The Digitizing Process: How it works

Introduction:

With the development of multimedia technology comes the need to provide a system where visual art forms such as drawing, video, and photography have a way to be produced and represented by computer programs. And because computers store and manipulate data in a digital format, the process of digitizing has become central to the world of art and multimedia.

History of Digitizing:

Digital image processing began with work done through the Jet Propulsion Laboratory in California in the 1960s and consisted of digitizing television images of the moon's surface sent by the spacecraft Ranger 7. Other uses included military intelligence, urban planning, medicine (such as the CAT Scan and the MRI), and of course digital video and photography (Digital Imaging, 1997).

Digital Cameras: how they work

When you take a picture with your digital camera it splits the light that passes through the lens into red, green and blue, various combinations of which make up all of the colors that we see with the naked eye. Then it focuses this light onto a very small area. Unlike film cameras, that direct the light onto a piece of film coated with silver, digital cameras must convert the light it registers into voltage. It does this by using photodiodes, devices coated with crystalline silicon that produce an electrical charge proportional to the amount of light that hits it. Many photodiodes strategically placed together make up a charge-coupled device (CCD). Each defined point on the CCD corresponds to a pixel in the digital image (Burdick, 1997). In turn, vertical strips of CCDs combine to form a

CCD array. Stronger light picked up by the CCD produces more electricity and vice versa.

Analogue versus Digital:

Burdick (1997) defines a digital image as "a discrete array, usually two-dimensional, of picture elements, or pixels, the intensities of which are represented by numbers" (p. 3-4). These images are originally in analogue form (like what the human eye sees); that is they are represented by waves of electrical current and are "represented by continuously variable physical quantities" (Burdick, p. 13). Computers work with data that is digital, that is, represented by real numbers. For this reason, the voltages that are created by the CCD then travel along a circuit to an "analogue-to- digital converter chip" (ACD) (p. 196). How much information an ACD can handle is described as its resolution, which depends on how many bits are used by the ACD for translation. A bit (short for binary digit), is "the smallest discrete unit of data that a computer can handle" (p. 145). It is represented by the number 1, or by the number 0. Voltage detected above a certain level is represented by the number 1 and is considered "on", while voltage below that level is represented by the number 0 and is "off". If there is only one bit available for any given voltage signal, then the result is a black and white photograph. 16 bits per voltage signal is more than enough to produce a high quality color photograph (see p. 195). The computer can use 1s and 0s to create other numbers such as 1101001110010100 that together represent a specific color and shade. 16-bit color or "high color" can produce a total of 16,777,216 color variations (p. 195). The information is then placed onto a floppy disc or a tiny CD for storage. Floppy discs can be removed from the camera and inserted directly into a computer's floppy drive. Cameras with tiny CDs can be hooked up to a computer and the information is passed through a cable.

Resolution:

Resolution refers to the quality of an image once it is digitized. High-resolution images show more pixels per inch (ppi) and therefore more detail. Low-resolution images show fewer pixels per inch. However, higher resolution images take up more memory such that a picture that is twice the resolution of its counterpart can require four times the memory (Burdick, 1997).

Compression:

Because every unit (pixel) of a digitized image must be stored separately in a computer, the file size of graphic images can be overwhelming, to the point that downloading them onto your computer screen can be very time consuming. To alleviate this problem, digital images are compressed for easier upload. This is especially crucial for web sites that cater to users who have average speed connections.

There are two forms of compression, namely "lossless" or "lossy". Lossless compression produces an image that has not lost any of the pixels that make up the image so the viewer sees no change in the quality. Lossy images lose pixels per inch and therefore produce a less detailed image, which may or may not be detected by the human eye (Burdick, 1997). Standards by which compression is achieved are indicated by the suffix found at the end of graphic file names and include JPEG or JPG (Joint Photographic Experts Group), GIF (Graphics Interchange Format), and TIFF (Tagged Image File Format) (Burdick, 1997 and Gookin, 2000) and each format has its ideal use. GIF and JPEG for example are preferred for photographs shown on the Internet while TIFF is useful for "sharing images with other applications" (Gookin, p. 59). Multimedia programs have set parameters about what format they accept images in, but the three

mentioned above are accepted by a wide variety of programs such as Director and Photoshop.

Conclusion:

The development of multimedia technology is intrinsically coupled with the process of rendering artistic data into a digital format. The digitizing process itself is achieved through the use of a charge coupled device (CCD) and an analogue-to-digital converter chip (ACD) that stores data in the form of binary digits (bits) and represents information as 1s and or 0s. The digitizing process in turn requires consideration of resolution, compression, format, the final use of the product, and the user's access to technology.

References:

Burdick, Howard, E. Digital Imaging. McGraw-Hill, 1997.

Gookin, Dan. Digital Scanning and Photography. Microsoft Press, 2000.

White, Ron. How Computers Work. QUE, 1999.

Vaughn, Tay. Multimedia: Making it work. Osborn/McGraw-Hill, 1998.

Web Sites:

http://www.pctechguide.com/24digvid.htm
The PC Tech Guide

http://dimdesigns.safeshopper.com/11/cat11.htm?564
"Improve your digitizing techniques"

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