The Preservation of Sound Recordings in Archival Repositories

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Sound recordings are found in many archival repositories today. From early examples of sound recording technology such as wax cylinders to the ubiquitous cassette tape, these media preserve music, speech and sounds that are a valuable part of our cultural legacy. Historians find that listening to the recorded voice provides an immediacy and context to events that is very useful for historical research but often missing from the documentary record.[1] Recordings made by anthropologists of the language of indigenous peoples are of great interest to both their descendants and scholars. Often archives hold the only copies of important musical recordings. The challenge for archivists is to preserve these valuable sound recordings and to provide access to researchers and the general public.

The Challenge

The archivist who seeks to preserve sound recordings needs to be concerned with climate control, storage conditions and intrinsic faults in the media themselves. Overly hot conditions will render analog tapes unusable. Disk recordings are prone to warpage if they are stored incorrectly. Acetate disks may develop a white powder that looks like mold but is actually a byproduct of the manufacturing process.[2] But an even greater challenge to the preservation of these recordings is the technological obsolescence of much of the sound recording and playback equipment. Analog tape recording equipment is quickly being withdrawn from the marketplace and spare parts for older reel-to-reel machines have become increasingly difficult to find. The newer equipment and formats that are replacing it have not been fully tested and their suitability for long-term storage is unknown. Because of the technological obsolescence of recording equipment and the limited life span of existing media the archivist must be concerned with the issue of preservation re-recording. There are also preservation considerations involved in providing for the use and access of audio recordings by researchers.

The Literature

Fortunately, a considerable body of scholarship exists to guide the archivist on the preservation of sound recordings. Much of the literature is quite technical in nature, and requires a basic knowledge of sound recording media. This is obtainable from some of the general, book length treatments on the subject.[3] A number of articles on the topic have been published in archival journals such as American Archivist and the Journal of the Association of Recorded Sound Collections, with several appearing in the past five years. Overall, the recent literature is differentiated more by its emphasis than by a substantive difference of opinion over the facts. Authors tend to focus on some specific aspect of sound recording preservation and then proceed to examine the issue from that perspective. By combining the different approaches a good overview of the major issues of sound recording preservation that concern the archivist today can be obtained.

Sound Recording Media

This discussion will focus on the categories of sound recordings most commonly found in archives today. These include wax cylinders, grooved phonodisks and magnetic tapes. Wax cylinders are an early form of recording that was developed by Alexander Graham Bell and associates in 1885 for use with the phonograph.[4] Grooved phonodisks include 78s, 45s and 33 rpm recordings on shellac and vinyl bases along with acetates, a type of instantaneous recording. Magnetic tape that is used with analog recorders ranges in size from 2" wide open reel tapes to 1/8" cassette tapes. The most commonly used tape in archival repositories today begins at 1/4" in width.[5] Special attention will be given to magnetic tape, a major sound recording medium held in modern archives. More recently introduced media include compact disks (CDs) and digital audiotape (DAT). Each of these media has specific preservation requirements for climate control and storage.

ANSI Standards

Peter Z. Adelstein of the Image Permanence Institute recommends that archivists use the ANSI standards for recording media (and imaging materials) to help

resolve the differences that arise out of the varied backgrounds found among authors who write on the issue of their preservation.[6] The ANSI committee (IT9) is composed of representatives of industry, government, archivists and universities and research laboratories. Representatives from Germany, Japan and the United Kingdom also regularly attend meetings, ensuring international input. There are several standards written for storage of different sound recording media by ANSI. A specific standard exists for the storage of polyester base magnetic tape and for estimating the effects of temperature and relative humidity on compact disks, magneto-optic disks and CD-R disks.[7] Each standard features an in-depth discussion on the preservation of the media and can be ordered directly from the ANSI. These standards can assist the archivist in planning adequate storage conditions for their audio collections.

Climate Control

Richard Warren Jr. takes an in-depth look at the issue of climate control as a factor in storage.[8] Effective climate control in an archival repository, he believes, is essential to the preservation of audio recordings. Warren recommends different standards for heating, ventilation and air conditioning for areas where service copies and preservation copies are kept. He bases his conclusions on data gathered from studies conducted in 1987 by the Associated Audio Archives committee (AAA) of the Association for Recorded Sound Collections (ARSC). For service copies a room should be kept at 68 degrees Fahrenheit with a relative humidity of 45%. Fluctuations in humidity should be kept to a minimum (+ or – 5%). For long-term storage of tape recordings 50 degrees (but no lower) is optimum. A period of twenty-four hours is needed to acclimate these recordings before playback. Wax cylinders are best stored at 55 degrees. The ideal humidity for preservation is 25% for tapes and 45% for cylinders. Although ideal conditions are difficult to achieve, Warren points to an (ANSI) study that found the most important factor in climate control is to maintain stability in temperatures and relative humidity.[9] Archives holding sound collections should strive to minimize large-scale fluctuations in temperature and humidity in their storage areas.

Storage

Along with climate control there are a number of other storage-related issues to be considered in the preservation of sound recordings. Warren discusses the factors of lighting, electromagnetic radiation, security and individual storage in the preservation of these media. Natural lighting is discouraged and the use of fluorescent lighting with ballasts is prohibited due to their output of electric and magnetic fields that can harm sound recordings. Monitoring for these fields, also generated by radios and televisions, may be necessary in some cases. Individual item storage requirements vary for the different media although in general, Warren recommends the use of supports, dividers and props to store all sound recordings. Cylinders need to be stored on end and grooved disks (including compact disks) should be stored vertically and separated by size. Cassettes need to be stored horizontally and a rack is recommended. Open-reel tapes should be stored on slotless NAB (National Association of Broadcasters) reels in plastic containers with the tape horizontal to the shelf.[10] Analog tapes, often used to record original sound recordings, present some serious preservation challenges for the archivist.

Preservation of Magnetic Tape

Dr. John W.C. Van Bogart of the National Media Laboratory has conducted an in-depth study on the storage and handling of magnetic (audio and video) tape .[11] In the report he discusses what can go wrong with magnetic media and how to prevent early degradation of tape. There are three parts of a magnetic tape - magnetic particles, binder and backing. Under average conditions the binder rather than the magnetic particles determine the longevity of tape. When the binder, that holds the magnetic particles to tape, is damaged through excessive heat or dryness a condition called tape hydrolysis (commonly known as sticky shed syndrome) can develop and make the tape unplayable. Other problems with magnetic tape, detailed in Bogart's report, are lubricant loss, magnetic particle instability and substrate deformation. The problems of tape hydrolysis and lubricant loss are especially common with cassette tapes.[12] The relatively short life span of cassettes, due to these

problems, and because of breakage, prevents most researchers from recommending them as an archival medium.

Life Expectancy of Tape

In addition to guidelines for proper climate control Bogart offers some practical suggestions for extending the life of tapes. These include the importance of a clean storage area, taking care not to drop tapes and the necessity of keeping tapes out of sunlight and away from water, radiators, televisions, windowsills and electronic equipment. A period of acclimatization is necessary when moving tapes out of climate control storage areas for use by researchers. Certain procedures such as frequent access and handling can shorten the life expectancy of a tape. The maximum life expectancy of an open reel tape is approximately thirty years depending on factors such as tape quality and storage conditions. In order to preserve the information on a tape the re-recording of a tape at some time will be necessary. Looking at the differences between analog and digital tape Bogart notes that one advantage of analog tape is that its loss is steady and quantifiable over time, allowing re-recording before the complete loss of sound quality. A digital tape though will show little indication before a sudden catastrophic loss of large portions of recorded information.[13] For that reason, re-recording on analog tape seems to be the best option currently available.

Preservation Re-recording

Christopher Ann Paton advocates a multi-part approach to archival work on sound recordings that involves assessing an audio collection, preparing for its preservation and ultimately planning a re-recording project.[14] Assessing a collection involves identifying vulnerable recordings and determining the sizes, speeds and formats of recordings. Paton provides detailed discussions of the different types of media and their preservation problems. The issue of preservation re-recording is the major focus of his article. He uses the definition of the Television Coordinating Committee (TCC) that calls preservation re-recording "a means to preserve the original sonic content of a recording ….The archivists function is to preserve history,

not to rewrite it." Therefore the use of filtering and noise enhancement or suppression is to be avoided when making master copies but can be used for service copies. [15] The basic concept of preservation re-recording is not concerned with specific technologies but rather with the maintenance of the original sound quality of a recording.

Analog Technology

In his article Paton offers a number of useful recommendations for making preservation transfers. He suggests employing analog technology and using new reel-to reel tape with an overall thickness of 1.5 millimeters. Recording should be done in full-track format for mono originals and half-track for stereo original sources at a minimum seed of 7.5 inches per second (ips). Tapes should be stored on metal NAB unslotted hubs. Splices should be avoided and a series of test tones are to be recorded at the beginning of the tape. He notes that re-recording is costly and time consuming with estimates for time being two-and-a-half times the original playing time of each tape.[16] While suggesting the use of analog technology Paton does not offer any solutions to the dilemma of the problem of the technological obsolescence of that equipment. How does an archive maintain existing analog equipment where parts and service are no longer easily available? An Internet search of reel-to- reel tape recorder manufacturers located only two companies that still produce this equipment: Studer/Revox and Otari. Inexpensive consumer models have been discontinued with only professional grade models available at substantially higher prices. One option might be to buy a used model from one of these two manufacturers and rely on their existing service centers for maintenance of the equipment.[17] This is only a short-term solution though; a hedge until a suitable digital re-recording archival format becomes available.

Digital Technology

The digital technology that is available today is new and still developing, making many archivists wary of employing this technology for preservation re-recording. Some of the problems with digital media addressed by Paton include

sampling rates, longevity and hardware obsolescence. The sampling rate describes how a "sound wave is "sampled " and converted to binary code by use of an analog-to-digital converter (ADC)."[18] A standard has not been developed yet for the optimum sampling rates for making digital copies and there are a variety of opinions on the issue. The longevity of digital media like CD-R's is still unknown. Paton warns that DAT (digital audiotape) should never be used for preservation purposes.[19] Hardware obsolescence for digital media is a major problem since manufacturers are constantly introducing new technology without concern for the continued viability of older digital media and hardware. Despite a large staff with an abundance of equipment and spare parts it took six months for the LBJ Library to find a machine that would play an obsolete databelt. The machine was finally obtained from IBM's Museum.[20] Despite archivists' reservations digital technology is being widely used today by recording studios and audio technicians who are less concerned with the longevity of recordings. They believe digital media has less distortion than analog and can produce copies from master tapes without a loss in quality. Other sound engineers dispute these assertions.[21] The best use for digital technology in archives at the present time, until longevity concerns are addressed, may be to improve access to existing analog recordings.

Access

Archives are challenged by the need to provide public access to audio materials in their collection. Original masters should never be used for service copies. A second service copy should be made instead.[22] A viable option is to make a digital (CD-R) service copy when re-recording a tape. The researcher can easily play this copy on a dedicated computer. If the service copy is damaged a second copy can be made from the master. Archivists have found that users of sound and video recordings need collections processed at the item level[23]. Cataloging at the item level should be a priority when re-recording a tape. A computerized item level catalog, when combined with digital service copies, will improve public access to sound recordings and make the best present use of the new technology.

Future Trends

In 1997 the Library of Congress, believing that new ways to insure the preservation of audio and video material were needed, commissioned a study by William D. Storm to look at the issue.[24] For the study eleven Federal groups were interviewed, including the American Folklife Center, Music Division, National Digital Library and the Motion Picture, Broadcasting, and Recorded Sound Division (MBRS). A list of needs was summarized for any new technology to be developed. Some of the needs highlighted for the new technology are the following capabilities: the ability to produce master preservation-quality copies, to facilitate access to audio and video materials to the public, to address technological obsolescence and migration strategy of media and to co-exist with current technologies and operational methodologies. A number of manufacturers were invited to make presentations on a specific set of related questions and a site visit was made to Sony Division headquarters to look at a digitally based system they have developed. Recommendations were made to adopt a unified strategy for the development of a new technology.[25]

The Unified Strategy

The unified strategy recommends the use of a common system that is capable of making preservation copies of both audio and video recordings. This equipment must be able to generate both preservation and service copies at the same time. It must also be able to manage associated material including images and text. Access can continue to be provided through MARC records. The new technology will be digital but existing analog equipment must be maintained until original analog material can be converted to digital. Because of the rapid technology shift that is occurring simply improving existing storage conditions is not enough. While the software needed for the system is fairly simple it still has to be developed and the issue studied.[26] The study is suggesting what is truly a paradigm shift in the way recordings, both audio and visual, are preserved for the future.

A New Medium

The Library of Congress study found that the digital optical tape format holds great promise for purposes of the preservation of sound and video recordings. This media, with capabilities of storing motion picture quality images, has yet to be produced due to manufacturers concerns about market size and profitability. The study recommends that the Library of Congress should focus on promoting digital optical tape, in the way it focused on developing acid-free papers, to provide a catalyst to encourage its manufacture.[27] Adelstein notes that digital optical disks are relatively stable as an archival format.[28] Storm's report also states that the Library of Congress should adopt a Digital Information Life Assurance (DILAP) policy when acquiring new equipment to deal with the problem of technological obsolescence. This policy would require the manufacturer to not only sell a product but to maintain a process. The technology adopted by the Library will have far reaching impact on other repositories so the institution needs to take a leadership position to develop national and international standards.[29] Hopefully this report has spurred movement toward development of a digital system that will be manufactured for both the consumer and professional markets, and will be available and affordable to archival repositories.

Conclusion

The preservation of sound recordings requires the archivist to have a basic knowledge in several different areas. One must understand the climate control and storage requirements of each the various media. The use of ANSI standards and the available literature on the subject will help the archivist learn about and implement the needed steps to insure sound recording preservation. To guarantee the longevity of sound recordings it is necessary to employ the technique of preservation re-recording. Analog tape recorder technology is still the best option presently for the maintenance of sound recordings and analog equipment should be maintained for this purpose. Digital technology, while promising, is still unproven as an archival storage medium but can improve access to collections. The Library of Congress research into the development of an archival digital medium, probably on optical disks, holds great

promise. This technology, once developed, tested and manufactured will allow the re-recording of the older media and improve public access to sound recordings in archives.

Notes

[1] Robert Perks, "Listening to the Past," *History Today*. 50:11, (November 2000), 36.

[2] Christopher Ann Paton, "Preservation Re-Recording of Audio Recordings in Archives: Problems Priorities, Technologies and Recommendations," *The American Archivist.* 61:1, (March 1998), 191-192.

[3] Two general works are : A. G. Pickett, and M. M. Lemcoe. *Preservation and Storage of Sound Recordings*. Silver Spring, MD: Association of Recorded Sound Collections, 1991, 74 p. and Alan Ward. *A Manual of Sound Archive Administration.* Brookfield, Vermont:Gower, 1990, 288 p. The former work, originally written in 1959 and reissued in 1991, is still considered useful by the ASRC and to have the most thorough treatment on the aging of sound recordings. The latter work provides a thorough discussion of the subject of sound recording preservation.

[4] Alan Ward, *A Manual of Sound Archive Administration.* Brookfield, Vermont: Gower, 1990, 122.

[5] Paton, 206.

[6] Peter Z. Adelstein. "The Why, How, What and Where of Image Permanence Standards,*" Journal of the Society of Archivists*, 20:1, (1999), 42-47.

[7] The standards are: IT9.23-1998 Storage of Polyester Base Magnetic Tape; IT9.21-1996 Method for Estimating Effects of Temperature and Relative Humidity on Humidity on Life expectancy of Compact Disks (CD-ROM); IT9.26-1997 Method for Estimating Effects of Temperature and Relative Humidity on Life Expectancy of Magneto-Optico (MO) Disks and IT9.27 (under development) Effects of Temperature and Relative Humidity on Life Expectancy on Recordable Compact Disks (CD-R).

[8] Richard Warren Jr. "Storage of Sound Recordings" *Journal of the Association for Recorded Sound Collections* 24:2 (Fall, 1993), 130-175.

[9] Ibid. 137-138.

[10] Ibid. 142.

[11] John W.C. Bogart. [Computer file] *Magnetic Tape Storage and Handling: a Guide for Libraries and Archives*. St. Paul Minnesota: National Media Laboratory and Washington D.C.: The Commission on Preservation and Access, June 1995. http://www.clir.org/pubs/reports/pub54/1introduction.html.

[12] Ibid.

[13] Ibid.

[14] Christopher Ann Paton "Preservation Re-Recording of Audio Recordings in Archives: Problems Priorities, Technologies and Recommendations," *The American Archivist.* 61:1, (March 1998), 188-219.

[15] Ibid. 203.

[16] Ibid. 211-213.

[17] This problem is not addressed in the recent literature. The discussion results from my professional experience in obtaining a reel-to-reel recorder for the Keene State College, Orang Asli Archive at. The archive chose the option of purchasing a used Otari recorder in good condition, at one-tenth the cost of a new model, and having it serviced by an Otari service technician.

[18] Paton 207.

[19] Ibid. 207-212.

[20] Ellen McCrady [computer file] "NARA Conference on Preserving Tapes and Disks, March 1996: Facts and Advice from Speakers," *The Abbey Newsletter*. 20:6 (November 1996), 1.

[21] Paton 207.

[22] Ibid. 212.

[23] Kathleen J.M. Haynes, Lynda Lee Kaid and Charles E. Rand. "The Political Commercial Archive: Management of Moving Images and Sound Recordings," *American Archivist*. 59:1, (March 1996), 54-55.

[24] William D. Storm. *Unified Strategy for the Preservation of Audio and Video*: Washington DC: Library of Congress, 1998. 78p.

[25] Ibid. 27-34

[26] Ibid.

[27] Ibid 27-36.

[28] Adelstein 45.

[29] Ibid 27-36

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