research project being carried out at Indiana University under a four-year grant from the National Science Foundation (we're now past the two-and-a-half year mark). The design of teaching and learning applications is just one of several research areas in the project. Among the features of Variations2 will be a new search interface designed specifically for music holdings; digital audio and eventually video; scanned score images that, relying on the DjVu format provide for zooming in and out without the phantom disappearance of staff lines and stems; symbolically encoded musical scores, that will support editing and content-based searching; and tools to enable instructors to use the materials effectively in class and to create activities in which students are creatively engaged with the music.

Although our focus is going to be on the pedagogical aspects of the Variations2 project, I'd like to take a moment to talk its new approach to catalog searching. Have you ever considered how inadequate standard library catalog interfaces are for finding music? They're really quite dreadful. The problem is that, unlike most titles, a *musical* work exists in many forms: scores, recordings, and sometimes as subjects of books. Furthermore, more often than not, that work is just one of several contained in a single volume, such as a CD, which has its own title, and is in fact the title by which the item is cataloged. Using our IUCAT system, I did a search for items in which "Franz Schubert" is the author. Schubert wrote a lot of music, so

Comment: SLIDE 5a: V2 title

Comment: SLIDE 5b: V2 Research areas

Comment: SLIDE 6: V2 Features

Comment: SLIDE 7: Search results

Comment: SLIDE 7b: first oval

getting back 2309 items doesn't sound too bad. But what are those items? Well, they are things with helpful titles such as "Piano music, selections" And how are these items arranged? Well, I'm not sure. I think it's in reverse chronological order of acquisition—an order that is utterly meaningless, except perhaps to the acquisitions librarian. Also, scores and recordings are all mixed up in the list and it's not immediately apparent which is which. The problem is that libraries catalog physical objects—bound scores, jewel-cased CDs. But what we are usually interested in finding are instances of *works*. Therefore the Variations2 library is being built around The Work. So if I enter "Schubert" in the Variations2 search interface, I get a list of works by Schubert. (There are only 395 because we've only begun the tedious process of re-cataloging works in the last few months.) The works are listed in alphabetical order. Once I select the work I'm interested in, I click its name and a list of scores and recordings the library has of that work appears. We'll see a bit more of the search interface shortly.

Comment: SLIDE 7c: 2nd oval

Comment: SLIDE 7d: 2nd oval

Okay, for the remainder of our time, we would like to focus on tools being developed as part of the Variations2 system that will enable instructors to effectively use the digital library's content to enhance classroom lectures and to create interactive student activities. The purpose of these Multimedia Music Theory Teaching (or MMTT) tools is to enable students and instructors to *interact* with the music in its various formats, not just to passively listen or look. These tools will provide in a single application a number of capabilities otherwise available only in separate programs (such as notation editor, media player, presentation software, and word processor), and they are designed specifically to work in a digital library environment.

Comment: SLIDE 8a: MMTT title

The tools include the media player and score viewer we've already seen, and a basic music notation editor (which we hope will eventually support analytic formats like Schenkerian notation). But in addition, it will include a digital timeliner that allows the creation of interactive

Comment: SLIDE 8b: MMTT tools

form diagrams; drawing tools for annotating scores and diagrams with text and shapes; labeling tools that allow for the quick creation of analytical symbols such as roman numerals, scale degrees, form labels, or cadence types; tools for creating various types of questions and the automatic evaluation of student answers; and lesson management tools that provide the ability to save, retrieve, share, and submit the lessons. In addition to enabling instructors to more effectively prepare classroom lessons using digital content, instructors will also be able to create interactive lessons which will enhance their students' abilities to develop critical listening skills and give them the opportunity to integrate visual, aural, and tactile modes of learning. And students will be able to use the tools for personal study.

Brent will now walk through some of the features of Variations2. Some of these are still in prototype stage, but the prototypes are robust enough to give you a sense of how things will eventually work. ...

PART II

In a typical music theory class, the instructor is required to present musical concepts both aurally and visually. Often, this entails shuffling back and forth between the piano, the blackboard, an overhead projector and the CD player. In the process, it is not atypical for transparencies to get misplaced or for stacks of CDs, tapes, and records to get jumbled. Just being able to cue music to appropriate places can be a challenge, let alone attempting to synchronize this music with a projected score. One of the goals of *this* project is to allow the instructor to collect as many of these materials as possible into a single location and to make navigation between these resources simpler.

[SEARCH WINDOW] The scanned scores and streaming audio that the digital music library provides can potentially simplify the teaching process, but instructors must also be able to

interact with this content in a meaningful way. The tools which I will now describe have been designed to fit the particular needs of music theory teaching and learning, allowing instructors to easily find and organize digital content, to annotate and edit this content, to create new content, and to flexibly interact with this content in the classroom.

The Variations2 search window offers several improvements over traditional catalog searching. **[mouse over]** Instead of searching by ‘author’ and ‘title’, you can search for composers, performers, and works. Other features allow searching for works in a particular key, for recordings alone or scores only. **[OPEN dropdowns]** Here we have done a simple creator search for ‘bach’, and have three options—**[CLICK on J.S. Bach]** we’ll choose J.S. Bach. The results that follow list all of the works by J.S. Bach currently in the library. **[CLICK on “Bist du bei mir”]** We will choose ‘Bist du bei mir’ and find... one digitized recording **[CLICK on recording, play, and stop]** (for other items, there might be multiple recordings and scores available). Choosing this recording opens a player and begins playing.

The media player provides standard playback controls and one additional feature that can aid in lesson preparation, which is: bookmarking. A “bookmark” is simply a time point in the audio or a page in a score that you want to keep track of. In this case, I have already added a bookmark at the beginning of the middle section. **[CLICK bookmark, PLAY, STOP]** (Clicking this bookmark will take us there...). All of the bookmarks that I have created are quickly accessible through a bookmark menu. **[SCAN bookmark menu]** (I have bookmarks here for particular classes and presentations...). For example, for today’s presentation I have bookmarked the development section of the first movement of Haydn’s Piano Sonata in E minor; both in a recording **[OPEN “MTMW Presentation” / Haydn / (recording)]** (which will open in a player...) and in the accompanying score, which opens in a score viewer. **[OPEN “MTMW**

Presentation” / Haydn / (score).

PRESS stop on Player.] In the near future, scores and audio will be combined into a single window, allowing you to synchronize the two with automatic page turning. **[GOTO web page called “Bookmark” (toolbar)]** Bookmarks to content in the digital library can also be put on a web page. For example, on this page I have created two bookmarks that will allow me to compare the beginning of the second movement in Beethoven’s Ninth Symphony with its reappearance in the last movement. **[GOTO web page called “Bookmark” (toolbar)]** One might do the same thing to trace the development of Wagnerian Leitmotifs in different operas.

The scanned digital scores can be zoomed without loss of image quality **[ZOOM]** and are easily navigable, but what we really need is a score that can be annotated, so that instructors can analyze music on the fly and students can create their own score-based analyses outside of class. **[GOTO “Presentation” prototype (toolbar)]** The challenge for MMTT is to develop a set of drawing and labeling tools that are as quick and effective as writing directly on a transparency or blackboard—but *without* the accompanying chalk stains and ink spots. In this prototype, **[DRAW circle or box, arrow]** the drawing tools can be used to annotate a score with text and with basic shapes such as circles, boxes, lines, and arrows (we might want to highlight a certain event...or connect two events...). The labeling tools will allow for the quick placement of commonly used labels such as non-chord tones or cadence types. **[CLICK NCT button. CLICK on score. CHOOSE type]** (Here we have placed a non-chord tone label, and choose the passing tone type...) And special text fields designed for roman numerals will automatically format standard text input into correct figured bass symbols **[TYPE I, IV, V7, viio65/bII. TAB between boxes]** (so... v7 is automatically changed into ‘five-seven’ and typing viio65/bII results in ‘seven-diminished-six-five-of-flat-two’...).

[OPEN Timeline: Chopin, G Minor Ballade (toolbar)] One of the MMTT components that has already been developed is the timeliner. The timeliner is used to create interactive form diagrams (or ‘bubble diagrams’) that are directly linked to digital audio. This diagram of Chopin’s g minor Ballade gives a visual representation of the boundaries and proportions of the work’s main sections. Each section of the work has been given a descriptive label and some sections have been grouped into larger formal sections. **[MOUSE over]** Although the timeliner is designed primarily as an analytical tool, timelines also offer an ideal means of navigating through a work’s structure **[CLICK on a bubble. PRESS play. PRESS stop]**—we can click on any section and press play. The labels below each timepoint on the line here give the beginning measure number of each section—**[RIGHT CLICK on timeline. CHOOSE “Show Times”]** we can also show their time offset in the recording. **[CLICK on “View Annotations.” CLICK on a few bubbles]** Each bubble also has an annotation which can be used to describe the contents and processes of the section. (These annotations describe the characteristics of the different themes, as well as the tonal areas of the work...)

[OPEN Timeline: Schubert, Die Forelle (Window menu)] (Now we’ll look at a different timeline...) This timeline of Schubert’s “Die Forelle” uses bubble annotations to give the German text and English translation of each vocal phrase. **[CLICK on a few bubbles]** You may also have noticed that hovering **[HOVER over bubble.]** over a bubble shows its annotation as a tool tip. The overall appearance of the bubbles can be altered in various ways: the timeline can be resized (...), **[RESIZE timeline]** bubbles can be set to black and white mode, **[HOVER over bubble]** which is ideal for printing (...), and some people might even prefer “square bubbles (...)
[CHOOSE “Square Bubbles” in Timeline menu].

(Now we'll look at one more timeline example...) **[OPEN Timeline: Bach, Brandenburg Concerto]** For more extended works, like Bach's Brandenburg Concerto no. 5, you may need to zoom in to sections of the diagram in order to read the labels **[SELECT section. PRESS "Zoom to Selection"]** (we can select a larger bubble and click "Zoom to Selection", and then zoom back by clicking "Fit to Window"), **[PRESS "Fit to Window"]** or you might choose to create an excerpt of one of the sections to work on separately **[SELECT third movement. PRESS "Create Excerpt"]** (so we might select the third movement and open it in a new window...)

Creating a timeline is quite easy. **[OPEN "Player: The early recordings"]** The first step is to choose an audio source—we'll use the 'Bist du bei mir' recording we found earlier **[RIGHT-CLICK on track. PRESS enter in pop-up dialog.]** (we can just right click on the track we want and make a new timeline...which opens with one big bubble...). The next step is to add timepoints at formal boundaries while listening. **[PRESS Play. PRESS "Add Timepoint" for first four phrases.]** Timepoints can later be adjusted by dragging them along the timeline. **[DRAG a timepoint]** We might next group these phrases into larger units **[SHIFT-CLICK on first two bubbles. PRESS "Group". Group second two bubbles.]** (we do this by selecting the bubbles we want to group and pressing "Group Bubbles") Now we'll add some labels to the bubbles to describe the form **[CTRL-CLICK first and third bubbles. PRESS "Edit Label..." SET label to "a". SET second and fourth bubbles to "b".]** (by selecting bubbles with similar material and clicking "Edit Label..."...). Lastly, we'll assign similar colors to similar phrases **[CTRL-CLICK second and fourth bubbles. SET color to orange]** (by choosing a new color from a pop-up palette...) One of the last steps might be to add annotations to each bubble, which we will not do now. At this point we can save our timeline **[OPEN File**

[menu](#)] in order to re-open and work on it later, we can print the timeline out [[OPEN web page “Timeline”](#)], or we can save the timeline as a web page that includes a small graphic of the timeline and a hierarchical listing of the bubble labels and annotations.

A timeline is just one of many components that one might want to include in a lesson or assignment.[\[OPEN “Lesson” prototype\]](#) As MMTT develops, we will implement an authoring application that will allow users to combine scanned scores, audio, timelines, notation, text, and graphics into a single “lesson.” These lessons might take the form of pageable presentations similar to those in PowerPoint, or of interactive contextual listening assignments for students to do on their own. *This* prototype lesson links a timeline with an encoded score. Students create a formal diagram [\[DOUBLE-CLICK on score\]](#) by double-clicking on boundary points in the score, choose phrase labels [\[CLICK on a phrase label\]](#) from the drop-down menus that appear, supply a roman numeral and non-chord tone analysis, [\[PAGE through other questions\]](#) and answer various multiple-choice questions about the piece. They may then submit their answers for evaluation by the instructor, or perhaps have their answers checked automatically. Such a lesson would truly make the most of the content in a digital music library.

Conclusion

We have been able to give you only a flavor of what the Variations2 system will be able to do. Let me highlight again that our aim is to provide *general-purpose tools* that can be used in a variety of settings by students and faculty of differing comfort levels regarding technology. As the tools are used, new tools will be imagined and added. Underlying all of this is notion that we learn more about music when we are actively and critically engaged with it. Variations2 is intended in part to facilitate new methods of engagement. In this way, we hope it will help students to be better able to explore the rich mysteries of our art.

For those who would like to explore the Variations2 system, ask questions, or make suggestions, we will be set up in a poster session tomorrow morning from 9 to 11 in M149C.

We hope you will have a few minutes to stop by.