THE SECRETS OF PERFECT MEMORY

By A. Wiley Pachyderm
COMPUTERS ARE THE PENCILS OF THE INFORMATION AGE.

FLOPPY DISKS ARE THE PAPER.

YOU ARE THE BRAINS.
MEMENTO MORI

MEMORY CAN STILL DIE,
EVEN IN THE COMPUTER AGE.
Popular Mythology: Computers are the brains of the future, rendering men's minds obsolete. Fact: Computers are so feeble-minded that they can't remember a thing. They have to write everything down or it's gone.

They may have no minds, and absolutely have no memories, but computers can crunch, shuffle and collate amazing mountains of data and write down thousands of words in a split second. The paper they write on is a precision, glass-smooth disk of magnetic crystals, thinner than a human hair, spinning around 5 times a second. Floppy disks remember everything.

Under ideal conditions, these disks remember forever. But when ill-treated, they can lose it all in the same split second it took to get it.

This book is a survival manual for floppy-disk users.
CHAPTER 1

TINY WRITING
Compared with computer writing, the Lord’s Prayer inscribed on this cherry stone (enlarged 4 times) is huge.
SO IT IS WRITTEN

CRYSTAL WRITING

Writing with magnetic dots requires special paper. The paper—a floppy disk—is a hair-thin wafer of mylar. Over the mylar, spread in precisely random fashion, are microscopic crystals of iron oxide about 1/1000 of an inch thick. Not ground-up metal, but clinically grown crystals. These crystals are created so that each
has the ability to hold a magnetic charge. In bursts of radiant energy, the disk drive charges these crystals. Each charge, positive or negative, reorganizes the crystals into a clear magnetic pattern. This pattern is the language of computers. It's the basic step from which all data processing flows.
THE SIMPLEST SOLUTION

No matter how complex the information gets, computers strip everything down into one of two alternatives: magnetic dots that say yes or no, either/or, plus or minus, according to whether they are posi-
tively or negatively charged. Just one dot or the other; that is all a computer has to work with. It makes one choice after another, after another, at least 120,000 times a second.
BITS AND BYTES

Each dot is called a bit. Because it is one of the two alternatives a computer is built to work with, a bit is called a binary digit. Binary meaning two. Eight bits in a row make a byte.
Every byte is an eight-bit code that stands for a specific letter or number. Computers only read and write in increments of eight (or multiples of eight), i.e. in bytes.
THE BYTE ALPHABET

A B C
G H I
M N O
S T U
Y Z

22
CHAPTER 2

DISC BASIC

25
Kirlian photo of 5 1/4" floppy disk shows the magnetic field of 40 million magnetic crystals which cover the disk’s surface.
NOT LIKE A RECORD

The phonograph uses a single spiral groove and moves sequentially by following it from the beginning to the end of a song. The floppy disk has no groove; it has invisible concentric circles or tracks. The disk drive head moves back and forth across the disk and reaches any of these tracks in any sequence, with equal speed. This is called "random access" and it means the read/write disk head searches out the correct individual data warehouse (or "sector") by using a timing hole as a guidepost, and a "format" (something like a zip code) as a destination. Most floppy disks have 48 or 96 tpi (tracks per inch). Newer technology has up to 192 tpi and beyond.

Actual floppy disk
track (enlarged 200
times) made visible
with magna-flux
photography. Each
line is a bit.
SECTORS
There are five standard types of sectoring for floppy disks.

8" soft sector

8" 32 sector
Actual number of soft sectors varies with format and computer.

5¼” soft sector

5¼” 10 sector

5¼” 16 sector
DISK NOMENCLATURE

FILE LABEL: your own description of contents.

THE SPECS: short for technical specifications, which have to do with compatibility between computer and floppy disk.

PROTECTIVE JACKET: tough polyvinyl outside, static-free, lubricated fiber inner lining cleans disk as it spins.

REINFORCED HUB RING: provides extra grip for drive, prevents slipping or tearing after long use.

No. 7 DOUBLE SIDED DOUBLE DENSITY 16 SECTOR
MOUSEBITS: also known as stress-relief notches.

READ/WRITE WINDOW: the disk drive tracks along the disk drive tracks along this channel. A window of vulnerability, don’t touch!

INDEX/TIMING HOLE: light-activated reference point for drive to find all data sectors and to track at right speed.

WRITE PROTECT TAB

WRITE PROTECT NOTCH prevents you from mis-takingly writing over data that should be saved. Located at the side of 5¼" disk bottom of 8" disk.

SPECIAL WARNING: Now you know it, now you don’t. Unraveling the write mystery is easy. On an 8" disk, you put the tab on to write. On the 5¼" you take it off to write.
A LOT IN A LITTLE

Disk capacity varies, but a typical single-sided, double-density 5¼" disk holds the equivalent of 55 pages of double-spaced, typewritten data. That means on five double-sided, double-density 8" disks, you could store all 900,000 words of the Old and New Testaments of the King James Bible. And have room for "Gone With The Wind" as well.
CHAPTER 3

DRIVER EDUCATION
X-RAY PHOTO OF FLOPPY DISK DRIVE

STEPPING MOTOR keeps read write head over proper track.

READ/WRITE HEAD

DRIVE MOTOR spins disk.
HUB RING GRIPPER

DISK DRIVE DOOR, insert disk here and close latch to engage drive

DRIVE INDICATOR LIGHT

TIMING LIGHT
THE POINT OF THE PENCIL

Computers can shuffle the data and floppy disks can remember. But only a disk drive can read and write.

The read/write head is the essential connection between the computer and floppy disk. In its writing mode, the head imprints each bit of magnetic writing (+ or −) with hair-thin blasts of radiant energy, 120,000 times a second (240,000 times a second in double-density disk drives). In its read mode, the same head simply recognizes the same magnetic patterns (+ or −) it has previously blasted onto the disk. The read/write head is attached to a little stepping motor which moves it precisely from one track on a floppy
disk to another, in milliseconds so the head is always on the right track, in the right sector, at the right time.

The other main piece of business in a disk drive is the motor which spins the disk around inside its protective jacket. When you slide a disk into a drive and close the door, a gripper clamps down on the disk's hub ring and immediately begins to spin it 300 revolutions a minute—5 times a second—no more, no less. If it spins too slowly, data backs up. If it spins too fast, data gets passed over.

Don't be rude to your disk drives. They have ways to get even.
CHAPTER 4

WORRISOME DETAILS
Computer writing is tricky business. Everything is extremely small and very fast. Who can imagine 120,000 radiant energy blasts a second? Consider moving information at nearly the speed of light. Think of a bump 30 millionths of an inch high, being big enough to derail the data. This is the stuff of floppy disks—very precise, very unforgiving. A fact that disk manufacturers can never forget.

DUST IS TROUBLE

It's simply too big. Take a piece of dust 1000 microns wide. A micron is one millionth of an inch. This is big dust. Dust this big can ruin an entire batch of little, 2 micron magnetic crystals. Bumps of dust only 20 microns high can pop the disk drive head and send it skipping right over the data.

In the floppy factory, there's absolutely no dust. None. It's cleaner than
a hospital. Everyone's in white with breathing masks, white hoods and white gloves. Untouched by human hands. The filtered and refiltered air is Class 100. That's 100 parts per million clean. Most office air is Class 10,000, 100 times worse. Dust is an enemy of the Information Age.
JUST SLICK ENOUGH

To work properly, the entire surface of a floppy disk must be almost perfectly flat (give or take 20 millionths of an inch). It can get away with a few microscopic bumps and pot-holes. As a matter of fact, it needs them. If the disk is too smooth, that’s trouble too. The disk drive head (which is also very slick) and the disk’s surface tend to stick together at high speeds and lock up, creating what can only be called "data squeal". Striking the balance is what it’s all about. After the magnetic crystals are laid down in a perfectly even veneer, 100 micro inches thick, (that’s 1/30 the size of a human hair) the crystals are then burnished with a ceramic wheel to polish the surface until it’s almost as smooth as glass, but not quite. More like a fine china cup.
Lasers scan the near perfect flatness of a 5¼” floppy disk.
NEVER TRUST DATA THAT WOBBLERS

RPM-0
Polarized light photos reveal the lines of stress as a 5 1/4" floppy disk accelerates in milliseconds from a dead stop to a precise 300 rpm.
Because disk drives operate at incredibly fast rates of speed, maintaining unflappable stability during operation is critical. To gauge that ability, our disks are subjected to
torque tests to insure perfect data without fluttering, buckling or backing up. A proper disk will stay flat and unrippled at all times and all speeds.
TESTING, TESTING

There are so many details to be sure of with floppy disks, that the only way to handle them is constant testing. Every Elephant Floppy Disk has been tested for:

- Missing Bits
- Extra Bits
- Surface Smoothness
- Resolution and Signal Amplitude
- Starting and Running Torque
- Clipping Levels
- Tear Resistance
- Coefficients of Expansion
- Substrate Material
- Magnetic Coating
- Resistivity
- Track Location
- Track Tolerance
- Recording Offset Angle
- Overwrite
- Signal Quality
- Field Tolerance
- Physical Track Identification
Only when it passes every test is it certified 100% error free and sealed air tight in its distinctive box.
CHAPTER 5

DON'T TOUCH THE SHINY PARTS
DON'T TOUCH THE SHINY PARTS

Disks are tough, but vulnerable. Treat them right and they'll stand up for you a long time. But touch them in the wrong place and it's serious trouble. Even impeccably clean hands have sticky fingers that can leave an oil slick 30 microns deep on the disk. This will destroy data instantly. It's almost impossible to wipe off a fingerprint. When floppies are made, no one ever touches the disk surface with his bare hands. It's not allowed.

Other handy disasters are labeling the jacket with a ballpoint and creasing the disk surface. Or, paper-clipping hard copy to the disk, thereby crimping it and causing it to flutter hysterically.
Kirlian photo reveals the magnetic fingerprint of a highly charged person. But, a fingerprint’s oil is the more likely culprit.
CHAPTER 6

BEWARE OF MAGNETISM
MAGNETIC MEMORIES

Memory works because of magnetism. But what magnetism gives, magnetism can take away. Many things can disturb the critical arrangement of those tiny magnetic particles on a disk's surface. When that happens, data can vanish completely. Or worse, it can just change the data a little. Like moving a decimal point over a place or two.

Most offices are filled with motorized contraptions that spin invisible magnetic fields. These can easily bewilder and befuddle your floppy disk. So avoid electric typewriters, air conditioners, electric fans and loudspeakers near your disk operation or storage. Remember any metal, no matter how lowly, can be magnetized by this machinery. Stray magnetism leads to amnesia in floppy disks.
CHAPTER 7

MAKE A COPY
Gravity at work. (Story overleaf.)
A SAD STORY WHICH COULD BE TRUE

Everything was flowing. Champagne was over-flowing. $20 million in sales. The little company. The Great product. The American dream come true . . . again.

This was a stockholders meeting to remember.

Alas. During the festivities a bit too much bubbly overran the floppy disk master holding all accounts receivable.

As the comptroller reached instinctively for his own throat, the euphoric CEO laughingly said, "Thank God. for back-ups."
Only when his trusted comptroller passed through the 27th story window did he realize the gravity of the situation.

Remember this like you remember your mother. If it's important. Make a copy.
CHAPTER 8

MEMORABLE TERMS
BIT: A Binary digit. Either a 0 or a 1.

BUG: A mysterious equipment malfunction or a software anomaly.

BYTE: A sequence of binary digits which are operated as a unit to represent a character. It is usually made up of eight bits.

CHARACTER: A letter (A-Z), a numeral (0-9) or a special symbol (@ or #).

CPU: Central Processing Unit. Portion of the computer that controls arithmetic and logic functions. Also controls transfer of internal data.

DISK: A flat, circular plate with a magnetic surface onto which digital data can be stored. Size and storage capacity of disks vary widely. See diskette, disk cartridge, and disk pack.

DISKETTE: A flat, flexible platter, usually 8” or 5.25” in diameter, capable of storing between 200 kb and 1 mb of data. A diskette is permanently housed inside a square vinyl, protective envelope.
DISK CARTRIDGE: A single rigid platter, usually 8”, 10” or 14” in diameter. It comes permanently housed inside a hard plastic case. Disk cartridge storage goes up to 10 mb.

DISK PACK: Multi-platter stack of 3 to 11 rigid disk platters. Packs come with a protective, but removable cover. Storage capacity on disk packs can go up to 100 mb.

HARDWARE: The physical equipment which constitutes a computer system.

HEAD: A component that reads, writes or erases data on magnetic media, such as magnetic tape, diskettes or disk packs.

HEXADECIMAL: A computer numbering system which uses a radix of 16.

INTERFACE: An electronic assembly that connects two computer components, such as a disk drive to the CPU.

K: The symbol for the quantity $2^{10}$ or 1024 decimal.
KBYTE (KB): 1024 bytes—often referred to as kilobytes.

MEDIUM: Plural is MEDIA—Physical substance upon which data is recorded. Floppy disks, magtape, disk packs, and punched cards are various forms of media.

MBYTE (MB): 1,048,576 bytes. Often referred to as megabytes.

OPERATING SYSTEM (OS): Collection of computer programs that controls the execution of subsequent programs. It performs tasks such as scheduling internal jobs, assigning memory locations, and controlling input/output (I/O) functions.

PERIPHERAL: A device, external to the CPU and main memory, such as printer, CRT or disk drive.

RANDOM ACCESS MEMORY (RAM): Means you can hear the song you want without going through the others. With random access, you can get at the information you want immediately, no matter where it is on the disk.
READ ONLY MEMORY (ROM): Is a memory of certain operating instructions built into your computer which you cannot alter (not write on). It is only to be read by the computer.

SOFTWARE: A set of computer instructions or programs that makes the computer perform a certain task or function.

SYSTEM: A configuration of hardware and software used to perform specific job functions.

TRACK: A written portion of magnetic media, such as a disk or a tape, that is accessible to the read/write head.

WINCHESTER: A sealed hard disk drive, with extremely high packing densities on the media. Winchester disks may be 5", 8", 10", or 14". They may also be multi-platter stacks.
ELEPHANT MEMORY SYSTEMS®
PURVEYORS OF
HEAVY DUTY
FLOPPY DISKS
(5 1/4" and 8")
A WARNING TO IMITATORS:
Uttered as the last words of General John Sedgwick, while looking over the parapet at enemy lines during the Battle of Spotsylvania. "They couldn't hit an elephant at this dist..."