A BASIC HANDBOOK ON INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) FOR ART EDUCATION

By

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A Basic Handbook on Information and Communication Technology (ICT) for Art Education

A Thesis Presented to the School of Graduate Studies Kwame Nkrumah University of Science and Technology, Kumasi, In Partial Fulfilment of the Requirement for the Award of Master of Arts Degree in Art Education.

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CERTIFICATION

It is certified that this is the
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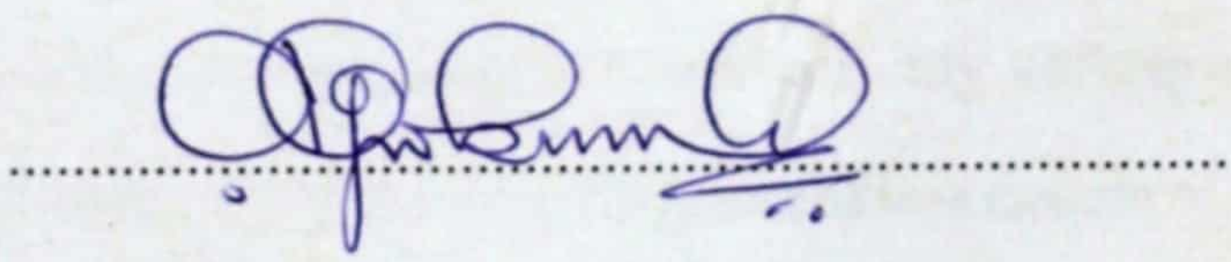

Nana Amponsaa Opoku-Asare

Supervisor

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ABSTRACT

Topic: A Basic Handbook on Information and Communication Technology (ICT) for Art Education

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Integration of computers into the Ghanaian school curriculum has become widespread in the country's senior and some junior secondary schools. Despite its numerous benefits, however, one wonders whether School ICT programmes are indeed serving their intended purpose of exposing students to the technological tools that would enhance skill acquisition and promote mastery over subject matter.

A study of information technology syllabus of Ghanaian Senior Secondary Schools however indicates that existing information and communication technology programmes consist of conventional computing which only enables students to use a narrow range of software that obviously has very little benefit for the Visual Art student in particular. This study therefore defines activities that would enable art students to develop their computer literacy skills beyond word processing, ultimately developing their creative thinking skills through information technology. A handbook on ICT has therefore been designed to enable students employ technology in the creative process.

The results from the trial testing of the activities outlined in the handbook suggest a proper attention to the entire idea of ICT in Ghanaian schools, since it stands to be of tremendous enhancement not only for the teaching and learning of art, but all the subjects studied at the senior secondary school level.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The link between globalisation and technological change is becoming real to us each passing day, and its power is being understood in almost all spheres of human endeavour. Their growth have accelerated in tandem over the past fifteen years and have created a new global economy "powered by technology, fueled by information and driven by knowledge" (Tinio, 2003). The sheer size of the new communities, the diversity of consumer market places, "the collective wisdom, the melting pot of political and ideological beliefs and the concerns for the future of the earth" are all facets of information technology that are ever present in the commentaries about the impact of the information explosion on our daily lives, countries and societies (Selwyn, 1998).

To the researcher, the indication is that understanding technologies of the information age only as technological artefacts, or machines that store information, and relevant to just a group of people may not be enough. Neither can globalisation be seen simply as an extension of the national picture. It is not confined to the "developed world" or overseas markets, nor is it just understanding other cultures. In the words of Selwyn "it is the context in which individuals and families live". In the discussion of globalisation therefore, technology, financial structures, the environment, education, culture, society and in fact all facets of our lives are interconnected.

The implications of the emergence of this new global economy for the nature and purpose of educational institutions is very serious. "As the half-life of information continues to shrink and access to information continues to grow exponentially, schools cannot remain mere venues for the transmission of a prescribed set of information from teacher to student over a fixed period of time". Rather, schools must promote "learning to learn," that is, the acquisition of knowledge and skills that make it possible for one to learn over the lifetime, with very little involvement of a teacher (Thornburg, 2000). "The illiterate of the 21st century," according to Thornburg, "will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn." These are the kinds of opportunities the new technology promises to offer.

To this effect, teachers have the vital role of helping all learners to see beyond their local lives, to acquire an integrated global world view. The responsibility of the art educator is therefore, how to make use of these technologies to enhance educational programmes or perhaps to redefine art education programmes so that students can become up-to-date in the creation of art as well as the use of information rather than obsolete and passive consumers of media.

In the field of art, there has been a rapid development of new multi-disciplinary communications technologies in recent times. Digital channels interconnect with traditional media. It is in the light of this that Thornburg (2000) predicts that "those who can exploit both the old and the new successfully will require extensive visual, verbal and technical skills. The new communication culture

will be led by artists of agility and intelligence with the expertise to respond to constantly evolving needs".

Teachers of art need to realize that information technology is not only the concern of some subjects in the educational sector. In all areas of art, technology is developing at great speed – in design, illustration, painting, sculpture. And very soon, without the appropriate skills in ICT, creative ideas alone will be of little value.

This study is intended to prompt art educators in Ghanaian secondary schools to define a framework for the appropriate and effective use of ICT in their teaching.

I.2 Statement of the Problem

The current upsurge in information and communication technology (ICT) provides profoundly new challenges to education. Information technology almost imposes an unconditional incorporation of ICT tools in the teaching and learning process as a means of preparing students to enter a job market where information technology is pervasive. Consequently, many senior secondary schools in Ghana have managed to acquire computers that are intended to enable them provide their students with basic knowledge and skills in the processing of information via computers.

Unfortunately, the emergence of ICTs in Ghanaian secondary schools seem to lack definite goals for teaching and learning and is happening so independently that the extent to which its infusion is benefiting education of the students is uncertain. Apart from using it for 'keyboarding' classes, ICTs hardly affect the

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teaching and learning of any particular subject directly. In the schools where ICT is considered within the purview of science, the ICT centre becomes nominally part of the science laboratory and is highly under-utilized. Many subjects are therefore looked down upon in matters related to information technology, with art being the most affected.

As far as Art Education is concerned, this phenomenon is indeed a great setback in education of the future artist considering the "enormous and exciting scope of ICT in art teaching" (Callow 2001).

A handbook that outlines and illustrates the basic use of computers for art and the unique role the computer can play in the teaching and learning of art is therefore necessary to provide students with a much broader view of information and communication technology.

I.3 Objectives

1. To assess the content of Information and Communication Technology programme in senior secondary schools in Ghana.

2. To conduct a comprehensive study of how the computer can be used to study the Elements and Principles of Design.

3. To design an illustrated handbook on information technology for Art Education.

4. To pre-test the Handbook by guiding students to ascertain its suitability.

1.4 Research Questions

1. Do educational goals for ICT in senior secondary schools have any consideration for the teaching and learning of visual art?
2. How would a handbook on ICT for art education impact on the teaching and learning of art?

1.5 Delimitation

The major tool for this study was the computer and the relevant application software, in this particular case, drawing and painting programmes. Since drawing, programmes are numerous and in most cases inaccessible, the researcher focused on two major software: Corel Draw (for drawing) and Adobe Photoshop (for painting). Apart from being accessible, these programmes offer a wide range of tools, which expose learners to almost all facets of image generation and manipulation with the computer.

The study was therefore limited to the use of these software for teaching basic concepts in art.

1.6 Limitations

The major constraint of this study was that it did not include the aspect of ICT which would enable art students to share and look for ideas, projects, with other students elsewhere through the Internet. This was because there was not adequate Internet facilities for the researcher to use at the time of the study. The handbook would therefore dwell largely on IT rather that ICT.

1.7 Definition of Terms

To make the handbook understandable to users, the following technical terms are explained as follows:

Bézier Curve A curve that is calculated mathematically to connect separate points in smooth, free-form curves and surfaces of the type needed for illustration programmes and computer aided design models.

Bit Abbreviation for binary digit, the smallest unit of information in a computer.

Bit-Mapped Graphics Computer graphics that are stored and held as collections of bits in memory locations corresponding to pixels on the screen. Bit-mapped graphics are typical of paint programmes (such as Adobe Photoshop), which treat images as collections of dots rather than as shapes.

Box: In a graphical user interface, a box is an enclosed area, resembling a window, on the screen. Unlike windows, however, you generally cannot move or resize boxes.

Click: To tap on a mouse button, press it down and then immediately release it. Clicking is usually performed to select or deselect an item or to activate a programme or programme feature.

Central Processing Unit: A microscopic circuitry that serves as the main information processor in a computer.

Communication medium: It is a means for recording and transporting a message or information. It is a channel or path for sending a message

between communicators.

Computer A computer is a *programmable*, *multiuse* machine that accepts data – raw facts and figures – and *processes* or *manipulates* it into information that can be used, such as summaries, totals, or reports.

Cursor A special symbol, usually a solid rectangle or a blinking underline character, that signifies where the next character will be displayed on the screen.

Data Distinct pieces of information, usually formatted in a special way

Disk A round plate on which data can be encoded.

Desktop An on-screen work area that uses icons and menus to simulate the top of a desk.

Desktop Publishing Using a personal computer or workstation to produce high-quality printed documents. A desktop publishing system allows you to use different typefaces, specify various margins and justifications, and embed illustrations and graphs directly into the text.

Dialogue Box In a computer's graphical user interface it is a box that appears on a display screen to present information or request input. Typically, dialog boxes are temporary -- they disappear once you have entered the requested information.

Digital Image An image comprising discrete units or pixels (picture elements)

that a computer can interpret. Each pixel has a single bit depth and tonal value.

Digital Technology The *s*tudy and development of devices that store and manipulate numbers.

Double-Click Tapping a mouse button twice in rapid succession. The second click immediately follows the first, otherwise the programme interprets them as two separate clicks rather than one double click.

Drag Moving an icon or other image on a display screen. To drag an object across a display screen, the object is selected with a mouse button ("grab" it) and the mouse is moved while the mouse button is kept pressed down.

Drawing Programme It is a computer programme for manipulating object-oriented graphics, as opposed to manipulating pixel images. In a drawing programme, for example, the user can manipulate an element such as a line, a circle, or a block of text as an independent object simply by selecting the object and moving it.

Hard A term used to describe anything that is permanent or physically exists.

Hard copy A printout of data stored in a computer. It is considered *hard* because it exists physically on paper, whereas a *soft* copy exists only electronically.

Hard drive The mechanism that reads and writes data on a hard disk

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Hard disk A magnetic disk on which computer data can be stored .

Hardware It refers to objects that can actually be touched, like the systems unit, display screens , keyboard , mouse, disk drives, printers.

Icon A small picture that represents an object or program.

Information technology The broad subject concerned with all aspects of managing and processing information with the computer.

Keyboard The set of typewriter-like keys that enables the entering of data into a computer. Computer keyboards are similar to electric-typewriter keyboards but contain additional keys.

Marquee box A box with a dotted outline that appears when you click and drag diagonally to select multiple objects or nodes on a curve.

Monitor Another term for display screen. The term *monitor,* however, usually refers to the entire TV-like box, whereas display screen can mean just the screen.

Mouse: A device that contrcls the movement of the cursor or pointer on a display screen. A mouse is a small object which can roll along a hard, flat surface. Its name is derived from its shape, which looks a bit like a mouse, its connecting wire that one can imagine to be the mouse's tail, and the fact that one must make it scurry along a surface.

Mouse button A button on a mouse that you click to perform various functions, such as selecting an object. A mouse contains at least one button and sometimes as many as three, which have different functions depending on what programme is running. Some newer mice

also include a scroll wheel for scrolling through long documents.

Multimedia A computer software that combines either all or some of the following media: Text, Images (illustrations, photos), Sounds (voice narration, button clicks), Animation, Video, and Virtual Reality (3-D environments, QuickTime VR).

Operating system A programme that manages the computer and the various resources and devices connected to it so that they may be used by other programs. It performs basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers. Examples of operating systems are DOS, Windows XP, and OS/10.

Paint Program It is an application program that creates graphics as bit maps—images stored as collections of pixels (dots) rather than as discrete lines, curves, and other such shapes.

Personal Computer A computer designed to be used by a single person at a time. In technical terms, a term given to all IBM compatible computers that run Windows and DOS.

Pixel Short for ***Picture Element,*** a pixel is a single point in a graphic image. Graphics monitors display pictures by dividing the display screen into thousands (or millions) of pixels, arranged in rows and columns.

Printer A device that prints text or illustrations on paper.

Resolution The amount of detail and information that an image file contains,

as well as the level of detail that an input, output or display device is capable of producing. It refers to the sharpness and clarity of an image. The term is most often used to describe monitors, printers, and bit-mapped graphic images.

Screen The display part of a monitor.

Soft Describes things that are intangible are easily changed .

Search engine An internet search engine allows the user to enter keywords relating to a topic and retrieve information about Internet sites containing those keywords.

Software Also called computer programmes: they are instructions that cause the computer hardware—the machines—to work.

Teaching/Leaning Material Presentation tools used to facilitate understanding of content (Chalkboards, whiteboards, handouts, flip charts, overhead transparencies, slides, computers, computer-drawn visuals, computer animation).

Technological artefacts All the various gadgets that have emerged out of the current digital technology.

Technology General term for the processes by which human beings fashion tools and machines to increase their control and understanding of the material environment.

Telecommunications systems All the electromagnetic devices and systems for communicating over long distances.

Vector Graphics A method of generating images that use mathematical

descriptions to determine the position, length, and direction in which lines are to be drawn. In vector graphics, objects are created as collections of lines, rather than as patterns of individual dots (pixels), as is the case with raster graphics.

Window An enclosed, rectangular area on a display screen. Computer operating systems and applications have graphical user interfaces (GUIs) that makes it possible for the user to divide the display into several windows. Each window runs a different program or display different data.

Word Processor An application program for manipulating text-based documents; the electronic equivalent of paper, pen, typewriter, eraser, and most likely, dictionary and thesaurus.

1.8 Abbreviations

Abbreviations used in the text are explained as follows:

ICT	-	Information and Communications Technology
IT	-	Information Technology
PC	-	Personal Computer
3-D	-	Three Dimensional
IBM	-	International Business Machines
VR	-	Virtual Reality
PDA	-	Portable Digital Assistant
DOS	-	Disc Operating System
OS	-	Operating System

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RAM - Random Access Memory

ROM - Read Only Memory

LCD - Liquified Crystal Display

CD - Compact Disk

MS - Microsoft

PTA - Parents/Teacher Association

CAD - Computer Aided Design

CPU - Central Processing Unit

FTP - File Transfer Protocol

GIF - Graphics Interchange Format

HTML- Hypertext Markup Language

DSL - Digital Subscriber Line

HTTP - Hypertext Transfer Protocol

LAN - Local Area Network

WAN - Wide Area Network

1.9 Importance of the Study

This study will provide art teachers and their students with a basic source of reference in their bid to integrate technology into the teaching, learning and creation of art.

It would also encourage school authorities to see the need to structure educational goals that would advocate the integration of ICT in other subject areas, in order to improve student motivation and achievement.

1.10 Organization of the rest of the text

Chapter Two reviews literature related to the topic. There has been a discussion on the definitions of key issues in the study, as well as classification and evaluation of what scholars and researchers have written on the topic..

Chapter Three discusses the methodologies used to gather data for the research .

Chapter Four discusses and analyses the main findings of the research.

Chapter Five outlines appropriate software that can be adopted for the teaching of basic concepts in art.

Chapter Six provides results of the pre testing of the handbook.

Chapter Seven, summarizes the findings, draws conclusions and makes recommendations for effective integration of information and communication technology in the Visual Art component of secondary school curriculum.

The bibliography has been arranged according to the alphabetical order of the surnames of the authors.

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CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter consists of a review of related literature on Information and Communication Technology (ICT). The first section defines and describes ICT in general terms. The second section reviews literature on some of the major ICT tools. The third section examines the relationship between ICT and general education whilst the fourth section examines the importance of ICT in Art Education in particular.

2.1. General Concept of Information and Technology

In order to clarify the understanding of Information Technology within the context of this study, it is important that the two constituent words are analysed.

2.1.1 Information

Hawgood (1983:7) uses the terms "meanings" and "physical representation" for "information" and "data" respectively. According to this author, "information is the meaning which a human understands, whereas data are the physical representation of that information in a manner formalized for transfer to another human or machine".

Hawgood (1983), defines information as formalized when it is spoken or written, using the agreed sounds, letters, words and symbols of the particular language in use. In writing, strings of letters represent words and strings of digits represent numbers. In artistic expressions, the elements and principles of design

represent images, objects or designs.

In computer operations data refers to raw facts and figures; these are the numbers, words and phrases, which are processed on a computer to produce information. In art, the various elements of design which are combined to create a composition can be said to be data.

The Webopedia (2004) provides the following definitions. According to the source, information is:

a. data and facts that have been organized and communicated in a coherent and meaningful manner.

b. facts, data, or instructions in any medium or form. It is the meaning that a human assigns to data by means of the known conventions used in their representation.

c. any communication or representation of knowledge, such as facts, data, or opinions in any medium or form, including textual, numerical, graphic, cartographic, narrative, or audiovisual forms.

d. is the result of processing, manipulating and organizing data in a way that adds to the knowledge of the person receiving it.

Information then, according to Williams and Sawyer (2001) is data that has been summarized or manipulated for use in decision-making. For example, the total number of votes that determines a winning candidate in an election. What would therefore represent complete information on the computer, as far as art is concerned, is an image or design (graphics) that has been generated by an artist.

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2.1.2 Technology

The word technology is derived from the Greek word "tekhnologia" which is broken into "Tekhne" meaning an art or skill and "Logia" an area of knowledge of study. (Myerson, 1990)

In common parlance, technology describes the things or products of our modern society. However, these are but the results of human endeavour and the complex organization of society which has developed alongside technological advances. Myerson (1990), therefore defines technology as an interaction of knowledge, skill and social organization (Myerson, 1990).

According to the Encarta Encyclopedia (2004), technology is a general term for the processes by which human beings fashion tools and machines to increase their control and understanding of the material environment. The source describes technology as a social process influences the society's way of achieving things, of inventing and planning to overcome specific problems.

Hutchinson (2000) defines technology as "the use of tools, power and materials, generally for the purpose of production".

"In technology", says Karsnitz (1993), "we employ a process called problem solving to meet out wants and needs". By Karsnitz's definition, technology is the human process for identifying problem solving opportunities (including those dealing with information), and solving them by using a variety of resources". (including knowledge, people, capital, tools, materials, organizations/processes and energy). By implication, humans employ

technology to adapt to their environment and meet their wants and needs which include "the need to communicate".

The marriage of these two terms is what has become known as IT (short for ***I**nformation **T**echnology,* and pronounced as separate letters)

2.1.3 What is Information Technology

In the Webopedia (2004), IT is described as the broad subject concerned with all aspects of managing and processing information. The term encompasses ali forms of technology used to create, store, exchange, and use information in its various forms (business data, voice conversations, still images, motion pictures, multimedia presentations).

Starkey has defined information technology as "the acquisition, processing, storage and dissemination of vocal, pictorial, textural and numeric information by microelectronics based combination of computing and technology" (Starkey 2003).

According to Curtin et al (1998:78), information technology is a process and devices that serve as tools for making life and career better or more efficient. Their definition for the phrases is therefore not different from what have been discussed above: Creation, gathering, processing, storage and delivery of information and the processes and devices that will make all this possible. Their discussion however goes a step further to outline some three major things IT can do.

- Information technology can process raw data into useful information.

- Information technology can recycle processed information and use it as data in another processing step
- Information technology can package information in a new form so it is easier to understand, more attractive, or more useful.

Williams and Sawyer (2001:18) see information technology as what comes out when computer and communications technologies are combined. They describe it as a technology that merges computing with highspeed communications links that carry data, sound and video.

The Australian Council for Computers in Education (ACCE) Discussion Paper (1999) however, gives a much broader definition to information technology. By this paper's definition, information technology encompasses information and communications technologies used in everyday life. This broad definition embraces the range of systems that are normally excluded from traditional computer formats. Examples are embedded computer technologies in automobiles, household appliances and personal tools. It also encompasses the software, hardware and human systems that contribute to a technological environment.

Von Wodtke (1993:304) on the other hand gives another dimension to information technology. According to him, information technology "is also about thinking skills, analysis skill, communications skills, team work skills, problem solving skills and creative processes".

In recent times however, the term IT seems to be less popular, and is gradually giving way to ICT.

2.1.4 What is ICT

The acronym ICT (pronounced as separate letters) has been explained variously by a number of authorities. Moris simply interprets it as *Information and Communication Technology* (Becta 2003). McNamee et al (2003) call it *Information and Communication Technologies.* The Department of Politics and International Relations (2002) adds an 's' to communication - *Information and Communications Technology.*

However, the difference in expansion of the acronym does not change the meaning of ICT. The HOP Associates (2000) attribute the shift from IT to ICT to the infiltration of the Internet in almost all human activities as well as the popularity in the transmission of information via the digital highway. "Therefore one can no longer refer merely to Information Technology, but also to Communication" (HOP 2000). They maintain that putting the "C" in the middle of the IT is important to emphasise that it is not just about "technology" issues but is relevant to everyone whose job involves communication (HOP 2000). In other words Information Technology (IT) which refers to the stand-alone items of computing technology and the skills required to use them effectively, including competency in personal productivity tools (such as office packages) or job-specific hardware that now includes connecting together IT hardware to enable communication with other users via the Internet to users anywhere in the world (Becta, 2004). It is therefore not far from right to agree with Taylor (2003),

that ICT is a term created to refer to the amalgam of computing and telecommunications technologies, including the Internet, which are the matrix within which information and digital media are created, distributed and accessed.

Adding to this, Selwyn (2003:7) refers to the term ICT as "an updating of the conventional 'information technology' to encompass the rapid convergence of technologies such as computers, telecommunications and broadcasting technologies as well as stressing the communicative and networking capacity of modern-day information technologies."

ICT has also been described by Webster and Herrmann, (2000) as "a key phrase to indicate the dynamism that can be achieved with the convergence of computing and telecommunications".

ICT by these definitions can be seen as an umbrella term for a range of technological applications such as computer hardware and software; digital broadcast technologies; telecommunications technologies such as mobile phones as well as electronic information resources such as the world-wide web and CD-ROMs. All these come to play in activities which contribute to the display, processing, storing and transmission of information through electronic means (Bruneau & Lacroix 2001).

2.2 ICT Tools

ICT is a huge, rapidly changing, and rapidly growing field embracing the full range of computer hardware, computer software, and telecommunications

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facilities. Thus it includes computing devices ranging from handheld calculators to multimillion dollar super computers; the full range of display and projection devices used to view computer output, the local area and wide area networks (LAN & WAN) that allow computer systems and people to communicate with each other; digital cameras, computer games, CDs, DVDs, cell telephones, telecommunication satellites, computerized instruments, computerized machinery, and computerized robots (Webopedia, 2004).

2.2.1 The Computer

A computer, according to the Encarta Encyclopedia (2003), is a machine that performs tasks, such as calculations or electronic communication, under the control of a set of instructions called a *programme*. Programmes usually reside within the computer and are retrieved and processed by the computer's electronics. The programme results are stored or routed to output devices, such as video display monitors or printers. Computers perform a wide variety of activities reliably, accurately, and quickly.

2.2.2 Components of the computer

Hardware and Software

The physical computer and its components are known as *hardware*. Computer hardware includes the *memory* that stores data and programme instructions; the central processing unit (CPU) that carries out programme instructions; the input devices, such as a keyboard or mouse, that allow the user to communicate with the computer; the output

devices, such as printers and video display monitors, that enable the computer to present information to the user, and *buses* (hardware lines or wires) that connect these and other computer components (Webopedia 2004).

The programmes that run the computer are called *software*. Anything that can be stored electronically on the computer is software. Software generally is designed to perform a particular type of task—for example, to write a letter, to draw images, to display photograph, to control robot movement or to direct the general operation of the computer. Software is often divided into two categories:

- *Systems software* : Includes the operating system and all the utilities that enable the computer to function, such as Microsoft Disc Operating System (MS DOS), Windows XP and OS/10.
- *applications software :* Includes programs that do real work for users. For example, word processors, spreadsheets, and database management systems fall under the category of applications software.

The terms *software* and *hardware* are used as both nouns and adjectives. Therefore statements such as *The problem lies in the software,* and *It's a software problem* are both correct, meaning that there is a problem with the programme or data, not with the computer itself (Webopedia 2004).

2.2.3 Types of Computers

Computers can be digital or analog (Encarta Encyclopedia 2004) . Digital refers to the processes in computers that manipulate binary numbers (0s or 1s), which represent switches that are turned on or off by electrical current. A bit can have the value 0 or the value 1, but nothing in between 0 and 1.

Analog refers to circuits or numerical values that have a continuous range. Both 0 and 1 can be represented by analog computers, but so can 0.5, 1.5.

One vital way of explaining the difference between analog and digital is via the desk lamp. If the lamp has a simple on/off switch, then the lamp system is digital, because the lamp either produces light at a given moment or it does not. If a dimmer replaces the on/off switch, then the lamp becomes an analog device, because the amount of light can be varied continuously at intervals between on and off and the range of intensities in between on and off positions.

Analog computer systems were the first type to be produced. A popular analog computer used in the 20th century was the slide rule which performed calculations by sliding a narrow, gauged wooden strip inside a ruler-like holder. Because the sliding is continuous and there is no mechanism to stop at any exact values, the slide rule is an analog computer.

Most modern computers, however, are digital machines . (The Computer Information Center 2004).

2.2.4 How the computer works

i. *The Operating System*

When a computer is turned on it searches for instructions in its memory. These instructions tell the computer how to start up. Usually, one of the first sets of these instructions is a special programme called the operating system, which is the software that makes the computer work. It prompts the user for input and commands, reports the results of these commands and other operations, stores and manages data, and controls the sequence of the software and hardware actions. When the user requests that a programme run, the operating system loads the programme in the computer's memory and runs it. Operating systems, such as Microsoft Windows and the Macintosh system (Mac OS), have graphical user interfaces (GUIs)—that use tiny pictures, or icons, to represent various files and commands. To access these files or commands, the user clicks the mouse on the icon or presses a combination of keys on the keyboard (Encarta 2004).

ii. *Computer Memory*

The memory of a computer is the internal storage areas in the computer. The term *memory* also refers to the actual chips capable of holding data. Every computer comes with a certain amount of physical memory, usually referred to as *main memory* or *RAM*. The main memory can be considered as an array of boxes, each of which can hold a single byte of information. A computer that has 1 megabyte of memory, therefore, can

hold about 1 million bytes (or characters) of information (Webopedia, 2004).

A byte is a useful quantity in which to store information because it provides enough possible patterns to represent the entire alphabet, in lower and upper cases, as well as numeric digits, punctuation marks, and several character-sized graphics symbols. A byte can also be interpreted as a pattern that represents a number between 0 and 255. A *kilobyte*—1,024 bytes—can store about 1,000 characters; a *megabyte* can store about 1 million characters; a *gigabyte* can store about 1 billion characters; and a *terabyte* can store about 1 trillion characters (Informationplease 2004).

The Webopedia outlines are several different types of computer memory. These include:

- RAM (random-access memory): This is the same as main memory. When used by itself, the term *RAM* refers to *read and write* memory; that is, you can both write data into RAM and read data from RAM. This is in contrast to ROM, which permits you only to read data. Most RAM is *volatile,* which means that it requires a steady flow of electricity to maintain its contents. As soon as the power is turned off, whatever data was in RAM is lost.

- ROM (read-only memory): Computers almost always contain

a small amount of read-only memory that holds instructions for starting up the computer. Unlike RAM, ROM cannot be written to.

- PROM (programmable read-only memory): A PROM is a memory chip on which you can store a program. But once the PROM has been used, you cannot wipe it clean and use it to store something else. Like ROMs, PROMs are non-volatile.
- EPROM (erasable programmable read-only memory): An EPROM is a special type of PROM that can be erased by exposing it to ultraviolet light.
- EEPROM (electrically erasable programmable read-only memory): An EEPROM is a special type of PROM that can be erased by exposing it to an electrical charge.

iii. *The Bus*

This is a term given to a collection of wires through which data is transmitted from one part of a computer to another (Informationplease 2004). The bus can be likened to a highway on which data travels within a computer. When used in reference to personal computers, the term *bus* usually refers to *internal bus*. This is a bus that connects all the internal computer components to the CPU and main memory. There's also an expansion bus that enables expansion boards to access the CPU and memory.

All buses consist of two parts - *an address bus* and *a data bus*. The data bus transfers actual data whereas the address bus transfers information about where the data should go.

The size of a bus, known as its *width,* is important because it determines how much data can be transmitted at one time. For example, a 16-bit bus can transmit 16 bits of data, whereas a 32-bit bus can transmit 32 bits of data.

Every bus has a clock speed measured in MHz. A fast bus allows data to be transferred faster, which makes applications run faster (Wepopedia 2004).

iv *Input Devices*

An input device is any machine that feeds data into a computer. An Input device, such as a keyboard or mouse, permits the computer user to communicate with the computer. Other input devices include a *joystick*, (a rodlike device often used by people who play computer games); a *scanner*, (which converts images such as photographs into digital images that the computer can manipulate); a *touch panel*, which senses the placement of a user's finger and can be used to execute commands or access files; and *tablets* (allow users to interact with their screens using a penlike devices) (Encarta 2004).

v. *The Central Processing Unit*

The Central Processing Unit (CPU) is the brain of the computer. It is

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sometimes referred to as the *processor* or *central processor,* The CPU is where most calculations take place. In terms of computing power, the CPU is the most important element of a computer system.

On large machines, CPUs require one or more printed circuit boards. On personal computers and small workstations as we have in our schools and offices, the CPU is housed in a single chip called a *microprocessor*.

Two typical components of a CPU are:

- The *arithmetic logic unit (ALU)*, which performs arithmetic and logical operations.
- The *control unit*, which extracts instructions from memory and decodes and executes them, calling on the ALU when necessary. Information from an input device or from the computer's memory is communicated via the bus to the *central processing unit* (CPU) This is the part of the computer that translates commands and runs programmes (Webopedia 2004).

vi. Output Devices

Once the CPU has executed the programme instruction, the programme may request that the information be communicated to an output device, such as a video display monitor. Other output devices are printers, LCD projectors, videocassette recorders (VCRs), and speakers.

2.2.5 Range of Computer Ability

Computers exist in a wide range of sizes and power. The smallest are embedded within the circuitry of appliances, such as televisions and wristwatches. These computers are typically preprogrammed for a specific task, such as tuning to a particular television frequency, delivering doses of medicine, or keeping accurate time. They generally are *hard-wired* . This means their programmes are represented as circuits that cannot be reprogrammed (Encarta 2004).

Programmable computers vary enormously in their computational power, speed, memory, and physical size. Some small computers can be held in one hand and are called *personal digital assistants* (PDAs). They are used as notepads, scheduling systems, and address books; if equipped with a cellular phone, they can connect to worldwide computer networks to exchange information regardless of location. Hand-held game devices are also examples of small computers.

Portable *laptop* and *notebook computers* and *desktop PC*s are typically used in businesses and at home to communicate on computer networks, for word processing, to track finances, and for entertainment. They have large amounts of internal memory to store hundreds of programmes and documents. They are equipped with a keyboard; a mouse, trackball, or other pointing device; and a video display monitor or liquid crystal display (LCD) to display information. Laptop and notebook computers usually have similar hardware and software as PCs, but they are more compact and have flat,

lightweight LCDs instead of television-like video display monitors. The terms "laptop" and "notebook" are considered by most sources as synonymous.

Workstations are similar to personal computers but have greater memory and more extensive mathematical abilities, and they are connected to other workstations or personal computers to exchange data. They are typically found in scientific, industrial, and business environments—especially financial ones, such as stock exchanges—that require complex and fast computations.

Mainframe computers have more memory, speed, and capabilities than workstations and are usually shared by multiple users by means of interconnected computers. They control businesses and industrial facilities and are used for scientific research. The most powerful mainframe computers, called *supercomputers*, process complex and time-consuming calculations, such as those needed to predict weather conditions. Large businesses, scientific institutions, and the military use them. Some supercomputers have many sets of CPUs which enable computers to break tasks into small pieces so that each CPU processes a portion of the task to increase overall speed and efficiency. Such computers are called *parallel processors*.

As computers have increased in sophistication, the boundaries between the various types have become less rigid. The performance of various tasks and

types of computing have also moved from one type of computer to another. For example, networked PCs can work together on a given task in a version of parallel processing known as distributed computing. (Encarta 2004).

2.2.6 Uses of computers

Computers are used in many ways. In business, computers track inventories with bar codes and scanners, check the credit status of customers, and transfer funds electronically. In homes, tiny computers embedded in the electronic circuitry of most appliances control the indoor temperature, operate home security systems, tell the time, and turn videocassette recorders (VCRs) on and off. Computers in automobiles regulate the flow of fuel thereby increasing gas mileage. Computers also entertain, creating digitized sound on stereo systems or computer-animated features from a digitally encoded laser disc (Trampe 2002).

Computer programmes, or applications, exist to aid every level of education, from programmes that teach simple addition or sentence construction to programmes that teach advanced calculus. Educators use computers to track grades and communicate with students; with computer-controlled projection units, they can add graphics, sound, and animation to their communications (Webopedia 2004).

Computers are also used extensively in scientific research to solve mathematical problems, investigate complicated data, or model systems that are too costly or impractical to build, such as testing the air flow around the next generation of aircraft.

The military employs computers in sophisticated communications to encode and unscramble messages, and to keep track of personnel and supplies (Encarta 2004).

2.2.7 Communications Devices

Communications technology or devices, according to William and Sawyer (2001:4) "consist of electromagnetic devices and systems for communicating over long distances". Examples of communications systems are telephones, radios, broadcast televisions and cable televisions.

In ICT, these tools combine with the computer to transmit information from one computer to another, or from one device to another. A *communications device,* therefore, is any machine that assists data transmission and this would include modems, cables, and ports.

In addition to these are communications software. These are the programmes that make it possible to transmit data.

The implication here is that "computing" and "information and communication technology" are not interchangeable concepts. Computing is seen as part of ICT, but is not the same as ICT. As explained above, ICT differs in definition to computing in that it includes not only computing technology but also communications technology (Wagood 1993).

By implication, ICT can be defined as including all aspects of computing, integrated with technological development in local and wide area networking and telecommunications technology.

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In her definition for ICT, Tinio (2003:4) sums up all what has been discussed above: "ICT stands for *information and communication technology* and is defined as diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. These technologies include *computers, the Internet, broadcasting technologies (radio and television)* and *telephony*".

2.3.0 ICT and Education

Information and communication technology (ICT) usage in education falls into three broad categories: *ICT as objects under study, ICT as support tools,* and *ICTs as catalysts for transformation* (Rodrigo 2003).

When ICT is the object under study, its technological tools are the subject matter in themselves. Students learn the history and parts of the computer, how to programme, how to navigate around a graphical user interface. The goal of this approach is for students to develop mastery over technology (NSTE 2002).

When ICT is used as a productivity tool or enrichment resource, this generally means that it supports the traditional teacher-led mode of instruction in subject areas such as maths, language, social studies, or science. Teachers show slides using digital projectors and record grades on spreadsheets while students write reports on word processors. Computers become better typewriters, calculators, and grade books (Castro 2003). Teachers may also use tutorials and drills to develop students' familiarity with and fluency in a subject (Roblyer & Edwards2000).

Transformative application of ICT refers to non-traditional emerging uses where exposure to and deployment of ICT fundamentally change the way education is conceived and delivercd to students. ICT tools become enablers that optimize student-centered pedagogical methods. They are used to develop broad, generic skills such as problem solving, independent and collaborative learning, and communication (NSTE 2002). They lead to more individualized instruction, less didactic delivery, and an emphasis on problem-solving and cooperative learning situations (Lawson & Comber 1999). Teachers assume the role of facilitators and skills developers. They help the students achieve a greater understanding of information by making use of new technologies.

These three categories are not mutually-exclusive. However the most dramatic changes to teaching and learning occur when the third approach is employed (Rodrigo 2003).

Horbart (1997) has observed that the introduction of information technology in the educational system has not been driven solely by the need to prepare children for a role in an information economy but also to enhance learning outcomes . It is believed that ICT has the potential to "pay its way" in improving educational delivery (Hobart 1997).

One of the most commonly cited reasons for using ICT in the classroom, according to Tinio (2003), has been to better prepare the current generation of students for a workplace where ICT, particularly computers, the Internet and related technologies, are becoming more and more ubiquitous. Technological

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literacy, or the ability to use computers effectively and efficiently, is thus seen as representing a competitive edge in an increasingly globalizing job market. Technological literacy, however, is not the only skil thatl well-paying jobs in the new global economy will require. EnGauge of the North Central Regional Educational Laboratory (U.S.) has identified what it calls "21st Century Skills," which includes digital age literacy (consisting of functional literacy, visual literacy, scientific literacy, technological literacy, information literacy, cultural literacy, and global awareness), inventive thinking, higher-order thinking and sound reasoning, effective communication, and high productivity (EnGauge 2003).

Tinio (2003) believes that ICT also has the potential for increasing access to and improving the relevance and quality of education and that it represents a potentially equalizing strategy for developing countries. He writes:

> ICT greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others who live in the poorest countries, is their sense of isolation. The new communications technologies promise to reduce that sense of isolation, and to open access to knowledge in ways unimaginable not long ago. (Tinio 2003:7)

However, the reality of the Digital Divide—the gap between those who have access to and control of technology and those who do not—means that the introduction and integration of ICTs at different levels and in various types of

education will be a most challenging undertaking. Failure to meet the challenge would mean a further widening of the knowledge gap and the deepening of existing economic and social inequalities (Tinio 2003).

According to Haddad et al (2002), ICT can enhance the quality of education in several ways: by increasing learner motivation and engagement, by facilitating the acquisition of basic skills, and by enhancing teacher training. ICT is also a transformational tool which, when used appropriately, can promote the shift to a learner-centered environment.

In Ghana, it is becoming increasingly necessary for people to have some knowledge in ICT, not only to enhance their chances of getting jobs but also to improve productivity in work places. Computer literacy has become a requirement in job acquisition. This implies the need for ICT to provide employable skills for high productivity and survival of the economy.

In the view of Gooden (1996:24),

> Students need to learn to communicate more effectively, both through speech and through the written word. They need to learn how to work with others to find new and better ways to solve problems and meet the challenges of everyday life. They need to develop skills they can use in college or the workforce. Perhaps most important, students need to discover the joy of learning. If students are to function effectively in this ever-changing world, they must continue to learn every day of their lives.

2.3.1 The Role of the Education Sector

This is what has been suggested for Australian education concerning the development of information technology:

> Our education and training systems must equip all Australians to be enterprising, innovative, adaptable and socially responsible participants in the information economy. There is an urgent need to recognise that Australia will be at a serious disadvantage in the global knowledge economy if it fails to produce workers, professionals and managers with the skills to work in the technological environment".
>
> National Office for the Information Economy (NOIE) (1998:11)

The basis for the Australian position is that schools are changing in definition, purpose and function. As society deals with changing employment patterns, increased concerns about youth employment and impacts of global media on youth culture, "schools walk the tightrope between community and government demands. Teachers are expected to take increasing roles in increasing complex circumstances in each innovation and educational solution to community problems and concerns. This is amidst the task of understanding curriculum and pedagogical responsibilities in the context of changing Information Technology environments, applications and consequences" (NOIE 1998:8).

Students on the other hand are also changing as they react to the global cultural shifts accelerated by Information Technology advances, which are changing the media, popular culture industries, employment patterns and lifestyles. Young people need to survive in a world more complex than that experienced by their parents. It is up to teachers to understand how to make use of Information

Technology and technological processes in curriculum to make sense of the world. (ACCE 1999)

The definition of what ICT is and what it means in the context of the concerns for education therefore relates to the need to understand the connection between the skills that should be embedded in the school curriculum, those that are valued in work places and what the collective impact is when the country makes use of its skills (ACCE 1999).

2.3.2 The Impact of ICT on Student Achievement

According to Head (1986) the use of computers in learning is derived from the work of behaviour modification done by B. F. Skinner. "Through the use of a computer to provide instant feedback, his theories of reward-and-punishment can be applied to the classroom. In this way students receive immediate positive response to their work and thereby tend to learn material more rapidly and retain information longer" (Head, 1986)

In the view of Curtin et al (1998), "even though they are a long way from fulfilling their potential, computers may become the most amazing teaching too! ever invented".

In the field of learning, information technology is also described as "learning technology", and represents a process. "It reflects a holistic picture where humans are engaged in activities and strategies for working and thinking while using technological tools and processes." (ACCE 1999). For educators therefore, information technology includes learning processes where students

are engaged in educational activities while using technological tools and processes.

The view that ICT can improve learning outcomes has largely been supported by research. While an important area of study in its own right, ICT is also having a major impact on methods of teaching. And that technology can help instill in students an eagerness to learn that will follow them throughout life and better enable them to reach their goals (Tinio 2003).

Research conducted by Apple Classroom of Tomorrow (ACOT) in 1997 indicates that ICT can be used to improve teaching and learning by enhancing existing classroom practice, and by opening opportunities to stimulate cognitive processes in ways that are impractical in a classroom devoid of technology.

Sandholtz et al (1997) have observed that the key to raising student achievement lies with providing students with a solid foundation of basic skills and motivating them to learn. This goal, they contend, can be achieved through technology. The authors' view is that, technology engages students and fires their imagination. It helps teachers to stimulate young minds in ways that make a profound and lasting difference.

Some of the research findings outlining the impact of technology on student achievement are outlined by Sandholtz et al (1997) as follows:

- Students, especially those with few advantages in life, learn basic skills—reading, writing, and arithmetic—better and faster if they have a chance to practice those skills using technology.

- Technology engages students, and as a result, they spend more time on basic learning tasks than students who use a more traditional approach.
- Technology offers educators a way to individualize curriculum and customize it to the needs of individual students so all children can achieve their potential.
- Students who have the opportunity to use technology to acquire and organize information show a higher level of comprehension and a greater likelihood of using what they learn later in their lives.
- By giving students access to a broader range of resources and technologies, students can use a variety of communication media to express their ideas more clearly and powerfully.
- Technology can decrease absenteeism, lower dropout rates, and motivate more students to continue on to college.
- Students who regularly use technology take more pride in their work, have greater confidence in their abilities, and develop higher levels of self-esteem.(Sandholtz, Ringstaff, Cathy and Dwyer, 1997).

The ACOT study reveals that in classrooms where technology is used, students interact more with their peers and teachers than in traditional classrooms. According to them, students change the manner in which they organize and accomplish their work and choose to work collaboratively to solve complex problems. The study indicates that students routinely employ inquiry, collaboration, technology, and problem-solving skills in the classroom, unlike graduates of traditional high school programmes. For this reason, collaboration becomes a learning tool or a means to an end and not just a chance for students to socialize.

A research study on learning with laptop computers conducted by Rockman in 2000 shows that the use of laptops encourage even greater collaboration among students. During the study, it was noticed that on average, students with laptops worked in groups several times a week as compared to a few times a month before the laptops were introduced in their classrooms. In addition to exploring topics more often on their own, students who regularly use laptops assume a greater variety of roles in the learning process, and are thus able to help to teach other students and even their teachers.

Rockman (2000) also asserts that technology provides powerful tools for organizing and analyzing information and modeling concepts and underlying structures. According to the source students who have the opportunity to use these tools gain a deeper understanding of complex topics and concepts and are more likely to be able to recall information later in life and use it to solve problems in non-school situations.

One of the most important contributions technology makes in the classroom is how it affects students' attitudes toward learning. The ACOT research shows that when technology is a routine part of their school experience, student attendance improves and dropout rates decline. When ACOT students were compared with their non-ACOT peers in the same high school, absenteeism was about half in the ACOT classes compared with the rest of the school. The research also revealed that over the five years of the study, there were no dropouts in the ACOT programme, while 30 percent of the student body dropped out from the regular school programme.

Interestingly, the research also revealed that more students finished high school and many more consider attending college when they routinely learn and study with technology. Fewer than half of the students in the ACOT study came into the programme without any interest in pursuing college. Overall, in the school where the study took place, only 15 percent of the graduating students went on to college. Not only did 100 percent of the students in the ACOT classroom graduate, but also more than 90 percent went on to college (ACOT research, 1997).

The Endeavor Research Group (1999) concluded that technology encourages students to take charge of their education. They observed that in classrooms where technology is part of the curriculum, students are more likely to initiate learning-based activities, sometimes even directing them. In general, they noted that students respond positively when given the chance to actively participate in the learning process via technology. They come to class eager to learn and take more pride in their work.

By giving students greater control of their education and increasing their motivation to explore and discover, technology plays a major role in instilling in students a love of learning that will help them to reach new heights of achievement not only in school, but also throughout their lives.

2.4.0 ICT in Art Education

In its *ICT advice: Entitlement statements for ICT in art and design 2003*, British Educational Communications and Technology Agency (Becta) suggests that,

'Many artists are using ICT to develop and create their work. Therefore to have the broadest experience students must also have access to ICT in relation to their artwork.'

Davies et al (2003) describe ICT in Art as 'the use of new technologies to support teaching and learning in art and design' (Davies et al 2003:4). By digital technologies, they are referring to digital hardware, peripherals and systems such as computers, scanners and digital resources which include software and multimedia facilities.

The scope of ICT has been described as encompassing some or all of the following: technologies as tools in art and design; a (multiple) mode of communication; 'professional' quality outcomes; a means for change in pedagogy and the curriculum and a vocational route in the 'Computer generated art' (Davies et al 2003).

2.4.1 What is Computer-generated Art

The World IQ (2004) defines computer generated art as "art created with a computer". Also known as digital art, it can be purely computer-generated, or taken from another source, such as a scanned photograph or an image drawn using vector graphics software, using either a mouse or graphics tablet (World IQ 2004).

According to World IQ (2004) there are two main paradigms in computer generated art. The simplest is Two Dimensional (2D) computer graphics and

directly maps how to draw an image on a piece of paper with a pencil. In this case, however, the image is on the computer screen and the drawing instrument might be a tablet stylus or a mouse, but the marks it makes will seem to be from a pencil or pen or paintbrush.

The second kind is Three Dimensional (3D) computer graphics, 3D graphics are created via the process of designing complex imagery from geometric shapes, polygons or nurbs to create realistic three dimensional shapes, objects and scenes for use in various media such as film, television, print and special visual effects (World IQ 2004).

Digital art is yet to gain the acceptance and regard reserved for other art forms such as sculpture, painting and drawing, perhaps due to the erroneous impression of many that "the computer does it"(Starkey 2003). Some people even argue that completely computer-generated art isn't really art at all, since computers cannot really appreciate beauty.

But the answer, according to World IQ (2004) is that the computer makes a great tool for art and has a lot of advantages over traditional tools. "The computer is a tool, albeit a liberating one; the standard paintbrush for example does not have an *Undo* feature" (World IQ 2004).

2.4.2 Applications for Computer Generated Art

The following is a description of some of the applications for computer generated art as outlined by Basista (1991:34-68) .

1. *Animation Programme*

Animation Programme is used to create moving images. It uses a rapid sequence of individual frames across time (30 frames per second in video, and 24 frames per second in film), to represent and display objects in motion. Formerly, only high-end computer systems were used to create special effects in the motion picture industry. Today personal computers (PCs) are being used as a viable platform for the production of industrial videos, computer-animated presentation such as super-natural feats in movies and interactive moving graphic displays. GIF is a graphics file format that allows animation to be viewed on a computer. Another format called Flash, created by Macromedia, allows for animation to be viewed over the Internet (Basista 1991). Software used for animation on the PC include Micromedia Flash, Corel RAVE, etc.

2. *Computer Aided Design (CAD)*

Computer Aided Design (CAD) is a term that encompasses a wide range of computer-based tools that assist engineering, architectural, industrial, fashion and package drawings. With CAD, models can be drawn in two-dimensional (2-D) form as schematics or as a three-dimensional (3-D) wire-frame necessary to design, conceptualize and test a product concept. Some CAD programmess can add surface attributes and photo realistically render the design. This helps in design evaluation and as a presentation tool for client approval of projects. The imports of this program can be fully utilized by sculptors, ceramists and artists who

handle three dimensional images (Basista 1991). Some of the popular CAD programmes for the PC are Rhinoceros, Corel Bryce and AutoCAD.

3 *Computer Generated Architectural/Interior Design/Rendering*

Computers play a major role in the designing process for modern architectural firms. They are used to assist in the planning, designing, landscaping, detailing and the specifying sites, building and interior spaces. Available software can correlate designs for the various subsystems of a building - lighting and electrical, plumbing, heating, ventilation and air conditioning. Once the design is finalized and approved by the client, the computer generates an itemized list of material specifications and sends this to contractors for bids. In addition to creating the plans and working drawings (blueprints) of the building, 3-D models can be generated with surface attributes. This would photo-realistically simulate the actual site, building or interior. When plotted, the 3-D model can be professionally rendered and composited with an actual photograph of the location for design or presentation purposes. The model can be animated to simulate a walk-through the site, building or space and also gauge a design's mass and scale. When furnishing or other decorative details are added, the animated walk-through is an effective presentation tool. Such a programme would not only be good for architects and interior designers (who are all artists), but can also be used by painters and illustrators to give visual renditions of ideas and artistic impressions of scenes and locations (Basista 1991).

4. *Computer Generated Business Graphics*

This include charts and maps, graphs and diagrams for business presentations. A large segment of the computer graphics industry creates business graphics for slide, video and printed company presentations. Systems like Genigraphics, Autographics and Videoshow specialize in this application, but personal computers (IBM and Macintosh) also have software that can convert numerical information into maps, charts and graphs, create slide shows or animate these elements for film output or computer viewing (Basista 1991).

5. *Computer Generated Graphic Design*

With a personal computer and the appropriate software such as Corel Draw, Adobe Illustrator, Paint shop or Photoshop, a scanner and printer, graphic designers can create and present concepts and designs for clients' approval. Comps done on a computer are more realistic and finished, and since changes to a design can be made quickly, finished designs can often be created in less time than using traditional methods, especially when a designer is showing variations of a single theme. Graphic designers are using computers in all graphic design markets, including corporate, environmental graphic design and signage, publication, advertising among others (Basista 1991).

6. *Computer Generated Illustration*

Illustration systems can mix colours, be used for freehand drawing and

for sizing and positioning of visual elements. Finished output ranges from black-and-white illustrations executed on personal computers to full colour illustrations executed on High Definition Television (HDTV), high-end paint systems. Computer generated illustration is used in publishing, broadcasting, advertising, corporate and educational markets (Basista 1991).

7. *Computer Generated Package Design*

This is a two-part process. First, the volume and shape of a container can be created with surface information. Second, the two-dimensional illustration, typography and layout can be created and mapped onto the 3-D shape. Computers can stimulate the final product for design testing and market research (Basista 1991).

8. *Computer Generated Scientific Visualization*

Computer Generated Scientific Visualization is the converging field of computer graphics, image processing, computer vision, computer-aided design, signal processing and user interface studies. Scientific visualization acts as a catalyst between scientific computation and scientific insight. It came into existence as the result of a need to visualize dense scientific data models, like wind and storm information. Artists and scientists are working together in this area to help visualize complex scientific information, making it easier to interpret and understand (Basista 1991).

9. *Desktop Publishing*

Desktop Publishing is an electronic process that combines text, graphics and photographs to produce professional quality documents. These publications can be produced with personal computer and a laser printer, or documents created on a personal computer can be sent to a service bureau for camera-ready quality reproduction or film, which is then sent to press (Basista 1991). Software for desktop publishing include Adobe In-design, Microsoft Word, Word Perfect, Lotus Word Pro, Corel Draw, etc.

10. *Desktop Video*

Desktop Video is a term used to describe the ability of personal computers to view video sequences; edit and add sound and assemble the result into a finished product. As computer and video technologies merge, inexpensive desktop video editing and production systems are becoming available at the personal computer level (Basista 1991). Desktop videoing can be accomplished with Pinnacle Studio.

11. *Electronic pre-press*

Electronic pre-press uses digital technology to create text, design graphics, layout pages and also scan photographs. A complete electronic pre-press system can digitally pass information through the production printing process from a copy that is initially created in a word processing programme to the final film separations that are used for printing the actual piece (Basista 1991).

12. *Electronic Retouching (Photo and Illustrative)*

Recent advances in technology allow electronic scanning and manipulation of images (including global colour collection, cloning a subject, distorting or enhancing an image and preserving an image without disintegration of dyes). As a time factor, electronic retouching dispenses with the intermediate step of a dye-transfer and the time necessary to recreate a facsimile of the original art work. However, when compared to hand work, computer retouching does not necessarily provide better quality or cheaper rates. Electronic retouching can do very subtle things (such as defining individual hairs in a hairdo or creating subtleties in skin tones). Electronic retouching is improving, but the colours of printed pieces that were electronically retouched may vary from the colours displayed on the screen, although those with the expertise can correct or allow for them. Electronic retouching is convenient: it has a justified compatibility with the mechanics of the pre-press process (Basista 1991). Such programmes allow people to venture into what is known as digital painting.

13. *Mixed Media*

It is also possible to combine traditional media with computer output devices (printers in particular) to create a finished work of art. For example, artists may add colour to black-and-white laser print using colour pencils and markers. Some artists transfer computer images to traditional printmaking media like silk-screens or etchings. Other artists

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use the computer as a sketch tool to develop an idea, which is then executed in a traditional media such as oil paint on canvas (Basista 1991).

2.4.3 Importance of ICT in Art Education

New technologies afford unprecedented possibilities for creative participation in an enormous range of activities in the school curriculum. They offer practical and technical solutions to all sorts of problems. In the context of art education, the creative potential of new technologies can encompass:

- all subjects, disciplines
- all types of audio-visual, text-based, sensory and kinetic media
  all phases, stages and ages
- all abilities, capabilities and special needs (ACE 2003).

The *Australian Council for Computers in Education (ACCE* 1999) suggests that if art teachers are to participate in modern education society and reflect its operation, they need to be immersed in using, ICT as much as possible and need to understand the processes and their consequences.

In rethinking the purposes and goals of art education, Craig (1994:2) has outlined the following four reasons why the learning outcomes of school art curriculum ought to be linked to the expanding presence of technology in our society.

> The integration of new technology into school arts programmes permits students to engage in unique and exciting forms of artistic expression and learning with contemporary media rooted in their everyday lives.

Craig is not suggesting that older and more conventional media such as crayons, clay, film, paint, radio, slides, wood instruments, and the like are any less worthy for their age. He believes that "all media technologies have a place in school arts curricula provided that they can help to promote the ends of art education".

The difference, according to Craig (1994), is that newer technologies such as computers, digital cameras, synthesizers, and video deserve special attention in that they collectively constitute a new genre of contemporary art forms that are dramatically altering our cultural landscape. He urges art teachers make use of ICT to bridge the gap between what happens in the classroom and what is happening in the real world. At the very least, the availability of new technology in arts classrooms may attract students who currently find little value or interest in the arts.

> The use of new technology as expressive arts media in schools provides many unique and significant opportunities for fostering the literacy skills required by our technological culture.

In Craig's view "a child's need to comprehend and participate in our technological culture goes far beyond the scope of what is commonly referred to as *computer literacy*." He does not believe that the ability to programme or use a computer is enough. According to him, "to be *literate* in our technological culture demands a deeper understanding of all media technologies and their potential for human interaction, communication and expression." In this sense,

he implies that a truly literate person today must not only be able to create and communicate one's own messages with new technology tools but also be able to "analyze, interpret and evaluate the messages that one receives in a technology-mediated environment".

He opines "*a very computer literate person* is the one who is able to use the technology *in his/her own area of specialization"*. The art student must therefore be able to use the computer for art. Gaining such literacy skills according to Craig requires education. In his view, students' ability to communicate and think effectively with electronic media as tools depend on their knowledge in the manipulation of the language of the new technology. This language, which is made up of images, sound, movement, voice, drama and text, is also the language of art. It is incumbent on art teachers to build on this connection by helping students to exploit the expressive potential of electronic media and by educating them to become active, critical consumers of its messages.

In other words, computer technology can be useful to students only if its potential would be fully utilized within the context of his subject of specialization. For the art student, the importance of the computer can only be realized if he is able to express himself sufficiently as an artist with the computer as a tool.

The introduction of new technology into arts classrooms provides a unique training laboratory for helping students to meet the high-tech occupational demands of the twenty-first century.

This point is supported by the fact that "innovative art curricula in computer animation, desktop publishing, electronic music, video, and multimedia production enable students to harness the power of technology". (Gooden 1996). Classroom art projects involving computer-based networks, instructional television videodiscs, and CD-ROM allow students to discover the potential of technology as an informational resource, which they can use to make new connections between people, places and ideas. As Gooden puts it, "students who have had first-hand experiences with the creative possibilities of electronic technologies and who are able to use new technology tools for accessing information and interpersonal communication will undoubtedly be an invaluable resource in the coming age". (Gooden 1996)

> Art itself serves as a counterbalance to the infusion of new technology into our daily lives.

Like many other observers, Craig (1994) has reservations about the "computer revolution" which has "brought about dramatic changes of many aspects of contemporary society" and making "more changes inevitable". He describes the new technology, as the fields of computers, consumer electronics, cable TV, and telecommunications merge as "onslaught of super gadgets and electronic services, that will transform all of our lives for the better". His reservation however is that, "in spite of all the promises and benefits of high technology its potential drawbacks are too great to ignore. In particular, its potential for fostering glitz over substance, speed over sustained effort, and entertainment

over critical reflection should be of concern to all of us - especially as art teachers" (Craig 1994).

If the intent of public education is to prepare children to become thinking, contributing members of the twenty-first century, then Craig believes that we must not allow technological advancement to overwhelm them, to numb their aesthetic sensibilities, or to dictate their personal identities. Rather, we must help children sustain their humanness in a highly "technologized" world. As John Naisbitt, (1999) suggests, "…whenever new technology is introduced into society, there must be a counterbalancing human response - that it, high touch--or the technology is rejected."

In this context, art in Craig's view, becomes curricular necessity for they provide fertile ground for cultivating in children those "high-touch" sensibilities and values that are essential for living full and productive lives in an increasingly artificial "high-tech" environment. Some of these uniquely human qualities nurtured in art classrooms include: "the willingness to take chances, challenge convention, and explore the unknown; the desire to work honestly, with self-discipline, while acknowledging the success or failure of one's endeavors; the ability to appraise and defend what is personally and socially important; as well as the capacity to appreciate the warmth of a cello being bowed or plucked, the gracefulness of a ballet dancer, the unpredictability of watercolour paint being applied to a wet surface, the pliability of clay being formed on a potter's wheel, and the excitement of live dramatic performance" (Craig 1994).

In the end, as Gooden (1999) puts it, whatever technologies are brought to bear on the art learning process, children must learn to use the tools they have available to think, to imagine, to create, to take on the impossible, to play with ideas, to explore, and to feel what it means to be human. As art teachers, seeing to it that this kind of authentic learning takes place in our classrooms may be the greatest investment we can make in children's future.

In von Wodtke's (1993:308) view, information technology in art education "provides means of investing in more sustainable and appropriate technologies that can reduce material and energy consumption". Students can explore sequences of actions and links between events and actions (if this tool is used or the mouse is moved like this – this happens); incorporate elements into drawings that they would not be capable of producing with traditional materials, complex shapes – stars; experiment with new creative tools, some of which are unique to ICT , such as transparent fills, blend tools and many more. With ICT, students can also try things out to see "what would happen if". They can easily undo, rub out or start again to make changes. Students are offered the opportunity to play with colour as much as they can without wasting colours, wasting papers or wearing off brushes.

2.4.4 Conclusion

The views expressed by the various sources indicate that ICT has not only expanded the way in which information can be generated and delivered but has also provided a valuable opportunity to practice new learning techniques. Computers are making much impact in education in many places, providing a

competitive advantage that has come to be essential in various aspects of education.

In Ghana educators, policy makers and researchers seem to agree on the potential of ICT to have a significant impact on education. What is not really certain is the precise role ICT should play in education reform and how best to ensure that potential is fulfilled. Because as Cuban laments "although promoters of new technologies often spout the rhetoric of fundamental change, few have pursued deep and comprehensive changes in the existing system of schooling..."(Cuban 2001:28).

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CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the nature, scope and content of ICT as it has been adopted by Ghanaian senior secondary school.

The section describes the strategies adopted to find answers to the research questions outlined for the study.

3.1 Rationale for the Study

The rationale for this study is based on designing a basic handbook on ICT for Art Education. The study should accomplish three goals: First, it should report the findings on the study of ICT programmes in Ghanaian senior secondary schools as well as provide an overview of the programmes in relation to the teaching and learning of visual art. Second, it should come up with a set of instructions on the use of two common computer software for basic activities in art. Third, the research study must analyze the practicability of the handbook through a pre-testing of the instructions on a selected group of senior secondary school students.

3.2 Research Methodology

The qualitative research methodology was employed for this study. This method investigates the quality of relationships, activities, situations or methods. Qualitative research also emphasizes more on holistic description, that is, on

describing in detail all that goes on in particular activity or situation, rather than comparing the effects of a particular treatment (Fraenkel & Wallen 2000).

Since this research seeks to investigate the nature of ICT programmes in Ghanaian senior secondary schools, vis a vis the teaching and learning of visual art, this method was considered appropriate.

The research dwelt on three of the prominent features of Qualitative Research methodology for findings.

- The natural setting was the direct source of data, and the researcher was the key instrument. In this case, the natural setting was the ICT centres in the schools. This was considered appropriate because the researcher had to go directly to particular schools to observe and collect data. A considerable amount of time was spent in the schools interviewing ICT instructors, students, some school officials and observing ICT lessons.

- Data was collected in the form of words or pictures rather than numbers. Data collected therefore were copies of ICT curricula as they exist in the sampled schools. In the report therefore, no attempt has been made at reducing the data collected to numerical symbols. Rather they have been described as they were observed or told.

- The research also sought to investigate how students and teachers

(especially art teachers and students) make sense of the information technology programmes in schools.

Descriptive method combined with Qualitative method to complete the final report.

3.3 Data collection

The data collected during this study enabled the researcher to answer the research questions he posed at the beginning of the study. The research generally focused on the subjective experience and perception of the research subjects in ICT. The researcher was the key instrument of data collection. Tools used included open personal interviews, field notes, 'conversations', on-site visits and practical teaching to gather data for this study (Tuckman, 1988).

3.3.1 Interviews

Interview conducted for the study were informal, and in the form of conversations (Fraenkel & Wallen 2000) with teachers, students and *instructors* of ICT in case study schools. They did not involve any specific type of sequence of questions or any particular form of questioning.

The interviews which were conducted personally by the researcher primarily sought to find out what was taught under ICT and whether the syllabus had any relevance to the teaching of art subjects. Selected art students and teachers and some school heads were also interviewed to seek their opinion on the content of their ICT syllabus.

The interviews with heads were concerned with school's history on ICT establishments, use as well related infrastructure goals. The computer instructor interviews were of more technical nature and it involved ICT resources and their usage.

3.4 Study area and Population Studied

The primary sample population in this study consisted of senior secondary schools who have incorporated ICT into their curriculum. Ten schools were selected for the study. The criteria for selection were: they run IT programmes, and they were situated within the three regions that have most of Ghana's grade 'A' schools. This was necessitated by the fact that ICT is a new concept in Ghanaian schools, so it was just important that studies should be conducted in schools where ICT has been on their academic programme for some time.

Ten schools located in the Greater Accra, Central and the Ashanti Regions were selected for the study - four from the Central Region; four from the Greater Accra Region; and two from the Ashanti Region. These schools would be referred to as S*A* (school 'A'), S*B*, S*C*, S*D*, A*E*, S*F*, S*G*, S*H*, S*I* and S*J*.

3.5 Sampling Method

The population under study was selected by the Purposive Sampling technique. This sampling procedure is appropriate on occasions when, based on previous knowledge of a population and the specific purpose of the research, investigators use personal judgement to select a sample. The researcher used

his knowledge of the population to judge whether or not a particular sample will be representative (Fraenkel & Wallen 200). Subjects were selected because of certain characteristics: the fact that they run ICT as well as Visual art programmes, and that some of them are connected to the Internet.

3.6 Reporting of Results

Results of the study was grouped into three: Findings from the study of ICT programmes in senior secondary schools, the design of the handbook on ICT for art and the results from the pre testing of the handbook.

Findings from the ICT programmes embraced a discussion on senior secondary schools' ICT syllabuses, hardware, software, connectivity and ICT uses for instruction.

3.6.1 The Handbook Design

The handbook would provide a general information source for visual art students in Ghanaian senior secondary schools. It would provide specific instructions on the use of Corel draw and Adobe Photoshop for basic activities in art. It would also contain reference information for certain aspects of art such as colour theory, and the elements and principles of art.

3.6.2 Pre Testing of the Handbook

Pre-testing of the handbook was done with 20 students of Winneba Secondary School to find out the practicability of the activities outlined in the handbook and

to link up the activities with the kind of Art Education provided in the schools. The 20 students were randomly selected from those in Forms Two and Three. No student was selected from Form One because at the time of the study, Form One students had freshly reported and therefore had not got the knowledge requisite for the exercise.

The pre testing involved a series of practical activities. Practical activities are in two sections: The first one comprised demonstrations and illustrations undertaken by the researcher to explain the tools of the software recommended for art education, as they appear in the handbook. The second is made up of students' activities during the pre-testing of the handbook. The activities documented in the handbook were derived from the researcher's practical use of the Personal Computer (PC) with the application software highlighted in this study.

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CHAPTER FOUR

MAIN FINDINGS

4.0 Introduction

This section presents the analysis of the study's results. It provides an overview of information technology education in 10 selected senior secondary schools in Greater Accra, Central and Ashanti regions of Ghana. The schools are (school 'A') Mfantsipim (SA), Aggrey Memorial (SB), Mfantseman Girls' (SC) and Winneba (SD) secondary schools in the Central Region; Accra Academy (SE), Achimota (SF) and Wesley Grammar (SG) secondary schools in Greater Accra Region; Armed Forces (SH), Yaa Asantewaa (SI) and Technology (SJ) secondary schools in Ashanti Region.

4.1 General Issues

The following information is general to all the schools:

- Information technology programmes are extra curricular activities.

- Schools are not satisfied with the information technology programmes they pursue, in terms of both logistics and contents. School authorities believe there is more room for improvement.

- Computers are mostly IBM compatibles.

- There are plans toward the full integration of IT into the curriculum, that is, making it a co-curricular activity.

- There are plans towards making IT relevant to specific subject areas (Including visual art).

- Word processing is a must and all schools use MS Word.

- Even though there are other application software such as Microsoft Powerpoint, Publisher, installed on their computers, the major concern of instructors is how students can do some word processing with MS Word.

- IT centres are originally established by the individual schools with a lot of assistance from the PTA and Old Boys/Girls, but latter receive support from various organisations.

- IT classes are attended class by class at specific periods that have been allocated by school authorities.

- Some students have attained extra skills in computing through private classes and have therefore been exposed to many other (and in some cases advanced) software.

- Instructors attend periodic training programmes and workshops organised through the World Link project.

4.2.0 Overview of ICT Centres

Tables 1 to 10 describe the nature of IT centres in the schools in the light of available hardware and software facilities. This is intended to provide a picture of the nature as well as the content of IT centres in the schools.

Table I - SA

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
40 (Fully Networked)	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	On the Internet	Network Communication Systems (NCS)

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word Word Perfect Lotus Word Pro	MS Excel Lotus 123	MS Encarta	M-Daemon *(for web browsing)* MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 2 - SJ

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
35	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	On the Internet	Africa On Line

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word	MS Excel	MS Encarta	Real Draw MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 3 - SB

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
20	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	Used to	NCS

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word	MS Excel	MS Encarta	MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 4 - SF

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
40 (Fully Networked)	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	On the Internet	Network Communication Systems (NCS)

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word Lotus Word Pro Corel Word	MS Excel Lotus 123 Quatto Pro	MS Encarta Compton's Enc Encyclopedia Britanica	M-Demon *(for web browsing)* MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 5 -SC

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
30	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	Yet to be	Nill

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word	MS Excel	MS Encarta	MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 6 - SD

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
40	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	Yet to be	Nill

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word	MS Excel	MS Encarta	MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 7 - SE

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
40	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	Used to	Network Communication Systems (NCS)

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word	MS Excel	MS Encarta	MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 8 - SG

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
25	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	Yet to be	Nill

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word	MS Excel	MS Encarta	MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 9 - SI

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
30	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	On the Internet	

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word	MS Excel	MS Encarta	MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

Table 10 - SH

NO. OF COMPUTERS	TYPES OF COMPUTERS	PERIPHERALS	NET CONNECTIVITY	INTERNET SERV. PROVIDERS
35	Personal (Table Top) Computers *(IBM Compatibles)*	Printers *(Lasers, Ink jets and Dot Matrix)* Scanners	On the Internet	Africa On Line

OP. SYSTEM	WORD PRO	SPREADSHEET	REFERENCE	OTHERS
MS Windows	MS Word	MS Excel	MS Encarta	MS Power Point *(for presentations)* MS Front page *(for basic web design)* MS Publisher MS Access MS Outlook

4.2.1 ICT Centres

In all the 10 schools cited, early responses to ICT involved creating a technology centre, or dedicating a building to house computers and peripherals. Students were being taken to these facilities when work with computers is needed. These buildings are called ICT centres.

4.3 Resources Available to schools

The availability of computer hardware and software were primary determinants of the quality of ICT usage in Ghanaian senior secondary schools. The results shown in the tables above give a general profile of the ICT infrastructure available in the Ghanaian senior secondary schools.

4.3.1 Hardware

A basic indicator of hardware availability in schools was the number of personal computers available for students use. Computer hardware components identified in all the centres mainly comprised of system units, monitors, keyboards and mouse.

Secondary schools keep most of their ICT resources in computer rooms. This pattern was consistent in all the schools.

4.3.2 Hardware Peripherals

Most of the schools had limited access to peripherals. At best, schools were equipped with colour printers and scanners. There was only one exceptional school which had digital cameras and LCD projectors that were used for teaching.

Because schools had few peripherals, students access to these devices were restricted. In all cases, printers were not made available for students' use at all times, because the instructors felt students would misuse them. Students were only allowed to print their work with the express permission of the teachers.

4.3.3 Computers

The computers used for ICT programmes in all the case study schools were Personal Computers or IBM compatible computers. Each of the schools had between 20 and 50 working computers (see tables). Their capacities differ and so are their general performances. No school had a computer classroom furnished with the same brand and quality of computers. There may be a lot of one particular brand of computers and a few different ones. With even that, some may have monitors whose brands are different from the systems units. This is because computers are not acquired all at once, at the same time. Computers available to schools were predominantly Pentium-based, ranging between Pentium 220 and Pentium 4.

4.4 Software

The extent of ICT use in schools was highly dependent on the types of software available to users. Two types of software was available to the schools visited. These were Operating System and Application programmes.

4.4.1 Operating System

Because all the schools use IBM compatible computers, the operating system they learn is Windows. Versions range from 98 to XP, depending on when a

particular computer was obtained. The hardware and operating systems platform available in schools implies that school facilities are capable of supporting art programmes such as Corel Draw and Adobe Photoshop.

4.4.2 Application Software

The Microsoft suit was available to all the ten schools studied. Because this software was installed on all the computers found in the schools, all the ten schools teach word processing, spreadsheet and presentations. The students and instructors interviewed confirmed that word processing receives more attention than the other programmes. Observation also revealed this in the schools' ICT lessons. At SA, SB and SF for example, the Corel Draw programme (Versions 9 and 10) had been installed on some of their computers, yet the students (including visual art students) made very little use of them. The interviews revealed that some of the instructors had considerable working knowledge of the programme, yet they did not teach it as part of the normal ICT programme. What was happening was that some students had some knowledge and skills that enable them to use the programme for designing. It was realised some art students knew how to use Microsoft Word, Publisher and Power point to design cards, calendars, etc. In SJ, teachers were, apart from the general ICT periods, allowed to use the computers when and where they felt necessary in their specific areas of teaching. According to the graphic design teacher, art students learn basic concepts of colour and typography with MS Word.

Tables 1,2, and 4 show that SA, SJ and SF tended to offer students greater

exposure to a variety of software types. Students in SA and SF had, in addition to word processing software, Internet-related software such as browsers and e-mail software, for example, Mdaemon. With that software installed on a computer, it is not always necessary to have a full-time connection to the Internet in order to provide email services to LAN. Without a dedicated connection, it is still possible to provide email services.

It must be mentioned however, that some of the students in all the 10 schools had sound knowledge and expertise in the use of ICT than some of the ICT instructors. This was because such students had access to computers in their homes; some even had laptop computers of their own. The ICT instructor in SA for example, said he learnt Dream Weaver (for web design) and Adobe Illustrator from a student. The researcher also found four students in *SF* who were so versatile on the computer that they could do basic film editing.

4.5 Internet

As it can be seen from the tables above, 5 out of the 10 schools (SA, SF, SH, SI and SJ) are on the Internet, SB and SF have been on the net before and SC, SD and SG are not, but have plans to get hooked to the net. SB already has a large dish that would enable them have all classrooms and offices hooked to the Internet. SD was working out plans to link up via the local University. The PTA of SC had also promised to get them hooked to the Internet. Interviews with selected students in the schools revealed that they knew about the Internet and its use for electronic mail.

The use of the Internet in the schools where the service was available was closely monitored by ICT instructors. This was to ensure that students put the facility to proper use.

4.6 Visual Art Teachers

For most of the teachers interviewed, new technology was seen as a set of tools and the availability of ICT within art and design (and specifically within the art department) was reported as a positive force, that can enhance motivation and self-esteem for teachers and pupils.

4.7 Support for ICT education

All the ICT centres receive a lot of support from local PTA's, Old Boys/Girls and Donor agencies. The SI ICT centre was provided by the Old Boys' Association with support from the two organisations World Links and International Institute for Communication and Development (IICD). World Links is an organization that promotes project-based, international telecollaboration activities among secondary school teachers and students from developing countries. The International Institute for Communication and Development (IICD) assists developing countries to realise locally owned sustainable development by harnessing the potential of information and communication technologies (ICTs). In SI the World Links project donated ten networked computers with accessories and one year Internet connectivity. Africa online is the internet service provider. The International Institute for Communication and Development (IICD) through the Global Teenage Project (GTP) also donated three networked computers with one year Internet connectivity. Network

Communication Systems (NCS) is the Internet service provider.

SB, SE, SF, SH and SI have received similar assistance from the above programmes. At the time of the study, SB had received five computers and a satellite dish from its overseas branch of the Old Boys Association.

The IT centre in SD was established by non-governmental organisation called Institute of Computer Technology (ICT), who also provided all the 40 computers and instructors to ICT in the school. A chat with one of the ICT staff indicated that they had established ICT centres in several senior and some Junior Secondary Schools in Ghana. It was also learned that some other organisations such as World Technology System (WTS), Technonet Computers, Valco Trust, Towers Computers, NIIT, Intercom Products and Manufacturing Company (IPMC), Expert Computer Technology (EC TECH), Network Computer Service (NCS), Tower Computers, Atlantic Computers and other ICT companies were involved in establishing ICT centres in schools.

This trend gives another dimension to ICT in schools where ICT avails itself as a business avenue for ICT companies. The implications are that, ICT companies are more likely to associate themselves with the 'big' schools where it would be possible for them to recoup their investments. It is obvious that if the introduction of ICT in education is done without careful deliberation, it can result in the further marginalisation of those schools which are already disadvantaged.

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4.8 Course content

There is no standard syllabus for ICT programmes. The syllabi for ICT programmes in all the schools are designed by the teachers themselves. In the case of ICT centres that are run by private organisations, course contents are determined by such organisations as is the case of SD and SF.

There were no differences in terms of content between the IT centres run by the schools themselves and those run by private organisations. Even though some of the schools had drawn much elaborate syllabi as seen in the case of SD, SB and SI, they hardly had enough time to do anything beyond what their colleagues in the other schools do. There was however, a great deal of difference in how the centres function from school to school, and this, to a very great extent, is dependent on the adequacy of computers and quality of staff. It therefore became obvious that school ICT centres which had enough equipment (computers and accessories) function more efficiently than those with limited equipment. Of the ten schools studied therefore, SA, SF, SH, SI and SJ are ahead of their colleagues because their centres are better equipped and programmes are well structured.

The following topics form the content of all the syllabi studied. It must be stated however that topics in the syllabi have not been exactly streamlined and designed in all the schools as they appear in this report. Schools like SC, SE and SG do not have any written syllabi at all. The instructors teach students from their experience. What Aggrey Memorial uses as a 'syllabus' is simply a content of a book which the IT instructor uses (see appendix).

A syllabus obtained from Institute of Computer Technology(ICT) (the organisation which established the ICT centre for SD and many others in Ghanaian secondary schools, was used as a yardstick (see appendix). This particular syllabus was used because the researcher found it elaborate.

4.8.1 Topics in the Syllabi

(1) **Computer Systems** - Definition of Computer and Concepts: Program. Input, output, electronic, memory, data and information, etc, and types of computer.

(2) **Hardware:**

- The System Unit - As the house of the Central Processing Unit (CPU) or the brain o f the computer.
- The Monitor and its functions - Types: Cathode Ray Tube (CRT) which looks like a Television and Liquified Crysta! Display (CRT).
- The Keyboard and the Mouse and their uses - means of sending information and instructions into the computer.
- Classification of hardware into Input and Output Devices; their parts, layout, uses and practice.

(3) **Peripherals** (external hardware components) such as Printers, Scanners, Graphic tablets (digitisers), etc.

(4) **Processing devices**, (microprocessor) Types: 286, 236, 486, Pentium I, Pentium II, Pentium III, Pentium IV.

(5) **Storage and Memory** : Primary: RAM and ROM (chips); Secondary: Hard disk, floppy disk, compact disk (D), magnetic tape; Measurement and access time: capacity – Bits, Bytes, Magnetic tape access time.

(6) **Typing** - Definition and Types: System and Application Software; Application Software packages:: Word processing, Spreadsheet, Database Management, Painting Packages, Drawing Packages, modelling and Simulation Packages, Desktop Publishing (DTP).

(7) **Software** - Types: Operating System (OS) and Application software.

(8) **Disk Operating System (DOS) as an Operating System** - Simple commands: Time, Date, Ver, CLS, DIR, CD, MD, MEM, RD, DEL, WIN, EXIT, etc; External Commands: Format, Unformat, Diskcopy, scandisk, MEMAKER, DEFRAG, WILDCARD, etc; Files: Creating Files, using text editor and copy con command.

(9) **Introduction to Windows** - Versions 3.1, 95, 98, 2000, Millennium Edition (Me), XP.

(10) **Exploring the Desktop** - Mouse Practice: Pointing, Clicking, Double-Clicking and dragging. Identification of Icons, Changing Wall Paper, Screen Savers, Command Line to a Program.

(11) **Basic Skills** - Displaying Start Menu, Selecting commands. Using a Dialog Box, Help, arranging windows, moving and sizing windows

using keyboard and mouse, disk formatting, viewing disk properties.

(12) **Disk Organisation** - Using Explorer and My Computer to view files, Creating folders and Sub Folders, copying files to Folders, Renaming, Deleting and Moving files, Deleting Folders. Copy Disk.

(13) **Windows Applications** - How to launch and use calculator, clock, calendar, clipboard viewer – transfer data between applications clipboard, notepad, word pad, (cut, copy, & paste, formatting, saving and printing documents using the mouse and keyboard), paint.

(14) **Application Software** (Programme)

- Introduction to Microsoft Word: Loading Program on PC: Placing toolbars, e.g. formatting Standard Drawing, Pictures, identification and use of command buttons on Toolbars (using keyboard to access menu). Use of scroll bars.
- Creating and Editing Documents: Inserting and Deleting text, Undo, Redo, Select and Copy text. Moving around text, finding and replacing text, Documenting a file, using a template to create a document.
- Formatting Documents: *Formatting paragraphs*: Line spacing, setting tabs, setting tab-stops using a ruler, setting tab-stops using the tabs dialog box *Indenting text*: Using the ruler to set indents, using the format toolbar, using the paragraph dialog box, using the keyboard shortcuts, hanging indents, creating hanging

indents using the ruler. *Text alignment*: Right, left, centre and ustified alignment. Adding bullets and numbers. *Formatting pages*: Changing page orientation, setting margins, paper size. Hyphenation: Hyphenating a document, removing automatic hyphens, Editing a style and auto format a text, changing font, font size, case and using format painter.

- Inserting Objects: Word Art, Auto shapes, Clip art Gallery, grouping, inserting special characters and symbols. Creating table and other things related to table creation.
- Creating Reports, Newsletters, Letterheads, Greeting Cards & Business Letters: Creating columns, section breaks, table of contents, headers, footers, text box, pages and text borders, border lines, shading importing graphics, drawings and enhancing drawings using fills and shadows, using captions, text directions, Drop cap, page numbering.
- Proofreading and printing documents: Proof read on the screen, using Dictionary, Grammar and Spell check, using Thesaurus, background printing.

(15) **Introduction to Microsoft Excel**: Load on and Use Program: Use of Spreadsheet. Types of Data-labels, values and formulae.

- Creating Worksheet: Entering data, clearing and editing an entry, changing column width, Inserting rows and columns, deleting rows and columns, alignment of cells, entering formulas

(addition, subtraction, division, multiplication and changing precedence of Arithmetic Operators using the bracket). Copying formulas, entering functions and using function wizard, adding cell notes, using absolute and relative references, linking worksheet, using Auto Fill, moving cell contents. Formatting data, Integer, Decimal, percentage, bold, italic, underline, save and print document, protecting worksheet and cells.

- Managing large Worksheet: Splitting windows, Freezing panes, viewing multiple windows, suing goal seek, linking workbook, Filter, Auto Filter, Advance filter.
- Data analysis and Functions: Concluding the mean, mode, median, standard deviation, SUM, MAX, MIN, COUNT. Using What If analysis, Goal Seek, Creating and using range names, tracing dependants & precedent, Financial functions (PMT. NOW, ABS, ROUND, IF)
- Creating Charts: Selecting data to charts, using chart wizard, changing the type of chart, creating a chart with multiple data series, adding patterns, legends, arrows, text box, and data labels. Using data analysis feature to draw histogram and cumulative frequency curve.

(16) **Internet:** Network: local area network (LAN) and wide area network (WAN); Servers and Topologies, Star/Hub, Ring/Loop, Bus/Line; Internet Terminologies and their meaning such as Electronic mail (E-

Mail), World Wide Web (www), Hypertext Transfer Protocol (http), File Transfer Protocol (FTP), TCP, Hypertext Markup Language (HTML), Digital Subscriber Line (DSL).

Means of Communication: Wireless and non wireless (radio waves – satellite, microwave fibre optics.

Effect of IT on society (advantages and disadvantages of the Internet)

4.8.2 Reference Tools

Some common reference software were identified in some of the secondary schools. *Encarta Encyclopedia* was available in SA, SF, SI and SJ; *Comptons Encyclopedia, Comptons Interactive Holy Bible* and *Webster's Interactive Dictionary Encyclopedia* was available in SF secondary school. These software are used to support traditional teaching practices. Schools with some reference software sometimes asked their students to search for information. One Geography teacher in SA, for example, lectured briefly about the atmosphere, presented students with several questions, and then asked them to search for the answers using the Encarta Encyclopedia CD-ROM.

4.9 Summary

This study has proved that all the schools with ICT centres had access to word processors, spreadsheets, and presentation software. This is consistent with the Microsoft suite of productivity tools. This implies that schools tend to use ICT to teach computer literacy. Students study ICT as subject, rather than as tools to

learn other subjects. The ICT curricula of all the schools require students to learn keyboarding, word processing and spreadsheet throughout their programme. Opportunities to use the Internet is limited. When available, the Internet is predominantly used for e-mail. Actual learning outcomes in all the schools are therefore centered on the acquisition of computer skills. The curriculum had no consideration for the visual art. There is no opportunity to learn with drawing, painting, simulations or modeling software. When art students had occasion to learn with computers, available software also limited the activities they could perform, and even in the cases where software such as Corel Draw is available, instructors find it difficult to show students what they can do with it.

4.10 Conclusion

The limitations on ICT use were attributable to schools' lack of hardware, software and human resources. The software available were limited in scope. The few hardware available were kept in computer rooms or laboratories and were manned mainly by ICT instructors. Non-ICT subject area teachers were therefore less likely to use them for instructional purposes. This implies that, in Ghanaian senior secondary schools, students generally use ICT only during "ICT classes" where the subject matter to be taught is always computer-related. As such, any outcomes from ICT exposure would be computer-related as well, without any direct linkage to any particular subject studied in the schools.

These outcomes fall short of the *transformative* goals that prompted the integration of ICTs in the secondary school curriculum. The data from this study

therefore substantiates Cuban's (2001) view that ICTs are still far from achieving deep and comprehensive changes in teaching and learning.

The attempt to introduce ICT into Ghanaian senior schools over the past few years is far from making any meaningful impact in the teaching and learning process. Obviously the idea of ICT in education has been fully endorsed by policy makers, educators, teachers and many others. It is disappointing therefore, that so much of its potential is not only unrealised but apparently unrecognised, particularly in what has traditionally been viewed as the creative area of the curriculum, art and vocational skills. The above findings paint a picture showing little consolidated progress in effective integration of ICT into art education. More alarmingly, while some art teachers report of a burning desire to integrate ICT into the teaching and learning of art, heads and school authorities see almost no need for that. Besides, the art teachers' knowledge and competencies in ICT is so low that they show very little evidence that they themselves are engaged with the creative process in their uses of ICT. And the worse aspect is that remarkably little has been done to promote the creative potential of what teachers and pupils can do *with* these new tools

Reference

Cuban, L.(2001) *Oversold and Underused: Computers in the Classroom*. Cambridge, Massachusetts: Harvard University Press.

CHAPTER FIVE

THE HANDBOOK DESIGN

5.0 Introduction

This handbook contains information and practical instructions on the use of the computer for basic activities in visual art. It is in the form of a set of how-to instructions on two graphic software - Corel Draw and Adobe Photoshop. The task for this handbook therefore centres on performance of basic artistic activities by the use of the computer and the software mentioned above.

5.1 Purpose of This Handbook

This handbook is guided by the observation that visual art students are missing out in the current ICT programmes that are run in Ghanaian senior secondary schools. It provides a framework for thinking about ICT also as a tool in the creative process (Wodtke1993). It is designed primarily to demonstrate how certain basic artistic activities can be performed with the computer. However, the hope of the researcher is that the activities in this handbook would motivate teachers and learners of visual art to embrace ICT and consider it as one tool which can open many doors in their artistic pursuits. For art educators with little or no experience in computing, and without the time to learn computing from the scratch, this handbook can provide a shortcut to otherwise long process. This handbook is not intended to serve as an exhaustive instructional guide in Corel Draw and Photoshop. It only touches on the aspects of the software which are relevant to this study.

5.2 The users of the Handbook

The handbook provides a set of systematic guidelines for teachers and learners of art as well as all those who concern themselves with creation of images/graphics with the computer.

5.3 The need for the Handbook

The handbook seeks to draw attention to the computer as a tool for the learning and creation of art in Ghanaian senior secondary schools. This has been necessitated by the observation that information technology as they are pursued in Ghanaian secondary schools today concerns itself mainly with word processing, and therefore makes very little impact on the teaching and learning of Visual Art. Activities have been based on the fact that it is through a constant practice and understanding of certain issues in art that enhances the smooth teaching and learning of art. For example beginners of art using paint, clay or pencil will become excited by the materials and be motivated to explore further. In much the same way, using the computer to learn about the elements and principles of design - creating, manipulating, moving them and so on, - may appear to be playing. But the underling factor is that, this basic experience of involvement with little regard for result can be an educative one. Because the computer makes it possible for learners to engage in many creative activities such as creating lines, shapes, mixing colours, very quickly and at a very little cost, it offers a much broader opportunity for experimenting and in-depth practice.

It is with such an understanding that the researcher considers the activities outlined in this handbook as capable of enhancing the teaching and learning of art. Insight gained from the basic use of computers for artistic expressions will put teachers and learners in a better position to appreciate the usefulness of the computer and for that matter information technology in art education.

What follows in this section is a justification to the fact that information technology in schools can mean more than learning how to type with the computer.

5.4 Objective of the Activities

The activities in the handbook aim at motivating students to use the computer to explore the effects of some of the basic elements and principles of design. Since it is much faster to use the computer for the creation of lines, shapes, colours, textures, the activities in the handbook would promote spontaneity in students' creative thinking.

The activities in the handbook therefore hinge on the following three components of Art Education:

Creative Expression: Developing understanding and familiarity with a different medium and with making aesthetic choices by means of actually making art.

Aesthetic: The philosophy concerning the nature of beauty. A belief that art can have intrinsic beauty and value that can be communicated to the viewer without words.

Art Criticism: Analysis and judgement of the nature and value of different arts. (Hubard 1994)

The handbook therefore aims at introducing the computer to students as a tool for creating art. This would lead students to explore further the area of beauty as they utilize the concepts of line, shape, texture and colour, thus presenting ideas visually. From this exploration, students would be able to appreciate what they can create with the computer as well as what others can do. In other words, they would begin to see the computer not only as machine that always comes up with similar solution to problems (as when it is being used solely for word processing), but also that which can promote divergent thinking.

5.5 Tools

The major tool for this study is the Personal Computer (PC), which is the most popular type of computer in Ghana. Besides PCs are compatible to a wide range of software - from high tech 3D simulation programmes to integrated word processors, encyclopedias, etc. Personal computers, which are also known as IBM compatible computers are easy to use and are found in all the schools that have ICT centres.

However, that is not to say that the Apple Macintosh is inferior in any way. On the contrary, Macintosh is many times considered a better piece of equipment for such applications as graphic arts. The only drawback to the Macintosh would be the lack of some of the more popular and less expensive software that is usually released for Pcs first, and of course the fact that it is more expensive.

Since the computer by itself cannot be a tool for art without the appropriate software, two software programmes were selected for this project. These are Corel Draw for drawing and Adobe Photoshop for painting. These programmes have been chosen because they are the least expensive of the drawing and painting programmes. At the outset, however, it is necessary to elaborate a bit about the programmes and their tools.

5.5.1 Corel Draw

This is a comprehensive vector-based drawing programme that makes it easy to create professional artwork from simple logos to intricate technical illustrations. It provides tools and effects that make it possible to work efficiently to produce high-quality graphics.

Corel Draw drawings are vector based because objects drawn are defined mathematically as a series of points joined by lines. Graphical elements in a vector file are called *objects*. Each object is a self-contained entity, with properties such as color, shape, outline, size, and position on the screen included in its definition.

Because each object is a self-contained entity, it is also possible to move and change its properties over and over again while maintaining its original clarity and crispness without affecting other objects in the drawing. These characteristics make vector-based applications ideal for illustrations, in which the design process often requires individual objects to be created and manipulated. Vector-based drawings are resolution independent. This means

that they appear at the maximum resolution of the output device, such as printer or monitor. As a result, the image quality of a drawing is a higher quality resolution.

Toolbox

The table below describes the tools in the Corel Draw toolbox that are relevant to the teaching and learning of elements and principles of art.

Tool	Description
	The Pick tool is used for selection and transformation of objects
	The Shape tool is used to edit the shape of objects
	The Freehand tool is used to draw lines and curves
	The Bezier tool is used to draw curves using a connect-the-dots style of drawing
	The Text tool is used to type words directly on the screen as Artistic Text or as Paragraph Texts
	The Zoom tool is used to change the magnification level in the Drawing window
	The Rectangle tool is used to draw rectangles and squares
	The Ellipse tool is used to draw ellipses and circles
	The Polygon tool is used to draw polygons and stars

Fig 1: Corel Draw Toolbox

When the Corel Draw progamme is launched, the above tools are found at the left hand side of the screen, with its colour pallette at the other side. Like more

familiar programmes such as Microsoft Word, the Title bar lies horizontally at the top of the screen, followed by the Menu and the Tooll bars. These are followed by one very different and quite significant feature (apart from the toolbox and the colour pallette). This bar is called the Property Bar. It changes with every tool that is selected from the tool box and it provides many options for the easy manipulation of any object drawn.

Below is the opening screen of Corel Draw.

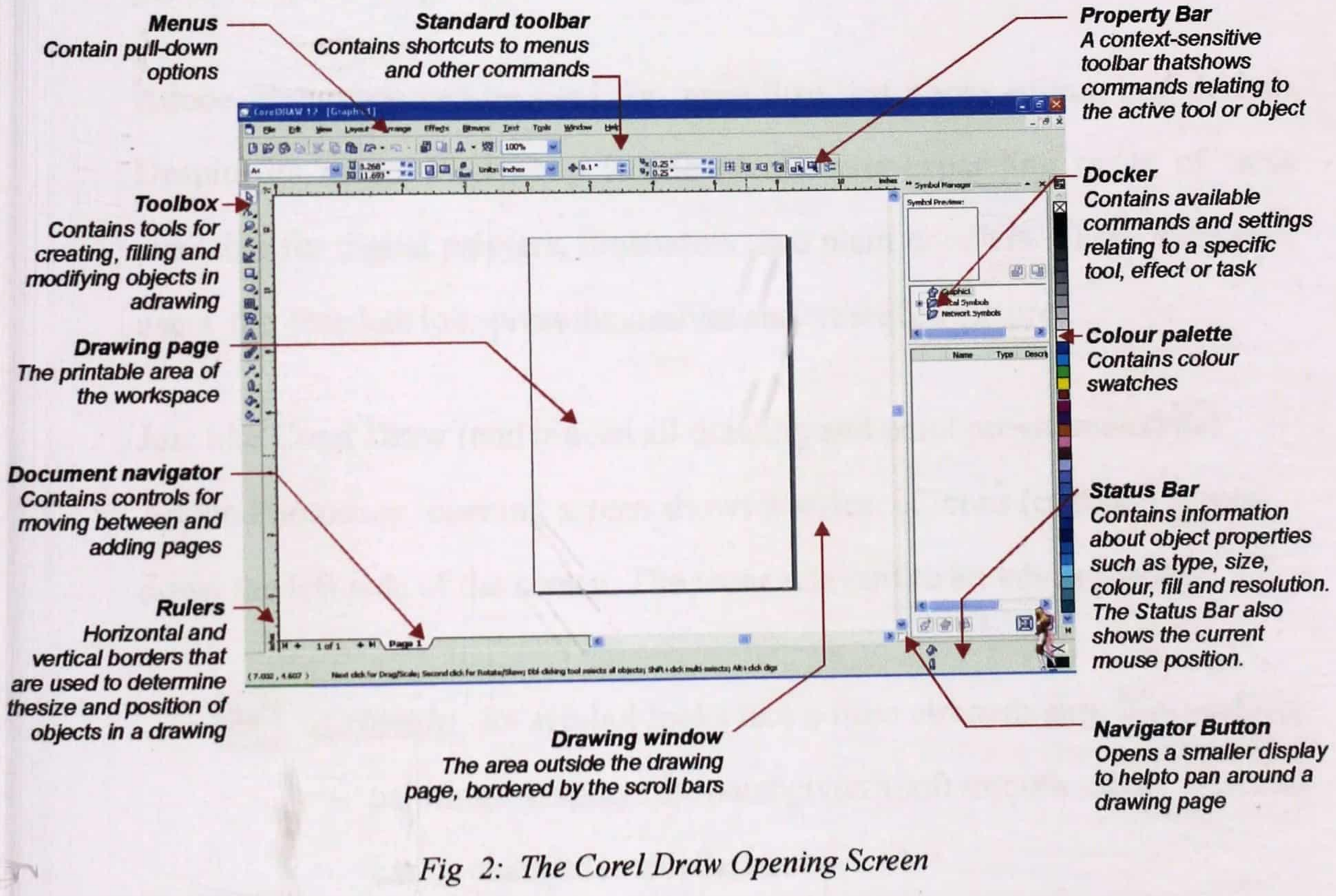


Fig 2: The Corel Draw Opening Screen

5.5.2 Adobe Photoshop

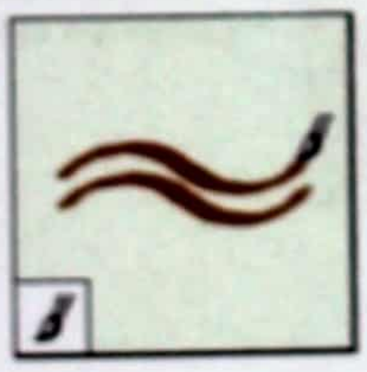
Adobe Photoshop is a Paint Program. In computing, a paint programme is an

application programme that creates graphics as bit maps—images stored as collections of pixels (dots) rather than as discrete lines, curves, and other such shapes. Unlike Corel Draw, the Adobe Photoshop, treats a drawing as a group of dots and is particularly appropriate for freehand drawing. It also provides tools for images that requires lines, curves, and geometric shapes. Unlike Corel Draw, this programme does not treat any shape as an entity that can be moved or modified as a discrete object without losing its identity. For fine details, Adobe Photoshop has a facility that enables pixel-by-pixel modification of a paint pattern or a small segment of a drawing.

Adobe Photoshop can be used for more than just photo editing and design. Despite its name, Photoshop is one of the ever-expanding range of tools available for digital painters, illustrators, and plain doodlers. These tools give users the freedom to express themselves and create fun pictures.

Just like Corel Draw (and indeed all drawing and paint programmes) the Adobe Photoshop opening screen shows a series of icons (of tools) spread down the left side of the screen. The icons relevant to art education are:

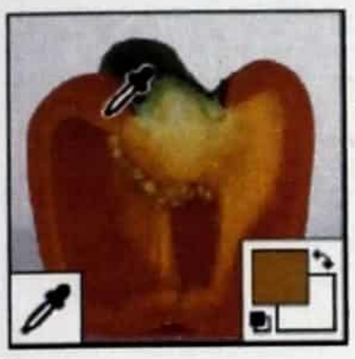
Airbrush: Its symbol looks like a little airbrush gun. It is used for painting. It sprays the paint given a soft smooth edge. Its size can be changed to suit the stroke.



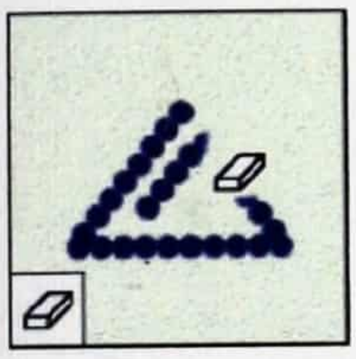
Paintbrush: The symbol looks like a small brush with a partial handle. It leaves the effect of a traditional painting tool. Its size can be changed too.

Smudge: This symbol looks like a hand with one finger extended. It is used to blend and smoothen tones. It has many different strokes.

Marquee: Used to "select" an area of the canvas. Its shape can be changed, depending on the shape of the area to be selected.



Eyedropper: Used to select a colour for the palette from an existing color on the canvas. This tool makes it possible to obtain the exact colour needed for areas that require similar shades



Eraser: As advertised, the eraser tool erases pixels from the canvas. It also has different shapes and sizes.

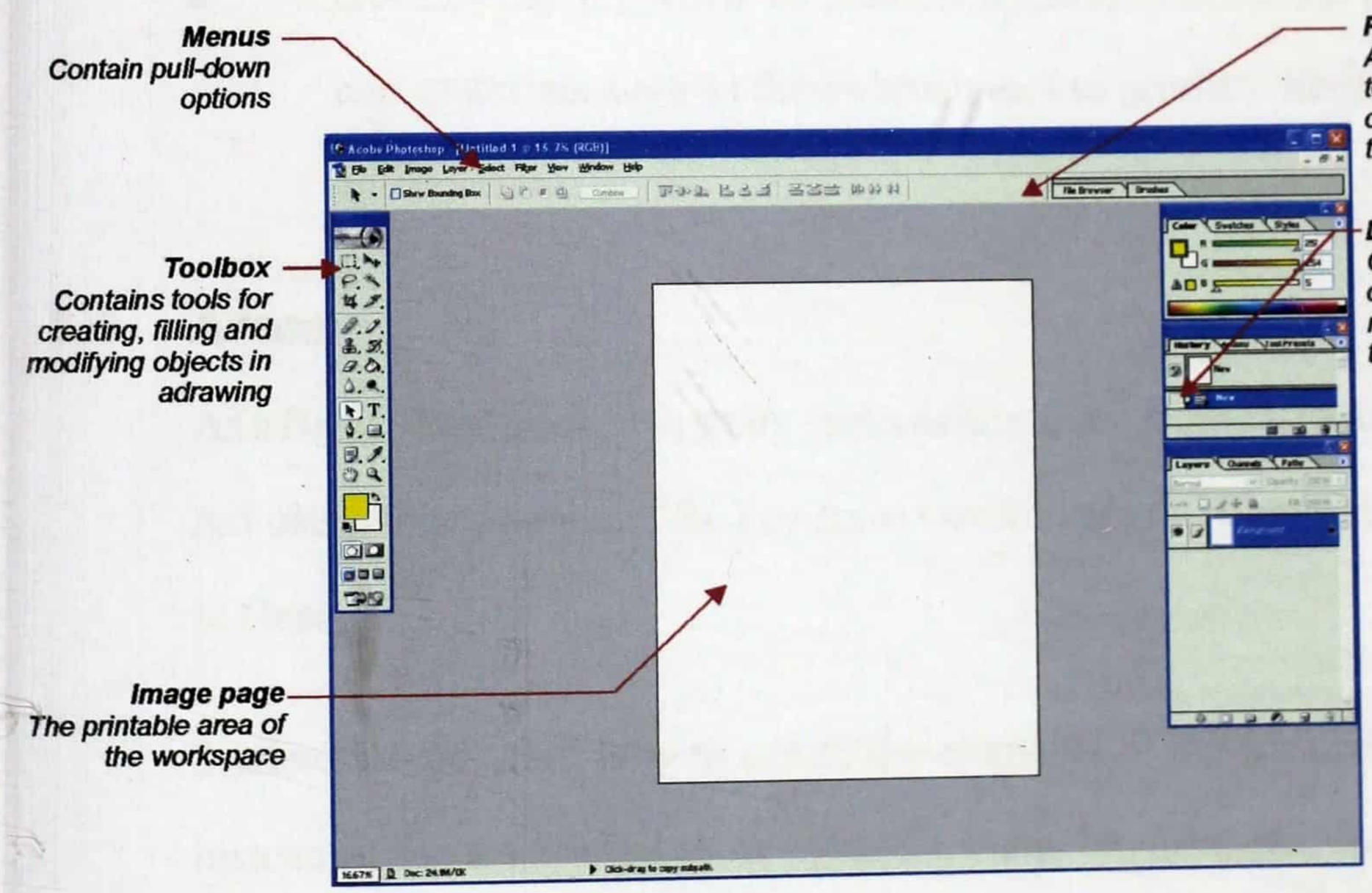


Fig 3: The Adobe Photoshop Opening Screen

This programme has been used to demonstrate how students can learn basic skills in digital painting. The activities with Adobe Photoshop aims at:

- Providing students with the opportunities to develop skills for painting in a playful manner, using the computer as the canvas, brushes and paint.
- Developing understanding of and ability to make decisions about a wide variety of colours and design relevant to painting.
- Providing students with opportunities to study and develop their appreciation for a wide variety of painting styles.
- Exploring the interpretive and expressive qualities of colour and paintings based upon personal experience.
- Developing growth in coordination and skill in the use of painting tools and materials such as the airbrush tool to produce lines, shapes, colour and texture.

5.6 Areas

As a Basic Handbook, this study seeks to introduce learners to basic concepts in Art using the computer. The key areas covered are the Elements and Principles of Design.

Student would learn how to create the elements of design using the computer instead of the traditional tools - pencils, pens, brushes, etc - and also organize them with the principles of design. These activities would expose students to

some of the advantages in using the computer as a tool. For example fastness, economy in the use of media, relationships between elements and principles, etc.

5.6.1 Elements of Design

The following areas would be covered under the Elements of Design:

- Dot or Point

  A tiny round mark made by or as if by a pointed instrument. The dot is the first mark made when drawing (Alderson, 1994). Line, shape, tone and texture can all be developed using dots.

- Line

  The path traced by a moving point. It is sometimes described as a series of points. As a geometric conception, a line is a point in motion, with only one dimension - length. Line has both a position and a direction in space. The variables of line are: size, shape, position, direction, number, interval and density. Points create lines, lines create shapes or planes and volume. There are a number of ways to use lines in a work of art: mechanical, freehand, soft, hard, vertical, horizontal, and diagonal. The way in which lines are used can also have an affect on a work of art. Vertical and horizontal line can imply or give the illusion of stability, strength, and order; while diagonal line can imply or give the illusion of instability, change, and movement. Line can also be used in such a way as to draw the viewer to the focal point of the subject of a particular work of art.

- Shape

Shape is defined as the characteristic surface configuration of a thing. Lovett (2003) describes shape as a line which is enlarged and connected. In Art, shape generally refers to a form in which something may exist. There are two types of shape used in art: *geometric* and *biomorphic*. Geometric shape is from the branch of mathematics dealing with the relations, properties, and measurements of solids, surfaces, lines, and angles. Geometric shapes are therefore shapes with a measurable, definite pattern. The three basic geometric shapes are square, circle and triangle. From these three any other shape can be created. All other design principles may be incorporated within the concept of shape (Alderson 1994).Biomorphic is a term applied to *free form* shapes. Free form means that the basic outline consists of irregular, curved or flowing lines. Most things found in nature are free form. These include trees, animals and persons. Shapes can be combined in a variety of ways . If they overlap, they form new shapes. Two dimensional objects are called shapes. Three dimensional objects are called form. Other terms related to shape are *enclosed* and *unbounded*. An enclosed shape is that which is confined by another shape. Unbounded is that which is not confined, i.e. positive and negative space giving the illusion of multiple shapes.

- Texture

  Texture refers to the quality or character of a surface. A surface can be smooth, glossy, rough, waxy, bumpy, grained, soft or hard Texture can make artwork more interesting by breaking up an otherwise flat surface and including areas of interest. Contrasts of texture will usually be far more interesting than using one texture across the entire artwork. (Adams 1994). In art, there are two types of texture - Real or Physical and Visual or simulative textures.

- Colour - Colour is a physical phenomenon of light or visual perception associated with the various wavelengths in the visible portion of the electromagnetic spectrum. (Microsoft Encarta 2003).

  Object appear to be certain colours because of their ability to reflect, absorb, or transmit light, which are perceived as colour.

  Colour is described in terms of three characteristics - hue, value and saturation. Hue is the wavelength of light reflected from or transmitted through an object. More commonly, hue is identified by the name of the colour, such as blue, brown or pink. Value (also called lightness) indicates the darkness or lightness of a hue. In other words, how close it is to black or white. Saturation (also called chroma) refers to the vividness or dullness of the hue. The word colour therefore, is a general term for the qualities of hue, intensity, and value observed in pigment or

light. Colour theory is based on the principal that colour is light. When white light is diffused by a crystal prism, a spectrum of the entire range of pure colours (red, orange, yellow, green, blue, violet) become visible to the eye. Every colour that is seen is light which has either been reflected from or transmitted by a colourant, such as a pigment or dye. Colours, because of their chemical structure, have the property of selectively absorbing and reflecting certain areas of the light spectrum. Example: If a colourant produces a visual sensation of red-violet, it has the property of absorbing all of the coloured rays in white light except violet and red, which combine to produce the colour that is seen.

5.6.2 Principles of Design

The principles of design are applicable to all design disciplines including architecture, art, graphics, fashion, industrial design, poetry, writing, and web design. They are however not exclusive to these disciplines.

The principles of design are tools used to format the elements of design.

The following areas would be covered under the Principles of Design:

- Harmony

In art, harmony occurs as a result of a recurrence or repetition of one or more elements within a visual format.

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- Variety

  This is the quality or condition of being various. In art, variety can be in the form of a either a number of different elements or different types of the same elements. Variety therefore represents a group that is distinguished from other groups by a specific characteristic or set of Characteristics.

- Contrast

  It is sometimes described as "automatic principle." Whenever an element is placed within a format, contrast is created in the various Elements. It can be emphasized with contrast in size, shape, colour, texture, etc. Contrast can also be the representation of the opposite: Light/dark, thick/thin, large/small, high/low, light/heavy, positive/negative, transparent/opaque, and direction are all examples of contrast. It also offers variety within a visual format.

- Balance

  The visually favourable distribution of elements. There are two types of balance, symmetrical and asymmetrical. Symmetrical is a formal balance with elements of equal or near equal weight on either side of a real or implied center fulcrum. Asymmetrical is an informal balance arrived at by the informal distribution of elements. A balance similar to that of a steel-yard scale. In design the elements of design converge to

create a design or arrangement of parts that appear to be a whole with equilibrium. This is achieved through proper arrangement of the elements to form a good *visual equilibrium*.

- Dominance

  Also known as emphasis. This condition exists when an element or elements within a visual format contain a hierarchy of visual importance. This is where an element stands out more than the others in a work of art.

5.7 Activities

The starting-point for the activities in this handbook would be the use of the Corel Draw and Adobe Photoshop to create the elements of design. This would gradually link up to the application of the elements of design to the principles of design.

5.7.1 Dots

Creating Dots

Tools *Rectangle*

Ellipse

Method

Dots can be created or drawn with Corel Draw with either the ellipse or the rectangle tool. Just as it is when using any other tool, dots are the easiest and the simplest elements that could be drawn with the computer.

To create a dot, select (click) the Rectangle or the Ellipse tool with the Pick tool. Click where the dot is supposed to be and drag (whilst holding down the mouse button) diagonally to the right.

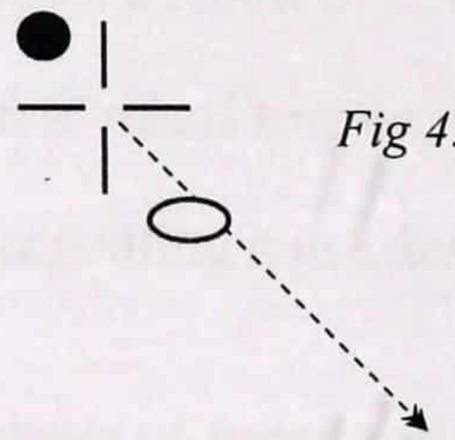

Fig 4: Creating a Dot

The further away the mouse is dragged, the larger the dot. Then click a colour in the *On-Screen colour palette,* to choose a clour for the dot.

The *dot,* once created, can be duplicated. To duplicate a dot, select (click) the dot with the Pick tool. Hold down the *Control key* and press 'd' on the keyboard). The number of times this process is repeated suggests the number of dots that would be duplicated.

Fig 5: Duplicated Dot (a)

If the first duplicated dot is reduced or enlarged before the subsequent ones, they would all be reduced or enlarged in progression by the same proportion by which the first one was reduced or enlarged. In the example below, the bigger dot was created (with a diametre of 0.5cm) and its first duplicate was reduced by 0.1. As a result all the subsequent duplicates became 0.1 less the previous dot.

Fig 6: Duplicated Dot (b)

Harmony of Dots

Since harmony occurs as a result of a recurrence or repetition of one or more elements within a visual format, one can achieve harmony of dots by creating a dot and repeating it in a desirable format.

There are so many ways of repeating an object using Corel Draw, but simplest one is 'duplication'. Duplicating objects is the quickest way to create copies of them. When an object is duplicated, the computer creates a copy of it and places it above and to the right of the original object, with a default offset of 0.25 inches (or the equivalent in other units of measurement).

When the duplicated object is moved from where the computer has originally placed it, it can be duplicated again to create another copy. This time the new duplicate is placed the same distance from the first

duplicate as the first duplicate was from the original. This type of duplicate is called smart duplicate.

To duplicate an object select the object with the Pick tool. Click Edit Duplicate. Select the duplicate with the Pick tool, and move it to another position on the Drawing Page. Click Edit, Duplicate.

With this process, dots can be created and duplicated to form Harmony.

Fig 7: Harmony of Dots

The fastest way to do this is by using shortcut keys on the keyboard.

To do a smart duplicate of an object using the keyboard, select the object with the Pick tool. But, instead of clicking edit, hold down Control key and press 'D'.

It is also possible to make many duplicates of an object very quickly without going through the entire process. All that is needed is to select the object with the Pick tool and move it around the Drawing Window while holding down the Spacebar as in fig 8.

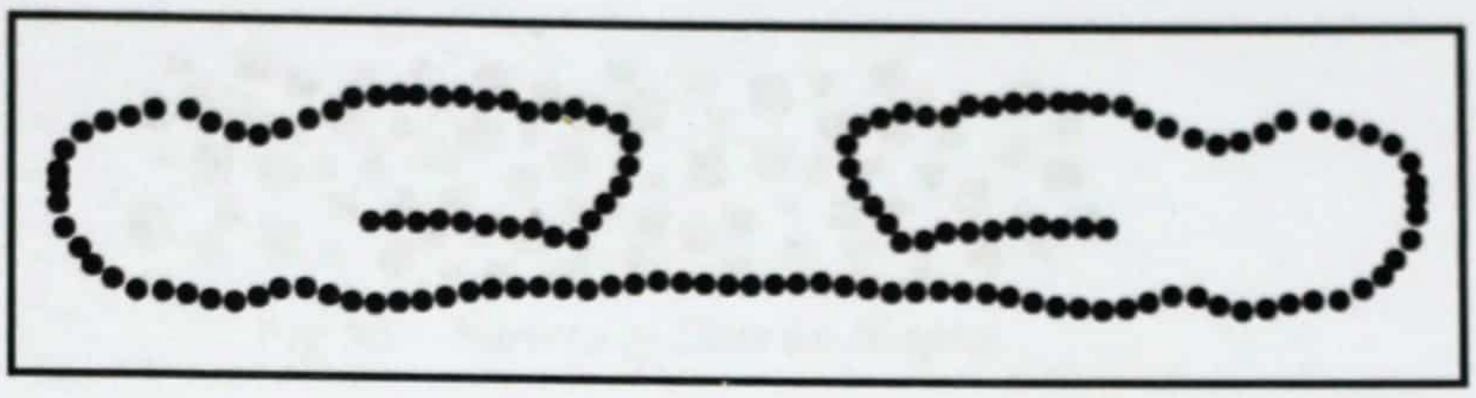

Fig 8: Duplicating Dots with the Spacebar

This kind of duplication is necessary when no accurate format is intended.

Following the above process, one can create harmony with line, shape and texture, as was done with dots.

Variety of Dots

It is possible to create dots of divers variety with the computer. Variety in dots can be determined mainly by their sizes. Since dots have shapes, it is also possible to determine variety of dots by their shape.

It has been established in the dot creation process that the curser of the tool being used to draw the dot (ellipse, rectangle, etc), is dragged diagonally to draw the dot. The further the curser is dragged, the larger the dot. To create a variety in the sizes of the dots therefore, it is only necessary that the different sizes of the objects are drawn.

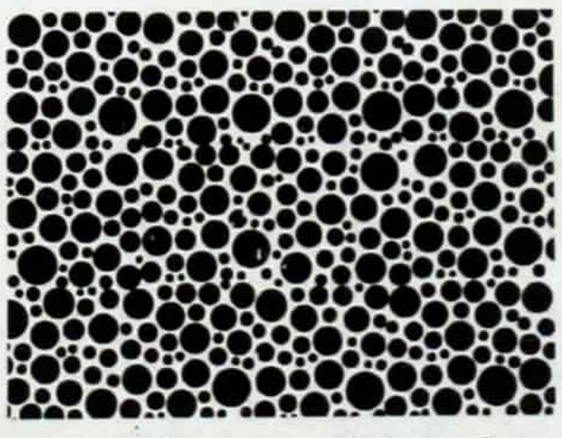

Fig 9a: Variety of Dots by size

Different tools used in the creation of the dots can also result in a variety of dots.

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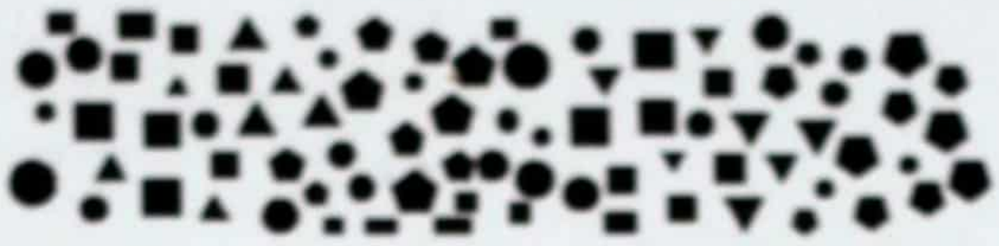


Fig 9b: Variety of Dots by shapes

Colour can also bring a variety in dots. After the dots have been created, they can be selected individually and given different colours by clicking on colours from the *On-screen Colour Pallette.*

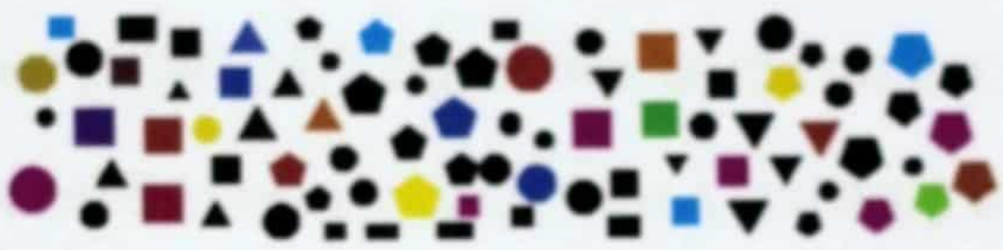


Fig 9c: Variety of Dots by colour

Contrast of Dots

Tools

Ellipse tool

Contrast in dots can be considered in terms of size. Drawing dots of different sizes bring contrast in dots. To create contrast of dots, draw a dot and make smart duplication of the dot. Select the duplicated dots individually and change their sizes by *sizing* them.

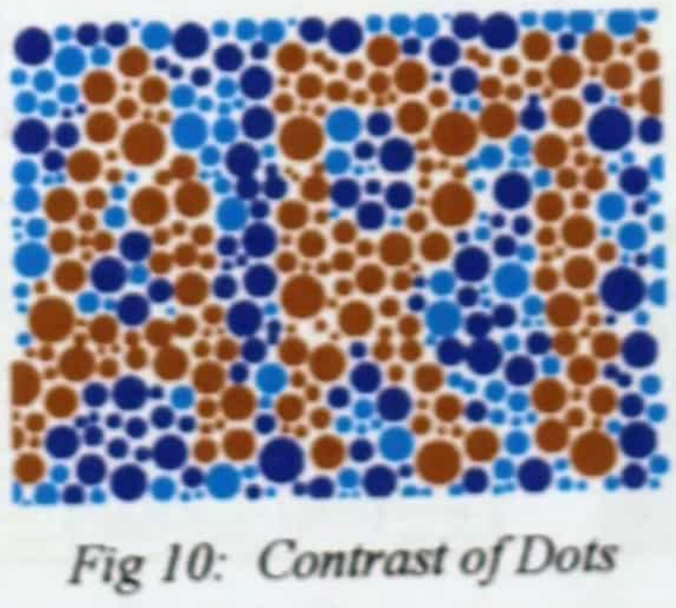


Fig 10: Contrast of Dots

5.7.2 Lines

Creating Lines

Tools

- *Bezier*
- *Freehand*

Method:

Two draw a line with the Bezier tool, select the tool from the toolbox. Since a line has just two point (AB), figure out on the drawing space where the points A and B are supposed to be. Click at point A and drag the mouse cursor across the page like a pencil on paper, releasing the mouse button at point B.

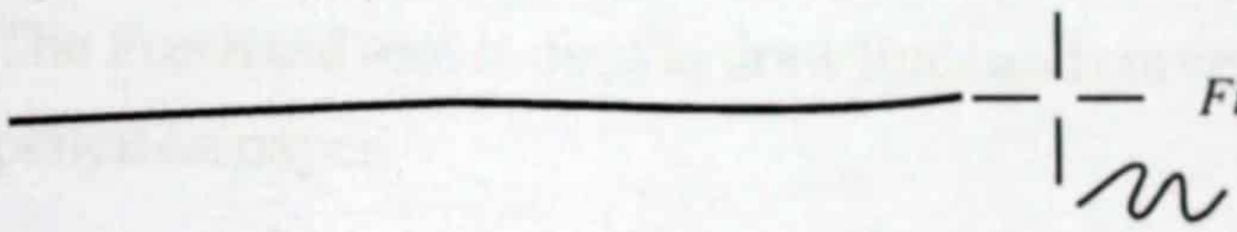


Fig 7a: Drawing a line with the Bezier tool

When drawing a line using the Bezier tool, nodes are placed by each click of the mouse. Each node is connected to the previous node by a segment. To draw a line with the Bezier tool, click at point A and B respectively.

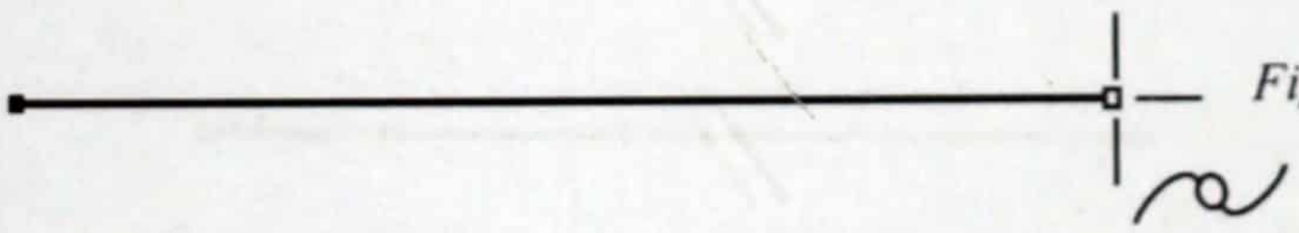


Fig 7b: Drawing a straight line with the Bezier tool

Harmony of Lines

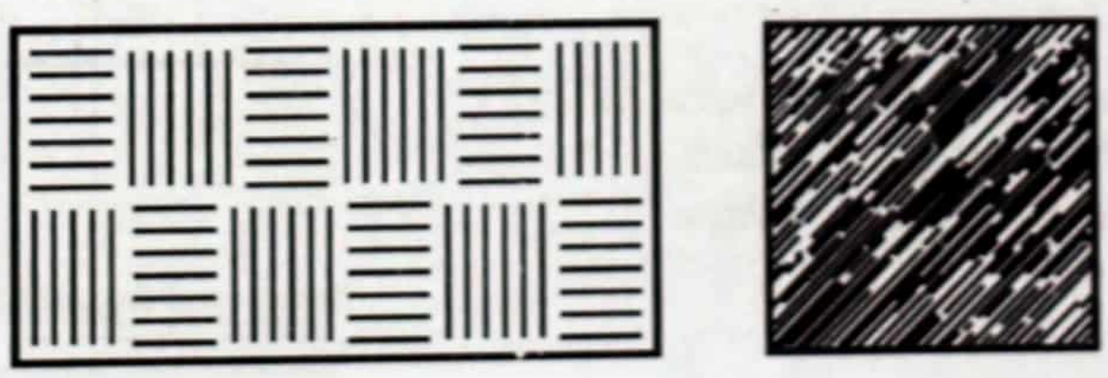


Fig 11: Harmony of Lines

Tools

Freehand Tool

Bezier Tool

Artistic Media Tool.

There are different kinds of lines. Thin, thick, zigzag, undulating, horizontal, diagonal, vertical, curved, short, long, broken, etc.

When it comes to the drawing of lines, two tools come to mind: The Freehand, Bezier and Artistic Media Tools.

The Freehand tool is used to draw lines and curves by dragging the mouse like a pencil on paper.

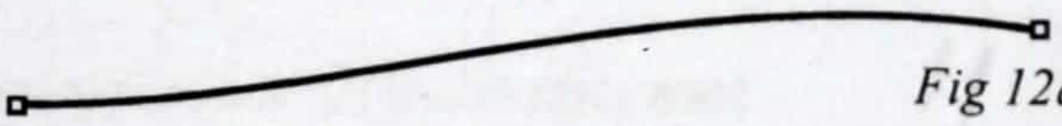


Fig 12a: Line drawn with the Freehand Tool by dragging like a pencil

To draw a straight line with the Freehand tool, click where the line is to begin and click where it is to end.

Fig 12b: A straight line drawn with the Freehand Tool by clicking at the starting and end points of the line.

Perfect horizontal, vertical and diagonal line can be drawn through the sam processes but with the Control key held down.

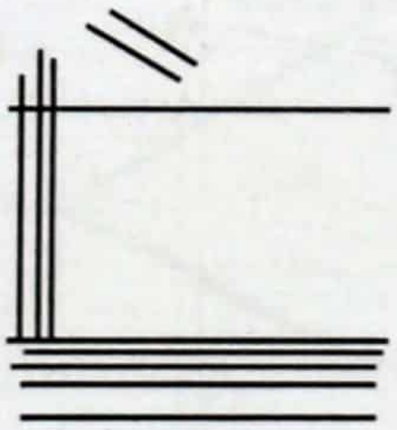


Fig 12: Horizontal, Diagonal and Vertical lines drawn with the Freehand tool

The Bezier tool is used to draw lines and curves by placing each point (node) with the mouse. As each point is placed, it is connected to the previously placed point by a line.

To draw a straight line with the Bezier tool,

Open the Curve flyout, and click the Bezier tool. Click where the first point is to be placed. Click where the next point is to be placed.

Repeat step 3 for each point that need to be added until the required line is achieved. Press Spacebar to finish the curve.

Fig 14: A zigzag drawn with the Bezier tool

To draw a curve with the Bezier tool

Open the Curve flyout, and click the Bezier tool. Click where the first point is to be placed and drag the control point in the direction that the curve is to bend. Position the cursor where the next point is to be placed and drag the control point to create the required curve.

The position and angle of the control points affects the shape of the segment that has just been created . Press Spacebar to finish the curve.

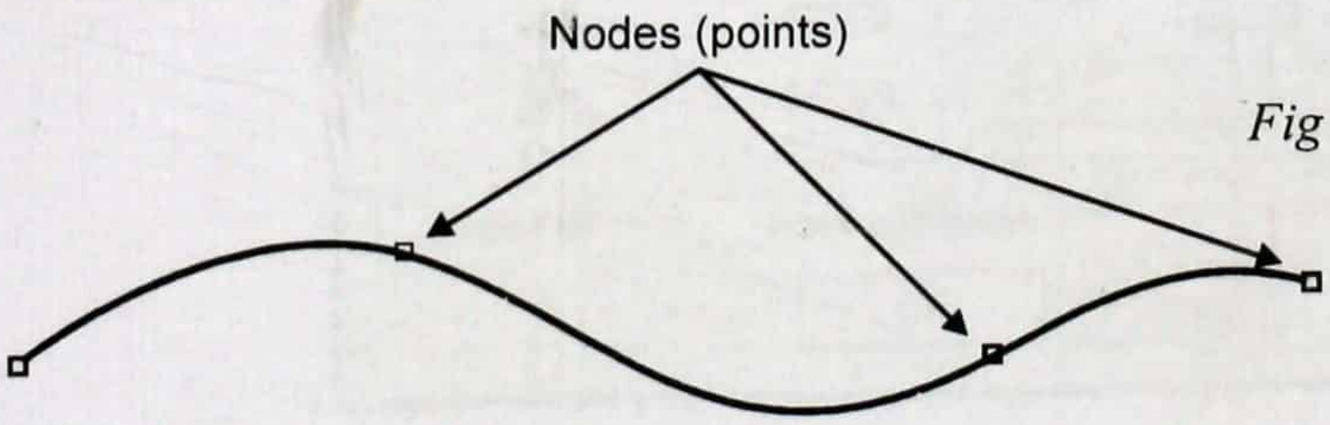
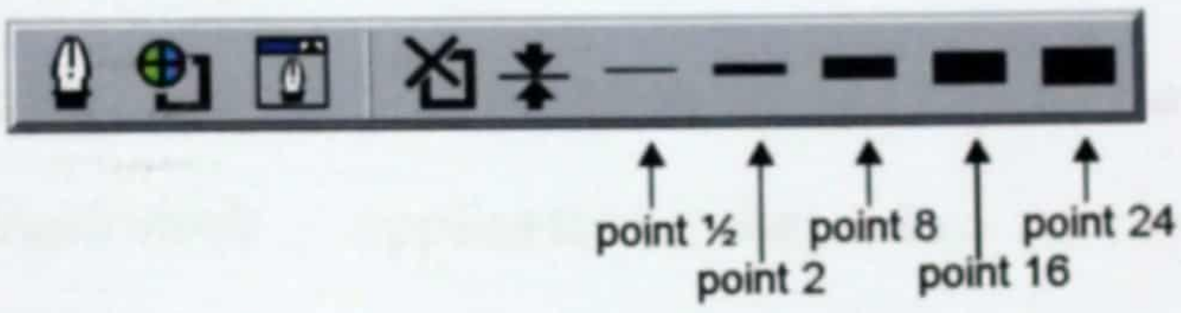


Fig 15: A Curve (showing the nodes) drawn with the Bezier tool

The Bezier tool is therefore an ideal tool for the drawing of zigzag and curved lines. (The nodes do not show in the final drawing. They disappear as soon as the object is deselected)

Lines once created can be edited to assume different sizes, colours, etc, using the outline tool.

To change the size of an object using the Outline tool, Open the Outline Tool flyout. Either click any of the line sizes shown in the tool flyout to give the line that thickness.



Or Click the Outline Pen Dialog .

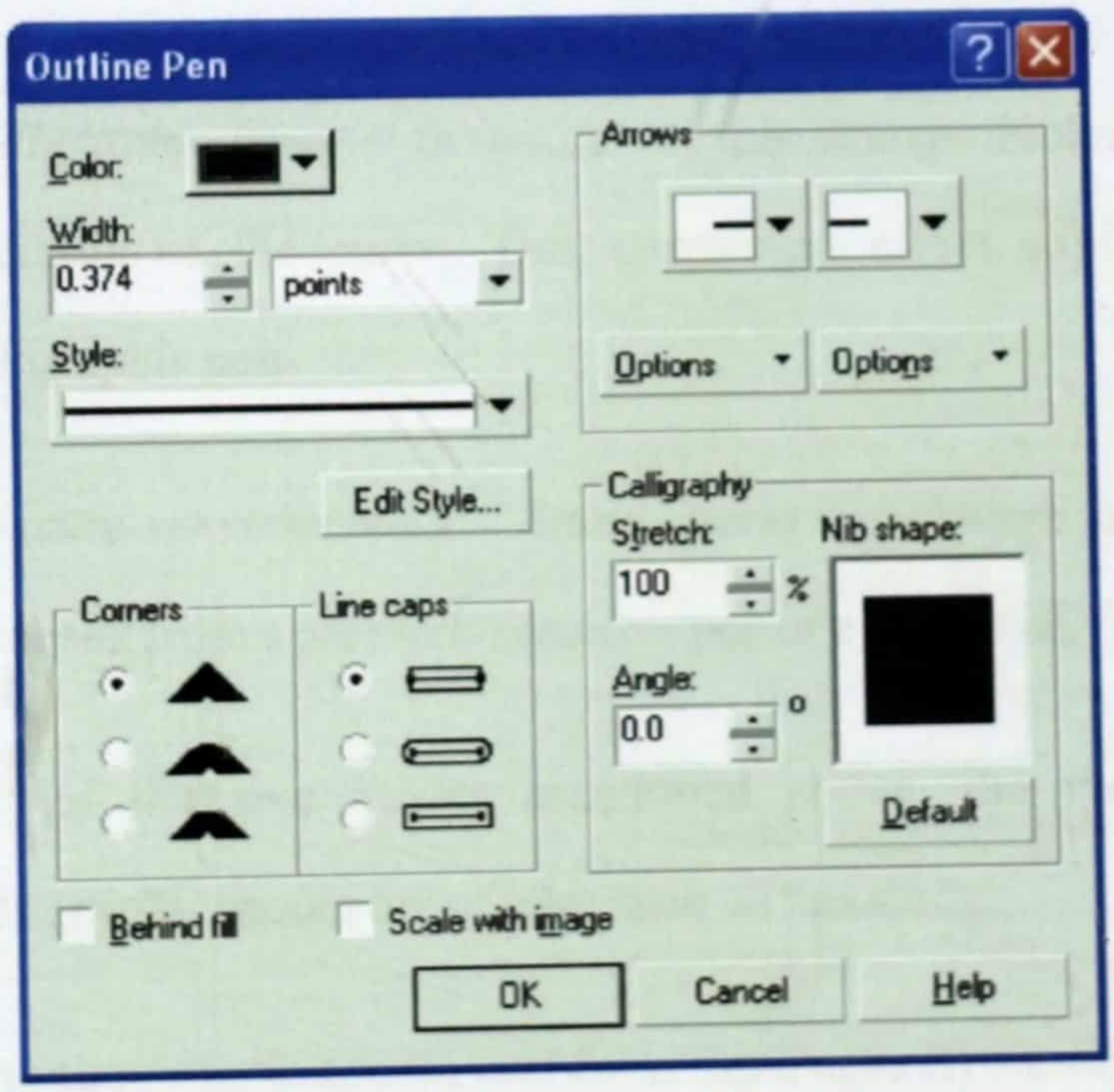


Fig 16: The Outline Pen Dialog box

Type a number in the *Width box* to give the line a thickness

Another tool that can be used to bring variety in lines is the Artistic Media tool (also called the Natural Media tool). This tool makes it possible to apply various effects to a curve. With this tool, it is possible to create curves that look like strokes from a calligraphic pen. One can also apply text, shapes, or images to a curve using this tool.

The Artistic Media tool has five modes:

Preset mode - draws curves that change thickness based on preset line shapes choose from a list box on the Property Bar.

Brush mode - applies text or shapes to a curve when that is draw.

Object sprayer mode - applies a series of images to a curve when being drawn.

Calligraphic mode - draws curves that change thickness based on the direction of the curve. This creates an effect similar to that of a calligraphic pen.

Pressure-sensitive mode - draws curves that change thickness based on feedback from a pressure-sensitive pen or a keyboard.

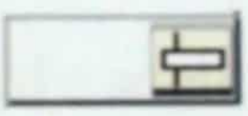
Out of the five modes mentioned above, the Preset, Brush and Calligraphic modes are of relevance to this study.

Clicking the Artistic Media tool from the Curve flyout on the property bar

will reveal the following icons

which represent the five modes mentioned above.

Lines and curves can be created with any of the tools the same way the Bezier or the Freehand tool would be used. For example to draw a curve in Preset mode

Open the Curve flyout, and click the Artistic Media tool .Click the Preset button on the Property Bar. Click the Freehand Smoothing box and move the pop-up slider  to select a smoothness setting. Move the slider to the right for maximum smoothing; move the slider to the left for no smoothing. Type a width in the Artistic Media tool Width box on the Property Bar, then press ENTER. The width that is set here represents the Curve's maximum width. Choose a preset curve shape from the Preset list box. Position the cursor where the curve is to start. Drag to draw the curve as shown below.

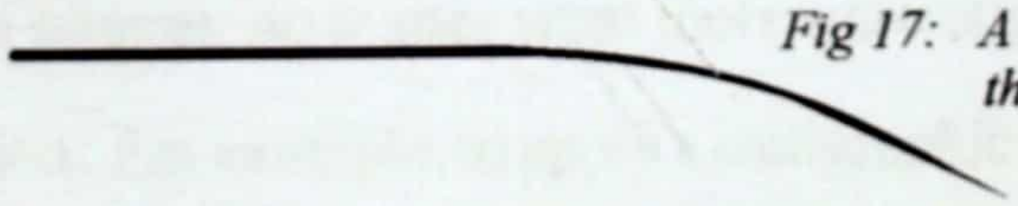


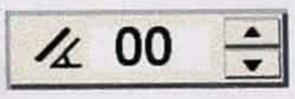
Fig 17: A line created with the artistic media tool

Drawing a curve in Brush mode follows a similar procedure:

First open the Curve flyout, and click the Artistic Media tool. Click the Brush button on the Property Bar. Click the Freehand Smoothing box and move the pop-up slider to select a smoothness setting as shown above for Preset. Type a width in the Natural Media tool Width box on the Property

Bar, then press ENTER. Select a brush from the Brush list box . Place the cursor where you want the curve to start. Drag to draw the curve.

Fig 18: A line created in the brush mode

When drawing in Calligraphic mode however, there is the need to type an angle in the Calligraphic Angle box on the Property Bar,  after typing the width of the stroke in the Artistic Media tool width box. This is because The Calligraphic Angle box controls the angle of the pen nib. For example, typing '0' gives narrow horizontal lines and thick vertical lines whist '90'gives thick horizontal lines and narrow vertical lines.

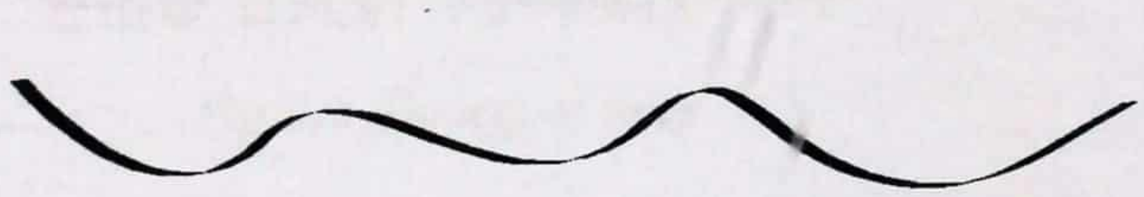


Fig 19: A line created in calligraphic mode

On the other hand, the Artistic media effects can also be applied to already created images, no matter what tools were originally used - whether Bezier or Freehand. For example, to apply a calligraphic effect to an object

Select the object with the Pick tool. Select the Artistic Media tool from the Curve tool flyout. Click (to enable) the Calligraphic tool. Type a width in the Artistic Media tool Width box on the Property Bar. Type an angle in the Calligraphic Angle box on the Property Bar. Press ENTER.

The lines of the object change into calligraphic mode as if they were drawn

with a calligraphy pen as shown below.

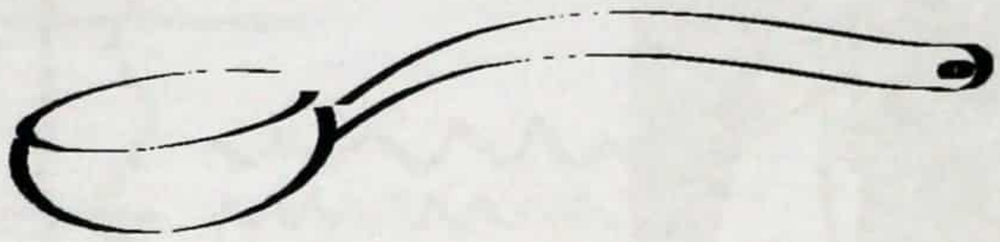


Fig 20: An object converted into calligraphic lines

By the processes explained above, it is possible to create a large variety of lines using Corel Draw.

Fig 21: Variety of lines

Contrast of Lines

Tools:

Ellipse tool

Bezier tool

Sizes, lengths and orientation of lines determine contrast in lines. To create contrast in lines, pitch the opposites of the various characteristics of lines (as seen in the variety of lines) against each other. For example a thick line against thin line, a short line against a long line, a horizontal line against a vertical line, a straight line against a crooked line, a wavy line against a zigzag, etc.

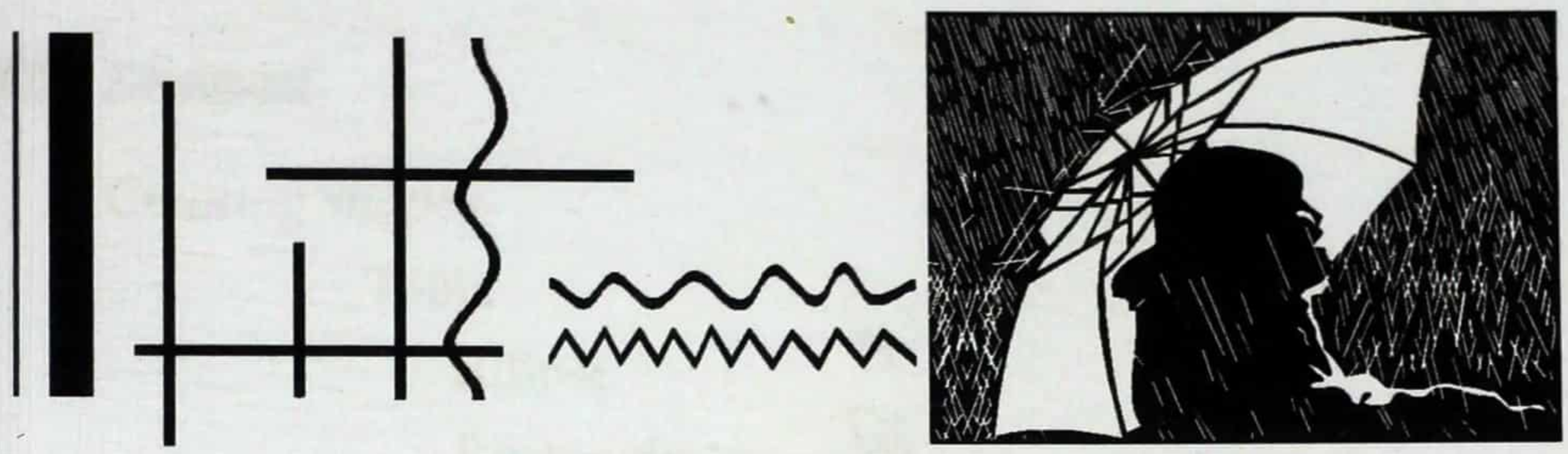


Fig 22: Contrast of Lines

5.7.3 Shapes

Creating Shapes

Tools

Ellipse

Rectangle

Polygon

Bezier

Freehand

Method:

To draw a shape with any of the above tools, drag diagonally in any direction until the shape is the size you want.

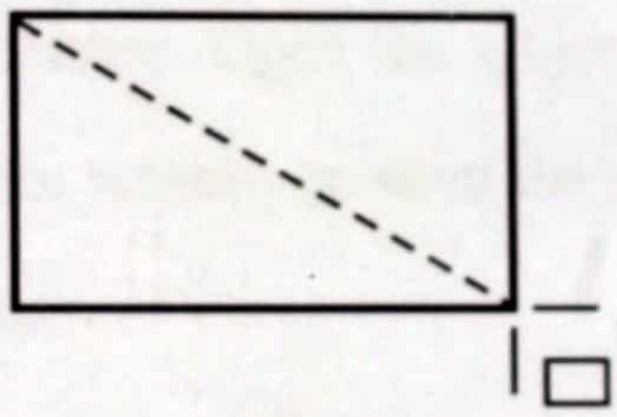


Fig 23: Drawing a Rectangle with the Rectangle Tool

Note that the Rectangle tool is used to draw rectangles and squares only. To draw a rectangular shape Click the *Rectangle tool,* Position the cursor where you want the rectangle to appear. Drag diagonally to draw the rectangle as shown above.

To draw a square hold down *Control* and drag diagonally. Holding down the SHIFT key creates the rectangle or square from the center outward as the tool is dragged. If the rectangle tool is double-clicked, one big rectangle covering the entire drawing page is created. This is necessary when there is the need to create a background for the drawing.

The Ellipse tool is used to draw ellipses and circles. To draw a circle or an ellipse

shape first Click the *Ellipse tool.* Position the cursor where you want the ellipse to appear. Drag diagonally to draw the ellipse.

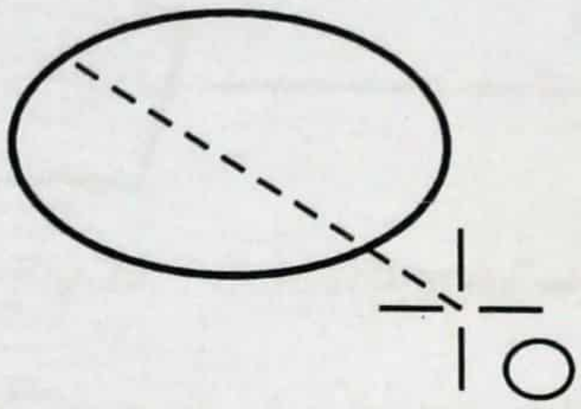


Fig 24: Drawing an Ellipse

To draw a perfect circle hold down CTRL and drag diagonally. Holding down the SHIFT key creates the ellipse or circle from the center outward as you drag.

The polygon tool is used to draw polygons and stars. (A polygon is a closed shape having from three to 500 sides. Stars have from three to 500 points.) To draw a polygon shape, Open the Object flyout, and click the *Polygon tool.* Position the cursor where you want the polygon to appear. Drag diagonally to draw the polygon.

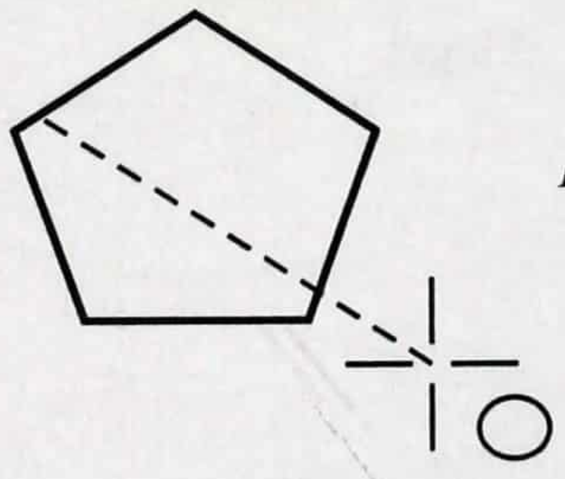


Fig 25: Drawing a Polygon

To change the number of sides on the polygon, type the appropriate number (after drawing the polygon) in the *Number Of Points On Polygon box* on the Property Bar, ☆ 8 then press ENTER.

To draw a star first draw a polygon with the number of sizes of the polygon representing the number of points the star should have. Then click the *Polygon/Star* button ☆ on the Property Bar. The icon in the button changes

from polygon to star, and so would the polygon drawn.

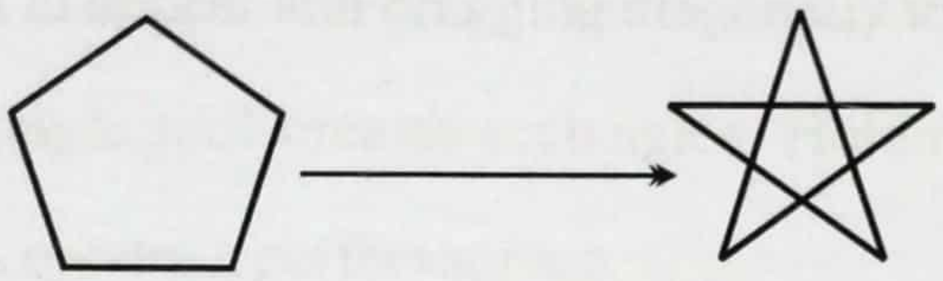


Fig 26: Converting a Polygon into a star

Many other shapes can be drawn with the above mentioned tools. This would be discussed under *variety of shapes*.

Harmony of Shapes

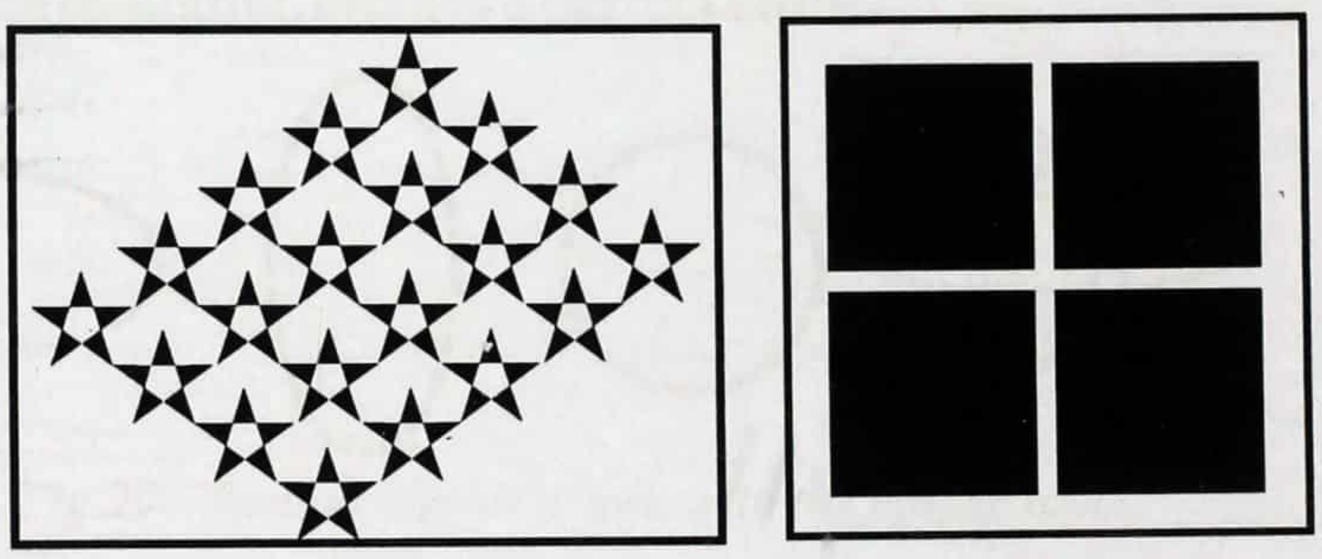


Fig 27: Harmony of Shapes

Variety of Shapes

Tools

Rectangle Ellipse Polygon Bezier

With the above tools, the computer can create numerous shapes. In the first place, the rectangle, ellipse and the polygon tools can create all the geometric shapes such as rectangles, squares, triangles, polygons, circles, etc.

As described elsewhere in the report, drawing geometric shape simply involves

clicking the appropriate tool, positioning the cursor where the object is supposed to appear and dragging diagonally to draw the shape there. This way, the Rectangle tool creates rectangles. Holding down the Control key when dragging, creates a perfect square.

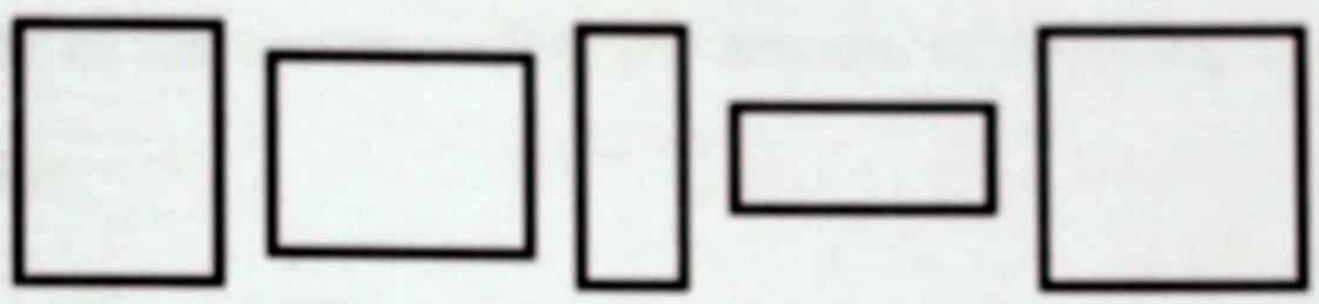


Fig 28: Various rectangles drawn with the rectangle tool

The Ellipse tool creates circles, ovals and related shapes. Holding down the Control key when dragging, creates a perfect circle.

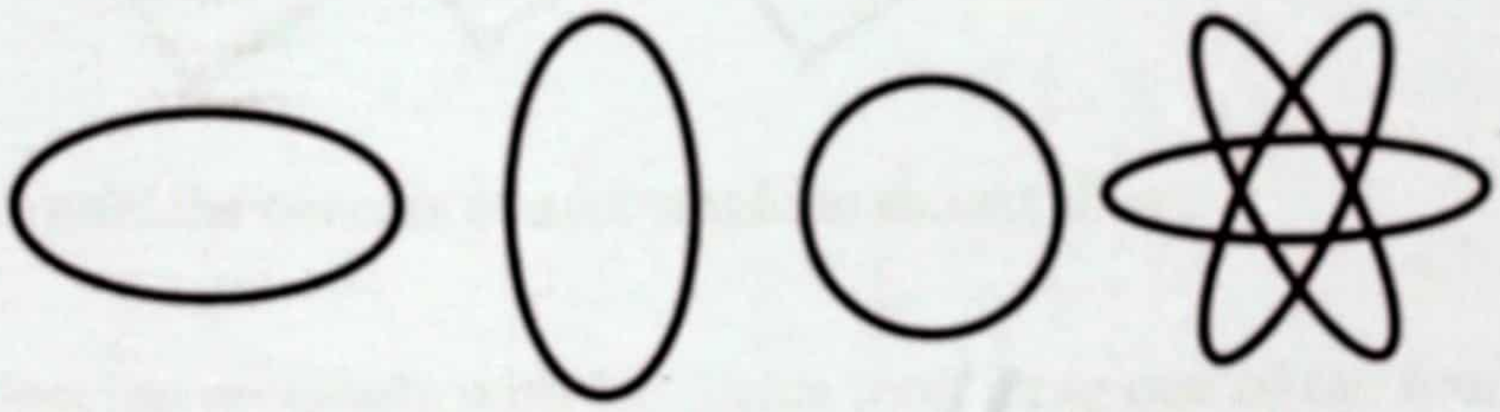


Fig 29: Various circles drawn with the ellipse tool

The Polygon tool creates all types of polygons such as pentagons, hexagons, octagons and stars.

Once basic objects have been created, a number of tools, buttons and commands can be used to change the shape of the object. For example, the Shape tool can be used to round the corners of a rectangle or shape an ellipse into an arc or a pie-shape. To shape a polygon or star, the Polygon/Star button ★ ⬠ can be used to switch from polygon to star and from star to polygon.

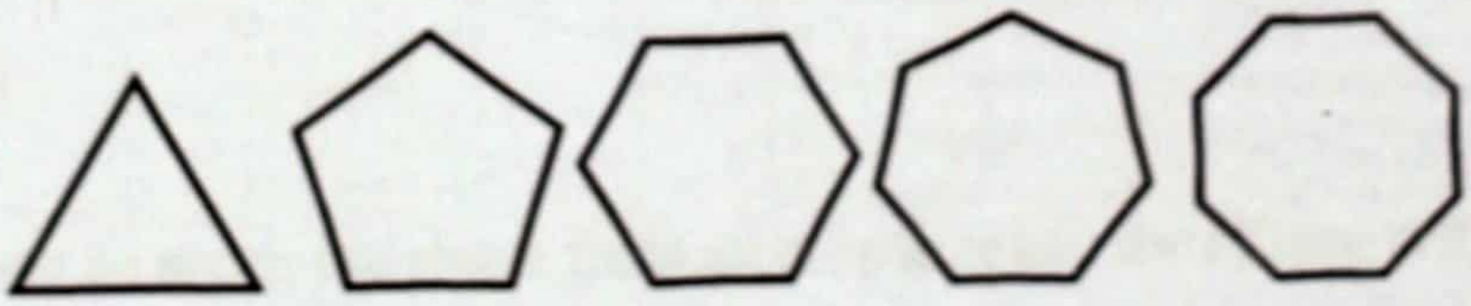


Fig : Various polygons created with the Polygon tool

The Shape tool can be used to round one or more of the corners of a rectangle or square. A rectangle has a node at each corner. When the corner of a rectangle is rounded, each corner node of the object is split in two and an arc is drawn between each of these two new nodes. The size of this arc can be controlled by moving any of the corner nodes. The amount of rounding is displayed on the Property Bar.

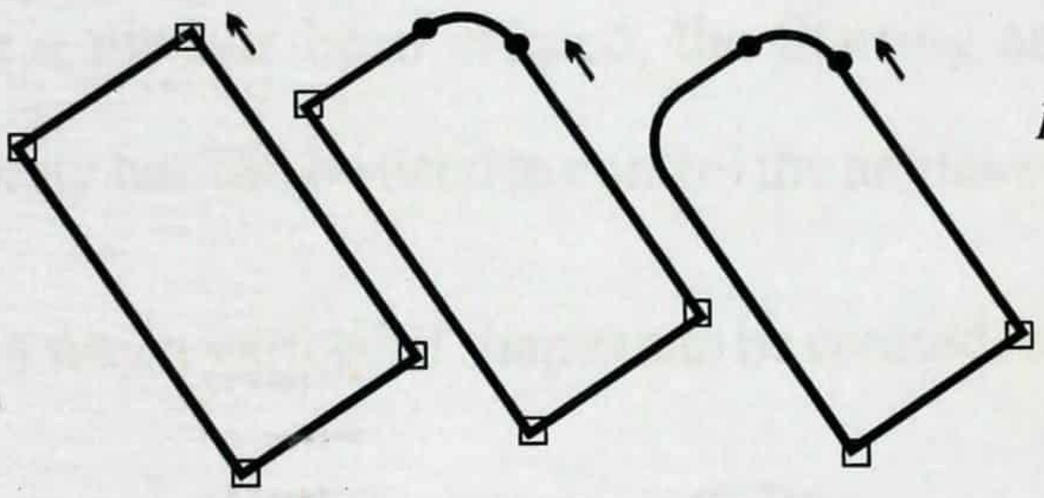


Fig 31: Rectangles with rounded corners created with the shape tool

To round the corners of a rectangle as shown above

Select the rectangle with the Shape tool. Drag one of the four corner nodes along the outline of the rectangle or square. Each corner node splits into two nodes joined by an arc. As the node is dragged away from the corner along the outline, the corners of the rectangle become rounder as illustrated above.

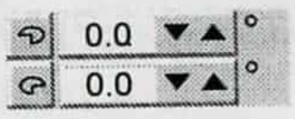
The Shape tool can also be used to turn an ellipse or circle into an arc or a pie shape. A simple ellipse has one node, but when an arc or pie shape is created, the nodes split.

The appearance of the arc or the pie shape can be controlled by moving these two new nodes.

To create an arc or pie shape from an ellipse select the ellipse with the Shape

tool. Drag the node along the outline of the ellipse. The either drag with the cursor outside the perimeter of the ellipse to create an arc. or drag with the cursor inside the perimeter of the ellipse to create a pie shape.

A circle or an ellipse can also be converted into a pie by clicking the Ellipse, Pie and Arc buttons on the Property bar .

Once a pie has been created, the Starting and Ending Angle buttons on the Property bar can be used to control the angles of the pie 

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This a way a variety of shapes can be created from an ellipse:

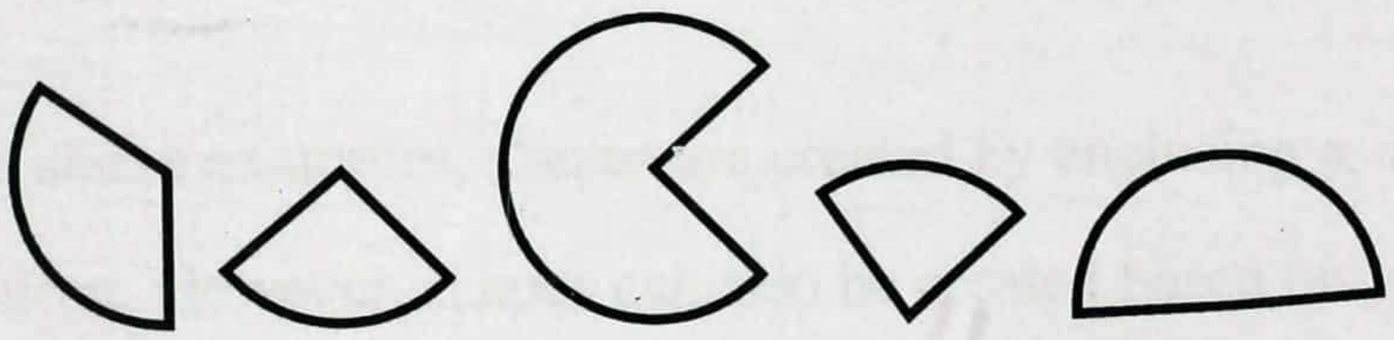


Fig 32: Circles converted into pie

Apart from the tools discussed above, the Bezier tool can also create complex, irregular shapes quickly and easily and gives precise control over the position and number of nodes that form a curve. The possibility of this lies within the fact that drawing with the Bezier tool involves simply clicking the appropriate points to place nodes with the mouse. As nodes are placed, they are connected to the previously placed nodes by a line or curve to form the object.

To draw a closed shape with the Bezier tool, first open the Curve flyout, and click the Bezier tool. Click where the first node is to be placed and, either click where the next point (that is the end of the line) should be, or drag the control

point in the direction the curve is supposed to bend (that is if a curve is to be drawn) The position and angle of the control points affects the shape of the segment that has just been created and the next segment that would be added. Note also that the placement of subsequent nodes must be guided by the various points in the shape to be drawn. Finally position the cursor over the first node and click once to complete the shape. See the illustration below.

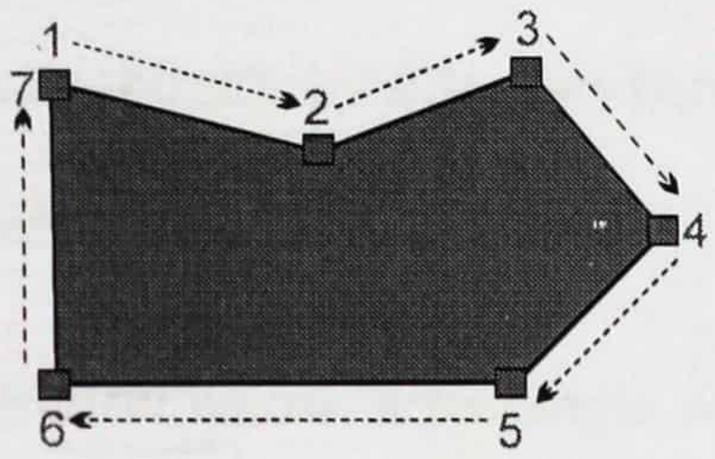


Fig 33: A closed shape created with Bezier tool

In all the above examples, shapes are created by enclosing a space within an edge contour. However, shapes can also be created based on visual properties such as colour, value or surrounding area with other shapes. Implied shapes are perceived because the viewer groups together those areas that are enclosed or that share similar properties. In the example below, the actual shapes drawn were the black shapes with the freehand tool. Yet as they are put together, white shapes are identified as well.

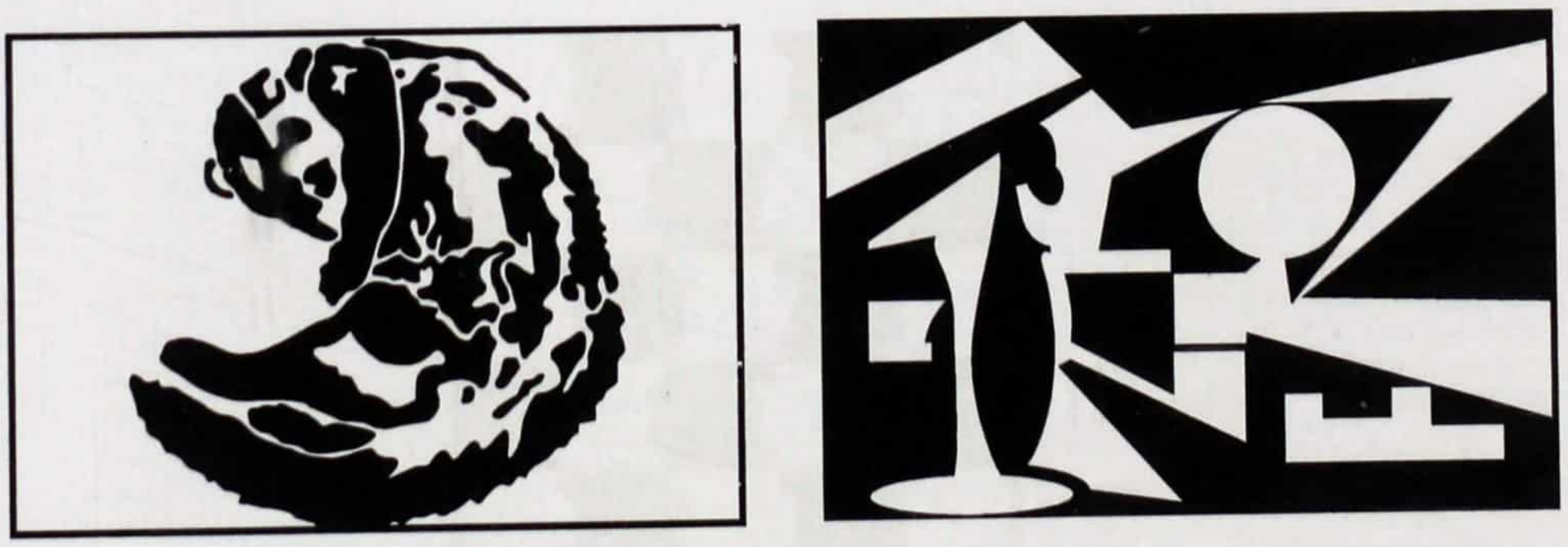


Fig 34: Shapes formed out of negative space

Example b is the exact opposite of a. The white spaces were drawn with the Free hand tool out of a black background.

Creating shapes by tessellation

Tessellation involves dividing a module into shapes that begin to have an ambiguous figure/ground relationship. These modules are then assembled into a structure so that when the portions of the module that were perceived as negative space are arranged side by side, they complete a shape that can now be perceived as a positive shape.

In the illustration below, a rectangle was drawn with the rectangle tool. The rectangle was converted into curves. Converting an image into curves render it flexible for manipulation.

To convert an object into curves select the object with the pick tool. Click Arrange on the menu bar. Select Convert to Curves. The left and right side of the of the rectangle were curved into the shape found below with the shape tool.

The shape was duplicated and arranged to form the illustration below.

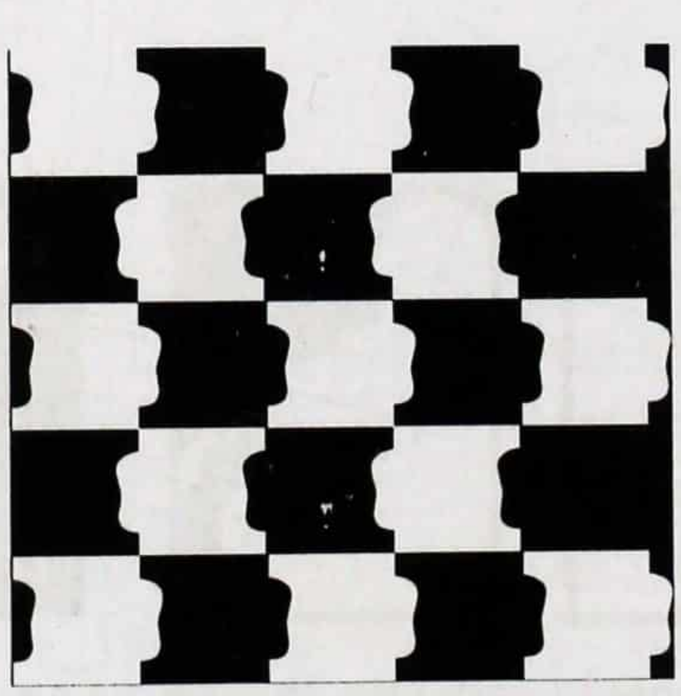


Fig 35: Shapes created with the tessellation method

Contrast of Shapes

Tools:

Rectangle ▭ *Ellipse* ⬭ *Polygon* ⬠

Contrast can be emphasized in shapes through size and nature. For example small sizes of the same shape can be contrasted against larger sizes of the same shape; shapes of different orientation such as angular and curves can be contrasted against each other. In this case, all shapes drawn with the rectangle tool and the polygon tool are contrast of all objects drawn with the ellipse tool.

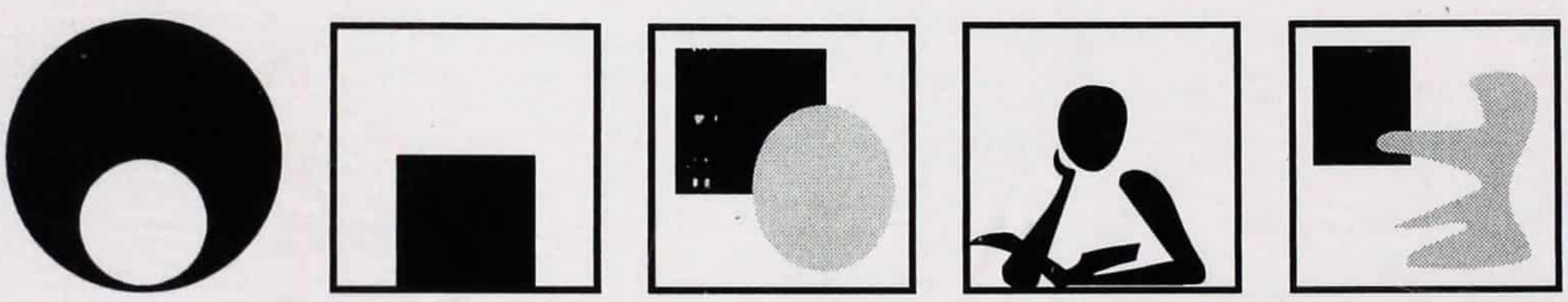


Fig 36: Contrast in shapes drawn with rectangle, ellipse and freehand tools

Contrast in shapes can also be brought about through sharp variation in tones. For example dark shapes against light shapes. In the examples that follow, some forms are perceived because the tone of the negative areas surrounding the shapes make them distinct.

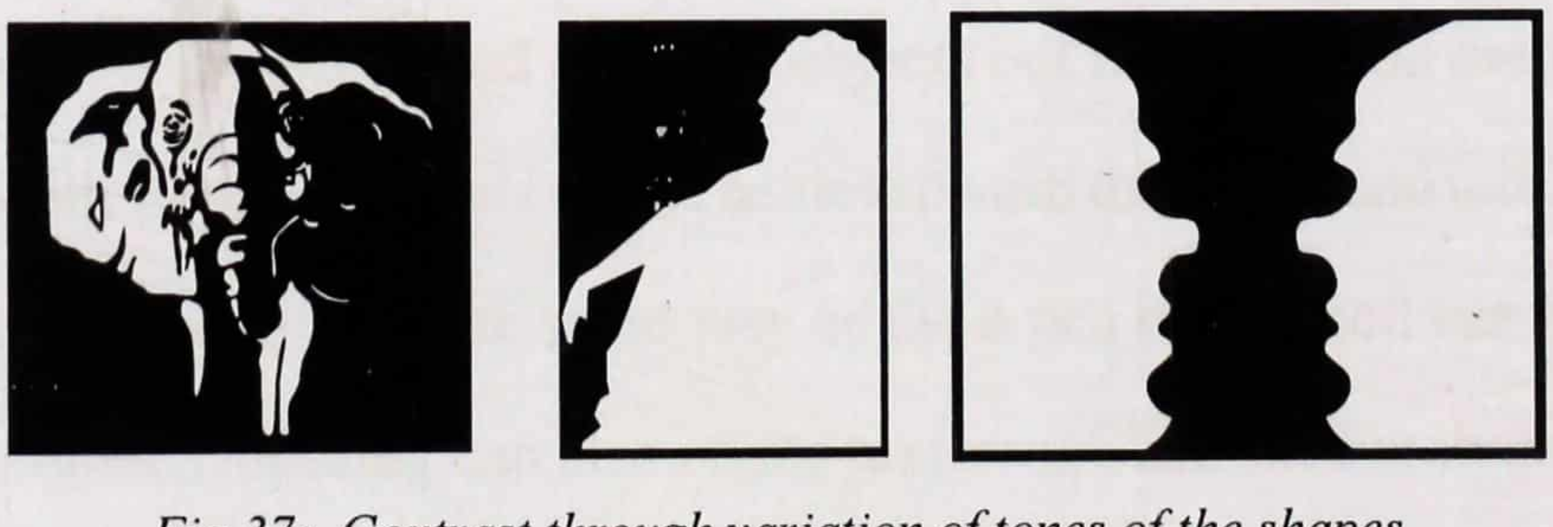


Fig 37: Contrast through variation of tones of the shapes

5.7.4 Textures

There are a number of ways to experiment with texture. Texture in the two-dimensional arts is an illusion comprised of other things that are seen that make it appear as if texture is present. In this exercise, texture has been created by the manipulation of lines, text, value, shape and the use of exiting texture in the corel draw programme. can add the illusion of depth to a two-dimensional work of art. Achieving texture by the following exercises can be quite fun. Imagination is the only limit. These exercises can help to broaden the imagination to achieve texture in other works of art, or can be used alone to create a design where the textures themselves are the work of art.

Creating Texture

Tools

Freehand

Bezier Text tool

Texture fill dialogue

Text Tool

Method:

Basically all the drawing tools can be used to create texture. After going through with the above mentioned tools, students may experiment with the rest of the tools.

Line is most commonly used to define objects but it can also be used to create texture. With Corel Draw this can be achieved with the Free hand tool. The Free hand tool is used in just the same way as the a pen or a pencil can be used to create textures. Doodling can also create textures. Click the Freehand tool and position it where you want to create the textures. Start doodling the same way

you would with a pen or a pencil.

Fig 38a: Creating Texture with lines: Doodling with the Freehand Tool.

A series of straight lines created with the freehand tool can also create textures.

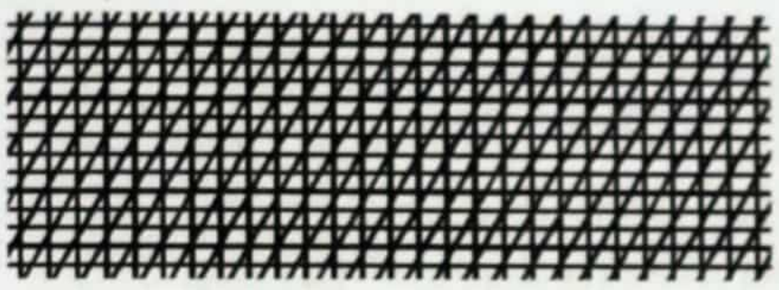


Fig 38b: Creating Texture with lines: Straight lines

The Bezier tool can be used to create a texture through a series of clicks on the drawing surface. This, depending on how and which direction the clicking would aim at, would create a number of intersecting lines that may end up in the creation of texture.

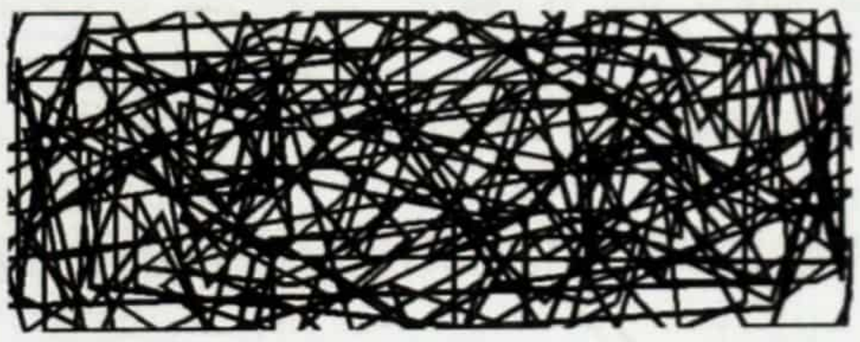


Fig 38c: Creating Texture with lines: Straight lines with the Freehand tool

According to Amanuke (1986),the letters of the alphabet and the numerals when repeated profusely on a surface can also create a texture. Because the Corel Draw Text tool is able to create letters that can be easily moved about and arranged in whichever way one finds appropriate, it should be much easier to create textures with letters and numerals.

To type a letter or a figure, Click the Text tool. Click anywhere in the Drawing Window (see fig. 2) and type. To type independent letters, move the cursor from

from where the first letter was typed and click a different point on the Drawing Window and type. The letters so created can then be arranged to form a texture.

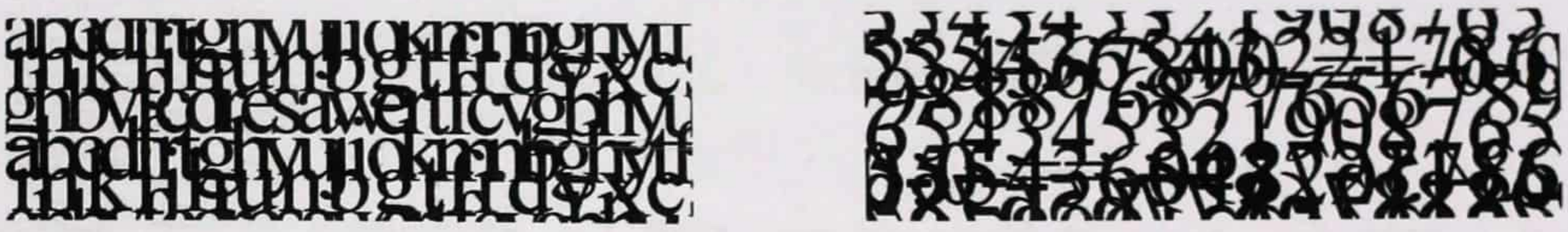


Fig 39: Creating Texture with letters and numerals

Harmony/Reptition of Textures

Fig 40: Harmony of Texture

Variety of Textures

As mentioned earlier on, almost every tool in the Corel Draw programme can be used to create texture. Apart from those discussed above (see creating texture), many other tools can be used. The rectangle, ellipse and the polygon tools can be used to create textures when many little shapes are drawn using either any one of them or all of them together as illustrated below.

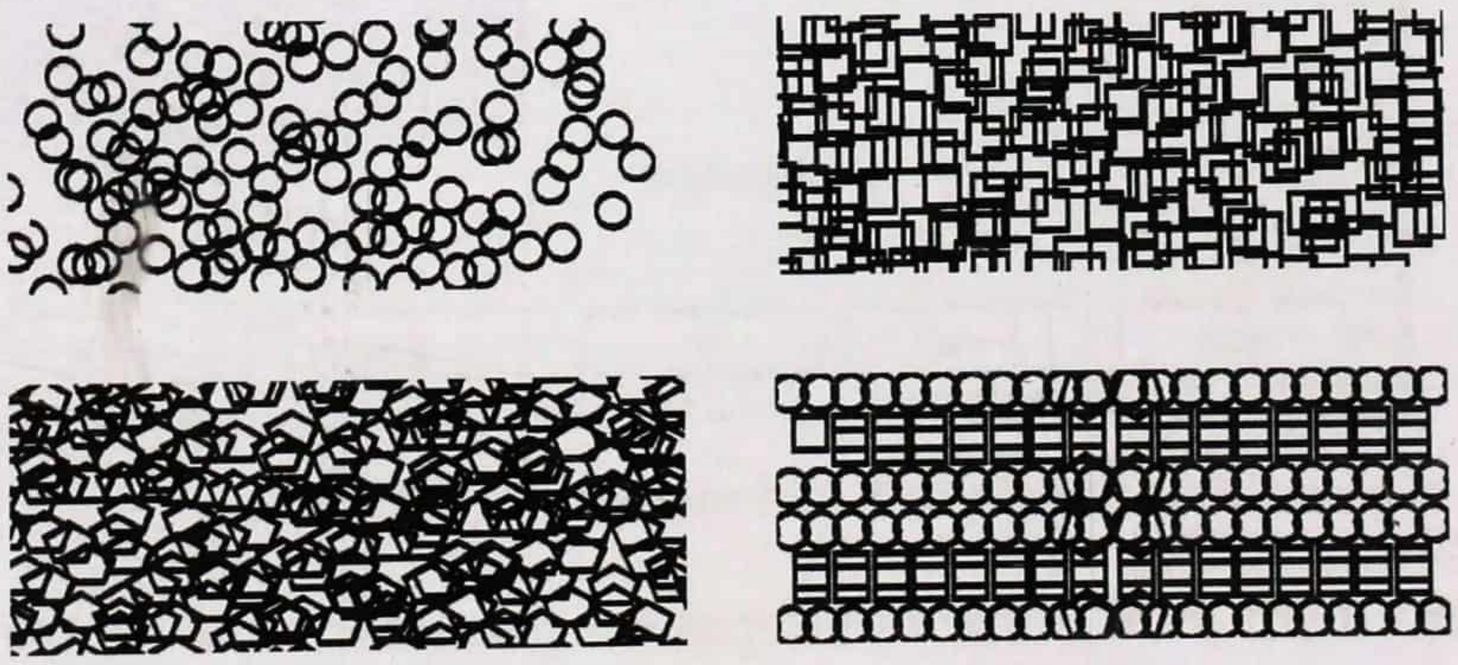
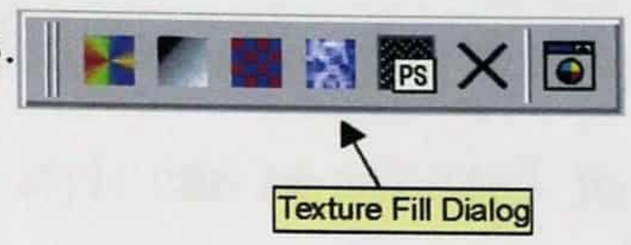


Fig 41: Textures created with shapes

Apart from the above examples, Corel draw has what is called Texture Fills. This tool is one of the Fill tool flyouts. 

A texture fill is a random fill that can be used to give objects a natural appearance .It may look like clouds, water, gravel, minerals, and other natural and artificial substances. A texture fill can therefore be applied only to an already create object. To apply a texture fill to an object, select the drawn object with the Pick tool . Then open the Fill tool flyout, and click Texture Fill Dialogue (see above)

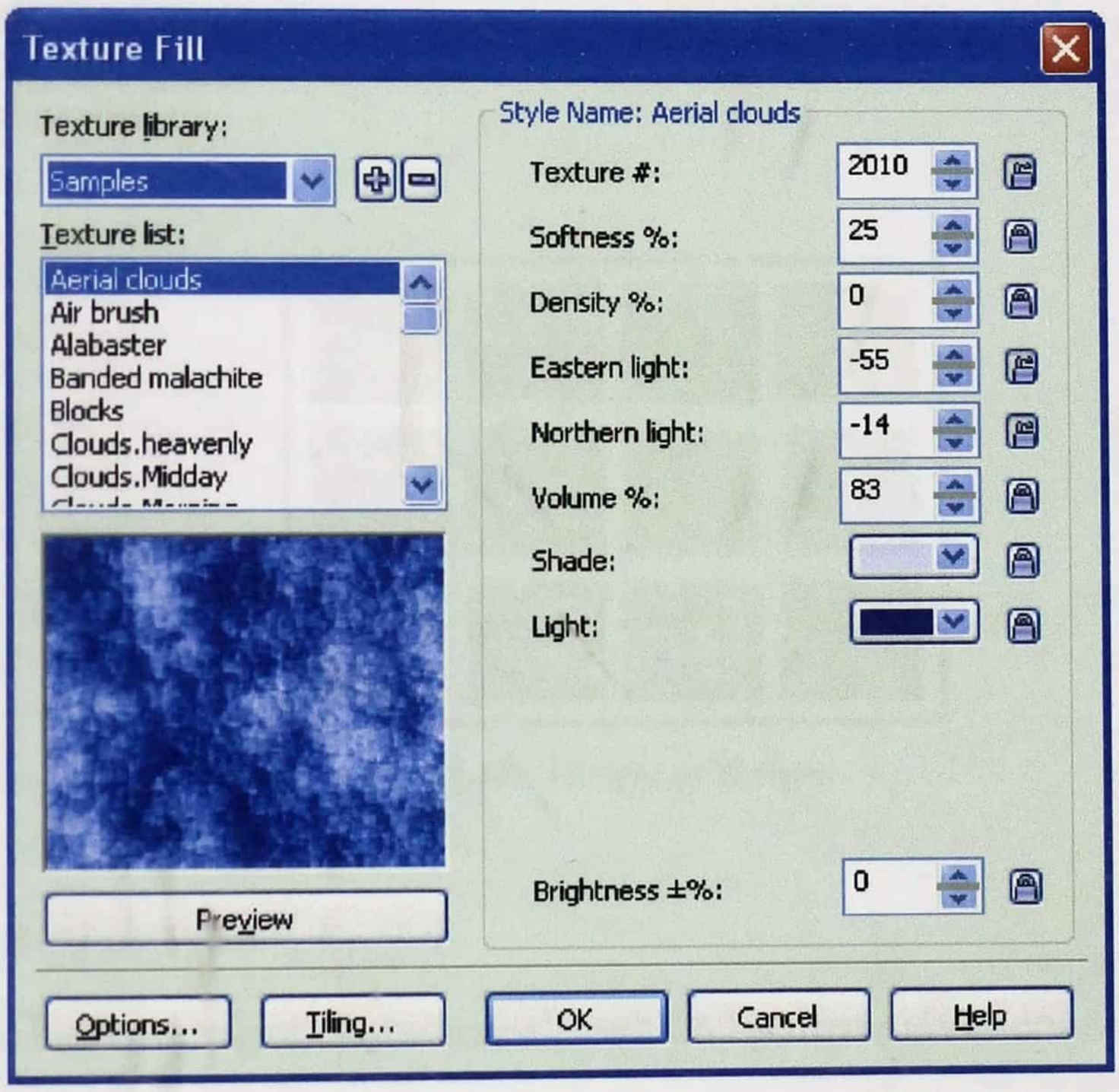


Fig 51: The Texture Fill dialog box

Choose the library containing the required texture from the Library list box,

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KUMASI-GHANA

for example *Samples.* Choose a texture from the Texture list box, for example *Airbrush*. The Preview window in the dialog box displays the fill attributes that have been so selected. The style can be adjusted to customize the texture as required. Then click OK.

With the above selections, the following texture would be applied to the object.

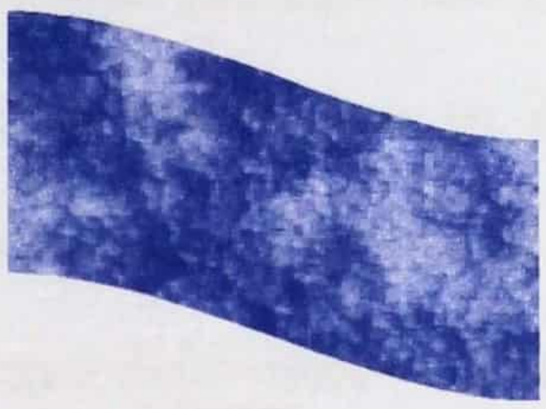

Fig 43: An object filled with a texture

Using the procedures described above, many different textures can be created with the computer.

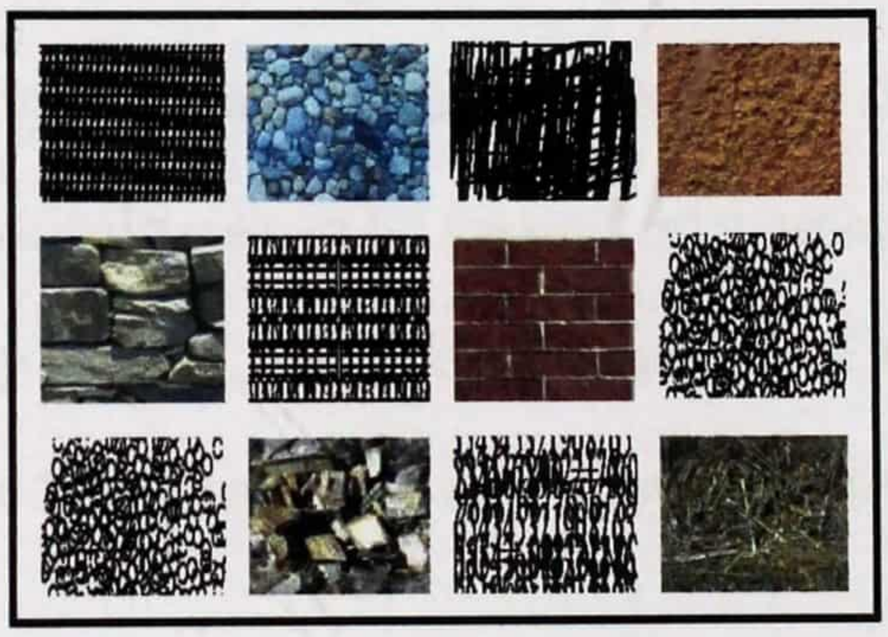

Fig 44: Variety of Texture

Contrast of Textures

Texture has two major characteristic, which by themselves contrast each other - smooth and rough. Be it real or visual, a texture may be perceived as smooth or rough. In the example in fig. 44, the contrast in the various textures is obvious from the seemingly roughness and smoothness in the individual textures.

5.7.5 Colour

Before creating colours, it is important to understand how colour is communicated by the computer in order to achieve a consistent and accurate reproduction of the desired colours. A basic understanding of this colour concept would help students to achieve the precise colour needed for a particular project. Colour management is the process of ensuring that the final colours seen in a project are as close to, or accurate a reproductions of the ones intended. Understanding how and what different factors influence colour perception, and what factors determine printed colours will help in the management of printing result (Lovett 2003).

Every device used to create a colour - be it a scanner, colour monitor, colour printer - reproduces a different range of colour. Even similar devices, such as two monitors made by the same manufacturer, can show the same colour differently. Many more colours can be viewed on a computer monitor than can be printed on a desktop printer. On the other hand, there are also printing effects created with varnished and metallic inks that can not be represented on a monitor.

In addition, colour monitors use a different colour model to describe colour from that used by the printer. As colours move from the computer screen to the printer, they are converted from one colour space to another, so the printed result may not exactly match the same colours intended and which was seen on-screen.

As a result of the many colour variations, a precise method for defining each

colour is required. For example, once the perfect shade of a particular colour is found, it should be possible to reproduce that colour and possibly show others how to do the same. A colour model defines that particular colour by breaking it down into precise components that makes it possible to accurately transmit the information to other people and to the electronic devices that are used to create projects. A colour model is a system used to organize and define colours according to a set of basic properties which are reproducible.

Colour models

There are many different colour models that define colours. Examples are, HSB, RGB, CMYK, and CIE Lab colour models (Grayson 1995). The RGB and CMYK colour models are only two of a number of models developed to suit a variety of digital design and desktop publishing applications. It is not necessary to be familiar with all these models, but it is helpful to be familiar with a few of the more widely used ones.

HSB model

Without any light or a viewer, objects all around us are colourless. Colour only occurs in our minds after our visual sensory system has seen the wavelengths that give objects their colour. Based on how people perceive colour, the HSB colour model defines color in three attributes: Hue (H) Saturation (S) Brightness (B). Hue (H) is the name given to a colour in everyday language. Hues form the Colour Wheel. The hue of a mango is yellow, that of a pepper is red. Saturation (S) refers to vividness of the colour or how much colour concentration does the object contain. The ripe orange does not contain very

much yellow when compared to the yellow saturation of a ripe mango. Colours can be separated into bright or dark colours when their Brightness (B) is compared. Brightness refers to adding or removing whiteness from a colour.

RGB model

The millions of colours produced by a computer's monitor can all be described as amounts of red, green, and blue. These three colour components form the basis for the RGB (Red, Green, and Blue) colour model. Video technology which includes the computer monitor uses the additive RGB model. It transmits varying proportions of red, green and blue lights which the human eye perceives as different colours. Each of the three colours is assigned a numeric value between 0 and 255. The RGB model is based on colours of light, and higher RGB values correspond to the presence of greater quantities of white light. Consequently, higher RGB values result in lighter colours. When all three colour components are at the maximum value, the resulting colour is white light. Because the RGB model creates colours by adding light, it is called an additive colour model. Monitors and scanners can employ the additive colour model because they emit light. They emit particles of red, green, and blue light and create the illusion of millions of different colours.

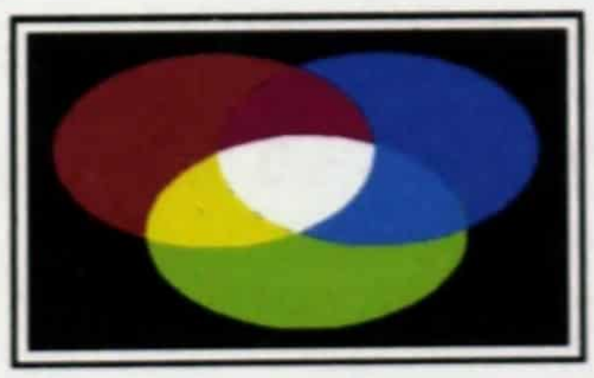

Fig 45: The RGB Colour Model

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One of the limitations of the RGB model is that it is device dependent. This means that not only are there colour variations between monitors but there are colour variations between identical devices from the same manufacturer.

CMYK model

In printing, translucent Cyan, Magenta and Yellow (CMY) inks are printed on a page. A fourth ink, Black which represented by the letter 'K' is used to deepen shadows and to print true black type and line. Hence CYMK. The colours seen on the monitor are reproduced on paper by the CYMK model using pigments instead of light. These four colours are the colour components of the CMYK (Cyan, Magenta, Yellow, and black) colour model. These inks absorb and reflect light, using the subtractive colour model. Difference in colours are in the CYMK model because different inks reflect and absorb light differently. For example, an object is perceived as cyan if it absorbs (subtracts) 100% red light and reflects green and blue. Cyan, Magenta and Yellow are therefore called the subtractive primaries, and form the basis for printed process colours.

Each colour of the CMYK colour model is described as a percentage (from 0 to 100). Pigments produce colour by reflecting certain wavelengths of light while absorbing others. Darker pigments absorb more light. Because the CMYK colour model is based on pigment colours, higher percentages of pigment result in darker colours. In theory, when 100 percent cyan, 100 percent magenta, and 100 percent yellow are combined, the resulting colour is black. In reality, a muddy brown is produced so black pigment must be added to the colour model and to the printing process, to compensate for the colour limitations. The CMYK

colour model is called a subtractive colour model because it creates colours by absorbing light.

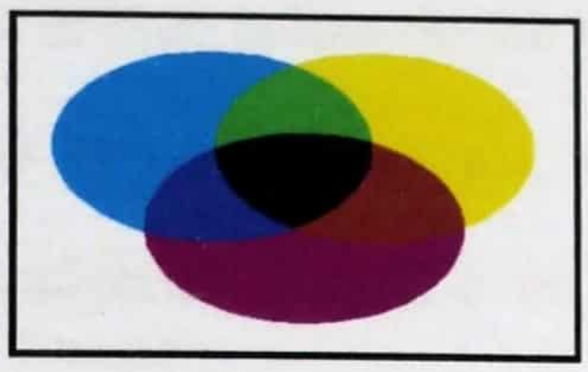


Fig 46: The CMYK Colour Model

CIE Lab model

A great deal of colour research has been accomplished in order to acquire a colour model that is device independent and repeatable. In 1931 La Commission Internationale de L'Eclairage (CIE) defined a device-independent colour model, based on how the human eye perceives colour. The CIE Lab model incorporates the theory that a colour cannot be both green and red at the same time nor can it be yellow and blue at the same time. As such, single values are used to describe the green/red and blue/yellow components of any colour. Lab stands for the three values this model uses to define colour's lightness value (L) which can range from 0 to 100 and two chromaticity ranges: green to red (a) and blue to yellow (b). The two chromaticity values can range from +120 to -120. Lab (sometimes called L*a*b*) provides a system for defining colour that bases colour values on widely accepted standards rather than on individual colour-producing devices (Grayson 1995).

Creating Colours

(i) Creating the Value Scale with the On-Screen Colour Pallette

One of the first exercises in colour is to create a value scale. Value locates a

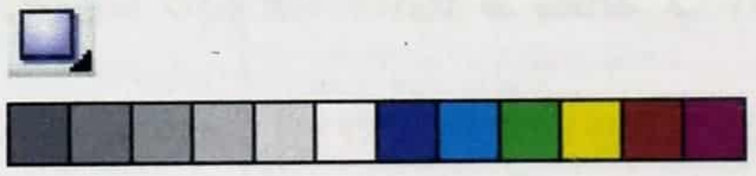
colour's approximate position in relation to white and black. A light colour, such as yellow is high on the value scale (closer to white) whereas a dark colour, such as violet or blue is low on the value scale (closer to black). Value distinction is one way to create contrast, and contrast is what is needed to enable the identification of things (Lovett 2003). Value contrast is the gradual change from light to dark in various places in a work of art. Value can be achieved through modulation, gradation, and shading.

Value Scale is important, and is one of those tiny little exercises that should be repeated, so that students can learn to achieve a gradual gradation with ease. There is a vast difference between creating a value scale with the computer and creating it with pigments. Whereas it is quite boring with pigments, using the computer is much fun.

The 9 Value Scale found below consists of three major value categories: low, middle, and high. The low value section of the scale consists of: black, low dark, and dark. The middle value section of the scale consists of: high dark, middle, and low light. The high value section of the scale consists of: low light, light, high light, and white. These nine values are arranged from black to white in the following order.

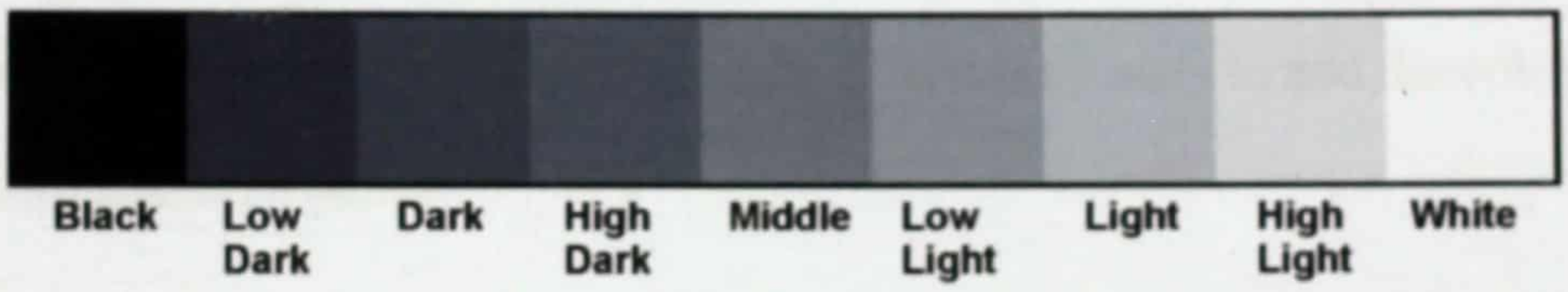
Tools:

Rectangle

On-Screen Colour Palette 

Method

To create the 9 Value Scale found below, create one rectangle and fill it with black. (To fill the rectangle with black, select (click) the rectangle with the Pick Tool and click black on the On-screen colour palette). Duplicate the black rectangle and select it with the Pick tool. Hold down the Control key and click the white colour in the On-screen colour palette twice. This means 10% white has been added to the black. Duplicate the second rectangle and add 10% white to it. By this process, the fill would be 100% white by the time its to the 9th rectangle.



Applying Fills

As indicated by the above example the quickest way to add colours to an object is by clicking on a colour swatch within any of the on-screen Colour Palettes (found vertically across the right hand side of the screen).

Fig 47: The On-Screen Colour Pallette

One feature that is unique to all on-screen Colour Palettes, is that they make it possible to augment the current colour of an object with a new colour. For example, you can add some red to a yellow object to create an orange object. Spot colours in the on-screen Colour Palette are marked by a dot in the bottom-left corner of the colour swatch.

To apply a fill or outline colour to an object, select the object with the Pick tool. Then either click a colour in the on-screen Colour Palette to give it a colour or right-click a colour in the on-screen Colour Palette to give it an outline colour.

(ii) Colour viewer

Colour can also be applied through the colour viewer. The default color viewer is based on the HSB color model. You can select different color models, e.g., CMYK, RGB, Lab, or grayscale for the color you are choosing, but the color viewer remains based on the HSB model. You can select other color viewers if you do not want to use the HSB color viewer. You may want to add the color you chose into a custom palette.

To choose the fill or outline color of an object Select the object with the Pick tool ,then either Open the Fill Tool flyout , and click the Uniform Fill button to give colour to an object.

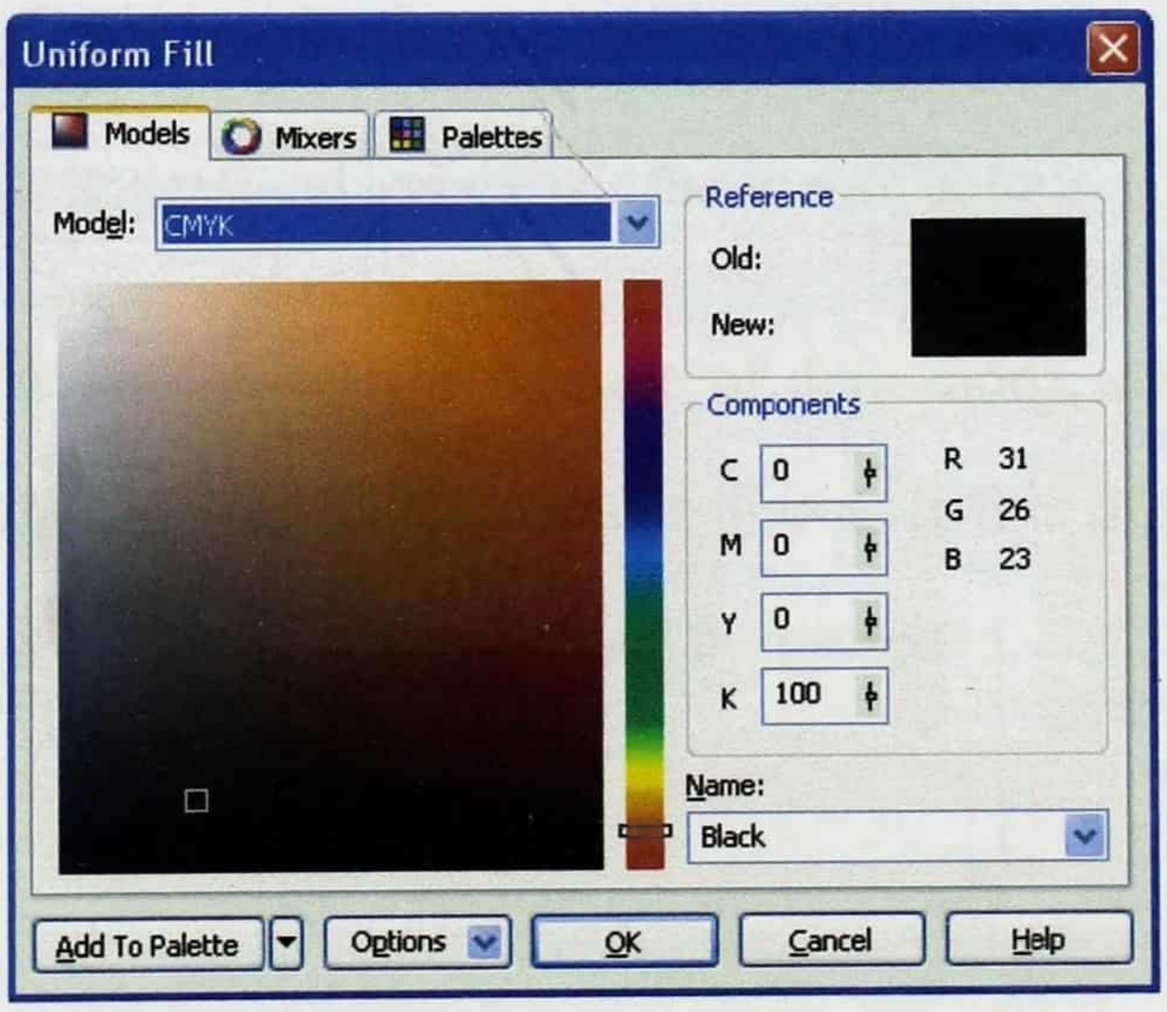


Fig 48: The Uniform Fill Dialog Box

Or Open the Outline Tool flyout and click the Outline Colour Dialog button to give an outline colour to an object.

Click the Models Tab. Hold down the mouse button on the Models list box to display the colour model list. Hold down the mouse button on the Options, select Colour Viewers to display and select the colour model from the color viewer list. Then either drag the small box in the color selection area to the colour you want to use or move the colour slider up or down to change the range of colours displayed in the colour selection area on the left. You may also use the name list box, and select a colour by name.

Colour can also be selected by entering the values of its color components. The colour components that can be changed depend on the colour model being used to define the colour. Colour can be selected by entering the values of its colour components only while in the Models or Mixers areas.

Harmony of Colours

To understand and apply the principles of design efficiently on colour it is necessary to first understand some basic theories of colour.

Colour theory encompasses a multitude of definitions, concepts and design applications which are quite impossible to discuss in this study. For the purpose of this study, the following concept would be discussed.

I. The Color Wheel

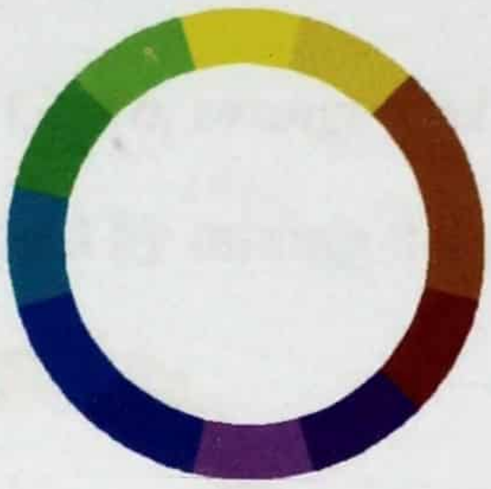


Fig 49: The 12-point Colour Wheel

The 12 part colour wheel below is based on the three ***primary*** colours (Red, Yellow and Blue) placed evenly around a circle. Between the three primaries are the ***secondary*** colours (Green, Orange and Violet) which are mixtures of the two primaries they sit between. The ***tertiary*** colours fall between each primary and secondary. Between yellow and orange, for example, is yellow orange, between blue and violet is blue violet and so on (Lovett 1999).

II. Primary colours - Red, yellow and blue

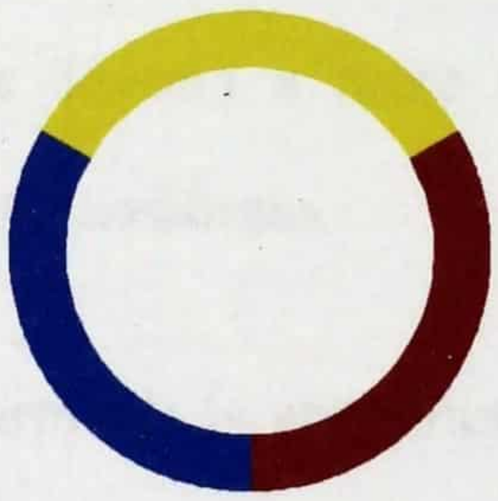


Fig 50: The Primary Colours

In traditional colour theory, these are the 3 pigment colours that can not be mixed or formed by any combination of other colours. These colours can be mixed in varying amounts to produce all other colours.

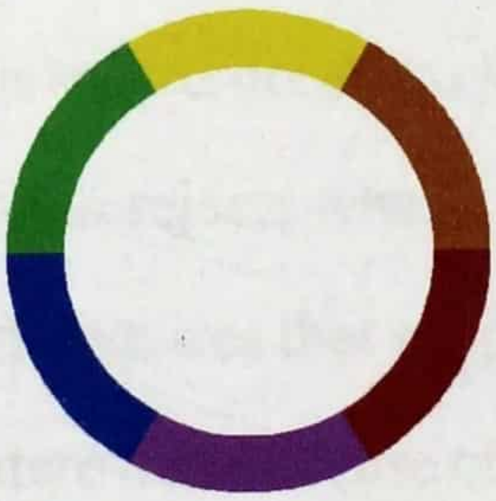


Fig 51: The Secondary Colours

III. Secondary colours - Green, orange and violet

These are the colours formed by mixing the primary colours.

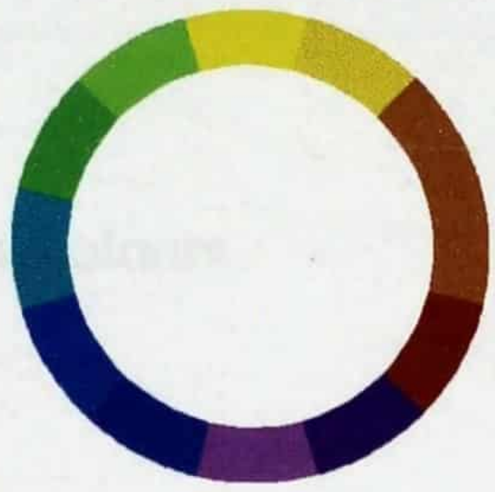


Fig 52: The Tertiary Colours

IV. Tertiary colours - Yellow-orange, red-orange, red-violet, blue-violet, blue-green and yellow-green.

These are the colours formed by mixing the secondary colours.

Colour Harmony

Harmony in colour goes beyond a mere *repetition* because of its heavy indulgence on the human eye and brain.

In visual experiences, harmony is something that is pleasing to the eye. It engages the viewer and it creates an inner sense of order, a balance in the visual experience. When something is not harmonious, it is either boring or chaotic. At one extreme is a visual experience that is so bland that the viewer is not engaged. The human brain will reject under-stimulating information. At the other extreme is a visual experience that is so overdone, so chaotic that the viewer cannot stand to look at it. The human brain rejects what it can not organize, what it can not understand. The visual task requires that we present a logical structure. Colour harmony delivers visual interest and a sense of order (Lovett, 1999).

Examples of colours that give harmony in a design are:

(a)	Tints	-	Colour + White
(b)	Tone	-	Colour + Grey
(c)	Shade	-	Colour + Black
(d)	Analogous Colours	-	Any three colours which are side by side on the colour wheel, such as yellow-green, yellow and yellow-orange.

Because looking at these colours evokes that inner sense of order, it is said that they are in harmony.

Creating the tint of any colour follows the same procedure as creating a value scale. For example, to create a tint for red, draw the object and fill it with red. Select the object with the Pick tool, then click white in the On screen colour palette.

Fig 53: Creating Tints

In the image above, the first red box was copied and pasted. The copied image was selected with the pick tool. And with the Control key held down, white was clicked twice to achieve a tint of the previous colour. The process was repeated until that bar of various degrees of tints was achieved.

Shades can be created through the same process. The only difference in the procedure is that instead of clicking on white in the On-screen Colour Pallette black is clicked.

Fig 54: Creating Shades

The above examples indicate the possibility of mixing colours right on screen with the Pick tool and the On-csreen colour Pallette. This procedure is also called augmentation of colours and it is basically used when working with monochromatic schemes. Monochromatic colour schemes can have a unifying effect and are created by varying the value of a single colour.

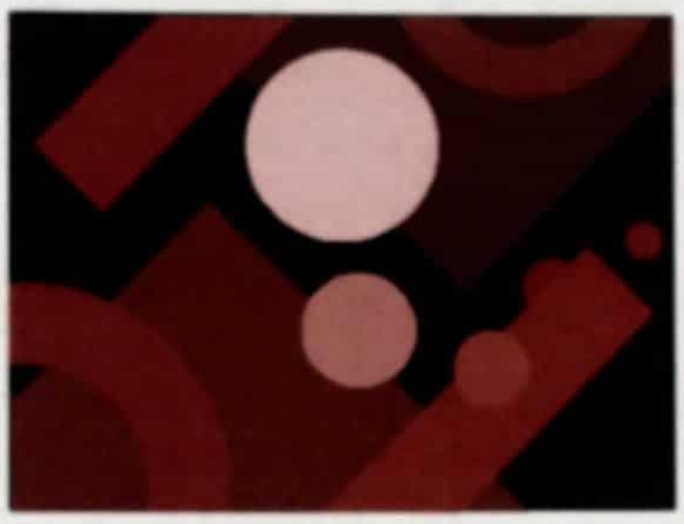


Fig 55: A Monochromatic scheme

How to Create analogous colours.

Analogous colours are next to each on the colour wheel and create harmony. They are any three colours which are side by side on the colour wheel as indicated in the illustration below:

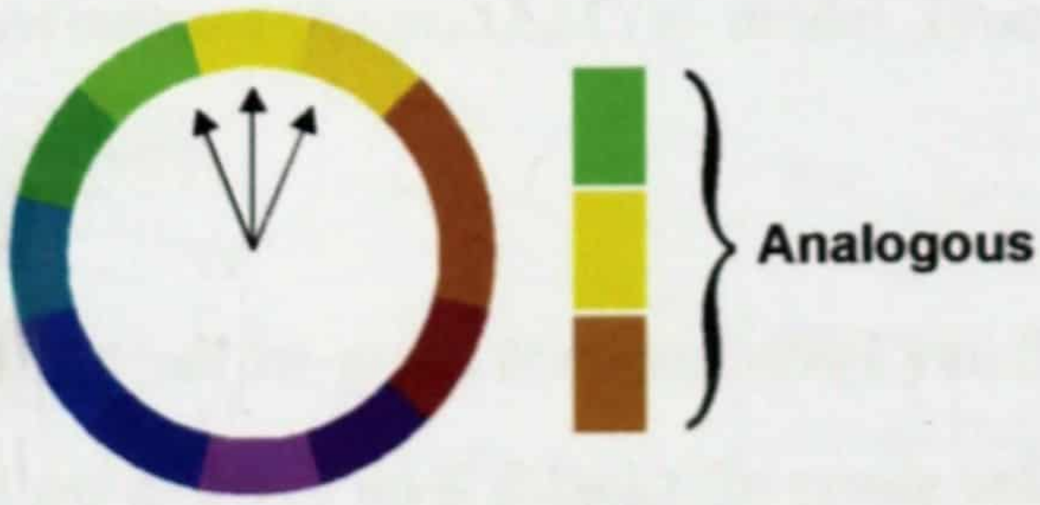


Fig 56: Determining Analogous Colours

In the above colour scheme, the key colour is Yellow because there is 100%

yellow both in yellow-green and yellow orange. For example the colour green is made up of 100% yellow + 100% Cyan (blue). This means, the amount of blue in yellow-green should be less than the yellow (just about 50%). This is how yellow green can be created using the *Uniform fill* tool. Select the object with the *Pick tool* . Open the *Fill Tool flyout* and click the *Uniform Fill* button to change the fill colour.

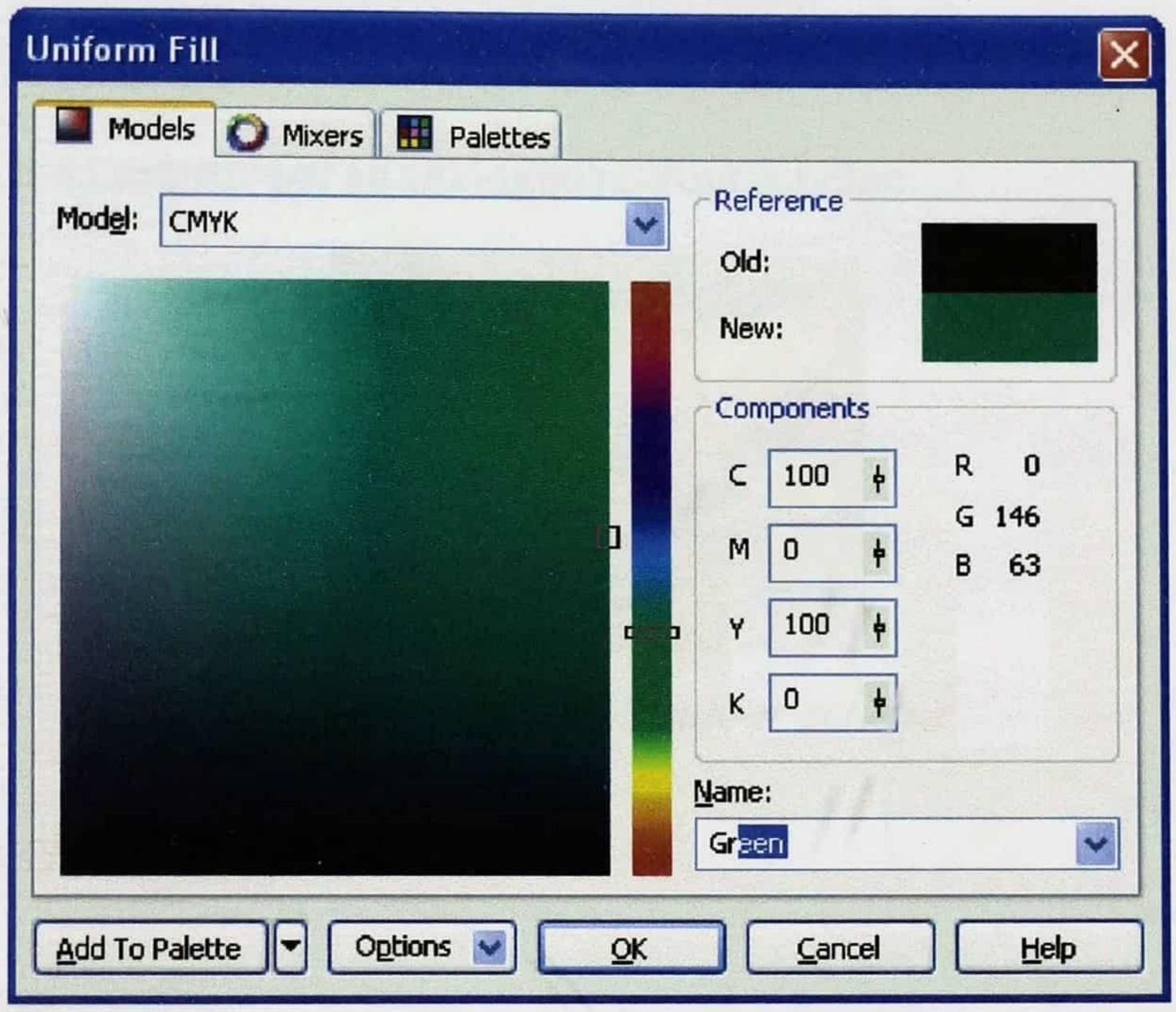


Fig 57: Mixing Colours with the Uniform colour Dialog

Click the Options button and select CMYK model. Type values 50, 0, 100 and 0 for CMYK respectively.

The meaning is that yellow-green contains 50% Cyan (blue), 0 or no Magenta (red), 100% Yellow and 0 or no K (black). To create yellow, just type 100 in Y. Creating yellow-orange follows the same procedure with 0, 50, 100 and 0 for CMYK respectively.

After putting in the numbers however, it is important to look in the reference area to see the colour that shows in it. If the colour is not what is expected, the figures can be adjusted until the appropriate colours are derived.

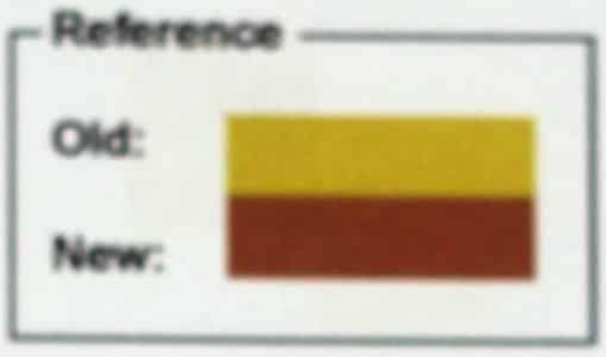


Fig 58: Colour reference in the Uniform Colour Dialog

Below is an example of an analogous colour scheme.

Fig 59: Analogous colour scheme

Variety of Colours

Tools

On screen Colour Pallette, Fill Colour Flyout.

The On-screen Colour Palette provides quick access to numerous colours. By default, the Corel Draw Pallette is docked at the right hand side of the screen. All that is required is to select the object with the Pick tool and to click the required colour to fill the object.

Fig 60: Objects filled directly with the On-screen colour palette

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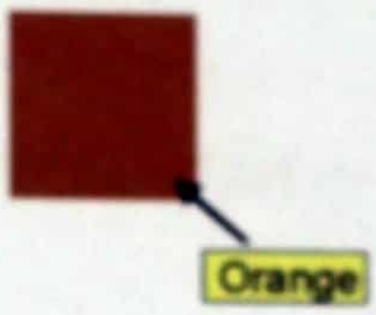
The On-screen colour pallette, apart from providing quick access to a variety of colours, also provide the names of various colours. By just pointing at a colour in the On-screen colour pallette, the name of the colour pops up.



This can help learners to become familiar with names of different colours very quickly.

Talking about variety of colours, it would be appropriate to mention some other means by which the computer is able to help the artist blend colours to come out with a unique effects in the application of colours.

Corel Draw has so many ways of blending or fusing colours, but we shall discuss one of the most effective methods. This is called fountain filling. The tool used for fountain filling is called Fountain Fill Dialog. It can be located in the Fill tool flyout.

A fountain fill causes two or more colours to flow into each other smoothly. This makes it possible to add depth and colour to a drawing. The fill can flow in four main directions. Linear - a straight line across the object, Radial - in concentric circles from the center of the object, Conical - in rays from the center of the object, Square - in concentric squares from the center of the object

There are two types of fountain fills: two-colour and custom. Two-colour fountain fills have a direct blend from one colour to another. Custom fills create a cascade of many colours. In this study, we shall discuss the two-colour fountain fill.

Below are examples of objects filled in the four directions of two-colour fountain fills.

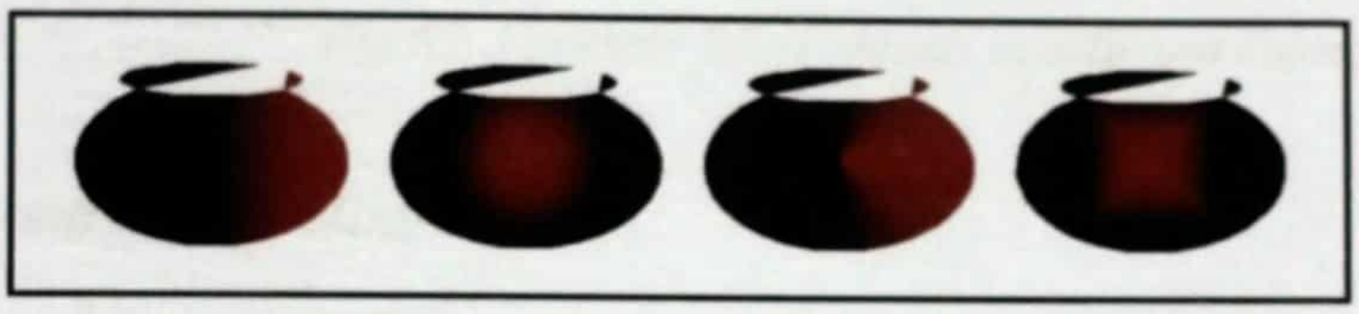


Fig 61: Objects filled with the fountain tool

To apply a two-colour fountain fill to an object, first Select the object with the *Pick too*l. Open the Fill Tool flyout, and click *Fountain Fill Dialog* In the Colour Blend section, enable the Two Colour button. From the *Type list* box, choose one of the following fountain fill types:

Linear

Radial

Conical

Square

Then open the *From* color picker, and click the colour that should be at the start of the colour progression. Open the *To* colour picker, and click the colour that should be at the end of the colour progression. In the above example *Black* began the colour progression and *Red* ended it.

Once created, the appearance of a two-colour fountain fill can be changed

without altering its pattern. This can be done by changing the colours used to create the fountain fill. This can make it possible to create a wide variety of colours or fills to the same object.

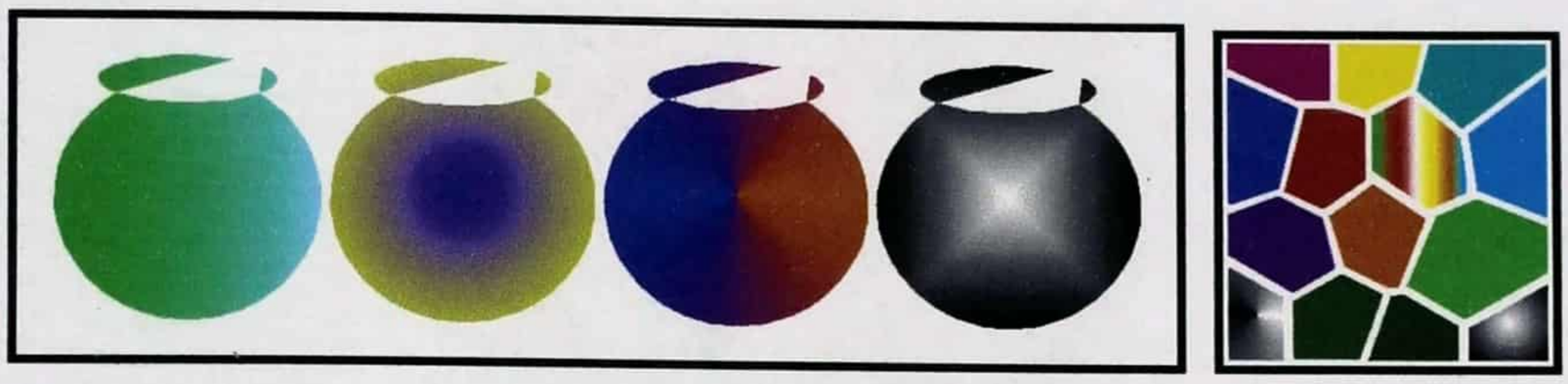


Fig 62: Fountain filled objects in different colours

Contrast of Colours

One of the simplest approaches to the goal of good contrast is the use of colour. Colours that contrast are colours that have characteristics that are distictively different from one another. Colours whose contrasting elements are easily identifiable are cool and the warm colours. Cool and warm colours are also known as receding and aggressive colours. Cool colours are the greens, blues and violets. Warm colours are the reds, oranges and yellows.

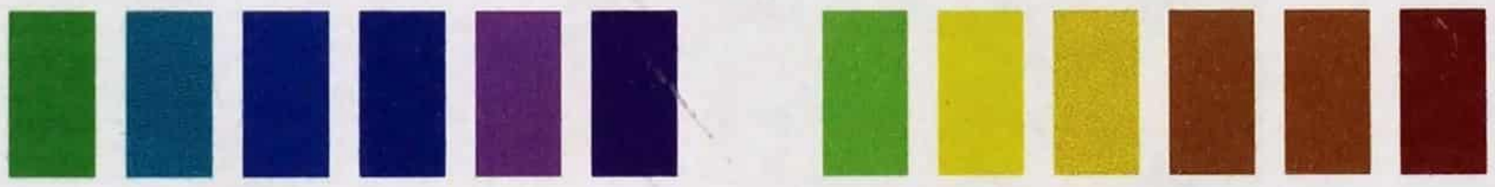


Fig 63a: Contrast of colours - Cool against warm

Another clue to contrasting colours is through the identification of complementary colours. Complementary colours are opposite to each other on the colour wheel. Examples are red and green, yellow and violet, blue and orange. By selecting two colours on opposite sides of the colour wheel, a complementary colour scheme is created.

Fig 63b: Contrast of colours - Complementary colours

Below is an example of a complementary colour scheme.

Fig 63c: Complementary Scheme

Split complementary colours can also create contrast. Split-complemetaries are colours that are on each side of a colours complementary. A split-complemetary scheme is created by selecting a colour and two hues on either side of the complement. The split complementary of blue for example are red-orange and yellow orange.

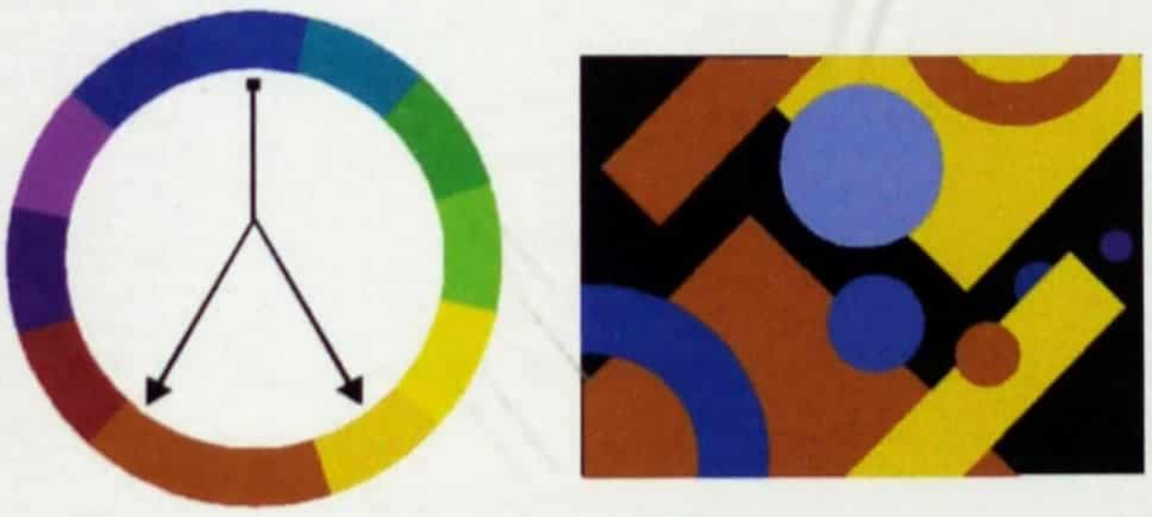


Fig 63d: Contrast of colours - Split Complementaries

Colours in a Triad are also complementary. Triad is a colour scheme that has three colours equally spaced from each other. A triadic colour scheme is created by colours that form an equilateral triangle on the colour wheel. A typical example are the three primary colours - Red, blue and yellow.

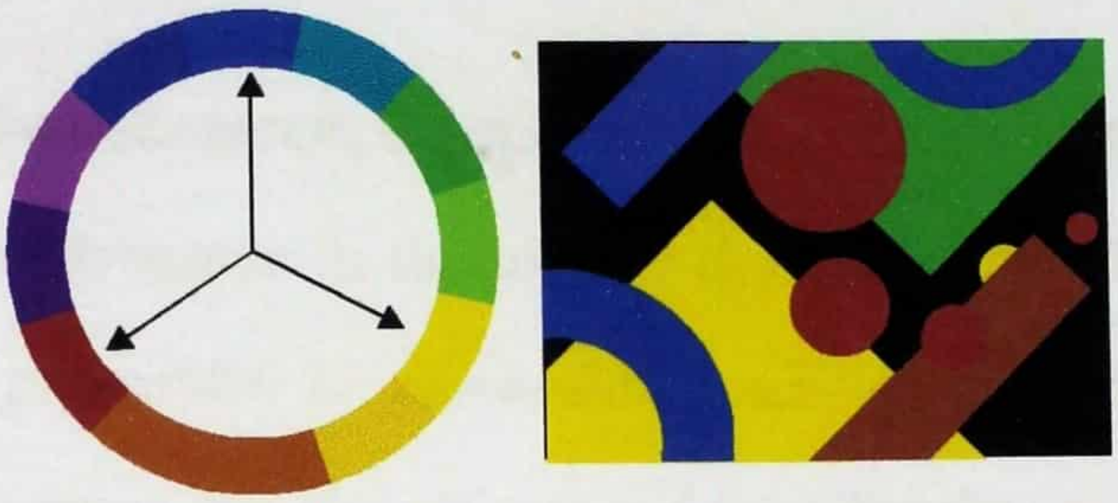


Fig 60d: Contrast of colours - Triads

Colours that form a Tetrad on the colour wheel are also contrasting. Tetrads are created using four colours that form the corners of a square on the colour wheel. Example of colours that form a tetrad are Green, Violet, Red and Yellow.

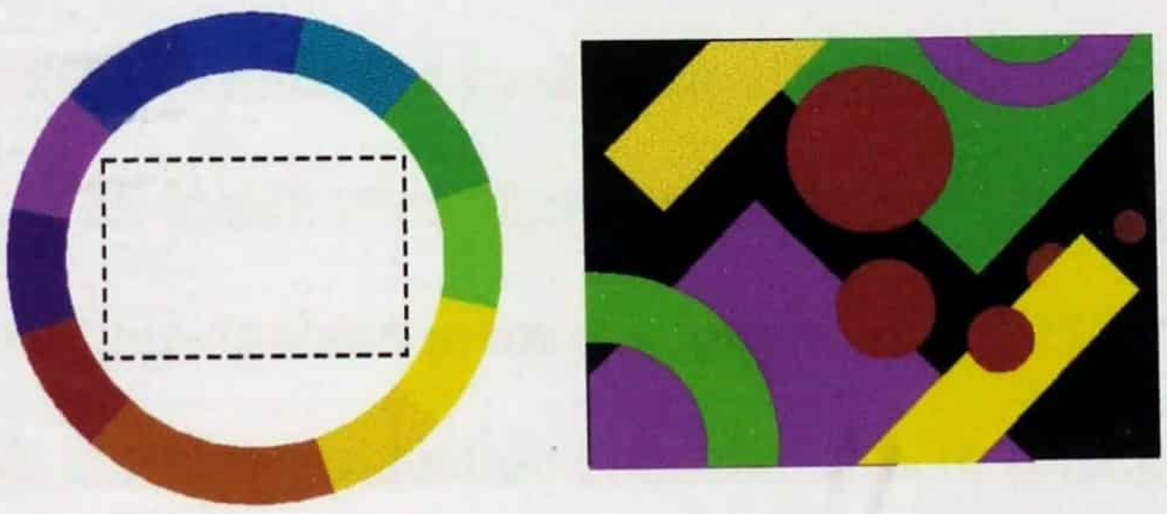


Fig 63f: Contrast of colours - Tetrad

5.7.6 Balance, Dominance, Proportion and Movement

The greatest advantage in the use for the computer when creating *balance, dominance, proportion or movement* in any form of design lies within the possibility to *move* and *size* objects and even blocks of texts, together with all their properties, about without altering anything.

Because balance is achieved *through proper arrangement of the elements to form a good visual equilibrium* (Lessel 1987), movement of objects is an important activity in balancing. Be it a dot, line shape or texture, proper balancing can only be achieved by consciously arranging the various elements in the design. The implication therefore is that, balancing objects primarily involves moving objects about in the design until satisfactory visual equilibrium is achieved. We shall in this section consider how to select, move and arrange objects to achieve balance with Corel Draw.

How to select objects

Note that objects are always selected with the Pick tool. Selecting an object with the Pick tool is very important when using Corel Draw. This is because an object has to be selected with the Pick tool before any action can be performed on the object. As it has been emphasized in the previous activities, an object has to be selected with the pick tool before colour or texture can applied to it. In much the same way should an object be selected with the Pick tool before it can moved, sized or arranged in any way.

There are so many ways of selecting an abject. In this study, we shall consider

how to select an object or objects with the *Pick tool only*, *Pick tool in combination with the Control Key* and *Pick tool in combination with the Alt Key*.

To select one object with the Pick tool, just click the Pick tool. Then click on the object to be selected just once to select it. When an object is selected, eight black dots, known as selecting handles appear around the object. The centre of the object is marked by a small 'x'.

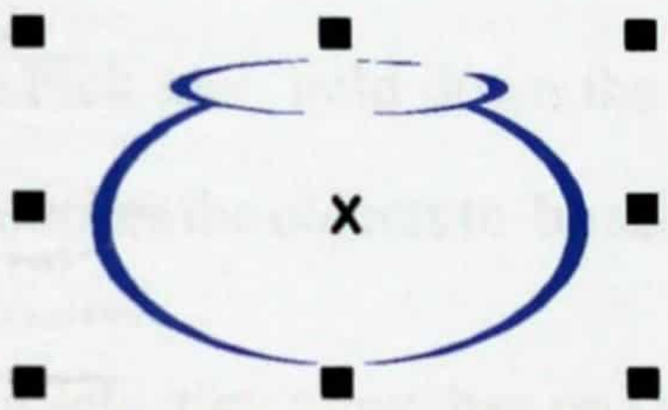


Fig 64a: An object selected with the Pick tool

The pick tool can also be used alone to select more than one object. To do this, select the Pick tool and draw a marquee box around the object to be selected. A marquee box is drawn by placing the pointer at the top-right side of the area that borders the objects and dragging horizontally down to the right hand side. The marquee box appear in the form of a dotted rectangle, and the further the pointer is dragged, the larger the marquee box. In selecting object without the marquee method therefore, the mouse is diagonally dragged until a marquee box encloses all objects.

On the release of the mouse button, the marquee box is replaced by the eight selection handles.

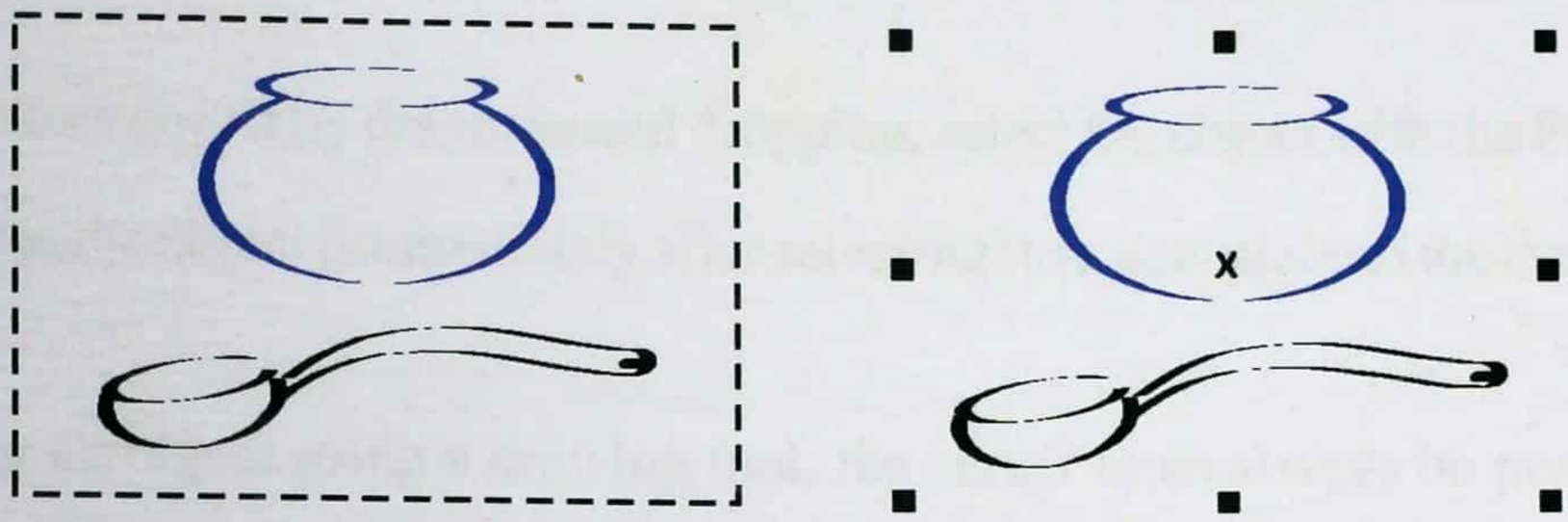


Fig 64b: Objects selected with the Marquee

It is possible to marquee select objects without entirely surrounding all objects. This is done with the use of the Pick tool in combination with the Alt key. To do this, Click the Pick tool, hold down the Alt key and drag diagonally until the marquee box touches the objects to be selected.

Another way of selecting more than one object is by the use of a combination of the Pick tool and the Shift key. To do this select the Pick tool, hold down the Shift key and click the objects to be selected one after the other to select them in a group. As each object is clicked with the Pick tool, the selection box for each selected object is displayed. This method of selection is necessary when there is the need to select some objects from a lot.

There is another smart method of selecting all the objects in the active page. This is by simply double-clicking the Pick tool. As soon as the Pick tool is double clicked in the Too box all the objects in the active page are select.

Now let us consider how objects are moved. An object is moved by simply dragging and dropping the object using the pick tool or a drawing tool (such as the rectangle tool).

To move an object by dragging and dropping, select the object with the Pick tool and drag the object (immediately after selecting) to a new place in the drawing.

To drag an object using a drawing tool, the curser must always be positioned over the small 'x' at the center of the selection box.

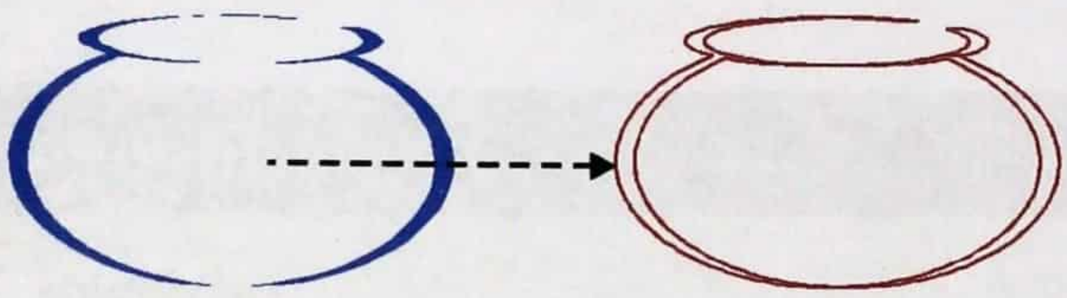


Fig 65: An object on the move

Objects can also be aligned horizontally or vertically. With the computer, there is always a choice as to how objects should line up in relation to each other. This is different from specifying where the object should line up on the page. For example, enabling the Right check box in the Align and Distribute dialog box aligns the right edges of the object's selection boxes with each other - not necessarily on the right side of the page.

To align a series of objects horizontally for example, Select the objects with the *Pick tool*. Click *Arrange*, then *Align and Distribute*. To indicate how the objects are supposed to line up with each other, enable one of the following check boxes which appear in the Align and Distribute dialog box:

- Top ☐
- Center ☐
- Bottom ☐

Then enable one of the following check boxes to indicate where on the page the alignment should occur:

- *Edge Of Page* to align objects with the edge of the page
- *Center Of Page* to center objects on the page
- *Align To Grid* to align objects with the nearest grid line

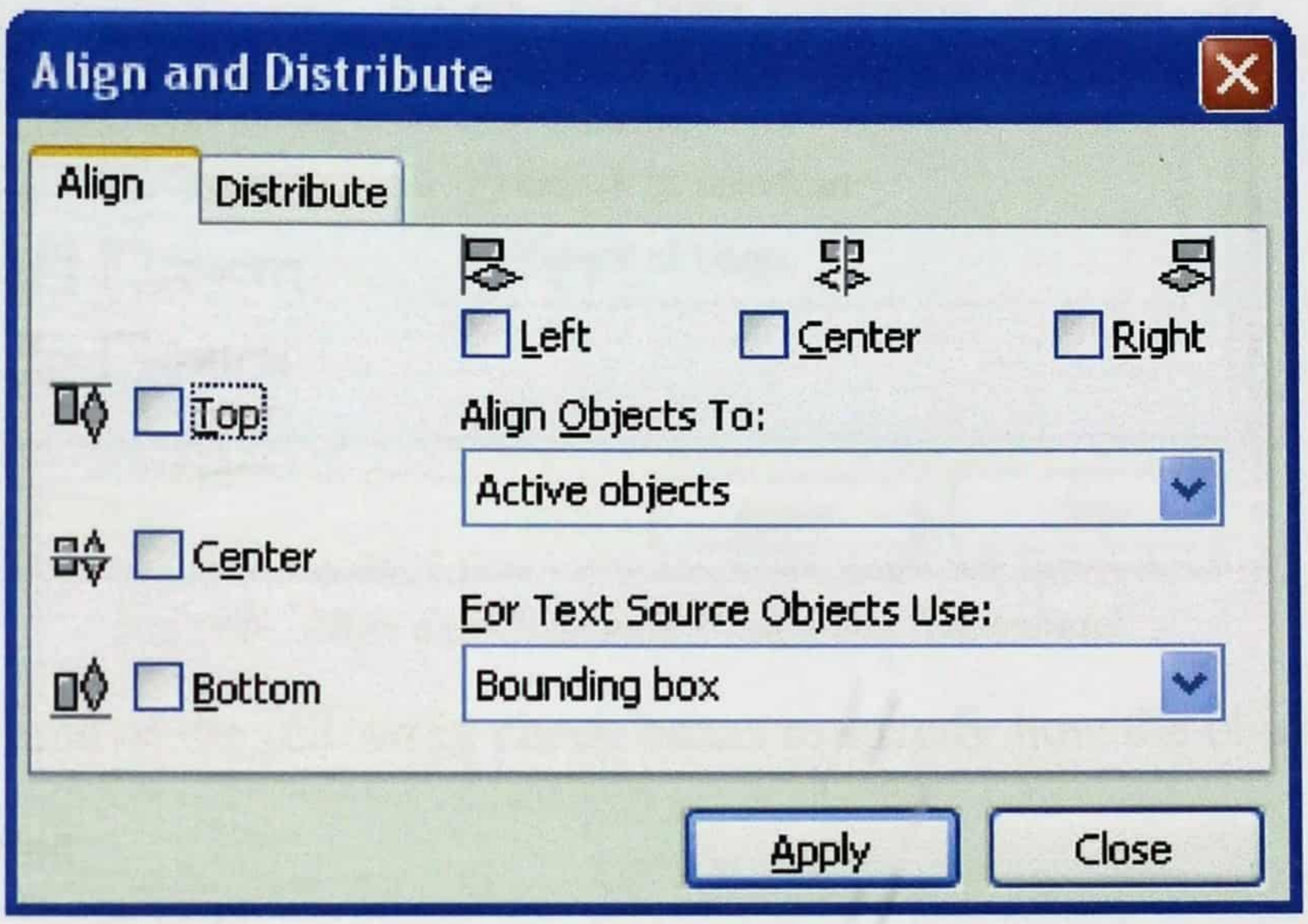


Fig 66a: Align and Distribute Dialog box (Align)

Aligning a series of objects vertically follows the same process except that to indicate how the objects should line up with each other, one of the following check boxes has to be enable in the dialog box.

- Left
- Center
- Right

Objects can also be *distributed* evenly, either horizontally or vertically. *To distribute a series of objects horizontally,* first *s*elect the objects with the *Pick*

*tool. Then c*lick Arrange, Align and Distribute. In the dialog box which appears, click the Distribute tab. The information in the Align and Distribute dialog would be as in the figure below:

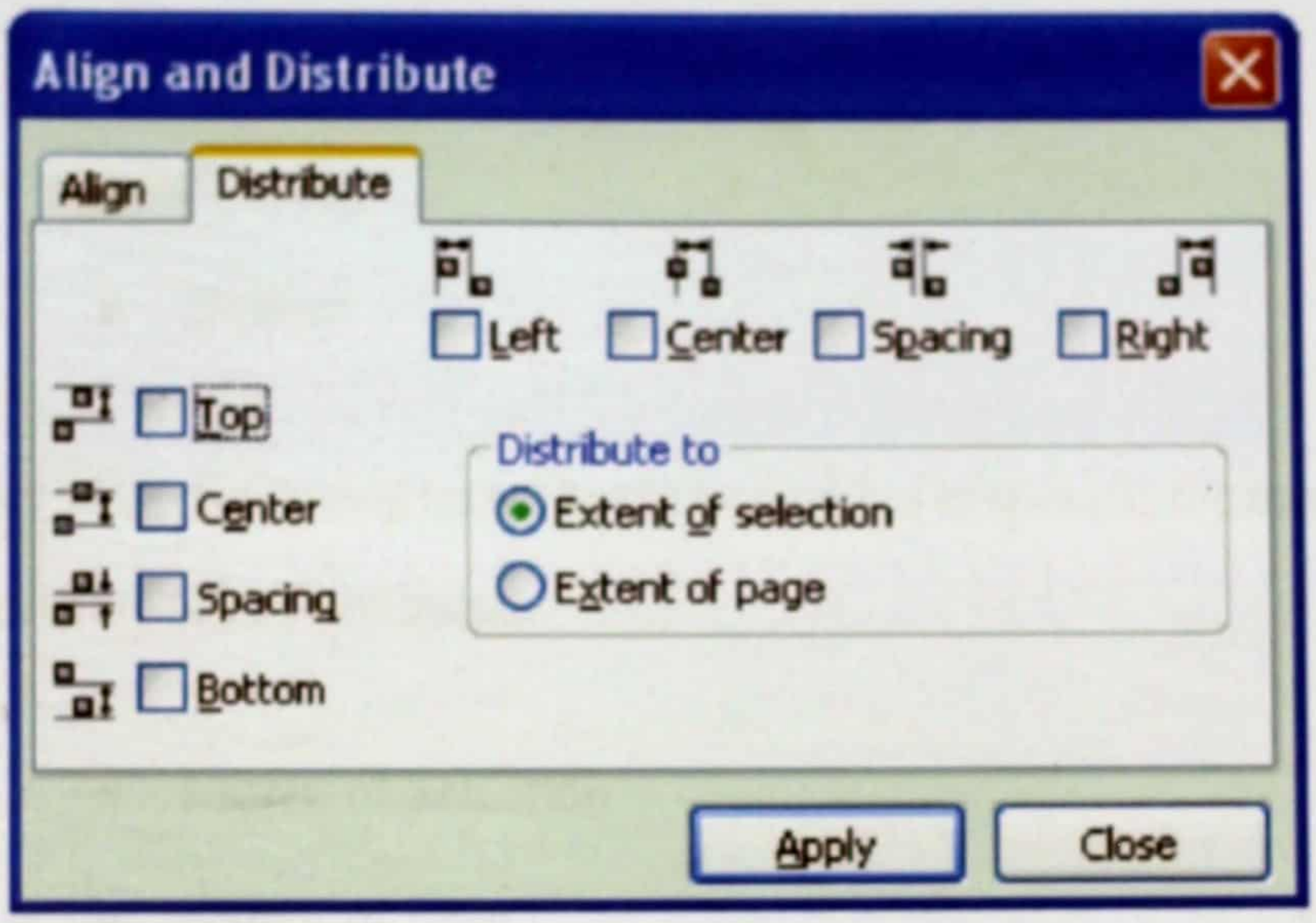


Fig 66b: Align and Distribute Dialog box (Distribute)

Enable one of the following check boxes to specify how the objects are to be distributed:

- Left
- Center
- Right

Then enable one of the following check boxes to indicate the area over which the objects are to be distributed:

- Extent Of Selection
- Extent Of Page

Distributing objects vertically follows the same procedure, except that one of the

following has to be enabled in the dialog box to specify how the objects are to be distributed.

- Top
- Center
- Spacing
- Bottom

Then one of the following boxes has to be enabled to specify the area over which the objects are to be distributed:

- Extent of Selection
- Extent of Page

This way objects can be selected and moved to change positions of shapes, objects or even texts, until the required positions are identified to create balance.

Balancing Elements: Dots, Lines, Shapes and Texture

There are two main types of balance: Actual and Optical. These two kinds of balance are not the same. One very obvious observation deals with the mathematical centre of any element within a given area.

The actual centre always appears to be below the optical centre. To achieve optical satisfaction, this mathematical element has to be moved above the actual centre.

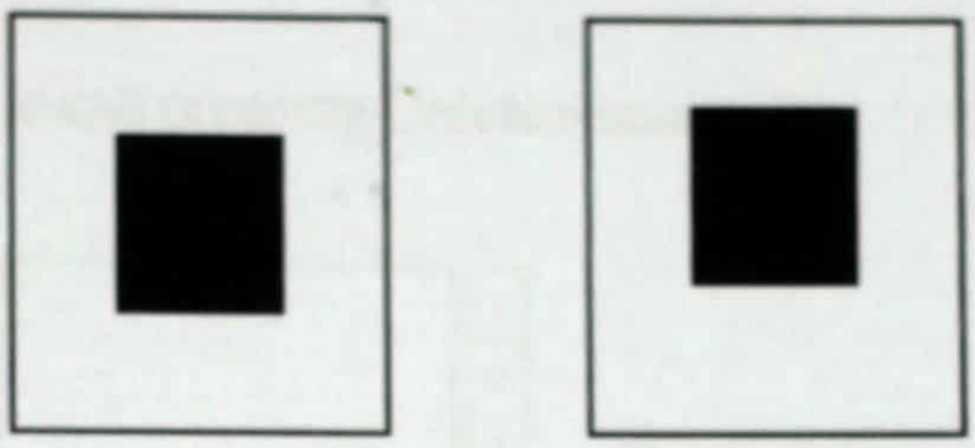


Fig 67: Actual and optical centre

The optical centre can be located by a mathematical approach when using the computer. To do this, divide the page or format into eight equal horizontal parts. A page or a format can be divided into eight equal parts using the Graph Paper tool. Open the Object flyout (which also contains the Polygon tool), and click the *Graph Paper tool* .

Type 0 in the first number box in the *Graph Paper Columns And Rows box* that appears on the Property Bar, since no columns are needed. Then type the number of rows needed (in this case 8) in the row number box in the Graph Paper Columns And Rows box on the Property Bar. Position the cursor at the top-right corner of the page or the format and drag diagonally to draw the grid. This would divide the page of format into eight equal horizontal parts as shown below

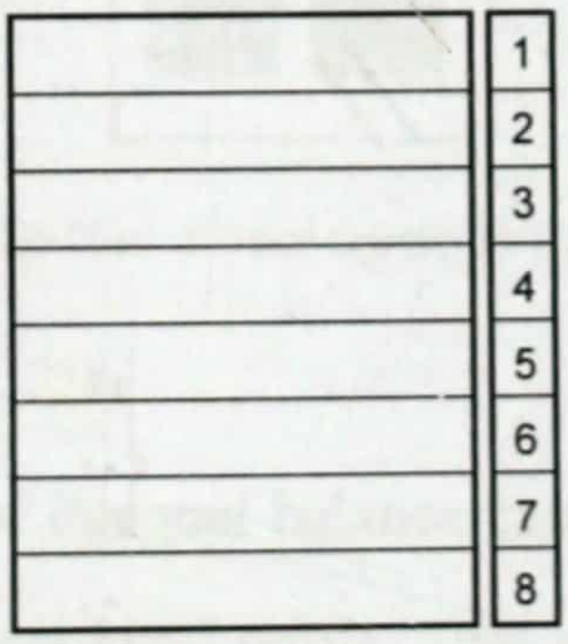


Fig 68: A format divided into 8 equal horizontal parts with the Graph paper tool

Mark the three-eighth line with a broken horizontal line and delete the grid.

(Clicking on a line and pressing Delete removes it).

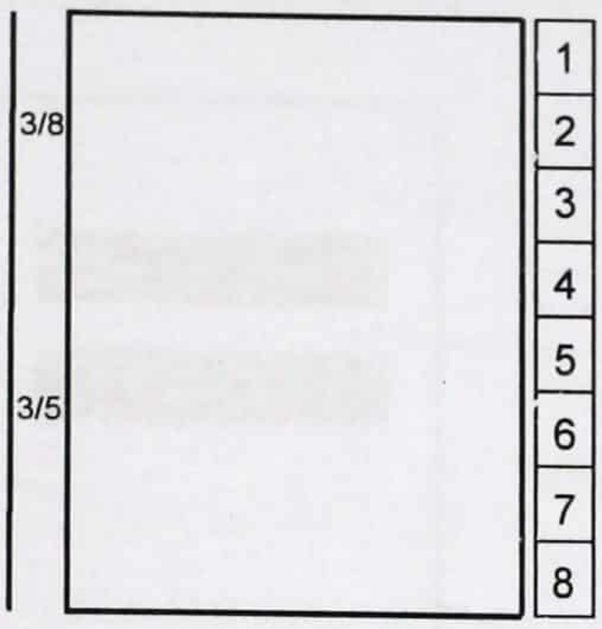


Fig 69: A format divided by optical centring

Then position the element on a line thee-eighth of the way from the top. As we can see from the above, actual balance is usually uninteresting and monotonous. Variously sized elements of type and illustrations need to be placed by moving, in such positions as to bring about a pleasing and optically balanced design (Lessel 1987).

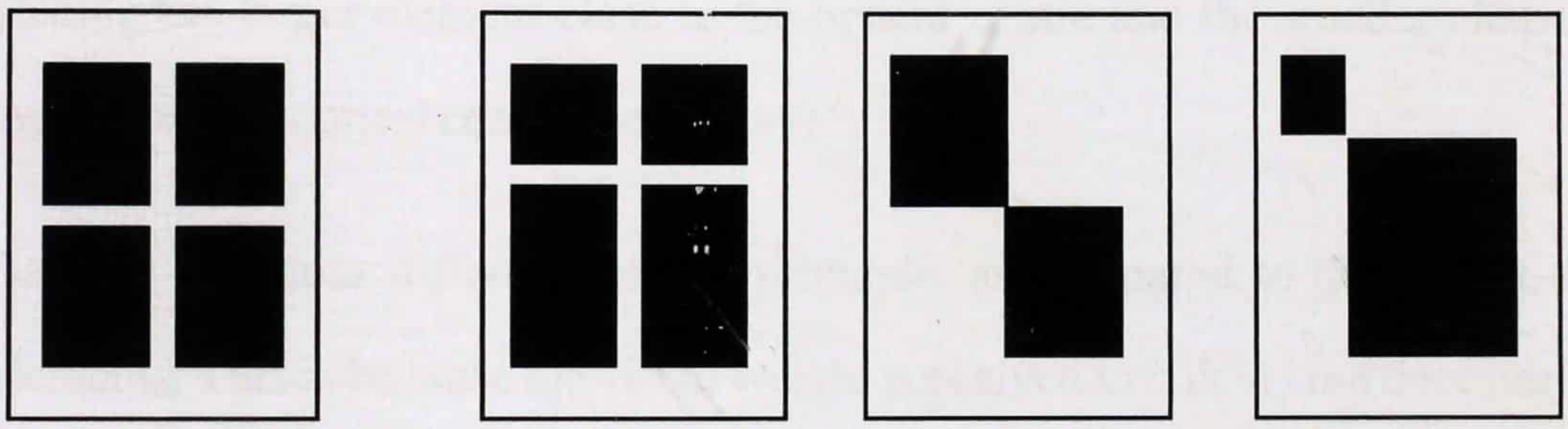


Fig 70a: Equal (symmetrical) and optical balance

The effectiveness of unequal balance can still be appreciated in a picture that evokes balance in practical terms. Two sacks of cocoa of equal size achieve balance by locating the same distance from the centre. This principle when

translated into a design is the same as placing two elements of the same value in equidistant positions from the optical centre.

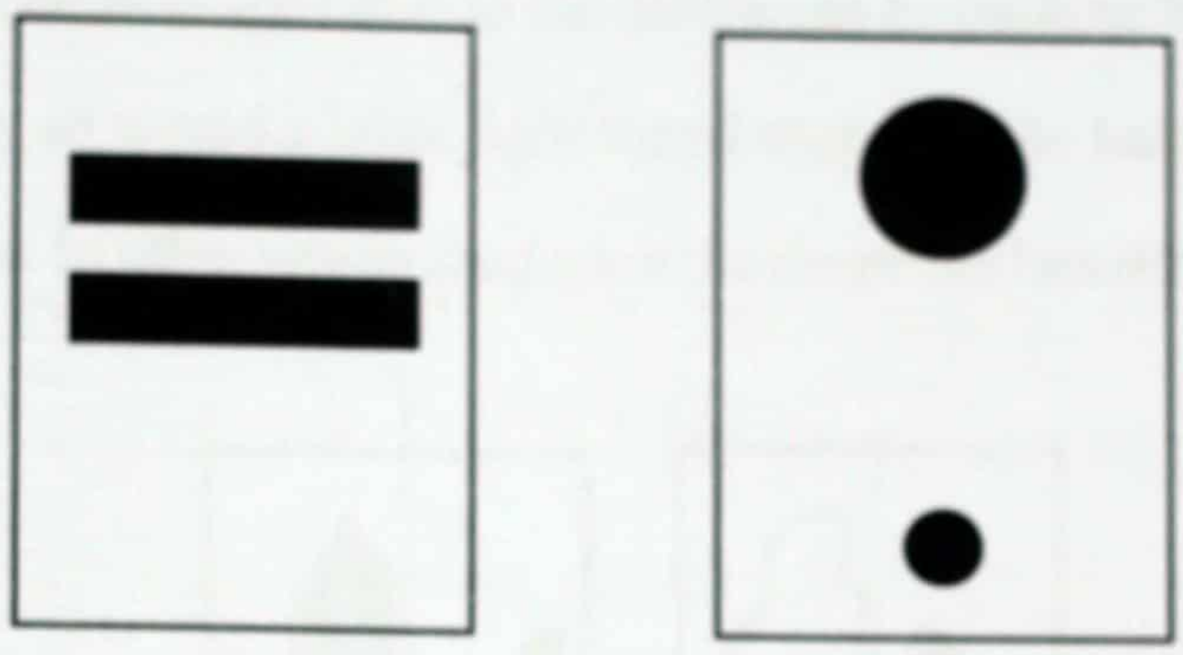


Fig 70b: Equal (symmetrical) and optical balance

The can be another image in which two sacks os cocoa of unequal size achieve balance, not by positioning at equal distances from the centre, but rather by unequal distances. To achieve this kind of balance, the larger sack would have to position himself nearer the centre, while the smaller sack is positioned further from the centre. This principle when translated into a design would mean placing the larger element close to the optical centre and the smaller element away from the optical centre. (see above)

Balance of colour differs a little in principle, as compared to the rest of the elements. This is because the visual weight perceived in colour not necessarily determined by the size of the object, as in a shape , line or dot. It is determined by the loudness or otherwise of the colours.

Balance in colour is therefore achieved through proper consideration and handling of contrast - the use of tone values. In other words, the functions of the principles of contrast and balance complement each other. Black and white for

instance is considered to be the most effective way of showing sharp contrast.

So just as a large shape close to the centre can be balance by a small shape close to the edge, so would a large light toned shape can be balanced by a small dark toned shape. In other words the darker the shape the heavier it appears to be.

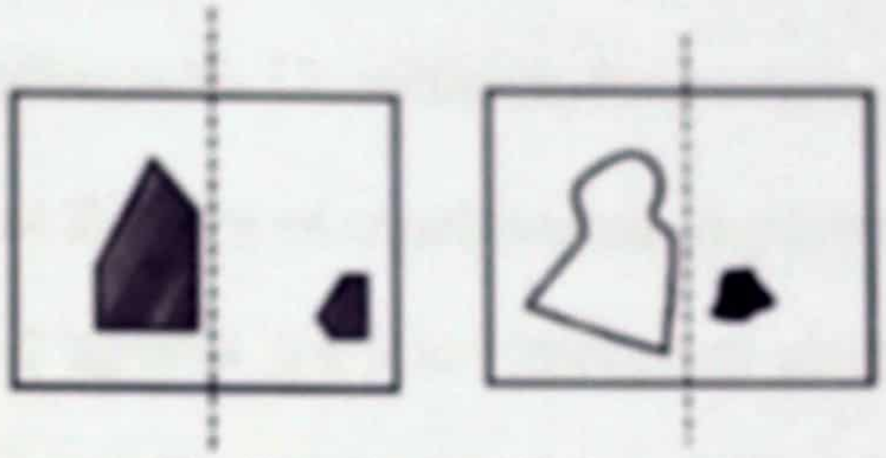


Fig 71: Optical Balance

A similar result can be achieved when cool and warm colours are handled in the same way. In this pursuit however, contrast in shapes need to be mentioned also, because when distinct shapes such as triangles, rectangles, etc, embody different colours, contrast, and for that matter balance can be achieved by varying sizes or shapes.

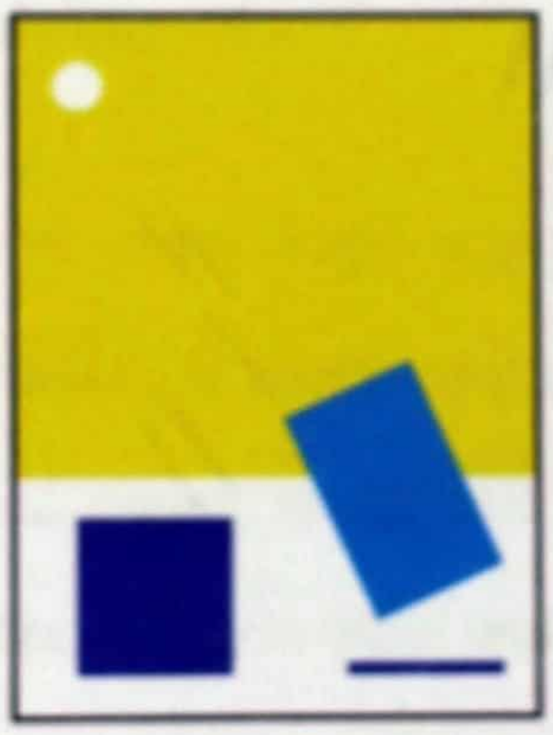


Fig 73: Balancing with colours

In the case of complex layout involving so many shapes in the forms of headings, type masses and illustrations or pictures, arrangement of the elements has to be considered not only in terms of the colours but also the sizes of the individual shapes.

We can conclude from the above that the skill of *selecting*, *sizing*, *moving* and *arranging* maybe important not only when we are dealing with the principle of Balance, but also other principles such as Dominance, Proportion, Movement, etc.

For instance all the processes involved in achieving good visual balance are applicable when dealing with Dominance, Proportion, Movement, etc.

Elements in a format that are of much visual importance need to be properly sized and positioned against the least important once so that the Dominance would be pleasant. Dominance therefore has to be handled within the framework of good proportion.

After all the major concern of proportion is the aesthetic and functional combination of the elements within a given design (Lessel 1987). And proportion is achieved by grouping elements in a manner that would make them interesting and harmoniously interrelated.

In illustration (a) below, the green shape occupies exactly half of the entire format. This obviously makes for monotony unlike in (b) where the same elements have been moved about, sized and rearranged optically to more interesting and pleasing proportions. In other words, the principles of proportion and dominance have been interplayed to achieve a much pleasing layout.

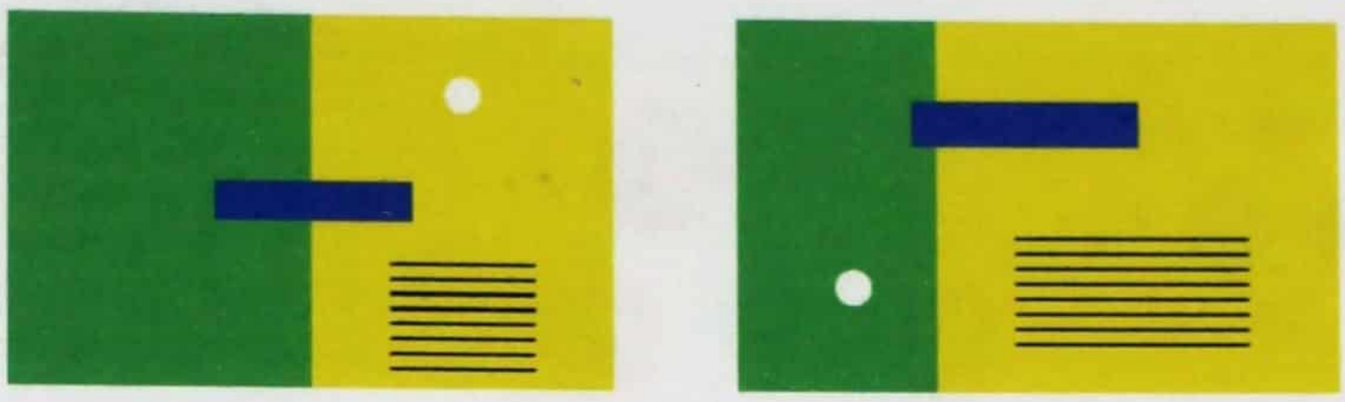


Fig 74: Equal and optical balance involving shapes, colours and text

It can also be observed from the above that similarity in the elements - shapes, dots, texture, colours, etc. - tend to create monotonous and uninteresting proportions. Meaning that even when dealing with proportions, variety need to be considered as well.

It follows that the basic approach to interesting and attractive proportion involves the determination of sizes in the elements in such a way that the eye does not readily recognize the similarity of the various elements.

The ability to move and size elements properly with the computer also helps in the creation of movement in a design.

Creating movement means stimulating action in a layout. It involves the arrangement of the elements in such a way as to direct the eye from the top through the entire layout, right to the bottom, or from left to right, etc. This is because the context as well as the direction or the position in which an object appears influences our perception of it. In Example 'A' of the illustration below, a B or an 8 is perceived depending on whether one reads the row of letters or the column of numbers. In Example B, the green circles are the same size but appear to be different sizes because of the context of the surrounding red circles.

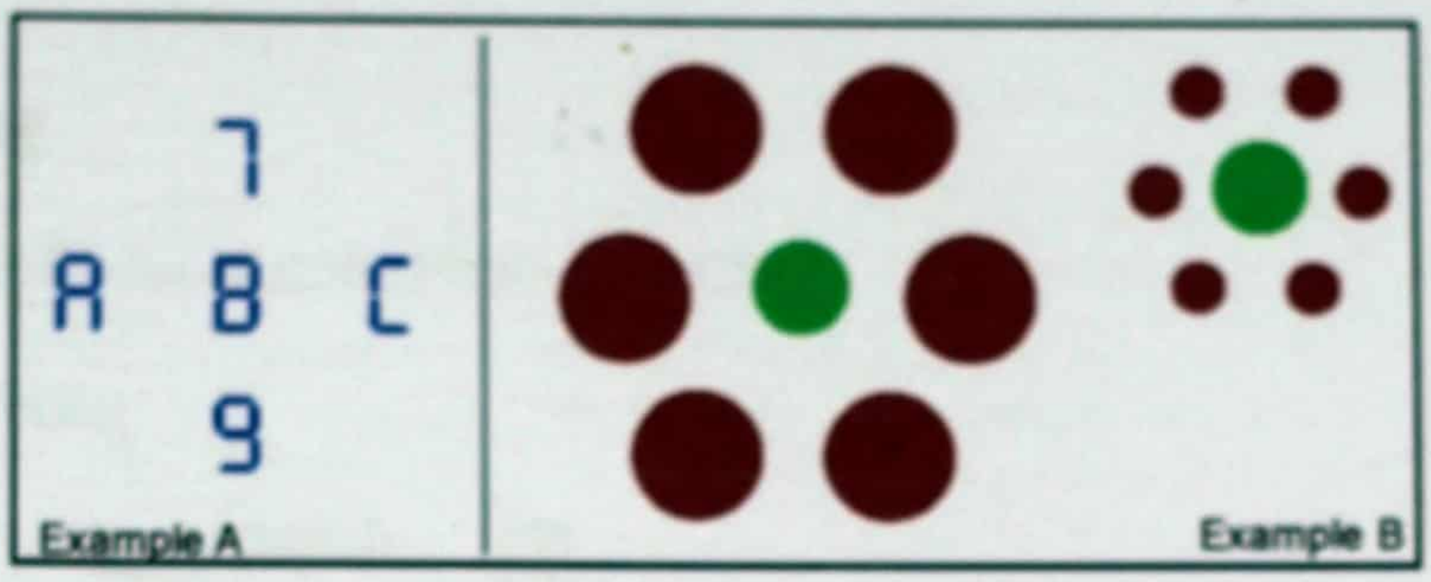


Fig 75: The effect of movement on the appearance of objects

This supports the importance of proper arrangements in a layout. If proper consideration is not given to how an object is sized or positioned, wrong emphasis would be given, wrong contrast would be created and the eye would move in the wrong direction on the layout. It becomes even more important when organising elements on the computer which provides a rather scaled down work area.

5.7.7 Painting

Software: Adobe Photoshop CS

Tools:

Airbrush

Smudge

Paintbrush

Eraser

The computer can also be used to paint. Even though the idea of painting with the computer (known as digital painting) has been around for quite a while, it is still a dream yet to materialize in Ghanaian secondary schools.

Contrary to the views held by some individuals about digital painting, the foundations of computer art are in traditional art skills, rather than filters or design techniques. As it would be shown later in this study, it is a very simple process, and a very few of the tools made available in the drawing and painting software programmes are really needed for painting with the computer. Once a few basic techniques have been noted down, the only limits are the amount of time and practice you commit.

The software for this section would be the Adobe Photoshop.

When the programme is opened, a series of icons would be seen spread down the left side of the screen just as we have in Corel Draw (see fig.3) Since this is an introductory exercise, activities would be based on a few of the tools .

The instructions that follow answers the question of how the object (call it a painting) at page 183 was created. The objective for the exercises therefore is enable students to create paintings similar to what follows, by following the exact procedure in this section. They would however have the option to make changes in the instructions, experiment with some other tools and create their own paintings.

The very first exercise after opening the programme is to choose "file" and then "new". This is because, Photoshop does not provide work area automatically as soon as the programme is opened. In the dialog box that appears supply the necessary information to determine the size of your work. See the figure below:

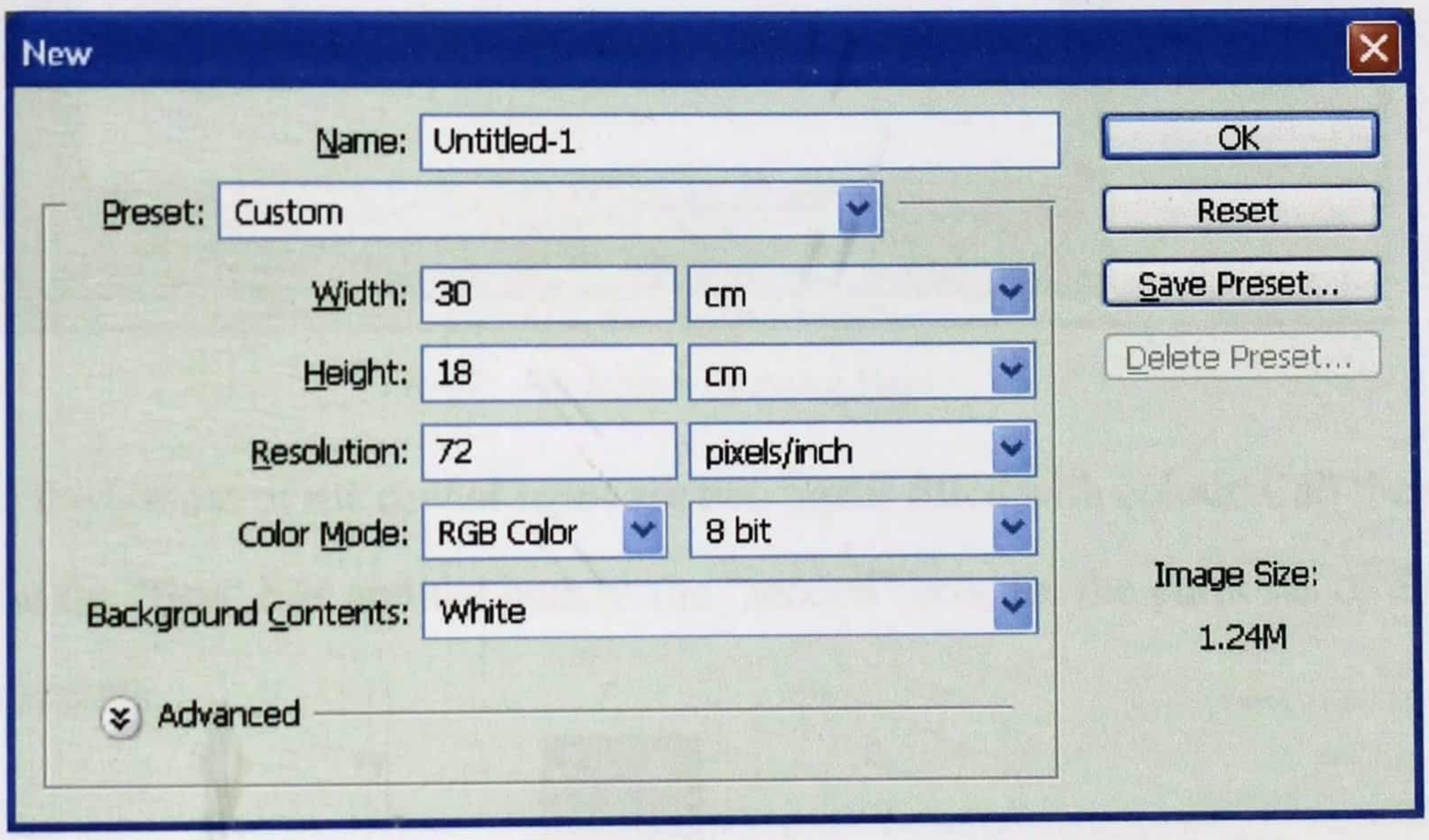


Fig 76: The New Page Dialog

In this particular example, the dimension given was 30 by 18 cm.

Once the blank canvas appears, go to "view" and select "fit on screen". This will enlarge the canvas to fit onto the screen. This is what is going to serve as the canvas for painting.

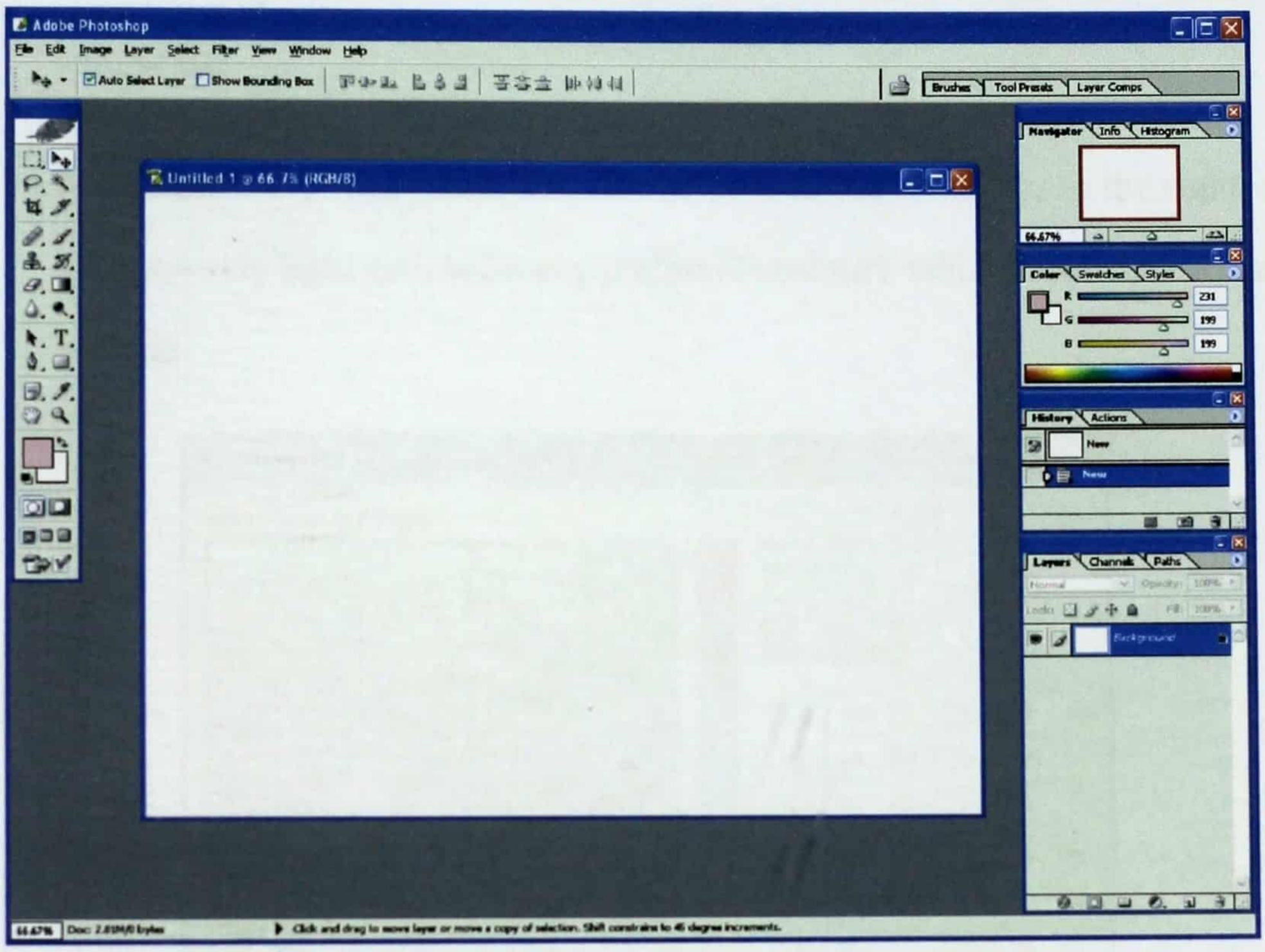
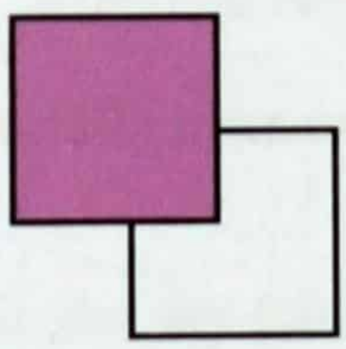


Fig 77: Photoshop Drawing Page

At the bottom of the row of icons are two boxes filled with colour. Call the top one the "first" box and the bottom the "second" box, for the purposes of these exercises.



Work primarily with the top colour box or the "first" box. When the top box is clicked, a large box filled with colour (similar to that of the Corel Draw Uniform

Fill Dialog box) will appear. There would be a small round circle placed somewhere in the large colour box. That round circle determines what colour would be obtained when OK is clicked. To the right of this box is a sliding scroll bar which can be rolled to select the areas of colour needed. i.e. Blue, red, yellow etc.

Now click the primary box and choose blue in the scroll bar to the right, then choose a very light yellow (or any preferable colour) which would be used at the horizon.

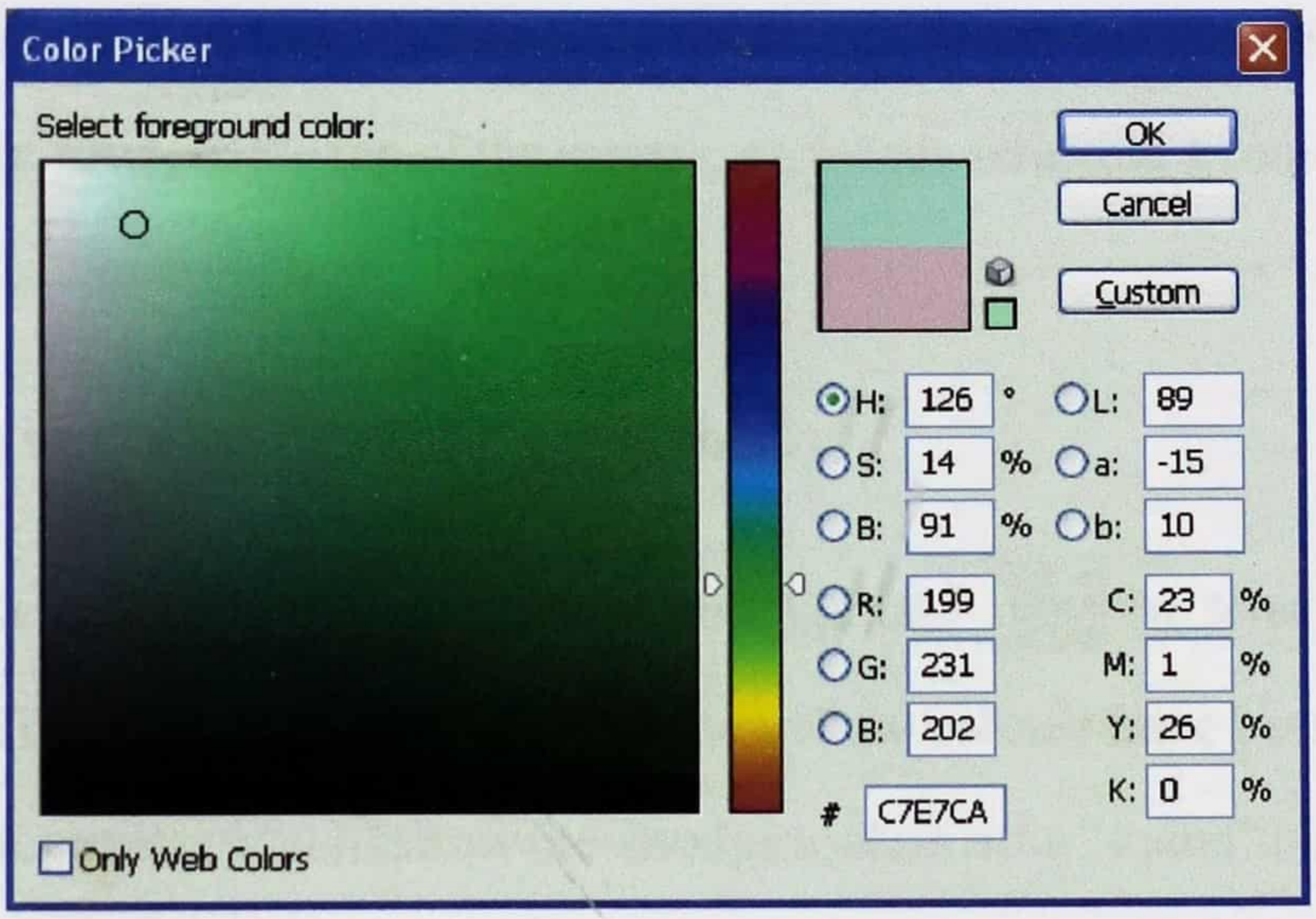


Fig 78: Photoshop Colour Picker Dialog

Click the Airbrush tool to select. Note that using the airbrush to apply the colour gives better result, especially in an exercise like this.

In order to have some action in the sky (since flat skies are not very interesting) apply the colour in short strokes as seen in the example below:

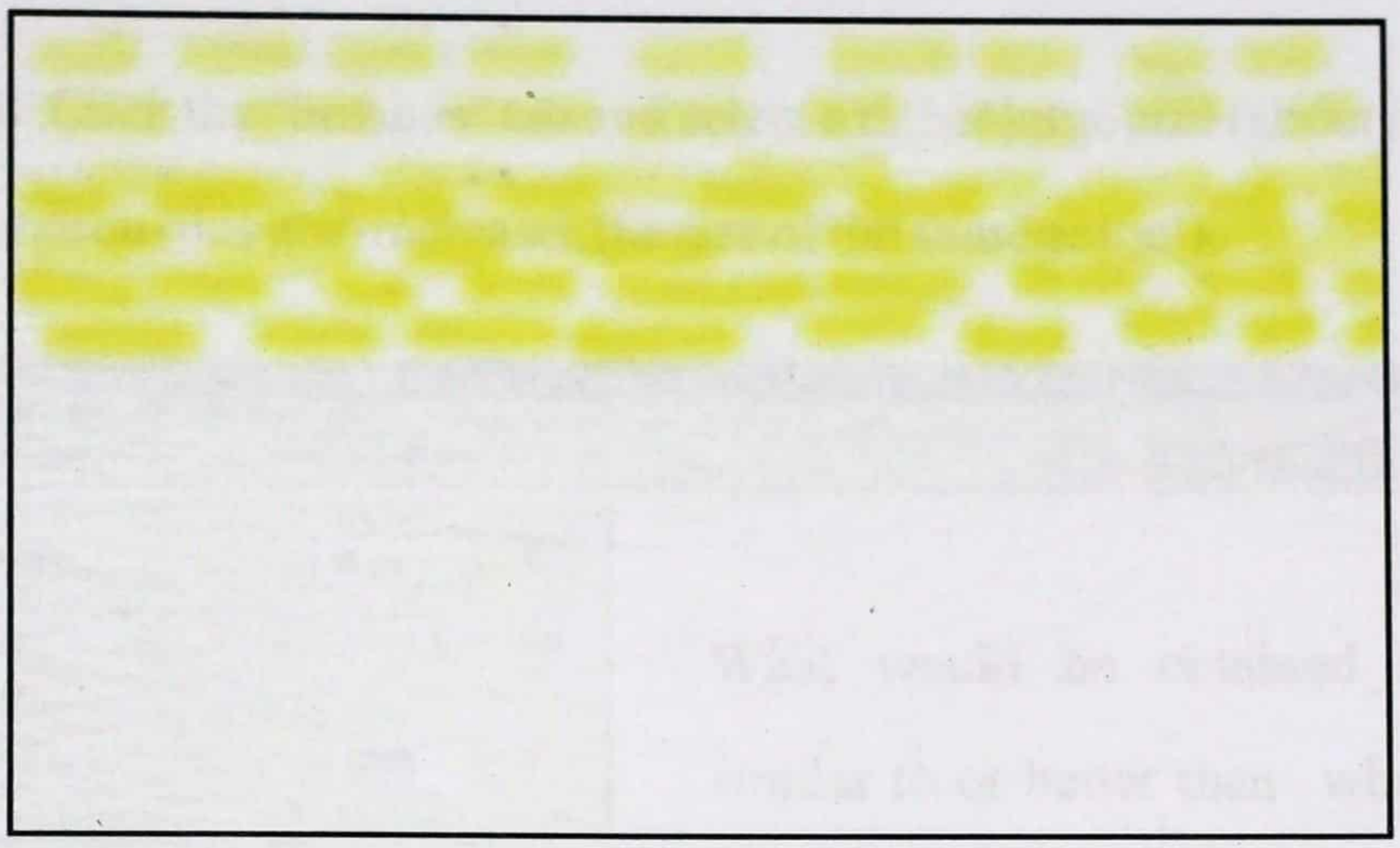


Fig 79: Painting Step i

Apply a couple of "rows" of this then select a some what darker yellow and do a couple of rows, to the top of the canvas, each time selecting a somewhat deeper yellow or the colour being used.

This is a way of building distance into the sky.

The next thing to do is to click on the "smudge tool" (to select it) and begin to work on the horizon. Click where the yellow colours have been applied and move the cursor (which is now the smudge tool) in little "round" circles and, just as paint would be applied with a brush. Care must be taken not to "pull" any of the dark down into the light colour. Work as long as necessary in order to "mix" the colour thoroughly. Overworking must however be avoided.

The last thing to do is to run the smudge tool across the sky to settle out the swirl marks being careful not to destroy "movement" in the sky. At the top left corner of the of the property bar the size of the brushes, smudge tool, etc, can be

selected. Click the "brushes" tab and select a rather large size (about size 19) for this operation (this also increases the size of the smudge tool).

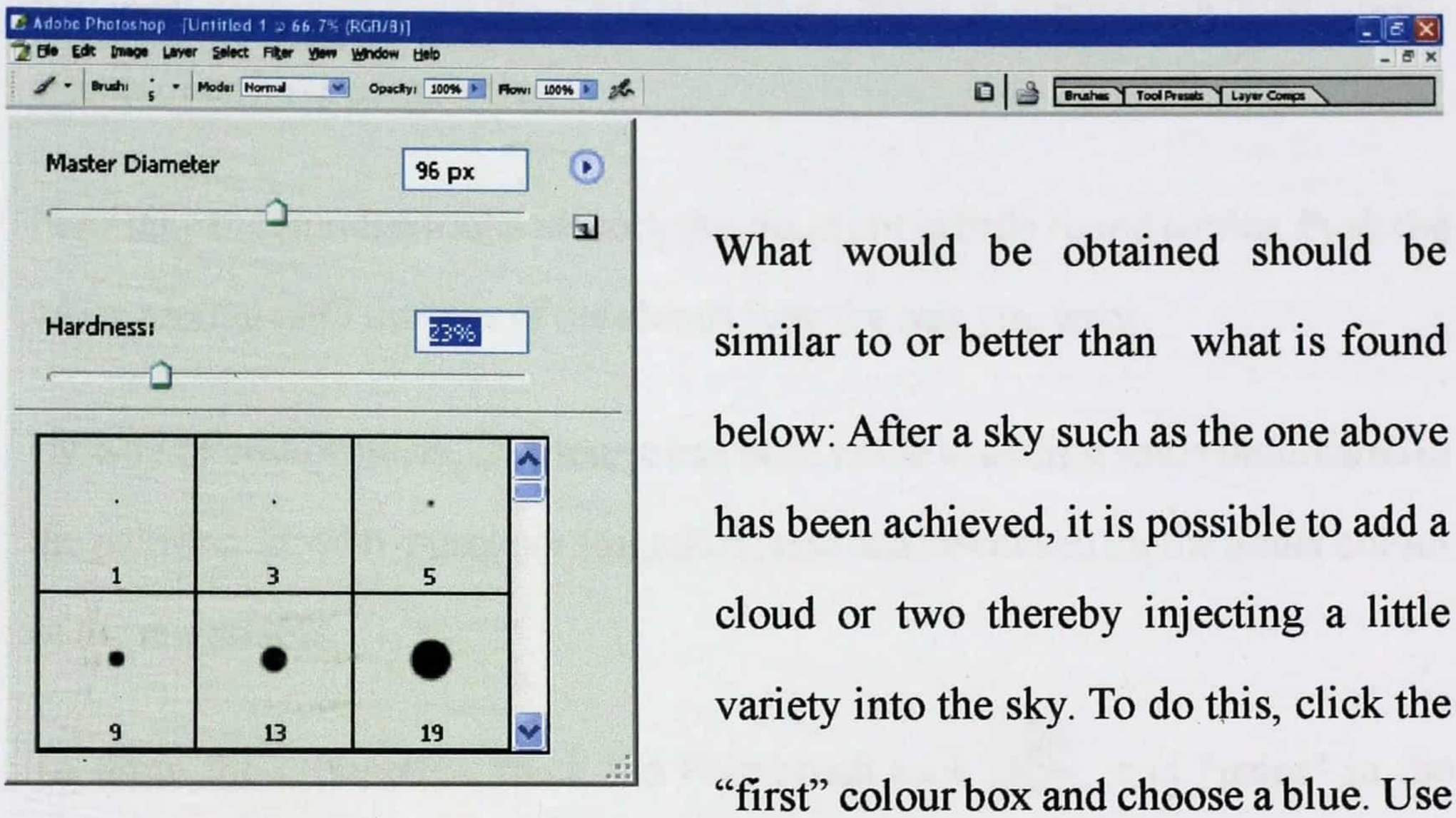


Fig 80: Photoshop Brush Size Dialog

What would be obtained should be similar to or better than what is found below: After a sky such as the one above has been achieved, it is possible to add a cloud or two thereby injecting a little variety into the sky. To do this, click the "first" colour box and choose a blue. Use the airbrush tool and spray some blue where a cloud is to be put.

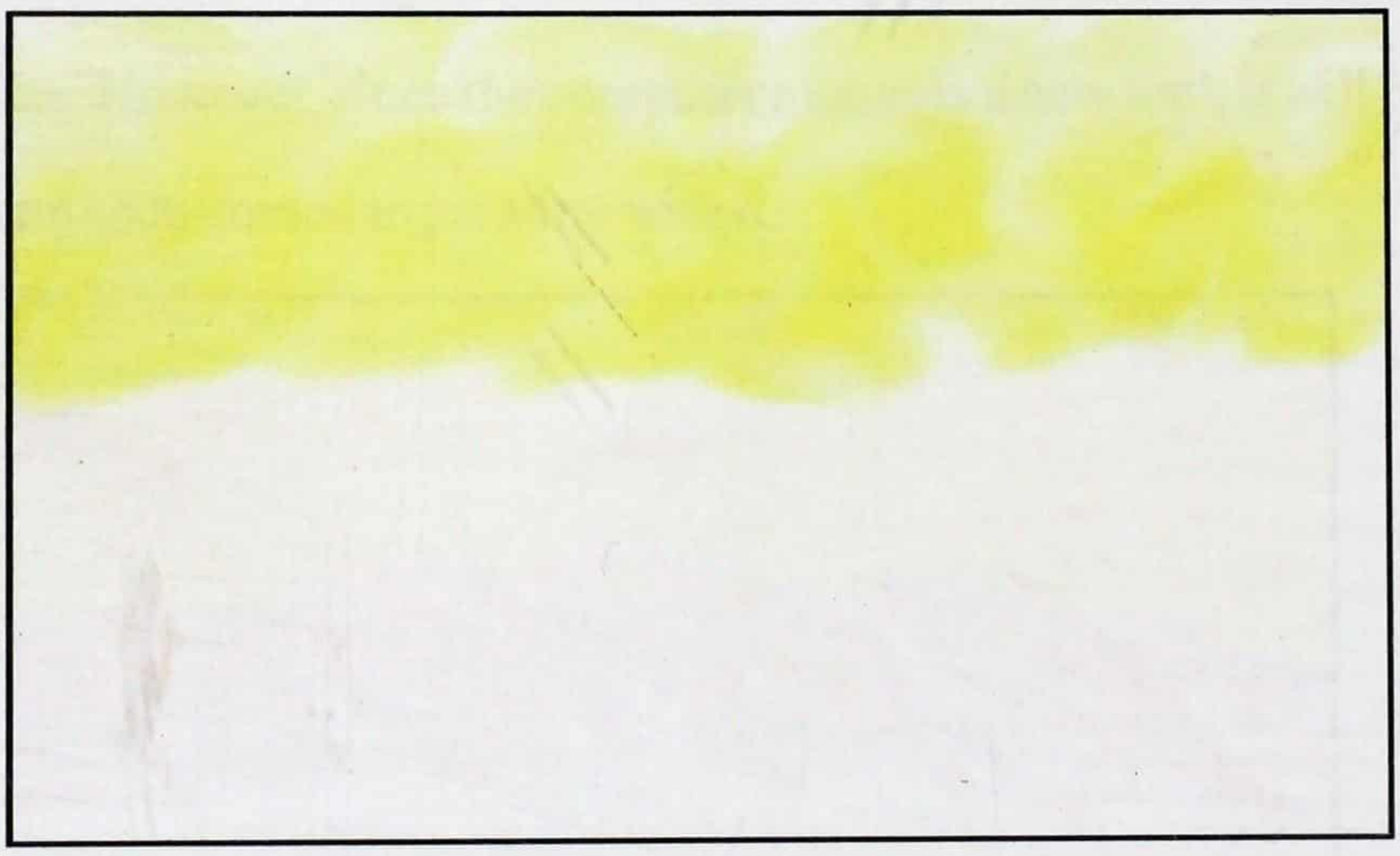


Fig 81: Painting Step ii

Cloud placement must be carefully chosen. A cloud should not be just thrown in.

Clouds are always more dramatic when they are placed next to the darker portion of the sky . It must also be noted that, if a cloud is put near the horizon, it will need to be smaller in order to maintain the sense of distance. In other words, clouds must have perspective.

Now take the smudge tool and work the cloud out in little round circles. Push the white around until the tops of the clouds look the way you want.

By way of composition, an attempt has been made at adding some mountains in the painting. Brown, purple or something else can be chosen for the under colour of the mountains.

To draw the mountains, click the Paintbrush tool and "paint" in the mountains as shown below. Once again, this must be done with the traditional way of using a paintbrush in mind. Of course the success of the drawing would not depend only on how good one can draw but also ones mastery over the use of the mouse. However, since the computer mouse is a new tool, it will take a while to become accustomed to painting with it.

Fig 82: Painting Step iii

The 'Brush size' may be changed to say 50% in size and at about 50% transparency

To make the mountains more interesting, choose a darker purple from the primary colour box (or lighter of the colour chosen for the mountains) for the light side of the mountains. Choose the paintbrush tool and choose the smallest brush size. Lay in some dark colour on the sides of the mountains where the light source will not hit them.

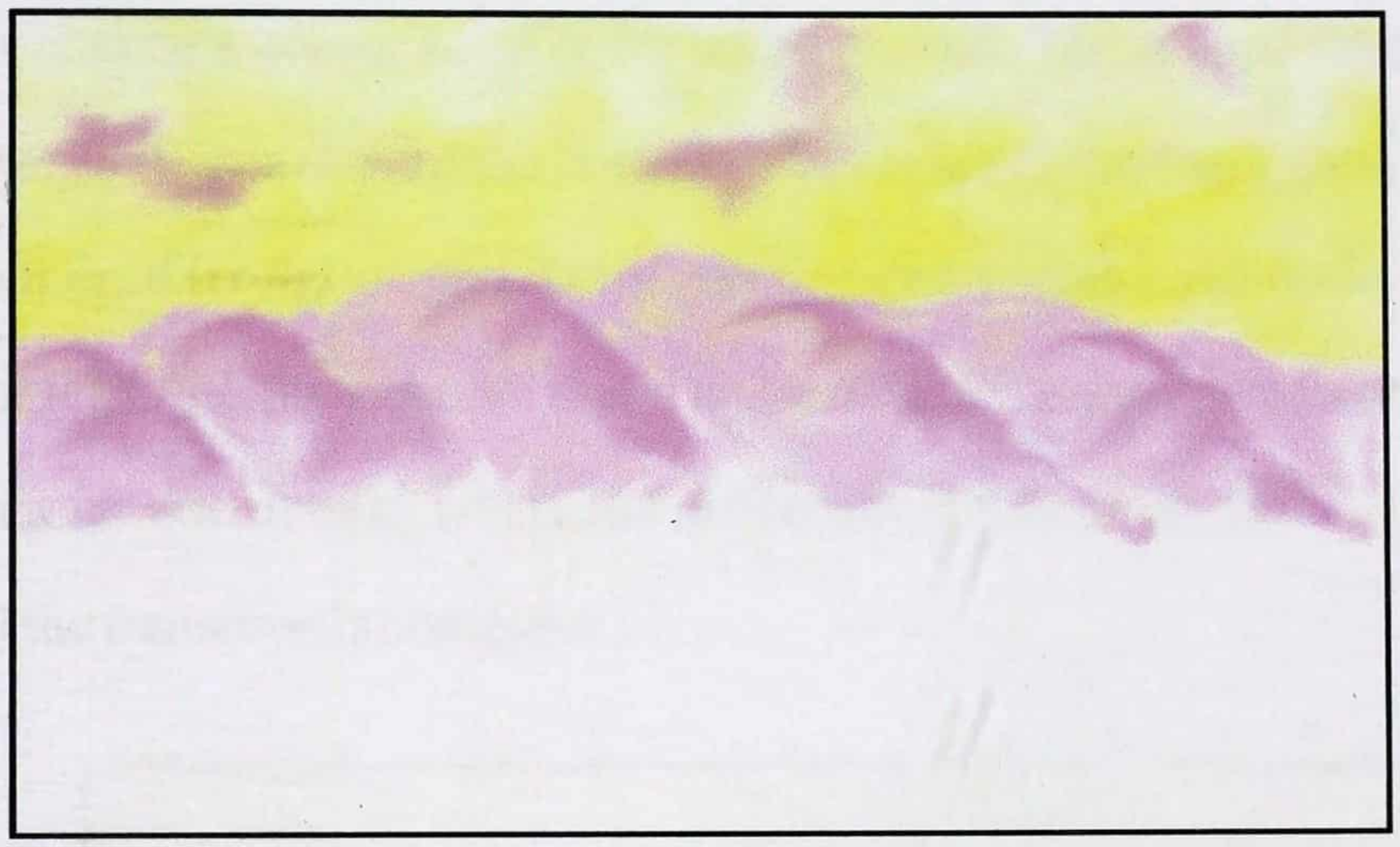


Fig 83: Painting Step iv

As with any kind of painting, some imaginative effects need to be applied. The following are some few that have been applied to the mountains.

Some dark spots have been left on the right side; flat spots and undulations have been made on the mountains; not all of the bottoms of the mountains end at the same level; after the dark colour has been lain in, the smudge tool is used to lightly smudge the colors together.

Fig 84: Painting Step v

Now choose a colour suitable for some ground. The ground ought to be made lighter as it goes toward the horizon. This means selecting lighter shades of the colour used for the ground as the painting progresses towards the horizon. First spray it in with the airbrush tool then smoothen it out with the smudge tool. Pay particular attention to where the different colours, meet and smudge that area until the transition is complete.

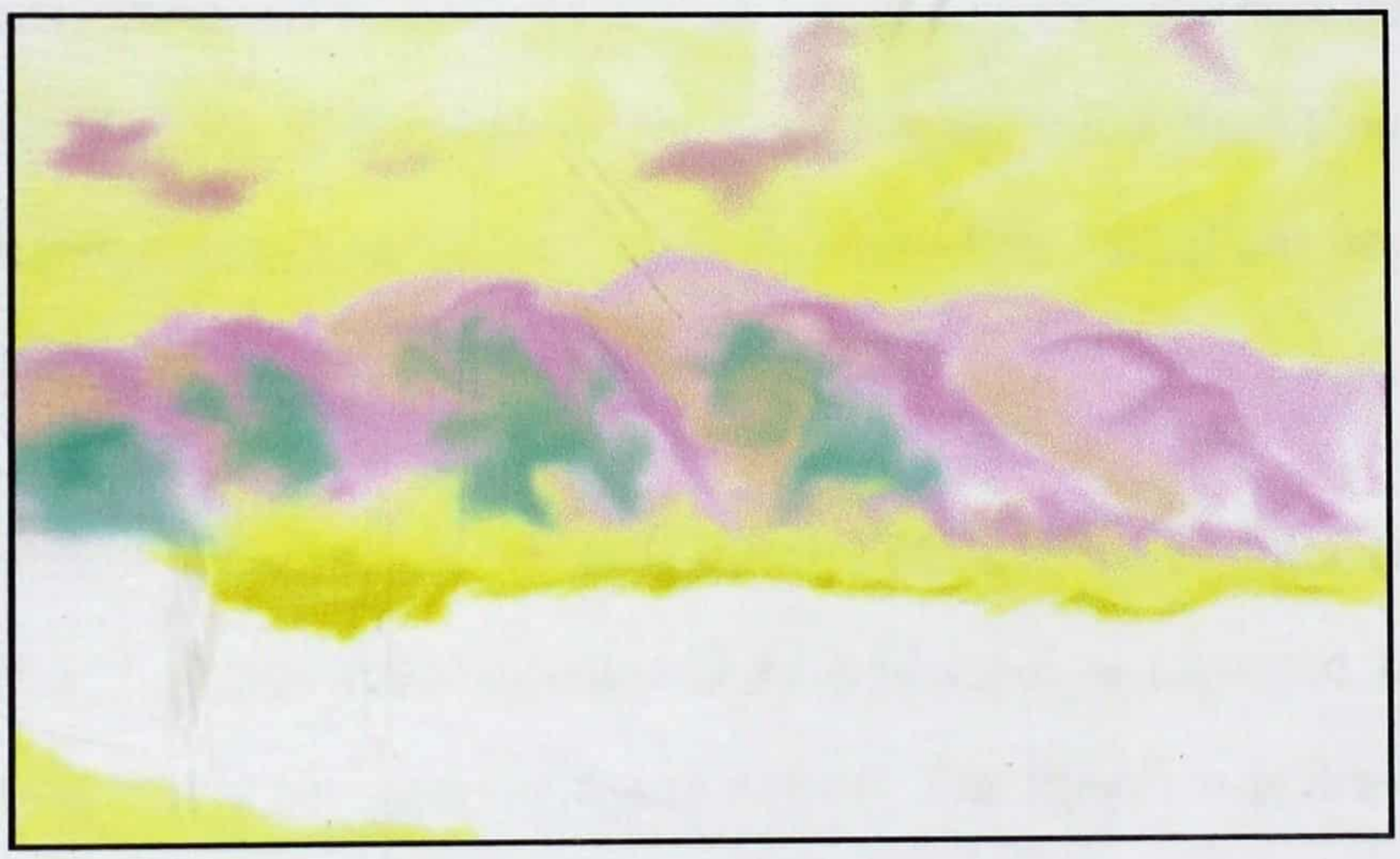


Fig 85: Painting Step vi

Bring the ground area down and add a shoreline with some of the same colour

that has been used to make the sky and the mountains. Remember it is good to repeat a colour for balance. A highlight or two can also be added. Again after each step use the smudge tool to "smooth" the area (see fig 85).

Fig 86: Painting Step vii

Now lay in some water just the same way as the sky but this time apply the strokes in horizontal streaks instead of the little circles. Again ensure that the water is lighter in colour next to the bank and darker as it advances forward. This keeps the feeling of distance in the work. Again, after the colour has been applied, use the smudge tool to "level" out the water. All of this has to be done across the canvas so as to lay the water down flat.

Now imaginations can be extended a little bit further. Some plants can be added Those found in this rendering may not be as pleasing as expected, but it can be enough for this study (see the figure above). The flower was drawn with the airbrush tool and the smudge tool.

Fig 87: Painting Step viii

The imaginary tree is quite simple. An outline was drawn first with the brush tool then leaves were added with a small airbrush.

Fig 84: Painting Step ix

The reflections are very simple too. Take the smudge tool, click a rather large brush size and grab the bottom of the green and pull straight down. For the reflections to "wave" in the water pass the smudge tool across the image! The paintbrush was used to add the white ripple at the shore line.