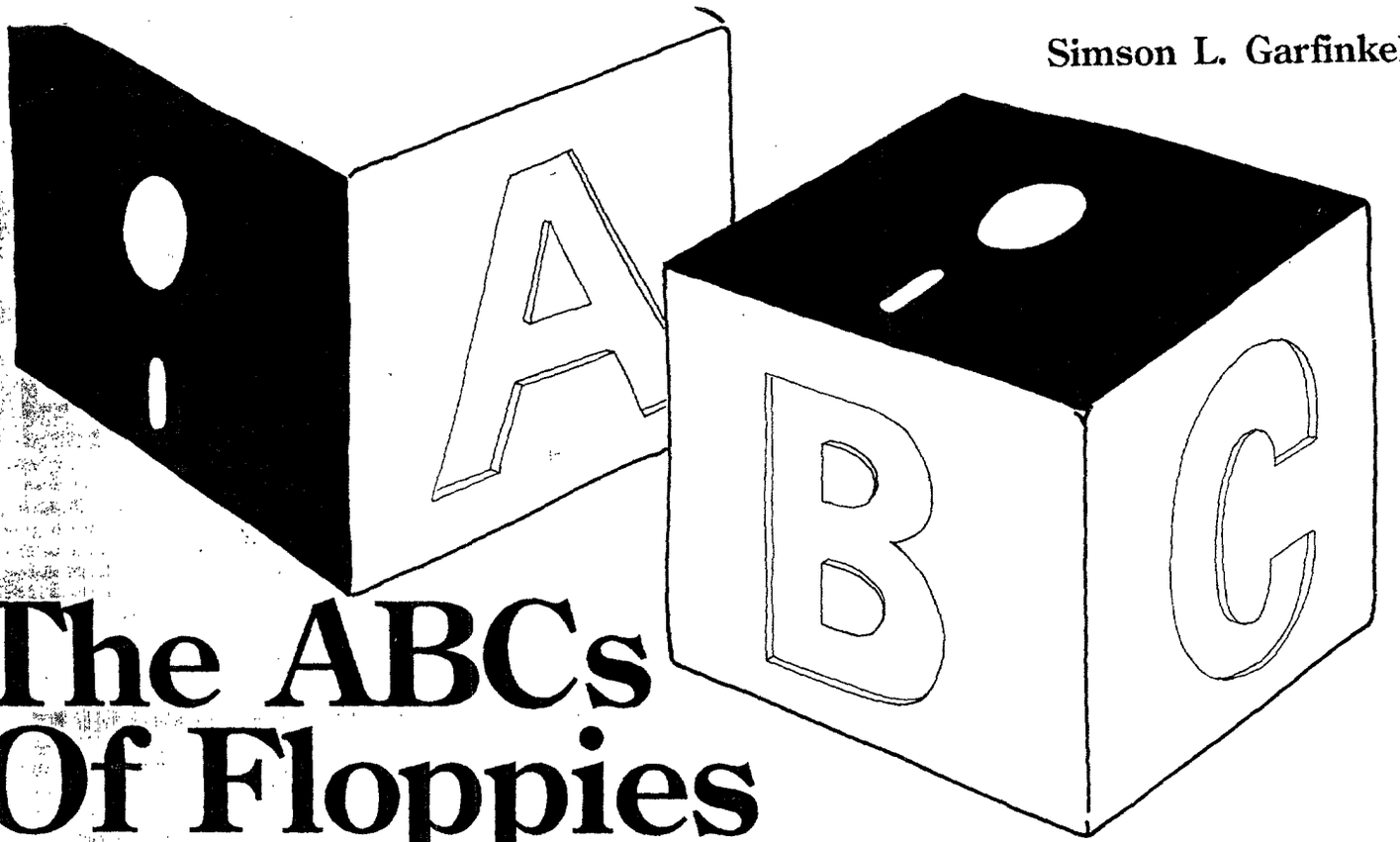
Simson L. Garfinkel



The ABCs Of Floppies

We take you on a behind-the-scenes look at how floppy disks come into life and how they withstand the test of time.

What makes a single-sided floppy disk different from a double-sided one?

How many years will the data on a floppy disk last if the disk is properly stored?

What should I do with those plastic sleeves that the 3.5-inch disks come with? Use them for storage, or throw them out?

Burning for the answers to these questions, I spent the day visiting the BASF manufacturing plant in Bedford, Massachusetts. While BASF makes only five percent of the floppy disks used in the United States (according to Dave Bunzell at the Santa Clara Consulting Group in California), the company has unique expertise in the field of magnetic recording technologies: After all, BASF invented the magnetic recording tape in 1934.

Just off Route 3 in Bedford, Massachusetts, is BASF's domestic floppy disk production facility, where "several hundred thousand disks a day" come off the production line, says Sigmar H. Tullmann, director of marketing in the computer media division of BASF's Information Systems. If that seems like a lot of disks, realize that in 1987, over 750 *million* disks were sold in the United States, says Bunzell.

The disks are assembled in a huge, squat, windowless building set back about 200 feet from Crosby Drive. I was shown through the facility by William J. Kelly, product manager of the diskette division. First, we put on "clean-suits" that covered our hair, clothes, and shoes. Then we entered the main assembly room through an air-lock, which blasted us from the sides with jets of air designed to remove any dust that might have stuck to the outside of the special clothes.

The first part of the tour was how minifloppies (5.25-inch disks) are made.

The assembly area is a colossal room that runs nearly the width and length of the entire building. At the back of the room is a twin pair of Bernal machines, the size of pickup trucks, that make the disk's jacket — the soft, black PVC plastic shell that surrounds the "cookie" of the magnetic media.

Between the cookie and the PVC jacket is a fibrous liner, which cleans the minifloppy every time it spins in its jacket. Five times a second the Bernal machine binds 10.5 inches of liner to a strip of PVC. It then punches out the unfolded jacket.

Stacks of these jackets are carried to a device that looks like a tailor's steam press, which folds them in half (along the bottom edge) and then folds down the side flaps, welding the jacket together. The jacket is now sealed on three sides. Each Bernal machine uses a slightly different "tacking pattern" for the welds, Kelly said, which makes it easy for engineers to trace problems with the welds back to the particular machine that caused them.

Next, the "cookie," (given its name, Tullmann says, "because it's punched out just like a cookie,") is burnished and inserted into the jackets. All of BASF's cookies are manufactured in Germany and sent to the United States in large, sealed canisters, Kelly says.

Stacks of the cookie-and-jacket assemblies are taken to the testers, where robot arms pick up each one and insert them into special drives. The drives write a testing pattern on both sides of the disk, from track number 79 to negative 5, and try to read it back. The test takes about 45 seconds. If the second side of a disk fails, it's sold as a single-sided disk. But since 10 percent of the floppy disk business is for single-sided disks, and since the rejection rate is "a whole lot less than 10 percent," Tullmann says, a lot of double-sided disks end up being sold as single-sided disks. If you're willing to take a chance, using single-sided disks as double-sided ones can be a bargain, although BASF, naturally, doesn't recommend the practice.

Stacks of the certified disks are taken to another station, where the top edge is sealed. At the final station, the hub reinforcement ring is applied and the test pattern is removed by an alternating magnetic field. Each disk is stamped with a lot number. Only then is the manufacturer's label applied.

"Cost and quality go together. The lousier your quality, the higher your manufacturing costs," Tullmann says. BASF has found that the failure rate of their disks has dropped as more of the production process has been automated.

Microfloppies (the 3.5-inch disks used on the Macintosh and laptop computers) are manufactured by a similar process, except the two halves of the cases are separately molded and welded together ultrasonically. Microfloppies have an additional step, in which the disk's metal shutter is crimped on and the spring is inserted. Each shutter is then opened by a robot arm, and an electric eye watches the shutter close. Any disk with a shutter that takes too long is thrown out. "This is a very difficult operation, so we do a lot of checks on it," Kelly says.

In the middle of the room is a machine called an "interchange

modulation tester." The tester is a computer with eight disk drives from eight different manufacturers. The idea is to measure how tolerant the disk is of differences between different drives. "We tried to find the worst drive we could," says Edward Clark, the plant's quality control manager. The ease with which a disk can be recorded on one drive and played back on another is a function of how carefully the disk's center hole (or in the case of the microfloppies, the disk's hub) is manufactured, Clark says.

The BASF plant makes both minifloppies and microfloppies; all of the company's 8-inch-disk production has been centralized in Germany because of the relatively low demand. In 1987, 8-inch disks accounted for only 4 percent of the disks sold in the United States, according to Santa Clara Consulting. Minifloppies accounted for 77 percent, while microfloppies made up 19 percent.

I asked about the plastic sleeves on the microfloppy disks and got a discussion about dust: Microfloppies, which record information at 135 tracks per inch (TPI), are much more sensitive to dust than minifloppies, which record at only 40 TPI. This means that a particle of dust that might not obscure a whole track on a minifloppy can obscure up to three tracks on a micro. But the hard plastic case and the shutter protect the disk inside far better than the plastic jacket of a minifloppy. "If you have a library box, [the plastic sleeve] is probably not needed," says Clark.

Without a box, the added protection of the plastic is welcome. "The greatest enemy of magnetic media is dirt and dust," says Clark. "Anything you can do to keep them from getting in is [a bonus.]" But the real purpose of the plastic sleeve, Clark says, is to protect the disk in shipping. He also admitted that it's there because the customer expects it to be there.

How long will the information on a disk last?

If the disk is stored well, Tullmann says, the answer is indefinitely. Disks should be stored in a room with comfortable temperature and humidity. Ideally, disks should be stored standing on end, "like a book," to minimize the pressure on them. "What destroys diskettes is people: stapling notes on them, shoving them in the drawer, walking across them—especially with cleats," Tullmann says.

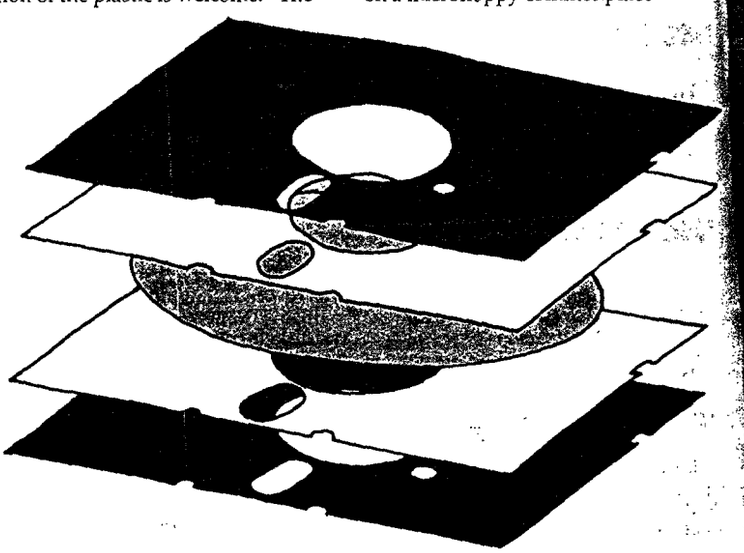
"We've taken disks out of fires, whose jackets had been completely destroyed by the fire-fighter's water," he says. He advises computer users in a similar situation to: "Take a new disk and open the jacket. Throw the [new] cookie away," he says, and insert the old disk. In most cases, the disk will be readable.

"The real experience suggests that if you treat the stuff okay, it lasts," he adds. "The real problem is the drive—[After a while], nobody makes the equipment to play it back."

Back in the factory is a corner called the "weartesting lab." BASF guarantees that its disks will complete 10 million revolutions—two weeks of constant spinning—without losing any data (dirt, grime, and equipment problems excluded). In the weartesting lab, they have dozens of floppy disk drives constantly spinning. "We write on the track and keep reading till we've lost 20 to 25 percent" of the signal strength, Clark says. Sometimes the disks last for months.

The lab also has a bunch of disk drives in an oven at 125 degrees Fahrenheit, which is the maximum operating temperature specified by the American National Standards Institute. "I've seen the front of some of the drives curl up," Clark says, but the disks survive the torture.

Tullmann sees 5 to 10 megabytes on a microfloppy commonplace within 4 to 5 years. "The real question isn't the availability of the technology. It's the demand. If IBM and Apple are able to perform successfully with their current systems, there's no pressure on them to explore new technology." Without one of those companies backing a high-density disk, Tullmann doesn't think such disks will ever gain wide market acceptance. ◻



Simson L. Garfinkel is a freelance journalist and computer consultant living in Somerville, Mass. Copyright 1989 by Simson Garfinkel.