TAPE DEHYDRATION AS PART OF THE "JOURNALE" PROJECT: ON DEALING WITH STICKY-SHED SYNDROME

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The "Ö1-Journale" Project

The journal-radio-news program of the ORF radio-channel Ö1 (Austria 1) is, without doubt, among the important acoustic documents of Austria's recent history. After the broadcasting reform in 1967, the journals brought about a new form of radio news program. It was the result of a major change in information policy and radio legislation in Austria. Public discontent with the radio-news-program, which was very much influenced by the government, peeked in a national referendum in 1964, which requested that information in Austrian radio should be independent and a new legislation should confirm this. The radio news line "Journale" was a completely new type of broadcasting when implemented in 1967. Henceforth the central part of the radio-news for a day was, and still is the "Mittagsjournal", the noon-journal, a one-hour daily news broadcast, except on Sundays, with detailed information on current events from national and international politics, economics and culture.

The "Journale" project focused on the cataloguing, digitization, long-term-preservation and online presentation of the "Mittagsjournal". This centerpiece offers the largest spectrum of information. "Journale" are continuously moderated and the anchorman/woman offers a short introduction to each subject dealt with and to the contribution that normally follows. The contribution period has fluctuated over time, but nearly each one includes original audio of one or more people. Additionally moderators often interview people live in the studio. The "Journale" thus offers, day after day, a lot of "original voices", and very lively and complex insights into the current situation and common attitudes. The flexible structure of the program made it easy to stress very up to date topics and to deal with most current affairs. Among the other formats from the "Journale" series, the morning and evening journals came into the project selection, though not regularly, to expand and deepen certain thematic topics of the project.

Overall, the project covers the period from October 1967 to May 1973 and from May 1976 to December 1989. The period from 1967 to 1973 consists entirely of footage from the ORF radio archive. The second period from May 1976 to December 1989 was covered exclusively by archival holdings of the Austrian Mediathek.[16] The time-gap between the years 1973 and 1976 is mainly due to the strict financial and time framework conditions of the project.

The online platform

Over 4,000 tapes from the archive of the Austrian Mediathek have been digitized for the project. The archive format for long-term preservation is a high-resolution broadcast wave file; the format of the online platform is an mp3. Over 5,000 hours of air-time is accessible, free and unrestricted at www.journale.at, however, due to legal reasons, it is not available for download. Those 5,000 hours represent over 60,000 individual contributions to both Austrian and international issues on politics, economics and culture from 1967 to 1989.[17]

The initial situation

The tapes we had to deal with were AGFA PEM 369 semi-professional magnetic long-play tapes (polyester) on metal reels with audio content recorded at a speed of 3.75 inches per second. Out of the more than 4,000 digitized tapes, over 1,200 tapes were, and still are, affected by the hydrolysis effect, also known as the sticky-shed syndrome. All recordings from the year 1986 on are affected. This problem was more than a slight setback; the

16 http://www.mediathek.at
17 http://www.journale.at

whole project was in danger. Because of the rather tight budget and time frame of our project, a complicated and costly solution was not possible. The solution had to be technically as simple as possible, it had to have a serial processing character and it had to be cheap, really cheap.

Let's go a little bit deeper into the actual subject. Sticky-shed syndrome affected and endangered the whole workflow of the project, but what's it all about and how did it become recognizable in the first place?

Digitization at the Austrian Mediathek

After getting a magnetic tape out of the air-conditioned Archive, the first step is to evaluate the analog material, which means defining its tape speed, length and overall condition. The next step will be to write all this information in a special Job Database, which contains all the Metadata produced alongside the digitization process. Then the actual digitizing process takes place. In the case of the Austrian Mediathek that will be a 96 KH 24 Bit broadcast wave file with an mp3 at 128KB produced from this wave file. The magnetic tapes themselves are played on either Studer A807 or Studer A820 tape machines. Due to the fact that the magnetic tapes we had to deal with for the Journale-project were stored "tail-out", a method to prevent a print-through effect when playing them back which occurs after storing tapes for a long time, it was necessary to fast rewind them before we could start with the evaluation and the ensuing digitization.

The problem occurred

With tapes that were recorded up to 1986, the above procedure always worked. Suddenly, with tapes that were recorded from 1986, they exhibited the following effect: when trying to fast rewind the tapes we noticed that there was quite an abrasion on the tape machine. Besides that it seemed as if the tape was running clumsily over the tape head until it got stuck completely. It was not possible to work with audio material in this bad condition. So before we can talk about solutions to this it is necessary to ask why this effect occurs. What makes analog magnetic tapes become sticky?

Sticky-shed syndrome

Magnetic tape normally consists of a plastic backing — although the backing of older tapes was made out of paper and some of steel — which is covered by a layer of magnetic particles. This magnetic layer is made out of metal oxide that serves as the carrier of the information. In our particular case the sound is of radio news broadcasts. These two different materials, the plastic backing and the magnetic particles, are held together by a special binder that serves as a sort of glue. In the mid-1970s some of the major magnetic tape manufacturers started to change the mixture of this binder and, what they didn't know back then and what became only noticeable years later, is that the new formulation of this glue attracts moisture that leads to stickiness when trying to play back these tapes. It may also lead to the magnetic tape losing its contact with its plastic backing. In this context it's important to mention that not all tapes from a certain manufacturer are affected by Sticky-shed syndrome and among the ones that are in question there is very often a slight degree of difference in the severity of stickiness. What we can say from experience is that it is more likely that this has something to do with certain batches of production rather than with storing conditions or with a loose tape pack. It also has to be said that Agfa immediately changed the formulation of the binder as soon as the company found out, which to our knowledge was sometime in late 1990. The binder that was in use before contained polyurethane that soaks up water and causes the urethane to rise to the tape's surface. This attraction of moisture is also known hydrolysis.

Adverse impacts of sticky-shed syndrome

Normally it's not really obvious and, in many cases, one cannot really see whether a tape is sticky or not by just looking at it. You may have to put it on the tape machine and start playing it. This leads to yet another problem: not only is the tape itself decomposing in its parts and the quality of its recorded content getting worse, but this will also lead to the contamination of the tape machine itself. The binder and the magnetic coating of the tape pass over the tape machine and adhere to the tape head and the stationary guides as well as to other rotating parts of the machine that the tape touches.

The problem manifests itself mainly in two different ways: either the sound files become more and more dull and hollow, or the tape cannot be played back at all. Examples of affected sound extracts can be found on our website.[18] Another typical symptom is a squealing noise when trying to play such a tape, sometimes oxide is even torn off the tape. Tape produced in the 1970s and 1980s is especially susceptible to break down as the oxide coating separates from the tape. The worst-case scenario is a completely contaminated tape machine plus damaged or torn magnetic tape. In addition to that it is obvious that a loss of magnetic particles means an irreversible loss of quality and information.

A look in the WWW

We were quite shocked about these effects when we first noticed them and they really endangered the whole online project. Nobody really knew how to deal with it so we started researching on the Internet only to find out that there were many archivists who were dealing with the same kind of problem. Other, and sometimes quite big, institutions were facing the problem of sticky tapes. Titles of articles we found on the web dealing with the problem range from "Tapes with Sticky-Shed Syndrome", "Dealing With Sticky-Shed Syndrome" to "Baking Audio Tapes Which Have 'Sticky-Shed Syndrome'" and the unusual yet accurately titled: "If I Knew You Were Coming I'd Have Baked A Tape!"[19] The repeatedly given answer in online discussion forums about tape machines and magnetic tapes leads in one special direction: baking!

This is still a wide subject and there are many possibilities when it comes to "baking" analog magnetic audiotapes. One archivist even told us about a baking contraption made out of a

18 http://www.mediathek.at/oe1_journale/Wissenschaftlicher_Aufsatz_Eins/Tape_Baking.htm
19 http://www.tangible-technology.com/tape/baking1.html

cardboard box, a hair dryer and a sugar thermometer. What is evident in the discussions on sticky-shed syndrome is that some audio archives use convection ovens that carefully create a uniform temperature with internal fans that evenly circulate hot air. We soon realized that this equipment is not cheap! Even for a rather big institution like the Austrian Mediathek with a collection of well over 400,000 objects this is a large purchase and who knows how often and how long we will need and use these ovens. But then there was another rather unusual solution: food dehydrators!

The practical implementation

For 150 Euro the Austrian Mediathek found drying devices made by a Swiss producer, including temperature adjustment and active warm-air circulation, a 12 hour timer and 3 drying trays. The 3 drying trays enabled us to "bake" 3 tapes in one dryer, with the same steady temperature and in an environment where the air is constantly circulating. So we started baking or rather drying our sticky tapes with these kitchen appliances.

6 dehydrators were in simultaneous use. 3 tapes per unit were dried at the same time, making a total of 18 tapes per day. We treated the tapes for 2 hours on one side, 2 hours on the other side, at 55 degrees Celsius. This process rendered playable tapes for digitization.

As for the digitization, with a workstation for 3 tape machines and a workstation for one tape machine provided by NOA audio solutions, the output in an 8-hour workday could have been up to 24 tapes, theoretically. However, dealing with problems such as broken playback equipment, updates and maintenance work of all kinds, the actual daily output was reduced to

somewhere between 12 to 20 tapes per day. This was not a major problem because the digital output matched rather well with the number of dried tapes. After a short period of time, between 10 to 14 days, the hydrolysis effect slowly starts to build up again. Within three weeks the effect is almost completely back. So it is not advisable to wait longer than 10 days after drying a tape to digitize it. What we dried one day, we digitized the following day.

The permanent failure of the years 1986 to 1989 would have introduced an additional time gap for the project. The whole project goal was in severe danger. Using these domestic dehydrators provided a simple, time-effective and cheap solution. In total, the dehydrators cost less than €1500, a financial burden, which was borne by the Austrian Mediathek itself, because the equipment will provide continued good service when needed.

Experimental studies

In preparation for this article we once again picked up ten of the tapes from the archive that we knew were sticky and started to digitize them right away without further cleansing or "baking". The results were again, after about two years of not having touched them, disillusioning. All of the tapes sounded hollow, some of them were not playable at all and some made the tape machine stop almost immediately. Another point to mention is that the azimuth value which should be around zero is much harder to control with these tapes than under "normal" conditions.

Next, we dehydrated the tapes in the food dehydrators again for 2 hours on each side at a temperature of 55 degrees Celsius (131 Degrees Fahrenheit) and digitized them again. All of the tapes were playable without contaminating the tape head or other parts of the machine; none of them showed signs of clumsiness and even the azimuth value was easier to control than before. So these tapes would have been able to be digitized without any further abrasion of the iron oxide coating or even risking a tape-rupture. And they sounded ok!

But we waited for another three weeks before we digitized the tapes again to see if hydrolysis was already starting to affect the quality of the tapes. And indeed, it did. The tapes again showed signs of stickiness and a loss in quality when played back. Some of them were not even playable at all! After dehydrating them a second time, they were without any problems ready to be played back and transferred to a digital device.

Lessons learned

What insights concerning the handling of tapes affected with sticky-shed syndrome did we gain during the implementation of the "Journale"-project? The main advantage of dehydrating sticky tapes as described above is apparent. First and foremost, it is cheap and effective. Furthermore, we think it is a sensitive way of getting rid of that unpleasant effect. Even for private collectors who want to digitize their audio material, this is an affordable and reasonable way of solving the problem. The quality does not audibly getting worse and, in our experimental case, this can be said even after dehydrating the tapes more than once (although we do not recommend that). Even the frequency level shows no differences compared with an unaffected reference tape.

Some advice

Before we come to some final remarks we would like to give you some advice in case you want to start dehydrating your analog tapes in anticipation of digitization.

First of all, do not dehydrate magnetic tapes on plastic reels but rather transfer them to metal hubs first. Although the chances are slim and some experts say that this will not be the case at these temperatures, plastic reels can warp and become deformed by heat.

Do not rewind or play the tape before you bake it, unless of course you want to exchange the plastic reel for a metal one, this will just further add to more damage on both the tape and

the tape machine. The problem here is that you do not really see whether a tape is affected by sticky-shed syndrome before it is placed on the machine and let run for a few seconds. Don't go any further than this and if you are not sure whether it is an affected tape or not, rather bake it before you risk destroying it. However, another proposition that we read about quite frequently contradicts this advice, which is to try to achieve an even pack before baking. Baking uneven tapes may damage the edges because they get too warm and this causes lasting artifacts in the stereo sound. The decision is yours as to whether it is better to have an even and tight pack or no further abrasion of oxide from the tape when you decide not to fast wind it before the dehydration process.

Furthermore make sure you are dehydrating your tapes at a stable and steady temperature as mentioned above. It is necessary, therefore to have a thermostat, which is normally included in a standard food dehydrator. Afterwards, return the tape to its box and let it cool for approximately 24 hours as a precautionary measure. The fact is that not all playback machines are equally gentle and a tape that is still warm is more likely to stretch than one at normal temperature.

Our experience showed that tapes could be baked more than once. Nevertheless do not attempt this until unless absolutely necessary: try to digitize the baked tape within the 2 week time frame. The quality definitely does not getting better if you perform the baking procedure over and over again for pure listening purposes.

In the discussion following a presentation at the last IASA conference held in Frankfurt earlier this year a colleague recommended wrapping the tapes in plastic bags and including silica gel to absorb moisture. So far we haven't attempted this technique; however we consider this to be another possible way of prolonging the positive effects of the dehydration of sticky tapes.

Final remarks

In contribution to a research project of the German Rathgen Institute in Berlin, a scientific institution for conservation and restoration, we sent some tapes from the archive of the Austrian Mediathek for further analysis of the impact that sticky-shed syndrome has on the chemical level for magnetic tapes. Experts at this research institute are trying to find out more about what actually leads to hydrolysis in magnetic tapes and what happens during the dehydration process in order to reverse sticky-shed syndrome. With this information it might be possible to figure out an ideal temperature and duration of dehydrating magnetic tapes affected by sticky-shed syndrome. Results of this study are expected soon and will be published on the Rathgen Institute website.[20] We are excitedly looking forward to hearing about their findings in order to gain an even better understanding of what actually happens during the process of dehydration.

There are still a lot of unanswered questions about how and why some tapes tend to become more sticky than others and why this effect does not hit some at all or only to a smaller degree. Let's hope that research studies as the abovementioned may cast a brighter light on that problem. Meanwhile, what we tried to show in this paper was how a renowned and representative audiovisual archive like the Austrian Mediathek is dealing with the problem of magnetic audio tapes affected with sticky-shed syndrome in a down to earth but nevertheless effective and — as far as we can tell so far — harmless way.

Sticky-shed syndrome is not a question of the correct way of archiving magnetic audiotapes. Even in the best and most ideal preservation environments, tapes can get sticky and binders can start to decompose. The problem we are dealing with here is inherent in the material and its chemical composites itself. Our experience shows that with the described method so far no audible aggravation of the audiotapes is recognizable and it is possible to preserve and transfer analog audio content into the digital era, where, yet again, new forms of problems are waiting to be solved.

20 http://www.ilkar.de