



---

# Variations: Building a Digital Music Library Community

---

Jon Dunn and Mark Notess  
Digital Library Program  
Indiana University

10 February 2010





# Variations: Original Concept

- Burroughs and Fenske, 1990
- VARIATIONS name
  - *Theme and Variations*
  - Variety of information formats for music
- “Networked access for the music student or scholar to sound recordings, scores, textual materials, and video recordings”





# The Initial VARIATIONS System

- Online in April 1996
- Digital library of sound recordings available in IU Cook Music Library
- Partnership between School of Music, Libraries, UITS
- Developed with support from IBM
  - SUR grants in 1995 and 1997
- Tape-based storage with disk cache
- IBM Multimedia Server (later VideoCharger)
- ATM network



# VARIATIONS (1996)

IUCAT - Indiana University Libraries - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media

Address <http://www.iucats.iu.edu/uhtbin/cgiirsi/wOCh9s2n3F/64250034/9> Go Links >>

Author/Composer, etc: **Horne, Marilyn.**

Title: **I will breathe a mountain [sound recording] : songs of Barber, Beethoven, and Bolcom.**

Published/Produced: **New York, N.Y. : RCA Victor Red Seal, p1998.**

Physical description: **1 sound disc : digital ; 4 3/4 in.**

URL: <http://www.music.indiana.edu/cgi-bin/var/access?CAR9723>

Label no.: **09026-68771-2 RCA Victor Red Seal**

Language: **Sung in English.**

Performer: **Marilyn Horne, mezzo-soprano ; Martin Katz, voice (in Nachspiel) ; Tokyo String Quartet (in Dover Beach).**

Recording info.: **Barber and Bolcom songs recorded Dec. 13 and 16, 1993, at Metropolitan Museum of Modern Art, New York; Dover Beach recorded Feb. 20, 1993, at Manhattan Center, New York; Bernstein songs recorded Nov. 15, 1993, at Clinton Recording Studios, New York.**

Notes: **Original works and arrangements, principally for voice and piano with string quartet acc.; Nachspiel for 2 humming voices and piano. Compact disc.**

Program notes by Steven Blier, biographical notes on performers, and texts in English ([16] p. : ports.) inserted in container.

Contents: **The daisies : op. 2 no. 1 (1:05) ; A nun takes the veil : op. 13 no. 1 (1:41) ; Bessie Bobtail : op. 2 no. 3 (3:14) ; The secrets of the old : op. 13 no. 2 (1:13) ; Sure on this shining night : op. 13 no. 3 (2:36) ; I hear an army : op. 10 no. 3 (2:26) ; Dover Beach : op. 3 (8:30) / Samuel Barber -- I will breathe a mountain (24:21) / William Bolcom -- My house (3:08) ; So pretty (2:21) ; Greeting (2:41) ; Take care of this house (1:55) ; Rabbit at top speed (1:19) ; Sonnet : What lips my lips have kissed (4:44) ; Nachspiel (2:04) ; Dream with me (3:31) / Leonard Bernstein.**

Internet

Variations Player

File Info Options Help

I will breathe a mountain <sound recording> : songs of Barb...  
Horne, Marilyn. voc

Track Name  
Bernstein, So Pretty

Time (MMM:SS): Track of Repeat  
Track Time Elapsed 0:06 20 26  None  All  One

Track 1  
Track 2  
Track 3



# Variations2 Project

- Research project funded by a \$3 million Digital Library Initiatives grant from NSF and NEH (2000-2006)
- PI: Michael A. McRobbie
- Large interdisciplinary team of investigators
- Establish a digital music library testbed system supporting multiple formats: audio, video, score images, score notation
- Conduct research in music pedagogy, metadata, usability, copyright, and networking



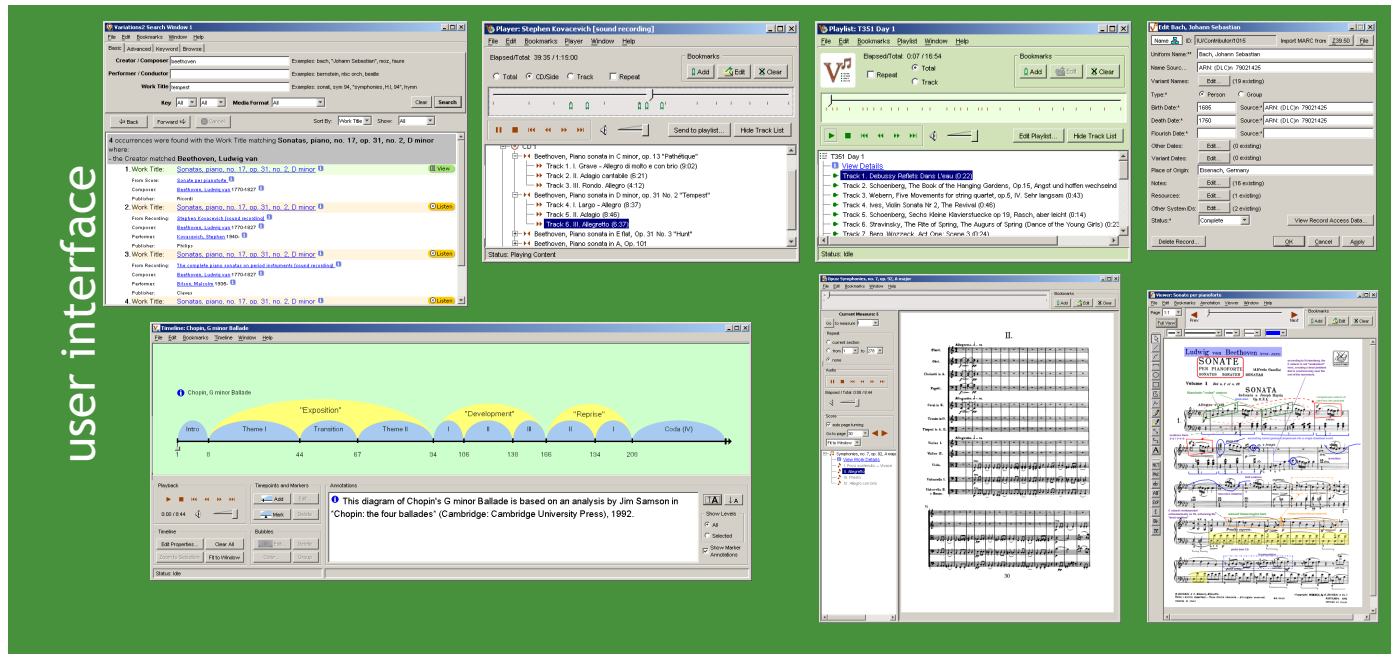
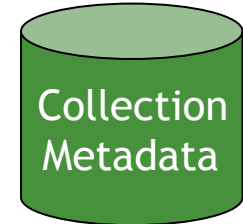
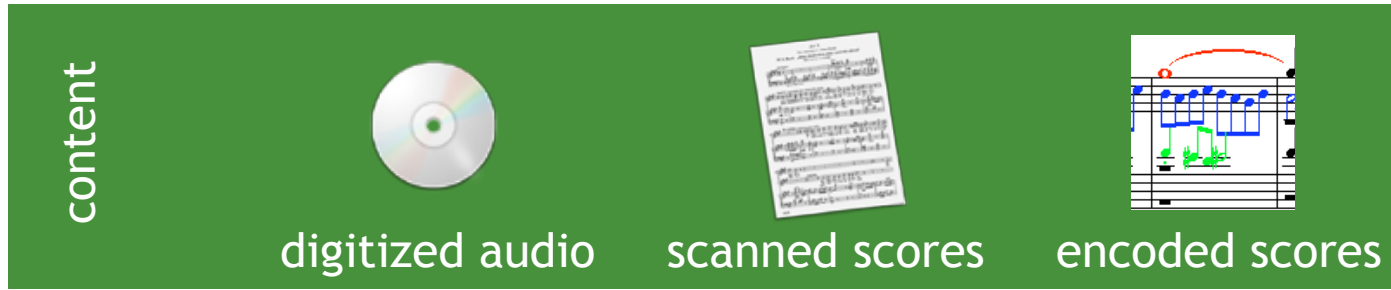


# Variations2 System

- Variations2 expanded on Variations by:
  - expanding representations of music in other media: score images, encoded scores
  - creating additional metadata and new software tools for enhanced searching, synchronization, and navigation
  - creating tools for pedagogical use
- Moved to production at IU in 2005



# Variations2 Overview





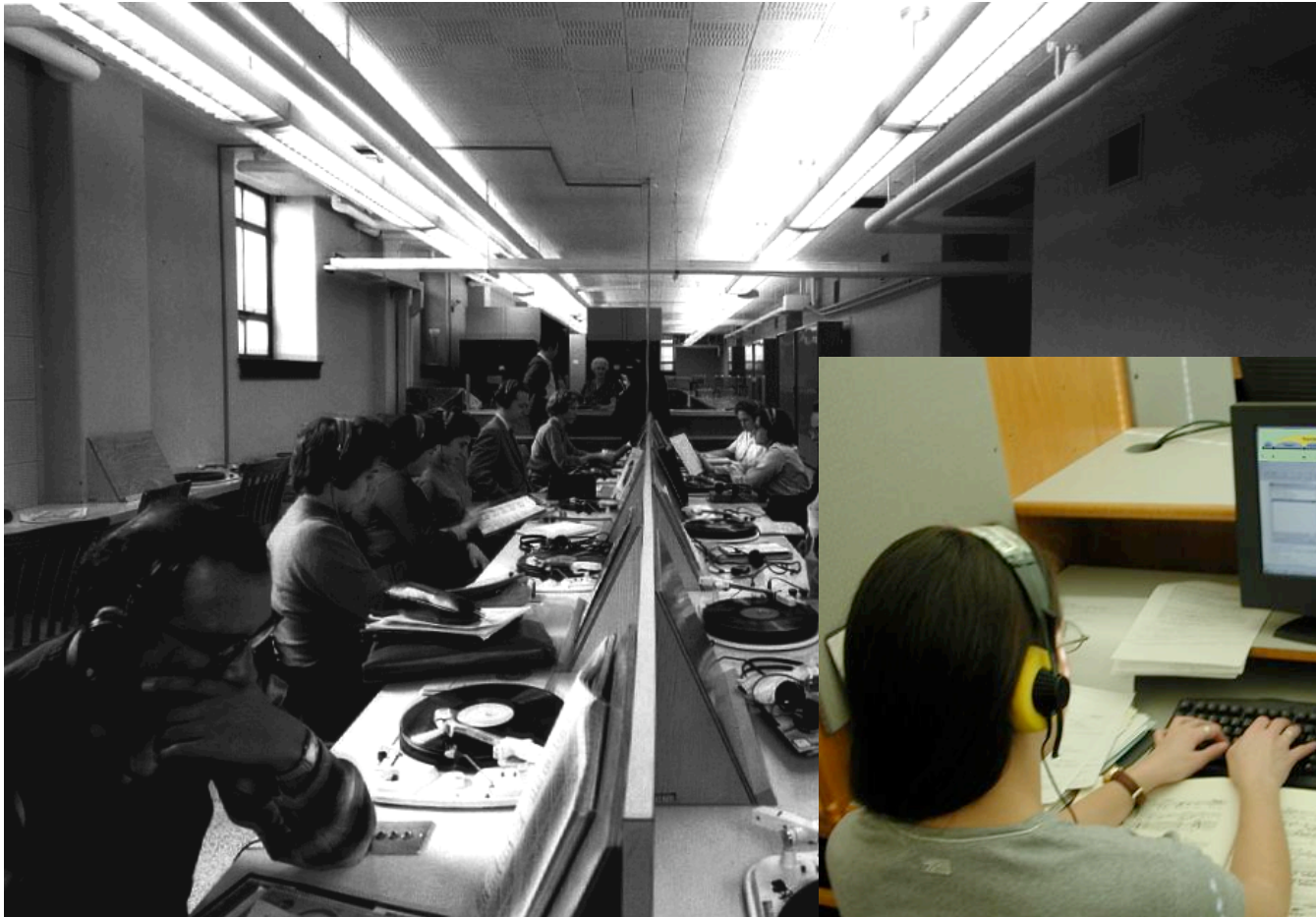


# What is the Variations System?

- Suite of tools providing online access to streaming audio and scanned score images
- Includes analysis and annotation tools useful in music teaching, learning, and research
- Flexible access control framework respects intellectual property rights
- Sources of content:
  - Institutional collections
  - Licensed third party content
  - Personal content
- Java client program for Windows or Mac, with Linux-based server (Darwin Streaming Server, MySQL database)



# Variations at IU





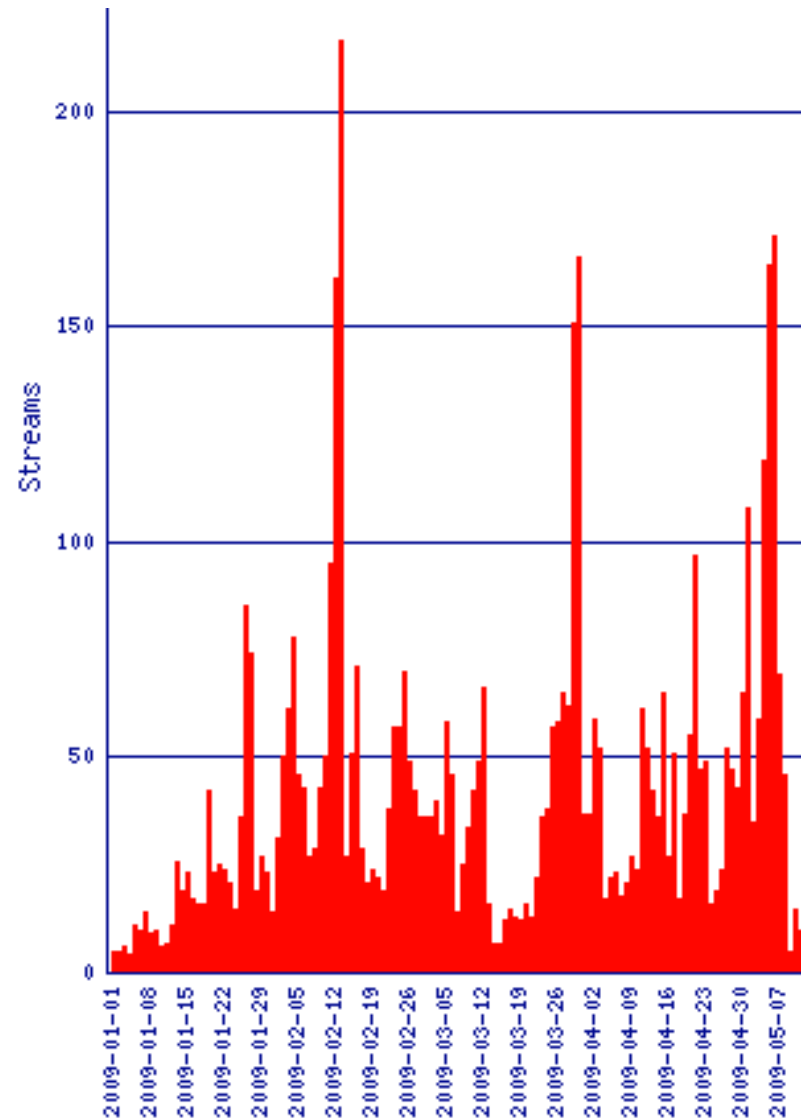
# IU Variations Collection

- 17,000+ complete sound recordings
  - Albums, not tracks
  - Mostly Jacobs School of Music **course reserves** listening drawn from Cook Music Library collections
  - Selected **IU performances**, both historical (open reel tape transfers) and current (“born digital” recordings)
  - 500+ from the **Archives of Traditional Music**
  - 200+ from the **Starr-Gennett Foundation**
- 2000+ additional albums streamed from the **DRAM licensed service** (mainly American music—see [dramonline.org](http://dramonline.org))
- 450+ **scanned scores** from the Cook Music Library



# IU Variations Utilization (2009)

- 440,383 recordings and scores accessed
- 97,962 Variations client invocations (# of times the program was run)
- Peak simultaneous audio streams: 216



*Spring '09 - typical streaming pattern:*



# Typical Student Uses

- Course reserves class preparation and assignments
- Test preparation via playlists and listening drill tool
- Timeline creation assignments
- Lesson, recital, audition and other performance



**William & Gayle Cook Music Library**

**M532 - ARVIN - SPRING 2010  
Reserve Recordings**

**20th century voices in America [sound recording].**

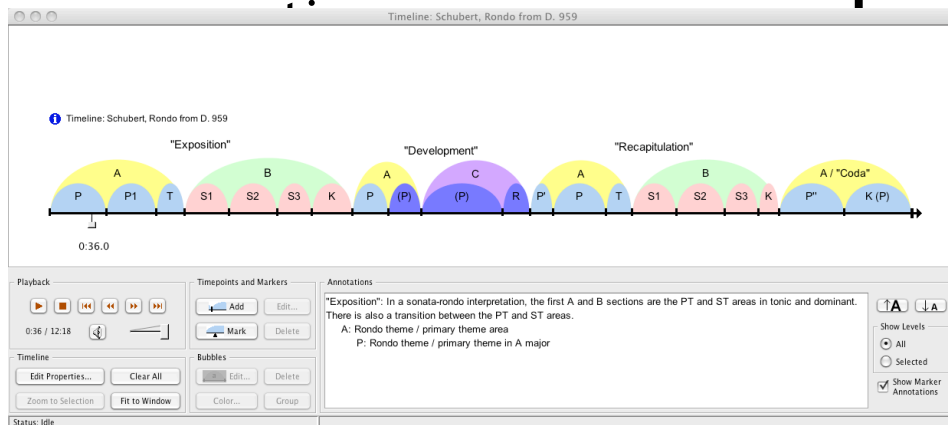
Englewood Cliffs, NJ : VoxBox, p1995.

2 sound discs (131 min.) : digital ; 4 3/4 in.

\*\*\*ON-LINE LISTENING ONLY\*\*\*

CD ZF.L126

[Listen to online copy in Variations2](#)



**on Copland & Leonard Bernstein [sound recording].**

Wadhurst, E. Sussex, England : Pearl, p1997.

1 sound disc : digital, mono. ; 4 3/4 in.

\*\*\*ON-LINE LISTENING ONLY\*\*\*



# Typical Instructor Uses

- Classroom presentation of audio and scores to illustrate lectures and discussion
- Guidance for student studying
- Assignment creation

## SCHEDULE

Week 1		
Tuesday, August 28:	Course Introduction Historical and Technical Romantic Pianos	
	Reading: <a href="#">online Grove</a> , articles I.5–I.10)	
Thursday, August 30:	<a href="#">Chopin</a> (1810–1849) Etudes	
	Listening: <a href="#">Mazurkas</a> :	
	A minor, Op. 17 no. 4 (1833)	
	C# minor Op. 30 No. 4 (1837)	
	A-flat major, Op. 41 no. 3 (1839)	
	C# minor, Op. 50 No. 3 (1842)	
		<i>Rubinstein</i>

Player: Variations & sonatas [sound recording]. Vol. 3  
Elapsed/Total: 0:16 / 6:03

Bookmarks: Add Edit Clear

Total Track Repeat

Send to Playlist... Hide Track List

- Variations & sonatas [sound recording]. Vol. 3
  - View Details
  - Haydn, Arietta con 12 Variazioni No.1 in E flat major, Hob.XVII/3
  - Haydn, Sonata in E minor, Hob.XVI/34
    - Track 15. Presto (6:03)
    - Track 16. Adagio (4:59)
    - Track 17. Vivace molto (3:28)
  - Track 18. Haydn, Andante con (2) Variazioni in F minor, Hob.XVII/6 (15:43)
  - Haydn, Sonata in D major, Hob.XVI/33
  - Haydn, Variationen uber die Hymne "Gott erhalte", Hob.III/77[II]

Status: Idle



# One Instructor View

- Not just a homework tool: provides improved access in classroom to listening assignments
- Playback tools and environment superior to embedded commercial players
- Provide timelines for all pieces in a course
- Students do listening study with the timeliner
- I can use the timeliner during class sessions
- Students come to class better prepared
  - The timeliner encourages active listening—even more than the score
- During class, coherent random access to course content
  - If I jump to a different part of the piece, it's easy for students to see what's going on



# One Instructor's View - Benefits

Students are...

- More easily able to sense musical form during listening
- Forced to develop aural analytical skills—crucial to good performance

The screenshot displays a music analysis software interface titled "Timeline: Scriabin Sonata no. 9, Op. 68 'Black Mass'". The main area shows a horizontal timeline with various musical sections and markers. The sections are represented by colored arches: Exposition (yellow), Recap (yellow), Development (yellow), and Coda (yellow). Below these are smaller colored markers for 1P, 2P, 1T, 2T, 1S, 2S, 1P, and 1S'. The Development section is further divided into "sombre mysteri", "Allegro", and "Più v.". The Coda section is divided into "Allegro" and "Alla marcia".

The interface includes several control panels:

- Playback:** Contains play, stop, previous, next, and fast forward buttons, along with a progress indicator showing 3:08 / 9:07 and a volume control icon.
- Timepoints and Markers:** Includes "Add" and "Edit..." buttons for timepoints, and "Mark" and "Delete" buttons for markers.
- Annotations:** A text area containing the annotation "\*: retransition". To the right are "Show Levels" options (All, Selected) and a checked "Show Marker Annotations" checkbox.
- Bubbles:** Includes "Edit...", "Delete", "Color...", and "Group" buttons.
- Timeline:** Includes "Edit Properties...", "Clear All", "Zoom to Selection", and "Fit to Window" buttons.

At the bottom, the status bar shows "Status: Idle" and "Duration of Selection: 0:30.0".





# IU Access Policy

- If faculty request Variations access for their class, students on roster have access to nearly all Variations content for the semester.
- Instructor “personal collection” items are excluded from general access.
- A small number of items are publicly available.
- Operate on a fair use basis.





# Variations3 Project

- Funded by Institute of Museum and Library Services (IMLS) National Leadership Grant
  - October 2005 - September 2009
- Goals:
  - Extend Variations **beyond IU**
  - Enhance work-based **metadata model** and the investigate streamlining metadata creation
  - Explore **sustainability** models



# V<sup>3</sup> Variations3 Development Results

- Created institution-specific configurability, removing IU hardcoding
- Moved to MySQL & Linux from IBM's DB2 & AIX
- Added support for more authentication methods
- Test sites could import metadata from IU's Variations instance
- Added support for streaming DRAM content
- Created browser-based audio player



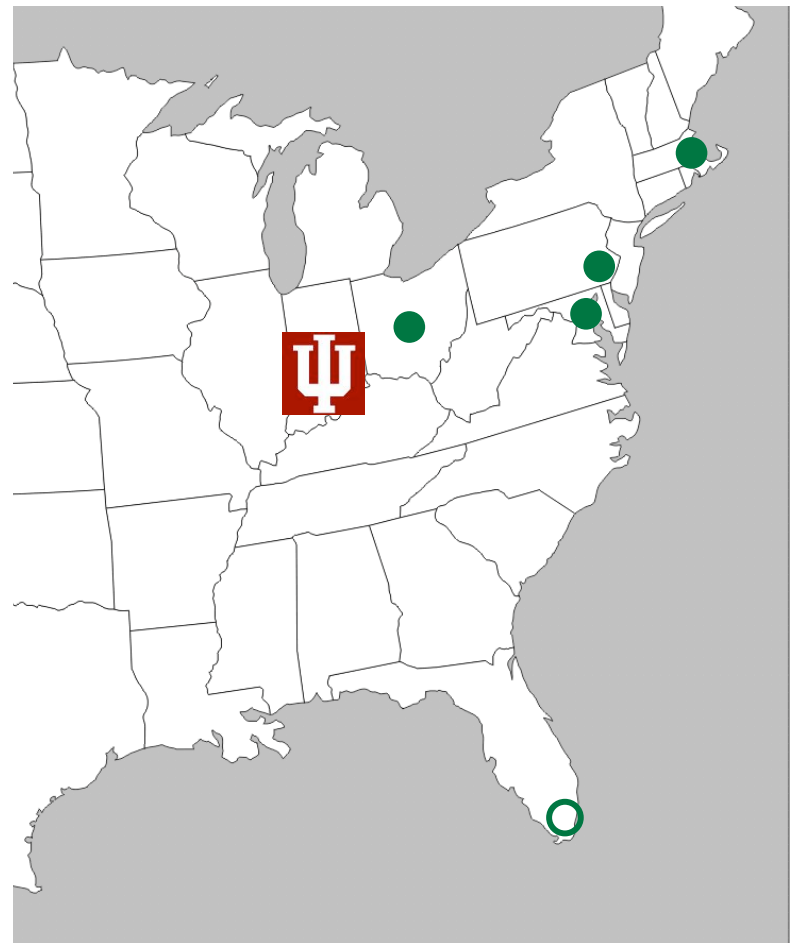
# Variations3 Support Activities

- Wiki-based documentation & installation testing
- New tools to support encoding and upgrades
- Multiple test site visits
- Phone, email, and Acrobat Connect sessions as needed
- Test sites took longer to come on line than planned
  - MOA process!
  - Hardware planning, ordering, delivery & setup
  - IT resource priorities and resource availability
  - IT skill sets
  - Infrastructure capabilities
  - Policy development
- Once Variations was up and working, test site IT load and our support load dropped dramatically
- Partial hosting as an intermediate step (Miami)



# Variations3 Test Sites

- Test sites each deployed full Variations system:
  - New England Conservatory
  - The Ohio State University
  - Tri-College Consortium: Haverford, Swarthmore, Bryn Mawr
  - University of Maryland
- Hosted pilot with University of Miami
- Variety of institution types
- Variety of technical infrastructures





# Summary from Ohio State

- Variations is the primary source for required listening in multiple sections/offerings of five courses: Rock 'n' Roll History, Jazz History, The World of Classical Music, Music's Meanings, and Music on the Move in a Globalized World. Several sections have been taught entirely online. In total, over 1,000 used Variations during the first year (in use January 2008).
- Approximately 2,000 complete CDs from collection have been digitized in Variations. Recently began scanning scores for use in Variations later this spring.
- Access limited to students currently enrolled in a course using Variations; student access restricted to recordings used for their own class (no other Variations content). Students can access Variations on PCs in the Music/Dance Library or they can download the software and access the system on a personal PC or Mac, on or off campus.
- *“Implementing Variations has allowed the OSU Music/Dance Library to provide reliable streaming of audio to students and faculty in numerous music courses. The system satisfies the needs of faculty who use specific recordings of a wide range of music, including classical, rock, ethnic and jazz. It has also provided a very effective way to meet the listening needs of online distance-learning courses.”*



# Summary from Tri-College Library Consortium

- Since January 2008, Variations used in several courses at Haverford and Swarthmore Colleges, including Introductory Piano, Jazz and the Politics of Culture, Principles of Tonal Harmony II, Chopin, and Chorus. Legacy RealServer still used for other audio in other courses.
- Digitized ~250 complete CD titles from the collections of Haverford and Swarthmore (Bryn Mawr has no music library or audio collection), including the complete Great Pianists of the 20th Century series.
- In the Tri-Co, complete access to all content granted to all students, faculty and staff with network IDs. Access limited to IP ranges within the Tri-Co. Variations installed on PCs in the Haverford Music Library, PCs and Macs in the Swarthmore Performing Arts Library, and on PCs in the Bryn Mawr Main Library. Access model predicated on our similar model for the sharing of digital images.
- Access and discovery through links or playlists in Blackboard and by 856 links in Tripod, the Tri-College online library catalog.
- *For the Tri-Co, Variations is a very effective solution for access-controlled streaming audio. Following the initial technical startup and period of familiarization for IT and library staff, the system has run smoothly and required minimal maintenance.*



# Other Comments

- “Participation in the Variations project has enabled New England Conservatory to digitize a significant portion of its audio collection. Because NEC is a small independent music school, it does not have the resources available to undertake such a project on its own. During the course of our partnership with IU, the NEC library staff has found the Variations software to be easy to use and has received ongoing help and support from the IU Variations team. The success of this project has helped NEC to greatly expand access to class reserve listening materials and to preserve several historical recordings in its archives.” - NEC
- “We chose to go with Variations for several reasons. First, I knew it was well tested at a large institution. If it worked well for IU, it would certainly work well for us here. Second, I knew we would have assistance setting up and maintaining the system from your talented, experienced and courteous staff, at least during the grant period. Third, we were excited to have the accompanying software such as the score markup and timeliner modules. Although we have not had much experience with them yet, we will have a professor using those modules during spring quarter.” - OSU





# Further Expansion

- Poster session & signup list at Music Library Association annual meeting, February 2008
- Variations Audio Timeliner (standalone) open source release, February 2008
- EDUCAUSE 2008 hands-on Variations tutorial
- Full system open source release, February 2009
- 4 March 2009 webinar & follow-up survey



# Variations Open Source Release

- Variations Audio Timeliner
- Variations system release includes
  - Server software
  - Client software
  - Source code
  - Sample content for testing—two recordings and two scores
- Documentation available on the web (wiki)
- Download counts (2/9/2010)
  - VAT - 1593
  - Variations Server - 186



Free Puppy!



## March 4 Webinar

- Received registration requests from 115 people representing 88 institutions
- Registered 103 people; over 90 participated in webinar
- 32 people filled out post-webinar survey



# Survey Participants

- Bates College
- Bavarian State Library
- Boston University
- Harvard University Library
- Illinois State University
- Kenyon College
- Library of Congress
- Manhattan School of Music
- Middlebury College
- Oberlin College
- Occidental College
- Rowan University
- Toronto Public Library (2)
- U. of Northern Colorado
- Université de Montréal
- University of Hartford
- University of Saskatchewan
- University of Tennessee Libraries
- University of Utah
- UW-Madison
- Wake Forest University
- Wellesley College
- Wesleyan University
- Anonymous (8)

# V<sup>♯</sup> Variations Implementation Plans

- We will evaluate it during the next year for possible future implementation (14)
- We will evaluate it soon, and if it looks feasible, adopt it over the next year (8)
- We will watch and see how well it works for other institutions and then decide whether to investigate it ourselves (7)
- Probably not a good fit (3)



# Preferred Support Model

- We can handle open source without needing to pay anyone for support (15)
- We would probably not implement Variations without some kind of arrangement that lets us pay only when we need support (6)
- We would probably not implement Variations without some kind of annual paid support arrangement (4)
- We can handle open source without needing paid support, and we would also probably contribute development resources to implement new features we're interested in (2)



# Community Implementation

- 9 institutions in production
  - Includes all Variations3 test sites
- > 10 institutions piloting or evaluating for pilot, e.g.,
  - University of North Texas
  - Grieg Academy and the University Library of Bergen
  - Bowling Green State University
  - ...
- 8 institutions - recent discussions, plans unknown
- CIC music librarians - lots of interest at recent meeting



# Variations3 Metadata Work

- Analyzed work needed to align Variations2 model with FRBR and FRAD. For reports, see <http://www.dlib.indiana.edu/projects/variations3/presentations.html>
- Conducted successive experiments in “FRBRizing” MARC records and batch-loading them into Variations, improving our FRBRization algorithm
- Led to successful IMLS grant proposal, “Variations/FRBR: Variations as a Testbed for the FRBR Conceptual Model” (\$481,987, October 2008 - September 2011) <http://www.dlib.indiana.edu/projects/vfrbr/>  
(See also 28 October 2009 DLP Brown Bag on this topic.)





# Variations3 Personnel

Management Team: Jon Dunn (Project Director), Mark Notess, Phil Ponella, Jenn Riley

Programming Staff: Chris Colvard, Paul McElwain, Jim Mullen

Graduate Assistants: Alex Berry, Caitlin Hunter, Casey Mullin, Kurt Peterson, Yi Sun

## Advisory Board

- Linda Barnhart - Head, Metadata Services, University of California San Diego
- Richard Griscom - Head, Music Library, University of Pennsylvania
- Jerome McDonough - Assistant Professor of Library and Information Science, University of Illinois Urbana-Champaign
- Pat Riva - Coordonnatrice section des monographies, Direction du traitement documentaire de la collection patrimoniale, Bibliothèque et Archives nationales du Québec
- MacKenzie Smith - Associate Director for Technology, MIT Libraries, Massachusetts Institute of Technology



# Future

The image illustrates a future music player interface. In the background, a web browser window displays a page for 'Roméo et Juliette / Charles Gounod' with a track list and a video player. The foreground shows a smartphone displaying a music player interface with a track list for Mahler's Symphony No. 3.

**Web Browser Content:**

- Page Title: Variations: Roméo et Juliette / Charles Gounod
- Elapsed/Total: 0:00:05 / 150:20:03
- [View IUCAT Record](#)
- Track List:
  - Charles Gounod, Roméo et Juliette
    - Track 1. Overture (2:16)
    - Track 2. Prologue: "Verone vit jadis deux familles rivales"
  - Act I
    - Track 3. "L'heure s'envole..." (3:23)
    - Track 4. "Eh bien! Cher Pâris" (3:20)
    - Track 5. "Ecoutez!... c'est le son des instruments j"
    - Track 6. "Enfin la place est libre, mes amis!" (1:11)
    - Track 7. "Mab, la reine des mensonges" (2:58)
    - Track 8. "Eh bien!... que l'avertissement" (2:53)
    - Track 9. "Voyons, nourrice... Je veux vivre" (4:53)
    - Track 10. "Le nom de cette belle enfant?" (0:54)
    - Track 11. "Ange adorable" (4:20)
    - Track 12. "Quelq'un!" (5:56)
  - Act II
    - Track 13. "O nuit, sous tes ailes obscures" (4:23)
    - Track 14. "Ah! lève-toi soleil!" (3:11)
    - Track 15. "Hélas!... moi, le haïre" (5:39)

**Smartphone Music Player Content:**

- Time: 9:23 AM
- AT&T
- Search: Google
- URL: variations-host-dev.dli...
- Track: Symphony no. 3 [sound recording] / Gusta
- Elapsed/Total: 0:00/0:00
- Buttons: Total, CD/Side, Track, Repeat
- Status: Loading
- CD 1
  - Mahler, Symphony No.3
    - Track 1. I. Kraftig (6:14)
    - Track 2. Langsam. Schwer (2:31)
    - Track 3. Tempo I (3:05)
    - Track 4. Schwungvoll (7:56)
    - Track 5. Immer dasselbe Tempo (3:37)
    - Track 6. Wie zu Anfang (4:47)
    - Track 7. Tempo I (4:51)
- CD 2
  - Mahler, Symphony No. 2 (part)



# Sustainability

- Simplify implementation
  - Browser-based tools to obviate client installation
  - Partial hosting as an intermediate or permanent step?
- Broaden appeal beyond just music
- Continue to support community as it grows and forms



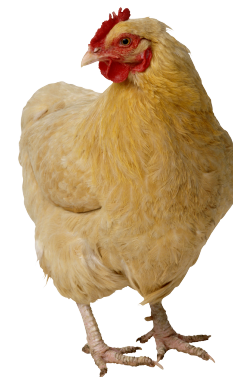
# Variations on Video

- One possible future path
- IMLS planning grant submitted February 2010
  - Would run September 2010 - January 2011
- Partnership with Northwestern University
- Committed participants: NYU, Stanford, Ohio State, Miami, DuraSpace, Opencast
- Extend Variations to support video
  - Serve broader set of needs
  - Build a larger community
  - IU *Empowering People* Action 37



# Sustainability: Governance

- Could have an independent organization, “Variations Foundation”, where paid membership would provide influence over future feature development
- Chicken and egg problem: need to have an adopter community of a certain size before an independent organization makes sense
- Still exploring possible options and financial models.





# Support Options

- Self-support via open source
  - IU will continue to update open source distribution
  - IU will participate actively in the variations-discuss mailing list on SourceForge
- If enough institutions adopt Variations, 3<sup>rd</sup> party support or even hosting options could emerge; chicken & egg problem again
- Exploring options for paid support services—but ongoing development is needed too



# More Information

- Try It Out!

<http://www.dlib.indiana.edu/projects/variations3/tryout.html> or visit music library and go to <http://variations2.indiana.edu>

- Variations Open Source Site

<http://variations.sourceforge.net/>

- Variations 3 project info:

<http://www.dlib.indiana.edu/projects/variations3/>

Questions?