Proposal Section C: Project Description (including Results from Prior NSF Support)

The Spoken Word: New Resources to Transform Teaching and Learning

1. Introduction

The Spoken Word Project proposes to transform undergraduate learning and teaching through integrating the rich media resources of digital audio repositories into undergraduate courses in history, political science and cognate disciplines in the U.S. and Britain. The project will take full advantage of the flexibility inherent in digital repositories and build processes for learning that will fundamentally expand the way students and teachers understand knowledge, knowledge resources, and their own complementary roles in higher education. Michigan State University, in collaboration with Northwestern University and the National Archives and Records Administration (NARA), and Glasgow Caledonian University, in collaboration with the BBC - Information & Archives, will develop and implement this vision. Starting with a rich collection of digitized audio resources, associated texts and images and a set of integrated online annotation tools, this work will promote the usability and integration of digital spoken word repositories to improve undergraduate teaching. The project will test whether and with what effect the integration of digital audio resources into university courses achieves four major project outcomes: (1) improving student learning and retention, (2) developing aural literacy in our students, (3) augmenting student competence to write on --and for -- the Internet, and, (4) enhancing digital libraries through a focus on learning.

2. Project Description

2.1. Intellectual Merit. The recent emergence of online digital audio archives has brought educators a major step closer to bringing original, reusable spoken word sources into the teaching of history. One might call it the "missing hyperlink" in the college student's multimedia research toolkit: a powerful set of original resources that can allow students to more directly experience and interpret history. Digital archives of spoken word sources permit us to combine the advantages of digital replication and segmentation with the recognized potency of speech, text, and images in classroom projects and historical study. The project's significance therefore will extend from the integration of historical audio in undergraduate courses to the transformation of curricular activity in higher education. A substantial portion of Western cultural heritage in the 20th century rests in spoken-word form. Only a tiny fraction of this vast content has been transcribed (Kutler, 1997; Beschloss, 1999, 2002; Miller Center 2001), and even that is inadequate as the spoken word – and not a transcription of it -- remains the best source.   While text versions may capture the words spoken, they cannot capture the emotional or ambient qualities that provide insight into events and participants.

Even today, access to audio still remains limited to physical visits to archival collections or secondary sources contained in films and video played for passive learners in class. For example, vast portions of the secret recordings of American presidents John F. Kennedy, Lyndon B. Johnson and Richard M. Nixon are accessible to the public only through actual visits to archival collections throughout the United States. Unfortunately, public release of these tapes has not yet translated to public access. (New York Times, 14 April. 2002) While much of the audio material available to address this classroom need remains in analog form, numerous and widespread efforts have begun to digitize significant audio materials both for preservation and for public and scholarly access. As a result of these efforts, the voices of the 20th century's public leaders, cultural spokespeople, and everyday citizens have become accessible as a living, public testament to our modern history. Our own programs have made some of the most significant headway in this field. The National Gallery for the Spoken Word (NGSW), Historical Voices, The Oyez Project, and BBC – Information + Archives have digitized and accessioned thousands of hours of spoken word resources into digital repositories. This project will build on this current research in digital library development, much of which was enabled through NSF or JISC support.

As with any primary source, these materials do not literally "speak" for themselves and impart wisdom; they require interpretation and analysis. We will create a set of tools and instructional methods that blend teaching, learning, and rigorous analysis into a sustainable historical research and teaching package using this new content. Because digital audio libraries now permit fast and simple audio segmentation, students and teachers can use online tools to listen and locate a precise section of audio within a larger audio file. Our project will build on this capability and offer students and teachers annotating tools to identify and mark sections of audio, create their own audio libraries, and then incorporate their findings and sources into electronic portfolios as class assignments and publications. The personal libraries will not contain actual audio, but will have pointers to the original archive, along with digital images, notes, text excerpts, and other media clips. Much like a scholar's note cards, the personal libraries will be the basis for new creative works and teaching strategies.

The infusion of digital spoken word materials into the classroom in this way will immerse students for the first time in historical utterance that they can replicate, reinterpret, even re-imagine in combination with existing forms of multimedia. Students of history gain a better understanding of historical context and the nuances and complexities of culture. Students of literature will gain better insights into the works of poets and writers through their readings and interviews. Students of ethnography and anthropology will gain experience with oral interviews. Students of political science will gain a better understanding of political rhetoric and change. Students of sociology will broaden their perspectives on social issues and various cultures. Students of linguistics will be exposed to regional dialects and deepen their skills in language analysis. In sum, voices from the past and present should help students and educators see connections between fields and enhance interdisciplinary explorations.

The project will be consistent with established principles and good practices in undergraduate education. The focus on spoken words, public discourse and communication will (1) promote better communication between students and faculty members and (2) open new avenues for better and more frequent feedback on learning. The annotation tools will (3) foster collaborative projects and more dialogue among students. Constructing resources collaboratively and online will (4) create a space for more active learning and (5) increase the time focused on task. Students will create resources that transcend the traditional exchange between student and teacher to instruct the class as a whole as well as interested students, educators, and researchers around the world. Students are often more excited by projects that allow them to experiment with multiple forms; in an online environment they create what has been termed "living resources" that contribute to the stock of knowledge in addition to meeting an immediate learning objective. Exposure to "significant real-life problems, conflicting perspectives, or paradoxical data sets" within the diverse collections of voices will (6) promote higher expectations for both students and educators, and (7) foster diverse talents and ways of learning.

Indeed, research shows an array of clear benefits when faculty use primary documents and multimedia in classrooms. Yet as K. Patricia Cross demonstrated in several landmark operational manuals on the subject, college faculty are not usually sufficiently aware of their students' learning and retention of content as it occurs and therefore cannot generate immediate returns in the classroom (Cross, 1996). This project will offer a significant contribution to the growing research on teacher-derived assessment of teaching and learning by incorporating active learning and historical method involving digital audio. Our project takes Cross's and others' work a step further because digital sources by their nature are conducive to more controlled and immediate classroom uses and assessment methods. These sources make it feasible for college faculty to engage in classroom research that lets them improve their teaching skills. For instance, student-created electronic projects that incorporate aural materials with other multimedia sources can be constructed from disaggregated digital elements more readily and with closer attention from the teacher regarding student use and comprehension of the material. In the process of construction, the teacher can obtain more immediate feedback from the student about the process of historical research and learning, including the challenges involved in multiple learning styles, in varying interpretations of spoken words, in understanding the subtle alterations in content revealed in contrasting transcriptions to the spoken word. It is through this kind of exercise that a digital library adds unique value. Teachers do not simply write comments; they can add, or suggest, a set of new connections or metadata from the wealth of sources within the digital repository. The audio, combined with the organization of the digital library, will make the learning exercises truly innovative.

2.2 Project Details & Design.
A. Summary. The Spoken Word in the Classroom project will: 1) identify and mine current digital repositories for pertinent content; 2) work with common virtual learning environments and re-craft existing online tools for them; 3) and most importantly integrate digital audio materials into classroom situations.

Specifically, the project team will customize existing online educational tools to facilitate access to existing digital repositories through widely used digital classroom environments such as Blackboard. The team will also adapt these tools to work with existing interfaces and online educational environments to exploit digital repositories. The resulting software kit will provide teachers with digital repository resources to build customized learning workspaces for themselves and students. Teachers can create web pages and sites stocked with resources to search and browse annotated collections by various parameters including user, teacher, and content area. Students will have note-taking facilities and web space for research, electronic projects, and presentations. The resulting classroom site will also cordon off a domain for the development of an annotation community to review, edit, and comment upon digital materials collected, deposited, or published there. At this site, classes can create their own libraries with student-justified metadata. Student assignments will include digital library searches through the class library based on their own metadata and links between digital objects. Follow-up class discussions about the relative virtue of metadata – based on search results – will emphasize the fragility of the meaning of historical materials in a digital world. This is an indispensable lesson that can happen only within the framework of a well-developed digital library and dedicated workspace.

B. Objectives. The Spoken Word in the Classroom will deploy these resources as part of innovative curricula to achieve four overarching objectives: A) increased content understanding and retention; B) improved aural literacy; C) improvement in student and teacher information literacy as measured by more articulated use of multimedia in an online setting; and D) improvement in the utility and value of digital libraries.

<u>Increased content understanding and retention.</u>   We know that students vary in their learning styles and that some media are better suited for certain learning tasks than others (Kozma, 1991). Some students learn most effectively through visual means; others learn most effectively through aural means. As teachers, we have mediated these learning strategies largely through text supplemented by film and sound. We assess student learning through examinations or assignments whose principal component is the essay, research paper, or class journal. Broader access to original materials afforded by the advent of photo duplication and analog tape strengthened educators' traditional commitment to bringing artifacts into the creative process. But use of these technologies has also encouraged teachers to re-conceptualize the old notion that interpretation inheres in the artifact as opposed to the informed mind of the learner. The same can be said for audio. Hearing the spoken word expands our understanding of the speaker's intent beyond the meaning given in its transcription at the same time that it encourages alternative explanations for those motivations. And as we have the opportunity to give students access to original documents (not simply their transliteration or text equivalents), we can extend this model to spoken-word collections as well.

For instance, recordings of court proceedings have significant information and a memorable psychological impact that text transcriptions of the court record do not capture or convey. In the oral argument in the landmark Supreme Court case of Roe v. Wade, Jay Floyd, representing the State of Texas, offered a sexist joke as he approached the bench. It was met with complete silence in the courtroom. A text transcription of the verbal content would never reveal this silence, which signaled that he brought the wrong assumptions with him to court <http:oyez.org>. The silence that greeted his joke, however, speaks volumes to the social changes that America underwent in the years leading up to the Roe decision. Understanding that silence can add depth to our understanding of the historic decision.

In the same way, oral history recordings provide invaluable post facto information and reflection upon events and experiences. In the Studs Terkel oral history repository <http:www.studsterkel.org>--originally collected for *Hard Times*, Terkel's book on the Great Depression--many common folk from various parts of the country speak in their local dialects about their experiences in the Depression. Because these interviews could be replayed in a variety of environments (a group discussion, on headphones, in a lone dormitory room, or a library carrel), the listener can both approach and absorb very different understandings of their meaning. The multitude of teachable moments that thus emerge give instructors the opportunity to examine the student's continually-refreshed impressions of this material, how it was collected, and how it can be used.

Students need not attend *only* to audio. Use of audio also offers an opportunity to *complement* video, schematics, images, and other visual instruction materials to multiply students learning. Paivio (1990) and Mayer (Mayer & Sims, 1994), among others, have shown the cognitive profitability from using two complementary sources of materials. Our minds can accommodate two streams of information, extract meaning, and build references across materials, so long as the two streams of information do not conflict. This application of audio will allow students to hear history while perusing maps, reviewing charts, watching social change via video. Their memories of the audio and visual materials will be linked, and meaning will be shared and rooted in both representations. In most cases what is missing from digital curricula in the social sciences and humanities is the audio to complement period representation. This project will provide it.

<u>Improved Aural Literacy.</u> This spoken word project will address the learning requirements of a new generation of both students and multimedia classrooms. It is a commonplace to observe the learning divide between university students today and their instructors. Students raised in the MTV age and weaned on computer games generally are comfortable with recreational technologies. (Heppell, 1993) Their teachers, on the other hand, emerged from the golden age of film and television ill prepared to use audiovisuals as dynamic elements in teaching. Simply displaying multimedia content in passive mode will not engage today's students and may reinforce ineffective teaching (Stiles, 2000). Today's students are visually and aurally attentive in large part because the sources of their entertainment and information are digital and dynamic as opposed to linear and textual. The project will capitalize on these new interests by introducing the use of spoken-word collections as an essential component of students' information literacy. The transition from the use of digital spoken-word collections to the introduction of digital video collections will be feasible from the work accomplished and lessons learned in this project.

Ong argues that our ability to write has changed our ways of thinking about the world and ourselves, our ways of remembering, and the progress of human development. Oral cultures deal with thinking, remembering, and relating to the community in fundamentally different ways than literate cultures do. Our literacy has allowed us to abandon these narrative and remembering techniques, perhaps to our impoverishment. (Ong, 1982) In recognizing these differences, we do not argue for an abandonment of literacy. But given the power and influence of oral and

visual media in our culture, oral resources – especially those that serve as linchpins to critical events – deserve attention and even prominence.

Having students contrast text and speech makes it possible to sharpen their acuity about aural clues and codes so important to the appreciation and understanding of human utterance in historical circumstances. The Roe v. Wade incident above is one example. But consider as well the deliberate polishing of ideas and refurbishing of motivations that occur with the publication of speeches that are also available in aural form. A collection of speeches in print concerning essential decisions that marked the intensification of Cold War attitudes during the Berlin Crisis in 1948 conveys perhaps more deliberation and forethought than events and emotions of the day permitted. Thus, a combination of such texts and various voice recordings can alert students to the heightened tensions of those days and help them comprehend the rapidly changing mindsets as the crisis unfolded. The BBC archives contain such materials: "witness statements" on the "Today Programme" at the 50th anniversary in 1998; Arthur Henderson, Secretary of State for Air, recorded at Northolt Airport (11/11/48) on his return from Germany; a contemporary radio documentary on the crisis (12/12/48); an account broadcast from Berlin.

The process of locating, identifying end and start points, editing and segmenting, and then commenting upon audio sources intensifies the student's awareness of nuances in the material – where a speaker's tone, vocal gestures, humor, sadness, or emphasis begin, end, rise, or fall. These nuances comprise elements of aural literacy that nowadays are confined to theater, graphics arts, and music appreciation courses. They also belong in the humanities and social sciences curricula.

Improvement in student and teacher information literacy measured by more articulated use of multimedia in an online setting. The multimedia computer is a fixture of the college dorm room and library. Students frequently download music and video to create their own personalized CD libraries, on occasion repackaging, editing, and recombining this material. But it is rare for them to annotate, integrate, and elevate this material beyond recreational contexts and use it to instruct others. That is the essence of information literacy: the transformation of information to wisdom through the use of multimedia tools in online settings. The annotation communities created in the course of this project will provide a collaborative environment where students sharpen their information literacy skills through the manipulation, analysis, and publication of digital objects. This exercise requires the development of electronic portfolios of reusable content drawn from digital libraries and secondary storage sites they create. A typical portfolio would contain digital objects that the student and the teacher develop with both the customized tools we supply and the common kit of internet and electronic publishing: word processors, web browsers and editing programs, audio playback and editing software, and image processing tools. The resulting skills will be of tremendous value to students entering an information-based economy. In addition, we expect portfolio building, and related constructivist activities, to serve a core mission of undergraduate education: helping students build a rigorous epistemology. No idea will stand completely on its own. It will be part of a network. Students will need to re-examine meaning as networks change. As a bonus, the network will be made up of original source materials, tacitly emphasizing that knowledge through secondary sources is not quite the same as the original.

Improved utility and value for digital libraries

This project exploits the broad flexibility of digital repositories by using methods that tie the digital assets of such archives directly to learning and teaching resources. The structure of the DL itself and the flexibility it offers for creating representations of history enable users to pace their understanding of content and the data mining procedure to their growing facility with digital sources and tools. Research in aptitude treatment interaction suggests that optimal learning results when the instruction is exactly matched to the aptitudes of the learner (Crohnbach & Snow 1977, Snow 1989). This is a crucial lesson to embrace if we want the introduction of digital libraries to have a democratic effect on education. Thus students that are independent learners can explore the archives on their own, developing their own organizations, attaching salient metadata to their personal networks of digital audio. Some of these audio networks might even find their way back into the archives, serving as commentary on meaning within a digital repository. This kind of self-generated, constructed knowledge is extremely durable. While it would be ideal if all students could successfully attempt this exercise, research suggests that it can be overwhelming for some. Those students requiring more guidance will have resources, roadmaps and other contributions to guide their understanding and exploration of the repositories. They can review networks of digital audio, whose links and annotations have been justified by the author, and offer critiques. This activity will require the students to use critical thinking skill without the overwhelming challenge of pure open-ended thinking.

Project activities will greatly enhance digital libraries by redirecting the challenges of research toward higher-level analysis and data sifting and away from mind-numbing search-and-browse routines that vast and growing data libraries can require. The project will achieve this by reducing the search for relevance, expanding the metadata with user-specific annotation, and tying the libraries' content directly to course materials. Among the strengths of the massive and growing resources existing in spoken word repositories are the versatility and quantity of the audio data. Audio is a powerfully rich medium, but it is also rigidly linear. Without accompanying reference, it must be listened to in real time to be comprehended. While transcripts provide a verbatim, searchable text that

parallels audio files, enormous volumes of raw transcripts defy pinpointed and targeted research. A benefit of the annotation package will be to narrow the search for relevance within the enormous volume of available audio data.

Any given audio file may be used in many different ways depending on the needs and interests of the user. For example, a student could use an audio clip of a WWII radio host for comparative media history, for arguing about public reception of the war, or for analyzing changes in language patterns over time. As students use the archive, the students' clip selections and annotations for these various uses will be saved in a MySQL database using PHP. Our MYSQL database is mapped to the METS schema and can be used to create XML records. The additional descriptive metadata produced in the annotation process will be linked to the audio file and to other metadata records for that sound file through the original unique record locator. This information will then refer to the particular audio file. Over time and with increased use, the metadata annotation will grow and enrich the archived repository. Thus new and returning users could search the repository for comments and annotation by others. This capacity to accommodate sense change and variability in knowledge is unique to learning with digital libraries and can help students come to understand how knowledge is constructed (Vygotsky, 1978).

Such a system of repository building and community annotation will necessarily introduce new questions of authenticity and data integrity to the digital repository community. The challenge requires a form of editorial oversight and information management that balances innovative use and exploration with the need for rigorous protection of the integrity of the entire library. The Spoken Word Project will model a data integrity process that will facilitate both the open community of resources and a peer-reviewed oversight to maintain authenticity. Such processes have been developed by H-Net: Humanities and Social Sciences Online, an international scholarly organization of online editors headquartered at MATRIX. Many of H-Net's 144 online communications networks grapple with culturally sensitive subjects and use a form of editorial peer review to manage what is published. There will be a formal process for removal of items if objections are raised, as well as a process that automatically screens new material for troubling phrases. New repository material will not be added to the course content areas without the approval of a field expert and teacher who examines it for adherence to academic research norms. This can help prevent the misuse of culturally sensitive materials and alert users to the importance of applying standards of logic, evidence, and data integrity when interpreting original sources.

C. Content. This project will utilize the wide variety of materials available in the digital repositories including: public speeches, private recordings, court proceedings, and oral histories. The quantity of materials in existing digital spoken-word archives multiplies the interpretive scenarios for exploring textbook and classroom themes. Public speeches demonstrate the sometimes-polished face speakers intended to portray to the world. The BBC collection is particularly strong in this area. For instance, a preliminary search of the BBC Sound Archive on the issue of the Berlin Airlift produced a range of items of interest to the nature and development of 'Cold War' attitudes: 'witness statements' on the Today Programme at the 50th anniversary in 1998; Arthur Henderson, Secretary of State for Air, recorded at Northolt Airport (11/11/48) on his return from Germany; a contemporary radio documentary on the crisis (12/12/48); an account broadcast from Berlin; and slightly unexpectedly (thus especially worth indexing), Pik Botha, the South African Foreign Minister, speaking on American TV in 1977, that "Africa has always sided with USA in two World Wars, in Korea and Berlin Airlift."

Private recordings, on the other hand, can reveal the process of argumentation and behind-the-scenes decision-making that shapes public policy. For example, the Cuban missile crisis tapes reveal a more complex debate within the Kennedy administration between 'hawks' and 'doves' <www.hpol.org>(May and Zelikow, 1999.) Recordings of court proceedings can convey significant information that transcriptions of the court record do not capture. Oral history recordings, in contrast to the historical recordings noted above, provide post facto information, questioning and analysis of events and experiences that contemporary historical recordings cannot offer.

We will utilize rich collections of digitized material already existing or in development in online multimedia repositories, supported by NSF, JISC and others. Among the sites to be explored are Historical Voices, The Oyez Project, History & Politics Out Loud, National Archives and Records Administration and their affiliated Presidential Libraries in the United States; and BBC – Information + Archives Section, and Tocher in the UK.

Historical Voices <www.historicalvoices.org> is an audio repository designed to develop both a rich set of exhibits and educational curricula that fully incorporate sound files. Amongst Historical Voices first featured public "galleries" are "Earliest American Voices," "Significant American Speeches," and "Voices of the Great Depression." Supported by funding by the National Endowment for the Humanities (NEH), NSF and MSU, the Historical Voices website provides public access to content digitized as part of the DLI2 research project, the National Gallery for the Spoke Word (NGSW). In Spring 2002, MATRIX launched a collection of Studs Terkel interviews, which initiated the distributed ingestion system based on the OAIS model. Over 800 hours of Terkel's original interviews are now available online. History & Politics Out Loud <hpol.org>, another gallery of Historical Voices, is a collection of public and private audio materials (300+ hours) that bear on higher education instruction in United States history and politics. It covers little-heard but oft-quoted presidential addresses (e.g., President Franklin

D. Roosevelt's 'fireside' chats), political stump speeches, informal remarks of great public significance, and popular oratory (e.g., exemplary sermons of Dr. Martin Luther King, Jr.). The project also contains the complete collection of secretly recorded White House conversations and meetings surrounding the Cuban missile crisis and the complete Watergate prosecution tapes extracted from the secretly recorded conversations of President Richard M. Nixon.

The OYEZ Project <oyez.org> provides an authoritative collection of oral arguments and oral announcements of opinions from the United States Supreme Court. All materials recorded by the Court have been added to this collection from 1995 through 2002. (Prior to 1995, only constitutional law materials were included in the collection.) The collection now stands at 2200+ hours and will grow by approximately 100 hours per year during the five-year grant period. Oral histories and interviews provided by several justices are also planned for inclusion in the collection. These materials convey extraordinary access to one of the least accessible institutions of American government.

The National Archives and Records Administration (NARA) has agreed to join this effort as a research provider. NARA will assist us in building our collections in two critical areas: World War Two and its aftermath and continued expansion of the Nixon and Johnson White House tapes. (1) "Sound Recordings: Voices of World War II, 1937-1945" is an exceptional example of NARA's holdings that will prove popular with teachers and students. Amounting to several hundred hours of public domain audio, the collection begins with President Franklin D. Roosevelt's 'Quarantine' speech of October 5, 1937 and ends with the surrender of Japan on September 1, 1945 (with remarks by President Harry S Truman, General Douglas MacArthur and Admiral Chester A. Nimitz). (2) The secretly recorded White House conversations of Presidents Lyndon B. Johnson and Richard M. Nixon contain riveting day-by-day accounts of two of the giant figures in 20th century American history and politics. Of the 3800 hours of materials in these collections, NARA will assist in creating a digital repository of 2000 hours of materials.

The British Broadcasting Corporation (BBC)—Information & Archives section—will be a research partner working with Glasgow Caledonian University in the UK. The BBC has underway an enormous digitization effort and is itself investing in building "collections" for educational use. Two areas with special appeal concern (1) World War II and its aftermath and (2) public debates in the history of science. Here are two examples:

(1) The 1948 Berlin Blockade is an apt example indicating the interest, depth, and interconnections to be found in audio archive material. The blockade marked the first serious crisis of the Cold War. Five thousand tons of supplies were airlifted daily for eleven months to the city besieged by the USSR. Historians value the importance of contemporaneous material. With so much documentary material in audio format, it is now possible to hear the actual people speaking about their personal experiences. Moreover, hearing exactly how the airlift was covered, what topics surrounded it, and especially its interconnections with other seemingly very different topics (like racism in South Africa and Australia) enriches the ability to situate the event while complicating our ability to explain it.

(2) The BBC Archive has an enormously rich collection, including interviews with all Nobel Prize science laureates post-World War II. Examples include: Prof. A. V. Hill on 'The Ethical Dilemma of Science' (1952), Dr. Francis Crick speaks of the difficulty of defining life (1962), Dr. Maurice Wilkins (who shared the Nobel Prize with Crick for the discovery of the molecular structure of DNA) discusses his wartime work on the atomic bomb as a stimulus to get away from destructive research (1962).

Tocher < http://www.pearl.arts.ed.ac.uk/Tocher/ >is a Scottish audio server. Tocher (a Scottish word meaning a dowry) is located at Edinburgh Universities School of Scottish Studies and serves music and dialogue. As an institutional JISC member, GCU receives a reduced subscription rate and thus staff and students do not have to pay for these sites. They complement BBC resources and can be used in various courses to chart changes in 20th century Scotland.

D. Methods: Classroom Integration

Tools Elaborated for Classroom Integration. The NGSW spoken word repository is a complex ingest and delivery system built with open source tools (see description below), yet the user interface is simple to use and is tailored to meet the needs of specific user groups. Ease of use is important since educators (and students) often have little time to invest in learning new technologies. Similarly, university faculty members are often asked to use software packages adopted by their institutions. Thus, educators have come to rely on courseware products such as Blackboard, WebCT, Anlon, WebLearner, among others, which ease the creation and use of online resources for both teachers and students. These increasingly familiar environments can serve as a "launching pad" for audio annotation tools developed by this project (NoteTaker) because it will be compliant with the Open Knowledge Initiative (OKI), increasing the likelihood of future alliances with university and commercial partners. Blackboard, for example, which holds the largest share among CMS use, is OKI compliant and could readily work with NoteTaker as a "Building Block" API. OKI compliance is vital here, as it will allow us to use simple java applets to integrate NoteTaker with our spoken word repository. With relatively little programming, we will be able to ingest annotations from Notetaker into the repository and delivery annotations out of the repository into Notetaker.

Central to this proposal is the elaboration of NoteTaker into an online interactive tool that will allow user-driven segmentation and annotation of streaming audio files. NoteTaker is an easy-to-use interactive API for general web annotation and collaboration now under development at Northwestern University. It will be extended to apply to audio resources as well as to text and images. NoteTaker can be used to organize and share an outline of research notes with an instructor or others in a work group. An initial version of NoteTaker was beta tested in Fall 2001 and underwent further refinement in Spring 2002. NoteTaker – and other software developed for this project – will be open-source. Source code will be free-of-charge for educational or non-commercial use.

The software provides a simple web annotation system that lets users take and organize notes linked to web based resources. The user creates an outline that is linked to web pages or objects within web pages. The user can browse the notes in the outline and view the associated web pages and resources or browse web pages and view the notes that are attached to that page. Notes and outlines are stored on a server and can be shared between individuals and groups. NoteTaker can be used to submit work to an instructor for review and comment or can allow a group of students to work collaboratively on a shared project. A new version of NoteTaker is nearing completion that allows the user to control access to notebooks, allows threaded discussions, and supports the editing and storage of structured content (forms).

NoteTaker will facilitate a process of marking and saving user-specific timestamp and metadata information. Users can listen to long files of audio, select particular segments of interest, and mark beginning and end points for those segments within the digital audio stream. (See <www.hpol.org/demo> for examples of possible NoteTaker results.) NoteTaker will also facilitate user annotation of the selected audio. Teachers, for example, could annotate a selected audio segment with notes on potential uses for themselves, course-related comments for their students, or grade level information and instructional suggestions for other teachers. The tool would then save user preferences to a server, including time code data, annotation and other metadata information users may enter.

While all digitized audio used in this project will have been ingested into the system with fundamental administrative and structural metadata, and basic descriptive metadata (usually Dublin Core), cost containment will severely limit the amount of descriptive metadata that will be catalogued. Annotation by teachers and students can therefore greatly enhance the educational value of digitized audio in our system by augmenting this minimal descriptive metadata with their annotations. Students and instructors will create topical annotated bibliographies or lists of media clips (or segments of media clips) and "publish" these for class, work group, or more general use. Students will then be invited to assign (provided) topic headings and rate materials relative to those topic headings. For example a student might rate a clip as very important for "exploring the controversy regarding African American voting rights in the 1960s." Students will be able to contribute short (two paragraph) reviews of particular media clips and segments. Every user will be provided with a notebook used to collect links to media clips or segments. Shared group notebooks will also let materials be shared among users. When a user listens to a media clip she or he will be given the option to "collect" the clip in a private or shared notebook.

 The annotation tools will be web forms that will have a variety of controlled vocabulary fields and open descriptive text boxes. Number of voices, time, grade level and subject categories, for instance, would be selectable through check boxes and dropdown menus containing controlled vocabulary; however, open-field text boxes for content summary, user notes, teacher notes, student notes would allow free-form user entry. These annotations and segmentations will be saved in descriptive metadata records, in a MySQL database for translation to XML files. Each file is saved as equivalent to the other files to enable searching by any field within the record. Similarly, through use analysis, we will be able to prioritize search results from the database by any field, or by popularity or user comments. We can also weight certain metadata fields to order search results for different users.

The tools will be developed at MSU and Northwestern, and testing will be conducted in classrooms at MSU, NU and GCU. Such a set of tools once fully integrated into the repository has the capacity to change what teachers do in the classroom and to change how students learn.

Classroom Integration and Transformation. The two primary objectives of this project will be researched and tested through direct classroom integration. The suite of online tools will be evaluated in the US and the UK in six types of basic undergraduate courses: Humanities, US History, US Politics, Constitutional Law, History of Science and World War II and Its Aftermath.

At Glasgow Caledonian University the learning and teaching innovations will be coordinated from the Learning Centre by David Donald (seconded from the School of Social Sciences). This makes best use of significant University resources and provides the most strategic location to generalize its impact both within and without the University. Initially modules hosted by the four-year BA Social Sciences Degrees Programme will be used as test beds. Modules in Law, Sociology and Mass Media will then be considered for inclusion in the project plan. All the modules in the first stage are in years 3 and 4. All are currently student learning centered and all are currently supported by web sites most of which involve some student contribution. All were designed with the intention of introducing a greater use of internet-based technology over time. Delivery in each of these will continue to be what

the Open University refers to as 'multi-channel' – a mixture of face-to-face, paper, email and web interactions. But in each channel, students will be encouraged to consider using an 'electronically intensive' study approach (including peer group interaction) and submitting their final assessment as an electronic document: for some modules a 'web log' portfolio of progress will be appropriate. The intention is to evaluate the capacities of students "to work on their own, think for themselves and contribute their work to the work of a group" (c.f. Hale, 1964 para. 95) and to induce 'deep learning' (Suskie, 2001 and esp. the contribution by Entwistle). It is in these modules that "collections" from the BBC and elsewhere will be used in conjunction with the US "collections". Typical collection themes of interest are "The Aftermath of World War Two" - with Cold War, Welfare State, Post-War Consensus and Anglo-American relations as sub-themes. ('The UK, USA and the Cuban Missile Crisis' is an example of where audio can be used alongside 'conventional' documents to evaluate events.)

We will also make audio content available at Levels 1 and 2 to demonstrate the significance of audio as a source, the ways in which it can be used to interest / motivate students in selected topics where audio is a particularly appropriate medium. These modules are short and involve extensive surveys with 80 to 300 students enrolled. We intend to use the partnership to explore the ways in which we can extend their use of electronic content but we recognize that they are for Caledonian the most challenging areas to manage. We intend to use the project to develop the uses of IT at these levels: in particular we hope to gain from discussion and joint development with our partner institutions.

Michigan State University will coordinate the classroom learning and teaching research through the Center for Integrative Studies in the Arts and Humanities (CISAH) and the History Department, both of which are in the College of Arts and Letters. Audio resources will be integrated into two major courses -- IAH201: US and the World, and HST203: US History 1865 to the Present. Each semester, MSU's Center for Integrative Studies in Arts and Humanities educates about 2250 first- and second-year students (more than 5000 annually) in a required interdisciplinary course IAH 201: "The United States and the World." Directed by American historian Kenneth Waltzer and led by a group of interdisciplinary faculty-of-record that oversee 40 graduate assistants, this course is part of the modified core curriculum at MSU through which undergraduate students meet their Arts and Humanities general education requirements. "The United States and the World" uses primary source readings, selected historical, literary, and autobiographical texts, some videos, an interactive CD-ROM (The American Identity Explorer: Immigration and Migration cd-rom), extensive class discussions, museum visits, student presentations, and significant student writing to broaden and deepen student understanding of processes behind the making and remaking of the American nation and of American identities in time and also about changing American role(s) in a changing world. The course is evolving toward greater focus on World War II, Vietnam, and contemporary globalization, for which significant audio resources would be highly relevant (FDR to LBJ, MLK, etc). CISAH is committed to offering assistance in evaluating the spoken word repository tools. In addition, CISAH will support some sections using the annotation tools and others relying on traditional means of teaching the same course materials, thus offering a control group against which to examine the educational effects of increased use of audio materials in the classroom.

At MSU, Professors Mark Kornbluh and David Bailey from the History Department teach History 203 (United States History Since 1865) The course usually has about two hundred students a semester, with sections led by teaching assistants. The audio resources developed in relation to this project will be of primary use to the second and third parts of the course, although the early voices (a few clips of McKinley, Bryan's Cross of Gold Speech, some early statements by Edison, Carnegie and Rockefeller) can illuminate lectures. For the second period, the audio resources add a richness and texture to assignments previously unimagined by faculty. Assignments on such issues as the nature of the depression can be developed around the testimony of participants in the Flint Sit-Down strike and memories of the "American Exodus" out of the Dust Bowl, as well as the public statements of such key figures as Franklin and Eleanor Roosevelt, Father Charles Coughlin and Upton Sinclair. Even more complexity can be added to student assignments with the rich materials on World War II, including public addresses from the major participants and radio broadcasts from such dramatic events as the London Blitz. We have also identified excellent oral materials on the Manhattan Project, which would be of particular interest to science majors who are required to take the class as part of their distribution requirements. It is, however, in the post-World War II section of the class in which the richness of this audio archive can permit students to begin to construct their own projects, looking at the origins of contemporary issues such as antiterrorism in the discussions of the Cold War, pluralism in the Civil Rights movement and protest movements in 1960s radicalism.

At Northwestern University, Professor Jerry Goldman teaches a large survey course each year on American government and politics. He also teaches courses on constitutional law. Goldman's teaching will serve as one of several envisioned test environments to determine the efficacy of digital audio libraries on learning. With respect to the large survey class taught annually (N=275), it is critical to establish base-line data for student knowledge. Goldman will survey his students using a basic-knowledge protocol developed in collaboration with the assessment

team. He will re-test again at the end of the quarter regarding knowledge and retention issues arising from his use of digital audio materials.

Goldman's students in his survey class meet weekly in small discussion sections. To assure a measure of control in testing for learning effects, Goldman will randomly assign his 10-12 sections into two groups (A and B). Students in both groups will be required to develop short papers (analog or digital versions). However, students in the A group will be encouraged to create individual projects (e-papers or presentations) using on-line spoken-word audio collections and relying on the listening skills that serve as one of the cornerstones of the class. Whether and to what extent students use the spoken-word materials for their projects will hint at the usefulness of the audio digital library materials.

Students in Goldman's constitutional law course (N=75) will be required to work on group projects examining particular oral arguments in key cases. These student projects will test the effectiveness of the annotation tools in the gathering and storing relevant data. User surveys will provide feedback on the annotation tool and seek ways to enhance its utility. Goldman has agreed to teach these courses on an annual basis during years 1-3.

Professor Kenneth Alder, a specialist in the history of science at Northwestern, has agreed to test access to and use of digital spoken-word collections in his   lecture classes at Northwestern dealing with the history of science and technology and in his small research seminars for undergraduates. Alder will work with the grant assessment specialist with regard to the collection of baseline information and the efficacy of these audio materials for his teaching and for his students' learning. The BBC collection of science radio broadcasts should prove invaluable in teaching students about the history of twentieth century science. Many of the BBC interviews involve scientists who actively contributed to the creation of the atomic bomb, who laid the groundwork for the discovery and exploitation of the structure of DNA, and who set the terms for our general lay culture's understanding of science.

Reaching Underrepresented Students. The institutions of the consortium cover a wide range of students and it may be that the diversity of learning strategies and styles has a systematic relationship to the backgrounds of students. Glasgow Caledonian has as an aspect of its objectives the inclusion of previously underrepresented groups. This presents many teaching challenges and raises quite complex issues in the evaluation of the use of multimedia and of audio in particular. The project allows some consideration of the factors determining the appropriate use of new media with different populations. We know, for instance, that there is a significant literacy gap between boys (who prefer action-oriented learning modes) and girls (whose literacy rates rise earlier in life in part because the preponderance of females in teaching slants learning materials toward narrative, didactic texts girls prefer).

3. Results from Prior NSF Support

3.1 The National Gallery of the Spoken Word project

The *National Gallery of the Spoken Word* (NGSW) has created a carefully organized on-line repository of spoken word collections. In doing so, it is developing a recognized set of standards for preservation and access, sophisticated and integrated search mechanisms, and flexible interfaces for aural resources. Now in its third year, the National Gallery of the Spoken Word (NGSW) has been strikingly successful. The principle investigators have made great strides in implementing key research areas, establishing paths to "Best Practices" in the delivery of online sound, continuing research on searching and watermarking tools, prototyping interfaces and educational exhibits, and developing the infrastructure for production. The NGSW addresses critical technical and intellectual problems in the delivery of high-quality voice materials online.

First, in the early attempts to present sound files on the WWW, little attention has been paid to standardization of digitization techniques. This project is creating a set of standards for future development of sound on the web, including for formatting, sampling procedures, archiving of sound, and tagging of materials. Second, while a number of search techniques work well for text, search techniques for very-large-scale databases do not yet exist for spoken materials. The project takes a multi-prong approach to searching---utilizing programming to tie sound files to text for searching and using algorithms for searching using the acoustic data directly. We are also setting standards for metadata by developing an XML metadata schema that can be easily deployed and searched by sound archives. Third, our goal is to make aural resources useful through the web to a wide variety of audiences, including researchers, teachers, students, journalists, and the educated public. Thus, we have undertaken extensive research in interface and presentation design and presentation. Fourth, we are paying particular attention to the incorporation of spoken resources into the educational curriculum, both at the k-12 level and in universities and will work with teachers in developing educational interfaces and uses.

At MATRIX, activities have focused on (1) designing and developing the underlying architecture for a large scale digital repository of sound, (2) metadata development for such a repository, (3) evaluating and revising best practices for spoken-word digitization, and (4) development of educational interfaces and tools to maximize usefulness of the NGSW. MATRIX personnel, working from a storage archive model proposed by NASA as the Reference Model for an Open Archival Information System (OAIS), have developed an OAIS based delivery

"archive" to temporarily store audio files as they are ingested from participating archives. For this delivery system to be successful, participating archives, one of which will be an OAIS compliant NGSW archive, are designed to work in a federated system. Within the system, the data is freely exchanged both between the NGSW delivery system and the federated partners in accordance with agreements as to rights of transfer, storage, and distribution.

This OAIS based delivery system incorporates the best ideas of an OAIS storage system – coordinated metadata management, coordinated data management, and user/administrator feedback - with what the NGSW needs to present a cohesive site to online visitors using a mass of files from different, remote institutions which actually store the data. To meet the needs of expected users, temporary storage, on-time delivery models, and caching systems have all been developed and incorporated into the OAIS model. The NGSW will host its own OAIS compliant archive, but participating institutions that join the federated archive system to supply the NGSW with external data need not be OAIS compliant. A white paper has been completed that explains the NGSW OAIS delivery and storage model <http://www.hsitoricalvoices.org>.

Working with a collaborative working group set up by the Digital Library Federation that includes the Library of Congress, University of California, Berkeley, Harvard University, NYU, and others, MATRIX personnel have established a beta version of a Metadata Encoding and Transmission (METS) XML schema extension for audio metadata (and text, images, and video). The METS XML schema provides an encoding format for administrative, descriptive, and structural metadata that is fully compliant with OAIS. Depending on its use, a METS document could be used in the role of Submission Information Package (SIP), Archival Information Package (AIP), or Dissemination Information Package (DIP). The development for the METS extensions is based on a number of existing standards projects including NISO, MPEG7, National Library of Australia, CEDARS, NEDLIB, and LOC, among others. METS has just been approved through the DLF formal review process. METS is now is being hosted by the Library of Congress Standards Department. Mark Kornbluh sits on the new editorial board to oversee the development of METS.

Given the current limitations of XML databases, XML was not used to store metadata in the NGSW repository. However, the database structure was designed to mirror the functionality of XML with the intent to migrate to XML in the future. Modeled after the METS schema, the database table structure of the NGSW repository was developed to be highly flexible. Because the repository integrates so many different kinds of metadata from different institutions, the design moved away from statically defined tables and incorporated a schematized table design. This design also allows partners within the repository the flexibility to design and modify their own metadata schemes and ingestion/administration forms for objects within the repository through an easy to use browser based utility. Because the repository stores information about the kind of metadata being used by each project, the NGSW has developed a PHP based online utility that utilizes this information to generate dynamically metadata ingestion/administration forms for each of the partners. This utility allows projects to begin their participation in the repository by selecting from existing metadata schemes (Dublin Core, MARC, EAD, etc.) or entering information about project-specific metadata to describe the objects they will store in the repository. This information is then stored in the database and instantly used to generate online forms to begin entering metadata. This tools developed facilitate the dynamic generation of galleries and aid in the searching for files by format.

The choice of appropriate digitization best practices for NGSW has been influenced by two distinct factors - the technological and the archival. Each of these factors poses a different set of questions and challenges to the project. When deciding on particular specifications of sampling rate, quantization, hardware, etc. our primary technological goal is to provide a digital copy that closely matches the analog original. To this end, it is possible to establish a process that, minimally, reconstructs the entire frequency response of the original while adding as little of the so-called "digital noise" as possible. To achieve this goal, it is sufficient to use the 44,100 Hz sampling rate and a 16-bit resolution. The former ascertains that we capture the entire audible frequency range of the original (based on the Nyquist theorem), while the latter, gives us a 96 db SNR (signal to noise ratio). However, from the archival standpoint, it is our desire to preserve as much information (both speech and non-speech) of the original as possible. Current technology makes it possible to use higher sampling rates and resolution of 96,000 Hz and a 24-bit resolution. This would result in a much increased frequency response of the digital waveform - from 0 to 48,000 Hz, and a dramatically improved SNR of 144 dB. The digital audio file captured at 96,000 contains over twice as much information as the one sampled at 44,000 Hz. Using an oversampling A/D converter can dramatically minimize the unwanted effects of the quantization error. Given the technological potential that we have at our disposal, the choice of digitization best practices is 96,000 Hz sampling rate and a 24-bit quantization.

In addition to the work on metadata and system architecture, MATRIX has also made great strides in its research on educational uses for sound. To this end, MATRIX personnel have created a SMIL package that allows users to listen to recordings while viewing images and text. The automated SMIL creation application suite uses an XML (trans13.dtd) Transcriber document and a RealMedia audio file as its input and creates a time-synchronized SMIL presentation with an audio timeline and an accompanying scrolling text display in one RealPlayer window

embedded into a custom HTML window. The process is entirely server-side and is controlled by a user-friendly web browser interface.

The Speech Processing Laboratory at MSU has worked on watermarking research that has concentrated on robustness testing, and subsequent algorithmic refinement, of the Transform Encryption Coding (TEC) based strategy that has been the central focus of the watermarking methods. A technique for recovery from one of the most destructive forms of watermark attack, cropping, has been completed. We have significantly expanded the repertoire of attacks against which TEC-watermarking has been tested, including a study of the cropping recovery procedure in the presence of channel noise, as well as deliberate destructive use of common signal processing operations such as re-sampling, compression, filtering, D/A conversion, and re-quantization, protocol attacks, counterfeit attacks, brute-force key search, statistical averaging, and collusion attacks.

The Robust Speech Processing Lab (RSPL) at Center for Spoken Language Research (CSLR), University of Colorado Boulder has been involved in three areas that contribute to the NGSW: one, formulation of an audio search engine for information retrieval; two, speech processing schemes for user selected enhancement of materials; and three, procedures for how the preservation of digital sound will interface with audio search and information retrieval systems. A research tool for preliminary studies on audio searching within the NGSW has been established. This research tool was originally developed under a research grant from the U.S. Navy for keyword spotting, and has been modified to work for NGSW audio streams. In addition, while the initial keyword spotter was trained with noise free speech, the present research tool has been retrained with models from the Broadcast News corpus (Broadcast News corpus is available from LDC-Linguistics Data Consortium and consists of radio and television broadcasts of news shows). A new graphical interface was also developed for the research tool that should allow tracking of search performance results as it is used. The search results are ordered in terms of a hit list for audio search, with the expectation that a researcher/user would sequentially probe the hit list to determine the first successful recognized phrase. The statistics of this the number of false hits before a success is used to quantify performance of the search engine. We have developed a very effective acoustic event segmentation scheme, which shows promise for speaker labeling in NGSW audio streams. The method is based on the Bayesian Information Criterion, and initial evaluations show very good performance

While this research tool will provide useful feedback for subsequent audio search development, we are focusing on a dual processing scheme that will first search resulting text transcriptions from a large vocabulary continuous speech recognizer (LVCSR), knowing that depending on acoustics and recording conditions, the word-error-rate will vary from 5-10% to as much as 80-90%. The architecture for the audio search engine will therefore consist of an initial search of the poor quality recognized text sequences to obtain regions for probing, followed by direct phrase recognition search of the audio stream areas identified based on the initial text search. This two-step process offers the best chance of removing low probable audio portions for search without needing to process the audio data repeatedly.

LVCSR research to increase recognition efficiency will continue and will be expanded to include researchers at IBM, Carnegie Mellon, and perhaps others working on LVCSR. The online repositories developed by MATRIX and Northwestern (including The OYEZ Project, Earliest Voices: A Gallery from the Vincent Voice Library, History and Politics Out Loud, American Voices, and The Flint Sit-Down Strike of 1937), which represent thousands of hours of catalogued spoken word resources—many files have highly accurate transcripts, will form the basis of an excellent test-bed for research and development that will enable us to effectively evaluate alternative Automatic Speech Recognition tools and deploy them where and how they are most useful.

4. Institutional Partnerships, Support and Sustainability

The partners bring to this project an outstanding combination of institutional leadership, commitment to innovative and effective teaching, strong experience developing state-of-the-art digital repositories and educational technology, as well as a proven history of effective professional collaboration.

4.1 Michigan State University is one of the largest public research universities in the United States. Michigan State has long since made a very serious commitment to providing the infrastructure and resources necessary to bring online material into the classroom. It was the first large state university to provide e-mail accounts to all students. MSU is a leader in developing Internet II and will continue to be at the forefront of Internet development into the next century. The commitment to information technology is a modern version of MSU's original mission. As one of the original land-grant institutions, MSU is formally dedicated to a balanced effort in the areas of teaching, research and outreach.

MATRIX: Center for Humane Arts, Letters and Social Sciences Online at Michigan State University is devoted to the application of new technologies in humanities and social science teaching and research. With a staff of over thirty (20 fte), MATRIX creates and maintains online resources, provides training in computing and new teaching technologies, and creates forums for the exchange of ideas and expertise in new teaching and research

technologies in addition to serving as the computing home for H-Net: Humanities and Social Sciences OnLine. Director Mark Kornbluh, an American Historian, is a specialist in American voting patterns and participation and international leader in the development of both scholarly and community networks. A nationally recognized teacher of twentieth-century American history, Dr. Kornbluh has extensive experience using technology to teach students at all levels about American history, democracy and civic education using Internet teaching tools. Kornbluh directs national, state, and privately funded projects focused on using the Internet for educational purposes and oversees the largest international consortium of online networks, H-Net. He is the lead PI for MSU's NSF-supported Digital Libraries Phase II initiative, "Creating the National Gallery of the Spoken Word" and its International Digital Libraries project, "Building a Multilingual Digital Library of West African Sources, " Professor David Bailey, Assistant Dean of the Honors College at MSU, also specializes in American history. He has over five-years experience in integrating new Internet technologies into his classrooms and has played a major role in the content development of the Historical Voices collection. Professor Dean Rehberger, Associate Director of MATRIX, is project manager for the NGSW and oversees the work on MATRIX's digital library projects.

The Center for Integrative Studies in the Arts and Humanities houses MSU's required general education courses in the humanities. IAH 201: The U.S. and the World -- led by MSU College of Arts and Letters faculty -- offers MSU undergraduates a common opportunity to examine the unities and diversities of the American experience on the basis of historical, literary, artistic, and other cultural materials. IAH 201 focuses on the making and remaking of the American nation, on the peopling of American society and the refashioning of American identities, on American cultural change and expression, and on the United States' changing role(s) in a changing world. IAH courses introduce students to the multiple ways of knowing in the arts and humanities, and they assist students to strengthen their analytical thinking, interpreting, writing, and communicating skills. Professor Ken Waltzer, Director of IAH and an American historian has pioneered the integration of new technologies in IAH courses.

4.2 Northwestern University is one of the country's leading private research universities, with an annual budget of more than $1 billion and 5,700 employees. Northwestern's campus network infrastructure is among the best in the world at this time, and it provides an exceptional testbed for determining the pedagogical potential of digital archives to support instruction. All academic buildings on the Northwestern Evanston campus are connected to the campus backbone with a Gigabit Ethernet connection, or better. The standard network port for the 4,000 students in NU Residence Halls is Switched-10 Ethernet, and beginning this year all students get MPEG-2 multicast video streaming of TV channels through at their residence hall rooms.   The standard network port for NU faculty offices is now Switched-10 or better, and approximately 70% of our faculty have upgraded to this grade of network service.

Northwestern network connections to other universities around the world are exceptional. Northwestern and its partners in the MREN network consortium have enjoyed the best-available network connections to international sites since the early 1990's. The MREN partners created the world's first GigaPOP at the Chicago Network Access Point (NAP) in 1994.   This GigaPOP served as a model for some of the architecture that took form later in the development of the Abilene Network.   MREN provides Northwestern faculty members' "regular" connection to the production research networks (such as Abilene) at 155Mbps.

The Partnership at Northwestern between the Library and NUIT Academic Technologies advantages our projects in digital archives. Two years ago, Northwestern University renovated one whole floor of its main Library tower in order to house the joint faculty support efforts of Academic Technologies, the Library's Digital Media Services, and Collections Management.   Known as "2EAST", this facility provides integrated support services for Northwestern faculty in instructional computing, archive development, media services and research computing. This integrated approach to service development advantages projects such as Goldman's work in audio archives.

Professor Jerry Goldman pioneered the creation and application of information technologies for research and teaching. His work in digital audio archiving and in the use of web-enabled multimedia-based experimental research earned him coveted professional and national awards. His teaching has been distinguished for its use of novel applications including the infamous 'law-baseball quiz' <baseball.oyez.org>. For more than fifteen years, he has worked in close collaboration with Academic Technologies and Northwestern University library staffs, including leading technologists Dennis Glenn, Jonathan Smith, Bill Parod, Claire Dougherty and Stu Baker. He has worked closely with Kornbluh on several projects and initiatives and is co-PI on the NGSW. Goldman has known Prof. David Donald professionally for more than 12 years. They met when Goldman presented a seminar at GCU in 1990 and they served for several years on the American Political Science Association's Section on Information Technology and Politics.

4.3 Glasgow Caledonian University is the 4th largest University in Scotland, has the largest Faculty of Health in Europe and the UK's 4th largest business school. The university, which is in the fortunate position of having a single City Centre Campus in Glasgow, has approximately 14,000 students and an annual turnover of £70 million. The

University has a Learning Teaching and Assessment Strategy that places strong emphasis on the development of the student as independent learner making effective use of new technology. Similarly, the University's C&IT Strategy and Policy places emphasis on the use of C&IT to enhance student learning. It is not surprising therefore that significant systems and infrastructure investment have taken place over the last 24 months. These developments have largely taken place since the appointment of a new University executive in 1999 when Les Watson was appointed as Pro Vice-Chancellor for Learning and Information Services.

Since 1999 the University has restructured its C&IT Service into a central unit with 70 staff that are organized around user needs and with a clear remit for the use of C&IT in learning and teaching. During this time the University has procured a new student record system and human resource management system, both based on e-business self service principles, and integrated these through a staff and student portal with the Blackboard virtual learning environment. The overall of these developments is to develop a robust Managed Learning Environment for the University. Currently Blackboard is used with 3,500 students with Glasgow Caledonian having the highest number of students studying on a single Blackboard module – 1600 students on the Fundamentals of Marketing. This investment in C&IT will continue into academic year 2002-02 and beyond. During the academic year 2002/03 the University is developing the Blackboard system to make it available to all 14,000 students and David Donald plans to make extensive use of this development as key part of delivery of the Spoken Word project. The University is also investing £500K (over two years) in the further development of its current portal to provide leading edge IT enabled access to a wide range of learning and support services for students. During the last year the University has also established an e-Learning Innovation Support Unit that works closely with academic staff to take courses on line. The eLISU will work with the Spoken Word project providing advice and support. A £35 million Campus Development will commence in 2002/03 that focuses on the building of a state-of-the-art Learning Centre.

In preparation for the development of the Learning Centre the University is in the process of integrating all of its academic related services to form a University Learning Service. This will report to Les Watson and it is where David Donald will work from to deliver the Glasgow Caledonian portion of the Spoken word project. The University Learning Service has a staff of 200 and a budget of over £7 million per annum and will provide David Donald with a broad base of expertise and support encompassing traditional Library services, C&IT support, and e-Learning support.

David Donald and the Department of Sociology have an excellent track record in the innovative use of C&IT in learning and teaching. Three projects are of particular relevance here. First, Enhancing Teaching-Learning Environments in Undergraduate Courses is an ESRC funded project that aims to work collaboratively with up to twenty departments in five contrasting subject areas. The History section within the department of sociology was approached to participate in the project in recognition of their previous innovations with C&IT in learning and teaching. The project involves working with and supporting partner departments in reviewing the effectiveness of their undergraduate teaching and in identifying new ways of encouraging high-quality learning. (Further details can be found on the project's web site at http://www.ed.ac.uk/etl.) The outcome of the project will be a 'collaborative initiative' that will involve the identification of a change in the way modules are organized, taught, supported and assessed with the potential to enhance the quality of students learning. Second, the History-On-Line Project, which was originally funded by a GCU Academic Development Fund Grant, has led to the introduction of Web-maintenance as a component of the Honours Dissertation. Students are now required to maintain a web site that records work in progress and provides them with a vehicle through which to record primary and secondary literature consulted and illustrative materials gathered in a creative manner. Sites also allow supervisors to monitor student progress on a more effective basis. In cooperation with our colleagues in Computers in Teaching Initiative in History, the grant holders have focused on the dissemination of the project to other History departments. To date the experience of the GCU History on-Line Initiative has been disseminated at the History 2000 Conference in April 1999, and at CIT conferences at the Universities of Durham and Staffordshire. Further dissemination will take place at a conference in Boston in 2000. The 'Caledonian Project' is gaining recognition as a successful illustration of how the WWW can be incorporated into mainline History teaching. Finally, the CITscapes project, a JISC funded project for which GCU is a partner, is investigating the development of student C&IT skills. Phase I of this project involved covered HE institutions and was a partnership between the University of Glasgow, University of Stirling, Glasgow Caledonian University, and the University of Gloucestershire. Phase II extended the scope of the project to cover FE. Les Watson is the convener of the CITscapes Steering Group.

4.4 Contributing Content Partners

Our collective enterprises under the NGSW umbrella possess upwards of 5000 hours of authoritative spoken-word material. In addition, we will work with the National Archives and Records Administration in College Park, Maryland to bring additional content to the web. NARA is a repository of information and, with few exceptions, does not have a plan in place to digitize its existing collections. NARA will assist in making its public-domain World War II materials available to us for digitizing. Fortunately, the units responsible for presidential audio

materials have embarked on a digitizing effort and this project will profit from that foresight. It is expected that NARA will provide access to about 2000 hours of White House conversations (about half of this unique collection) in digital format, which can be easily stored and encoded, for streaming purposes.

The BBC-Information + Archives is budgeted to digitize 300,000 hours of its spoken-word collection. About 14,000 hours have been digitized to date. Glasgow Caledonian University will work closely with the BBC to identify the areas where collection building will have the greatest pay-off for university instruction. There is no cost to the grant for this digitizing effort or for the priorities we shall create on the BBC's digitizing plan.

4.5. Research plan/Institutional Approval

We will develop permissions regimes and human subjects oversight procedures for two phases of this project. First, the acquisition and use of nonpublic, unpublished secondary data in existing digital archives requires clearances for publication and research use by student participants. Second, informed consent will be requested of the student participants to cover both the deposit of their works in the annotation archives and the subsequent use of that material by succeeding generations of teachers and students. These permissions and oversight procedures will be presented for review and approval by the pertinent institutional review boards and advisory ethics groups of the partner universities: MSU's University Committee on Research Involving Human Subjects, and Northwestern University's Institutional Review Board.

5. Evaluation

Imagine a college campus that did not have a library. Now imagine meeting someone from that same campus three years after his or her library first opened and asking, "So, what is it like having a library?" This is, to say the least, a challenging question. The question(s) we need to ask are subtler. In our case, libraries are already in place, so paradigms for libraries and their virtues/limitations exist. We are introducing a new breed of library and asking: 1) "What difference does it make?" and 2) "How can we use it to make worthwhile differences in undergraduate education?" This framework will drive our assessment activity. We are committed to offering answers to these questions that will be useful to a range of constituencies: Faculty, Deans of Undergraduate Education, College Presidents, Budget and Finance Officers, University Directors of IT, and Funding Agencies that support these programs. We recognize that the assessment has to create useable knowledge for communities outside our own project group (Shadish, Cook, and Leviton, 1991).

In the absence of an overall theory for integrating digital libraries into undergraduate education (which would point us toward key measurement variables), we will create a set of comprehensive instruments to gather data about students, faculty, and institutions that history suggests are good predictors of results from educational innovation. We will complement information from these quantitative instruments with ethnographic activities and records of activity that describes use of our digital libraries. These measures will serve as foundations for models we develop, which describe processes and outcomes from our project.

We will pursue a range of focused assessment activities, all of which will feed back into the design of our project and the development of a program model (Lipsey, & Pollard, 1989) for integrating digital libraries into undergraduate education. Some assessment activities will be formative (Flagg, B. 1990) – intended to be sure that the project tools and activities we put in place are working as we hope and expect. We cannot expect students to benefit from browsing digital libraries and becoming part of annotation communities if the tools are not suited to the job. All claims we make about the use of digital libraries will be made only after specific parts of the program have passed tests of quality assurance and good design. Formative activities will focus on directions from the project management team, user interface design of the library itself, the tools we ask people to use and the curricula we put in place for digital libraries and their resources. Techniques for formative assessment will include protocol analysis (rigorous interviews with students and faculty while they use tools), focus groups (post use reviews) and expert/novice comparisons (to develop a model for anticipating changes in tool/library functionality as faculty and students go from naïve users of digital libraries to experts).

Some activities will be summative – designed to measure outcomes central to our project: A) increased content understanding and retention; B) improved aural literacy; C) increased student capacity to write on and for the Internet; and D) enhanced digital libraries. Each of these will be coordinated across sites (Michigan State, Northwestern, Glasgow Caledonian University) so the impact of site and culture will be accommodated. Overall, we will rely on an aptitude treatment interaction model that emphasizes the match between students (based on our comprehensive data) and the specific treatment (in this case digital library tool, curriculum, assignment, etc). Specific outcome variables will be identified for each goal. For instance, content analysis of emotive terms used in papers could serve as a proxy for aural literacy. (We expect that students who listen rather than read transcriptions will appeal more often than their peers to emotive elements conveyed in historical audio.) Beyond the four specific outcomes described in the proposal, we are interested in the broad development of students epistemology and the extend use of their personal annotated libraries. These outcomes come from the nature and structure of digital

libraries rather than the use of historical audio. Developing annotations, working with a range of sources (transcriptions and original source materials), and building libraries all suggest a growing sense of how students assess their own knowledge and knowledge across networks. This kind of development – typically not part of specific curricula - is essential to evaluate. We expect to measure this kind of development through the use of protocol analyses, adaptation of instruments designed to measure epistemology, and reviews of references students use in papers in other courses (Goldman, Pelligrino, and Bransford, 1994). Long term, if we are successful in creating tools that make the entire repository easier to use, we would expect to see students using the repository much as they may browse in the library. A recent digital library federation study noted that 85% of faculty and student time in the library is spent online. Online repositories are rapidly replacing print sources. We would hope to see students browsing our repository collection in a meaningful way. (Analysis of the change in interaction with the repository will become part of the evaluation and proxy for students' critical thinking about their own knowledge.

Finally, as we emphasize in the section on dissemination, we recognize and hope that our assessment activities can be coordinated with those on similar projects. It would be to everyone's advantage if instruments, units (of analysis), outcome variables and broad details of the evaluations could be identified and implemented across projects. We welcome this opportunity. We do not see a meta-analysis of evaluations as a substitute for a sound coordinated effort launched at the start of these projects.

6. Dissemination

The proposing partners have invested years developing digital libraries and historical audio repositories. Our goal is tell the world all we know and learn about using these resources for education and scholarship. The partners in this project, and the organizations they are a part of, are in an excellent position to sustain a world-class dissemination effort. The infrastructure and credibility are already in place. We can take the lead in dissemination activities or implement nearly any dissemination plan put in place by a larger govern body. Either role serves our purpose. We are committed to sharing our work, methods and results with colleagues from other projects and members of agencies that fund us. The formative and summative results we share will be tied closely to our assessment plan. We are eager to participate in early discussions about developing our assessment plan to serve the larger purpose of the funding program.

H-Net and MATRIX reach over 115,000 scholars and educators around the word through its variety of mailing lists; the Center's World Wide Web sites conduct over 1 million web transactions per week from over 75,000 distinct hosts around the world; and H-Net and MATRIX are well-represented at professional conferences and forums nationally and internationally in humanities computing and digital culture. The expertise is already in house to develop a project web site and much more. The scholars that work with MATRIX have published in a range of scholarly journals, in the classics, learning sciences, education, and technology, digital libraries and related interdisciplinary fields. With careful planning, this group is in a position to address a range of questions central to scholars and teachers in any of these disciplines. This expertise is especially essential since so many of the activities will cut across disciplines. Before results and ideas and ideas are disseminated that have to be careful constructed. We are in a position to put together interdisciplinary teams that have a history of working successfully together on challenging issues related to the use of digital libraries. Regular videoconferences will be scheduled to promote collaboration with partners in the UK. This will assist us in producing materials that can address culturally different audiences and identify times when we need to produce separate report for diverse constituencies.

In addition to making the project results and resources available via digital libraries project web sites and existing communications portals, we have made preliminary efforts to link our work with course management systems that already have a well-established place in higher education. Our lessons learned, tools, curricula, and resources are being developed so they may dovetail with existing infrastructure and add novel, effective functionality.

7. Conclusion

Digital repositories are a key to the future of education. By preserving and disseminating both traditional materials (texts and images) and new media (audio and video), they will become the heart of the new information economy. Yet they will be of little value unless we can make them more accessible to students and teachers and transform the classroom and its use of media. The Spoken Word Project directly addresses these pressing needs by using digital spoken word repositories to build processes for learning that will fundamentally expand the way students and teachers understand knowledge, knowledge resources, and their own complementary roles in higher education. The project shows that bringing digital audio, voices of the past and present, into university classrooms can move us toward four primary goals: improve student learning and retention; develop aural literacy in our students; increase student capacity to write on -- and for -- the Internet; and, in the process, enhance the usefulness of digital libraries for learning and scholarship.

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