Chapter 1

Optical Storage: It's All in the Pits

In This Chapter

- Defining the disc
- Understanding how stuff is saved on a disc
- Examining the insides of CD and DVD drives
- Understanding the different types of optical media
- Comparing tape, disks, and hard drives with CD and DVD
- Checking your system requirements
- Saving different types of stuff
- Taking care of your discs

When's the last time you really looked at a CD? I mean *really* stared at it, in rapt fascination? Believe it or not, CDs used to be enthralling!

CDs and DVDs are now both staples of the technical wonderland that you and I live in. Unless you're older and you were around long before 1980 — the days of disco, *Charlie's Angels,* and Rubik's Cube — you won't remember the lure of the compact disc. In those dark times, before the introduction of CDs, music lived on huge, clunky vinyl albums. Computer software was loaded on floppy disks. Movies? They were kept on videotapes. (Remember *those?*)

At first, this situation wasn't a bad one — at least until you kept these old-fashioned storage media for a year or two. Suddenly, you would find that those records had picked up scratches and pops. Computer programs were growing so large that they would span five or six floppies. And sooner or later, those floppy disks and movie videotapes could no longer be read reliably; after a mere 100 viewings or so, you would end up buying another VHS copy of *Enter the Dragon.* (Okay, so I'm a big Bruce Lee fan. Substitute your favorite movie instead.)

Like a circular knight in shining armor, the arrival of the CD heralded the beginning of the digital consumer age. I'm not kidding; I can remember an entire room of technotypes jumping with excitement just to *see* their first compact disc! (None of us could afford an audio CD player, and computer CD-ROM drives hadn't arrived yet, but it was great just to see a real CD.) In the beginning, audio

CDs brought us crystal-clear sound and the convenience of jumping instantly from track to track. Then, computer software suddenly fit on one CD, and the software could always be read reliably. With the advent of DVD, widescreen movies are accompanied by luxuries like alternative soundtracks and interviews with the cast and director. Would you go back to anything less?

In this chapter, I introduce you to the basics of compact disc and DVD storage: You don't have to know *all* this stuff before you jump into recording your own discs, but if you understand the basics of what's going on, you avoid mistakes. (Always be prepared.) I promise to tell you along the way about what you absolutely need to know. You find out how discs store information, video, and music as well as what's inside your CD or DVD recorder. I cover what types of media you can use and what you can store. Finally, I show you how to properly care for your optical pets. (You may not stare wistfully at CDs like I used to, but you still have to keep them clean.)

Always Begin with a Definition

In this case, let me start by defining the now-familiar term *CD-ROM* — short for *compact disc read-only memory*. (I've shortened this to *CD* throughout this book, which will save about 200 trees by the time I've finished.) This high tech description simply means that a CD stores information of some sort that your computer or audio CD player can read but can't write to (which makes the CD-ROM drive different from a hard drive, for example, which you can both read from and write to). In general, I use the word *disc* to describe both CD-ROMs and DVD-ROMs; they're both similar, read-only, and look very much alike.

Keep this in mind: Whenever folks refer to just a CD-ROM or DVD-ROM drive (without using the word *recordable*), they're talking about the drives that just read discs and can't record them.

Dig that crazy acronym!

I have to use a truckload of acronyms in this book. Luckily, each one has only one meaning, right? Almost! One strange exception applies: You may be wondering what DVD stands for, and as the mondo author expert, I *should* be able to tell you.

When DVD-ROM technology was first introduced, everyone agreed that it stood for *digital versatile disc read-only memory* because it could store so many types of data. Although a CD can store music and computer files, it doesn't have the room for a full-length movie at the highest-quality level. DVD-ROM was the first optical media to hold all the different types of digital information we use today: lots and lots of data, an entire movie, or even super-high quality audio. Hence, the word *versatile,* and everyone seemed happy. (You find out how to cram

huge amounts of stuff on a DVD-ROM in the section "Ready for stardom: DVD-R/W" later in this chapter.)

At some point, however, those first owners of DVD-ROM players who weren't acronym aficionados decided that DVD stood for *digital video disc* — and for a time that was true because DVDs were first used for only movies. This name situation leaves us in a quandary because more and more folks think *video* rather than *versatile.* Naturally, it doesn't matter a hoot because everyone just uses the acronym anyway, but it does make a killer trivia question!

The basic specifications of both audio CDs and data CDs (those discs you use in your computer) are the same; they're 12 centimeters in diameter and a millimeter thick, and they have an opaque top and a reflective bottom. Such is the Tao of the disc.

As you can see in Figure 1-1, however, the structure of a mass-produced disc isn't a single piece of plastic. It's made up of a number of layers, each of which has something special to add to the mix:

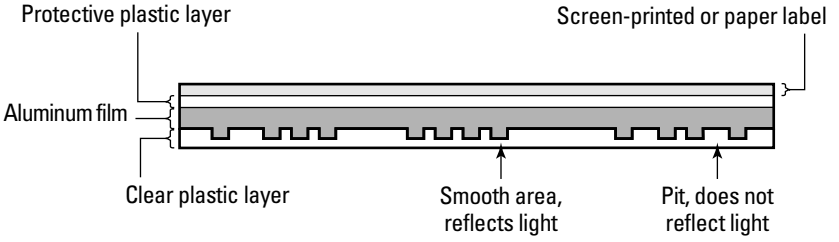


Figure 1-1: And you thought that a CD was just a piece of plastic!

- **A label:** Commercially manufactured discs you buy in the store have screen-printed labels; these graphics are created from layers of ink applied one on top of the other (like that Metallica T-shirt you may be wearing).

  What's that, you say? You don't have $2,000 or so to spend on a special CD screen printer? (Come to think of it, neither do I!) In that case, do what I do and use your inkjet or laser printer to create a fancy paper label, complete with the graphics and text you choose (more on this topic in Chapter 14).

  "Do I really need a label?" To be honest, no. A disc you've recorded works fine without one. However, if you've ever dug through a 6-inch stack of unlabeled CDs to find that *Andy Williams Greatest Hits* disc you burned a month ago for Aunt Harriet, I *guarantee* that you will understand. If you don't need a professional look and you're not into appearances, just use a CD-marking pen and scribble a quick title on top. Most recordable discs have blank lines printed on them for just this purpose.

You can pick up one of these handy pens at any office supply store, but make sure that you buy a pen designed especially for marking CDs.

- **Opaque plastic:** You need something to protect the top of the disc. I suppose that you could use steel, but then a disc would weigh two pounds and cost much more. Therefore, the manufacturer adds a layer of scratch-resistant plastic.
- **Aluminum film:** Mass-produced CDs use a thin layer of aluminum that's covered with microscopic indentations called *pits.* These pits are arranged in a single, tiny groove that spirals around the disc, just like the groove on one of those antique record albums. (If something works, why mess with it?) However, the groove on a CD starts at the center and spirals to the outside of the disc, so it goes in the opposite direction.
- **More plastic:** Again, all that shiny aluminum has to be protected — however, in this case, the plastic must be crystal-clear (for reasons that soon become apparent), so the manufacturer adds another layer. Here's a hint about why this layer is clear: It has to do with the passage of laser light.

As I mention earlier in this chapter, this yummy sandwich is a cross-section of a commercial CD produced at a factory — the discs you record are different in one important way, which I cover in a minute.

DVDs are similar to CDs in construction, but, as I remind you from time to time, commercially produced DVDs can be double-sided (so you can flip them to watch the second half of a really long film, like *Das Boot* or *Gone with the Wind*). Therefore, they may not always have a label side, in which case the sides are marked around the spindle hole.

How Is Data Recorded on CDs and DVDs?

Consider just how audio, video, and computer files are stored on CDs and DVDs. Although these three types of information are different, they're stored in the same way: digitally. But what does that word really mean?

Programmers, technotypes, and hardware jockeys use the word *digital* when they're talking about *binary,* the language used by computers around the world. Unlike the imprecise languages spoken and written by mere humans, binary data is built from only two values — 0 (zero) and 1, which are often referred to as Off and On, respectively shown in Figure 1-2. (In fact, a computer is only a huge collection of switches, but that's another story.) Therefore, computer files, movies, and digital music are long lines of 0s (zeros) and 1s. If you sat next to a light switch for 100 years and flipped it off and on in the proper sequence, you would have the visual version of a digital song from a CD (and a bad headache along with incredibly sore fingers).

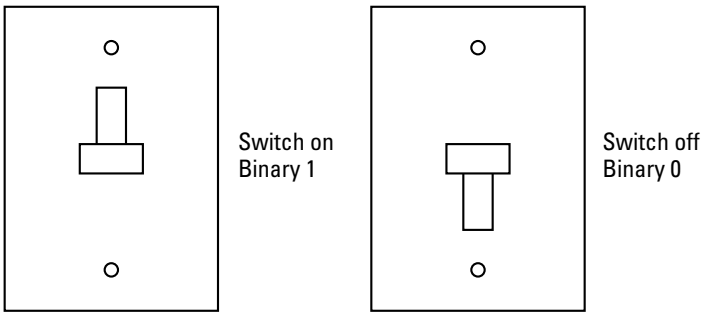


Figure 1-2: All that information is just a big bunch of binary 1s and 0s.

Now that you're privy to the binary master plan, you can see how the absence and presence of light perfectly represents binary data — a room is either dark or bright. The geniuses who developed CD and DVD technology took this concept one step further! They had the great idea of using a laser beam to read the binary data stored on a disc, and that's where those pits in the aluminum layer that I mention in the preceding section take center stage.

Figure 1-3 shows how the binary data is read: When the laser beam hits a pit on the surface of the disc, the beam scatters, so most of it isn't reflected back: hence, darkness, which in this case stands for a 0 (zero) in binary data. If the laser beam hits one of the flat surfaces — they're called *lands,* by the way — the beam is reflected cleanly back, and the drive senses that reflected light. (Think of a 1 in binary.) And, ladies and gentlemen, that is why the business end of a disc shines like a mirror; the rainbow effect is caused by the microscopic groove that runs across the surface. Naturally, this process happens very fast (I talk about speed in Chapter 2), but that's really all there is to it.

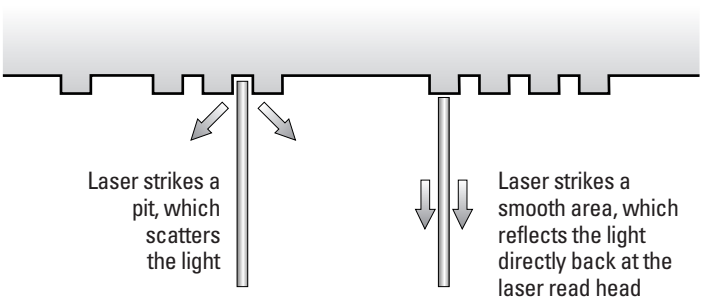


Figure 1-3: The surface of a CD or DVD, as read by your friendly neighborhood laser beam.

Essentially, DVD technology works the same way — with a difference or two. A DVD-ROM can hold the approximate equivalent of seven CDs, and Figure 1-4

shows how: The pits on a DVD-ROM are much smaller and are packed closer together on the surface of the disc, and the drive uses a much more powerful laser beam to read them. DVD can also have multiple reflective layers. (That's the reason that data can be stored on both sides.)

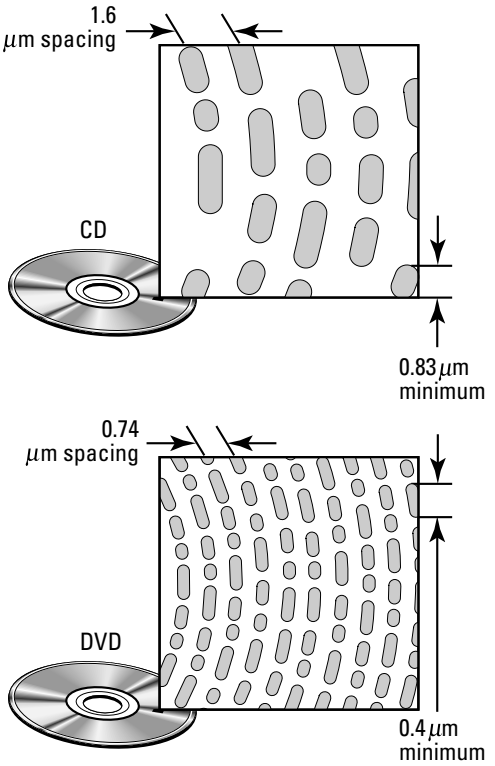


Figure 1-4: Compared with a CD, the pits on a DVD-ROM don't have much elbowroom.

Believe it or not, the DVD specification standard provides for double-sided DVD-ROM discs that have *two* layers on each side, for more than 27 CDs' worth of storage space on a single DVD-ROM! However, these discs are so hard to manufacture that they're on the endangered species list, and I've never actually seen one.

It's All in the Dye

Consider the structure of recordable discs, which includes both recordable CDs and recordable DVDs. Remember the aluminum film that I mention in the section "Always Begin with a Definition" earlier in this chapter? Sounds permanent, doesn't it? Indeed it is, which is why you can't use commercially

manufactured discs to record your own data; your recorder has to be able to create the equivalent of pits and lands in some other way. (Not even Bill Gates has a CD-R manufacturing plant in his house.)

Figure 1-5 shows the answer as well as a really bad pun. The CD-R (short for *compact disc recordable*), which can be recorded once, uses a layer of green or blue reactive dye under a smooth reflective surface of either aluminum or gold. The groove is still there, but until the disc has been recorded, the disc is perfectly empty. This dye permanently melts or darkens when hit by a laser beam of a certain frequency, which results in a pit. (As you find out later in the chapter, a number of DVD recordable formats are currently on the market, but things work the same.)

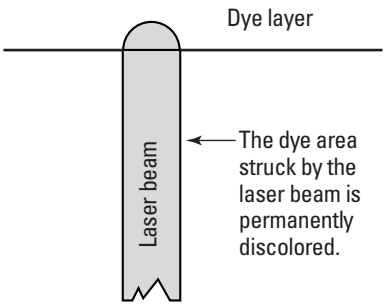


Figure 1-5: Make pits the old-fashioned way — burn them!

"Hang on, Mark — wouldn't the beam from my regular read-only CD-ROM or DVD-ROM drive cause problems?" Good question, but the designers of recordable CD and DVD drives have you covered. The laser beam that is used to read a disc is far less powerful than the beam used to record one. Therefore, when the beam from the laser in your CD-ROM or DVD-ROM drive hits one of these dark spots, the beam is swallowed like an apple pie at a state fair, so it acts just like a pit in a mass-produced CD. In fact, your read-only drive is completely fooled . . . it can't tell the difference.

Why all the different colors?

I get asked this question all the time. Some CD-Rs, DVD-Rs, and DVD+Rs are gold with a green dye, and others are silver with a blue or purple dye. Everything acts the same: You're just looking at two different recipes for the dye used by different manufacturers. Most drives record on either type of disc, but in rare situations, an older drive seems to work better with one or the other color combination. Personally, I think that it has something to do with the alignment of the planets and the phase of the moon, but I must report what I hear.

On the other hand, CD-RWs and rewriteable DVDs use the same type of crystalline layer, so they're all colored the same.

The inside of your CD or DVD recorder sounds like it's getting a little crowded with all these different laser beams, but it's really not. A recorder has a beam that can be set at two levels: a lower power setting that can read a disc and a higher setting to record it. Slick, eh?

A CD-RW, which is short for *compact disc rewriteable,* is another story. (Get ready: You're going to *love* this description. It honestly sounds like something out of *Star Trek* — the original series, not any of those later failures that don't have Captain Kirk.) Here goes: Both rewriteable CDs and DVDs use a "phase change recording process" using a "crystalline layer with amorphous properties" rather than a dye layer. Didn't I tell you? It sounds like something Spock would say! You can promptly forget that stuff because nobody but an engineer cares, and no one gives a test afterward.

Anyway, although the crystalline layer starts out clear, the correct type of laser beam can change it to opaque, creating — you guessed it — a pit. When you're ready to erase the disk, that same beam of laser light resets the crystalline layer to clear again, and you're ready to record all over again. Talk about recycling!

Behind the Curtain: Inside CD-RW and DVD Drives

Before I delve into the depths of your hardware, I want to make one thing perfectly clear: *You do not have to read this section!* In fact, if raising the hood on your car and just looking at the engine gives you a headache, I encourage you to skip this section entirely. It's definitely not necessary to know what makes your drive tick.

Still here? I didn't scare you away? Good! If you're like me, and cool machinery like your recorder fascinates you, stick with me and read on! In this section, I show you the interior guts of your CD-RW or DVD recorder.

The motor

Because pits are arranged around the entire disc, something has to turn it — in this case, an efficient, high-speed electric motor. (No coal or gas here, Bucko.) The motor turns a spindle, which holds the disc by the hole in the center — yet another similarity to vinyl record albums!

The laser stuff

A CD-ROM or DVD-ROM drive has a laser read head, and a recorder has a read head that can be set to variable power levels. When you read a disc, the laser beam is focused through a lens upward toward the surface of the disc; if the beam is reflected by a land, the light travels through a prism to an optical pickup. In turn, the pickup yells to your computer (in effect) "Hey, I just passed a land back there, so add a 1 to the file."

When a drive is recording, the laser beam is switched to its higher power; the beam simply travels up to the surface of the disc and creates a pit by discoloring or melting the dye layer in one tiny spot.

How does the laser get around the entire surface of the disc? It's on a moving track that can move forward and back between the center and outside edge of the disc.

The tray

The tray is self-explanatory but still pretty doggone important: You need some method of inserting and ejecting discs. Although most drives use a tray that extends to hold the disc, some integrated CD-RW and DVD drives use a slot with a motor-loading system that draws the disc inside the drive (just like a car audio CD player). Older drives used a thin plastic box called a *caddy* — you opened the caddy and stuck the disc inside. Although you would be hard pressed to find a new CD-RW recorder that uses a caddy, some high-capacity DVD-RAM recorders now use them to help protect the disc. (More on DVD-RAM in the section titled "The rewriteable warehouse: DVD-RAM" later in this chapter.)

The controls

Your recorder is certain to have an eject button and probably also a headphone jack and volume control for listening to audio CDs. More expensive drives can go a step further with more audio CD controls, like Pause, Play, Next Track, and Previous Track.

The emergency hole

I know that it sounds weird, but every drive has an *emergency disc eject hole*. Think of it as being similar to the ejection seat in a jet fighter plane or one of those cool emergency airlock controls that crops up in every science fiction

horror movie. (How many times has Sigourney Weaver blasted something nasty into space by slapping a button?) You can use this microscopic hole on the front of your drive to forcibly eject a disc whenever your drive has locked up or if a disc is caught inside. To use the emergency eject, push the end of a paper clip or a piece of stiff wire into this hole. This technique usually works even when there's no power to the drive.

Love Those Discs: CD-R, CD-R/W, DVD-R/W, DVD+R/W, and DVD-RAM

If you've been reading this chapter at a single sitting, you may have a media-induced headache by now. No, I'm not talking about the nightly TV news — I mean all those different kinds of discs I mention from time to time in this chapter. You may have read a little about CD-R and CD-RW in this chapter, but it's high time that I identify each of the five types and fill in all the details. This section does just that.

"Hey, can't I buy just one drive?"

Yes. In fact, I've installed an all-format Sony drive in my Batcomputer; the drive can handle everything in that list except DVD-RAM. (Ah, there's the rub.) If you're already the proud owner of a CD-RW drive, I can assure you that it can't be upgraded to record DVDs — on the flip side, any DVD recorder can record CD-Rs and CD-RWs. (Hence their growing popularity. Versatility is always A Good Thing.)

You'll often see kindred write-once and rewriteable formats grouped together as a single name: For example, CD-R/W actually stands for CD-R *and* CD-RW. (Remember, a CD-RW drive can also record CD-Rs.) Likewise, DVD-R/W stands for DVD-R and DVD-RW, and — you guessed it — DVD+R/W includes both DVD+R and DVD+RW.

First on the block: CD-R

In the beginning, there was the CD-R, and it's still by far the most popular media on the market. A typical CD-R can store anywhere from 650 to 700MB (megabytes) of computer data or 74 to 80 minutes of audio. (The higher numbers are for higher-capacity, 80-minute CD-Rs.) You can also stack more stuff on a CD-R by using the overburning feature; read more on this rather nasty-sounding feature in Chapter 2. As I mention earlier in this chapter, after you've filled a CD-R to capacity, there's no turning back; the data is permanently recorded and can't be erased.

Other sizes of CDs are indeed available — for example, discs with a diameter of 8 centimeters that can hold 184MB — but they're so specialized that you and I can safely ignore them. Some higher-capacity CD-Rs that can hold more than 700MB have hit the market, too, but they're not compatible with older CD-RW drives.

Time for the first Mark's Maxim for this book:

If you need compatibility, think CD-R.™

Take heed: Any CD-ROM drive — no matter how old — can read CD-Rs, and they're the only discs that are guaranteed to play in any home or car audio CD player. In other words, use CD-R whenever

- You're recording a disc to send to someone else.
- You're recording an audio CD for playing on anything other than your recorder.
- You're not sure whether a drive reads a CD-RW.

Reusable and loving it: CD-RW

The CD-RW is the most common rewriteable media on the market right now. It can store 650MB (74 minutes) of audio. A CD-RW must be formatted before you use it, just like a floppy disk or your hard drive; most discs come preformatted from the manufacturer. You also have to reformat the disc if you want to erase its contents.

Did you read about the amorphous crystalline stuff I mention earlier in this chapter? On the positive side, that's what allows your CD-RW drive to erase the disc and use it again. On the downside, however, most read-only CD-ROM drives that are older than three or four years old can't read a CD-RW disc, and a CD-RW can't be used in older audio CD players. Use CD-RW whenever

- You're recording a disc for use on your computer, like a backup.
- You're sure that another CD-ROM drive (or audio CD player) can read a CD-RW.

How can you tell whether a CD-ROM drive can read CD-RWs? Many manufacturers add a MultiRead symbol to their faceplates; if you're still unsure, try reading a recorded CD-RW in the drive (don't worry — you won't hurt the hardware). If you can load files from the CD-RW, you have a MultiRead drive. An audio CD player that supports CD-RW is likely to announce the fact in its documentation or specifications.

Ready for stardom: DVD-R/W

Perhaps I shouldn't say "ready for stardom" — heck, in the video world, the DVD-ROM has already overtaken the traditional VHS tape. (I don't suppose that makes Betamax VCR owners feel any better, but every dog has his day.) DVD-ROM is also poised to take over the reign of CD as the media of choice for virtually every new computer on the planet. But what about recordable DVD?

Unfortunately, things are still a little tenuous in the world of recordable DVD standards. However, two format standards are now in use and are (in my opinion) destined to win any turf battles. Luckily, they correspond pretty closely to the world of recordable CDs.

The first of these standards is the DVD-R, which is short for — you guessed it — *DVD recordable.* Like your old friend the CD-R, a DVD-R can be recorded only once. However, the DVD-R can hold a whopping 4.7GB (that's gigabytes, friends and neighbors) per side of the disc, for a total of 9.4GB of data on a double-sided disc. DVD-R is the darling of the video-editing crowd because it allows you to record a disc that can be used in a standard DVD player. Naturally, the DVDs you create with a DVD-R drive can't be read on a standard CD-ROM drive (but you can burn regular CD-Rs and CD-RWs).

On the rewriteable side, the standard is called DVD-RW. (Note the dash there; it becomes pretty important in a page or two.) These discs can also store 4.7GB, and you format them very much like a CD-RW. Any DVD-ROM drive should be able to read a DVD-RW. Unfortunately, not all DVD players can read DVD-RWs, so if you're an up-and-coming Hollywood type that's interested in producing your own movie discs, you should stick with the DVD-R standard (which is compatible with all DVD players).

Oh joy, what confusion: DVD+R/W

Okay, here's where everything gets a little hairy. No, that plus sign isn't a typo: Two other completely independent DVD standards, DVD+R and DVD+RW, are available as well. These two more recent formats are being touted by an entirely different group of computer hardware manufacturers. (I suppose that they needed different names — but couldn't they have chosen something *easier* to remember? Whatever happened to the guy who chose the name *Microsoft Bob* for an operating system? By the way, I still have my copy.)

Anyway, DVD+Rs and DVD+RWs can store 4.7GB, and a DVD-ROM player can read both types of discs. Again, however, you run into the same problem — DVD+Rs are compatible with most DVD players, but DVD+RWs aren't widely supported by DVD players. Plus, DVD-R/W and DVD+R/W are incompatible. (Insert sound of my hand slapping my forehead here.)

In fact, these two disc formats are roughly equivalent — DVD+R/Ws are cheaper to manufacture, though, so they may eventually get the nod. (Of course, if you buy an all-format drive like mine, you don't really give a darn about that plus or minus. I can record both DVD-R/W and DVD+R/W, smiling quietly to myself all the while.)

If your DVD recorder is limited to one format or the other, take care when you're buying DVD media! Make *doggone* sure that you remember which type of discs your recorder can burn — you'll be deluged by the choices on store shelves, and it's easy to mistake DVD-R for DVD+R if you're not careful. (Some readers have told me they're considering a tattoo to help them keep things straight.)

The rewriteable warehouse: DVD-RAM

Finally, there's good old DVD-RAM — a rewriteable disc that can store as much as 9.4GB of data by using both sides. (Remember, a double-sided DVD doesn't have a standard label; printing can appear only around the spindle hole.)

DVD-RAM is well-established, and there's no "plus" format competing for fame and fortune. DVD-RAM is a great option for storing those huge digital video files, and because DVD-RAMs are reusable, I find them the best media for backing up my hard drives. Note, however, that most DVD-ROM players can't read a DVD-RAMs, so use one of the other DVD formats if you're recording something to distribute to others.

What's Wrong with Tapes, Disks, and Removable Media?

Nothing, really! It's just that they're antique technologies compared with rewriteable CDs and DVDs. In this section, I list the most important reasons that optical beats magnetic hands-down.

Here I go, continuing my own personal crusade against the Great Pretender: the archaic floppy disk. I strongly recommend that you *never keep any data of value stored exclusively on floppy disks!* They are the most unreliable media on the planet — they're easily demagnetized, they don't hold much, and they often can't be read by other computers.

More reliable

First (and to many folks, most important), a rewriteable CD or DVD provides permanent storage with a high degree of reliability. Unlike magnetic media — including tape cartridges, floppy disks, and even Zip disks and hard drives — a CD or DVD doesn't stretch or demagnetize. As long as you keep your discs clean, reasonably cool, and free from scratches, you should be able to read them without error for a century or more. (I don't know about you, but I don't know just how important my tax returns will be in 100 years; then again, I want my priceless family photographs to last as long as possible!) Discs have no moving parts to wear out, and they don't rust.

Higher capacity

Forget about storing 700MB of data on a floppy disk! Even the latest Zip disks are simply no match for the 9.4GB capacity of a double-sided DVD-RAM. All that room comes in handy for backing up your system's hard drive, too.

Cheaper

Have you priced a stack of 50 blank, 700MB CD-Rs these days? At the time I wrote this book, I could find that 50-pack all over the Internet at $15; a 50-pack of 650MB CD-RWs is about $30. DVD-RAM prices are hovering around $15 for a 9.4GB disc, and 4.7GB DVD-Rs are selling for about $35 for a 50-pack.

As you can imagine, the lower the cost per megabyte for a storage method, the better, and no other type of media can beat recordable CDs and DVDs. And, if the current trend continues, prices will just drop lower. Ain't life grand?

Faster and more convenient

If you've ever waited for a tape to rewind or a floppy disk to load, you've wished for a faster method of loading your stuff — CDs and DVDs feature fast access time, and there's no rewinding. To put it another way, even if something did fit in the tight space of a floppy disk, would you want to run that program from that floppy? Unlike tape drives — which must move linearly from one section of tape to another — you can jump directly from one part of a disc to another instantly. Take my word for it, this speedy delivery makes restoring files from a backup *much* faster!

Compatibility

Virtually every PC that's still running these days has a CD-ROM drive, so compatibility is a big advantage to recordable CD for folks like software developers, network administrators, and your Uncle Milton. To put it another way: Ever tried to stick a Zip disk into your car audio player? 'Nuff said.

"What Do I Need in Order to Record?"

You knew that there would be a catch, didn't you? You're probably thinking, "I bet that I have to have a $1,000 software program and a cutting-edge computer to record discs." Not true, good reader, not true! It used to be that way when I wrote my first book on CD recording (*Recordable CD Bible,* written in the ancient mid-1990s), but CD and DVD recorders are now tame and lovable creatures. They ask for only the basics — in fact, if your computer came with a CD or DVD recorder already installed, you can skip this section because you're likely to have everything you need.

What you need for Windows

Here's a list of the basic minimum requirements you need for DVD recording on a PC running Windows 2000 or Windows XP:

- **A Pentium III PC (or better):** You need at least 64MB of memory and 1GB of free hard drive space (for a CD recorder). If you're recording DVDs, you need up to 6GB free.
- **A CD or DVD recorder:** Naturally, you also need the proper connection. Internal recorders use Enhanced Integrated Drive Electronics (EIDE) or Small Computer System Interface (SCSI) connections. External recorders can use SCSI, Universal Serial Bus (USB), or FireWire connections. If you're using an external drive, it should come with the necessary cables you need.
- **Recording software:** Most recorders come bundled with some sort of software; if your computer already has a recorder, it probably also came with the programs you need to burn your discs.
- **Blank media:** Naturally.

What you need for the Macintosh

Here's a list of the basic minimum recording requirements for a Macintosh running Mac OS 9 or Mac OS X:

- **A PowerPC Mac of any speed with at least 64MB of memory and 1GB of free hard drive space:** Again, you need up to 6GB if you're recording DVDs.
- **A CD or DVD recorder:** Most Macs use external recorders with SCSI, USB, or FireWire connections.
- **Recording software:** Mac OS X allows you to burn discs from the Finder menu, and you can burn discs from within iTunes as well. Other commercial recording programs are available, like Toast from Roxio.
- **Blank media:** Gotta have it.

If all this talk of connections is making you nervous, don't worry: It's all covered in rich detail in Chapters 2 and 3, including what you need to know before you buy and install a drive.

"What Kinds of Discs Can I Record?"

This question is the easiest of all to answer: Everything! If you can use it on a computer, listen to it in your stereo's CD player, or watch it on your DVD player, you can record it using either a CD or DVD recorder.

Later in this book, I take you step-by-step through the creation of different types of discs; for now, this section gives you an overview.

Briefcase backup

Never heard of that term? It's my own; I always carry a *briefcase backup* when I'm traveling with my laptop. Because my computer has a CD-ROM drive (and the notoriously small hard drive found on most laptops), I record on a CD-R any files that are specific to my trip. PowerPoint presentations, Word files, contracts, digital audio and video — even an offline copy of my Web site — they all fit on a briefcase backup. Therefore, my trip-specific data doesn't take up space on my laptop's hard drive, and it's protected from damage. Plus, copying any of that data to my client's computer if necessary is a cinch: No cables, no network configuration — just pop the disc in and read files and programs directly! (My mom always said that I had potential.)

Computer files and data of all sorts

If it can be stored on your hard drive, you can store it on CD or DVD as well. This includes

- Files and programs
- Digital images
- Sound clips
- Web sites
- Backups

Digital audio

With a CD-RW drive, you can record standard audio CDs for use in any audio CD player, mixed CDs that have both audio and computer data, and MP3 discs that can be enjoyed on your computer and some audio CD players. Plus, you can extract, or *rip,* tracks from existing audio CDs and record them on a new disc in any order you choose.

Digital video

A CD-RW drive can create standard Video CDs for your Video CD player, and a DVD-R/W or DVD+R/W drive can create interactive DVDs with your own digital video.

Network storage

If you have data that is accessed often but never changed on your home or office network, record that data to a CD-R and load it in your file server's CD-ROM drive. (Getting your network administrator's help with this process is a good idea — those folks can get very nervous about such initiatives.) Now you can still access every byte of those files, but you're not using precious network hard drive space and you don't have to worry about backing up that information.

Photo discs

You can use your CD-RW or DVD recorder to create slideshow discs with images from your digital camera or with scanned photographs.

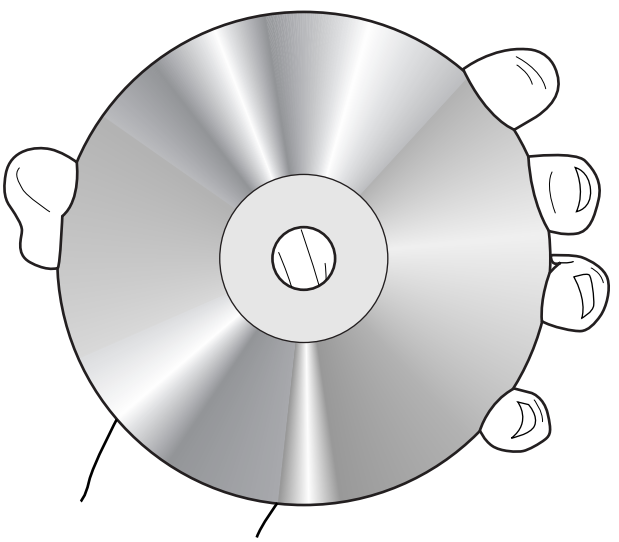
Caring for Your Optical Pets

I tell you earlier in this chapter about how CD and DVD are nearly perfect storage media — but notice the word *nearly.* You have two or three outstanding methods of ruining a disc; the trick is not to become proficient at any of them, so in this last section I cover the best ways to use, clean, and store your discs.

You gotta grip 'em by the rim!

Let me sound like your mother for a second: Take a good, close look at your hands! When was the last time you washed them? Reading data from a disc covered in fingerprints and dust is a touch-and-go process at best because the laser beam has to work harder to get through all that crud twice (especially on DVDs because the data is packed even closer together). Therefore, you must find out how to hold a disc properly.

In my travels, I've encountered two methods of comfortably holding a disc for a decent length of time. You can even jog or tap dance when using these holds — whatever floats your boat. Either hold the disc by the outside edge, as shown in Figure 1-6 or — if your fingers are small enough — create your own spindle with a convenient finger, as shown in Figure 1-7.



Fingers grip on outside edge

Figure 1-6: I call this the Wilt Chamberlain hold.

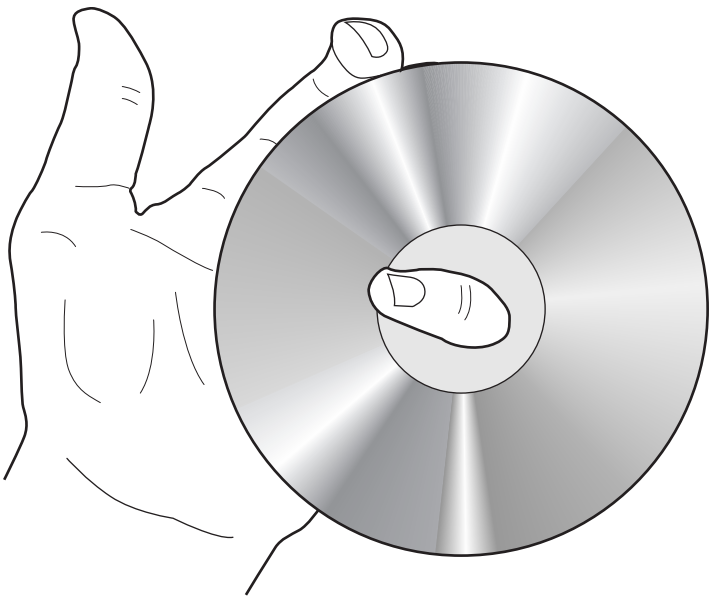


Figure 1-7: Look, Aunt Harriet, I'm a spindle!

It's time for a dire Mark's Maxim:

> **Never touch the underside of a disc, and never put a disc down (label-side up) on any surface.™**

Flipping a disc over and setting it label side down for a second or two is okay, but put the disc back in its case as soon as possible.

The deadly enemies

To keep your discs safe and avoid skips or data read errors, shelter them from these archvillains:

- **Pointed objects:** Scratches are taboo, and that goes for either side of a disc.
- **Heat:** How would you like to spend a hot summer afternoon in a closed car, baking on the seat? Underneath all that high tech, a disc is basically a circle of plastic. Keep your discs cool and out of direct sunlight: A warped disc is a terrible thing to behold. (Your audio CD player may not be able to read it, either.)
- **Surface crud:** This includes liquids, dust, dirt, and peanut butter.

You may have seen one or more CD/DVD laser lens cleaners at your local computer store; they usually look something like a disc with a little hairbrush mounted on it. *Never use one of these cleaners on a CD or DVD recorder because it can damage the laser!* In fact, the laser head inside a recorder needs no maintenance.

The Disc Hotel

So where should you put all your recorded discs? Stacking them in a big pile in front of your monitor is one answer, but it's the *wrong* answer. Your discs must be protected from dust and scratches! Of course, storing discs in their jewel boxes is a good idea — that is, until you have an entire 200-disc stand filled up, and it takes up an entire corner of your room! Take a tip from me and my collection of over 1,200 audio CDs: You can save that space and still provide the protection your discs need with a disc binder, as shown in Figure 1-8. A binder has individual pockets for anywhere from 10 to 250 discs, so you can donate your jewel boxes to your friends.

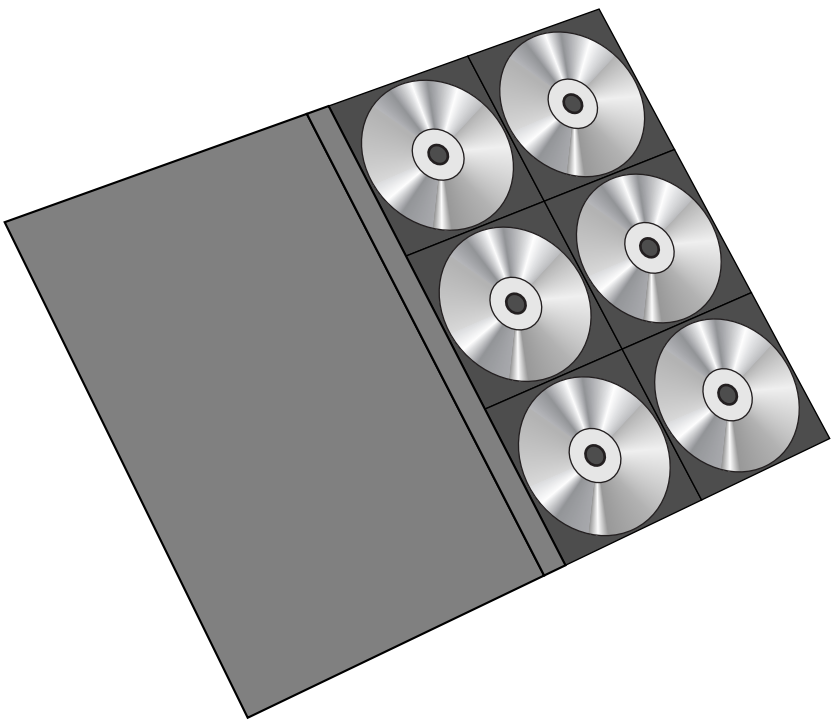


Figure 1-8: A true technotype uses a disc binder to save space.

Sometimes you've just gotta wipe

You may say, "I've seen an entire shelf full of CD cleaning stuff at my local Maze O' Wires store. Do my discs need cleaning?" If a disc is only dusty, I recommend a lint-free photographer's lens cloth, which you can pick up at any camera shop. You can also pick up a spray bottle of disc cleaning fluid for liquid disasters, like those unavoidable soda stains. Other than a cloth and some fluid, however, you can leave all the expensive James Bond gadgets on the shelf at the store.

To close this chapter on a high note, Figure 1-9 illustrates how to wipe a disc: Start at the center spindle hole and wipe straight toward the outside of the disc, making sure that you apply no more than fingertip pressure. Wiping harder — or wiping in a circular motion, as shown in Figure 1-10 — can scratch your disc and invite chaos into its ordered world of 1s and 0s (zeros).

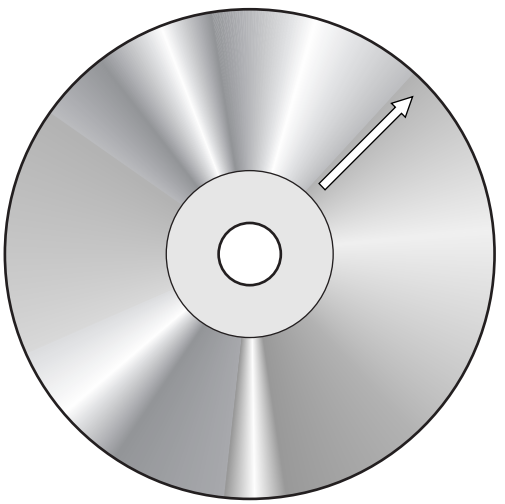
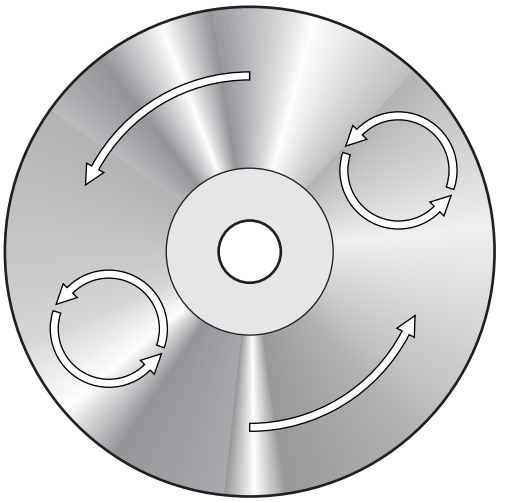


Figure 1-9: Wipe correctly, and the digital world is your oyster.



If you wipe a disc like this, you're asking for trouble.

Figure 1-10: Wipe incorrectly, and your data eventually shows you the door.