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International Research on Permanent Authentic Records in Electronic
Systems (InterPARES):
Experiential, Interactive and Dynamic Records

Sound Preservation
Annotated Bibliography

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Preservation of Sound Recordings

Allen, J.S. "Some new possibilities in audio restoration." *ARSC Journal* 21.1 (1990): 39-44.

Allen identifies and describes some techniques which he says become possible with digital audio. Particularly, he says, time alignment with digital technologies make several new techniques possible, which will be useful in sound restoration. Included among these possibilities are the ability to synchronize multiple copies of recordings for noise reduction, the maintenance of editing histories of recordings, and correction of errors caused by disk warp or mechanical speed variations. As the goal of restoration work is to recover original sound, one can infer that the application of such techniques could have implications for collectors and archivists interested in preservation of authentic sound recordings. In particular, Allen points to the necessity of preserving the initial qualities of recordings being restored to prevent the loss of information.

Borwick, John, ed. *Sound recordings practice*. 3rd ed. London: Oxford University Press, 1980.

This is a sound engineering text book and is, for the most, very specific. The book is focused on a commercial music recording market. There is information on the practical process of recording prior to the time when any sound record is fixed. In one introductory article, "The programme chain," Borwick provides flow charts illustrating the stages of the "manufacture of a typical long-playing record (4)" which is useful in understanding the phases of a procedure that produces a sound recording. Borwick also gives a general description of these stages and introduces some key terms. For example, when recording "the best passages from several takes will be selected and edited together to form the *Original Master* [author's emphasis] (7)." The "Production Master" is the product resulting from the refining or sweetening for optimal sound quality (7).

Boston, George. "Ethics and New Technology." *Audiovisual Archives: A Practical Reader*. Helen P. Harrison, ed. Paris: UNESCO, 1997: Non-paginated, Section I, Chapter 1.13. <http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

Boston suggests that new digital technologies offer "many powerful tools to alter the information when copying a document. Without a generally accepted set of guidelines--an ethical base--to work from, everybody making copies will apply their own rules (Non-pag., Section I, Chapter 1.13)." He suggests that there should be standards for digital copying. Referring to sound recordings, he writes that "the hiss, clicks and bumps...can also be copied. This additional information is part of the history of the document. With the creation of digital copies of documents we are often in the fortunate position of not being required to physically restore the original before copying (Non-pag., Section I, Chapter 1.13)." Drawing on definitions issued by the International Association of Sound Archivists (IASA), Boston explains that a copy can be a replica, a historical copy or a recreation of the original document. A historical copy, or a copy that sounds exactly like the original including imperfections, reproduced faithfully as primary information, is the only "achievable copying standard and does not require any subjective decisions. The copy made is either an accurate copy of the original, warts and all, or it is not (Non-pag., Section I, Chapter 1.13)."

Boston, George. “New Technology - Friend or Foe?” *Audiovisual Archives: A Practical Reader*. Helen P. Harrison, ed. Paris: UNESCO, 1997: Non-paginated, Section XI, Chapter 11.1. <http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

Boston warns against thinking that technology will solve all problems. He writes: “A digital recording represents the information as a series of binary coded numbers. This is a much more rugged system because only two pieces of information - the binary digits 0 and 1 - are ever recorded....As we are dealing with numbers, it is possible to construct a copying system that checks the number on the original carrier against the number recorded on the copy. If the numbers match, the copy is an exact facsimile, a clone, of the original. This means that there has been no degradation in quality or fidelity because of the copying process (Non-paginated, Section XI, Chapter 11.1).”

Brylawski, Samuel. “Preservation of Digitally Recorded Sound.” Washington, DC: Council on Library and Information Resources, 2002. <<http://www.clir.org/pubs/reports/pub106/sound.html>>.

Discussion of the challenges faced by librarians and archivists who must determine which and how much of the mass amounts of digitally recorded sound materials to preserve. Identifies various types of digital sound formats and the varying standards to which they are created. Specific challenges discussed include: copyright issues pertaining to various digital formats; technologies and platforms from which digital audio acquisitions are selected; digitization and preservation including the necessity of preserving print elements associated with digital objects, metadata standards, and other standards related to digital preservation. Concludes with a call for collaboration between commercial archives, such as those of record companies, and institutional archives, to ensure the preservation of important audio recordings which are at risk of being lost, and to reduce redundancy.

Copeland, Peter. “What Should a Sound Archive Really Do?” *Care of Photographic, Moving Image and Sound Collections: Conference Papers, York, England, July 20-24, 1998*. Susie Clark, ed. Worcestershire: Institute of Paper Conservation, 1999: 11-12.

Briefly discusses transferring sound across media and objective techniques for the reproduction of sound. Copeland writes that the quality of sound for analogue media is defined by the “power-bandwidth product (11).” The power-bandwidth product is an assessment of the “number of octaves of required sound from the original, and the number of decibels between the power of the loudest undistorted sound and the power of the background noise (11).” Recordings should be transferred to a destination medium which has a greater power-bandwidth product so the new medium does not “drown some of the power-bandwidth product of the original (11).” The two aims of Copeland's research into objective techniques for the reproduction of sound are: 1) To quantify the behaviour of early sound-recording machinery, so it might be reverse-engineered in effect and the fidelity of the original sound improved; and, 2) To quantify the deliberate (but usually undocumented) distortions imposed by recording engineers, again to improve the fidelity of the recorded sound (11).

Edmondson, Ray et al. "Worldview and Paradigm of AV Archiving." *Audiovisual Archives: A Practical Reader*. Helen P. Harrison, ed. Paris: UNESCO, 1997: Non-paginated, Section I, Chapter 1.3. <http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

The authors contend that copying "is not a value-neutral act; a series of technical judgments and physical acts (such as manual repair) determine the parameters of the resulting copy. It is possible, in effect, to distort, lose, or manipulate history through the judgments made and the quality of the work performed. Documenting the processes, and the choices made, from generation to generation is essential to preserving the integrity of the work: the AV equivalent, perhaps, of the archival concepts of respect du fonds and original order. The same logic applies to the restoration and reconstruction of AV media: only if the choices are documented can the 'new' version be judged fairly, in context (Non-paginated, Section I, Chapter 1.3)."

Edmonson, Ray et al. "Ethics." *Audiovisual Archives: A Practical Reader*. Helen P. Harrison, ed. Paris: UNESCO, 1997: Non-paginated, Section I, Chapter 1.12. <http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

A guideline for the ethical use of archival sound recordings: "Reconstructions, compilations, excerpting, abbreviation, format transfer or other ways of manipulating collection material for the purpose of presenting it to a contemporary audience shall (a) not threaten the preservation, unchanged, of the source material and (b) shall be documented in terms of the purpose, parameters and actual work done, so that an audience need be in no doubt as to the true nature of the new work so produced (Non-paginated, Section I, Chapter 1.12)." The authors also include a mandate for AV archivists: "AV archivists are guardians of the AV heritage. They respect the integrity of the works in their care and do not mutilate or censor them, nor in any other way attempt to falsify history. They resist the efforts of others to do so. They endeavor to complete what is incomplete, restore what has been lost, remove the accretions of time, wear and misinformation. They hold in tension their personal tastes and critical judgments against the need to responsibly protect and develop their collection in accordance with policy (Non-paginated, Section I, Chapter 1.12)." On the topic of copying the authors write that an AV archivist "does not edit or distort the nature of the work being copied, nor expose an original or preservation copy to undue risk. Within the technical possibilities available, new preservation copies shall be an accurate replica of the source material. The process involved, and the technical and aesthetic choices which it entailed, will be faithfully and fully documented so the trail back to the original will always be clear. The terminology, concepts and data recording methods used shall be precise and allow the unambiguous transmission of information for the future (Non-paginated, Section I, Chapter 1.12)."

Fox, B. "Not fade away." *New Scientist* 177.2384 (1 March, 2003): 40-43.

This article describes some techniques being used to distinguish meaningful sound from noise and to recover and restore the true elements of recordings from wax cylinders and acetate disks. A technique used for wax cylinders simultaneously captures two separate recordings--one from each side of the groove. A digital processor is used to compare the two recordings and extract meaningful sound from random noise and to switch from one recording to the other. Similarly, a

technique used on acetate discs where two identical copies exist involves synchronizing their playback using a specialized double turn-table or re-recording the disks digitally and using sound peaks to synchronize their play. As with the wax cylinders, comparison helps to distinguish noise and from sound. Without explicitly discussing the issue of authenticity, the article does briefly discuss the use of technologies developed for saving old recordings in establishing the identity and integrity of sound recordings.

Godsill, Simon J. and Peter J.W. Rayner. *Digital audio restoration: a statistical model based approach*. New York: Springer, 1998.

The authors discuss, in technical language, methods of restoring analog audio signals by converting them to digital signals and processing them. In the introduction, the authors define degradation as “any undesirable modification to the audio signal which occurs as a result of (or subsequent to) the recording process (1).” For example, the authors suggest that audience noise at a musical performance is not considered degradation of the audio signal because it is seen as part of the performance (2). This raises questions about what noise is seen as an acceptable part of the record. The authors write that “an ideal restoration would then reconstruct the original sound source exactly as received by the transducing equipment...[but] this ideal can never be achieved perfectly in practice, and methods can only be devised which come close according to some suitable error criterion.” The authors suggest that this criterion would “ideally be based on the perceptual characteristics of the human listener (2).”

Harrison, Helen P. ed. *Audiovisual Archives: A Practical Reader*. Paris: UNESCO, 1997. <http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

In her introduction to this book, Harrison looks at the work of audiovisual archives: “it is not just a question of preservation of materials, it has to be a question of continual transfer, copying and restoration of the originals. ... By their very nature, therefore, archive materials in audiovisual formats are rarely masters or originals. But what do you do with the material you have carefully restored and copied. The increasing tide of opinion of audiovisual archivists is that wherever possible you should copy material for use but keep the original in the very best possible conditions in order that as technology advances and restoration techniques improve you still have the original to return to when such a circumstance arises (Non-pag, Section I, Chapter 1.1).” This compilation contains several articles discussing sound recordings which touch on issues of copying, manipulation, and digitization, for example. Entries on articles that might interest InterPARES are included in this bibliography.

Klaue, Wolfgang. “Audiovisual Records as Archival Material.” *Audiovisual Archives: A Practical Reader*. Helen P. Harrison, ed. Paris: UNESCO, 1997: Non-paginated, Section I, Chapter 1.4. <http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

Klaue contends that archives must be handed on in the form in which they were produced. Records, according to Klaue, should be passed on as records, not cassettes. He asks: “is not the archivist duty-bound to the original? (Non-paginated, Section I, Chapter 1.4)”

Lazar, Wanda. "A proposed university specialization in sound preservation." *ARSC Journal* 26.1 (1995): 46-52.

This article presents an argument for and an approach to designing a university course for sound archivists working in sound preservation. "The significance and complexity of work performed in sound preservation are discussed, and a design of a university course syllabus for sound preservation specialization is offered; the focus is on the audio engineering dimension of sound preservation studies" (46). Lazar contends that sound archivists have a duty to preserve authentic sound artifacts because "[m]istakes in any copying, reconstruction, or deciphering are duplicated and later taken as historically accurate" (47). When their work involves the reproduction of original documents, Lazar says that sound archivists must avoid the temptation to improve sounds quality. She says that "the most common case of an unethical decision or action occurs when the original qualities of the sound recording are changed, as a result of playing the sound recordings at wrong speeds, or over-filtering in search for the 'better' quality of sound" (50).

Lee, Brent. "Issues surrounding the preservation of digital music documents." *Archivaria* 50 (Fall 2000): 193-204.

This brief study identifies and describes the types of digital documents currently generated in the process of making music: digital recording which represent actual sound; notation files which represent notated music; and formats which serve to control computer operations that generate notation or sound. It then articulates the challenges the passage of time poses for these documents, specifically, their readability, intelligibility, adequacy of representation, and authenticity. Though focused on music documents specifically, the study provides a concise description of audio sampling which is applicable to all digital sound recording. A brief discussion of authenticity refers to the InterPARES project and the study concludes with a call for more research into the preservation of digital music documents.

Lindquist, Mats G. "Long Term Strategies for Electronic Documents - Report from a Swedish Study." *Audiovisual Archives: A Practical Reader*. Helen P. Harrison, ed. Paris: UNESCO, 1997: Non-paginated, Section XI, Chapter 11.2.

<http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

Describes a study launched in 1994 which aimed to identify methods for the long term preservation and access of e-documents. The study found that a "method for the preservation of e-documents encompasses a set of choices or selections" regarding materials, technologies, forms for representing and storing information, access mechanisms and systems (Non-paginated, Section XI, Chapter 11.2). The author notes that physical deterioration of the information carriers and technical obsolescence of the recording methods, equipment, and computer software and hardware are problems to consider when assessing the long term adequacy of different media and the form of information for representation and storage. The article includes a number of the study's recommendations which should contribute to an overall strategy for the long term preservation of electronic documents, including sound documents. The article concludes with the following statement on authenticity and restoration: "E-documents can be copied without loss of quality. Together with the ease of manipulation this compounds the problem of establishing authenticity.

The distribution of ‘originals’ cannot be controlled by technical means. The quality of an e-document can be enhanced by algorithmic methods. [Sic]shapes and forms can be made more distinct, shadows can be washed away. Restoration of e-documents must be considered as part of preservation (Non-paginated, Section XI, Chapter 11.2).”

McKee, Elwood A. “AAA Audio Preservation Planning Project: a preliminary progress report.” *ARSC Journal* 18.1-3 (1986): 20-32.

McKee describes the preliminary findings of the project that “was to gather as much information as possible about all aspects of the conservation, preservation, and restoration of sound recordings...then organize access to the mass of collected data through development of definitions of key elements, a bibliography, a glossary of terms, listings of pertinent standards and a variety of research reports. These materials would be incorporated into a final report which would summarize the nature and size of the audio preservation problem, identify gaps and needs, and make prioritized recommendations for further research and cooperative activity to ensure the continued availability” of sound recordings (20). The article discusses how the group defined a “sound recording (26).” It was recommended that certain “types of documentation” be preserved with each sound recording so that people could understand the recording without having to play it because too much playing of older recordings would be damaging (27). They named seven categories of documentation: Chief Source, Artifact, Content, Audio Technical, Storage and Handling, Administrative and Transfer. Among other preliminary conclusions, the group suggested that the development of an archival medium for sound carriers be a priority (28). As of the date of publication, the Committee recommended that magnetic recording tape be used although it did not meet all the criteria for an archival medium that they had developed (29). They specifically noted that digital formats were not appropriate for the generation of archival preservation transfer copies at that date because: there were no nationally accepted Standards for the various digital recorders and formats; the audio industry had yet to resolve its conflicting systems; and, neither equipment nor formats had yet been tested or proven reliable in an archival setting (29).

McWilliams, Jerry. *The Preservation and Restoration of Sound Recordings*. Nashville: The American Association for State and Local History, 1979.

This book is aimed at archivists dealing with sound recordings. In the first chapter, “History of Sound Recording,” McWilliams gives a good summary of problems that arose with the onset of electrical recording, including a breakdown of the different kinds of equalization practiced to adjust the sound during and after a recording (3-21). He defines equalization as “an emphasizing and de-emphasizing of particular parts of the frequency spectrum during recording and playback to provide linear reproduction (10).” He also offers a good explanation of the digital sound recording process, writing that when the analog form is electronically processed or sampled and converted into digital information, the “sampling rate [must be] kept sufficiently high to ensure that the process - high-speed but not continuous - does not lose audible sonic information (20).” He suggests that sound archivists have a double responsibility: they must preserve the physical carrier through proper storage and its “sonic content” through necessary migrations or transfers that will allow the recordings to be played (22). The book is primarily concerned with the preservation of the physical carriers, but when discussing the restoration of sound recordings, McWilliams

explains how methods of electronic signal processing, dynamic range expansion and computer processing can be abused, as restorers improve the original material instead of simply filtering or eliminating noise (106-108).

Morton, David. *Off the Record: The Technology and Culture of Sound Recording in America.* New Brunswick: Rutgers University Press, 2000.

Discusses the emergence of a “culture of sound recording (12)” in the United States, looking at the creation of sound recording over time in different contexts. Addresses the change of meaning of the term 'high fidelity' from the ability of a sound recording to faithfully duplicate a performance to the ability of a sound recording, perhaps after manipulation, to give the listener an impression of 'realism.' Looks at sound recording technologies in the workplace where there were issues regarding the usability of equipment, the quality of the sound and the need for media to be reusable, as opposed to being preservable. Morton suggests that office sound recording technology, such as dictation machines “complimented or transformed other forms of communication, such as the business letter and the typewriter (107),” which implies that sound recordings were never considered to be records. Likewise, Morton describes the emergence of oral history recordings, secret recordings (recorded conversations) and answering machine messages, but does not discuss their preservation. Morton discusses sound recordings in terms of information storage, not as records. He uses the term “authenticity” to express the concept that recordings can “approach the experience of hearing a live experience (177),” but points out that this idea is faulty. He also mentions that tape recorded evidence has been admissible in US courts when voices could be authenticated. He concludes by suggesting that the rise of digitization might mean the end of sound recorders and tangible sound media (187).

Pasquariello, Nicholas. “Archival sound restoration.” *Studio Sound and Broadcast Engineering* 36.9 (1994): 47-48.

“Nicholas Pasquariello asks what did the audience miss if they caught a movie the second time around?” (47). This short article describes some of the processes and techniques used to restore sound quality to motion picture soundtracks (including dialogue, music, and effects). Several examples are drawn from restoration projects which aimed to obtain clear original sound from movies whose original soundtracks were deteriorating optical recordings or which had to be pieced together from several versions of the soundtrack. The practices involved in restoring sound quality can potentially affect the authenticity of the recording. Engineers may have to distinguish original sound from extraneous noise and remove extraneous noises, correct problems caused by original recording techniques, compensate for generational loss caused by re-recording, work with several incomplete versions of a soundtrack, loop tracks to fill in gaps and/or cut frames from the picture where no original sound existed or could be recreated.

Paton, Christopher A. “Preservation re-recording of audio recordings in archives: problems, priorities, technologies, and recommendations.” *American Archivist* 61.1 (Spring 1998): 188-219.

This article is recent, reputable, and information-rich. From the abstract: “This article offers a context for examining archival audio holdings, determining preservation needs and priorities, and

planning audio re-recording (reformatting) projects” (188). Determination of the size, speed, format, and deterioration of grooved phonodisk and magnetic tape recordings are discussed in detail. “[The article] addresses such issues as identification of the most vulnerable recording types, the meaning of ‘preservation re-recording,’ and the skills, equipment, and personnel that are necessary for working with older recordings” (188). Although it does not address issues of authenticity and integrity specifically, the article would be of interest to researchers interested in these issues as they relate to re-recorded audio materials.

Schuller, Dietrich. “Ethics of preservation, restoration, and reissue of historical sound recordings.” *Journal of the Audio Engineering Society* 31.12 (1991):1014-16.

This paper is about “the ethical side of preservation, restoration, and re-recording (1014)” as opposed to the technical possibilities of re-recording. Schuller attempts “to analyze what the original carrier represents, technically and artistically, and to start from that analysis in defining what the various aims of re-recording may be (1014).” The article includes a block diagram breaking down levels of recording process and moving forward and breaking down levels of re-recording (1015). Schuller discusses the kinds of alterations of the sound recording that are made at all these levels. The two aims of re-recording are identified as: 1) the historically faithful reproduction (either the recording as it was heard in its time, or the recording as it was produced at the time, or the recording as produced but with additional compensation for recording imperfections caused by the recording technique of the time) and 2) reinterpretation at the creative level for re-issuing and marketing (1016). Schuller concludes that sound archives are concerned with the first aim of re-recording and that documentation of all procedures is imperative (1016).

Schuller, Dietrich. “Strategies for the safeguarding of audio and video materials in the long term.” *IASA Journal* 4 (November 1994): 58-65.

Schuller contends that “[p]reservation of the information rather than the carriers is the only feasible solution to preserve in the long term what is considered of archival importance” (62). He suggests that preserving the carriers of audio and video recordings by attempting to extend their life expectancy is an outdated approach which is not archivally sound. Schuller advocates the use of centralized digital mass storage systems for audio and video signals. Unlike analog recordings, digital information can be “cloned” without generational loss, making it easier to migrate information as hardware becomes obsolete. He contends that such systems can control and verify the integrity of the information being stored and can detect and correct errors that may occur during migration, as well as being able to store metadata associated with audio and video recordings. Though not explicitly discussed, Schuller’s strategy hints at the implications of preservation discourses and practices for the authenticity of sound recordings.

Schuller, Dietrich. “Data Density versus Data Security: Formats Suitable for Archival Purposes” *Audiovisual Archives: A Practical Reader*. Helen P. Harrison, ed. Paris: UNESCO, 1997: Non-paginated, Section VII, Chapter 7.6.

<http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

Schuller discusses the concept of data density when storing sound information. He argues that

storing records in too compressed a format leads to a loss of quality. He writes that despite initial costs in storage space, “[e]conomists are challenged to calculate the costs of long term preservation including the costs of subsequent transfer of whole archives to new formats. Such a calculation may prove that radical miniaturization may in the end not be the most economic way to store audiovisual material over long periods (Non-pag., Section VII, Chapter 7.6).” Schuller concludes that archivists should “prefer formats which optimize data security rather than data density (Non-pag., Section VII, Chapter 7.6).”

Schuller, Dietrich, Lloyd Stickells and William Storm. “Guide to Technical Equipment Audio Archives” *Audiovisual Archives: A Practical Reader*. Helen P. Harrison, ed. Paris: UNESCO, 1997: Non-paginated, Section VIII, Chapter 8.3.

<http://www.unesco.org/webworld/ramp/html/r9704e/r9704e00.htm>. Internet. Available August 21, 2004.

The article begins with the idea that the role of the archivist is to faithfully preserve the content of original sound recordings and that re-recording serves a very specific function; it is a means to preserve the original sonic content of a recording. The authors identify four different kinds of re-recording, three of which are “legitimate for archival preservation (Non-pag., Section VIII, Chapter 8.3).” These three are: 1) re-recording a replica where the intention must be to provide the researcher with a secondary source which is the equal (or at least equivalent) to the original source in as many respects as possible; 2) re-recording an audio history where the sound of an original recordings is perpetuated as it was originally reproduced and heard by the people of the era (i.e. reproduce the sound captured on the historical carrier with real fidelity); and 3) re-recording as a recreation of the original sound source, eliminating distortions made in the original recording in order to attempt an “objective” reconstruction of the artist or performer of the sound (Non-pag., Section VIII, Chapter 8.3). The authors argue that it “is essential to fully document the process of re-recording any historic carrier. The make, model and serial number of all machines and audio processing equipment used in the record/replay chain, details of the equipment settings used, the equalizations used, the size of stylus etc. must be noted to allow future researchers to, if necessary, restore the sound to as near its original form as possible (Non-pag., Section VIII, Chapter 8.3).”

Storm, William. “The Implementation of Proposed Standards for Copying Audio Recordings” in *Archiving the Audio-Visual Heritage*. Berlin: FIAF, 1988.

Storm writes for professional sound archivists who, he says, have subscribed to the philosophical standard of historical accuracy. “The philosophic standard does not enumerate specific technical procedures, but it definitely does exclude re-recording techniques that can be shown to be subjective and which falsify the original sound recording” (108). The article describes factors to consider before any technique is applied to an audio recording and in determining what the original recording sounded like, such as, original recording equipment, media formats, and acoustics. It also describes some of the questions that must be addressed in the re-recording process and some cooperative efforts that are aiming to answer those questions. The article concludes that “advocating the philosophy of ‘saving and not rewriting history’ demands that the re-recording engineer seek an understanding of the many variables that affect the perception and actuation of original sound recordings... Implementation of this philosophy is beginning to emerge in sound archives in great part due to improved communications among sound archivists.

Questioning each other provides a good system of checks and balances that minimizes subjective rewriting of history” (108).

Swartzburg, Susan. “Preservation of Sound Recordings.” *Encyclopedia of Recorded Sound in the United States*. Ed. Guy A. Marco. Garland, 1993.

This article is an overview of issues in the preservation of sound recordings that are broken down by medium. The author states that the “goal of preserving sound recordings is to maintain the aural quality as closely as possible to the quality when the recording was made (543).” At the time of publication, the author addressed digital recording as follows: “There are no standards for this medium...The compact disc is considered a transitional medium. It is ideal for the transmission of information, but it is not the medium for storage of information (545).” Swartzburg also writes that re-recording “older sound recordings in a suitable format, without enhancements, for playback, is a preferred method for preservation and access in archival collections. Of concern is the fact that there are, at present, no standards for the re-recording of sound recordings into a newer medium for playback. When dealing with the preservation of aural materials, the goal is to retain the quality of the sound as closely as possible to the original, blips and all, not to enhance the quality of the sound (546).”

Vihonen, L. “Digitization and its consequences for radio sound archives: Finnish Broadcasting Company (YLE).” *IASA Journal* 9 (May 97): 29-31.

Brief outline of radio sound archiving practices and issues at the Finnish Broadcasting Company (YLE). As YLE's began to digitize its broadcasts, it continued to archive broadcasts by recording, simultaneous to broadcast, on traditional sound carriers like analogue tapes, DATs or CD-R. Vihonen suggests that, in the future, audio files will be “transferred as automatically as possible from the [broadcast] systems to the archive system (30)” and that “producers of the chief editors will be the persons who decide in practice which radio programmes ...are worth [sic] of permanent storing (30).” Different broadcast systems produce different file formats and for this reason, Vihonen suggests that an “archive system has to be as open as possible (30).” However, he also mentions that the European Broadcasting Union (EBU) has started work on a standard which will help to transfer audio files from the broadcast systems to the archive systems (31). Vihonen notes that the EBU standard will “probably recommend some audio file formats but the main point is that the users have to add some extra information [that] tells the systems, for example, the type of audio file (is it linear or bit-reduced and so on) and also some broadcasting and copyright information (31).” Vihonen also suggests that the EBU standard should include a field for “the status information” that will have information concerning the storage time of the audio files and further adds that many manufacturers have promised to follow the standard when it is approved (31).

Welch, Walter L. and Oliver Read. *From Tinfoil to Stereo: Evolution of the Phonograph*. Indianapolis: Howarrds W. Sams & Co., Inc., 1976.

This book discusses recording practices and the development of the sound recording industry. The authors point out the problems of recording due to the different sound-producing aims of using different equipment. For example, when using a telephone, not all sound frequencies should be

captured because the extraneous sounds will distract from the person's voice, whereas the perfect reproduction of music should have the same relative intensity and phase relationship reaching the ears of listeners as they would have experienced at the actual performance. The authors write that more research should be conducted on the purposes of musical reproduction to determine what qualities a reproduction should possess compared to the original (371). The chapter titled "A National Archive of Recorded Sound" illustrates the need for preservation by giving examples of lost recordings; however, the authors only state that the physical carriers need to be preserved, writing that recordings should be transferred to a newer carrier if necessary, without going into the qualities that need to be preserved (409-22).

Welch, Walter L. "Preservation and restoration of authenticity in sound recordings." *Library Trends* 21.1 (July 1972): 83-100.

Based on research conducted at the Syracuse University Audio Archives and Thomas Alva Edison Foundation Re-Recording Laboratory. "The laboratory is interested not only in the preservation and restoration of authenticity in historical material, but also in problems concerning the extent to which current sound recordings truthfully represent the world of sound, and the extent to which modern artifacts will survive the vicissitudes of time and use (83)." Welch writes that "the authentication of sound depends on its reproduction free of disturbing or diluting effects produced by ambient conditions in the recording or reproducing environment (83)." He considers the mechanisms used to record and reproduce as part of the primary source of recordings. To evaluate a truthful representation of the world of sound, recordings should be heard "with the two ears as nature designed them to be used - with a slightly different sound pattern received by each ear (85)" and Welch discusses how this stereophony is necessary to evaluate the fidelity of recordings in terms of tone, sound-level and timbre. Welch goes on to discuss the evolution of wax cylinders to discs and magnetic tape, and their longevity in use and in storage. He calls on institutions of higher learning to assume a role in determining acceptable standards for sound recordings and reproducing practice.

Welch, Walter L. "Preservation and restoration of authenticity in sound recordings-to standards." *Library Trends* 30.2 (Fall 1981): 297-305.

Describes early tone tests by Thomas A. Edison, Inc. in which recordings were compared to live performances in an attempt to prove the authenticity of recording. Also, describes Edison's attempts to build standards to address problems such as the uniform surface speed for the recording and reproducing of cylinders. For the majority of the article, Welch discusses components of the physical carriers or recording/reproducing process that impacted on the quality of sound recordings such as, for example, the smoothness of the playing surface of the carriers.

Wickstrom, David. "Speakers' corner: recorded sound preservation in the digital age." *ARSC Journal* 30 (Spring 1999): 30-32.

In this short commentary, Wickstrom observes an inconsistency in sound preservation practices. He suggests that this inconsistency is caused by the contradiction between recommended standards (the Associated Audio Archives Committee's ten year old *Audio Preservation: A Planning Study*, which officially recommends analog as a preservation medium), and popular digital technology. He encourages his audience to actively seek agreement and standards on this issue.