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ABSTRACT

Today the chemical processing of film is being replaced by a virtual digital darkroom. Digital image storage makes new levels of consistency possible because its nature is less volatile and more mutable than traditional photography. The potential of digital imaging is great, but issues of disk storage, computer speed, camera sensor resolution, projection, and hard copy output continue to make the necessary hardware expensive. In the case of digital movies for the personal computer, random accessibility advantages are being offset by low resolution. Both digitized stills and digitized movie clips are now typical components of presentations in electronic classrooms and other distance learning situations because many of these images can be compressed to reduce transmission costs. Digital imaging can also be easily manipulated, creating new flexibility in advertising and the fine arts and giving rise to the view of the photographer not as the deliverer of a final product but as the producer of raw products that can be altered later. Composite images in photography have always been possible, but now there are fewer restraints than ever. The mutability of digital imaging also serves to depict photography as increasingly subjective, rather than undistorted expression of optical reality. Understandably, many imaging education programs are finding niches in both fine arts departments and technical departments. (BEW)

Digital Photography and its Impact on Instruction

by Chris Lantz

Historical Context

Soon after the invention of photography the craft of hand film making was replaced by a film manufacturing industry. Film manufacture and development was mostly taken out of the photographers hands, making industry wide standards possible. These standards gave rise to such advances as the electronic light meter and exposure automation (Jenkins, 1975). Today the chemical processing of film is being replaced by a virtual digital darkroom. Digital imaging has also made new levels of consistency possible by the less volatile and more mutable nature of digital image storage. Despite small advances in photographic technology since the introduction of Kodachrome in 1934, the most dynamic gains have been, and are likely to remain in the electronic imaging sector. Once the basic technical barriers of memory, processor speed and image sensor resolution are solved, an advance in the utilization of photography comparable to the introduction of roll film is likely. The import of these developments is magnified when we consider their extension to the recent introduction of digital movies for the personal computer.

Previous electronic advances in photography were slow and incremental. In 1931 the invention of new electronic components such as powerful capacitors, prompted Harold Edgerton to develop an electronic flash light source. Its original purpose was to record moving objects on film but the technology was eventually applied to portable flash units. In the 1960's lasers became an important new light source for processes such as holography. More significant electronic innovations in conventional photography came with the first integration of the computer in the photofinishing industry, and then into cameras. Electronic imaging has been routinely used since 1982 for big budget applications such as commercial publishing and special effects in Hollywood movies. Use of highend personal computers for digital photography did not become practical on a mass market basis until the mid 1980's. Consumer level desktop imaging did not become available until the late 1980's. The development of low cost digital video imaging on microcomputer came as late as December 1991.

The main restraint on digital photography of the last decade has been the need for expensive computer hardware. The recent introduction of comparatively low cost, fast and memory intensive microcomputers has made imaging possible to those on limited budgets. Because of this new accessibility digital images are routinely integrated into interactive instruction, multimedia presentations, educational video and distance education. Photography is now a small subset of a new imaging field which is comprised of video, desktop publishing, graphic arts and others. Photo education has been transformed by digital photography. Undergraduate and graduate programs in electronic imaging have been introduced and virtually all undergraduate instruction in photography has a digital imaging component or core course.

Hardware Issues

The five main technical barriers to inexpensive high quality digital imaging are: disk storage, computer speed, camera sensor resolution, projection and hard copy output. Digitizing in photographic resolution requires large random access memory and disk storage capacity. It takes nearly 40 megabytes to store the uncompressed information contained in one

8x10 inch black and white photograph. Currently the photograph itself is a less expensive storage medium than 40 megabytes of hard disk storage. Efficient computer storage and dense sensing devices already exist but cost and size have not shrunk to the degree necessary for the construction of small, inexpensive cameras of photographic resolution. Currently every major overseas electronic manufacturer has industrial still imaging systems on the market in some form. The Canon Corporation has widely marketed their consumer level *Zapshot* still video camera. This camera can output low resolution images to conventional TV, a color thermal printer, or a color copier. Apple's *Quicktake* digital camera can directly input digital still images into computers without the aid of a digitizing board. Many of the hardware restraints on still imaging are effectively lifted for low resolution applications such as classroom instruction in digital imaging. Current low end computer models are adequate for many educational imaging tasks. Other more demanding applications of the digital still image such as commercial color separation require high end equipment.

Kodak's introduction of the Photo CD solved memory barriers for many still image applications in education and graphic arts. Lack of a low cost and easily transportable medium for student image files necessitated storing files in low resolution format. Picture files on Photo CD can be opened at resolutions ranging from low to very high. An additional advantage of the Photo CD is very inexpensive compact disk authoring of memory intensive multimedia programs through the Photo CD Portfolio disk.

In contrast to the success of still images, the present special effect and random accessibility advantages of digital movies are often offset by the disadvantage of low resolution. This low resolution is the result of the extremely high memory and speed requirements of the moving image. Apple's introduction of the Power PC can make digital movie quality and length more tolerable than its current four postage stamp size.

The cost of fast microcomputers will to a large degree be solved in the short term for entry to middle level imaging applications because cost of memory and speed lowers on a monthly basis. The cost of high resolution camera sensors, color hard copy and projection are more long term problems because the fidelity of film is hard to match with computer hardware. Many of these technical barriers are being addressed in colleges by the availability of costly permanent electronic classroom installations. Another approach is the use of many lower resolution portable systems that can be used in any classroom. The electronic classroom is one in which the professor can control from a central podium microcomputers and multimedia equipment for selective display on a video projector.

Impacts on Instruction

Digital still images and digital movie clips are now typical components of presentations in electronic classrooms or in individual interactive multimedia. Visually enhanced instructional programs can be inexpensively mastered on a variety of recently introduced compact disk formats. Educational television applications such as distance education have also been heavily impacted by the use of digital non-linear video because it can be compressed to greatly reduce transmission costs. Digital movies have many advantages over linear video tape systems that are specific to educational applications. The random access capability of digital movies is conducive to the integration of clips into instructional computing applications such as self-paced learning. Another main advantage of the digital video file format is its mutability within the computer for special effect applications. Digital data filtering has made professional editing effects accessible to those on limited budgets. The same tools available to the commercial producer are now available in low resolution to the home computer user.

Digital movies can be defined on two levels for the Macintosh environment. On one level, Apple's original Quicktime digital video format can be utilized as a final production tool. In its original format Quicktime video clips are small and low in resolution. Low resolution

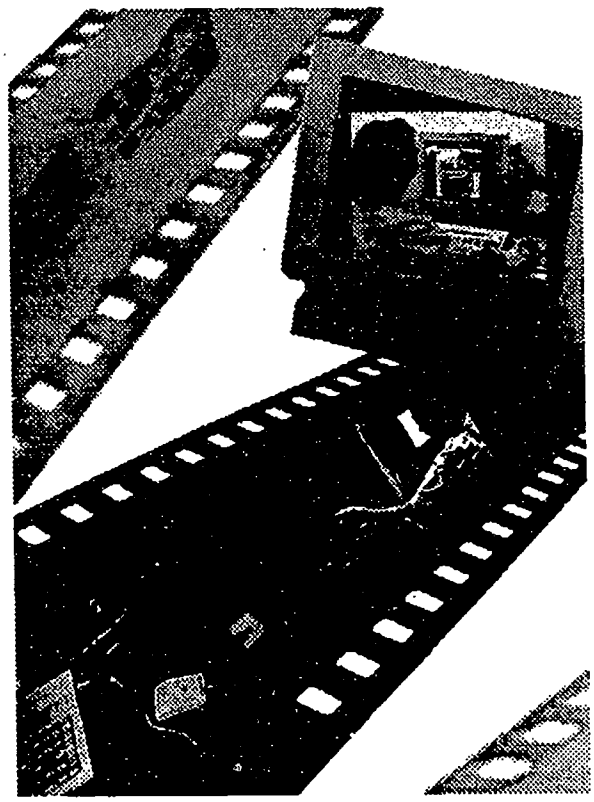
Quicktime is appropriate for applications which demonstrate basic motion or non-detail intensive visual information. It is adequate in introducing the concept of digital movies to many students at a time on low cost computers. On another level Quicktime can act as an introduction to higher resolution digital movie editing equipment used for the creation of a near-professional quality video production.

Evolution of the Digital Themes

Computer image processing technology has long been responsible for creating futuristic graphics, but as computer capacity increases so does its ability to render or simulate more complex natural forms. Once photographic information is digitized the computer is very flexible in its ability to manipulate the digital image. With the shift from manual to electronic methods, art directors are no longer limited to the restrictions of physical retouching tools and dyes. Common electronic work on commercial and educational images is becoming almost reconstructive, whereas in the past it was only cosmetic. Photographers used to be responsible for final products. Increasingly, they are being thought of as producers of raw products for input and perfection on electronic publishing systems. This attitude among clients often manifested itself only in high budget national advertising, but as technology has become cheaper and more accessible most photography is now affected.

Composite imagery of realistic elements in often unrealistic combinations is descriptive of many digital tabloid photos today. Figure 1 illustrates that several photos may be cut, pasted and blended into different combinations. These techniques are not unique to digital images, although digital composites are much easier to achieve. Early pictoralist photographers also explored the possibility that the realism of photography could be used as a special effect. Photographers such as Robinson and Rejlander were the first to create composite images that blended several photos into one. Their purpose was to pursue the formal Victorian themes but also to bring them to life by adding a new degree of realism. Robinson constructed scenes which resembled and even copied specific paintings and artistic styles. Rejlander worked in the 1850's and is well known for using print manipulations to increase the artistic capacity of photography (Coke, 1972). This work was immensely popular at the time but contemporary critics criticize it for not being original.

Figure 1
PHOTO MONTAGE CREATED IN PHOTOSHOP USING THE CUT INTO AND BEHIND COMMANDS



From its inception, the movement to establish photography as an art form was headed by painters turned photographers. The early movement is loosely termed pictorialism and started in the mid 1850's. The work of a well known pictorialist was Peter Emerson, who initially disagreed with the movement in his book: *Naturalistic Photography*. He argued that the "photographer's task is to discover the cameras own rules", not to apply the rules of painting. Shortly thereafter, Emerson acknowledged the photographer's free will to manipulate photography, but doubted the

veracity of photography as an art form. Emerson was willing to accept the manipulation of photography but was not ready to accept it as an art form (Emerson, 1899).

The passing down of themes from one medium to another is essentially what is happening today with the introduction of electronic photography. Many electronic artists today who deal with digitized images come from the field of photography and they continue to work with many of the same restraints imposed by analog images. As initial photography emulated painting, initial digital imagery tends to emulate photography. As photography separated from painting and the pictorial movement, digital photography must also find it's own rules. Electronic photography is considered a lessor craft by many traditional photographers because it is thought of as a replacement for tasks better suited to film. Once the role of digital images is better defined it will be judged on its uniqueness apart from traditional photography.

The Digital Image and Realism

Much of current criticism emphasizes photography's subjectivity. According to Ritchin, photography "... constitutes a rich and variegated language, capable, like other languages, of subtlety, ambiguity, revelation and distortion (1990, 1). The photograph can distort detail, frame, vantage point and time. Fine art photographers and art critics have been leaders in disclosing the ability of the realistic photograph to deceive (Sontag 1973). These criticisms are often not part of popular discourse because of the trust in optical reality. Both the distorting and artistic power of the photograph will be greatly magnified through the advent of computer aided image making.

The public has come to expect the bending of reality in advertising, but it is also sometimes put to unwitting use in photojournalism. One of the most famous examples of tampering is the 1982 *National Geographic* cover of the Pyramids of Giza. In this example, the distance between the pyramids were compressed to make a horizontal photo fit into a vertical format for the cover. The editor referred to this as "retroactive repositioning of the photographers' viewpoint" (Ritchin 1990, 14).

Traditional negatives and prints are easily authenticated. But, when the image originates as digital data for direct input into publishing systems, this safety buffer does not exist. As the possibilities of manipulation become public knowledge, photographic realism could lose credibility. Public trust in realistic images could decline and as a result photographer's might be held more responsible for the reporting of reality. The public may come to trust the viewpoint and credibility of certain feature photographers, just as they may come to trust some reporters more than others.

Public assumptions that the camera doesn't lie promotes acceptance of information at face value. Photography has the ability to deceive without detection because of its perception as optical reality. This deception will be even more problematic with highly mutable digital images. These issues demonstrate a greater need for emphasis on visual literacy because of the increased ability of visuals to deceive and communicate.

Approaches to Imaging Education

Amidst early artistic innovations in the history of photography photo education was still mostly a technical course of study. The mixing of the art and science curriculums in photography originated in the Bauhaus School of Art and Architecture in 1919 Germany by professor Laszlo Moholy-Nagy. The curriculum joined the study of pure art and science with pragmatic craft. The school expounded the philosophy: form follows function. Moholy-Nagy's department was the first to offer a graduate degree program in photography. Today several technical and fine art programs are founding departments of digital imaging.

For those concerned with self expression, the most important value in a image

is the meaning it conveys, and it is symbolism which conveys meaning in visuals. Symbols are more easily formed or manipulated in digital photography. To the commercialist, highly developed technique is often considered the preeminent vehicle used to express the clients vision or symbolism. Fine art programs traditionally emphasize expression and interpretation of meaning through symbols, and commercial or vocational programs emphasize. meeting clients needs through technique.

One approach to these differences in photo education was the "new photography movement." Frank Webster defined new photography through the belief that technique and meaning are whole and should not be separated. Photography is defined as a communicative process in which culture both influences the photographer and the viewer of the photograph. Webster compared traditional photography education with the training of writers. He argued that great writers do not read the dictionary cover to cover or draw upon a thesaurus like a pool of techniques. They integrate the knowledge as they need it. Such knowledge is a part of them, not drawn upon from some separate identity. Thus photographic techniques should be integrated into the photographic applications, not separated (Webster, 1985, 15).

In many contexts digital imaging education has focused exclusively on solving technical barriers. As in the beginnings of photography, the form follows function or the integration of only relevant technique takes on heightened importance with digital imaging. Because the digital image environment is so versatile and its technique so volatile to obsolescence it would be impossible to teach every tool available. Only through the application of broad features can digital curriculum be made relevant.

Conclusions

The pattern of photography's acceptance into society suggests that there was a period of initial experimentation where the novelty of the new process was sufficient to hold the interests of the public. As photography became more integrated into culture and the novelty wore thin, society demanded more of it. What started out as a mirror of reality was thrust into the new role of art, documentation and photojournalism, among many others. Once these applications of photography were socially digested, more contemporary movements took their place. Contemporary themes rediscover a novelty which was most appreciated at photography's inception. Electronic imaging is likely to receive a similar pattern of acceptance by society. Today the initial contributions of computer imaging are mainly recognized for their technical novelty. The content in many cases is irrelevant. Viewers will increasingly demand more content and context from computer imaging because the form will cease to be a novelty.

Digital photography is likely remove many of the technical restraints that define photography today. As a result the public perception of images is likely to shift from that of a precious document or object to a commodity or raw product which can be manufactured into any of a variety of digital products (Mitchell, 1992). Some of the perceived advantages of electronic photography in addition to providing new avenues of expression may also redefine the role of traditional photography. Traditional photography could become more valuable for applications that require a greater degree of authenticity or perceived realism. Since digital images are so easily transmitted and much more widely accessible, photographic images might become more desirable as a limited edition art object. Wide popularization of image art on electronic networks could actually increase the demand and popular support of the traditional craft.

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