THEODORE CALVIN PEASE AWARD

Sound Practices: On-line Audio Exhibits and the Cultural Heritage Archive

Ian Craig Breaden

Abstract

This paper examines the functionality of twenty-five on-line Web exhibits in their use of audio media, against a backdrop of the changing character of archives in the age of virtual access to primary materials. Each Web exhibit is scored against a matrix measuring specific aspects of audio performance. The scores are compiled, ranked, and analyzed. Based on these scores, the state of audio technology, and insights provided by digital archival preservation, a set of standards is proposed as a starting point for archives to use in increasing audio exhibit performance.

D igital platforms enable cultural heritage archives to reach broader audiences with greater flexibility. As information seekers rely more on digital resources, institutions providing virtual representations of holdings may benefit from increased collections usage, justifying further funding while safeguarding source materials through use of digital surrogates.

It is little wonder, therefore, that digital access in archival literature continues to focus primarily on digital preservation and encoded description, and that standards for these have kept step with available technologies. Less clearly defined for archives in the digital age is the role of the on-line exhibit. Identified at turns as marketing channel, outreach effort, or education tool, the on-line archival exhibit appears to have neither the gravity of the digital preservation project nor the immediate practicality of the EAD finding aid. Because of this, perhaps, standards for on-line exhibition of archival materials lack significant supporting literature beyond project-based efforts. But as the on-line exhibit may function as the virtual face of the archives, a consideration of standards is critical. First impressions may in fact be lasting impressions, and as cultural heritage repositories enter the twenty-first century with the potential to open their doors to audiences worldwide, they should do so cognizant of the fact that when it comes to virtual users, even archives must compete for eyes.

This paper analyzes one subcategory of on-line digital representation, the audio Web exhibition. Twenty-five on-line audio exhibits produced by prominent cultural heritage institutions are scored against a matrix designed to measure audio performance, contextual information, and user support. The results provide a glimpse into the exhibition of, not merely the simple mounting of, archival materials on the Web. An analysis of the results yields a set of suggestions for the delivery of audio on-line, along with a simple tool to help archives score their own exhibits as they develop them. While the elements of the matrix and its results are worthy of debate, it is hoped that this study contributes to developing standards for creating audio exhibits on-line.

Digital Domains: Exhibition of Audio On-line

> The web is an interesting blend of the passive and the interactive. . . . Unlike the gallery visitor, . . . the visitor to the online exhibition must move from passive absorption of the exhibition to active participation through clicking or scrolling. Though a gallery exhibition may lose visitors if they turn and walk out, the online exhibition can lose visitors through the simple click of a mouse.[1]

Archives wishing to mount audio as a major component of on-line exhibits face several dilemmas.

- There are substantial and growing archives of recorded sound. The century-plus backlog of audio materials are at a preservation crossroads,[2]

---

[1] Martin R. Kalfatovic, *Creating a Winning On-line Exhibition: A Guide for Libraries, Archives, and Museums* (Chicago: American Library Association, 2002), 73.

[2] For the crisis in audio preservation due to sheer weight of holdings, see particularly Abby Smith, et al., *Survey of the State of the Audio Collections in Academic Libraries* (Washington, D.C.: Council on Library and Information Resources, 2004).

and as digital surrogates are increasingly easy for even "off-the-shelf"
computers and software to make, the Web has become a tempting place
for their representation.

• Digitization methods for Web presentation are varied. While images
typically utilize 72 dpi JPEG or GIF files for on-line presentation,
there is no gold standard for presenting on-line audio. Choosing formats
for on-line audio representation remains a challenge, as potential users
of exhibits cannot be expected to have ready access to playback software.
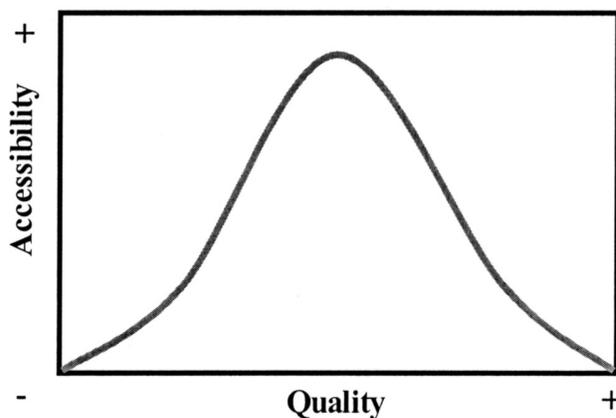
In delivering digital audio, accessibility decreases if sound quality is too low or too high.

The nature of audio makes it unwieldy on-line. Delivering digital audio
is tricky business because, for it to be effective, sound files must be trans-
lated back to analog sound waves that require high levels of hardware
and software performance. "Performance" in this context is important
in its other meaning as well: a recorded sound has a discrete beginning
and end—its primary dimension is time rather than the image's height
and width. While a digital representation of an image can be beautifully
wrought onscreen even when its file size is substantially compressed (by
working within the inherent limitations of screen resolution), the qual-
ity of audio representation is in almost all cases proportionate to its file
size, which reflects the length in time of the recorded sound. Because a
three-minute clip of uncompressed audio would in many cases take
longer to download than it would to listen to, audio compression is
generally necessary to create deliverable audio files, although making
an audio file smaller generally compromises sound quality. Archivists
wishing to exhibit audio holdings on-line without alienating visitors

therefore tread a narrow path: too much compression of audio for on-line exhibition influences sound performance negatively, while inadequate compression influences file playability negatively. In either case, meaningful accessibility is put at risk. In delivering digital audio, accessibility decreases if sound quality is too low or too high.

On-line audio exhibits face the same challenges encountered by all exhibits, but these challenges are amplified for audio exhibits because of the file sizes, compression schemes, rights issues, and the technological infrastructure of users. To understand the issues attending digital audio and access to it on-line, it is important to account for the background of digital audio and the development of user tools in recent years.

A Short History of Digital Audio

Many of the same principles that apply to digital imaging also apply to digital sound. For both, a measure of resolution is accompanied by bit-depth, also known as word length. Where in imaging, pixels per *inch* define resolution, in digital "sampling" of sound, the measure of resolution is sound-wave frequency per *second*, expressed in kilohertz (kHz). Where greater bit-depth in imaging allows for a larger color palette and therefore greater color precision in the digital scan, so in sampling of sound greater bit-depth allows for a larger spectrum of tones and therefore greater tonal precision in the digital sample.

The advent of the compact disc in the early 1980s set the first widely held standard in digital audio, with a sampling rate of 44.1 kHz and a bit-depth of 16 bits (or 2 bytes). Twice the spectrum size of common human hearing, 44.1 kHz, it was believed, provided reliable representation of audio nuances. The CD offered extended playtime, greater clarity than LPs or tapes when played on most consumer equipment, and a seemingly unlimited number of plays. CDs changed the way music was both recorded and listened to, and according to some not for the better. Audiophiles accustomed to high-end analog setups in fact called foul early on, as the digital spectrum allowable by CDs clipped out what they considered hearable chunks of sound, harmonics, and nuances not picked up at 44.1 kHz/16-bit. Sound archivists, already hard-edged audiophiles with a sense of historical mission, continued to preserve to tape.

A generation later, digital technology capable of rendering analog sound into digital had grown considerably stronger and tremendously cheaper. A basic consumer computer with a bundled soundcard could generate better-than-CD quality copies of analog sources (typically 48 kHz/16-bit), while with some modest investment a home computer could make a WAV file (Wave form audio format) at 96 kHz/24-bit (even if this file couldn't be rendered onto a playable CD without dumbing it down to the 44.1 kHz/16-bit CD-playable file). The WAV

file, the audio equivalent of the BMP or TIFF raster image, had become the common currency of digital audio recording.[3]

The drawback of the WAV file was its size; with a CD-quality, three-minute file taking up around 30,000 megabytes, the format did not lend itself to easy desktop processing or Web transfer, and thus creators of .WAVs could not easily share them using the Internet. MPEG technology, particularly MP3 technology, mitigated this problem. At work on compression standards for audiovisual materials since 1988, by 1992 the Motion Picture Experts Group developed a means of dramatically reducing sound file size. Based on the psychoacoustic principle that humans best hear tones of 2–4 kHz (within an overall hearing spectrum of 20 Hz to 20 kHz), an MP3 file rendered from an uncompressed source and set to stream at 128 kilobytes per second (KBps) reduced an uncompressed audio file by a factor of ten, getting rid of the tonal ranges humans don't hear so well. This "lossy" compression scheme sliced out audio information from the extreme portions of the audio spectrum, much as the JPEG image rendering system did with pictures, leaving behind what to the human senses might constitute a fair mirror of the original.[4]

The passable audio quality provided by MP3, especially when compared to other portable sound packages with inherent limitations (e.g., cassette tape), sparked a revolution in the way people listened to recorded music; or, put another way, changed the face of delivering cultural material to audiences. In retrospect, the success of MP3 appears to be serendipity: By the time MP3 emerged, consumer technology had developed at a pace where it could capably handle the format, and users recognized that digital music could finally be processed effectively on a desktop and on-line. Audio quality in this context was secondary and convenience was king in the MP3, much as it had been in the format's cassette tape predecessors. Additionally, MP3 became the first audio medium that was neither created nor controlled by the recording or broadcasting industry.[5] It is difficult to overstate the significance of the resulting cultural shift. MP3's wide adoption, by the listening public and the computer industry

[3] 96.1 kHz/24-bit sampling is the Library of Congress's standard for master copies. Most original sources don't exceed 15 kHz, and the theoretical rule of thumb in digitization of sound is to sample at twice that. Since industry standard is 44.1 kHz/16-bit for CDs, even low-end consumer software can effectively digitize analog originals, at least in theory. However, audio engineers in archives prefer to preserve at 96.1 kHz/24-bit (and some even advocate going to 192 kHz/24-bit) as a stop-gap, to cover operator mistakes, to ensure harmonic capture, and in case future technology allows for more efficient rendering. Carl Fleischhauer, "Audio and Video Preservation Reformatting: A Library of Congress Perspective," Preservation Conference: Digital Technology vs Analog Technology, 27 March 2003, accessed 5 November 2003, http://www.archives.gov/preservation/conferences/papers-2003/fleischauer.html.

[4] Geoff Nicholson, "MP3 Explained: A Beginner's Guide," *Shareware Music Machine News,* March 1999, http://www.hitsquad.com/smm/news/9903_109/. See the Moving Pictures Expert Group homepage for greater detail on MPEG technology at http://www.chiariglione.org/mpeg/.

[5] Amy Harmon, "What Price Music?" *New York Times,* 12 October 2003.

(e.g., Apple's iTunes), has redefined the traditional recording industry, challenged popular perceptions of copyright, and given rise to a whole new business model keyed to the convenience of music as "download."

Controlling the rights to audio in an MP3 environment has become enormously important because of the format's compression ratio and the power of digital file copying. The ability to download an MP3 audio file with relative ease, enjoy it at leisure, then place it on a Web site, enabling its download by millions of others, threatens intellectual rights holders and recording industry giants alike. As a result, in the wake of MP3's emergence, other on-line listening schemes have appeared to offer an alternative to the download. The "streaming" methods devised by companies such as Real (RealAudio and RealMedia), Apple (Quicktime), and Microsoft (Windows Media Player), while often employing compression detrimental to audio quality, have given rights-sensitive materials the ability to be played on-line without being downloaded. Streaming servers send "packets" of audio information that are then played back by proprietary software players and discarded. No artifact is left with the user, and any recording of the audio the user might do via computer soundcard would not be a digital copy but rather an analog derivative of reduced quality.

Whether audio is downloadable or streaming, however, the unknown factor in preparing audio for on-line delivery remains the audience. Archives and cultural heritage organizations planning to exhibit audio on-line must consider the variations in technological infrastructure their users work within. In an educational or outreach program geared toward the general public, this means accounting for everyone.

Broadband and Dial-up

Current statistics (early 2005) show that 65 percent of American Internet users (about 65 million people) connect to the Internet with high-speed or "broadband" connections, with 39 percent subscribing to broadband at home.[6] *Broadband* is defined by the FCC as 200 kbps, four times the speed of a standard 56.6 kbps dial-up modem. Because access speed has been shown to determine on-line activity and may be the single most influential factor in intensity of Internet use, the blooming of broadband in the last five years (its user base growing about 1,600 percent) cannot be underestimated, especially by providers of content.[7] This is especially true considering the average time Internet users

---

[6] Matt Richtel, "Dangling Broadband from the Phone Stick," *New York Times,* 19 March 2005; Don Fernandez, "Little Luxuries, Big Bills," *Atlanta Journal Constitution,* 26 December 2004.

[7] John B. Horrigan and Lee Rainie, *The Broadband Difference* (Washington, D.C.: Pew Internet and American Life Project, 2004), 7, 14, http://www.pewinternet.org/PPF/r/63/report_display.asp; Fernandez, "Little Luxuries."

spend on individual Web pages, clocked by Nielsen in February 2005 at just fifty-two seconds per Web page.[8] Broadband users may be spending more time on-line, but they are spending a very small amount of time on individual Web pages.

Given the constraints in presenting audio on-line, expanding broadband usage appears at first a windfall to exhibit creators eager to connect with more people and expand their audience base. The faster the connection, and the faster audio files can download or stream, the less likely a user will be to leave the site. And yet broadband is simply not a fact of life for many Internet users, 45 percent of whom still use dial-up connections, connecting less often and for shorter periods,[9] for reasons including:

- Expense—at $20–$30 more per month than dial-up, broadband access constitutes an annual expense running in the hundreds of dollars, not an option for many lower- and middle-income households.[10]
- Geographic location—in the U.S., many rural areas simply do not have a broadband infrastructure. Only 10 percent of rural Americans have high-speed access at home.[11]

In addition, as products of public cultural heritage institutions, many on-line audio exhibits must make allowances for all their potential users, in order to fulfill their missions. For instance, the University of North Carolina at Chapel Hill's mission statement includes the goal, "to serve all the people of the State," by extending "knowledge-based services and other resources of the University to the citizens of North Carolina . . ."[12] In states like North Carolina, with large rural populations, mounting on-line exhibits while maintaining the University's mission means extending the idea of community beyond the wealthier urban and suburban areas of the state, where broadband users tend to cluster.[13]

While audio exhibits mounted by cultural heritage archives may be challenged by low-speed connections, the reward in making such exhibits accessible to all Internet users is considerable, especially if raising awareness of resources such as historical documents and educational tools is a motivator. John

---

[8] "United States Average Web Usage, Month of February 2005, Home Panel," Nielsen//Net Ratings, 23 March 2005, http://direct.www.nielsen-netratings.com.

[9] Rob McGann, "High Speed, High Spend," clickz.com, 24 January 2005, accessed 22 March 2005, http://www.clickz.com/stats/sectors/broadband.

[10] Fernandez, "Little Luxuries."

[11] John B. Horrigan, "Broadband Penetration on the Upswing: 55% of Adult Internet Users Have Broadband at Home or Work," 19 April 2004, accessed 22 March 2005, http://www.pewInternet.org.

[12] "University Mission," University of North Carolina, 25 March 2005, http://www.unc.edu/about/mission.html.

[13] Horrigan and Rainie, *The Broadband Difference*, 10.

Horrigan and Lee Rainie's 2004 study of broadband Internet usage discovered that, more than anything, users liken the Internet to their library, while nine out of ten broadband users say that as a tool it helps them learn new things.[14]

The Exhibits

This study was undertaken with two purposes. The first was to develop a tool that might be used to evaluate on-line audio exhibitions. The second was to analyze and score twenty-five Web exhibits, thereby evaluating not only the Web sites but also the evaluation tool. Exhibits were assessed on their ability to provide access to audio information and contextual information, in light of considerations of bandwidth and in what is assumed to be an educational or outreach environment on-line. Although it could be argued that several of the Web sites analyzed do not conform to some definitions of "exhibit," in that they do not contain a narrative story, all of them have been mounted on-line to display selections of materials from collections within cultural heritage institutions.[15] Therefore, where no textual narrative appears, the objects make up a kind of narrative-by-selection. Every site showed clear intention, and in no case were random selections of objects displayed.

The sample was taken, with the exception of one site, from the Smithsonian's list, "Library and Archival Exhibitions on the Web."[16] Searching on "multimedia" as a keyword returned approximately 225 sites, of the several thousand on the list that would possibly include audio. Sites on the list were sifted manually to exclude video as well as exhibits using secondary audio representations of originally nonaudio materials (for example, an actor reading a letter written by Thomas Jefferson). Then, a fair representation of primary materials and resources was sought from a variety of archives, historical societies, and repository-minded museums. This process met with some challenges: oral history has a much greater presence in Web-empowered archives than music, so of the twenty-five sites chosen for analysis, only slightly more than one-third (nine) were oriented toward music, and two of those came from the same institution, the Library of Congress. In addition, two other "parent" organizations were chosen more than once (University of North Carolina at Chapel Hill and

[14] Horrigan and Rainie, *The Broadband Difference*, 4, 17.

[15] In his tremendously helpful volume on on-line exhibitions, Martin R. Kalfatovic argues that, "Though a collection may have an idea behind it, . . .what separates an exhibition from a collection is that an exhibition has a tight connection between its idea, objects, and script that ties them all together." While accepting Kalfatovic's argument on principle, I would disagree on the degree of its application, especially in light of nonscripted museum exhibits. Kalfatovic, *Creating a Winning Online Exhibition*, 3.

[16] See http://www.SIL.si.edu/SILPublications/Online-Exhibitions, accessed 15 February 2005.

University of North Carolina at Charlotte), although differences among the individual exhibits were substantial.

For each site, thirty-two assessment fields were completed. Of these fields, twenty-three contained criteria against which the sites could be measured with objectivity. The remaining fields were informational, with one, "Navigational style," certainly worthy of further user study, but here not scored because of the subjectivity of navigational values. Points were assigned to criteria using two methods, both of which could weight the qualitative value of a particular criterion, with weighting based on assessment of the sites as educational or outreach documents generated by an archives with trained staff.

1. A "yes/no" method, where an element was either present or not. Depending on the assigned qualitative value of the criteria assessed, the presence of an element would add 1, 3, 5, or 10 points to a site's overall score.
2. A ranking method, where an element was present to varying degrees. For the fields in which a ranking method was used for assessment, depending on the assigned qualitative value, the scoring possibilities were (0,1,2), (1,3,5), (0,1,3,5), or (0,5,10). A "0" score here can be

Table 1 The Sample: Exhibit Sites

Exhibition	Institution
Battle of Britain Recollections	Imperial War Museum (UK)
Bridgeport Working	Bridgeport Public Library
Brush Creek Follies	University of Missouri at Kansas City
Charlotte Voices: Earle Sumner Draper	University of North Carolina at Charlotte
Gold Band Records	University of North Carolina at Chapel Hill
Helen Creighton	Nova Scotia Archives
Hoagy Carmichael Collection	University of Indiana
In Their Own Words	National Institute of Health
John and Ruby Lomax	Library of Congress
Kent State at Baruch	Baruch College
Lift Every Voice	University of Virginia
Like a Family	University of North Carolina at Chapel Hill
Max Hunter Folksong Collection	Southern Missouri State University
McGuinn's Folkden	Private, high-profile folk music archive
New South Voices for K–12 Teachers	University of North Carolina at Charlotte
Oscar Peterson: A Jazz Sensation	Library and Archives of Canada
Project Jukebox	University of Alaska at Fairbanks
Studs Terkel: Conversation with America	Chicago Historical Society
Tejano Voices	University of Texas at Arlington
The Cuban Missile Crisis, 1962	George Washington University
Virginia Roots Music	Library of Virginia
Voices from the Days of Slavery	Library of Congress
Voices of the Colorado Plateau	Southern Utah University
Witness and Response	Library of Congress
Women Who Dared	Jewish Women's Archive

Table 2 Assessment Fields and Point Values

Assessment Fields	Options	Possible Points
Exhibit Title		
URL		
Institution		
Number of Collections Drawn From		
Extent (exhibit)		
Extent (number of primary source recordings)	<5,0; <50,1; >50,2	2
Audio Formats	1, 0; 2, 5; 3,10	10
Audio Time or File Size Listed With Link?	No, 0; +1, 3; +2, 5	5
Metadata Embedded in Audio File (beyond title)	0,10	10
Extent (primary source images)	>50, 5; >25, 3; >1,1	5
Extent (primary source textual documents)	>50, 5; >25, 3; >1,1	5
Secondary Scholarship	>50, 5; >25, 3; >1,1	5
Metadata	0,5 (Mtag), 10 (DC)	10
Simple Index for Audio	0,5	5
Search Feature	0,5	5
Navigation Style		
Download Time Broadband	<5sec,10; >5, 5; >10,0	10
Download Time Dial-Up (56.6K)	<15sec, 10; >15,5 >90,0	10
Links to Relevant Finding Aids/Collections	0,5	5
Educational Tools or Lesson Plans	0,10	10
Further Resources Outside Archive	0,1	1
Help or FAQ on Playback	0, 5	5
Digitization Methods Explained	0,1	1
About the Institution (contact, hours)	0,1	1
User Feedback Capability	0,5	5
Date Visited		
Date Created/Last Update	0,1	1
Google Homepage Ranking (title search)	Top 10,5; 20,3; 30,1; >30,0	5
Yahoo Homepage Ranking (title search)	Top 10,5; 20,3; 30,1; >30,0	5
MSN Homepage Ranking (title search)	Top 10,5; 20,3; 30,1; >30,0	5
Notes	Total	126

reflective of the understood baseline presence of an element, e.g., that a site exhibiting audio materials uses at least one audio file format.

A site could be awarded a maximum of 126 points. Although the highest scoring site achieved significantly less than this, the ability to produce an exhibit capable of achieving the total, or close to it, could not be considered beyond the scope of any of the parent organizations. The scored criteria were selected and weighted with the following in mind:

- *Extent (number of primary source recordings)*: With a possible maximum score of 2 points, the extent of the audio collection, i.e., the number of audio files offered in the exhibit, was not considered of tremendous value, insofar as an excellent, thoughtful exhibit could be made from a handful of recordings, while a poorly organized exhibit might contain hundreds of recordings. Therefore, while greater extent of recordings

is rewarded to a small degree, the extent criterion in this case is less important than it is in the case of other primary and secondary documents within the site that provide context.

- *Audio formats*: Providing more than one format of audio file adds tremendously to the value of a site that wishes to speak to many audiences, among whom hardware, software, and bandwidth configurations vary. Offering one file format therefore gained a site no points, offering two formats added 5 points, while 10 points were awarded to sites offering three or more formats.

- *Audio time or file size listed with link*: Letting visitors know the length of a selection, or the size of the file they have to download or stream, gives them the ability to decide if a) they wish to invest the time in listening to the file, and b) they wish to invest the time and resources in downloading or streaming the file. Because the time of an audio selection is not consistently reflected in a file's size, it is important to list both in an exhibition of audio materials on-line. For this criterion, listing neither gained a site no points, listing one gained it 3, and if a site listed both it was awarded 5 points.

- *Metadata embedded in audio file (beyond title)*: Most audio file formats that are Web-adaptable, particularly MP3 and streaming formats, are capable of carrying metadata beyond the simple file title. As files produced by cultural heritage institutions with archival missions, it is very important that alterable digital files sent across the Internet be described appropriately. Additionally, sending users details of the file within the file itself is roughly equivalent to museums providing "tombstone"-style labels to convey basic information about the work for easy reference. Therefore, a score of 0 or 10 points was possible for this category.

- *Extent (primary source images, textual documents, and secondary scholarship)*: Each of the "extent" categories for other primary and secondary sources was worth a maximum of 5 points each, ranked in terms of quantity, where greater than 50 supporting documents added 5 points; 25–49 added three points; and 1–25 added 1 point. In exhibits, these sources function as context, and include introductory and exhibit narratives. While contextual sources can become overwhelming in on-line environments, this has been mitigated somewhat in this measurement exercise by distinguishing sources displayed from sources referred to (such as bibliographies and links, which are assessed separately).

- *Metadata*: While all the documents in all the exhibits were described to some degree, metadata as a criterion here means, specifically, information carried in the source code of the Web page itself describing the nature of the site. Including metadata in the heading of a Web page's source can make the page more accessible to search engines, and, much

like the metadata embedded in the audio files, helps track the Web page as an object produced by the archives in question. If a site carried no metadata in its coding, it received no points; if it included "meta" tags for description, keyword, and so on, it received 5 points; and if it utilized the standardized Dublin Core metadata schema for archival Web pages, it received 10 points.

- *Simple index for audio and search feature*: Providing a simple checklist of objects in an exhibit is a time-honored museum practice that adds great value to on-line exhibits, especially those that contain a great number of audio files, textual documents, and images. A search engine can also enhance access, whether it is site specific or covers the larger organization of collections housed in the institution. In both cases, the presence of the finding feature added 5 points to an exhibit's total.

- *Download time (broadband)*: "Download time" here means time elapsed to the beginning of a streaming audio file's playback. Using broadband greatly facilitates access to audio files, and in this study an ethernet connection through the University of North Carolina at Chapel Hill server typically began streaming large files in under five seconds.[17] While it could be assumed that any delays would thus be originating on the exhibit provider side, it is important to recognize that bandwidth shifts as demand on connections increases and decreases. Therefore the scores assigned here are very specific to the session, and they are changeable. This makes them no less important to the heart of exhibiting audio on-line, which is the actual delivery of sound. With this in mind, delivery under five seconds scored 10 points, delivery between five and ten seconds scored 5 points, while delivery over ten seconds scored no points.

- *Download time (dial-up)*: Dial-up performance is more perceptibly variable than broadband, with connections using a 56.6 kbps modem and a major Internet service provider rarely reaching the 56.6 kb maximum and more generally falling in the 28–48 KB range. Unscheduled service dropouts are also more common, so that downloading often goes unfinished before service disconnects. Accessing audio using a dial-up connection is therefore difficult, an exercise in patience that, as noted earlier, could just as easily end up in a user leaving a site altogether. Most streaming softwares can detect modem performance and adjust the size of the stream accordingly to accommodate slower connections. Even so,

---

[17] In examining the sites via broadband and dial-up connections, the same system was used: A Hewlett-Packard laptop using a Pentium 4 processor @ 2.2 GHz, with 640 MB RAM and all current software playback packages loaded.

streaming speed cannot always keep up with playback once it begins, and interruptions in playback on a dial-up connection are not uncommon. In this study, if a site streamed its audio in under fifteen seconds, it was awarded 10 points, if it did so between fifteen and ninety seconds, it was awarded 5 points, and if time-to-playback exceeded ninety seconds it was awarded no points.

- *Resources (links to relevant finding aids/collections; educational tools or lesson plans; further resources outside archive)*: If exhibits function as doorways to collections, contexts, and further exploration, accommodating the desire to learn goes a long way toward achieving the common goals of outreach and education. Constructing solid resources challenges institutions whose Web designers may believe all they are doing is mounting a sampling of material on-line, but providing a lesson plan to teachers, finding aid access to researchers, or simply links to other relevant resources, can add great pedagogic value to an on-line exhibit. The presence of a finding aid (or a link to a more detailed description of the collection from which the exhibit gets its materials) was worth 5 points in scoring, a lesson plan was worth 10 points, while links to outside sources were worth 1 point.

- *About the site (help on playback; digitization methods explained; about the institution; user feedback capability; date created/updated)*: Information about the site becomes most important in terms of help regarding audio playback and feedback. The first is critical to user satisfaction, while the ability of a user to interact with the exhibit's creators demonstrates that the institution is interested in dialogue and the site can function as a reference desk. These two aspects were worth 5 points each, while the others were worth 1 point each. Of particular note, knowing when the site was created or updated can give the user an idea of the technologies available to the exhibit's creators, as well as the creator's ongoing involvement.

- *Homepage search ranking (Google, Yahoo!, MSN)*: Searches for exhibits across popular search engines give an idea of how an exhibit name, used as a search term, correlates with "hits" on the exhibit homepage. The actual worth of a hit is debatable, dependent not only on search engine algorithms, but variable also by date searched and the commonness of the search terms. Searches were conducted on the exhibits' main titles only (i.e., no subtitles or secondary titles were included), and without use of enclosing quotation marks. A top ten hit scored 5 points, a top twenty hit scored 3 points, a top thirty hit scored 1 point, while anything over thirty scored no points.

With these criteria defined and valued, an analysis of the twenty-five Web sites revealed the following overall scores as percentages:
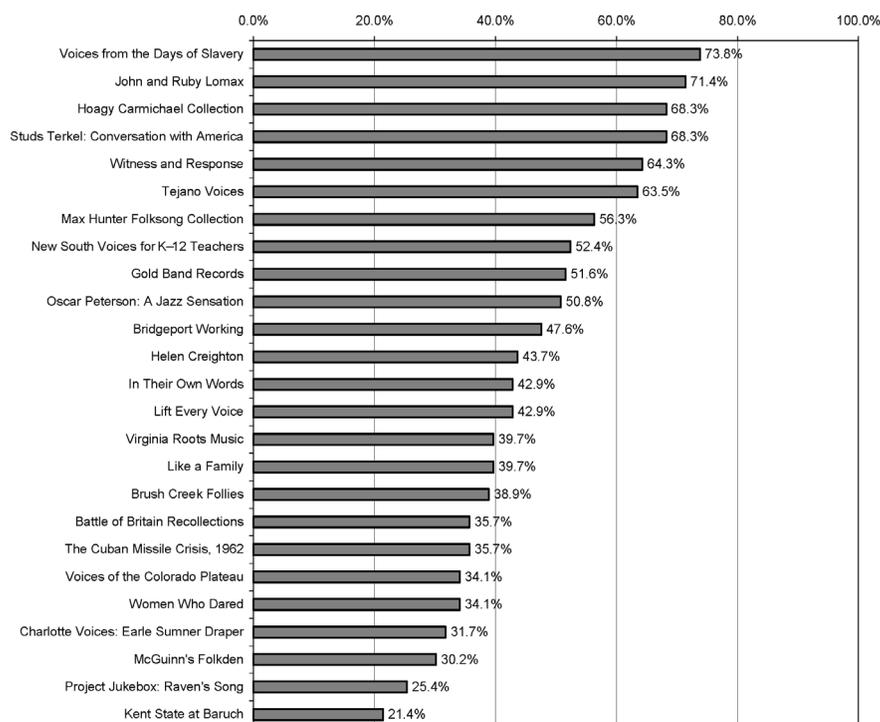
F I G U R E 1 . **Ranking of Exhibits by Percentage of Possible Points**

With three of the top five positions occupied by Library of Congress exhibits, it is clear that the work on standards that the Library of Congress has done with regard to archival audio has translated well to the representation of its collections on-line, whether those collections are virtual (Voices from the Days of Slavery presents oral interviews with former slaves from a number of collections, while Witness and Response is a cooperative effort, with a physical counterpart, to bring together materials from across collections regarding the events of 11 September 2001) or standalone (the John and Ruby Lomax Collection). The other two exhibits in the top five likewise come from archives that have taken great care in following and creating digitization standards. Indiana University's Hoagy Carmichael Collection exhibition is the result of a high-profile project undertaken to digitize the thousands of items within that collection (only a portion of the audio is available on-line). Likewise, the Chicago Historical Society's (now the Chicago History Museum) Studs Terkel Collection was a large project undertaken to digitize and make available on-line Terkel's considerable spoken word/radio archives. From the initial results of the total scores, it appears that large, comprehensive projects fared better overall, which may be the result of greater funding and the responsibilities inherent

therein (such as adherence to public or institutional mission, the creation of evaluation instruments, etc.), as well as greater focus on project management due to the sheer weight of the materials.

In reaching the total scores, several categories stood out as being particularly important, the first being the number of audio formats used in the Web exhibits. As discussed above, increasing the number of audio formats available to audiences significantly increases the likelihood of a successful connection to the sounds, for two reasons. Hardware and software configurations vary widely, even among users who have state-of-the-art equipment, and bandwidth of Internet connections ranges from 14.4 kbps to 100 mbps. But, while even a slow Internet connection can eventually deliver even weighty audio files, the ability of a user's machine to play those files is variable.

As an example, the RealAudio streaming files on the Library of Congress's John and Ruby Lomax site would not play back on the testing machine, despite using the latest version of the RealMedia player. Additionally, compatibility issues can arise between Web browsers and media players if configurations are not set correctly and updates are not maintained. This appears particularly problematic with the RealMedia player, which updates often but also may have trouble playing back earlier versions of RealAudio (such as that used on the Lomax site). Browsers vary significantly in their ability to play back audio, with Microsoft's Internet Explorer performing particularly poorly with RealAudio in this study. To access RealAudio files, Mozilla's Firefox browser often had to be used. An additional usability problem demonstrated with the RealMedia player was the prompt to change settings to accommodate different bandwidth environments. If a user takes a portable machine from a broadband to a dial-up environment (as done in this study), he or she is urged to change playback settings so the audio will stream more efficiently. While Real considers this a positive feature of its software, for a user visiting an on-line exhibit, it is an obstruction that may discourage further use of the collection.

At the John and Ruby Lomax site, exhibitors provided other file formats (both spoken-word quality MP3 and the higher performance but heavier weight WAV), and therefore met head-on potential user difficulties with software. This was less the rule than the exception across the sites considered. Of the twenty-five sites, only 24% provided more than one audio file format for playback, while 72% of these sites offered RealAudio in combination with other file types. Fifty-two percent of the sites overall offered RealAudio exclusively.

Windows Media files, or WMA, used on one site only, also demonstrated slightly more usability across bandwidth environments than RealAudio, but like RealAudio, WMA suffers from frequent prompts to update, prompts to change user settings, and an advertising-based support system that, while allowing the companies to distribute their players and encoding systems for free, may lend an uncomfortable commerciality to archives-based exhibits.

Other playback systems, such as Apple's Quicktime, proved far more durable, but just one of the sites used Quicktime (.av) files. However, Quicktime playback was also used on the local machine to stream those MP3 files not configured to stream as RealAudio files (which was the case on two sites). An emerging benefit of the Quicktime format is its ability to be embedded in HTML pages by exhibitors, so that compatibility with user systems becomes, if not assured, at least more likely. The chief drawback to Quicktime streaming, as in the case of AIFF (WAV files formatted for CD) and WAV files, was an apparent inability to readily show metadata (including a simple time read-out or file title) associated with the audio file.

Embedding metadata (beyond the simple file title) in an audio file is supported in MP3 and streaming file formats. Typically, a limited number of fields are available, usually including title, author, copyright, and description. It was therefore something of a surprise to learn that over half of the audio exhibits surveyed did not embed metadata in their files, in consideration of the acknowledged importance of the practice within the archival and museum communities. However, failing to embed metadata in audio files may be attributable to reasons beyond carelessness. Embedded metadata doesn't always survive the streaming process, particularly if playback software is out-of-synch with the encoding software. A file may play back, but the software may not be capable of showing the metadata embedded therein. Additionally, technologies for ripping MP3s vary widely in their advertisement of embeddable informational fields, and there may be a disconnect between the exhibitor-archivist's knowledge of the software and the software's capabilities.

While the ratio of sites that included metadata in their HTML source code to those that did not is identical to the ratio embedding metadata in their audio files to those that did not (60/40), there does not appear to be a significant correlation between these two measurements. Only half the sites embedding metadata in their audio files also embedded metadata in their HTML coding. Including metadata in HTML is a fairly simple process facilitated by either plain META NAME tags or by the Dublin Core schema developed using those tags. Such metadata embedded in the header of an HTML page can assure interoperability among organizations, facilitate searching, and may or may not, depending on a search engine's algorithm, increase "hits" on the site when potential users look for related information. Using metadata in the header of an HTML page also reflects the institution's attitude toward the exhibit as a document generated by the archives, with a need for its own distinct metadata.

With regard to other kinds of information structures, particularly user interfaces that facilitate searching for materials, the two primary tools adopted by the on-line audio exhibits could be broken down into search engines and indexes, the latter of which would be comparable to a museum exhibit's object checklist. A majority (76%) of the sites used one of these methods, with several

using both. Lists often were not used when sites, such as the Brush Creek Follies or In Their Own Words, relied heavily on a narrative in which the audio had been carefully placed. Often, too, if audio files constituted a relatively small, if important, portion of the exhibit, as in Witness and Response, separating the audio out into a distinct list may not have appeared useful to the creators. Several sites went further than a simple list of all audio and broke down the files into thematic categories mirroring the exhibit's organization or, as often occurred with sites exhibiting music, allowed users to access lists arranged by artist or song title. When search engines were made available on the exhibit pages, in almost all cases they interfaced with the parent organization's database or On-line Public Access Catalog (OPAC).

Once an audio piece has been selected by the user, the time elapsed to the beginning of an audio stream is of critical importance. The low percentage of sites listing play times or file sizes is surprising given the often elaborate description and contextualization of the audio pieces in their respective exhibits. It is also surprising given the challenges of usability of audio on-line. These challenges may seem less apparent in the measurements for accessing the audio files using a broadband connection. A significant percentage (72%) of audio exhibits streamed the selections tested in under five seconds, while only 12% took longer than ten seconds. With dial-up connections, however, the numbers tell a very different story. While streaming audio performs surprisingly well in dial-up situations if the files have been encoded to play back at low streaming speeds (16–32 kbps), those encoded at higher bitrates, as well as MP3 files (which were streamed, not downloaded to the hard drive, in this study), often took over ninety seconds to begin streaming. This again demonstrates the thin line that audio exhibits on-line must traverse: as higher streaming rates equal higher quality, they also equal slower download to the user's machine, which increases the potential for interruption during playback.

Providing contextualization for audio and other exhibited objects was achieved to varying degrees in all cases. Exhibitors' abilities to provide materials that could add further value to the site for educators or those wishing to learn more about the topic also varied widely but were not present in all cases. Exhibits were most successful in listing links to further resources, including bibliographies and Web sites. Less than half linked to finding aids or similar documents explaining the nature or extent of objects' source collection. Seven sites (28%) added tremendous value to their exhibits by including lesson plans or similar educational tools that teachers might reference in using the sites in the classroom.

As discussed at length above, processing audio on-line is neither simple nor easy, for the organization delivering the audio or for the user. For novice users, many Web sites employing complex technologies provide "help" files of different types to aid user accessibility. Well-written help pages serve the purpose of

answering user questions quickly and can limit customer service calls or e-mails asking for specific technological help (which many archives, it could be argued, would be pressed to provide). In this study, 36% of exhibits provided some form of help geared to playing back of audio, although the number includes those that simply provided links to sites providing the playback technology, such as www.real.com (RealAudio). Often some degree of help could be found in pages explaining the actual digitization process, although only 24% of sites offered to explain the methods they used, which is interesting given the effort of digitization of audio for Web readiness. Additionally, users of digital audio may be baffled by unusual bitrates or MP3 files size, especially in spoken word (oral history) audio where files can be effectively rendered at lower settings than those demanded by music. Transparency with regard to institutional contact information fared somewhat better, with 60% of sites providing clear contact information, although in some cases it was necessary to link to the parent organization's site to find it. Surprisingly, less than half the sites made a feedback form or e-mail contact readily available. As funds for projects such as on-line exhibits may come increasingly from outside granting sources, this figure will likely change as evaluative tools will be required more and more.

The last measured category enumerated the success with which the exhibit Web site homepages could be searched, by main title and without quotation marks, using three of the top search engines: Google, Yahoo!, and MSN. Most sites faired well in this assessment, with the majority being returned in the top ten hits for each search engine. It should be noted that this assessment may be as much a measurement of search engine effectiveness as it is of any effort made by the exhibiting Web sites to get ranked higher through use of metadata, unique naming, or simple popularity. It should also be noted that of the measured categories, this one is least relevant to the site as an exhibit, either of audio or any other kind of object.

The goal in undertaking the assessment of these twenty-five Web sites was to develop 1) a tool for audio exhibition assessment; and 2) baseline knowledge, using the evaluation tool, on the state of Web exhibits produced by cultural heritage institutions in which audio plays a primary or important role. The results of the assessment appear to show that repositories adhere to few standards in the construction of audio exhibits. While this could result from limited institutional resources, more likely it is the result of poorly articulated standards or the lack of standards altogether. The categories that were formulated to measure the Web exhibits studied here might be used as a starting point for the development of standards. It is necessary to note, however, that the categories cannot be considered exhaustive. Further consideration of the evaluation tool by sound archivists in a variety of cultural heritage institutions would certainly advance its development.

C o n c l u s i o n :   S o u n d   P r a c t i c e s

"Your archives has many publics."[18]

Archives-based audio Web exhibits are representations of selections from archival holdings. They are, literally in the case of recorded oral histories, "talking" artifacts (as David Levy might call them) that include secondary context as well as primary content.[19] Some are more design conscious than others, more narrative heavy, or more intent on simply providing an enhanced list of audio objects. As expressions of archives concerned with the long-term welfare of collections, exhibits may be passing artifacts, temporary placeholders. Yet Web exhibits, often appearing little more than second thoughts, should perhaps be taken at more than face value, especially by their builders. They are, after all, virtual doors to archives, even if they are not the fully realized content interfaces for which many archives currently strive. And yet it appears that the care with which archivists approach notions of permanency, authenticity, trust, and accessibility are not always manifest in the Web documents they build to demonstrate the value of their holdings. The irony here, of course, is that of all populations, archivists are perhaps most tuned to the power of the document as both artifact and living force. Additionally, the transformative role of digital environments in the information professions may be affecting archives most profoundly. The archives therefore seems like the natural progenitor of the digital exhibition of "content."

If archives do not appear to represent their materials on-line as well as they could, legitimate excuses could be made. Resources in archives are universally hard to come by, and exhibits are typically not first on the list when prioritizing projects. This is certainly the case in the audio archives. Beset by a surfeit of formats, harnessed with a muddled set of copyright laws, and charged with puzzling out the stability of the latest digital media, archives may see their collection management challenges obscuring outreach efforts like exhibits. Yet standardization in audio archives regarding digital audio and accessibility is becoming increasingly defined in terms of preservation rather than presentation. Samuel Brylawski identifies several areas where efforts must be concentrated, including:

- Audio format migration based on a program that "presumes media obsolescence";
- Meaningful descriptive, structural, and administrative metadata;

---

[18] Elsie Freeman Finch and Paul Conway, "Talking to the Angel: Beginning Your Public Relations Program," in *Advocating Archives* (Chicago: Society of American Archivists, 1994), 5.

[19] Levy writes: "Documents work to hold talk fixed, to ensure its repeatability. . . . It is something that documents do well and people by and large don't." David M. Levy, "Heroic Measures: Reflections on the Possibility and Purpose of Digital Preservation," in *Digital Libraries 98,* ed. I Witten, et al. (New York: ACM, 1998): 153.

- Digitization standards; and
- The importance of collaboration in managing access and rights issues.[20]

Brylawski's concerns and recommendations briefly encapsulate general archival thinking regarding digitization and its focus on issues of preservation, capturing digitally the authentic and reliable object, making it accessible, keeping it sound, and in so doing retaining the public trust.[21] No matter the specific direction of the literature, what archival theorists return to at core is the importance of public access to materials. Perhaps, then, the worlds of digital preservation and Web exhibition are not so different in their goals.

Since Paul Conway wrote "Preservation in the Digital World," much has changed with regard to virtual access, but his advocacy for the user and society has endured. "Organizations that accept preservation as central to their mission also serve a larger societal need. . . . Part of the service that libraries and archives provide to society is (or will be) their investment in converting, storing, and making available research resources in digital form."[22] In performing these tasks, Conway acknowledges that modern archivists transform the access/preservation relationship, so that the focus shifts from the original artifact to the digital container holding the bits capable of virtually rendering the artifact. This sea change has had a dramatic impact on the "social value" archives provide through digitization.

> The particular value to society of preservation in the digital world has less to do with historical consciousness and group memory—as advocates for traditional preservation have claimed—and much more to do with service to academic, scholarly, and public communities. Active use is the lifeline of the loosely connected clusters of unique (in digital form), highly valuable,

---

[20] Samuel Brylawski, "Preservation of Digitally Recorded Sound," in *Building a National Strategy for Digital Preservation: Issues in Digital Media Archiving* (Washington, D.C.: Council on Library and Information Resources, 2002), 61–64.

[21] While not explored in detail in this paper, these issues are exhaustively considered in Peter B. Hirtle, "Archival Authenticity in a Digital Age," in *Authenticity in a Digital Environment,* ed. Abbey Smith (Washington, D.C.: Council on Library and Information Resources, 2000); David M. Levy, "Where's Waldo? Reflections on Copies and Authenticity in a Digital Environment," in *Authenticity in a Digital Environment*; Donald Waters and John Garrett, *Preserving Digital Information: Report of the Task Force on Archiving of Digital Information* (Mountain View, Calif.: Research Libraries Group, 1996); Kenneth Thibodeau, "Overview of Technological Approaches to Digital Preservation and Challenges in Coming Years," in *The State of Digital Preservation: An International Perspective* (Washington, D.C.: Council on Library and Information Resources, 2002); Peter Lyman and Brewster Kahle, "Archiving Digital Cultural Artifacts," *D-Lib Magazine* (Jul./Aug. 1998), accessed 17 September 2003, http://www.dlib.org/dlib/july98/07lyman.html; Howard Besser, "Digital Longevity," in *Handbook for Digital Projects: A Management Tool for Preservation and Access,* accessed 10 September 2003, http://www.nedcc.org/digital/ix.htm; and *Trusted Digital Repositories: Attributes and Responsibilities* (Mountain View, Calif.: Research Libraries Group, 2002).

[22] Paul Conway, "Preservation in the Digital World" (Washington, D.C.: Council on Library and Information Resources, 1996), accessed 10 September 2003, http://www.clir.org/pubs/reports/conway2/index.html.

and intensely consulted digital collections that form a digital library worth preserving.[23]

The shift in emphasis to "active use" of collections has tremendous ramifications for the quality of user services that archives provide. With regard to digital documents, especially as they appear on-line, usefulness, as David Levy points out, may come down to the individual user and the "fluidity" of the digitized document, that is, its ability to meet the same needs, unique to each user, of the original document.[24] In this type of environment, where behaviors of digital objects so easily demand center stage, Levy warns that it is easy for archivists to lose sight of their audiences.

> In both the library world and the world of archives, people at times have become so focused on the artifacts themselves that they have risked losing sight of their users or their users' needs. A similar tendency exists in the world of computers—the tendency to turn inward and become preoccupied with the computational artifacts, with their elegance, simplicity, internal consistency and so on. . . . The problem comes when one's gaze is narrowly restricted to the digital object.[25]

Even if, as Levy hopes, archives can succeed in taking a "more deeply human-centered perspective,"[26] access may still not be easily realized on-line. Rights issues have a significant impact not only on whether, but how, users are *allowed* to access digital documents. Additionally, another divide exists even after copyrights are determined and cleared, a divide obscured by the push for open content, much as David Levy's "computational artifacts" take attention away from the users of those artifacts. The socio-economic and geographic divide, suggested earlier in the discussion of broadband versus dial-up, very concretely makes access to digital materials, especially weighty multimedia files, difficult if not impossible for many would-be users of archival materials.

Avoiding the pitfalls of the digital world and the on-line exhibition of materials is therefore a tricky, and risky, business. Barbara Craig counsels archivists to "disconnect the hype that surrounds the business of 'getting connected' from the legitimate expectations that the net encourages."[27] Craig brings enthusiasm for the on-line archives back to earth, framing it within the "information economy," where quality of presentation is at least as important as getting the entirety

---

[23] Conway, "Preservation."

[24] Levy, "Heroic Measures," 156.

[25] Levy, "Heroic Measures," 159.

[26] Levy, "Heroic Measures," 160.

[27] Barbara Craig, "Old Myths in New Clothes: Expectations of Archival Users," *Archivaria* 45 (Spring 1998): 120.

of a collection on-line. "It is well to remember that the problem of delivering information in context is not new. What is new now are the demands to provide access to archives equitably to all users on site and remotely," she writes, adding that the archival Web presence must be an environment not only of the "seasoned habitue," but of the casual visitor as well.[28]

With the considerations of archival theory, practice, and both the student/researcher and casual virtual visitor in mind, what approaches appear reasonable for the exhibition of media on-line, particularly audio? Clearly, in the case of on-line access to exhibits, archives will benefit from a "lowest common denominator" approach to the display of their materials. This is not to suggest exhibits and related on-line productions (home pages, news and events, etc.) cannot be smart, or even groundbreaking, in their representations of the intelligent archives, but rather that the simplest technological infrastructure is assumed on the part of the virtual visitor. Simplicity, on the one hand, must characterize the structure of the information, allowing informed choices; and on the other hand, must characterize sites concerned with universal access.

Suggested Guidelines

If the assessment tool used in this study is assumed to be an effective one, the following emerge as suggested guidelines for improved exhibit access and performance.

1. *Audio delivery type options*: Both downloading and streaming options should be offered. While downloading gives the user the ability to play back audio files from his or her hard drive (thus allowing off-line, anytime-access to the audio file), streaming can allow more timely access and less hard-drive commitment. As streaming technologies improve, with both proprietary and open formats now available, they become more reasonable as options for acceptable-quality, uninterrupted playback. They may also allow for greater use of rights-restricted materials. They do, however, have their drawbacks (see no. 3 below).

2. *Audio file size/quality options*: At least two options should be offered users: high and low quality, with, ideally, a middle-range option as well (see recommended settings for these in no. 4 below).

3. *Multiple format options*: To borrow and modify the LOCKSS acronym (Lots-of-Copies-Keeps-Stuff-Safe) from the field of preservation, this category can be thought of as Lots-of-Versions-Keeps-Stuff-Accessible. At least two audio file formats should be available to users, even if the decision has been made to download or to stream only. While RealMedia

---

[28] Craig, "Old Myths," 123.

and WindowsMedia now dominate the streaming market, along with Apple's Quicktime, Ogg Vorbis, an open-streaming software, is gaining ground, is rated higher in quality, and is playable on popular playback softwares such as WinAmp. Commercial streaming softwares such as RealMedia and WindowsMedia are notorious for requiring users to update their players. If a user does not already have a player, download-ing one means enduring a registration process and waiting as much as a half hour for the player to download, *before* setup and configuration. Additionally, these companies tend to let old versions go unsupported, so refreshing and migration are factors for archives exhibiting these for-mats.[29] For downloading, MP3 will probably remain the primary choice for some time to come, although WAV and the nonlossy compression system FLAC can provide a more pure audio experience to audiophiles with broadband connections. It should be noted that streaming media players can be configured to stream downloadable MP3, but the (typi-cally) heavier MP3 files will take much longer to begin playback, tying up both user and server resources. Regardless of the format chosen, the capability of the medium to support metadata, so that (the potentially numerous) derived files describe their relationship to original sources, is an important consideration with regard to the authenticity of the derived audio.

4. *Balanced audio quality*: Here an experienced ear is necessary, as well as a dose of good judgment and common sense. The idea is to create a qual-ity listening experience without overwhelming the visitor's technologi-cal infrastructure. Since quality will be relative not only to a listener's taste but also to his or her technology, optimizing audio file settings for different environments is a good idea. It should be noted that in the case of exhibits, the archivist's impulse to provide the unmodified represen-tation of historical audio (that is, without normalization, equalization, or compression) might in some cases reasonably be sacrificed to the necessities of user technology, without compromising the integrity of the story being told. This is ultimately a question of transparency and should be echoed in the metadata as well as in an explicit message to the user (e.g., "This audio file has been optimized for on-line listening").

Part A. Streaming audio—Exhibitions using streaming audio need to assess their host server capabilities; often parent institutions will have streaming servers already employed, so this may determine the type of software that can be used. That said, streaming audio encoders typically allow a variety of settings, starting with a 16 kbps bitrate for

---

[29] See http://www.real.com. Real, while not supporting older versions of its software, does have the good sense to list for users what versions it does and does not support.

low-bandwidth dial-up connections. Although most dial-up systems in 2006 are in all probability using 56.6 kbps dial-up modems, actual connections to Internet service providers typically range in the 28.8–48.8 kbps range—rarely is anything over 50 kbps actually achieved. Therefore, a 16 kbps setting may still be a best bet for a low-bandwidth user option, with a maximum of 32 kbps if the original file has already been compressed. This is a key consideration, as quality in streaming files depends on the source audio file from which the streaming file has been derived. If starting with a clean, CD-quality, 44.1 kHz 16-bit WAV file, compressing to a 16 kbps streaming file will make for passable on-line audio, especially if the audio content is spoken word. However, recompressing an already compressed MP3 or low-quality WAV file to 16 kbps will typically yield substandard results, which will be even more noticeable if the original recording was made under the constraints of poor equipment or conditions. Deciding on the higher quality streaming file is much easier. While technically able to derive files from originals at a very high quality, encoding at 64 kbps for on-line delivery will yield fast performance and good quality over a broadband connection.[30]

Part B. Downloadable audio—At the broadband end of the spectrum, downloadable audio may be restricted only by rights owners. However, with CD-quality WAV audio weighing about 10 MB/minute, and standard MP3 (128 kbps) coming in at about a tenth of that, the decision to provide the spectrum of quality made possible by these formats may also come down to server space and management. If the point of the exhibit is to represent audio faithfully for on-line audiences with reasonable expectations (i.e., nonaudiophiles), stereo MP3 at 128 kbps will in most cases be sufficient as a higher-end option, although if space and resources allow CD-quality, WAV or the slightly smaller (and open) FLAC formats may be seen as adding value to sites heavy in music audio, which requires greater fidelity. It is possible also to create WAV files of lesser resolution that still offer acceptable quality (for instance, the Library of Congress offers 22.1 kHz mono WAV recordings on its John and Ruby Lomax site). Downloadable audio options for dial-up users could include mono MP3 at 96 kbps, or even mono MP3 at 64 kbps (for spoken word). As it is doing in streaming audio, Ogg Vorbis has developed MP3 technology based on a quality scale rather than on a bitrate,

---

[30] For discussions of practical applications of streaming in project environments, highly recommended articles include Trevor James Bond, "Streaming Audio from African-American Oral History Collections," *OCLC Systems and Services* 20, no. 1 (2004): 15–23; and Kristine R. Brancolini, "Digital Star Dust: The Hoagy Carmichael Collection at Indiana University," *First Monday*, June 2002, accessed 28 September 2003, http://www.firstmonday.org/issues/issue5_6/brancolini/index.html.

which is reported to deliver higher quality at lower bitrates. This may also make a good option for low-bandwidth users.

Part C. The future—Keeping in mind Samuel Brylawski's observations on media obsolescence, and the idea of digital preservation as an ongoing process, it would be wise for designers of Web audio to keep abreast of developments in audio compression, streaming, and downloading, as they continue to rapidly change.

5. *Lengthy audio pieces should be divided where possible.* Often spoken-word pieces, the substance of oral history programs and Web sites, can be thirty minutes long or more. Breaking these into technologically digestible chunks benefits the listening visitor to the audio exhibit. While dividing long spoken-word files may be more critical for downloading files and less so for streaming efficiency, in either case another potential benefit in breaking up longer files is the opportunity it gives exhibit designers for supplying descriptions of discrete passages of audio.

6. *File times and/or sizes should be listed with audio selections.* Describing an audio piece in terms of length and file size allows the listener to make an informed choice in selecting the work for playback, from the perspective of both the commitment of technology and time investment.

7. *An index or search tool for audio should be made available.* Often on-line exhibits, particularly those that use narrative extensively and integrate audio into that narrative, neglect to collect their "exhibit checklist" of objects and make it accessible to users, who might then be given the opportunity to link to pieces directly from the list. The Web facilitates these types of indexes; an object need be present on a server only once to be linked to many times. Collecting the audio on one page and sorting it in a logical order (by title, artist, date, region, collection, call number, etc.) is a simple way to enhance access. Employing a search tool is also helpful, depending on what the tool has been configured to search—allowing users the ability to search by format (e.g., MP3) or type of media (e.g., audio), as well as keyword, tunes the searching mechanism to be more sympathetic to users of the site.

8. *An audio help or FAQ page can greatly benefit new users.* As made abundantly clear in the foregoing pages, playing back on-line audio can be a complex, frustrating process for visitors unaccustomed to using multimedia on the Web. Simple instructions on downloading software players, hints on browser settings, and an explanation of digitization methods and why they were used (which should also have its own page, although for site usability this is less critical) can make using audio exhibits much easier.

9. *Simplicity of page design.* While perhaps not having as much of an influence on Web audio functionality, the Web page, as the container holding the content, should be designed with an eye to a simplicity that

facilitates fast page loads. While presentation plug-ins such as Flash or Shockwave can provide an eye-popping wow! factor, they can also require that users download software, and they can consume precious processing power. To paraphrase a common rule of composition, if an element in the construction of a work doesn't advance the story being told, leave it out. It will be at best a distraction and at worst will drive audiences away. Additionally, while not addressed directly in this paper, it is also important, and in many cases mandated, to consider the Americans with Disabilities Act in constructing Web exhibits— institutional guidelines for these distinct issues of access will have to be consulted.

10. *Adequate contextualization should be provided for each object.* As in number 4 above, this one is ultimately a judgment call. Contextualization can mean other primary media, such as photographs, text, and video; it can refer to secondary works regarding the piece in question; it can be the exhibit "label" itself; and it can be the metadata provided in the page and audio file coding. Deciding how much is enough in the description of an audio work should perhaps start with questions such as: Is there a transcript (if spoken word)? Are there supporting primary sources? Are there easily integrated secondary sources? Would a newcomer to the subject understand, given what's provided, what this work is about?

The table below is a succinct representation of the recommendations above, transformed into a quick evaluation tool. It is designed to assist in building Web audio exhibits, allowing designers to score their sites on a 100-point scale, and may help in planning for digitization for Web presentation.

Rigorous archival thought regarding digital preservation can inform Web presentation. Both require standardized practices recognizing the complexities of electronic media. Thankfully, the more highly evolved canon of preservation literature can shed light on many of the issues Web exhibitors will face. Archival theorists have begun to argue strongly for preservation practices that increasingly focus on user needs as well as the requirements of the artifact. Such urging needs to be doubled with regard to Web exhibition of archival materials.

On-line exhibits must also be considered on their own, as important new forms of archival practice and expression. While they may be affected by preservation standards, their digitization needs are distinct from those required for preservation. While they may aid in helping users find materials, they are distinct from finding aids. As outreach or educational documents they must consider the user, not just the object, especially in variable on-line environments. Yet this does not have to be an either/or proposition. Emphasizing the needs of the user does not imply that the integrity of the original archival object should not or cannot be upheld in its on-line proxy. Exhibit descriptions may in fact allow for extended

Table 3 Accessibility Top 10—Quick Checklist for On-line Audio Exhibits

Factors Enhancing Audio Access			Factors Limiting Audio Access
Option to download and stream files	☐+10	☐–10	Streaming only or download only
Multiple file sizes or quality options	☐+10	☐–10	One size or quality option only
Multiple audio file formats available	☐+10	☐–10	One file format only
Audio file quality neither exceeding intended bandwidth capabilities nor falling below acceptable exhibit quality	☐+10	☐–10	Audio quality too high (exceeding bandwidth capabilities) or too low (audio distorted) for on-line exhibit
Lengthy spoken-word pieces divided at appropriate intervals	☐+10	☐–10	Lengthy pieces not divided, must be downloaded or streamed as one file
Descriptions of file play time or size	☐+10	☐–10	Pieces lack time or size descriptions
Index or search tool for audio	☐+10	☐–10	Narrative organization only
Audio help page	☐+10	☐–10	No help page for listening back to audio
Simple design yielding fast page loads	☐+10	☐–10	Plug-ins (e.g., Flash, Shockwave, etc.) used for nonfunctional purposes; overly large images
Adequate contextualization provided with regard to the origin and interpretation(s) of the piece	☐+10	☐–10	Contextualization inadequate for a newcomer to the subject
Totals			
Audio Accessibility Score Total:			

contextual interpretations and metadata opportunities, backing up the authenticity of the archival resources upon which the virtual ones are based. In the on-line audio exhibit, where quality is often intentionally sacrificed to access, transparency in description can maintain the delivery of authenticity, even in derivative copies made for Web consumption.

That an exhibit's digital surrogate is a worthy representation of authentic material will ultimately depend on trust in the institution and the quality of the coded and narrative metadata. That an exhibit will be successful with its audiences, however, will ultimately depend on user satisfaction as well as sound documents. A trustworthy archives holding authentic resources can still be responsible for a badly designed and poorly delivered exhibit. Effective archival Web exhibitions may be credited to the design, technological, and pedagogic skills of archival staff, as well as the delivery of authenticating material. This is the on-line exhibit's challenge, as Web technology promises to be in a state of flux for some time to come. Providing access to wide audiences, in as equal a measure as possible, demands that exhibitors evaluate their presentations with the care of archivists, the minds of educators, and the eyes of users.