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Moving Image and Sound: Basic Issues and Training
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November 18, 2010
Final Paper Annotated Bibliography

Tape Baking: Heating Things Up

AMIA. Video Preservation Fact Sheets.

http://www.amianet.org/resources/guides/fact_sheets.pdf

These fact sheets, made by the Association of Moving Image Archivists, are meant to provide a guide for professionals in the field at libraries, archives, and other institutions. They cover the widest array of issues associated with video preservation, including sticky shed and a basic understanding of tape baking. They make recommendations according to established field experiences and knowledge and are written to be easy to read and implement by stewards of collections of any size, with core field definitions, a comprehensive glossary of terms, and easy to peruse dos and don'ts listed for the busy professional. Fact Sheet 6 explains sticky shed syndrome and tape baking. Fact Sheet 11 explores the drying procedure using silica gel.

Bertram, H. Neal and Edward F. Cuddihy. Kinetics of the Humid Aging of Magnetic Recording Tape, IEEE Transaction on Magnetics, Vol. MAG-18, No. 5, (September 1982): pg. 993-999

A very mathematical approach to the kinetics of hydrolysis of magnetic recording tapes consisting of polyester urethane binders. Here, the authors conclude that hydrolysis is reversible and from this, they make recommendations for appropriate long term archival storage conditions of tapes to prevent deterioration.

Bogart, Dr. John W.C. Van. "Magnetic Tape Storage and Handling: A Guide for Libraries and Archives." National Media Laboratory, June 1995. Accessed 13 November 2010. http://www.clir.org/PUBS/reports/pub54/2what_wrong.html.

A survey of problems that can occur with magnetic tape deterioration. Dr. Bogart describes the construction of magnetic tapes, binder degradation, sticky tape syndrome, and tape baking, in addition to a host of other preservation concerns specific to magnetic tape preservation. Helpful sections and color photographs make this a very easy read.

Ciletti, Eddie. "If I Knew You Were Coming I Would Have Baked A Tape (A Recipe for Tape Restoration)." 11 October 2010. <http://www.tangible-technology.com/tape/baking1.html>

An independent sound engineer and video restoration consultant, Ciletti's website advocates for the tape baking process. As one of the proponents of homemade tape baking remedies for sticky tapes, he provides information on his use of a commercial dehydrator to bake tapes. Ciletti states that if you are not sure of your tape's quality, bake it first before playing, another perspective on the use of tape baking in the field.

Cuddihy, Edward F. "Hygroscopic Properties of Magnetic Recording Tape." IEEE Transaction on Magnetics, (March 1976): pg. 126-135.

In 1976, Cuddihy did a series of experiments to record the hydroscopic properties of magnetic tape under multiple conditions. A foundational paper on the causes of tape deterioration, Cuddihy offers an interesting conclusion; he discovered that increasing the water content of the magnetic coating would increase the tendency for tape wear products to be gummy. This is a precursor to the understanding of the breakdown of polymer molecules in causing sticky shed syndrome, but it connects the properties of the binder to the deterioration of tape and the breakdown of the binder to the increase in the humidity of the storage environments.

This article explores Cuddihy's experiments in depth and is written with a very technical and scientific approach. The experiments tested the changes in the weight of tapes of a variety of ages after experiencing different humidity levels. Subsequent tests weighed the tapes after removing the topcoat and then the back coat to determine the hydroscopic properties of each part of the tapes. More experiments test the effect of tape pack on sealed containers. One section in the report explores heating and cooling the tape to measure change in humidity and water content. Cuddihy's experiments report that with the increase of temperature, the tape case RH dropped and the tape pack began to desorb water. This is also the beginning of Ampex's research into tape baking years later.

DeLancie, Philip. "Sticky Shed Syndrome: Tips on Saving Your Damaged Master Tapes" Mix, May 1990, pp.148-155.

A mastering engineer at Fantasy Studios in Berkeley, California, Philip DeLancie wrote this article for the music community to provide them with some solutions to sticky shed syndrome. In the early 80s, record companies were increasingly revisiting tapes from the 70s, and thus, encountering sticky tapes. This article briefly explains sticky shed, and then provides the field with a basic overview of baking tapes by exploring tape baking through three examples. DeLancie interviewed John Matzarro to discuss Agfa-XT, Agfa's service to clients to send in their tapes to be treated and reformatted. Steve Smith at Ampex Recording Media provides the company's perspective on sticky shed concerns, and DeLancie uses him to explain the scientific aspects in the body of his article. Lastly, DeLancie himself explores a homemade solution invented by his company using an oven made with cardboard and a blow dryer. Mike Rivers' user centered

article is heavily influenced by DeLancie, providing a more subjective view of this homemade solution from the point of view of a homemade user.

Gibson, Gerald. "Magnetic tape deterioration: recognition, recovery and prevention." Presented at the IASA Conference in Perugia, August 26, 1996. 17 November 2010. <http://www.unesco.org/webworld/ramp/html/r9704e/r9704e11.htm>

On overview of problems associated with magnetic tape. One section on tape baking is especially helpful to this story as it quotes information from Ampex/Quantag.

Hess, Richard. "Degrading Tapes." Updated 28 May 2010. Accessed 12 November 2010. <http://richardhess.com/notes/formats/magnetic-media/magnetic-tapes/analog-audio/degrading-tapes>

Hess provides a helpful list of tape brands that are known to deteriorate. His list includes a section on tapes that are liable to have sticky shed syndrome and also respond well to baking. This list could be helpful to professionals in the field who do not have a reliable mechanism for checking tape quality without playing it on a playback device; specific brand names are listed. This site also provides a link to the Ampex patent on the baking tape process.

Hess, Richard. "Tape Degradation Factors and Challenges in Predicting Tape Life" Fall 2008. *ARSC Journal*. 13 November 2010. <http://richardhess.com/notes/2009/01/03/arsc-journal-tape-degradation-article-available-online>

A tape deterioration primer. Hess is a main voice in the field and he explores both tape baking and soft binder syndrome.

Holland, Bill. "If I Knew You were Coming, I'd have Baked A Tape." *Billboard* 111, no. 23 (1999). *Proquest Central Database*. 2 November 2010. Accessed NYU Libraries.

A one-page article on the tape baking process, told in a narrative structure than some of the more technical approaches. Holland also provides viewpoints from the field that do not agree with tape baking in addition to stories where baking has not worked for some professionals. Anecdotes make this a fun read.

Image Permanence Institute. "The Preservation of Magnetic Tape Collections: A Perspective." NEH Grant Report. 22 December 2006. http://www.imagepermanenceinstitute.org/shtml_sub/pr_magnetic.asp

This report by the Image Permanence Institute summarizes the research undertaken by the Institute to plan for a diagnostic tool to test for tape deterioration. Currently, no diagnostic tools for obtaining quantitative information

on the level of deterioration on tapes exists for the institutions to use when assessing their collections. Visual examination, machine tape cleaning, and playback analysis have been the only available methods by which to attempt tape condition assessment. Its conclusions point to the difficulty in forming a diagnostic tool because of the vast differences, which affect tapes across the board. Tape Baking is not mentioned.

Library of Congress. "Sticky Shed Syndrome in Magnetic Tapes: Characterization, Diagnosis, and Treatment. 23 September 2010.

http://www.loc.gov/preserv/rt/projects/sticky_shed.html

A one-page fact sheet on the initial survey of sticky shed conducted by the Library of Congress in 2008. It provides helpful information on the goals of the organization regarding recent research into tape baking.

Library of Congress. Introduction to the work of New Preservation Science Laboratories of the Library of Congress: Update on LC's Electronic Media Research. April 16, 2010. Dr. Steve Hobaica Report.

<http://www.loc.gov/preserv/tops/tops50/hobaica/hobaica.ram>

The most up to date information from the Library of Congress. This short webcast updates us on the research still being conducted by the Library of Congress on the effectiveness and consequences of tape baking. Start 15 minutes in.

Lindner, J. "Magnetic Tape Deterioration: Tidal Wave at Our Shores". February 1996.

Video. 12 October 2010. <http://cool.conservation-us.org/byauth/lindner/tidal.html>

A veteran voice in the field of tape restoration, Lindner writes this piece to outline the scope of tape deterioration. In it, he tries to contextualize this problem, providing a little history, touching on obsolescence concerns, interchange error, and some other basic problems that professionals encounter when trying to deal with planning for the preservation of tape materials. He briefly discusses tape baking, warning the industry against using it as a catchall cure and outlining some of the problems associated with it.

Martin, Jeff. "The Dawn of Tape: Transmission Device as Preservation Medium." *The Moving Image* (2005): 45-66.

Martin chronicles the advent of videotape at its moment in 1956 with the presentation of the first videotape device by the Ampex Corporation to CBS staff members, with a focus on its television recording capabilities in response to time-shifting needs by the major television networks. His history documents the move from kinescope recordings to videotape. This history is important both because it documents the transmission priorities of videotape upon its commercial use, without regard to preservation of either the carrier or the content. Here we see that the carrier is the priority, and early recordings using tape were only necessary for a

one-time rebroadcast for other US time zones. This has profound implications for the preservation of videotape in contemporary times. The other important note is the chronicling of Ampex as the producer of the first commercially used video recorder, as Ampex was also the first to bake tapes for preservation.

Quantegy Recording Solutions. History of Quantegy. 13 November 2010.
<http://www.quantegy.com/index2.html>

A very short history of Quantegy, which was the Ampex Corporation until 1995. History is provided by the company.

Rary, Rich. "Baking Old Tapes is a Recipe for Success". *The Association of Independents in Radio*. Radio World Magazine. 10 October 2010.
<http://www.airmedia.org/PageInfo.php?PageID=197>.

Originally written for October 1995 Radio World, this article gives practical step-by-step instructions for baking tapes. As a part of AIR's catalogue, it is written for the radio professional in mind

"Restored Magnetic Recording Media and Method of Producing Same." United States Patent #5,236,790. August 17, 1993. Ampex Systems Corporation. 14 November 2010. Retrieved through <http://richardhess.com/notes/formats/magnetic-media/magnetic-tapes/analog-audio/degrading-tapes>

The official patent for the tape baking process, awarded to Ampex in 1993. It includes background for the invention, a summary, a detailed description, and examples.

Richardson, Charles. Patent. Filed 17 Sept 2003. Inventor Charles A Richardson. 1938. 21 October 2010.
<http://www.google.com/patents?id=DxERAAAEBAJ&printsec=abstract&zoom=4#v=onepage&q&f=false>

Richardson's patent on his Rezerex project.

Richardson, Charles A. "Solving the Sticky Shed Problem in Magnetic Recording Tapes: New Laboratory Research and Analysis Provides a Safe and Effective Remedy." *Audio Engineering Society*. Convention Paper Presented at the 121st Convention. 5-8 October 2006. 4.

A summary of Richardson's project in pursuit of an alternative cause of sticky shed. In the paper he posits that sticky shed syndrome is the cause of the tape's backcoat, which can be removed, a process he patented. It is an interesting article because his initial sections deal with some of the issues surrounding tape baking controversies.

Rivers, Mike. "How To Bake A Tape". Josephson Engineering Microphones.
http://www.josephson.com/bake_tape.html

Mike Rivers is an advocate for baking tapes, asserting that the baking process cures tapes temporarily of their sticky shed syndrome. He also warns against baking tapes that have lubricant problems, not sticky shed. In this short article, Rivers provides a practical knowledge of the process of baking tapes from home. He describes how to convert an oven into a viable space for tape baking, offers the option of a convention oven, and details how to make a good oven with a cardboard box and a hairdryer. He approaches the process as if it were a recipe for cooking a meal, making this a great source for anyone wishing to make a hairdryer oven to bake tapes.

Sargent, Ralph N., 1941-. Preserving the Moving Image. Washington: Washington Corp. for Public Broadcasting, 1974.

This survey, written in 1974, offers a very technical approach to the makeup, recording processes and preservation tactics of both film and video. Sargent documents conversations with leaders in the field, in addition to providing specific case studies. His videotape section is of value to this paper, as he is very technical in explaining the historical processes of videotape creation and recording, as well as defining terms specific to the field, many of which occur as a result of binder degradation like dropout and print-through.

Television and Video Preservation 1997 : A Report on the Current State of American Television and Video Preservation: Report of the Librarian of Congress. Report on the Current State of American Television and Video Preservation., edited by Library of Congress. Washington, D.C.: Washington, D.C. : Library of Congress : For sale by the U.S. G.P.O., Supt. of Docs, 1997. (Pp87, 300, 382,)

Wheeler, Jim. Video Preservation Handbook. 2002. 10 October 2010. <http://www.media-matters.net/docs/resources/Traditional%20Audiovisual%20Preservation/WheelerVideo.pdf>.

A basic overview of the properties of tape, preservation concerns, and related issues meant to be a starting point for archivists and librarians who are in charge of collections. The article reviews care and handling, preservation management, and basic problems of tape. It also provides a thorough summary of tape history, beginning in the 50s with Ampex, in addition to a comprehensive glossary of terms, extensive appendices, and detailed bibliographies for further study.

Weise, Marcus and Diana Weynand. How Video Works: From Analog to High Definition, 2nd ed. Amsterdam: Focal Press, 2007.

A wonderful book on the ins and out of videotape, including helpful sections to this query.

