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When Good Discs Go Bad

Ever wonder what makes a disc bad? Here's why they vary in quality, and why you should worry about the discs you've entrusted with your data.

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Burning CDs and DVDs is the easy part.

Knowing your data will be there when you go back to it days, months, or even years later--well, that's a bit harder. Not all discs are created equal, as Fred Byers, information technology specialist at the National Institute of Standards and Technology, can attest.

Byers is part of a team heading up an independent study of DVD media quality. Based on the first wave of testing results, the situation is murky at best.

"We've found the quality varies, depending upon the type of dye used to make the write-once discs and [on the] the manufacturer," reports Byers. Even discs from the same manufacturer, with the same brand, can test differently, Byers adds. "But there was more of a significant difference when you compared discs between manufacturers," he explains.

DVD Media Quality: The First Tests

In the first phase of testing, completed late last year, NIST focused on the most popular media: write-once, single-layer DVD-R and +R discs. Rewritable discs will be tested in the second phase, slated to start this fall. An interesting footnote to the study's methodology: NIST uses media purchased off store shelves and via Web sites; and while researchers are tracking the media by brand, they are not tracking the specific factory source of the media tested. For example, a given manufacturer's discs could originate from different production lines, which could account for a variation in disc quality by the same manufacturer.

Hearing that there's a difference between the generic, unbranded 100-spindle value-pack of media purchased online and the branded offerings you might find on a Best Buy store shelf is not surprising. After all, as David Bunzel, president of the Optical Storage Technology Association, points out: "With a generic product, there's no consumer recourse. It's buyer beware."

If a disc isn't properly manufactured, the consequences can be dire. At best, the disc will fail immediately during the burn process; this is a best-case scenario because then you know from the start that the disc is faulty. At worst, you may get an abundance of errors during the burn process. These errors won't interrupt the burning process, and since write-once and rewritable DVD media have built-in error correction to compensate for scratches and other abnormalities on the disc (as do their CD cousins), any errors will be virtually invisible to you. You'll only know they're there if you use a disc diagnostics program, such as those offered by Ahead Software or Plexor. Nor will these errors affect the playback of the disc--initially.

Down the road, however, such invisible-to-the-eye errors can reduce the effectiveness of a DVD's built-in error correction so that if some other issue develops on your disc, such as a scratch, you could end up with an unreadable disc when you go back to it months or years later.

But what would cause such a wide disparity in media quality between branded discs from the same vendor?

"We don't know why it's different--it could be a different dye, it could be a different manufacturing process," notes Byers. "Manufacturers are constantly trying to improve their dye formulas--in theory improving the disc."

Nonetheless, at the same time, competitive forces are driving manufacturers to find ways to economize on production costs. And cost-cutting measures can result in discs that don't perform as well as those generated during an earlier production run, either in terms of failing outright or not burning at the maximum possible speed on a given DVD drive. "It varies over time, as the output changes," Byers says.

Brand Disparity

As for the disparity between brands that NIST found, the distinguishing factors come down to quality control and the dyes used in disc production. Declining to name names, Byers points out that "some manufacturers make their own discs, and some purchase them from someplace else--which opens you to variations in the manufacturing plant, or changes in the source [of that media]."

Vendors like Maxell and Verbatim manufacture discs on their own production lines, as do Asian manufacturers CMC Magnetics, RiData, Taiyo Yuden, and others; other name brands contract with a third-party manufacturer to produce discs to their own specs; and still others just buy third-party-produced media wholesale, without imposing their own set of quality controls on the media production.

The intricacies of disc production and quality control aren't the only variables that seem to affect media. More surprising is the number of discs that seem to have a propensity for specific hardware.

"One thing we've found in compatibility testing [of DVD-R and +R media] is that it's a relationship between a specific brand of media and the manufacturer of the hardware," observes Byers. "There was no one drive that played every single type of compatible media, and there was no one media brand that played perfectly in every drive."

And, he adds, sounding as frustrated as any consumer might, "You can't say there's a clear, delineated set of reasons as to why."

A Grading System?

One of the most common questions I hear is, "What's a good brand of media to buy?" DVD and CD media are so commonplace nowadays that it's easy to forget the complexities that go into producing them. And if anything in that production process is off, it could, in time, affect the integrity of the data you've burned to a disc.

"It's very tough to answer that kind of question, because there are so many variables," says Byers. "You don't get 100 percent yield when you manufacture these discs. We can talk about the materials that produce a good disc, but it also has to do with the manufacturing process. So, just to say the materials to look for doesn't necessarily relate to it being a better disc." The same is true vice versa.

So how can you know that the media you're using will last you for the duration, so those archived photos will still be there when you go back to a disc 20 years from now--or more?

For the moment, you can't. All DVD and CD vendors make vague claims about disc life expectancy being somewhere

between 60 and 100 years--when the discs are treated with care and stored properly.

But NIST's Byers is seeking to change that. At an OSTA meeting in San Francisco this week, Byers is proposing an industry-wide grading system to indicate disc quality.

Byers is motivated by the desire to see a uniform mechanism in place to guide institutions and individuals who'll be storing data, music, videos, and images for long periods of time. "They need to be confident in their purchasing, so they can plan for their strategies in storing their information," Byers says. "Long-term storage has different meanings: For some, 30 years might be enough. For others, 50 or 75 years might be archive, or long-term, quality."

Longevity

Under Byers's proposal, a series of tests would be developed to determine whether a DVD would last for a given number of years. "If you were to purchase a disc in a store with a grade that indicates it has passed a test to last X number of years, it removes a lot of uncertainty for the consumer, and it can save some expense in premature migration [to a new storage technology], or loss of data because they waited too long [and the disc was no longer playable]," he says.

Although some archivists--both individual and professional--are concerned about whether today's digital storage mediums will be readable 50 or 100 years from now, Byers believes the bigger concern for users will be when to migrate their data to the next technology, "before the existing technology is obsolete."

The Disc Rot Myth

Media obsolescence isn't the only thing people fear after committing a personal library's worth of data to CDs and DVDs. But some worries--namely, fear of disc rot--are not fully warranted.

Like a bad seed, the myth of disc rot self-perpetuates, cropping up every now and again as a sudden and mortal threat to your copious collection of prerecorded and self-created discs.

The myth was once rooted in fact. It is true that back in the 1980s, with the first generation of prerecorded audio CDs, the edges of the discs were not always sealed properly, which allowed moisture to get into the disc. Replicated, prerecorded discs use aluminum for the reflective layer; when moisture came into contact with the aluminum on prerecorded discs, explains Byers, it in turn oxidized, causing the aluminum to become dull. "That's where the term 'rot' started," he says.

But that problem was quickly identified and overcome. "The manufacturers learned what was going on, so now the edges of discs are sealed with a lacquer," according to Byers. Though the problem is typically associated with CDs, Byers notes that the potential for interaction with oxygen is the same with both CD-ROMs and DVD-ROMs.

The so-called rot issue does not apply to recordable discs. For one thing, recordable optical media do not use aluminum; instead, they use silver, and very rarely gold, or a silver-gold alloy, for the reflective layer. "If the silver comes into contact with sulfates [i.e., pollution, or high humidity], it could affect the silver, but the likelihood of that is less than the likelihood of moisture coming into contact with the aluminum on prerecorded discs," says Byers.

Enduring Myth

The term rot has persisted, however inaccurately, as a means of identifying a plethora of problems with optical discs. "If you get a faulty disc and see a problem that you can visually see, you call it rot, but it could be the way the disc was manufactured," says Byers. "Or if it was subjected to extreme moisture and that moisture came into contact with the aluminum, it could be that the reflectivity has changed. It's not really rot, it's oxidation of aluminum. It should be a rare event on a disc, unless it's defective."

Beyond the realm of defective discs, improper handling can cause otherwise good discs to go bad. Since there's little protection between the label side of a CD and the data layer itself, "scratches on the label side can scratch the metal, and that will ruin the data," says Byers. It's not an issue for DVDs, though, since the dye layer is sandwiched between two plastic layers.

Byers observed a similar problem occurring with press-on labels: "For long-term storage, we recommend not using press-on labels on CDs; when these start to dry up, they can peel the metal right up, damaging data."