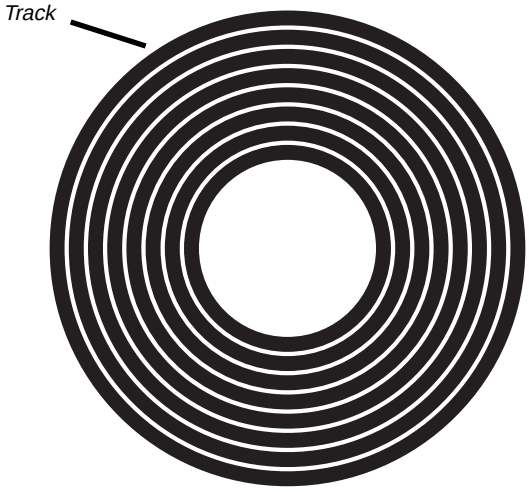
HOW DOES IT ALL FIT?

We need to spend a little time looking at how the data is organized on a floppydisk. Picture in your mind how the platter spins around under the write head, and how that write head is busy spitting out its ones and zeroes onto the platter. Once the platter has gone all the way around, anything we continued to write would erase or cover up what we've already written on the previous time around, wouldn't it?

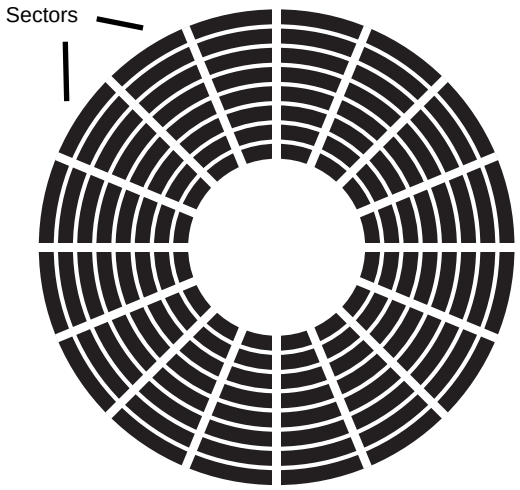
Obviously, we don't want to do that. However, if we move the head just a little closer to the center of the platter, we could write another circle of data that wouldn't cover up the first one. And then we could move it even closer to the center, and write a third row of ones and zeroes, and then a fourth and a fifth, by moving the head a little bit each time. And that's exactly what we do. Eighty times, in fact.

Each one of these circles of data on the platter is called a **Track**. We have 80 tracks on each side of the platter, for a total of 160 tracks.



Track Diagram for a 3.5 Floppy Disk

When we are looking for a few bytes of data out of that total 1.44 MB, it's not enough to know which track it is in. To help narrow the search, we divide the track into 18 pieces, called **Sectors**. Each sector can hold 512 bytes of data. Each track is divided into the same 18 sectors, but each track becomes smaller as we get closer to the center of the diskette. If we look at Sector 1 for all 80 tracks, we get something shaped like a piece of pie with a bite out of the tip.



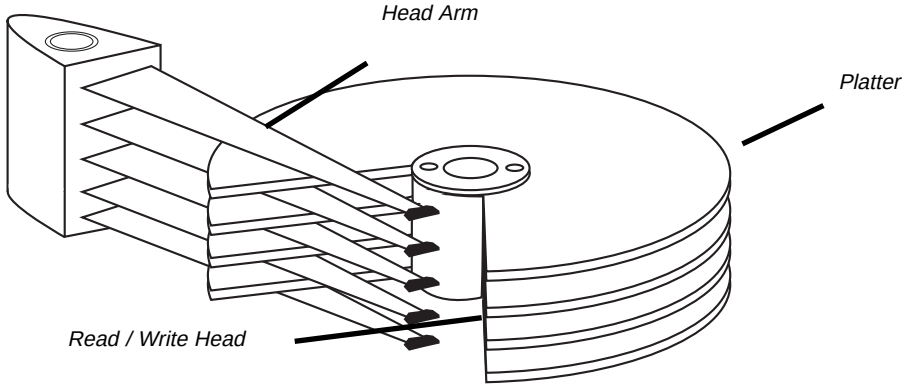
Sector Diagram for a 3.5 Floppy Disk

Since each track holds the same amount of data, obviously those bits are packed even closer together as the tracks get closer to the center. That's why we can't go all the way to the center.

Hard Drive

Although the floppy drive may not be very floppy, the Hard Drive certainly is hard. Not only is everything sealed inside a metal case, the platters inside are often made of glass!

However, the way it works is almost identical to the floppy. The platters are coated with a magnetic material, and they spin under write heads that magnetize the material in a pattern of ones and zeroes, and under read heads that sense those same ones and zeroes.



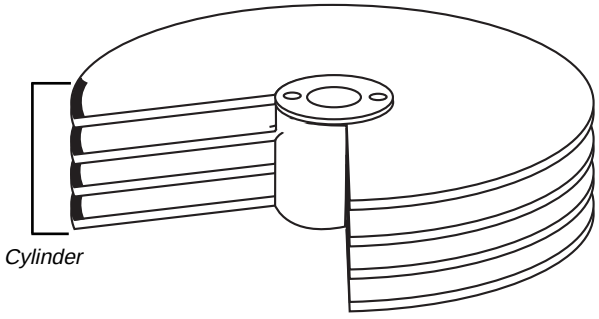
Hard Drive Platter Assembly

If you noticed in the previous paragraph that everything was plural (platters, heads), you've already guessed one of the main differences between floppies and hard drives. Hard drives have multiple platters, up to a dozen or more in some drives, one on top of the other like a stack of pancakes. Each side of each of the platters has its own read and write head. All of these heads are connected to the same arm, so the same track and sector of each platter is under the heads at the same time.

Everything in a hard drive works at higher speed and to closer tolerances, compared to a floppy. The disk spins at least 10 times as fast as a floppy, often more. The space between the heads and the surface of the platters is so small, at the factory the units must be assembled in special dust-free rooms called Clean Rooms, because even a speck of dust could get jammed between them and cause the disk to crash.

The amount of data in each sector is 512 bytes, the same as a floppy sector, but there are many more sectors in a typical hard drive. There is no standard number, though. It just depends on how close the engineers can pack those 512 bytes, so every brand of drive is different. That same consideration also fixes the maximum number of tracks the disk can hold.

Here's one more part of the organization of data on a drive. If we are reading or writing Track 1 on the top platter, every other platter has its own heads positioned over its own Track 1. The same-numbered tracks of all the platters make up a **Cylinder**. In other words, all of the Track 1s together make up Cylinder 1, all track 2s make up Cylinder 2, etc.



Cylinder Layout

There's a reason why the Cylinder is useful in organizing data on the drive. Get the picture that we are writing data onto Track 1 of Platter 1. We get to the end of the track but there is more data to write. We could go to Track 2 of that same platter, but this would require moving the heads. It will be quicker and easier to continue writing on Track 1 of another platter, rather than going to Track 2 of Platter 1, because we don't have to move the heads. The same is true when we read that data back.

The movement of heads from one cylinder to the next is called a **Seek**. Although this movement happens incredibly fast by mechanical standards, it's still one of the slowest things that happen inside a computer. One of the things to consider when buying a hard drive is the **Average Seek Time** of the drive, because this will largely determine how fast the system can transfer data on and off of that drive.

The hard drive platters are sealed inside a metal box that is attached to a frame inside the computer cabinet. Because of this, the hard drive is sometimes referred to as a '**Fixed Disk**'. This 'fixed' quality makes them very reliable and ideal for storing large amounts of data inside the computer, but completely useless for transferring data into or out of the PC. For that, we must turn to other devices.