

# **Computer Generated and Photographic Images**

**Sarah Jane Wood**

**Submitted in partial compliance of the  
requirements for the National Diploma:**

**Photography**

**Department of Photography**

**Faculty of Human Sciences**

**Technikon Free State**

**November 1998**



# SUMMARY

Photography is undergoing a revolution, as profound as when glass plates were replaced by acetate film. No longer are photographers reliant on darkrooms, and often poisonous chemicals to process their films. Images can now be recorded in digital form using conventional cameras fitted with special backs containing electronic form, loaded into a computer where they can be enhanced, manipulated or analysed, and the output directly to printing plates, or high quality paper printer. There is no fundamental change in the way pictures are taken - photographers still need the skills of lighting and composition, but now have far greater control over the image. By the same token their role is changing, no longer are they just photographers, they require to transmit the image via a computer, and a result on paper. The barriers between printer, photographer and designer are becoming blurred.

This script explains the new technologies of electronic imaging. It looks at the past, future, predictions and the advantages and disadvantages between traditional and digital photography. A range of cameras and printers are also mentioned. It also shows how I went about getting to my final images. There are also a variety of images included to show you, the reader, what results can be achieved.

Although the traditional skills of the photographer will not change, anyone working in the field of imageing needs to change their working methods if they are to survive in this rapid expanding field of technology.



Central University of  
Technology, Free State

# TABLE OF CONTENTS

**Summary i**

**Table of Contents ii**

**List of Abbreviations iii**

**1. Introduction 1**

**2. Basic Digital Photography 3**

**3. Uses of Digital Photography 10**

**4. Predictions regarding the digital imaging market 15**

**5. Current Equipment Options 17**

**6. Computers 26**

**7. Image Processing 33**

**8. The Future 37**

**9. Discussion of own work 40**

**10. Conclusion 43**

**11. Bibliography 44**

**12. Appendix 45**



# LIST OF ABBREVIATIONS

- ETHERNET:** A system of networking computers and peripherals together to send data rapidly to each other.
- PHOTO CD:** System of recording film images onto a CD disk.
- PIXEL:** Picture element - the smallest are capable of resolving detail in a pick-up device, or displaying detail on a screen - fixing the maximum horizontal resolution.
- CD-ROM:** A form of compact disk used for storing digital data of all types. They are capable of storing 550 megabytes, but cannot be updated or changed by the user.
- ISO SPEED:** The rating applied to photographic emulsions to denote the relative sensitivity to light. Most digital cameras have 'equivalent' ISO ratings, to enable comparison with film.
- SCSI:** Small Computer Systems Interface - an industry standard for connecting peripheral devices to computers.
- TIFF:** Tag Image File Format - a standard image file exchange format.
- RAM:** Ram Access Memory - temporary memory created when the computer is switched on. The size of images which can be opened is dependant on how much RAM is installed in the computer.
- GUI:** Graphical User Interface - a computer interface such as the Macintosh system, or Microsoft Windows, which uses graphical icons to represent computer functions.
- DCS:** Digital Camera System - the name for Kodak's digital camera, based on the MegaPixel imager attached to conventional Nikon cameras.
- CD-I:** Compact Disc Interactive - a version of the compact disk carrying text, audio and vision for interactive users.
- CCD:** Charge Coupled Device - a solid state image pick-up device that produces an electrical output.





# 1

# INTRODUCTION

①

What if photography worked on a different system other than the one we use and take for granted? What if the light that reflects off an object passes through a lens but struck something other than film, something magical? Something magical that would allow the photographer to control the image in ways that nobody dreamed of, if the lighting ratio and exposure considerations were treated as afterthoughts, as minor technicalities that should not be allowed to get in the way of creating the image? If the photographer were free to concentrate solely on the image, and had almost total control over each element in the scene? Well this magical something is not a fantasy, but the revolution of computerized or digital photography.

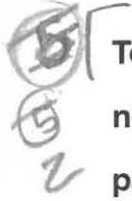
One can say that the revolution is one of the most exciting times in the history of photography. Not only are the rules of traditional photography up for review, but it is a time that new skills are being learned and some old ones retired and obsolete.

If you look at traditional photography you will find that the greatest changes in imagery is a result from technologic innovations and not from the lack of self-expression. Photography is simple; light reflects off an object passes through a lens, where it is focussed onto a piece of film. When one compares photography to painting, the fundamental difference between recording the different arts is that all the elements have to exist to make a photographic image complete, while a painter can paint existing and imaginative elements to complete the final image. Painters are free to express themselves freely, while photographers are bound by the different elements like lighting, which film to use, and so on. Creativity of the photographer is bound and everything depends on the narrow straits of technology of traditional photography.

Basically, the computer revolution has taken the important elements of the painter and the photographer, bound them together and developed a new era of computerized or digital photography.

**2**

# **BASIC DIGITAL PHOTOGRAPHY**




To describe digital photography in a nutshell, I would say it is a product of technology which involves digitizing a image, may it be a photographic image, a painting or even a negative or a slide. The roots of the digital camera system began with the development of the portable video camera.

The digitizing process involves the conversion or translation of the colours or different shades of the original image into numbers. When this conversion or translation has taken place, then the manipulation of the image can take place through changing the numbers.

Manipulation can take place in many forms. One can either change just the colours or colour cast of the image. Or shades can be made darker or lighter. If one wants to go a step further, solarization can be done. With the vast range of filters available to you in Adobe Photoshop 4.0 specifically one can twirl the image, distort it, make waves were there was nothing before and a whole lot more. One can even create your own new images by binding elements from two different images together. That is what I have concentrated on with my images. Basically the manipulation process consists of three different steps: The original image is "captured" and stored on a magnetic disk or the medium of ones choice. The image is processed and changed into numbers and loaded onto the computer. Here the image is manipulated, and finally, the image is taken from the computer and recorded onto film, paper or some or other form of hard copy. Each one of these processes require special equipment which will briefly be discussed.

Firstly the image has to be recorded and this can be done by using either a digital camera, video camera, videotape recorder or even the television set. The information is stored onto a medium of a preferred choice, mine being a Rewritable Magneto Optical Disk. The image is then sent to the computer, using a cable. This cable allows the pictorial information to be sent directly from the source of information to the computer, example, from an external Optical Drive gathering the information from an Rewritable Magneto Optical



 disk to a Macintosh computer... the computer: then converts the pictorial information into numbers. Another way of getting the images to the computer is by using a scanner. What a scanner does is senses the different colours or grays in a print then translates them into numbers, then transmits the numbers from the scanner via a cable which connects the two different elements, to the computer. Both these two methods that have been mentioned result in the digitized image.

The digitized images are then manipulated. Many different programmes have been written for the manipulation of images and in such a way that they are applicable to not only the computer whizzes but to everybody that uses them. The manipulation process can be a lot of fun and because of the new freedom, creativity can be born.

After the appearance of the image has been manipulated and completed to your satisfaction, the image can either be stored in the computer or converted onto your desired format like paper or transparency. If your preferred choice is paper, all that has to be done is to connect a printer of your choice and compatibility to your computer. If you prefer a slide or transparency to be your final result then a device called a film recorder is to be connected to your computer. The film recorder uses the numbers that make up the computerized image to create the slide or transparency.

The photographic process used today is essentially the same, though obviously greatly improved, as that invented by William Henry Fox Talbot in the 1830's. Film emulsion, in the form of silver halide crystals and gelatin is coated on to acetate sheets or rolls. These are exposed in a camera for a very short period of time, where the latent image is formed. This contains all the information necessary to produce an image, but requires processing before it can be seen. The development stage amplifies the latent image, and converts the exposed silver halide crystals into metallic silver. The unexposed silver halide crystals

4  
7  
4  
are removed during the fixation process, leaving a permanent image. Remarkably, over the 150 years or since Henry Fox Talbot (Lamford, 1980:19) invention, the process remains very similar, although with huge improvements in the speed and quality of the process. Modern emulsions are capable of resolving huge amounts of detail, with extraordinarily good colour fidelity.

These stages of exposure, development and printing are similar to the electronic imaging process, as mentioned briefly before. Included on page nine is a diagram that shows the digitizing process. (Fig 2.1)

Many however do ask the question about how the quality of the traditional photographic method and the digital method compare. It is however very difficult to compare the two because there is no common ground of quality that exists. Although to help you understand, Figure 2.2 (Fig 2.2) shows clearly the difference between the conventional photographic methods which use analogue or continual methods of recording and the digital systems. The digital system of recording data from the image which is compatible with digital based computers. Pixels are the digital equivalent of film grain - the more pixels in a given area of film, the more detail can be resolved.

Now that a basic relationship has been established between the traditional photographer and the one using digital lets discuss the advantages and the disadvantages of each.

#### DIGITAL:

##### The Advantages

- \* *Imaging on Demand.* There is no waiting for processing, deliveries, lab work on prints etc.
- \* *No Re-shoots.* Images can be examined immediately and adjusted whilst on the shoot.
- \* *Adjustable Colour Layers.* Although film has three colour layers, they are



chemically combined. One correction in light exposure affects all colour. Digital layers are separated. If it was necessary to correct something this could be done independantly of all the other colours.

- \* ***New Business Sectors.*** Digital iimaging on demand has opened new sectors of the market offering high margin business to the photographer.
- \* ***Compositing.*** Images can be collaged quickly and accurately. Tex and other elements can be incorporated into the image.
- \* ***Special Effects.*** Virtually unlimited effects and controls can be applied. These effects were very restricted and awkward in silver halide technology.
- \* ***Worldwide Image Transmission.*** Whether you are on set and shooting, or in your office, you can send your work to offices around the globe without fuss and literally instantly. People on the opposite side of our globe can make adjustments to your shoot, while you are on the set.
- \* ***Super Organised Image Storage and Retrieval.*** No digging through negs, scratched emulsions, lost contacts etc. CD media is fast and clean.
- \* ***Lifetime Guarantee On Longevity of Images.*** Film fades, changes colour and deterirates in many ways. Digital means permanent archiving.
- \* ***Digital Systems Offer Ther Flexibility of Adding Design Work and Publishing Options to Excisting Systems.***

## DIGITAL:

### The Disadvantages

- \* ***Some problems with extremely fine patterns in hghlights called artifacts, can handicap a picture. This is repairable on the computer but can take time to fix.***
- \* ***The Cost of The Whole System and Training.*** If you require really large pictures, you cannot use the instant capture system.
- \* ***Even the Portable Digital Cameras Required a Charge After a Hundred or or so Shots.*** If you fill your drives with pictures, you have to download them to use the drive again. This would require computers and cables.



## **SILVER HALIDE:**

### **The Advantages**

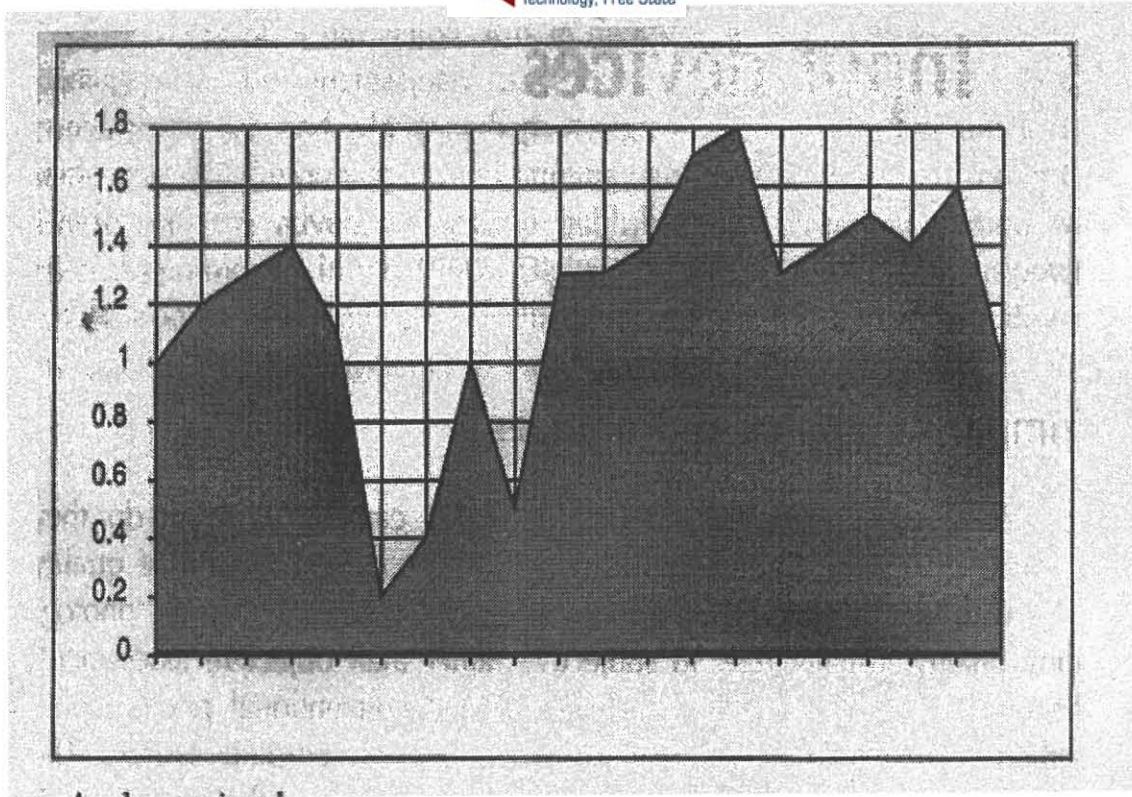
- \* ***You do not need a Computer to Proof Images.*** You do not have to learn the computer systems or technology.
- \* **Certain cameras do not require batteries and can shoot in odd locations endlessly.**
- \* ***Current Digital Instant Capture Systems Cannot Produce Murals or Very Large Prints.*** There are scan cameras that can do this but they are not instant capture systems.
- \* **Larger variety of Camera Systems and Capabilities.**

## **SILVER HALIDE:**

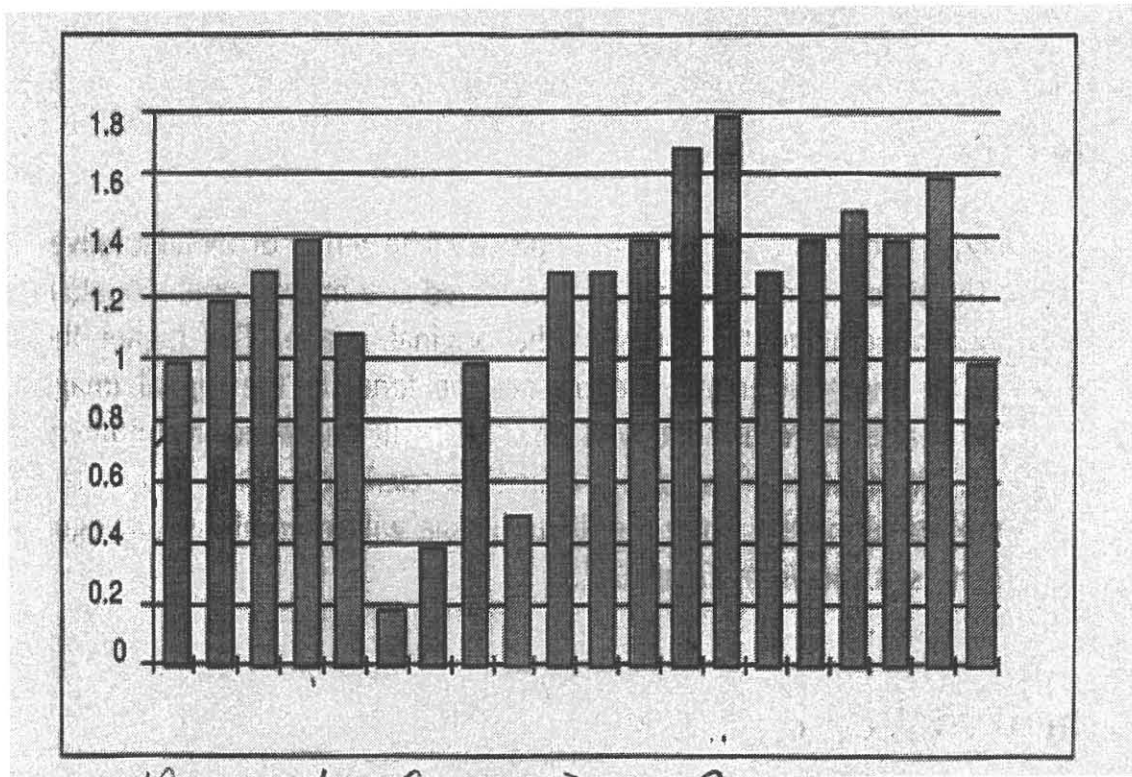
### **The Disadvantages**

- \* ***Slow Production.*** Imaging on demand is competing and can remove a silver halide photographer's once permanent customers.
- \* ***Very prone to errors.*** Whether human or chemical, a great deal more can go wrong with the silver halide image.
- \* ***Not Keeping pace with today's modern deadline.*** You may become less popular with your once patient customers.
- \* ***No Effects or Control over the Final Image.*** You can make only a nicely balanced print. No logos, text and effects that are becoming much of a demand these days.





**Analogue Signal**



**Digital Signal**

# USES OF DIGITAL PHOTOGRAPHY



11  
If one was wondering why digital photography is necessary when traditional photography is as advanced as it is? I will elaborate on two features that make digital photography so much more appealing than what everybody thinks it is.

Firstly it has tremendous flexibility when it comes to manipulating the different images and secondly the speed at which the images can be created is greater. Its speed makes it a valuable tool for communicating ideas within a company and over long distances, while the flexibility makes it ideal for fine art, advertising, commercial and fashion photography or can I say for any purpose for which traditional photography is used.

The main reason why industrial and in-house corporate photography departments are rapidly switching to digital photography is speed. In the past the artists used to draw graphs, charts and hand-lettered or set types for tables, and then the industrial photography department would copy the art onto slide film. This time consuming process was solved by the computer revolution. The computer has an immediate advantage over the artists, due to the fact that all the graphs done by the artist has to be done one by one and by the hand and the computer can many at a time. Then the computer converts the information onto any visual format needed, like 35mm slide film, overheads, or paper prints. This takes the place of the photographer that had to copy the information and put it onto slide film. It is even now possible to use a video projector to project the computer image directly onto a large screen, like a slide is projected. This technique does not only save time, but it is also cost effective, cutting out the cost of all the materials needed.

Other industrial photography tasks, such as documentation of manufacturing processes are also benefiting from the increased speed characteristic of digital photography. For example, suspected malfunctions in machinery can be videotaped. The video image can be put into the computer, where the image can be enhanced or enlarged, arrows or marks can be added to draw attention to important visual information, and then the print can be sent to the paper

printer which will print a dry colour image of the information. The entire process of computerizing the image and making a print can take as little as ten minutes.

Given that digital photographs are essentially a sequence of numbers, they can be transmitted quickly from one computer to another over long distances via telephone lines. Digital photography allows information to be sent to corporate headquarters from distant locations to other locations for rapid decisions. For example, if difficulties necessitating corporate intervention arise at a building site, a photographer can take pictures with a digital camera and send the image, via telephone lines or cellular technology, directly to the corporate board room. Many departments stores now use digital photography to transmit pictures of products to corporate headquarters for immediate approval of purchases, which again saves the company time.

News photography also benefits from the speed of digital photography. Fast-breaking news stories can be shot with digital photography equipment and the images transmitted directly to the newsroom where prints can be made by electronic printers in a matter of a few minutes. The time required to transport the film to a photo lab for processing and printing is saved, which can make the difference between having visuals for an important story by deadline or not.

A truly extraordinary feature of digital photography is that it enables discussion and modification of visual images over long distances. For example, it is possible for a photographer to transmit a digital photograph over telephone lines to a computer in an advertising agency in another city. The photographer can actually manipulate the image appearing on the advertising agency's screen, showing what the picture would look like darker, in pastels, or with a different composition, while talking to the art director on a telephone. The art director can give his own input and make suggestions that can be changed immediately. This ability not only helps the creative process but also eliminates misunderstandings which sometimes also arise when talking about visual images without



actually seeing them.

Besides speed, digital photography offers virtually limitless flexibility in creating imagery. Many visuals, especially those used in advertising, commercial and fashion photography, are meant to grab the viewers' attention. It is up to the photographer to make the product stand out. The digital photographer can create images that would be difficult or impossible to shoot with traditional photographic techniques. Moreover, many alternatives can be explored in a brief period of time. A full colour image can be changed into a pastel image with the touch of a few keys on a computer keyboard; resulting image can be modified by increasing or decreasing the contrast, lightening or darkening the image, or changing it into charcoal - like drawing.

The digital photographer can create many variations on a theme, and in doing so, has more precise control over the photographic process. In traditional photography, techniques such as posterization may be accomplished in seconds, and if it is not appropriate for the job at hand, it can easily be modified or abandoned, as the time investment is minimal.

Digital photography can be applied in all areas of traditional photography, allowing a previously undreamed control of the image, regardless of the subject: wedding, landscape, architectural, food, fashion, sports, etc. Every portion of the digital image can be individually manipulated, making digital photography the ultimate retouching medium. If a model's eyebrow needs to be touched up, the digital photographer can do it in seconds. If the light coming through a window in an interior shot is too bright, it can be darkened, while the remainder of the image is left untouched.

In addition to its use as a retouching tool, digital photography is an extremely powerful special effects generator. Its ability to merge portions of one image with another, for example, merging the sky from one slide to the buildings from another, adds to the fine or commercial artist's ability to create unique visualizations.

Digital photography can also be applied to do things totally beyond the domain of traditional photography. For example, computerized architectural renderings of proposed buildings can be inserted into the photographs of the actual building site, to make more meaningful presentations to clients or prospective financial backers. Landscape architects and gardeners can merge photographs of clients' houses with photographs or paintings of shrubbery, lawns, and flower beds to present their ideas. If the client wants to see what his house would look like with shrubs, the computerized image can be changed as the client watches. A colour printout can be made in a matter of minutes for the client to take home to study.

Computerized photography is being used by plastic and reconstructive surgeons to show end result of the proposed surgery. Cosmetics companies can show the client the ageing effects of the sun, by photographing customers and then using a computer program to show what the individual will look like in 20 years, based on answers to questions about the customer's skin type, hours of exposure to the sun, and so on.

Digital photography is being used to catalog and allow for viewing via computer-televised imagery, extremely rare and fragile works of art, which otherwise would not be displayed. For example, the Getty Museum in Los Angeles is using digital photography to copy its collection of illuminated manuscripts onto video disks or videotape for viewing.

These are but only a few of the uses of digital photography, more will still show their faces....

# 4

# **PREDICTIONS REGARDING THE DIGITAL IMAGING MARKET**



Digital cameras seem certain ~~one way to invade~~ the mass market. The question is when? (The Economist, 30/10/97) Some indications are:

History

- : In 1997 over 2 million digital cameras were sold over the world, outselling the 35mm SLR (single lens reflex camera) for the second year straight.
- : Since Adobe introduced the software, Photoshop, in 1989, growth of the digital cameras exploded. The sales of the digital cameras are expected to increase six - fold within the next two years.
- : Kodak Eastman Corporation estimates that of the 72 billion photographers take each year worldwide, between 20 and 40 percent are going to be processed digitally. And with the year 2000 round the corner, there will be even a greater demand for image editing tools.
- : Dataquest predicts digital still camera growth to trippe over the next four years, from 1.9 million units in 1997 to 5.98 million in the year 2000. Other experts predict the market close to 10 million.
- : "Fifty - nine billion photographs are taken every year world wide. Approxiamately 1.7 million digital cameras were shipped worldwide in 1996 and according to the International Data Corporation, that number may reach 8.4 million units in the year 2001."
- : "Eventually, film will be to photography what vinyl is to recorded music: an antique medium with a special nostalgic feel" (James Glick, New York Times Magazine)
- : "Ellison said some 7 million United States homes aquired colour inkjet printers within the past year, and new models from Hewlett - Packard will be optimied for FlashPix formats."
- : "The real explosion in digital photography will happen when the 300 dollar, million - pixel camera arrives."
- : Sarnoffs low - cost CMOS sensor will not only reduce manufacturing cost for sensors, but will also allow other components to be combined with it, further driving down the cost of the camera.

This makes one wonder, when we will see the first "disposable" digital camera?.



# 5

# CURRENT EQUIPMENT OPTIONS

This chapter aims to help one understand the basic variety and technology that is available at the present moment. (Macworld, Issues May and June 1998)

## 1. LENSES

Just about every digital camera today uses a fully - glass lens with a typical focal length of 43mm. This is considered as a medium angle lens. Many point and shoot cameras offer a wide angle lens capability of 28mm. Digital cameras (aswell as camcorders) have difficulty offering a wide angle view due to the optical limitations poised by the very small size of the actual LCD, and this problem will not be solved in the near future.

## 2. DOWNLOADING IMAGES

I have already briefly mentioned the downloading process in chapter two: Basic Digital Photography, I am just going to elaborate on it.

At present there are three different methods that can be used to download images from the camera to your personal computer (P.C.). The most inexpensive way is by using a serial cable connected to your serial port. Due to the sizes of the different images many users often complain about lengthy download times. This is due to inherent speed limitations of the serial port and CPU time required. Similary, a parallel port with a pass - thru connector is sometimes used. Unfortunatley, manufacturer's hate this method because of the greater chance for system conflict and thus resulting in either a returned unit or call to the technical line.

Some cameras particulary those that are at the high end, have ventured to use SCSI connections. (pronounced scussy). The SCSI connections are more for the more technically savvy persons but it does result in an increased download speed.

All the methods above require the users to fiddle with a cable and connecations at the rear of the computer, which can be hazardous. Infrared is offered by an handful of firms, however, it is a bit off the beaten track, and only the real enthusiasts use this method. Later you will be finding cameras offering USB or Universal Serial Bus. This high speed two cable connection which offers a hot plug

and play facility and a cable up to five meters in length. USB ports are being included into the new computers and a plug-in interface card should also be available to upgrade older computers.

### 3. FEATURES

One should consider the desired features before making a purchase of a digital camera. Also to make sure that the choice being made suites the buyer best.

The tv and video out is a connection which allows one to display ones images on a television monitor after a days outing with the camera. This mode is favoured by approximately one third of users and is quickly becoming a standard feature.

Many cameras offer a LCD viewing screen so that you can quickly see the picture you have just taken. This screen can be convient but it is a every consumer and it attracts unneccesary fingerprints and while working outside in very sharp light, it will be difficult to view. If your camera has a built in memory and if you will not be able to download immediatly, LCD screens are a great feature to assist in immediatley deleting unwanted images. LCD are however not a necessity and keep in mind, the energy consumption when looking at this feature.

Not all the digital cameras have an optical viewfinder, not because of the cost involved, but because of the valuable space it consumes inside the camera. The advantage of the optical viewfinder in the digital camera, is it allows the camera to be used in much the same manner as a normal camera (single lens reflex camera).

A flash is one of the features that is a total necessity. Due to the lower ISO ratings of all cameras which is normally a ISO of 100, you will need a flash for inside and shadowy outside pictures. Some manufactures save money by not putting a flash into the camera, hoping that an inside brightly lit store test will convience you. Do not let it, a flash is a definate necessity.

Many people are concerned by the way the camera looks and take it into great



consideration when purchasing a new camera. There are choices, like the traditional point and shoot camera look alike. Even a VCR camcorder look alike. The traditional look is probably the most preferred one, but at this stage, due to the amount of electrons required inside the camera, the VCR camcorder look is sometimes the only direction available. But as time goes by, the manufactures will reduce their elements and more space will be available and the traditional look will be on the market.

There is most definately not a shortage of the choices one has when having to purchase a digital camera. In this chapter the specifications of a group of digital cameras will be discussed, to give one a better understanding and more information about the different digital cameras available to the buyer. Agfa, Epson and Canon digital cameras will be discussed.

There is a great range of cameras available from all three of the above mentioned. Firstly a variety from the Agfa range will be discussed.

#### **4. AGFA DIGITAL CAMERAS**

##### **4.1 AGFA ePHOTO 780:**

This camera has a resolution factor of 1024x768. It contains a SmartMedia memory card which is removable aswell as a very important factor, a flash. The optical and 1'8" LCD viewfinder are present. Ther cameras capability of storeing images rangers from eight to ninety - six images. It also has a NTSC video output, but this camera is not recommended much.

##### **4.2 AGFA ePHOTO 1280:**

The ePhoto 1280 has got a few more specifications than the ePhoto 780. It also has a resolution factor, but slightly bigger, of 1280x960. The SmartMedia memory card and flash is also present. There is no optical viewfinder but a large 2' LCD viewfinder. The camera has a 4 mb removable memory card and its storage capacity is up to sixty photo images. It also has a NTSC aswell as a PAL video out and a three times zoom. Included is a universal power supply and a tripod



mount. That is not all, it has the ability to accept standard filters aswell. Does this sound good or what?

#### **4.3 AFGA ePHOTO 307:**

Now that one knows what the professionals would choose, lets have a look at what digital camera is best suited in the agfa range for the beginner. This camera is a low priced camera and has a resolution of 640x480. There are two resolution modes and they maximum amount of images that can be stored are seventy - two JPEG pictures. For home users for picures up to 4x6 in size this may be your choice. Enlargements larger than this size will need a bigger resolution factor. The camera uses a standard AA batteries. It has a fairly fast re-cycle time (3 seconds between shots and a mediocre download speed which is up to 5 minutes from camera too computer. So this camera is ideal for home users.

#### **4.4 CANON POWERSHOT A5:**

This camera has a standard 35mm lens with a maximum shutter speed of 750th per second. It has a compact flash memory for extended storage needs a standard JPEG file system and a resolution factor of 1024x768. A optical and LCD viewfinder is also present.

#### **4.4 CANON POWERSHOT 350:**

This camera also uses standard AA batteries for a source of energy. The resolution factor of this camera is 640x480, it has a fixed lens and a removable two meg compact flash memory card. It can store up to forty-seven images varing from eleven and twenty-three. There is a 1.8" LCD viewer and no optical viewfinder. The camera has a six second re-cycle time between shots and a macro capabiltiy which allows one to shoot as close as one inch away. It has a NTSC video out and a download time of  $\pm$  six minutes.

#### **4.5 CANON POWERSHOT 600:**

This camera has no optical viewfinder and a resolution of 832x608. There are

three selectable modes of resolution and one mb of memory offering up to eighteen images. It has an additional memory modules using standard ATA PC cards. The lens is fixed at 100 ISO.

#### 4.7 EPSON PHOTO PC 550:

Unfortunately this camera has no flash, but other than that, the specifications look rather good. Read through and see for yourself. The cameras energy source is supplied by standard AA batteries. The resolution has three levels and is 640x480 and it uses a standard JPEG. There is a built-in microphone for recording sound and a removable four mb memory card allowing up to one hundred and forty-seven resolution images per card. SmartMedia memory cards and a self-timer for including yourself in the picture. It also has a speedy download of  $\pm$  ninety seconds form camera to computer.

#### 4.8 EPSON PHOTO PC 600:

This cameras resolution factor is 1024x768, with a remarkable four mb compact flash memory cards which stores from seven to fifty images. LCD and optical viewfinder, flash, NTCS video out capabilities and three times digital zoom.

### 5. SCANNERS

There is a variety of flat bed scanners, sheet bed, built-in and slide/negative scanners available on the market place. Selecting a scanner is a real challenge. A good scanner matches reasonable hardware with superb software. HP, Microtek and Umax have generally done well on both counts.

Many scanners require a SCSI interface and are generally packaged with a cheap ISA base card. SCSI interfaces are often the source of needless aggravation due to the general complexity. SCSI cards are available in two flavours, ISA and PCI. These are the type of interface “slots” you will have in your computer. ISA is an older technology and most newer computers are limiting the number of ISA slots and focusing on the newer PCI standard.

Modems and sound cards are generally ISA slot based. ISA is prone to numerous

complications that can be difficult to resolve, including the need for a famous “internups”. PCI has fewer opportunities for interference and offers a wider data speed. Unfortunately, PCI interface cards are a bit more expensive to make.

Due to the headaches (for both the manufacturer and the user), several consumer grade scanners also offer parallel port pass-thru connectors eliminating the need to fiddle with an interface card. Unfortunately, you may have other devices that also desire a pass-thru connector (Zip, CD-Rom and Tape-backup drive) which can create conflicts (not to mention cable confusion). Parallel connectors require some “software” tricks and thus are susceptible to their own type of problems. However, they do indeed generally work well.

If you have a USB equipped computer, you are in luck. USB which stands for Universal Serial Bus is a simplified two pair cable that allows for the easy installation (hot plug and play) of medium speed peripherals (up to 12 MBPS through put). USB can be thought of as a desktop LAN and it can support up to 127 different devices separated by up to five meters. Devices can be either star wired (using an inexpensive USB hub) or daisy chained SCI. The sorta part is that there are no current scanners using USB. The arrival of Windows ‘98 which offer out of the box USB support thus there will be a major USB push to justify a larger market for scanners with USB interfaces.

## 6. FLATBED SCANNERS

### 6.1 MICROTEK SCANMAKER E6:

This scanner receives constant raves based upon the important image quality factor. The internet is alive with fanatics in love with the E6 machines. The ScanWizard also is a joy to use offering enough simplicity for beginners and enough controls to satisfy the advanced user. The negatives of the scanner is it looks a bit cheesy (especially the cover lid) and should you run into problems, there is support from Microtek. Microtek has also released two other scanners (V300 and V310), both use the great ScanWizard software and differ



in software bundles, scan size, and other things. The entire Microtek line is well worth considering.

## 6.2 HEWLETT-PACKARD SCANJET 5PSE:

This is a distant competitor to the E3. This fine scanner, the package software is aimed more at the beginner. Scan image quality is proportionated to the hot rival, E3 above, but in our opinion you probably will not notice it. HP (Hewlett-packard) has consistently gotten high marks for service and technical support. If you want a scanner for occasional photographs, this unit is fine.

## 7. SHEET SCANNERS

### 7.1 STORM TECHNOLOGYS:

Storm, as well as Kodak and Polaroid, make external photo scanners designed for family shot up to 5"x7". These units automatically scan using rollers to pull the photo through the unit and are perfect for getting lots of basic photographs into your computer. Storms Easyphoto drives actually installs in a 5 1/4 bay in your computer eliminating any desktop space requirement. The software is a bit basic, so while easy to get started, you may find them a bit lacking once you get the hand of them.

### SOME GUIDLINES:

Use the same paper brand as that of your printer, it will always give the best results. Scan the resolution you need, a colour glossy photograph has no more than 200 dots per inch of information. You can not get more no matter how great your scanner is. For inkjet printouts, I scan at 300 dpi, Epson recommends 240 dpi for their colour inkjet series. If you will be displaying on the Web or CRT, you can scan at 72 dpi, but in no case more than 300. Never use the brightness and contrast features of any editing program. This is the most common mistake and always leads to terrible results. There are the other ways to correct things. Always adjust your exposure settings first, then play with colour if necessary. Fiddling too much will yield horrible and non-recoverable results. Where possible, use your scanner control panel to adjust

the picture first before the scan. Trying to fix a poor scan after the fact is often difficult. Turn-off any colour management features when printing. Microsoft and Hewlett-Packard should stick to what they know, we have never seen anyone happy with these features turned on. Colours are often too bright and do not reflect reality.

The computer and digital market is one that changes very quickly. New products are brought out regularly and replace the older ones so statistics of the different products can change.

# 6

# COMPUTERS



Other than the actual camera that is used is recording the images that are needed the computer used is probably one of the most important elements used in this new form of producing the final image.

When the computer first became widely available, perhaps ten years ago, they were slow, had small memories and required a great deal of knowledge to operate them. They were not ideally suited for imaging purposes, but within the last five years or so the situation has changed dramatically. Computers have become “user-friendly” and much cheaper. No longer is it necessary type in strings of commands. Instead, most computers have Graphical User Interfaces whereby the majority of operations are controlled with a pointing device known as a ‘mouse’ which moves a cursor around the screen. Many of the computer functions are shown as symbols (icons). With modern computers, the display on the screen is analogous to that of an office, with a desktop, stores of files and a wastepaper basket. Files (collections of named data or images) are retrieved from their storage place (hard disk, floppy disk or external disks), and brought on to the desktop screen to be viewed or worked upon. A click switch on the mouse is used to move or access items, and menus on the screen give the user a range of command options. Files are deleted by dragging them into the wastebasket and emptying it. The Apple Macintosh computer has become very popular, almost a cult, with artists, designers and photographers as it is extremely easy to use. It was originally designed so that a small child could operate it, without any knowledge of computers at all. Recently, the PC type of computer has also adopted the GUI approach of the Apple with its Window software, and many imaging and desktop publishing programs, previously only available for Apple computers are now available for PC’s as well.

As to the question of which is the best machine for electronic imaging applications, there is no simple answer. Many different machines costing a range of prices will perform many of the tasks required by photographers, at different speeds. Before investing in a system, photographers must ask themselves several questions.

Whilst it is possible to print directly from digital files, many photographers will still

need to output on to film for many purposes. This is to be high resolution 10"x8" transparency, a specifically designed imaging workstation is probably the best answer, but these are very expensive. Much controversy exists regarding the size of files required to give sufficient quality for such purposes. Output to 5"x4" and smaller film, or thermal print, can be achieved quite easily on a desktop computer, though it will invariably need to be equipped with a large amount of RAM. This information will answer the question about what type and quality of output will be required.

Another question to consider and probably the most important is how large your budget is and what other types of work will the computer have to carry out? The budget question is probably a very important one to most people. Over the last couple of years, prices of desktop computers have fallen dramatically, but even so, computers for imaging have special requirements of memory and speed which make them relatively expensive. Remember to cost all of the extra items required for imaging purposes, such as external storage, CD-Rom drives for PhotoCD, SCSI connectors and Ethernet cards if these are not included in the price of the machine. Also will the computer have to run more than one application program at the same time, and swap data between them? These questions have to be answered before your ideal computer can be purchased.

Now that an understanding has been established about a basic computer and the different needs that you need, I am going to elaborate on the basic operations of the computer. Take note this is not a computer book, so further information can be found elsewhere. (Digital Imaging and Publishing Magazine, Macworld Magazine, and even the Internet)

## 1. BITES AND BYTES

Before discussing the various components of a computer, and differences between various systems, it is necessary to understand some fundamental concepts and terminology of computers, how they work, and how information is stored.





One item of digital data, represented by a switch that can be either on or off, is called a bit (short for binary digit). Two bits can give four instructions (i.e. 0 and 1 can be configured in 4 different ways: 00, 01, 10 and 11). A group of eight bits, or switches give 256 possible combinations of 0s and 1s, and represent single letters, or other characters for example. This is called a byte. Eight bits is sufficient for all of the upper and lower case characters and other symbols required on a standard keyboard. 24 bits give 16.7 million combinations. Originally, most personal computers using 286 processors for example were 16 machines. Nowadays, PCs with 386 and 486 processors, and all Macintoshes are 32 bit processors.

#### *Terminology:*

8 bits = 1 byte

1024 bytes = 1 kilobyte (K)

1024 kilobytes = 1 megabyte (Mb)

1024 megabyte = 1 gigabyte (Gb)

## 2. HARDWARE

This term refers to the actual components of the computer system, which is generally divided into three main areas, the processor, the monitor display, and the keyboard and mouse. Many peripheral devices, CD-ROM drives, scanners and graphic tablets and printers. The main requirements for any photographic computer imaging system are large amounts of memory (RAM), large amounts of storage space, speed of processing the data and high resolution of monitor display.

## 3. THE PROCESSOR

The computer is controlled by a microprocessor, or 'chip', the type of which often gives rise to the generic type of computer (e.g. 286, 386, 486 in PCs). The higher the processor number, the more elements are available for communication, and therefore the more powerful it is. The processor runs at a fixed clock speed, which is the speed at which the Central Processing Unit (CPU) communicates with the various elements within the computer. The speed is rated in megahertz (MHz) - one megahertz representing one million instructions per second. It is not, however, sufficient just to compare clock



speed of chips however, as modern chips, with integrated co-processors and memory, may run faster than older chips. For imaging purposes, speed is a critical consideration when selecting a machine. The central micro-processor can be accompanied by other devices such as a 'maths co-processor' (or 'floating point co-processor' or FPU), which helps speed up applications requiring large amount of mathematical computations such as graphics or complicated spreadsheets. Motorola 68040 processors, used in Apple Macintosh computer, and several Intel 486 processors used in PCs have built-in maths co-processors.

#### 4. OPERATING SYSTEMS

The operating system of a computer is a series of computer programs which enable other programs to run on the computer. It creates an environment enabling different programs to perform functions such as saving, displaying lists of stored files and deleting. Without an operating system, each program would need to have these functions built-in. IBM clones use "MS-DOS" (Microsoft Disk Operating System) whilst Apple Macintosh computer currently use 'System7'. Many new operating systems are under development including 'Windows 95'. Most PC users also run their programs under Microsoft Windows. This is really a collection of programs enabling the user to perform many tasks on the computer more quickly and easily than under DOS, which requires the typing-in commands to instruct the computer to perform operations.

#### 5. RAM (Random Access Memory)

Programs and other data are stored on disks, usually the internal hard disk of the computer. Before the computer can carry out any functions, the program must be transferred into RAM, together with the data required to be viewed or manipulated. Perhaps a better term for RAM is Read Write Memory, in the form of chips. RAM is temporary storage - when the computer is switched off, everything stored in RAM is lost. Anything that you wish to keep must therefore be saved either to the hard disk or other form of storage such as a floppy disk. Generally the larger the effective RAM, the more easily tasks such as image manipulation can be carried out.

An imaging program like Adobe Photoshop requires at least 3 Mb RAM (preferably 5 Mb). Therefore, before an image has ever been opened, we used up at least 5 Mb of RAM. The images themselves will be large, anywhere probably from 500 Kb to several Mb. As a general rule, an image requires three times as much free RAM as it is large (this is because the program maintains a record of the image prior to manipulation to enable that operation to be 'undone').

## 6. MONITORS

Important considerations for imaging are the size of the monitor, the number of colours which can be displayed on a monitor, and the sharpness of the image. When running imaging programs such as Adobe Photoshop, a minimum of 16 bit per pixel is required, and preferably 24 bit to give photographic quality images. The correct combination of computer, monitor and graphics card is required to give this facility, and it must be checked carefully when selecting a machine. With some Apple models for example, extra VRAM (Video RAM) chips can be added to give the required bit depth with some monitors. It is easy to calculate the amount of VRAM required for specific bit depth for certain monitor sizes.

A 14" monitor, with a resolution of 640x480 pixels, displaying just black or white, requires 307 200 bits of information, or 38 400 bytes or 37.5 kilobytes. To achieve 8 bit colour (256 colours or grays) this monitor will require  $37.5 \times 8 = 300$  k. Therefore, a computer with 512k of VRAM fitted as standard is capable of displaying 8 bit. With other monitors, graphics cards will be required. Different computers will require different cards, and advice should be sought from the dealer for each specific machine. Monitors resolutions are quoted in pixels. A single pixel is created by several adjoining points of light on the display. The fewer the dots of light used to create the pixel, the better the resolution. The size of a monitor is quoted in inches, and is measured diagonally from corner to corner. This may be misleading however, as this figure will probably not be the actual image size.



## **SOME GUIDELINES CONCERNING COMPUTER USES:**

- 1. Always save an image after scanning or digitization before commencing any enhancement or manipulation. Most programs have a 'revert' option, enabling you to revert back to the previously saved version of an image. If you have not saved it you will have to start the process all over again.**
- 2. Because images are large, always crop out any redundant information such as unwanted borders, to reduce the file size to a minimum.**
- 3. If you are carrying out complex manipulations or enhancements to an image, save several versions so that you can go back to a particular one. Most current image processing programs on desktop computers only let you undo the very last operation carried out. If you are not sure whether a particular manipulation is right or not, then save it with a different file name for reference.**
- 4. Do not work with images that have higher resolution than is necessary. As when the resolution is doubled, the file size increases by a factor of four. If the final output is to be low resolution, or small size, then consider re-sizing the imaging to a lower resolution, in the same way as you would decide what camera/film combinations to use for a particular photographic job.**
- 5. Compress images before saving them, using JPEG or some other image compression package, and always keep a second back-up copy on another disk.**
- 6. If you are manipulating images, and perhaps adding new elements, or moving existing elements of an image, be careful to ensure that the result 'looks right'.**



# 7

# IMAGE PROCESSING

In order for the computer to enhance, manipulate or analyse images, it must contain image processing programs (software). There are a variety of different programs available, varying both in their capabilities and price. Many of the less expensive programs will still carry out a wide range of image enhancement and retouching procedures, and it is worth examining these carefully to see if they are adequate for purpose required.

The photographic imaging programs can be broadly divided into those for image retouching and manipulation, those for scientific image analysis, and those designed for enhancing images before outputting to print and other media. There is considerable overlap between them, and increasingly powerful programs are constantly coming on to the market. Programs are updated at regular intervals by the authors, and it is very important to register your software immediately with the manufacturer to ensure that you receive the latest versions and upgrades.

Most of these programs will perform all of the familiar operations of image adjustment which photographers now carry out in the darkroom such as altering the brightness, contrast and colour of images, dodging and shading, sepia toning, posterization and solarization, and even conversation from negative to positive and vice versa. But on top of this the computer is capable of performing many operations not possible with conventional photography. To describe the potential of the software available, I will use Adobe Photoshop, it is probably the best known of the packages currently available and it is the program used for my own images. The current version available today is compatible with Macintosh, PC and Umax platforms, and its basic operations are very similar on all of these systems.

## ADOBE PHOTOSHOP

Upon opening the program, the screen will be seen to display a menu bar at the top, and a toolbox running vertically down the left hand side. Images stored in a large range of file formats can be opened. The software also has various 'acquire modules' often supplied with scanners and digital cameras, Photo CD, so that the device is actually accessed through Photoshop.

The 'toolbox' contains familiar items such as pencils, paint brushes and buckets, rubbers, dodging sticks, together with others for selecting areas of the image, creating text, cropping images and filling selected backgrounds with a gradient tool.

Tools are selected from the toolbox by clicking the cursor on the required one, then taking it into the image area. The arrow cursor then changes to the shape of the tool in use. There are a total of 40 different cursors within Photoshop. With most of the tools, double-clicking with the mouse brings up a range of further options which may be selected. Some of the cursors, such as the rubber stamp and the paintbrush, are quite large, and may obscure parts of the image if highly precise work is required. By depressing the 'caps lock' key, the cursor changes to a cross hair, which does not interfere with the image being viewed

The Selection Tools enable you to select parts of an image for modification or adjustment. Once selected, the required area is outlined by 'marching ants', an animated dotted line. When applying modifications to the image, only the area selected is affected.

Painting and drawing tools are the next eight tools found in the toolbox, they are con-



cerning with painting and ..... they all have different results.

The menu bar at the top of the screen contains sub-menus for such operations as changing the mode of display of the image, adjusting brightness, contrast and colour balance, applying electronic filters and controls for copying and pasting parts of images together. When working with large images, particularly on relatively slow computer, it is good practice to select a small part of the image, make adjustments to the area, and then apply the settings to the whole image when the desired result has been achieved.

Other than the toolbox and menu bar, Photoshop has many other features, with too much detail to go into, that can be used. For-instance, selected parts of an image can be copied, and 'pasted' into other images, or back into the same image. The pasted image can be rotated or flipped, altered in terms of its transparency, and have its edges softened by feathering. A built-in densitometer shows you information regarding the density, or colour composition of any pixel on the screen, and its position within the bitmap.

All my images included have been manipulated in Adobe Photoshop, so a better visual understanding can be obtained. This can be seen in the Appendix.



# 8

# THE FUTURE

With the rapid developments in electronic imaging, many people are asking the question as to how long conventional silver-based film will last. Film of course relies on silver, an expensive precious metal, and huge amounts of potentially dangerous and polluting chemical are consumed in the production and processing. As all photographers know, film is capable of recording huge amount of information, with excellent degrees of sharpness and colour fidelity. A 35mm slow speed, fine grain transparency can record a phenomenal amount of information. To achieve approximately the same amount of information digitally would require about 18 million pixels, giving a file size around 72Mb. This obviously takes up far more space, and costs far more than a piece of 35mm film. It is likely that for many purposes, silver-based film will continue to be used for the foreseeable future.

Fuji have recently been quoted as predicting the death of silver film within 15 years for still photography within the amateur market. US military organizations expect to ban all wet photographic processes by the end of the decade. These predictions are obviously dependent upon the development of new digital cameras, with such factors as price and quality which will affect the market. In the 1950s, the atomic weapons an ever present threat, the Army Signal Corps feared that silver film might be fogged by atomic explosions. They funded research into a new silverless imaging system, which became known as Xerox process. The first microwave ovens were very expensive. Now, with large consumer demand, they are relatively cheap. For electronic cameras to take over from film cameras will mean persuading large numbers of people to buy new cameras. The same argument applies to high definition television, where many of consumers will need to buy new televisions if they are to benefit from the new technology.

With Camera developments, new CCD chips are currently under development which will mean huge increases in quality of digital images. Kodak have demonstrated a 35mm size 6 million pixel chip which gives outstanding quality, and it is likely that these developments will continue. At present, CCD imaging chips, are put into conventional single lens reflex and other



other types of camera. They are also found in video cameras and camcorders. One possibility is for new hybrid cameras to be developed fulfilling two functions of moving video images and still digital pictures.

Before launching into the world of digital imaging it is worth considering the motives behind any investment. A number of photographers have found that the digital imaging system is an expensive addition to their business appearing as a minus on the company profit sheets instead of a plus.

# 9

# DISCUSSION OF OWN WORK



With the technology changing and pointing more in the direction of digital work, I decided to combine the two different mediums, seeing I enjoy both photography and working on the computer. Most of my images are first photographed with any medium camera, then scanned into the computer with an Agfa scanner. Then I changed and manipulate the images as I wish and the final image I print out onto paper with a Canon BJC 4550 printer.

**Pillar and Clock** consists of a staircase background, a sunset and a clock that were put together. The colour cast was changed to obtain the blue background and the shear filter was used to distort the clock. The sunset used was pasted into the image.

**Sunflower** consists of a sunflower, a sunset background which were converted and copied on opposite sides of each other. A colour cast was used to change the colours and a zigzag filter to get the wave like effect.

**Hands** consists of a seashore for the background. Hands were photographed and then cut out and pasted onto the background. The spherize filter was used to make the ball that you see. After the ball was completed, I chose the different colours and with the fill and gradient tool coloured the ball in. I then did an overall colour change and had my final result.

**Blue Peppers** was more of a simple image to create. I photographed the red peppers with a Single Lens Reflex Camera on rocks. Scanned the image into the computer did a colour inverse, which gave it the blue colour and then used a wave filter around the edges.

**Leaves** was a collage of leaves of which I cut one out. The background consists of the collage which I copied and pasted opposite each other. The colour cast was changed, and with a Zigzag filter I placed the whirlpool in the middle.

Same as the Blue Peppers, the image was photographed and given a colour cast change.

**Bouncing Balls** background consists of stairs which were placed together to form a dungeon looking background. The spherize filter was used to create the balls. And a wave and zigzag filter were used to complete the water.



**Absolute Puzzling was an original image of a vodka bottle. The colour cast was changed and cut into puzzle pieces and placed in a puzzle format. A text was included using the text tool.**

**Out There was an image that was manipulated by filling in different colours with the fill tool.**

**Winter is a collage of leaves that give a wintry feel. Each leaf was cut out separately and with the layer transform tool sized differently and pasted onto a background.**

**Broken fence was also an image that the colour cast was changed.**

**Basically what I have done with the images is give them a different feel to that of an original photographic image. I use any camera I want to, and enhance the images with an Apple Macintosh Computer, using mostly Adobe Photoshop which is the software. The images are printed on a Canon BJC 4550 printer and the images scanned in with an Agfa Studio Scanner iisi.**

# CONCLUSION

**Has the technology spawned new images or merely made old ideas easier? I would say technology has made old ideas easier!**

**Photographers have to now learn a new technology. Their job description has also changed. Hopefully the reader will take full advantage of this script and of the new developments that are happening around us, as illustrated in my own work.**

**Although many questions have been answered, one still remains: “Where are we as photographers heading in the future?”**



# 11

# BIBLIOGRAPHY

1. **PETERSON, B. 1995. Using Design Basics to get Creative Results. Collins, London.**
2. **BRESLOW, N. 1996. Basic Digital Photography. Seeley, Service and Co. Limited, London.**
3. **DAVIES, A. AND FENNESSY, P. 1996. Electronic Imaging for Photographers. Penguin Books, London.**
4. **COLLEEN, B. 1991. Digital Imaging and Publishing. Issues March '98 to September '98. Royal Publications (Pty) Ltd.**
5. **EATON, G. [guy-eaton@macworld.co.uk](mailto:guy-eaton@macworld.co.uk)**
6. **MUSTAFA, M. [mustafa-mustafa@macworld.co.uk](mailto:mustafa-mustafa@macworld.co.uk)**
7. **RIDYARD, A. [anne-ridyard@macworld.co.uk](mailto:anne-ridyard@macworld.co.uk)**

# 12

# APPENDIX



# **CONTENTS**

**PILLAR AND CLOCK**

**SUNFLOWER**

**HANDS**

**BLUE PEPPERS**

**LEAVES**

**WATER WILLOW**

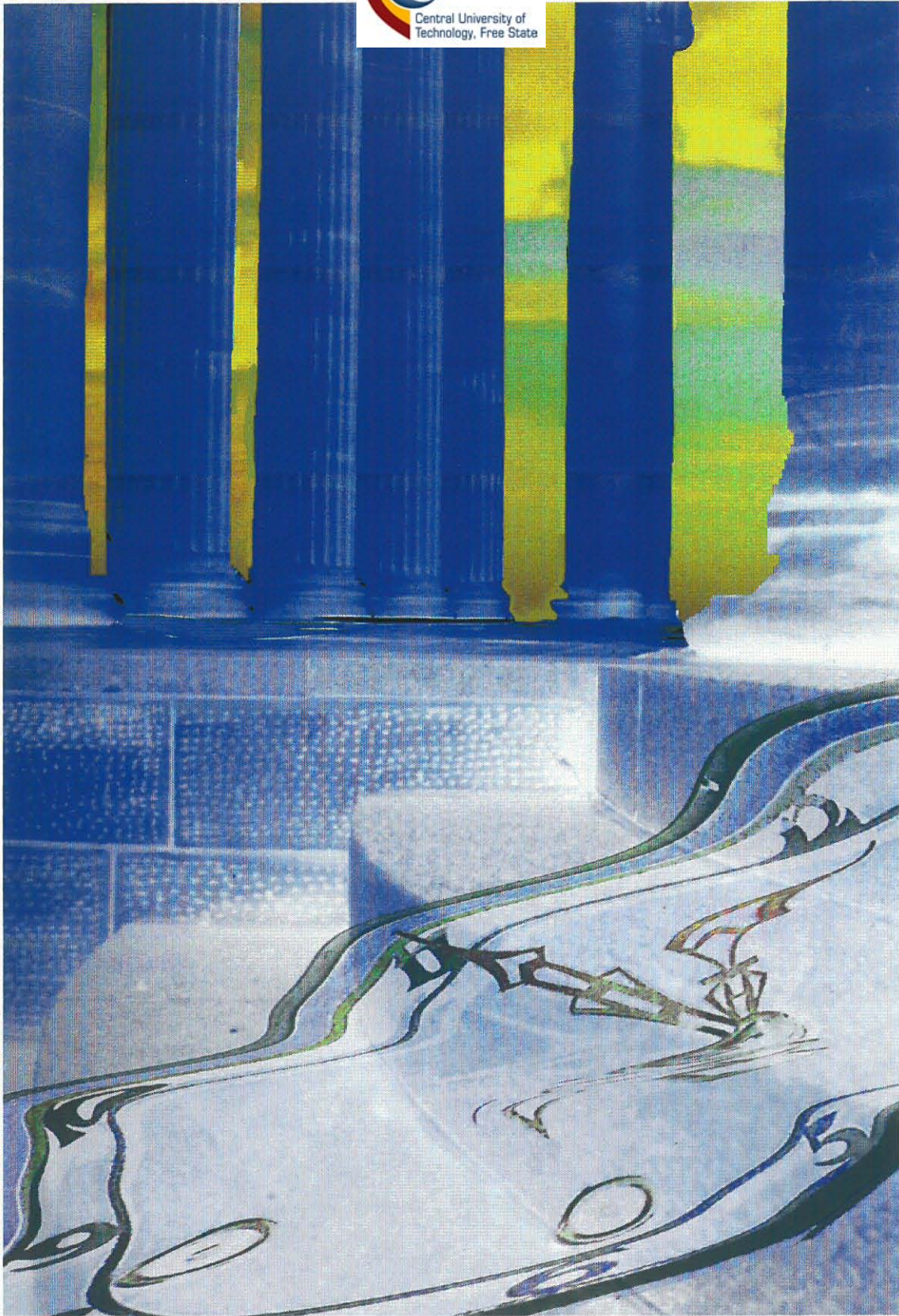
**BOUNCING BALLS**

**ABSOLUT PUZZLING**

**OUT THERE**

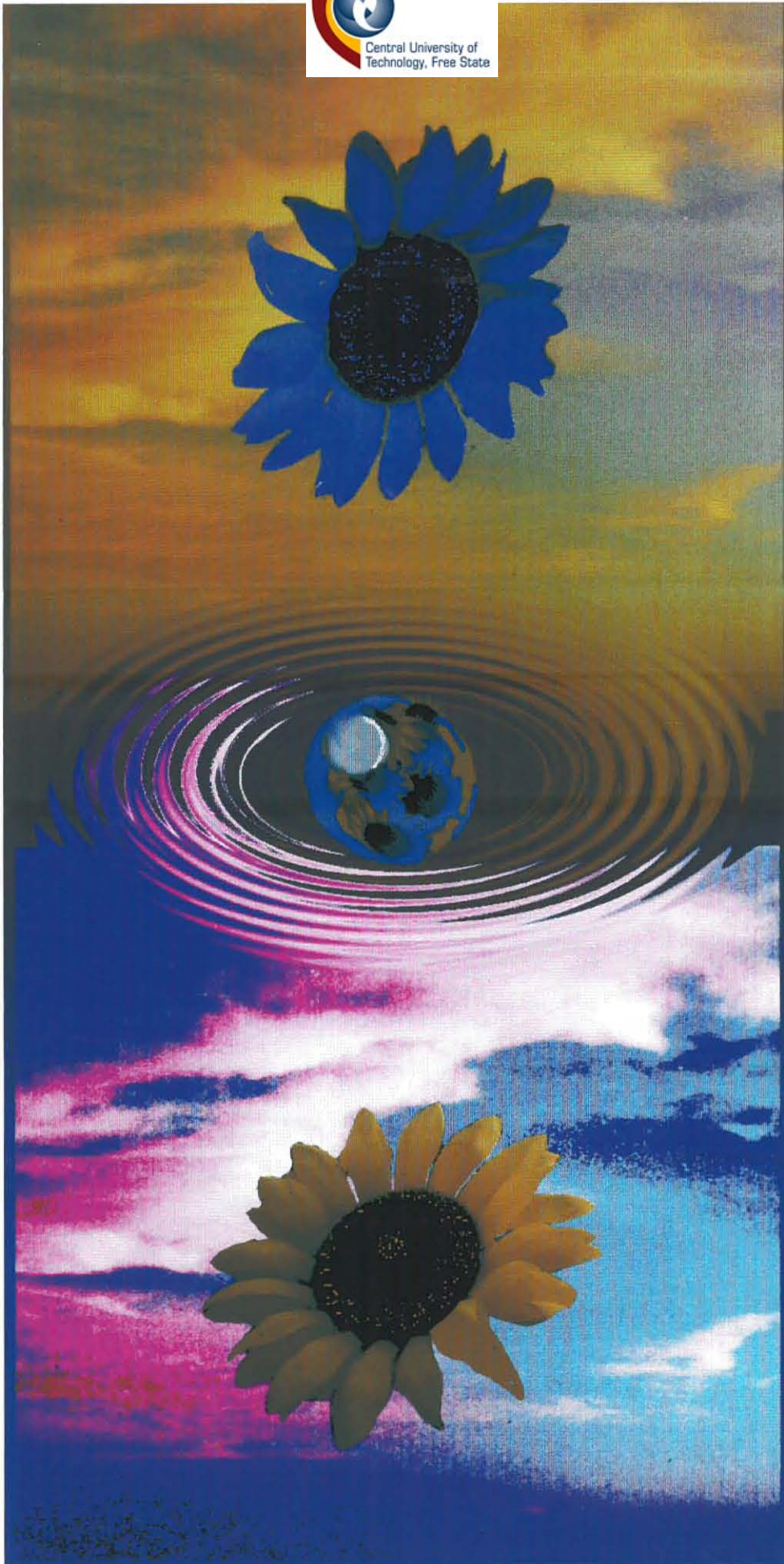
**WINTER**

**BROCKEN FENCE**



# PILLAR AND CLOCK





# SUNFLOWER

© Central University of Technology, Free State





THIS BOOK IS  
THE PROPERTY  
OF THE  
12 MAY 1999  
TECHNIKON  
FREE STATE

TECHNIKON  
VRYSTAAT/FREE STATE  
10 MAR 1999  
PRIVAATSAK X20539  
PRIVATE BAG  
BLOEMFONTEIN

# HANDS





# BLUE PEPPERS





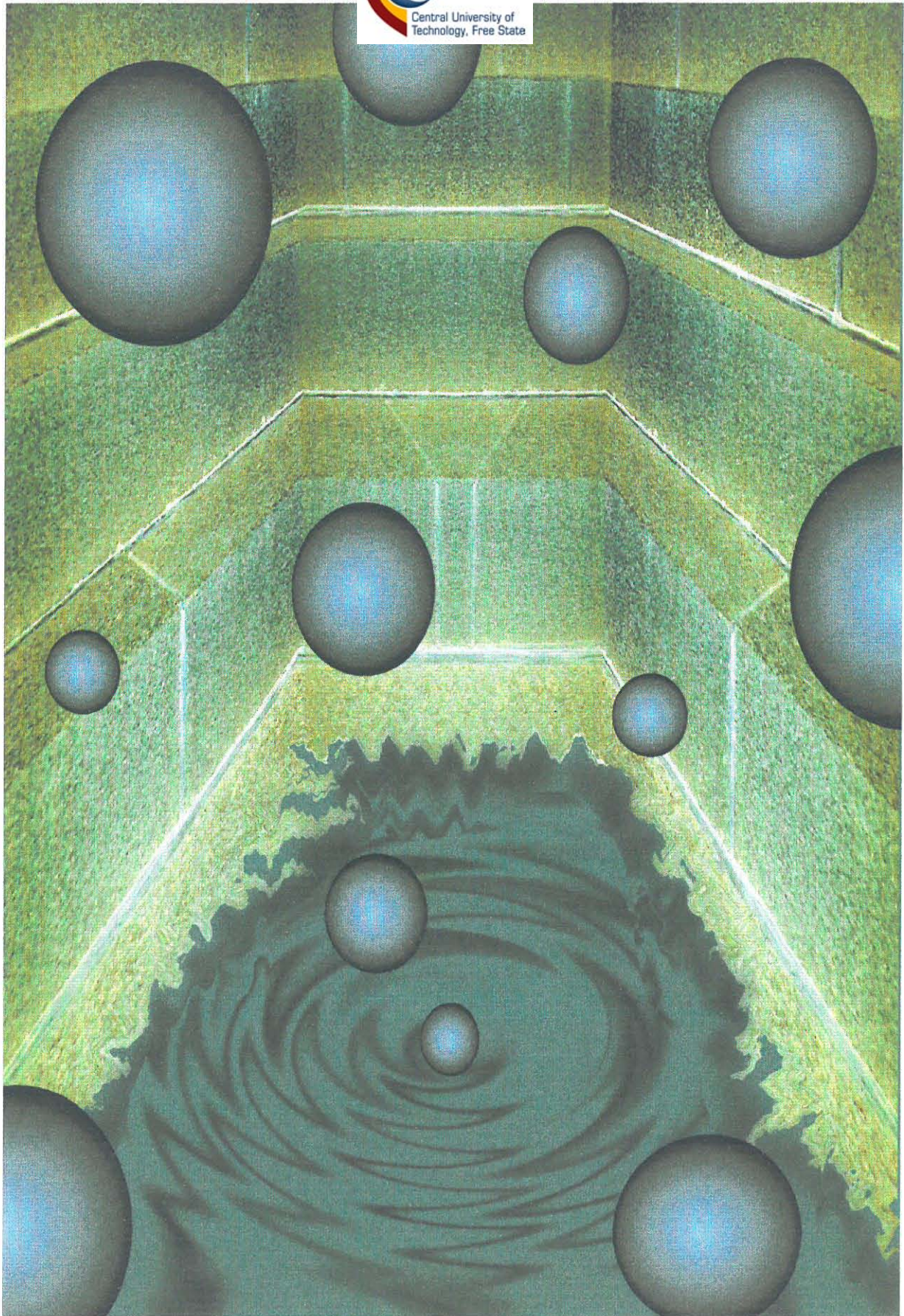
# LEAVES





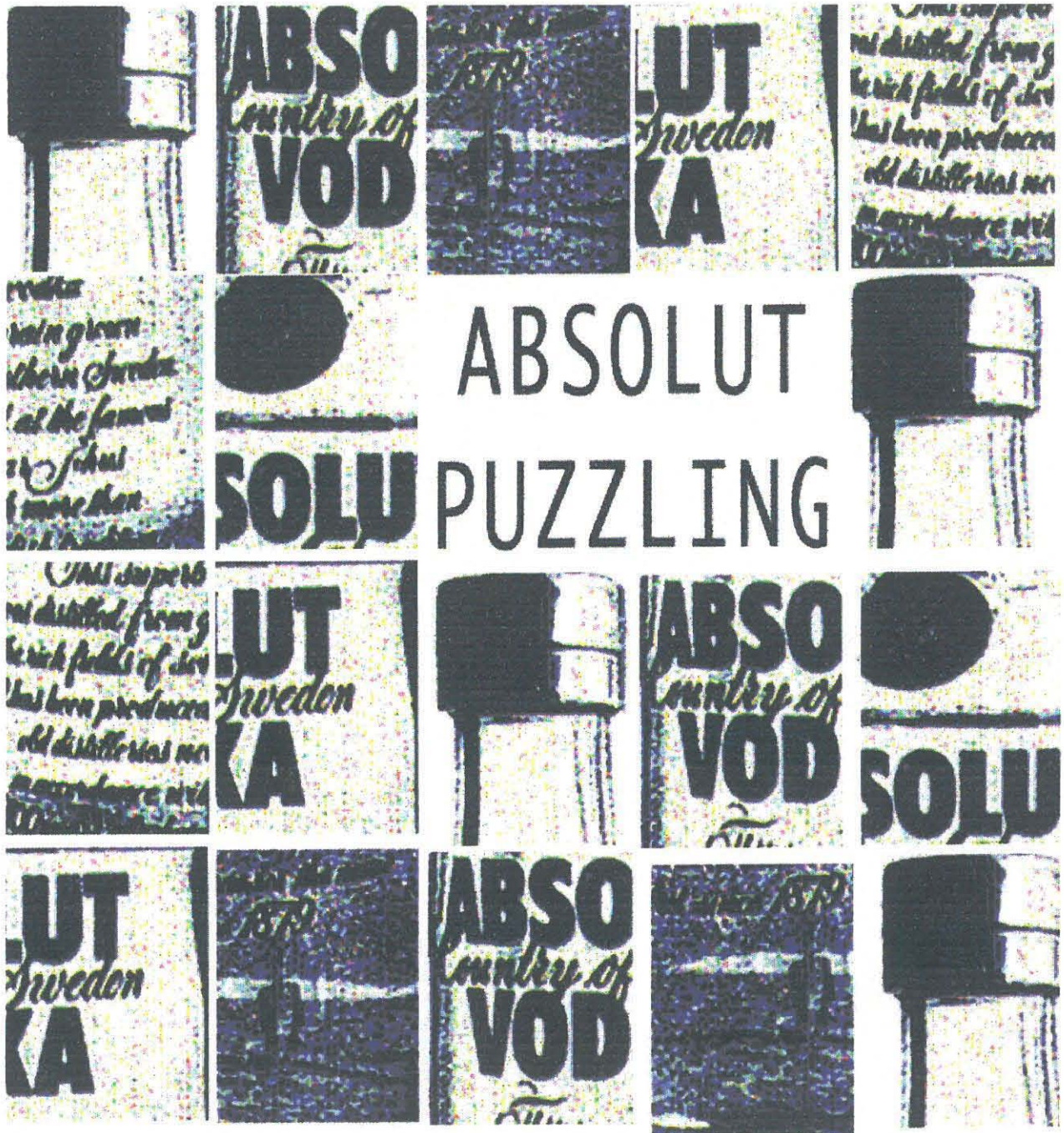
# WATER WILLOW





# BOUNCING BALLS





# ABSOLUT PUZZLING





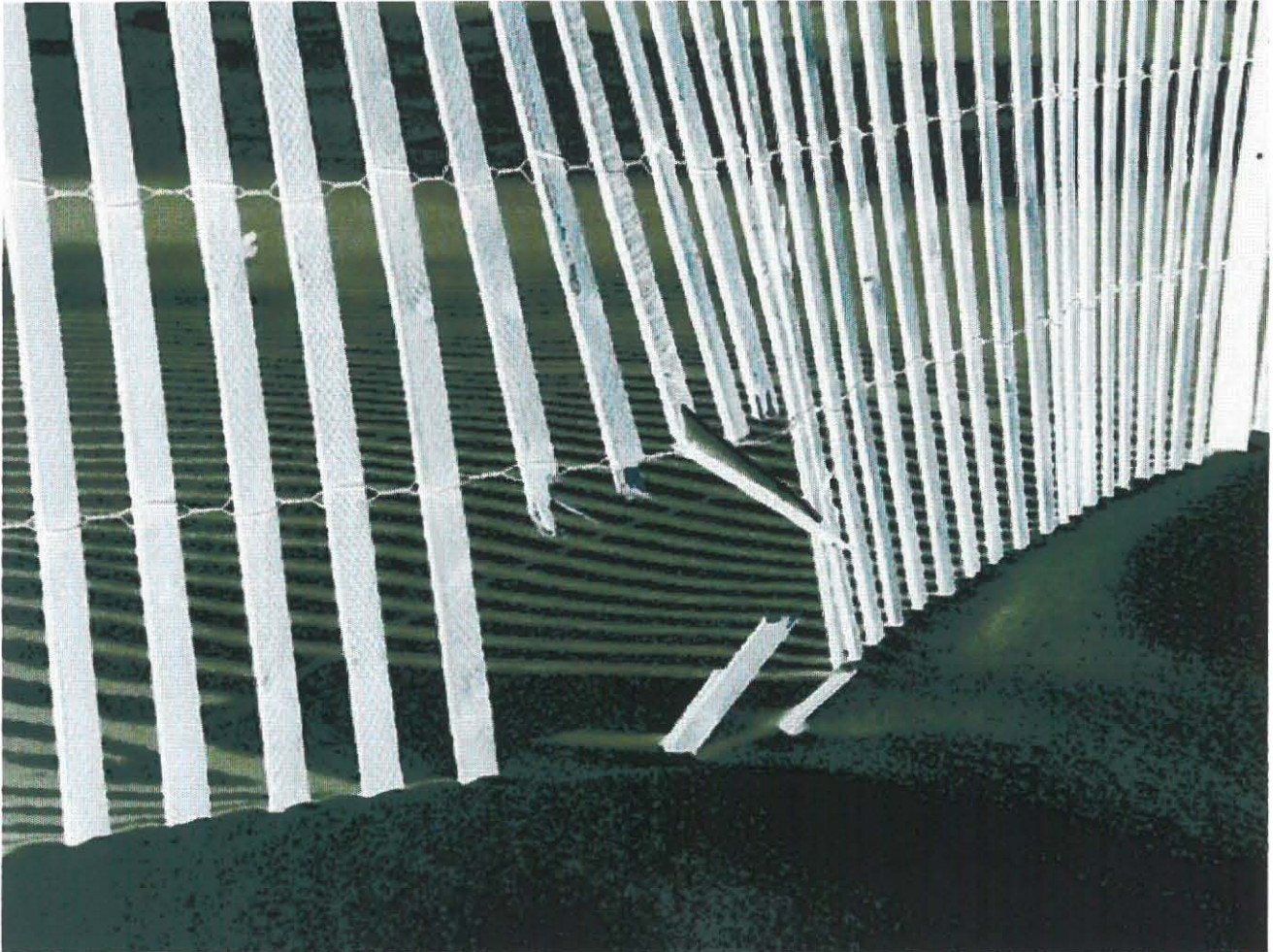
**OUT THERE**





# WINTER





# BROCKEN FENCE