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DVDs: The Other Vintage Moving Image Media

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Mixed Media: Working with Audio and Visual Materials—

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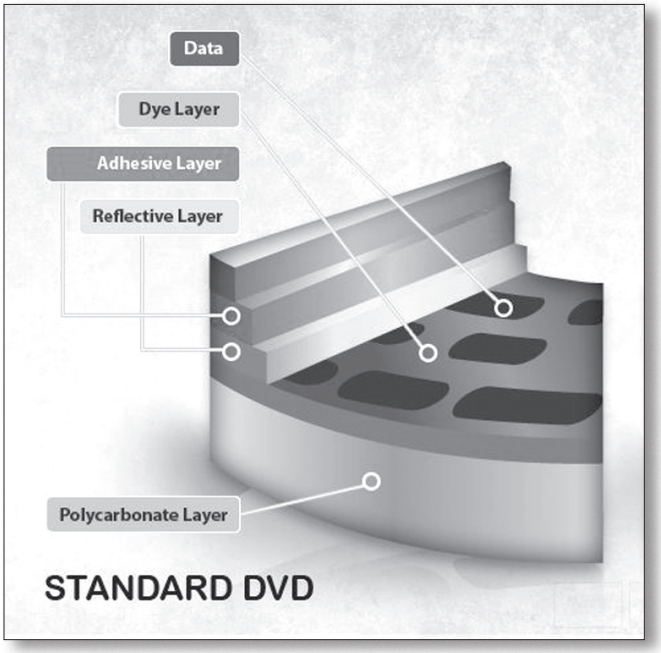
DVDs: The *Other* Vintage Moving Image Media

By Paul Eisloeffel, Nebraska State Historical Society

Over the years within these pages we've explored the most common forms of vintage moving image media: motion picture film and videotape. But one medium has thus far escaped our gaze, one that is still in widespread use but like the others is itself destined for obsolescence: the video DVD. It's the *other* vintage moving image media we're all likely to encounter in our collections.

DVDs are optical discs. They (and their little brother, the compact disc) are media that use light technology (specifically, laser light) to retrieve the digital data stored on them. The grandfather of the modern video DVD was the laser vision disc, which was developed during the 1970s to store analog video signals. While this didn't last all that long in the commercial world, the basic idea of a disc played by the use of a laser light beam was borrowed by the compact disc (CD), which was standardized as a digital audio replication format in 1982. In 1985, the CD-ROM was born—a disc used for general data storage. The DVD (digital video disc or digital versatile disc) was introduced in 1995, with enough increased storage capacity to hold large video files.

To understand DVDs and care for them, it's important to know something about how an optical disc works. In its simplest construct, it is a thin disc encoded with binary data in the form of "pits" (or depressions) and "lands" (or flat surfaces) on a special material that makes up one of the disc's layers. A laser reads the pits and lands as zeros and ones (respectively), and software translates this into picture and sound (or other data). A standard DVD can hold up to 4.7 gigabytes of data.



There are four basic types of DVDs (and this goes for CDs too):

- **Pressed discs.** These are the mass-produced, prerecorded discs you can buy with movies or other data on them. The pits and lands are pressed on these in manufacture, much like the process used in making vinyl records. You can't record on these.
- **ROM.** These "read only memory" media are generally used for storage of data. They won't play on video DVD decks.
- **R.** These are "recordable" discs on which a laser etches, or "burns," pits and lands. While you can add data to them until they're filled up, you can't erase or rerecord over the existing data. R discs also come in dual-layer and double-sided versions, with capacity of up to four times the standard 4.7 gigabyte DVD.
- **RW.** These are "rewritable" discs on which a laser can essentially "melt" the previously recorded data and record new data in its place.

This sounds complicated, and it is. Consequently, the physical makeup of a DVD can be complicated—more so than film or videotape. Nevertheless, there are similarities with film and video—specifically, it's all about *layers*:

- **Base (or body).** This is made of a polycarbonate material, a transparent polymer with temperature resistance, impact resistance, and optical properties. This makes up most of the thickness of the disc.
- **Data layer.** The makeup of this layer depends on the type of disc. ROM discs use metal (usually aluminum). Recordable (R) discs us a photosensitive organic dye—cyanine, phthalo-cyanine, or azo. Rewritable (RW) discs use a phase-changing metal alloy film. In any case, this is the layer on which the pits and lands are stamped or burned.

- **Reflective layer.** This can be aluminum, silver, silver alloy, or gold. It reflects the laser beam back to the photosensor in the laser head.
- **Adhesive layer.** This helps bind the others together.
- **Protective layer.** This adds more polycarbonate.

In addition to these functional layers, an optical disc might also sport a printed label or printable surface. Recordable DVDs that are dual-layer and/or double-sided have the most layers of all, because some of the layers are repeated.

What about optical disc *longevity*? Tests indicate that some DVDs (specifically the recordables) can last for a few decades; most, though, for only five to ten years.[1] But this is a somewhat meaningless measure. Even as you read this, DVDs are becoming the latest in a long line of obsolete media. In reality, a DVD will last only as long as the technology still exists to play it.

Now, let's consider the *vulnerability* of DVDs. How fragile are optical discs, really? Well, they share some vulnerabilities with motion picture film and videotape. Like film and videotape, optical discs go bad mostly because they have not been stored, used, or handled properly. And like film and videotape, mechanical, biological, and chemical factors contribute to their deterioration.

Mechanical damage is mainly in the form of scratches or cracks. These are most likely to be caused by improper handling. The polycarbonate base is all-important here, because that's what the laser shines through. While it gives the disc its foundation and rigidity, it is actually a relatively soft plastic that can be easily compromised. Really, anything that interferers with the laser light's ability to focus on the data layer is a bad thing.

Playing a disc will not harm it from a friction standpoint, because the laser makes no physical contact with the disc. Playback can have a detrimental cumulative effect, as the laser light affects the layers. But if this happens at all, it would only be after several thousand playbacks.

Biological damage comes in the form of the same mold, mildew, and fungus that can attack film and videotape. This happens in environments of high humidity and heat.

Chemical damage can happen within the layers themselves and is sometimes known by the general term "disc rot" or "data rot." The polycarbonate can become cloudy. The dyes are unstable, degrade over time, and are especially susceptible to UV light. The reflective layer (except the gold ones) can oxidize. Label glue can leach into the protective layer, or handwritten ink labels can damage layers. Of course, dirt and debris can contaminate the surface of the disc, which can cause abrasion and make it difficult for the laser to read through to the data layer.

As with videotape, physical examination alone may not identify every problem that an optical disc has, but it's a start.

- Examine the case. If it's visibly stained or otherwise damaged, the contents may have suffered as well.
- Check for odor. If a disc smells musty, it may be contaminated by mold or fungus.
- Examine the bottom surface of the disc and the edges. Mainly you're looking for scratches or chips, or evidence that layers have begun to separate. Look also for dust, dirt, or other foreign matter.
- Check the color of the underside. Discs with gold coloring will generally be of the best quality.
- See if you can identify the manufacturer. Sometimes this will be noted on the inner hub. The bigger names (JVC, Mitsui, MAM-A, Taiyo-Yuden, Sony, Maxell, etc.) might indicate a more robust manufacture. Store brands are more suspect.
- Try to play the disc in a trusted machine. Since it's laser based, trying to play a disc won't harm it. Playback will detect problems with data retrieval. Do this only after the disc has been cleaned.

Ideally, discs are best stored upright (like a book) in "jewel" cases that secure the disc by the center hub. Polyethylene and polypropylene cases are best. Since it's the underside of the disc that is vulnerable, some cases will "float" the disc so neither side touches the case. For greater economy of space, discs can also be stored in powder-coated cabinets or acid-free boxes, with each disc in a Tyvek sleeve.

Here are some other preservation tips:

- Store away from sources of UV light.
- Always handle a disc by its edge or center hole. Don't bend or flex the disc.
- Cool, dry storage is the way to go. Generally, storing discs at a low temperature and low relative humidity will increase useful life, since chemical degradation is reduced in these conditions. Store at 55 degrees F and 45% relative humidity. Fluctuations should not exceed +/- 5 degrees F or 5% RH.

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treatment decisions should be left to a professional with extensive experience.

It was exciting to explore the topic of adhesives in conservation with the four presenters and the experienced professionals in the audience. Adhesives are complex materials that can have serious implications for the preservation of library and archives collections. Reviews from the colloquium attendees have been very positive, and we look forward to hosting the next event on another preservation or conservation-related topic in late 2016.

Notes

1. V. Horie, *Materials for Conservation: Organic Consolidants, Adhesives, and Coatings* (Boston: Butterworth-Heinemann, 1987).
2. Jane L. Down, Maureen A. MacDonald, Jean Tétreault, and R. Scott Williams, "Adhesive Testing at the Canadian Conservation Institute: An Evaluation of Selected Poly(Vinyl Acetate) and Acrylic Adhesives," *Studies in Conservation* 41, no. 1 (1996): 19–44.
3. Bibliographies and tables of information on both precoated repair materials and cast composites, as well as cellulose ethers and leather consolidation, can be found on Reidell's website at sarahreidell.com/research.
4. Merrily A. Smith, Norvell M. M. Jones II, Susan L. Page, and Marian Peck Dirda, "Pressure-Sensitive Tape and Techniques for Its Removal from Paper," *Book and Paper Group Annual* 2 (1983): 101–13.
5. Descriptions of Weaver's workshops are available online at gawainweaver.com/workshops.

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- It is best to avoid adhesive labels, inks that contain solvents, or sharp writing instruments that can scratch the surface when labeling a DVD. If you must hand label a disc, use a water-soluble or alcohol-based soft marker made for optical discs and write on the clear inner hub. Inkjet-printable, thermo-printable, silkscreen-printable, and Lightscribe disc labeling methods appear to be nondestructive.
- Clean a disc by blowing off any dust with canned air and wiping with a clean cotton or microfiber cloth, from the center of the disc straight to the outer edge. Commercial cleaning solutions are available, as are machines that clean and polish discs, and these are generally useful.

Scratches on the polycarbonate base of a disc, which can render it unplayable, can be approached in two ways: filling in the scratches, or sanding the base down to remove the scratches. Many "home remedies" for filling in scratches, ranging from white toothpaste to liquid car wax, can be effective. Sanding the polycarbonate is a more invasive but more permanent solution; machines made specifically for sanding can be had, and many gaming businesses offer the service. In either case, a good cleaning and polishing is in order.

As a further preservation measure, a repository may opt to save the data on a video DVD to a more stable medium, like a backed-up server (assuming the disc is not copy protected). Typically, a video DVD's data is stored in a VIDEO_TS folder. This folder contains various files: the .ifo files, which tell the playing device what to do; .bup, or backup files; and most notably, .vob (*v*ideo *ob*ject) files. .Vob files are wrapper files that hold the majority of the data on the disc, including the video (in MPEG-2 format), the audio, and any subtitles, and correspond to chapters of the video. Saving the entire contents of the VIDEO_TS folder can help to preserve both the content and the interactivity of a video DVD. Media conversion programs can also convert a video DVD's .vob files to another video file format, but the disc's menu system and other interactivity will not be replicated this way.

So, as we have seen, DVDs certainly aren't perfect as media go. Yet they are both likely to be found in archival collections and are (for now) a viable tool for reference use. Which recordable DVDs are best to use? Type R (not RW) with a gold reflective layer and phthalo-cyanine dye seem to be the most robust. But, in any case, we shouldn't count on optical discs for long-term archival storage of digital video or other data. They're really an access or temporary storage tool at best.

Note

1. One disc has been developed that, according to its manufacturer, will last 1,000 years (see mdisc.com). This "Millennial Disc," or "M-Disc," uses a stone material as a data layer. Nevertheless, as with other obsolete formats, the devices that read and write such discs will likely not last as long as the media.