Putting the "digital" in "digital film".

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The goal of photography has always been to "fix light" and save a long lasting representation of what we see with our eyes.

Over the years there have been many approaches to saving images. Starting in the 1500's the camera obscura was used for tracing images. Some of them were as big a room, and basically consisted of just a lens and viewing screen. What is generally considered to be the first photograph was taken in 1826 by Niépce using tar. Later photographers used sensitized polished silver plates, paper and glass plates. It wasn't until George Eastman put a photographic emulsion on a clear flexible base in 1889 that photography was really available to everyone. Today, over a hundred years later we have solid-state memory cards instead of film.

Deciding how to store digital images has always been a critical part of digital camera design. The original Kodak DCD professional digital camera (later known as the DCS-100) was introduced in 1991. It captured 1.3 mega pixel images and stored 156 of them on a large external 200 MB hard drive that was attached to the camera with a cable. Interesting enough, the images were stored as unprocessed data from the sensor – what we now call RAW files. The images were transferred for processing to a computer over the relatively speedy SCSI bus.

The first mass-market consumer digital camera was the Apple QuickTake 100 introduced in 1994, designed and manufactured by Kodak Japan. Flash RAM was expensive at the time and to keep costs down, the camera only included 1 MB of internal non-removable memory. The camera could store 8 highly compressed VGA resolution images and relied on slow serial bus transfer of the images to a computer.

Also in 1994, Kodak introduced the first profession digital cameras with removable memory – the NC 2000 and DCS 420. These cameras relied on the PCMCIA computer card standard developed by the Personal Computer Memory Card International Association. The standard defined three physical sizes of cards: Type I, Type II, and Type III. Type III Cards are twice the thickness of the others. The Kodak cameras used Type III cards that contained miniature hard drives with thin glass platters. The cards had high capacity and fast

access times, but you could only drop the cards once.

The memory cards we use today are based on semiconductor flash memory technology and are very rugged. Flash memory is non-volatile which means the images are retained for extended periods even when no power is applied to the card. The cards can also be easily erased for reuse by the application of the proper electrical signals.

In 1994, SanDisk introduced CompactFlash memory cards containing a single chip ATA controller that carries out all file management, error correction code, power management and PCMCIA controller I/O functions. Measuring 42mm x 36mm, CompactFlash cards are about size of a matchbook.

About the same time, Fuji and Olympus introduced Solid State Floppy Disk Cards (SSFDC) later known as SmartMedia. The cards are 37mm x 45mm and VERY thin. SmartMedia cards require the controller be in the camera and while this keeps cost of cards lower, it limits the forward and backward compatibility of SmartMedia with competing cards. Be aware that these cards come in two versions: older 5V cards and newer 3.3V cards. Some equipment supports only 3.3V SmartMedia, some only 5V, and some both types. In general, 5V SmartMedia does not work in equipment designed for 3.3V cards. Be careful.

In 1998, Sony introduced the Memory Stick format for use as a means of sharing and exchanging content, such as video and music, as well as data, text, and graphics in new consumer electronics products. Similar in appearance to a stick of gum, and measuring 50mm x 21mm, the "sticks' now comes in standard and pro versions.

MultiMediaCards and Secure Digital (SD) Memory cards arrived in 1999 and are a postage stamp sized 24mm x 32mm. MultiMediaCards and SD cards are based on separate but related industry standards. They are similar in size and appearance except that MultiMediaCards are thinner and have fewer contact pins. Similarities in the standards allow MultiMediaCards to be used in electronic devices with expansion slots that are made for SD cards. However, SD cards cannot be used in devices with slots made specifically for MultiMediaCards.

In 2002, Olympus and Fuji announced the xD-Picture Card which, at 20mm x 25mm, is presently the smallest size of any digital memory card.

Flash memory is susceptible to wear as a result of repeated write and erase cycles and relies on "wear leveling" techniques that insure the entire range of memory is written/erased – not just the same small block of memory. The good news is no one using their cards for digital photography should experience wear problems.

The file system used by digital cameras on memory cards is typically one of three versions of FAT - an acronym for File Allocation Table. The FAT file system keeps track of where each picture is stored on the card and is put onto the card when the card is formatted in a digital camera.

The different FAT standards allow addressing different amounts of memory. The multi-gigabyte cards now becoming available require the FAT 32 file system. This isn't supported many cameras so verify your camera will work with such cards before purchasing one.

There are many ways you can loose the ability to recover images or use a card. Sometimes the file system on the card becomes corrupted if a card is pulled out of the camera while it's still writing, or if there is an interruption of power. You may also have accidentally erased images from the card. If any of these problems happen to you, you'll be glad to know that data recovery software exists that can recover the lost images.

Software such as Lexar's Image Rescue, SanDisk's RescuePRO and DataRescue (available from the web) is designed to go to the root of the card's data structure to identify and retrieve deleted or lost images even if the computer doesn't recognize the card. I hope you never need to use such software, but it's very nice to know that it's available.

To download images from memory cards, I generally recommend digital camera owners buy a memory card reader/writer that can be left attached to their computer. This saves a lot of "wear and tear" from repeatedly plugging and unplugging a cable in the small USB jack on the camera. Like the memory cards themselves, the reader/writers have gotten cheaper and faster. My original two format unit cost me well over $100US. Now you can buy 8-in-1 units for under $20US. If you plan on using large capacity cards, you probably will want one that supports USB2 or FireWire.

There may be times when you find it necessary to use a card reader/writer hooked to your computer to write images to a memory

card so they can be viewed on a TV set with something like SanDisk's Digital Photo Viewer or taken to a store to have the images printed. Be careful! I always recommend that images not be deleted from a card using a card reader/writer. To avoid problems with your cards delete images using your camera. You should ONLY format a card using your camera. (The one exception to this rule is if you need to use "rescue" software to format an already damaged card using your computer.)

One of photographic film's advantages is that it is “eye readable”. You can pickup a piece of processed film taken yesterday – or a hundred years ago – and see the image without any additional equipment. Memory cards are really only a partial replacement for film because the images they contain exist only with the aid of a computer.

The cards are now being used in many handheld electronics devices such as cellular phones, car radios and MP3 players in addition to digital cameras. Competition between equipment makers, working in cooperation with semiconductor manufacturers, will continue to lead to the development of new memory card families that are: higher in storage capacity, smaller in size, support faster transfer rates, and are lower in cost.