MULTIMEDIA

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MODULE 1 BASIC CONCEPTS IN MULTIMEDIA

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INTRODUCTION

Multimedia simply means numerous or multiple medium. The term medium implies the existence of a channel through which messages or information pass through. Multimedia therefore refers to multiple channels through which we can send, receive, present, store or perceive message or information.

When a teacher uses some sets of instructional materials such as the chalkboard, flash card, textbook, flannel board, graph paper, audiocassettes and videocassettes etc. What he simply does is to ensure effective teaching and learning of the subject matter.

DEFINITIONS

Multimedia has been defined variously by different scholars based on the technology available as per time dictum. We will examine some of these definitions:

Multimedia is media that uses multiple forms of information content and information processing (for instance audio, graphics, and video) to inform, entertain *or educate* the user (Access Developer Network).

Multimedia is a combination of text, animated graphics, video, and sound delivered to an audience which can be learners, listeners or viewers through electronic means (Batch elder).

In the words of Xie (1997), multimedia involed the computer-controlled integration of text, graphics, still and moving images, animation, sounds and any other medium where every type of information can be represented, stored, transmitted, and processed digitally.

Mayer (2001) defined Multimedia as presenting words (such as printed text or spoken text) and pictures (such as illustrations, photos, animation, or video). Multimedia refers to the combination of multiple media to effectively convey a message (Dorin & McCormack, 2000).

According to Marshall (2001), multimedia is concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.

Ayo (2001) d e f i n e d multimedia as the delivery of information in intuitive, multi-sensory ways, through integration of distinct media such as texts, graphics, computer

animation, motion video, and sound in a single presentation which is computer controlled.

Multimedia is the combination of a variety of communication channels for presenting text, graphics, audio and video with links and tools that allow users to interact, create, navigate and communicate (Elsom-Cook, 2001)

Multimedia refers to computer-based materials designed to be used on a computer that can display and print text and high-quality graphics, play pre-recorded audio and video material, and create new audio and video recordings (ICT4LT).

The concept of multimedia as observed from the various definitions above connotes three facts, namely:

1. **Presence of a message or information (content)**. The information could be a learning material, news, business presentation, awareness creation on some health, political, social issues, or entertainment etc.;
2. **Source and destination**, speaker and listeners, teacher and students, government and her citizens, business and its customers etc.;
3. **Communication channels (media) through which the information is passed**. These channels could be traditional means such as symbol, text, scrolls, spoken words, graphics drawing, pictures, illustrations and images, or they could be in electronic forms such as audiocassettes and radio presentations (audio), videocassettes and television presentations (videos), slides, computer PowerPoint, YouTube, graphics animation.

Therefore, multimedia is a medium with multiple content forms (combination of different media) having multiple content forms (combination of different content forms). In contemporary terms, it refers to electronic (digital and computer) representations of information (text, voice, still images, pictures and illustrations) and their interactive electronic presentations (text, audio, video, animation, and interactive content forms).

Benefits of Multimedia

Multimedia is used based on the following reasons amongst others:

i. it enhances effective presentations;
ii. it is an effective and flexible communication tool;
iii. it is conducive to cooperative work environment;
iv. it facilitates high retention rate, hence high recall of knowledge content;
v. its supports large audience;
vi. it encourages participatory learning through interactivity;
vii. it stimulates audience or learners interest in the subject; and
viii. it is easy to use, learn and understand.

Applications of Multimedia

A multimedia application is an application which uses a collection of multiple media sources e.g. text, graphics, images, sound/audio, animation and/or video.

Applications and delivery platforms of multimedia are virtually limitless. Multimedia finds its application in various areas including, but not limited to, e-commerce (advertisements, home shopping), education (hypermedia courseware), art and entertainment (video-on-demand, interactive TV, games, digital video editing and production systems), engineering, medicine, multimedia database systems, mathematics, business, scientific research, spatial temporal applications (World Wide Web, Video conferencing, Groupware, Virtual reality). Several examples are as follows:

1. **Simulations**: computer-based models of real-life situations or environments;
2. **Business Presentations**: used to sell products or ideas, can also serve to illustrate data analysis or trends;
3. **Computer Based Training**: type of education in which students learn by using and completing exercises with instructional software (also called Computer Aided Instruction CAI). CBTsoftware are generally flexible, time-wise, location-wise and customized teaching programs with instant feedback. They are self-paced study and one-on-one instruction;
4. **Courseware**: the name given to interactive CBT software which can be used to teach new skills, teach quicker and at a lower cost, and train for situations;
5. **Web Based Training** (WBT)/Distance Learning: same basic principle as CBT but delivery is via the web; Classroom and special education;
6. **Electronic Books**: a digital text that uses links to five the user access to information. E-book is a small book-sized computer that can hold up to 4,000 pages (10 books) worth of text and images. Electronic Reference (e-text) – a digital version of a reference book which uses multimedia to provide additional information;
7. **Multimedia Newspaper/ Electronic Magazine**: electronic version of a newspaper distributed via CD-ROM or the Web. E.g. The Punch etc;
8. **Virtual Reality (VR)**: the use of a computer to create an artificial environment that appears and feels like a real environment and allows you to explore a space and manipulate the environment;
9. **Kiosks**: a computerized information or reference center that allows you to select various options to browse through or find specific information (usually uses touch screen). E.g. Target's gift registry, Information centers at malls, hospitals, museums, airports etc.

Others include:

Commerce

Electronic commerce which is the process of buying, selling products and services and information on computer networks dominate most commercial platforms today. Advertising has gone through some laudable changes with the influence of multimedia. Sales presentations are being conducting with catchy and stimulating PowerPoint presentations which combine different forms of media content. Creative and advanced multimedia presentations are being combined with a variety of online methods (matching services, web services and advertising services of exchange) to reach business customers in business to business (B2B) marketing.

Education

In Education, multimedia is used to produce computer-based training courses (popularly called CBTs) and reference books and websites like encyclopedia, wikipedia and almanacs. A CBT lets the user go through a series of presentations, text about a particular topic, and associated illustrations in various information formats. Edutainment is an informal term used to describe

combining education with entertainment, especially multimedia entertainment.

Arts and Entertainment

Multimedia is heavily used in the entertainment industry, especially to develop special effects in movies and animations. Multimedia games are a popular pastime and are software programs available either as CD- ROMs or online. Some video games also use multimedia features. Multimedia applications that allow users to actively participate instead of just sitting by as passive recipients of information are called *Interactive Multimedia*.

Engineering and Industry

Software engineers may use multimedia in Computer Simulations for anything from entertainment to training such as military or industrial training. Multimedia for software interfaces are often done as a collaboration between creative professionals and software engineers.

In the Industrial sector, multimedia is used as a way to help present information to shareholders, superiors and coworkers. Multimedia is also helpful for providing employee training, advertising and selling products all over the world via virtually unlimited web-based technologies. Creative industries unse multimedia for a variety of purposes ranging from fine arts, to entertainment, to commercial art, to journalism, to media and software services provided for any of the industries listed below. An individual multimedia designer may cover the spectrum throughout their career.

Mathematical and scientific research

In mathematical and scientific research, multimedia are mainly used for modelling and simulation. For example, a scientist can look at a molecular model of a particular substance and manipulate it to arrive at a new substance. Representative research can be found in journals such as the Journal of Multimedia.

Medicine

In Medicine, doctors can get trained by looking at a virtual surgery or they can simulate how the human body is affected by diseases spread by viruses and bacteria and then develop techniques to prevent it.

Document Imaging, Digital Publishing and Library

Document Imaging is a technique that takes hard copy of an image/document and converts it into a digital format

Spatial Temporal Applications

Video conferencing (web conferencing) is a virtual meeting in which participants in one location can see and interacts with participants at other locations separated by geographical distance but which is facilitated by digital technology capable of linking various types of computers across different networks.

Groupware are software products that support collaboration over networks among groups of people who share a common task or goal.

Virtual reality is a system that delivers interactive computer-generated 3D graphics to a user through a head-mounted display.

CLASSIFICATION OF MULTIMEDIA

Multimedia may be broadly divided into:
LINEAR and **NON-LINEAR** categories. Linear active content progresses without any navigation control for the viewer such as a cinema presentation. Non-linear content offers user interactivity to control progress as used with a computer game or used in self-paced computer based training. Hypermedia is an example of non-linear content.

Multimedia presentations can be **LIVE** or **RECORDED**. A recorded presentation may allow interactivity via a navigation system. A live multimedia presentation may allow interactivity via an interaction with the presenter or performer.

Multimedia presentations can be in electronic forms and in printed form.

MULTIMEDIA DATA ELEMENT

The following multimedia data elements and their various forms are described below:

1. **Text:** This is any of the signs or symbols that are used in writing or printing and which represent a speech sound. Text mode refers to alphanumeric or character operation mode which computer uses in displaying letters, numbers and other text characters.

2. **Facsimile (or Fax):** A letter or a message that is sent in electronic form down a telephone line and then printed using a special machine called Fax Machine.

3. **Document Images:** These are electronic versions of printed images which are captured and converted through electro photographic process.

4. **Photographic Images:** This refers to the production of permanent images by means of the action of light on sensitized surfaces.

5. **Geographic Information Systems Maps:** A geographical information system (GIS) is a computer system that synthesizes, analyses and displays many different types of geographical data in an easily understandable form. Geographical maps are now being made from computer databases. Such digital maps combine and clearly display different kinds of information (e.g. census, pollutions, minerals, political affinities, residential patterns etc) for a given geographical area.

6. **Voice Commands and Synthesis:** Voice is the sound (phonation) produced in the voice box (larynx) by the expiration of air through vibrating vocal cords. It is defined in terms of pitch, quality, and intensity or loudness. Voice command is the use of words and syntax of spoken language to operate or control the computer. Voice synthesis refers to the ability of a

computer to produce spoken words.

7. **Audio Messages:** These are sounds which are recorded and probably broadcasted. Sound is physical phenomenon that stimulates the sense of hearing; and in human beings, hearing takes place whenever vibrations of frequencies between about 15 and 20,000 hertz reach the inner ear.
   Electronic circuits provide different functions to process audio signals into from analogue to digital form and verse versa. Digital functions include the coding, storage an d transmission of information-bearing in binary form, and the logic operations and numerical processing performed in computers.

8. **Music:** This is the organized arrangement and movement of sounds made by instruments or voices through a continuum of time in a pleasant or exciting way.

9. **Graphics:** This describes the process of information (objects, images, people, data distributions, statistics etc) representations through drawing, pictorial illustrations, tables, charts. The computer screen is divided into pixels which made it possible for lines and characters to be drawn pixel by pixel on the computer screen. A pixel (picture element) is the smallest unit $(1\ 1000th)$ tiny spots of an image in a grid display on a computer screen.
   Animated graphics produces the illusions of movement in graphic images using some. In a computer, it is the simulation of movement produced by displaying series of successive images on the screen.

10. **Full-Motion and Video:** This is the art of making motion-picture films (telling a story using sound and moving pictures) and projecting such films onto a screen for a large audience. Video is the process of recording and showing pictures along with sounds on television.

11. **Holographic Images:** These are 3D photographic images obtained using a lensless photography technique called Hologram. Holograms are made by exposing a piece of film to laser light, which is scattered by the object being holographed.

12. **Fractals:** These are geometric shapes that are complex and detailed in structure at any level of magnification.

CATEGORIZATION OF MULTIMEDIA DATA

Multimedia data element can be categorized as presented in the table below

Category		**Description**
1.	Nature /Media	Captured from real world
		Synthesized by computers
2.	Spatial-temporal properties	Discrete: space-based only
		Continuous Space-based and time based E.g. animation, motion, video etc.

Source: Winter 1997

HISTORY OF MULTIMEDIA

This section presents an overview of the pioneering works through to the contemporary contributions of people that have over many centuries labour to bridge the divide between the arts, science and technological disciplines. We shall study the work and ideas of artists who have explored new interactive and interdisciplinary forms, as well as engineers and mathematicians who have developed information technologies and influential scientific and philosophical ideologies that have influenced the arts.

This broad historical analysis will help illuminate an understanding of the emerging digital arts and its aesthetics, strategies, trends, and socio- cultural aspirations. Central to this analysis will be an understanding of key concepts for the interpretation of evolving multimedia forms: including integration, interactivity, hypermedia, immersion, and narratives.
Some of the important events in relation to Multimedia in Computing include:

Dates	**Events**
15,000 - 13,000BC	Prehistoric humans paint images on the walls of their caves
1895	Gugliemo Marconi sent his first wireless radio transmission at Pontecchio, Italy
1901	Gugliemo Marconi detected radio waves beamed across the Atlantic. Initially invented for telegraph, radio is now a major medium for audio broadcasting. Television was the new media for the 20th century. It brings the video and has since changed the world of mass communications.
1906	Color photography became practicable concept.
1914	Silent movies incorporated multiple media by using film and text captions together
1928	Walt Disney debuts the second short starring a mouse named Mickey, and the first cartoon to use synchronized sound.
1928 – 1931	Movies with sound replace silent movies
1930s	Technicolor is introduced in film and most movies are filmed in colour after
1937	Bell Laboratories had a breakthrough in creating dual sound tracks on film.
1940	Fantasia was the first commercial movie with a complete surround soundtrack in movies.
1945	Vannevar Bush wrote about Memex “As We May Think”
1960s	Ted Nelson, created Xanadu, “a universal instantaneous hypertext publishing network”.
1967	Nicholas Negroponte formed MIT Architecture Machine Group (later in 1985 MIT Media Lab opens).

1969	Nelson & Van Dam hypertext editor at Brown. Birth of Arpanet (Internet) by US Military. DARPA
1971	The first E-mail was sent and received successfully,
1976	Negroponte's Architecture Machine Group proposed Multiple Media to DARPA.
1977	Apple starts to gain control of the PC market with its Macintosh Computers.
1980	Lippman & Mohl: Aspen Movie Map.
1981	IBM PC announced and captures market share in 18 months..
1983	Backer's Electronic Book was launched.
1985	Negroponte & Wiesner opened MIT Media Lab.
1987	RCA's David Sarnoff Labs' announce Digital Video Interactive.
1988	Apple "Knowledge Navigator" vision
1989	Tim Berners-Lee proposed the World Wide Web to CERN (European Council for Nuclear Research).
1990	K. Hooper Woolsey, Apple Multimedia Lab opened.
1991	Motion Picture Experts Group. World Wide Web debuts thanks to Tim Berners-Lee. Apple Multimedia Lab launched Visual Almanac, Classroom MM Kiosk.
1992	MS Windows 3.1 is released HTML debuts The first M-bone audio multicast on the Net also debuts.
1993	The first graphical browser called MOSAIC which allows us to view web pages containing IMAGES was launched by Marc Andreessen, Erin Brina &Tim Clark at University of Illinois National Center for Supercomputing Applications (NCSA).
1994	Jim Clark and Marc Andreesen launched Netscape Creation of World Wide Web Consortium (W3C) The Rolling Stones become the first major band to broadcast a live performance over the Internet.
1995	Disney releases Toy Story, the first feature length computer generated movie (77 minutes long, 4 years to make, 800,000 machine hours to render). JAVA for platform-independent application development launched.
1996	Portable Network Graphics (PNG) was launched.Microsoft, Internet Explorer was launched. Affordable digital cameras widely available.
1997	HTML 4.0
1998	XML 1.0 Google Search Engine operates by Larry Page & Sergey Brin was launched.

1999	XSLT 1.0 and Xpath 1.0 Napster debuts, allowing users to download and share MP3s.
2000s	Integration of computer, memory storage, digital datacamcorders, MP3 players, IPods, speakers, telephones, HD TV and other technologies explodes.
2001	MPEG-7, JPEG 2000, SVG.
2002	Intellectual property and JPEG 2000

The **MULTIMEDIA COMPUTER (MPC)** was the next major landmark in the history of multimedia, appearing in the early 1990s. The MPC was a breakthrough in terms of its compactness, price and user-friendliness. Most PCs that are currently available can be classified as multimedia computers. These following **components** are essential features of an MPC:

- a soundcard
- twin loudspeakers or a set of headphones
- a microphone
- a CD-ROM drive - but modern MPCs are likely to be equipped with a combination CD-ROM / DVD drive as standard.

There were earlier computers that qualified as multimedia computers, e.g. the **Apple Mac** and the **Acorn Archimedes** in the UK, but the dominant multimedia computer is the MPC. Apple computers appear to have a commanding position in the print and graphic design industries, while Acorn computers only ever gained a foothold in the UK schools sector and finally lost their market share to the MPC.

Now we have **multimedia on the Web**. It's a growing area but has not yet completely supplanted CD-ROM or DVD technology. Web-based multimedia may offer more in terms of **presentation** rather than **interactivity**, and broadband access is essential in order to avoid hiccups in delivering sound and video.

UNIT 2 HYPERMEDIA

CONTENTS

INTRODUCTION

Multimedia components are used in combination with the interactive and hyperlink features.

DEFINITIONS

Hyperlinking is an index which allows for jumping around to different sections of electronic documents such as e-books, webpages, etc.

Hyper Text Mark-up Language (HTML) has features that allow a person to build hyperlinks to other webpages or location on the same page.

Hypertext is a text which contains links to other texts and is therefore usually non-linear. It is the general term applied to 'clickable' text. Once a user click on a word or words, he is then taken to a different document or another area of the current document.

HYPERMEDIA

Hypermedia refers to multimedia systems that include nonlinear structure of information units, events, and discrete media. Hypermedia can be considered as one of the multimedia applications which combined materials in many media—text, graphic art, sound, video and animation; are delivered via digital computer or other electronic means, and provides a linked structure through which a user can navigate through elements.

Hypermedia is a general term applied to 'clickable' media. Once a user clicks on a particular word or graphic, he is then taken to other text, graphics, sound files, animation or moving video. The World Wide Web is a classic example of hypermedia, whereas a non-interactive cinema presentation is an example of standard multimedia due to the absence of hyperlinks.

Most modern hypermedia is delivered via electronic pages from a variety of systems including Media players, web browsers, and stand- alone applications. Audio hypermedia is emerging with voice command devices and voice browsing.

Hypermedia development tools

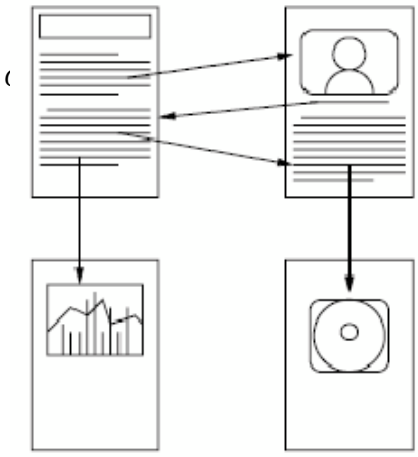
Hypermedia may be developed in a number of ways. Any programming tool can be used to write programs that link data from internal variables and nodes for external data files. Multimedia development software such as Adobe Flash, Adobe Director, Macromedia Authorware, and MatchWare Mediator may be used to create stand-alone hypermedia applications, with emphasis on entertainment content. Some database software such as Visual FoxPro and FileMaker Developer may be used to develop stand-alone hypermedia applications, with emphasis on educational and business content management.

Hypermedia applications may be developed on embedded devices for the mobile and the Digital signage industries using the Scalable Vector Graphics (SVG) specification from W3C (World Wide Web Consortium). Software applications such as Ikivio Animator and Inkscape simplify the development of Hypermedia content based on SVG. Embedded devices such as iPhone natively support SVG specifications and may be used to create mobile and distributed Hypermedia applications.

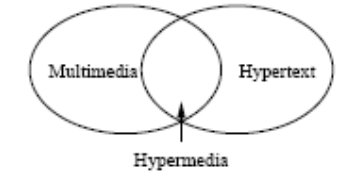
Hyperlinks may also be added to data files using most business software via the limited scripting and hyperlinking features built in. Documentation software such as the Microsoft Office Suite allows for hypertext links to other content within the same file, other external files, and URL links to files on external file servers. For more emphasis on graphics and page layout, hyperlinks may be added using most modern desktop publishing tools. This includes presentation programs, such as Microsoft Powerpoint, add-ons to print layout programs such as Quark Immedia, and tools to include hyperlinks in PDF documents such as Adobe InDesign for creating and Adobe Acrobat for editing. Hyper Publish is a tool specifically designed and optimized for hypermedia and hypertext management. Any HTML Editor may be used to build HTML files, accessible by any web browser. CD/DVD authoring tools such as DVD Studio Pro may be used to hyperlink the content of DVDs for DVD players or web links when the disc is played on a personal computer connected to the internet.

Hypertext

In contrast to traditional document, hypertext and hypermedia have as their major property, a *non-linear information link*. A hypertext structure is a *graph*, consisting of nodes and edges. The nodes are the actual *information units*. The edges provide *links* to other information units. One can *navigate* through a document by clicking the edges (arrows or links). The root of the arrows are known as *anchors*. The links serve as a navigation aid allowing users to access information quickly and to navigate from one topic to another in a nonlinear manner.



Hypertext refers to a document containing purely text, or sometime some images but no continuous media, with non-linear links, while there have been a number of hypertext systems before the recent bloom of World Wide Web, e.g., Apple's Hypercard.



Document Structure

Document structure is the logical organization of the information, i.e., the *contents*. Traditional documents, such as a book, may contain only text and still images. They can be organized linearly. The logical structure will be, for example, chapters, sections, subsections, paragraphs. When documents are exchanged, everything about the document has to be transferred. These include the contents, the structure and the presentation. Therefore, it requires some way of describing the structure and the presentation of the document along with the contents.

Document Markups

When exchanging hypertext documents, we need to transfer the contents as well as the structure and the presentation of the documents. Document markups allow us to specify the document structure and how it is presented by inserting commands into the document. These are known as *markups*. There are in general two kinds of markups: a) *logical* and b) *visual*.

The logical markups marks the document elements according to their functions and relations with other elements, e.g., chapter, section, paragraph. It does not tell how the elements looks. The advantages of logical markups are:

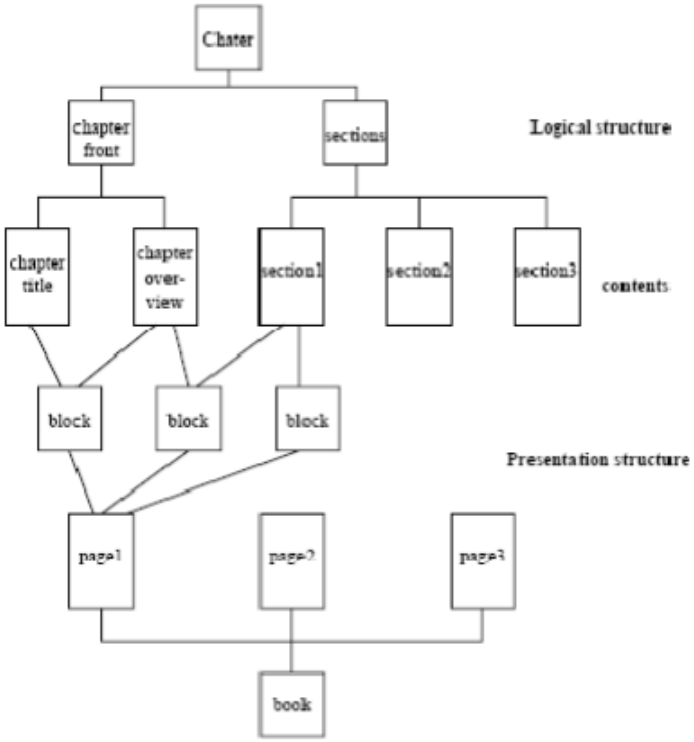
- The document structure is explicit, thus the organisation of information is clear.
- It is easy to maintain the consistent look of the document.
- It requires a more powerful process to render the document.

The visual markups defines how the elements are rendered, for example, a chapter title is formatted in Helvetica Bold 24 point, while a section heading is formatted in Times Roman Bold 20 point. With visual markup, the logical structure is lost. The visual

effects of the elements are explicit.

- It is easier to keep the fidelity.
- It is easier to render the document.
- It is hard to maintain the consistent look of the document.

A document can be viewed in these two aspects at the same time. In the diagram on the right, if we start from the top, we will see the logical structure of a document. If we start from the bottom, we will see the presentation aspect of the document.



Hypermedia can be thought of as one of the multimedia applications which combined materials in different media—text, graphic art, sound, video and animation. Hypermedia applications are delivered via digital computer or other electronic means, and provides a linked structure through which a user can navigate through elements.
of the information

UNIT 3 INTERACTIVE MULTIMEDIA AND METAMEDIA

CONTENTS

INTRODUCTION

Interactive multimedia implies allowing an end user some control over what elements to present and when. Thus, it allows user-response to *alter* the way the presentation proceeds. For someone to truly learn how to use a program or a product, it's essential that they actually use it. Interactivity allows each user to actively participate in the viewing process, instead of passively watching the material presented. The nature of your material determines the amount of interactivity you should use. The desktop computer is currently a popular vehicle for interactive multimedia presentation.

Interactive Multimedia can be defined as an integration of relationship between multimedia and interaction. It is a multimedia system in which related items of information are connected and can be presented together. It involves combination of the followings:

- knowledge and information
- a collection of technologies
- collection of multimedia components (modality, channels of communication, medium)
- a set of collaborative systems
- virtual environments

INTERACTIVE MULTIMEDIA

Interactive multimedia is a type of collaborative media and refers to media that allows for active participation by the recipient, hence interactivity. Traditional information theory would describe interactive media as those media that establish two-way communication. In media theory, interactive media are discussed along their cultural implications. The field of human–computer interaction deals with aspects of interactivity and design in digital media. Other areas that deal with interactive media are new media art, interactive advertising and video game production.

While much traditional analog electronic media and print media qualifies as interactive media, the term is sometimes misunderstood as exclusive to digital media. The significant increase in possibilities for interactivity (especially over vast distances) brought by the internet boosted the availability of digital interactive media. Still, e.g. language in face-to-face communication would formally belong to the category of interactive media.

Interactive media are often designed by information designers. As all media they rely on communication. In the case of e.g. computer games this is visual, acoustic, and haptic communication between the user (player) and the game. In mobile telephony, the communication happens between two people and is purely acoustic at the first glance. Yet, according to media theory the cultural implications of the medium have to be taken into account. Thus, aspects like constant availability, customization of the mobile phone and Short Message Service are also part of the interactive medium called mobile telephony. Media restrain from being translated to technological entities.

COMPONENTS OF INTERACTIVE MULTIMEDIA

The components of interactive multimedia include the followings:

- Asset – an object which encapsulates a single piece of 'media' (e.g. video, sound clip, graphic)
- Information – the collection of data by a particular encoding
- Knowledge – the interpretation and understanding of information

Metamedia

Metamedia refers to new relationships between form and content in the development of new technologies and new media. Metamedia utilizes new media and focuses on collaboration across traditional fields of study, melding everything from improvisational theatre and performance art, to agile, adaptive software development and smart mobs. Succinctly, it refers to the theoretical effects of mass media and focus on provision of flexible online environment for creating and sharing rich media documents for learning on core humanities subjects.

UNIT 4 ISSUES IN MULTIMEDIA SYSTEMS CONTENTS

A *Multimedia System* is a system capable of processing multimedia data and applications. It is characterised by the processing, storage, generation, manipulation and rendition of Multimedia information.

CHARACTERISTICS OF A MULTIMEDIA SYSTEM

A Multimedia system has four basic characteristics:

1. Multimedia systems must be *computer controlled*.
2. Multimedia systems are *integrated*. Multimedia = multi X separate medium.
3. The information they handle must be represented *digitally*. All information is ONLY in the images or video.
4. The interface to the final presentation of media is usually *interactive*. Query by example is best access method. Editing of media is almost always off-line.

CHALLENGES FOR MULTIMEDIA SYSTEMS

Supporting multimedia applications over a computer network renders the application *distributed*. This will involve many special computing techniques -- discussed later.

Multimedia systems may have to render a variety of media at the same instant -- a distinction from normal applications. There is a temporal relationship between many forms of media (*e.g.* Video and Audio. There are two forms of problems here

1. Sequencing within the media -- *playing frames in correct order/time frame in video*
2. *Synchronisation* -- inter-media scheduling (*e.g.* Video and Audio). Lip synchronisation is clearly important for humans to watch playback of video and audio and even animation and audio. Ever tried watching an out of (lip) sync film for a long time?

The key issues multimedia systems need to deal with here are:

- How to represent and store temporal information.
- How to strictly maintain the temporal relationships on play back/retrieval
- What process are involved in the above.

Data has to represented *digitally* so many initial source of data needs to be *digitise* -- translated from analog source to digital representation. This will involve scanning (graphics, still images), sampling (audio/video) although digital cameras now exist for direct scene to digital capture of images and video.

The data is *large* several Mb easily for audio and video -- therefore storage, transfer (bandwidth) and processing overheads are high. Data compression techniques very common.

CHALLENGES OF MULTIMEDIA SYSTEM DESIGN

- Host computing power requirement
- Data Storage and Management requirements
- Human Interface Usability requirements
- Network latency and throughput requirements

DESIRABLE FEATURES FOR A MULTIMEDIA SYSTEM

Given the above challenges the following features are desirable (if not a prerequisite) for a Multimedia System:

1. **Very High Processing Power:** needed to deal with large data processing and real time delivery of media.
2. **Multimedia Capable File System**: needed to deliver real-time media -- *e.g.* Video/Audio Streaming. Special Hardware/Software needed *e.g* RAID technology.
3. **Data Representations/File Formats that support multimedia:** Data representations/file formats should be easy to handle yet allow for compression/decompression in real-time.
4. **Efficient and High I/O:** input and output to the file subsystem needs to be efficient and fast. This needs to allow for real-time recording as well as playback of data. *e.g.* Direct to Disk recording systems.
5. **Special Operating System:** to allow access to file system and process data efficiently and quickly. This needs to support direct transfers to disk, real-time scheduling, fast interrupt processing, I/O streaming *etc.*
6. **Storage and Memory:** large storage units (of the order of 50 -
7. 100 Gb or more) and large memory (50 -100 Mb or more). Large Caches also required and frequently of Level 2 and 3 hierarchy for efficient management.
8. **Network Support:** Client-server systems common as distributed systems common.
9. **Software Tools:** user friendly tools needed to handle media, design and develop applications, deliver media.

COMPONENTS OF A MULTIMEDIA SYSTEM

Now let us consider the Components (Hardware and Software) required for a multimedia system:

1. **Capture devices** include Video Camera, Video Recorder, Audio Microphone, Keyboards, mice, graphics tablets, 3D input devices, tactile sensors, VR devices. Digitising/Sampling Hardware
2. **Storage Devices** include Hard disks, CD-ROMs, Jaz/Zip drives, DVD, *etc*
3. **Communication Networks** include Ethernet, Token Ring, FDDI, ATM, Intranets, Internets.
4. **Computer Systems** include Multimedia Desktop machines, Workstations, MPEG/VIDEO/DSP Hardware
5. **Display Devices** include CD-quality speakers, HDTV,SVGA, Hi- Res monitors, Colour printers *etc.*

TRENDS IN MULTIMEDIA

Current big applications areas in Multimedia include:

1. **World Wide Web**: Hypermedia systems -- embrace nearly all multimedia technologies and application areas. Ever increasing popularity.
2. **MBone:** Multicast Backbone: Equivalent of conventional TV and Radio on the Internet.
3. **Enabling Technologies**: developing at a rapid rate to support ever increasing need for Multimedia. Carrier, Switching, Protocol, Application, Coding/Compression, Database, Processing, and System Integration Technologies at the forefront of this.

MULTIMEDIA DELIVER

Multimedia contents can be accessed or delivered via videotape, hard- disk, CD-ROM or over a distributed network such as the World Wide Web. Also it can be non-interactive or interactive, or printed multimedia. Multimedia and the Internet require a completely new approach to writing. The style of writing that is appropriate for the 'on- line world' is highly optimized and designed to be able to be quickly scanned by readers.

A good site must be made with a specific purpose in mind and a site with good interactivity and new technology can also be useful for attracting visitors. The site must be attractive and innovative in its design, function in terms of its purpose, easy to navigate, frequently updated and fast to download. When users view a page, they can only view one page at a time. As a result, multimedia users must create a ‘mental model of information structure’.

Patrick Lynch, author of the Yale University Web Style Manual, states that users need predictability and structure, with clear functional and graphical continuity between the various components and subsections of the multimedia production. In this way, the home page of any multimedia production should always be a landmark, able to be accessed from anywhere within a multimedia piece.

Delivery of Multimedia Applications

Multimedia applications can be delivered via the World Wide Web or on CD-ROMs/DVD.

	World Wide Web	**CD-ROM/DVD**

Access Time	Can experience slow connection speeds. Access time depends on internet bandwidth and available resources on the local computer.	Content are viewed immediately the CD/DVD is inserted into the CD- ROM/DVD drive
Ability to change content	It is easy to update material on web. New updates can be instantly accessed off the web	Content cannot be changed but can be recreated and redistribute to audience.

Computer based delivery of delivery multimedia applications include Video Games, Interactive Web Applications, CD ROM discs and Informational kiosks. Computer-based multimedia applications integrate the various media components and allow interactivity and hyperlinking.

Web-based multimedia applications are faced with two major challenges, namely link fossilization, and server and network overload. Link fossilization challenges include when the host server has changed, the applications is no longer residents at the host, or when a host contain only an outdated version of the applications. The challenges related to network and server overload include when large size of multimedia applications, users are not informed of their network capabilities in relation to application file sizes, when users and authors are not conscious of network implications, and sub-optimally designed servers and protocols (same applications being transferred many times between a server and a client size).

UNIT 5 MULTIMEDIA TOOLS: HARDWARE

CONTENTS

MULTIMEDIA HARDWARE

Certain minimum hardware specifications are desirable for a use to run multimedia applications on a computer. Modern computers are normally equipped with all the essential components as standard, but the variety is huge and careful choices have to be made. These are typical minimum hardware specifications:

- A fast multimedia PC running at 1000 MHz or higher.
- At least 2GB of RAM (memory). The more RAM the better!
- Hard disk drive with at least 100GB storage capacity.

- Monitor. Buy the best-quality monitor you can afford.
- Soundcard (an expansion card that provides both input and output).
- Loudspeakers or headphones.
- Microphone.
- Video card / graphics card.
- CD-ROM drive.
- DVD drive.

Soundcard

An adequate soundcard is essential for multimedia. Modern multimedia computers are fitted with soundcards as standard, so the choice of soundcard may already have been made for you. A user should be familiar with soundcard controls under the *Windows* operating system in other to be able to adjust the output volume of the soundcard and the input sensitivity of the microphone.

Loudspeakers/Headphones

Speakers or headphones are essential for listening to sound recordings. When purchasing speakers it is worthwhile checking that they have their own inbuilt amplification system. The sound level of all speakers or headphones can be controlled under the *Windows* operating system, but good speakers have a volume control knob that also enables the user to adjust the volume manually. Headphones can be integrated with a microphone - the so-

called pilot's headset that is used in language laboratories. Stereo speakers or headphones are advisable for most multimedia applications.

Microphone

The importance of selecting the right kind of microphone is often not appreciated by ICT technicians. For good quality sound recordings the language teacher needs a high-quality microphone. A dynamic microphone (also known as a karaoke microphone) is satisfactory but provides a softer signal than a condenser microphone (also known as a powered microphone).

The level of the input signal to the microphone can be controlled under the *Windows* operating system. A common mistake made by newcomers to multimedia applications is a failure to set the input signal control properly so that very faint sound - or no sound at all - is emitted when playing back recordings made by the user. It is advisable to purchase a microphone that has its own on/off switch.

Video card/Graphics card

The terms video card and graphics card are used to mean much the same thing. The term card in this context is jargon for an electronic circuit board. You will not be able to see the video card from outside the computer. All that is visible is the rear of the card is the socket into which you plug the monitor. It is important to know what kind of video card your computer is equipped with, as this affects what the monitor can display. When you purchase software make sure that your computer has a video card that is compatible with the software you wish to use. Some software will only work on computers equipped with video cards with high specifications.

CD-ROM drive

CD-ROM stands for **Compact Disc Read Only Memory**. A CD-ROM is an optical disk onto which data has been written via a laser - a process often referred to as "burning a CD". A CD-ROM looks much the same as an audio CD but can contain text, sound, pictures and motion video.

A CD-ROM drive - which is standard on modern multimedia computers
- is essential for running multimedia applications. CD-ROMs are the commonest **storage media** for multimedia applications.
Modern computers are now usually equipped with a **combination drive** that enables both CD-ROMs and DVDs to be played and recorded - as well as playing and creating audio CDs and movies. A CD-ROM drive can also play standard audio CDs, so you can listen to your favourite music while you work or follow a language course supplied on audio CD - but most computer technicians keep quiet about this as they don't want their computer lab turning into a discotheque or language lab! It is possible to extract or copy tracks from an audio CD and save them to your computer's hard disk as audio files, which can then be played, edited, written back to another CD, or saved to an iPod or similar mobile player. This process is often referred to as **"ripping a CD".**
CD-ROM drives are available in a variety of different speeds, the speed being described thus: 12x (12-times), 24x (24-times), etc. This indicates the speed at which data can be pulled off the CD-ROM drive - the so-called **spin-rate** - 150 kilobytes per second being the notional original

1x spin-rate - long since superseded. A high spin-rate helps speed up data transfer, which is crucial when playing sound or video. A low spin- rate may cause hiccups when audio and video recordings are played. CD-ROMs work fine on stand-alone computers but networking CD- ROMs containing large amounts of sound and video can be problematic. Although it is technically possible for a limited number of network users to access data on the same CD-ROM, the success of this depends on a number of technical factors that are too complex to discuss here, and you are therefore advised to consult your network manager.

CD-ROMs can store at least 650 megabytes of data. Compared to other storage media, the CD-ROM's storage capacity is impressive. A single CD-ROM can comfortably accommodate 500 medium-length novels, a
12-volume encyclopaedia, the complete works of Shakespeare, or a whole year's edition of a newspaper. It is this enormous storage capacity that makes CD-ROMs attractive. When graphics and audio and video recordings are stored in computer-readable format they take up much more space than text, and they can only be made available to consumers in reasonable quantities if they are stored on CD-ROM or DVD.

Once written, the data on a CD-ROM can be fixed and rendered unalterable, hence the term **Read Only** - but modern computers are usually equipped with a **CD read/write drive** that enables new material to be stored on a special kind of CD-ROM: CD-R (recordable) or CD- RW (rewriteable). A CD-read/write drive is useful for making backups and storing your own multimedia materials. Blank CD-Rs or CD-RWs can be bought from computer media suppliers at a relatively low cost. You can store data on CD-Rs using a read/write drive, adding to it until it is full, and then you can format the CD-ROM so that it is fixed and can be read by a standard CD-ROM drive. You can also store data on CD-RWs in the same way, but these disks can only be read by a CD read/write drive. The advantage of CD-RWs is that they can be erased and used over and over again, but now that the cost of blank CD-Rs has fallen to such a low level it is questionable how useful CD-RWs are. It is also possible to create or copy audio CDs on a CD read/write drive.

Multimedia CD-ROMs are designed mainly for use on stand-alone computers. This is because the main target of CD-ROM manufacturers is the home user.

DVD drives

Most modern PCs come equipped with a **DVD drive**. **DVDs (Digital Video Discs)** - or, more accurately, **Digital Versatile Discs** - are relative newcomers to the multimedia scene. They look just the same as CD-ROMs and audio CDs, but they are much more versatile and can store much more data. They are already in widespread use to store movies that can be played back on domestic TV sets. DVDs can also be used to store computer data, which can be read by a computer equipped with a DVD drive.

Modern multimedia computers usually come equipped with a DVD read/write drive or a **combination drive** that can read and write to CD- ROMs too, as well as playing and creating audio CDs.
First, an important distinction:

- A **DVD-player** is the name given to the device used in home entertainment

systems to play back video and audio. A DVD- player can play:

- DVD-Video discs - also referred to as **DVD-Movie discs**: e.g. containing, full-length feature films, videos of concert performances, etc;.
- audio CDs.

- A **DVD drive**, as fitted in a multimedia computer, can play:
  - DVD-ROM discs, which consist of combinations of computer programs and high-quality motion video;
  - DVD-Video discs - also referred to as **DVD-Movie discs**: e.g. containing, full-length feature films, videos of concert performances, etc;
  - CD-ROMs ;
  - audio CDs.

A DVD-player cannot normally be used to play DVD-ROM discs - but bear in mind that this technology is in the process of coverging and moving towards fully integrated systems, including DVD read/write players that can be linked to TV sets.

The main advantage of all types of DVDs is that they offer very high quality video and sound. In this respect they have finally caught up with
- and surpassed - the video quality offered by older 12-inch **laserdiscs**. Their capacity is impressive - up to 25 times the storage capacity of a CD-ROM, which means that a DVD can comfortably hold a full-length movie. Most modern computers can play DVD-Video discs and DVD- ROM discs.

DVD-Video discs

Standards for DVD-Video are still in the process of settling down. An annoying aspect of DVD-Video is that the world is carved up into six regions, also called **locales**, each of which has its own DVD standard. DVD-Video discs are regionally coded - look for a small standardized globe icon on the packaging with the region number superimposed on it. If a disc plays in more than one region it will have more than one number on the globe. The current six regions are:

1. USA, Canada
2. Western Europe, Japan, South Africa
3. South East Asia
4. Australia, Spanish America
5. Russia, Eastern Europe, Africa
6. China

A DVD-Video disc coded for Region 1 (USA, Canada) will not play on a DVD player sold in Region 2 (Western Europe, Japan, South Africa). When you buy a computer equipped with a DVD drive, the region will have been pre-set, but you can change it via Windows. The problem is that you cannot keep doing this: you normally only have **five chances** (more on some systems) to change regions! There are various reasons for this non-standardisation, one of them being that movie producers release movies at different times in different regions and in different variations. There are various ways of getting round the problem of non- standardisation - but this is beyond the scope of this introduction and you are advised to consult someone who is technically competent in this area.

DVD-Video discs have impressive advantages. You can play back a full movie with 8-channel surround-sound cinema effects. You can easily jump to a particular sequence (a scene or chapter), and DVD-Video discs often offer alternative soundtracks in different languages, subtitles (i.e. subtitles in a language other than the one in which the film was recorded), closed captions (i.e. subtitles in the same language as the one in which the film was recorded), and information about the director and cast, as well as the possibility of previewing and playing your favourite scenes over and over again.

DVD-ROM discs

DVD-ROM discs are not subject to the same geographical restrictions as DVD-Video discs. They only run on computers equipped with a DVD drive and cannot be played on a domestic DVD player - but, having said that, DVD technology is in the process of settling down and moving towards fully integrated systems. DVD-ROM discs combine computer programs and movies and are becoming increasingly flexible as an instructional medium, especially for Modern Foreign Languages.

Each DVD is divided into six sections:

i. **Video & Script:** The whole movie can be viewed in full-screen mode without subtitles or in small-screen mode with subtitles and an optional rolling script. If the learner wishes to view a particular scene and play it over and over again, it can be selected from a menu.

ii. **Movie Quiz:** The learner takes part in a quiz on the movie, pitting his/her wits against a "virtual" competitor - a character who has already appeared in another EuroTalk series.

iii. **Record Yourself:** The learner can choose a character in a short clip from the movie and record his/her own voice, which is then substituted for the character's voice.

iv. **Dictionary:** The learner can look up a word, which is then spoken aloud and illustrated with a still picture from the movie.

v. **Word Search:** The learner can look for an example of a word in use. A short clip containing the word will then play.

vi. **Activities:** These consist of a four types of interactive exercises:

- **Vocabulary:** The learner attempts to match a spoken word with a still picture
- **Missing Word:** A gap-filling/multiple-choice drag-and- drop exercise in which the learner attempts to match a blanked-out word in the movie subtitle with a selection of possible words that appear below the subtitle.
- **Spelling:** An activity which is similar to **Missing Word,** except that the learner has to drag the word letter-by-letter into the gap in the subtitle.
- **What's the next line?** A multiple-choice exercise in which a short clip from the movie is played and the learner has to anticipate the next line.

3.7 Scanners

A **scanner** is a device that copies hard copy information (printed page, graphic image, photograph etc) into digital data, translating the information into a form a computer can store as a file. Thus it is possible to make a digitised copy of a printed page, graphic

image or photograph. Simple graphic images are usually stored in a format known as **GIF**. Photographs are usually stored in a file format known as **JPEG** or **JPG** and they can then be printed on a colour printer, sent as an email attachment to a friend or colleague, or incorporated into a website.

Scanners do not distinguish text from graphic images and photographs, so you cannot use a word-processor to edit directly a printed page that has been scanned. To edit text read by an optical scanner, you need **Optical Character Recognition (OCR)** software to translate the image into 'real text', i.e. a format that can be read by a word-processor. An OCR machine scans individual characters, isolates salient features, and then some decision is made as to what letter or other character lies below the reader. When the characters actually occur as part of natural- language text, it has long been recognized that contextual information can be used to assist the reader in resolving ambiguities. Most optical scanners today come bundled with OCR software.

The most popular type of scanner is known as a **flatbed scanner**. This looks a bit like a photocopier and works in a similar way. You lay the picture or page containing the text to be scanned on a glass plate, start the scanning software and watch the digitised image appear on screen. The image can then be saved as a file on your hard disk. Text saved as an image can then be converted into "real text" with the aid of OCR software. OCR software does not work 100%, as broken characters and faded characters are liable to be misread, but surprisingly good results can be achieved - and it certainly beats typing!

Some scanners are small hand-held devices that you slide across the paper containing the text or image to be copied. Hand-held scanners are fine for small pictures and photos, but they are difficult to use if you need to scan an entire page of text or larger images.

3.8 Other Hardware Tools

These include the followings:

a. **Audio digitizer** – pair of A-D and D-A converters
b. **Wavetable synthesis** – has the capability of producing sound
c. **Mixer** – combines the above 2 signals with mixing audio from a CD-ROM or DVD-ROM
d. **3 jacks**: - Microphone input, Line in from stereo, TV, radio, etc. and Speaker output
e. **PC Camera (Webcam)** – allows a user to see people at the same time they communicate on the Internet as well as edit videos from a video camera or a VCR, create a move from still photographs and videos, and take digital photographs automatically at preset times or when the camera detects motion. Typically, a video in plug is present on the camera while some models will attach to USB ports.
f. **Digital Cameras** – like a regular camera except images are stored to a floppy disk, PC Card or internal memory.
g. **Display Device** – (monitor and video card) allow for the display of visual multimedia components

h. **Televisions** – must have an NTSC converter to change computer's digital output to the television's analog input. HDTV's don't require the converter.

i. **Multimedia (Data) Projector** – a device which connects directly to the computer with a cable and uses its own light source to display a multimedia app or presentation

j. **Video Capture Card** – enables you to connect a video camera or VCR to a computer and manipulate the video input.

UNIT 6 MULTIMEDIA TOOLS: SOFTWARE

Media players

Software that you require for running multimedia applications will probably be supplied with your multimedia computer. A **media player** should automatically spring into action when your computer needs to play an audio or video clip. A media player is in effect a "virtual" playback machine, complete with Play, Stop, Pause, Fast Forward, Fast Reverse and Volume Control buttons. Media players installed on your computer can also act as a plug-in when an audio or video clip is accessed onthe Web.. Examples of media players include:

1. **iTunes** is used for playing and organizing multimedia files and transferring them to an **iPod** or similar mobile devices. **iTunes** also offers an extensive online library of music r e c o r d i n g s and video recordings. The Open University in the UK has made some of its language-learning materials available via **iTunes.** http://www.apple.com/itunes/
2. **VLC Media Player:** A cross-platform (PC and Mac) media player that plays virtually any type of media file: http://www.videolan.org/vlc/
3. **QuickTime:** http://www.apple.com/quicktime/ - for playing audio and video files.
4. **RealPlayer:** http://uk.real.com/realplayer/ - for playing audio and video files.
5. **Windows Media Player:** Normally bundled with the *Windows* operating system.

CODECs

CODEC is short for **COmpressor / DECompressor** or **COder / DECoder**. A CODEC is software that is used to compress or decompress a digital audio or video file. CODECs are additional pieces of software that operate in conjunction with different media players, and certain types of audio and video recordings will only play back if the relevant CODEC is running in conjunction with the media player that you are using.

A CODEC can consist of two components, an encoder and a decoder. The encoder compresses the file during creation, and the decoder decompresses the file when it is played back. Some CODECs include both components, while other CODECs include only one. CODECs are used because a compressed file takes up less storage space on your computer or on the Web.

When users play an audio or video file in media player, the media player will use a CODEC to decompress the file. The extension WAV, MP3, AVI, WMA, WMV or MPEG is not a guarantee that an audio or video file can be played in the media player, as the file may have been compressed using a CODEC that is different from those already installed on your computer.

3.2.1 Digital Language Labs

Digital language labs incorporate a media player/recorder, but go one step further insofar as they offer, in digital format, the same kind of audio-interactive facilities found in a traditional language lab, including teacher monitoring facilities and video

playback. The following businesses supply digital language labs:

- **CAN-8 VirtuaLab:** http://www.can8.com
- **Keylink Computers:** http://ds.dial.pipex.com/keylink
- **Melissi Multimedia:** http://www.melissi.co.uk
- **Robotel:** http://www.robotel.com
- **Sanako:** http://www.sanako.com
- **SANS (Software And Network Solutions), Sony Licensor:** http://www.sansinc.com
- **Sun-Tech:** http://www.suntechgroup.com
- **Televic Education (Artec):** http://www.televic.com

3.3 DVD media players

If a computer is equipped with a DVD drive it will need a media player that enables DVDs to be played. It is likely that your computer will have a DVD-compatible media player pre-installed if you have purchased a computer with a DVD drive. But many other media players will also play DVDs.

3.4 Multimedia Editing Software

A user that intends to develop multimedia applications, there is need for additional editing software to create and edit images, audio files and sound files - collectively known as *assets*. A selection of packages for creating and editing images, sound and video is described below.

- **Adobe Photoshop** and **Adobe Illustrator**: http://www.adobe.com/uk/
- **Corel Paint Shop Pro** and **Corel Painter:** http://www.corel.com
- **LView Pro:** http://www.lview.com

When using the above packages, it is important that to be aware of the different formats in which images can be stored on a computer. Most image editing packages allow you to save images in different formats and to convert from one format to another. The commonest formats are:

- **BMP:** Bitmap format. This is the standard format used by *Windows Paint*. Images stored in this format tend to be rather large, however.
- **EPS:** Encapsulated Postscript format. An image file format that is used mainly for printing images on Postscript printers.
- **GIF:** Graphic Interchange Format. This format is commonly used for storing simple graphics on the World Wide Web, e.g. line drawings and maps. GIF files use a palette of 256 colours, which makes them practical for almost all graphics except photographs. Generally, GIF files should be used for logos, line drawings, icons, etc, i.e. images that don't contain a rich range of colours. A GIF file containing a small number of colours tends to be small, but it will be big if the image has a wide range of colours, e.g. a photograph. GIF files are commonly used for storing images on the Web. GIF files are also suitable for storing animated images.
- **JPG (or JPEG):** Joint Photographic Expert Group format. The JPEG/JPG format uses a palette of millions of colours and is primarily intended for photographic images. The internal compression algorithm of the JPEG/JPG format, unlike the GIF format, actually throws out superfluous information, which is why JPEG/JPG files containing photographic images end up smaller than GIF files containing photographic images. If you store an image, say, of a flag containing just three

colours in JPEG/JPG format it may end up bigger than a GIF file containing the same image, but not necessarily a lot bigger - it depends on the type and range of colours it contains. JPEG/JPG files containing photographic images are normally smaller than GIF files containing photographic images. JPEG/JPG files are commonly used for storing images on the Web.

•**TIFF or TIF:** Tag Image File Format. Files stored in this format give a high-quality image but they are huge.

3.5 Scanning and OCR software

Most image editing packages also include software for acquiring images from **scanners** above. When you buy a **flatbed scanner** it is normally supplied with software for scanning images from photographs or other printed media, and with **optical character recognition (OCR)** software for scanning in texts and converting them into a format that can be read with a word-processor and then edited.

3.6 Sound recording and editing software

Making and editing sound recordings and turning them into podcasts are not difficult. These are some of the tools available for making sound recordings:

•**Adobe Audition:** The "industry standard", the successor to *Cool Edit*: http://www.adobe.com/uk/

• **Audacity** (freeware): Allows for all the basic features of editing, but you need to download addtional software in order to create MP3 files: http://audacity.sourceforge.net. There is a tutorial on the *Audacity* site on how to use the software. Joe Dale's Blog contains many references to audio recording using *Audacity*: http://joedale.typepad.com. Joe has also set up a comprehensive set of links to tutorials on *Audacity*: http://delicious.com/joedale/audacity

• **GoldWave:** http://www.goldwave.com

• **NCH Swift Sound:** A wide range of useful tools, including some downloadable freeware: http://nch.com.au

•**Sound Recorder** - supplied with *Windows*. Rather primitive, with only basic operations. Suitable only for introducing language teachers to audio recording and editing.

It's easy to make recordings directly onto the hard disk of a computer, but it is preferable to make them first on a portable recorder (analogue or digital) and then upload them to the computer using a connection lead. See the range of audio recording devices offered by **Olympus** and **iRiver**:

- **Olympus:** http://www.olympus.co.uk/voice/
- **iRiver:** http://www.iriver.com

When using the above editing packages, it is important that you are aware of the different formats in which sound can be stored on a computer. Most sound editing packages allow a user to save images in different formats and to convert from one format to another. The commonest formats are:

•**MP3:** The standard format for storing sound files, especially music, on the Web. MP3 is the form favoured for **podcasting**. The advantage of this format is that it

compresses the sound - therefore saving space - without a significant loss in quality. MP3 is a variant of MPEG .

• **MP4 AAC:** Abbreviation for **MPEG-4 Advanced Audio Coding**. The MP4 AAC file format is used to store audio files in a more manageable size without affecting the quality. MP4 AAC's best known use is as the default audio format of Apple's **iPhone**, **iPod** and iTunes media player**.** See also the reference to MPEG-4 Advanced Video Encoding.

• **WAV:** Until recently, the commonest format. Produces high- quality sound but takes up quite a lot of space.

• **WMA:** Windows Media Audio is Microsoft's own audio encoding format that is starting to gain popularity due to its high- quality output at lower file sizes.

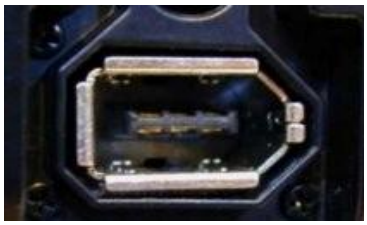
Use Audacity rather than *Windows Recorder* to make the recordings and then save them in MP3 format. You can then copy the recordings into iTunes and onto your iPod, and you can burn selected recordings onto CD-ROM or audio CD.

3.7 Video editing software

Pre-recorded video on a camcorder these can be uploaded to the computer by means of a cable connecting the camcorder to the **firewire port** (firewire socket) on the computer. **A firewire** is in essence a device that allows you to transfer video recordings very quickly from your camcorder to your computer. Many modern computers already have a firewire port built in. If your computer does not have a firewire port then you have to buy a firewire card and slot it in - and here you need a bit of technical knowledge. Most modern computers systems that are designed for audio and video applications have firewire ports built into them. If you are not sure that you have a firewire port, have a look at the sockets for connecting to externaldevices on your computer. A firewire port is smaller than a **USB port**, but it will probably be located near the USB port(s).

Firewire cable

USB cable



Firewire port

Firewire port (left)

There is a good range of products offered by Hauppauge for the efficient digitisation of video materials from a variety of sources http://www.hauppauge.com

- **Adobe Premiere:** http://www.adobe.com
- **Ulead VideoStudio:** http://www.ulead.com
- **Pinnacle Studio**: http://www.pinnaclesys.com
- **Final Cut Pro (Mac):** http://www.apple.com/finalcutpro
- **Matrox** offer a wide range of products: http://www.matrox.com
  - **Movie Maker** is bundled with Windows.
- **NCH Software** offers a wide range of packages: http://www.nchsoftware.com
- **VideoSpin by Pinnacle:** A free video editing package: http://www.videospin.com/Redesign/

3.8 Software Format

- **ASF:** Advanced Streaming Format. This is a Microsoft's own file format that stores both audio and video information and is specially designed to run over the Internet. ASF enables content to be delivered as a continuous stream of data (**streaming audio** or **streaming video**) with little wait time before playback begins. This means that you no longer have to wait for your audio and video files to fully download before starting to view them. Cf. the WMV format (below).
- **AVI:** Audio Video Interleave format. Still very popular, but giving way to MPEG, which takes up less storage space.
- **FLV:** Abbreviation for Flash Video, a proprietary file format used to deliver video over the Web using the **Adobe Flash Player** plug-in.
- **MOV:** The standard format for storing video files on the Apple Macintosh to be played in the **QuickTime** media player - which is also available for the multimedia PC. Economical in terms of storage space. http://www.apple.com/quicktime
- **MPG or MPEG:** Motion Picture Expert Group. Probably the commonest format for storing video, especially on the Web. Economical in terms of storage space.
- **MP4 AVC:** Abbreviation for **MPEG-4 Advanced Video Coding**. The MP4 AVC file format is used to store video files in a more manageable size wihout affecting the quality. It is also increasingly being used for storing video on iPods and similar portable devices. See also MPEG-4 Advanced Audio Encoding.
- **RM (RealPlayer):** Used for playing **streaming audio** and **streaming video**. RM enables content to be delivered as a continuous flow of data with little wait time before playback begins. This means that you do not have to wait for your audio and video files to fully download before starting to view them: http://uk.real.com/realplayer/. RealPlayer enables you to download streaming files (e.g. **YouTube** videos) from the Web.
- **WMV:** Windows Media File. This is Microsoft's own file format. WMV is the same as ASF (see above) except that it can be downloaded instead of streamed from a server located at a distance.

3.9 Plug-ins

A plug-in is an extra piece of software that a Web browser needs to run certain elements of a Web page, e.g. animated sequences and audio or video clips. You will find that when you click on an icon that signifies the availability of streaming audio or video material, your browser will link with a plug-in. If the plug-in is not already installed on your computer then you will be able to download it free of charge. Web pages incorporating multimedia often need plug-ins such as **Flash Player**, **QuickTime**, **Shockwave Player** or **RealPlayer**. Plug-ins are usually quick and easy to install, normally free of charge and open up a wealth of new material. Sites that require a plug-in usually provide a link to a site from which the essential plug-in can be downloaded. These are the sites from which Flash Player, Shockwave and RealPlayer can be downloaded:

- **Flash Player**: http://www.adobe.com/products/flashplayer/
- **QuickTime:** http://www.apple.com/quicktime
- **RealPlayer:** http://uk.real.com/realplayer/
- **Shockwave Player:** http://www.adobe.com/products/shockwaveplayer

3.10 Podcasting

A **podcast** is a broadcast digital audio recording, usually in MP3 format, made available via the Web in a way that allows the recording to be downloaded automatically for listening at the user's convenience. The term **vodcast** is used to describe a broadcast digital video recording, usually in MPG format, also made available via the Web. The term **podcast** takes its name from a combination of **iPod** (Apple's portable digital media player) and **broadcasting**, but podcasts and vodcasts do not necessarily require the use of an iPod or similar device. Podcasts and vodcasts can simply be downloaded to a computer and played using a standard media player program.

3.11 Saving and converting streaming media for use offline

It is possible to save streaming audio or streaming video clips to your hard disk so that they can be used offline. **RealPlayer** enables you to play and save video clips from popular websites such as **YouTube** and **Metacafe** (http://www.metacafe.com), record live streams, and play a wide range of popular audio and video formats. There are many software tools available that enable you to capture streaming media and convert it from one form into another, e.g.

- **ConvertTube**: An online service for converting YouTube video clips to a variety of other formats: http://www.converttube.com
- **DVDVideoSoft:** Offers a range of different converters: http://www.dvdvideosoft.com
- **FlashLynx:** http://www.nchsoftware.com/streamvcr/index.html
- **HiDownload:** http://www.hidownload.com
- **How to Capture Streaming Media:** http://www.stream- capture.com
- **Keepvid:** http://keepvid.com
- **Orbit:** http://www.orbitdownloader.com
- **Net Transport:** http://www.xi-soft.com
- **Replay Converter:** A tool for converting audio and video files http://applian.com/replay-converter
- **YouConvertIt:** Free online media conversion. http://www.youconvertit.com

• **YouTube Tutorials:** See these tutorials on embedding YouTube video clips into *PowerPoint*: http://www.youtube.com/watch?v=Zwqyg5uNClY http://www.youtube.com/watch?v=hChq5drjQl4

• **Zamzar:** Free online file conversion. Convert images, audio files, video files and document files from one format to another without having to download software. http://www.zamzar.com

3.12 Audacity

Audacity is a free, easy-to-use audio editor and recorder for Windows, Mac OS X, and GNU/Linux. You can use Audacity to Record live audio; Cut, Copy and Paste, Delete, Duplicate, and Split audio files; Change the speed, pitch or volume of a recording; Apply effects to any part of the sound; and Align audio segments.
Audacity is a popular Open Source tool for creating and editing podcasts; it is freely available to download, install and modify, and is relatively easy to use. You can download a copy of Audacity for Mac, Linux, or Windows from http://audacity.sourceforge.net/. For a n overview of downloading and installing Audacity including the LAME MP3 encoder, see:http://www.youtube.com/

a. Download and Install Audacity from http://audacity.sourceforge.net/
b. Read through the Audacity tutorial in www.wikieducator.org/Using_Audacity/
c. Load Audacity and record audio into Audacity using a microphone.
d. Import audio files into the Track Window from your computers hard-drive.
e. Edit audio files by selecting, cutting, pasting, silencing, and deleting track, zoom-in, fade-out, fade-in etc.
f. Name, sort and label tracks.
g. Compress an audio file.

MODULE 2 PROPERTIES OF MULTIMEDIA ELEMENT

UNIT 1 TEXT

CONTENTS

1.0 INTRODUCTION

Text plays vital role in multimedia delivery and is composed of combinations signs or symbols that are used in writing or printing and which represent a speech sound. Texts are used in effective communication of ideas, thoughts, plans, feelings and emotions precisely and without any loss of form. Text mode refers to alphanumeric or character operation mode which computer uses in displaying letters, numbers and other text characters. In actual fact, texts are numeric codes stored in computer systems.

Succinctly, text suitability is an important consideration when designing multimedia applications. This is due to the fact that text has some form of graphical element in its texture and like all graphics; it must appeals to the eyes without leaving sour taste in the mouth of the reader. The choice of appropriate text attributes to be used in multimedia applications must be based on the nature of the audience (formal, informal, children, adult etc) and the essence of the multimedia presentations (education, business, news, information or entertainment etc).

In this unit, we shall study a subject called **Typography**. Typography deals with the appearance of text in multimedia presentations, its attributes and design considerations.

3.0 CHARACTER SETS

The visual appearance of a text come in variety of forms without altering the information it conveys. Basically, alphabets, digits, punctuations and other symbols forms the simple character set called *abstract characters* of a text. Abstract characters in a particular language are grouped into alphabets. E.g. the alphabet of English contains the upper case letters *A to Z*, the lower case letters *a to z*, the digits and a number of punctuations.

Digital representation of text involves defining a mapping *(*called *character set)* between the abstract characters and the values (called *code points)* that are stored in a computer system. The domain *(abstract characters)* of this mapping is called *character repertoire*.

3.1 Digitization of Text

Text is the common and most acceptable communication means among many computer systems which are heterogeneous in nature. A common character set is therefore desirable and essential. The American Standard Code for Information Interchange (ASCII) character set has been extensively adopted across many computing platforms to code plain text in binary forms.

ASCII has a 7-bit code range which infers that the code points can be store in 7 bits, and 127 codeable characters. Its domain only comprises
95 printable characters (A-Z, a-z, 0-9, !, @, ?, ^, &, *, (,), +, =, /, \, |, ;,
:, , , #, $, %, etc). The values 0 to 31 and 127 are assigned to *control characters*.

In 19____ ISO 646 adopted ASCII as its standard and later came out with an improved standard ISO 8859 with 8-bit characters to address the inadequacy of the 7-bit ASCII character set. However, ISO 8859 have limited code points available due to its 8-bit nature and having 7-bits ASCII identical characters in all its parts. To address this

shortcoming, ISO produced another standard called ISO/IEC 10646-1: *Universal Multi-Octet Coded Character Set* in 1993. ISO/IEC 10646-1 uses four hierarchical bytes (group (*g*), plane (*p*), row (*r*), column (*c*)) to encode a character, and can therefore have at most 232 code points.
Another standard is *The Unicode Standard, Version1.0* in 1991 (version 3.0 came out in year 2000). The Unicode character system uses 2 bytes (16-bit character set) to encode each character. Unicode 32-bits system is now available in some computing platforms. Unicode attempts to specify a character set to embrace all languages of the world. The Unicode transmission format 8 (UTF-8) protocols provides for support of extended ASCII characters and translation of Unicode. A UTF-8 enables a far greater range of names than can be achieved using ASCII or extended ASCII encoding for character data.

3.2 Text Attributes
Text can be created and presented in most appealing ways using combinations of the following attributes.

3.2.1 Font Type
Each character may be represented in different sizes, shapes, and shades, and a character' visual representation is refer to as *font face* or *typeface*. A *font face* is a family of graphic characters with a coherent design, similar look and feel while a *font* is a set of graphic characters with a specific design in a specific size and style. Here are some of the common families: Times, Helvetica, Courier, Garamond, and Universe. Some examples of the available *font face* are shown in figure 3.1 below.

Arial Arial Black Arial Rounded MT Bold
Bookman Old Style Copperplate gothic bold Elephant Franklin Gothic Medium Cond Imprint MT Shadow Tahoma Times New Roman

Figure 3.1 Sample Font Types

In some other terms weight which is a measures of characters' darkness, or the thickness of the strokes is used. The names used to distinguish weight are not uniform between type suppliers. The commonly used names are: ultra light, extra light, light, semi light, medium, semi bold, bold, extra bold, etc.

3.2.2 Font Style
Font style or shape refers to the different appearance within a family. Example include regular or normal (upright), bold, sloped (oblique), *italic*, SMALL CAP

Font Style Normal Style **Font Style** Bold Style *Font Style* Italic Style FONT STYLE Small CAP Style

Figure 3.2 Sample Font Styles

3.2.3 Font Size

When putting characters on to a page, we need to know some basic measurement of the types we use. Each character has a *bounding box*. This is the rectangle enclosing the entire character. Each character has an origin. It is usually place on the *baseline*. The width of the character determine where the origin of the next character will be. The distance between the origin and the left side of the bounding box is called *left side bearing*.

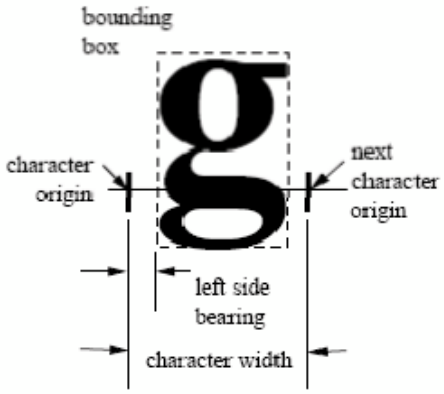


Figure 3.3 Font measurement
(Source: COMP3600/SCI2600 Multimedia Systems, Department of Computer Science, Hong Kong Baptist University)

As we all know, some of the lower case letters extend upward, like b and h, while others extend downward, like g, p and q. The height of the lower case letter without ascender and descender is called the *xheight*. The height of the upper case letters is called the *cap-height*.

Figure 3.4 Font Size
(Source: COMP3600/SCI2600 Multimedia Systems, Department of Computer Science, Hong Kong Baptist University)

Font size can be measure using any of the following two measurement criteria: point and pixel. The point measurement criterion uses dot per inch (dpi) which is the standard used in measuring computer monitor and printer resolution. It is expressed as the number of dots that a device can display or print per linear inch and the greater the number of dots per inch, the better the resolution.

A picture element (pixel) is the smallest element that computer screen, printer and software can manipulate to create letters, numbers, or graphics. The pixel measure one spot in a rectilinear grid of thousands of such spots that form an image produced on the screen by a computer or on paper by a printer. The resolution of the computer monitor is measured in term of pixels per inch (ppi) of monitor display and determines the amount of information that appears on the computer monitor.. A monitor setting of 1280 x 1024 has 1.3 million dpi while
800 x 600 monitor setting has 480,000 dpi. On a Macintosh monitor, the standard resolution is 72 dpi while on a Windows monitor, the standard
resolution is 96 dpi. Low resolution, such as 640 x 480, makes items on the screen appear large, although the screen area is small. High resolution, such as 1024 x 768, makes the overall screen area large, although individual items appear small

Comparison table of points and pixels on windows computer				
Points	Pixels		Points	Pixels
6pt	8px		16pt	22px
7pt	9px		17pt	23px
7.5pt	10px		18pt	24px
8pt	11px		20pt	26px
9pt	12px		22pt	29px
10pt	13px		24pt	32px
10.5pt	14px		26pt	35px
11pt	15px		27pt	36px
12pt	16px		28pt	37px
13pt	17px		29pt	38px
13.5pt	18px		30pt	40px
14pt	19px		32pt	42px
14.5pt	20px		34pt	45px
15pt	21px		36pt	48px

Table 1: Font Size: Points vs. Pixels
(Source: L. Reid & V. Tryphonopoulos (2009). Computer Science CS1033: Multimedia and Communication, www.csd.uwo.ca/courses/CS1033)
*Font Width**:*** the amount of expansion or contraction with respect to the normal or medium in the family.

Size: 1 inch = 72.27 point in printing industry and 1 inch = 72 point in PostScript systems.

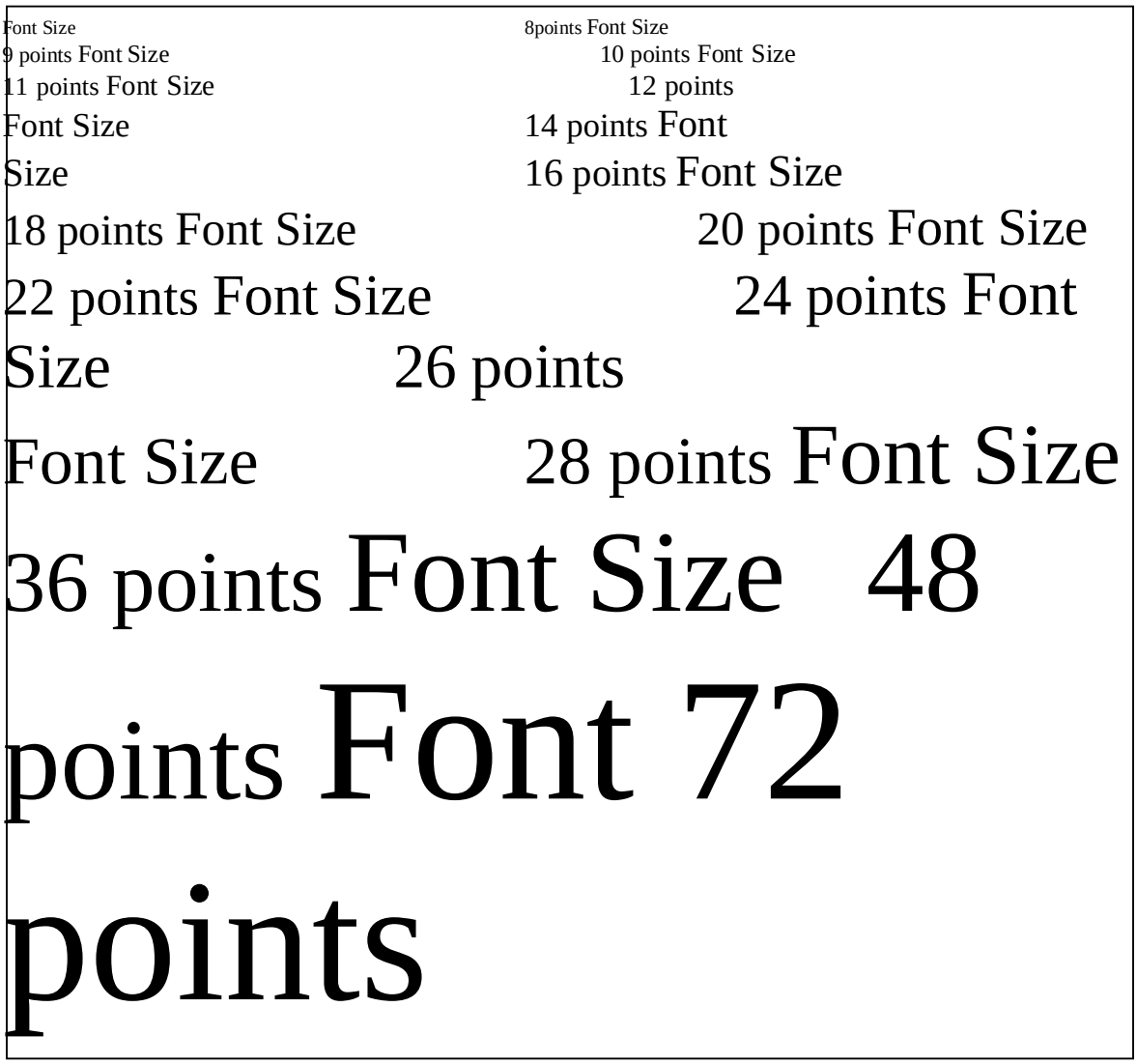


Figure 3.5 Different Font Sizes

3.2.4 Font Colour

Colours add some flavour to the general appearance and visual appeals of texts when used in the right manner and context. Over time, colours have been used to describe interesting and exciting personal, group, event, or location's details or qualities. Colours have a way somehow of reflecting our characters, attitudes, beliefs and opinions. There are some guidelines (*colour scheme*) concerning the appropriate choice and use of colours when working with texts. The colour scheme is a combination of colours (primary and secondary) choosen to add esthetics' values to the document while ensuring the content is preserved.

Primary colour is one of three colours, red, yellow and blue which can mix together to obtain secondary colours. The multidimensional color space consisting of the cyan, magenta, yellow, and black intensities that make up a given color. Commercial color printing devices generally use this system of four-color process inks on hardcopies (papers) while the three-colour (red, green and blue) process is usually used on monitors, scanners, digital cameras, and computer printers. The following colour properties are worth considering when choosing colours for texts and background.

Properties of Color

- **Colour *management:*** The process of producing accurate, consistent color among a variety of input and output devices. A color management system (CMS) maps colors between devices such as scanners, monitors, and printers; transforms colors from one color space to another (for example, RGB to CMYK); and provides accurate on-screen or print previews.
- **Colour *profile:*** A profile contains the data needed for translating the values of a color gamut. This data includes information about color, hue, saturation, and brightness.
- ***Hue*:** The "colour"of the color (or the wavelength of light) is the position of a color along the color spectrum. For example, green is between yellow and blue.
- ***Saturation*:** The intensity of the color, the purity of a color's hue moving from gray to the pure color.
- ***Brightness/Value*:** This is the relative lightness or darkness of the color
- **Colour *space*:** A set of three values that defines how a color can be represented on computer devices such as monitors, scanners, and printers. For example, in the LAB color space, the terms luminance or whiteness (L), redness-greenness (A), and yellowness-blueness (B) are used; in the HVC system, the terms are hue (H), value (V), and chroma (C). Color space refers to the three-dimensional space that is defined by the respective values, such as L, A, and B.
- **Running the *gamut:*** The gamut is the particular range of colors that a device is able to produce. A device such as a scanner, monitor, or printer can produce a unique colour spectrum, which is determined by the characteristics of the device itself. The relative saturation of colors is maintained from gamut to gamut. Colors outside the gamut are changed to colors of the same saturation, but different degrees of brightness at the edge of the gamut.
- **Colour *depth:*** The number of colors per pixel the monitor and graphics adapter support.

Figure 3.6 Different Font Colours

3.2.5 Special Effects

The examples below are some special effects that can be apply to texts within a multimedia presentation for emphasis, clarity, visual appeal reasons.

Underline UNDERLINED FONT Strikethrough STRIKETHROUGH FONT e.g. N

Double Strikethrough DOUBLE STRIKETHROUGH FONT e.g. N

Shadow SHADOW FONT Superscript SUPER^{SCRIPT} FO^{NT}

Subscript SUB$_{SCRIPT}$ FO$_{NT}$ Outline

Emboss EMBOSSED FONT

Engrave ENGRAVED FONT

3.2.6 Font Layout

3.2.6.1 Kerning

Kerning is the extra adjustment between two specific characters and specifies the distance between adjacent individual letters and the measurement is expressed in "em" (negative, 0, positive values). Normally, characters are placed one next to the other, i.e., the distance between the origins of the adjacent characters is equal to the character width. But due to the shape of the characters, the space between certain characters may look uneven, e.g., the A and v in the figure. Therefore, we need to kern the characters

KERNING Normal with no kerning
KERNING Expanded spacing with 1pt kerning
KERNING Condensed spacing with 1pt kerning
K E R N I N G Normal spacing with 1.5pts kerning K E R N I N G Normal spacing with 2pts kerning K E R N I N G Normal spacing with 4pts kerning

Figure 3.8 Characters Spacing with Kerning

3.2.7 Classification of Font face

Generally font faces can be classified as either *serif* or *sans serif*. *Serif* is the little flag or decoration at the end of a stroke. On printed pages, serif fonts are used for body text while sans serif fonts are used for headline because the serifs help guide the reader's eye along the line of text. Multimedia presentations are displayed on low resolution screen where sans serif fonts will be far more legible.

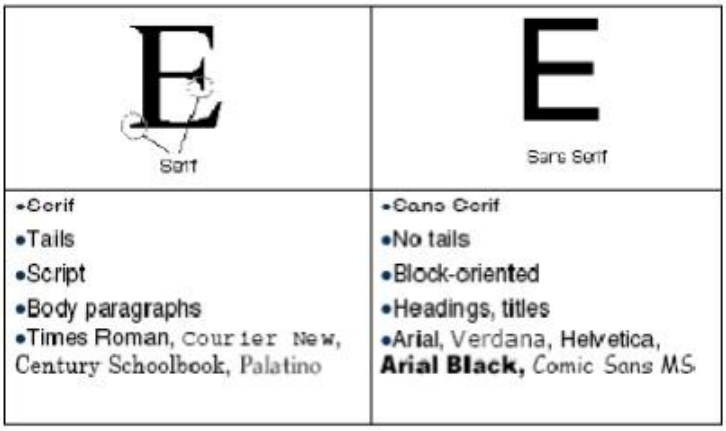


Figure 3.7 Font Faces
(Source: L. Reid & V. Tryphonopoulos (2009). Computer Science CS1033: Multimedia and Communication, www.csd.uwo.ca/courses/CS1033)

3.2.8 Font Formats

Font formats can be divided into two main categories: *bitmap* fonts and *outline* fonts.

Bitmap fonts come in specific sizes and resolutions. Because the font contain the bitmaps of the character shapes. The result will be very poor if they are scaled to different sizes. Outline fonts contain the outline of the characters. They can be scaled to a large range of different sizes and still have reasonable look. They need a rasterizing process to display on screen. Nowadays, outline fonts are much more common than bitmap fonts. There are two kinds of outline fonts: *PostScript* and *TrueType*.

All version of Windows support TrueType fonts. Windows3.1 and Windows95 require Adobe Type Manager (ATM) to display PostScript fonts. PostScript printers have a number of resident PostScript fonts.

3.3 Criteria for Choosing Text in multimedia

Choosing the combination of fonts to use in a multimedia presentation does not come quite easy and cheap. It requires careful planning and consideration of some text design criteria which may enhance the esthetics of the presentation and thus makes it more exciting, appealing and stimulating for the audience to watch, view or listen to. We outline some of these criteria as follows:

3.3.5 Readability and Legibility

Legibility which means that fonts must be written or printed clearly for easy reading is a basic requirement when designing multimedia presentations. The font face, its shape and sizes must be appropriate to allow for easy reading by the intended audience. In most cases for instance, adult audience require large font size while young or children

would make do with small font size. Here are some tips:

a. Use right contrasting and avoid dark text against dark background;
b. For small type, use the most legible font available, decorative fonts are useless;
c. Use as few different faces as possible in the same work, but vary the weight and the size and using italic or bold styles;
d. Vary the size of a font in proportion to the importance of the message;
e. Never underline a text in a webpage;
f. In large size headline, do proper kerning so that the spacing feels right; and
g. Use maximum of between 2 and 3 different font faces in a multimedia presentation.

3.3.6 Visual Appeal

Use the following tips to ensure that the fonts chosen make visual appeal to the audience eyes:

a. Make sure that both the font and graphic complement each other;
b. Choose font that coordinates with the graphics being used;
c. Explore the effects of different colours and of placing the text on various backgrounds;
d. Carefully position the font to achieve good balance with the other multimedia elements;
e. Avoid using exotic fonts in other to ensure font consistency on different computing platforms; and
f. Use maximum of 2 to 3 colours in a multimedia document or website.

3.3.7 Text Layout

The layout is very important when developing multimedia presentations. It provides detailed overview of how the document would look like after it must have been prepared. Font and other multimedia elements should be spread over the multimedia presentations to ensure readability and visual appealing. Thus the chosen font must be simple, clear and must make use of white spaces between characters, words and lines appropriately. In text block, adjust the leading for the most pleasing line spacing. Lines too tightly packed are difficult to read.

3.3.8 Mood Creation

a. Set the mood using appropriate font attributes and text layout; and
b. Use *San Serif* for headings and *Serif* for body. *Sans Serif* headings create better visual appeal while *Serif* body looks better.

3.4 Cross platform issues

When you build your multimedia project on Windows platform, and play it back on a Macintosh platform, there will be some differences. Fonts are perhaps the greatest

cross-platform concern. If a specified font does not exist in the target machine, a substitute must be provided. Some cross-platform applications, e.g., Director, allow the developer to specify the mapping of fonts.

Different encodings on different platform is also a big problem. Special characters may need to be converted to bitmaps in order to be display correctly on different platforms. Different systems and font manufacturers encode different symbols in the extended character set.

UNIT 2 GRAPHICS, PICTURES AND IMAGES

CONTENTS

1.0 INTRODUCTION

Graphic is concerned with drawing, printing or designing pictorial illustration of places, events, people etc. and gives a vivid description of what it is being represented. Graphics refers to drawings or images that represent objects or fact in computer software. It is a digital representation of images and non-text information (i.e drawing, chart, table, and photograph). Graphics are used to illustrate certain concepts more clearly than text can.

Graphics play an important role in teaching since many people are visual learners – think about car icons or road signs. There is no movement or

animation in a graphic and as navigation aids in many software packages.

3.0 The Nature of Digital Images

An *image* is a spatial representation of an object, a two-dimensional or three-dimensional scene or another image. Often the images reflect the *intensity* of lights. Most photographs are called *continuous-tone* images because the method used to develop the photograph creates the illusion of perfect continuous tone throughout the image. Images stored and processed by computers, displayed on computer screens, are called *digital images* although they often look like continuous-tone. This is because they are represented by a matrix of numeric values each represents a quantized intensity values.

3.1 Basic Concepts

3.1.1 Pixel (Bitmap)

A digital image is represented by a grid (array, matrix) of squared picture element known as a *pixel.* The pixel reveals the minutest details in a digital image. Each pixel is a numerical value corresponding to a graphical object. A 640-by-480 screen is capable of displaying 640 distinct dots on each of its 480 (rows) lines, or about 300,000 pixels. A
800-by-600 screen is capable of displaying 480,000 pixels.

3.1.2 Digitization

Digitization refers to the process of translating a piece of information (text, images, sound recording, or video) into *binary digits (BITS).*
A bit is an electrical pulse or signal that represents the state at which it can be in a given moment of time. Usually, electrical pulse is either in "ON" or "OFF" state at any given time. In the computer, these pulses are represented in the binary digital form of "1" and "0" for "ON" state and "OFF" state respectively. Words and images are represented in bits or bytes where a byte is a collection of 8bits (i.e. 0000 0000). So with 8 bits there are: (28)= 256 possible combinations of 0s and 1s.

Binary	**Power of 2**	**Decimal**	**Hexadecimal**
1	2 to the power of 0	1	1
10	2 to the power of 1	2	2
100	2 to the power of 2	4	4
1000	2 to the power of 3	8	8
10000	2 to the power of 4	16	10
100000	2 to the power of 5	32	20
1000000	2 to the power of 6	64	40
10000000	2 to the power of 7	128	80
100000000	2 to the power of 8	256	100

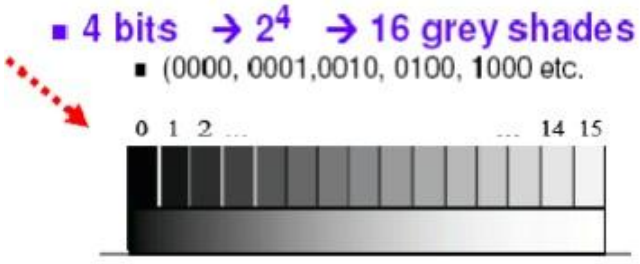
Binary	Decimal	Hexadecimal
0000	0000	0000
0001	0001	0001
0010	0002	0002
0011	0003	0003
0100	0004	0004
0101	0005	0005
0110	0006	0006
0111	0007	0007
1000	0008	0008
1001	0009	0009
1010	0010	000A
1011	0011	000B
1100	0012	000C
1101	0013	000D
1110	0014	0000E
1111	0015	000F

3.1.3 Depth

The depth of an image is measured in the number of bits used to represent each pixel.

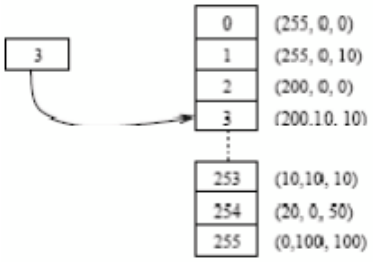
- 1-bit black-and-white image (with no gray), also called *bitmap image*.

- 4-bit can represent 16 colours, used in low resolution screens(EGA/VGA)

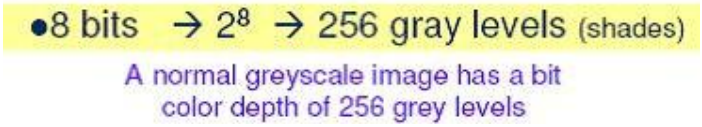


- 8-bit can have 256 colours. The 256 colour images are often known as *indexed* colour images. The values are actually indexes to a table of many more

different colours. For example, Colour 3 is mapped to (200, 10, 10).



• 8-bit grey 256 grey-levels. The image contains only brightness/intensity data without colour information.



(Source: L. Reid & V. Tryphonopoulos (2009). Computer Science CS1033: Multimedia and Communication, www.csd.uwo.ca/courses/CS1033)

•16-bit can have 65536 colours, also known as hi-colour in Windows systems. The 16 bits are divided into 5 bits for RED, 6 bits for GREEN and 5 bits for BLUE.

•24-bit 224 = 16,777,216 colours, true colour. Each byte is used to represent the intensity of a primary colour, RED, GREEN and BLUE. Each colour can have 256 different levels.

COLOUR	RED	GREEN	BLUE
Red	255	0	0
Green	0	255	0
Blue	0	0	255
Yellow	255	255	0
Magenta	255	0	255
Cyan	0	255	255
Light gray	127	127	127
White	255	255	255
Black	0	0	0

•32-bit 232 = 4,294,967,296 (4G). Usually, 3 bytes are used to represent the three primary colours and the fourth byte is used as the *alpha channel*.

3.1.4 Resolution

Resolution measures how much detail an image can have as previously mentioned in Module 3 Unit 1 Section 3.2.3. There are several resolutions relating to images; some of which are the followings:

a. *Image resolution* is the number of pixels in an image. 193 x 145

= 27,985 pixels, 3088 x 2320 = 7,1641,60 pixels.

b.*Display (Monitor) resolution* — refers to number of dots per inch (dpi) on a monitor. Windows systems usually have 96dpi resolution. Some high resolution video adapters/monitors support

120dpi. For example, a 288 x 216 image displayed on a monitor with 96dpi will be 3" x 2 ¼".

c. *Output resolution* — refers to number of dots per inch (dpi) on a (hard copy) output device. Many printers have 300dpi or 600 dpi

resolution. High-quality image setters can print at a range between 1200dpi and 2400dpi, or higher.

Sources of Digital Images

There are many sources from which digital images may be acquired or created. Notably among them are:

a. Draw/Paint Programs

Make an image from scratch with a paint program. A good program will allow you to choose the depth, resolution and size.

b. Clip Art Packages

Grab an image of a screen. The depth, resolution and size is determined by the screen.

c. Digital Cameras and Camcorder

Capture an image from a digital camera or a camcorder. The depth, resolution and size are determined by the camera or the camcorder. The popular depth is 24-bit. The commonly used resolution is 320 x 240, 640 x 480 and 800 x 600.

d. Scanners and Digitizers

- Scan or print a photograph using a scanner. You can select from a range of different depths and resolution. The choice should be determined by the type of original and the final output form.

- Convert from existing digital media— e.g., photoCD. The attribute is determined by the original image.

e. Synthesize an image from numerical data i.e. using MATLAB Software.

f. Stock photograph agencies

Vector Graphics

In mathematical and scientific applications, images are seen as vector objects or graphics. They are thus represented by such attributes as size, colour, spatial location, dimension etc rather than pixels. This is an abstract representation of a 2-dimensional or 3-dimensional scene. A vector graphics file contains graphics primitives, for example, rectangles, circles, lines. There are many languages for describing vector graphics; some of which are:

a. PostScript was developed by Adobe as a page description language.
b. Virtual Reality Markup Language (VRML) use for describing a scene in a virtual world.
c. Scalable Vector Graphic (SVG) user for describing two-dimensional graphics in XML. It allows three types of graphic objects: vector graphic shapes, images and text.

3.3 Comparison of Bitmap Graphics against Vector Graphics

Comparison Factor		**Bitmap**	**Vector graphic**
1.	*Processing*	A bitmap image is easier to render.	Displaying a vector graphic usually involves a large amount of processing.
2.	*Attributes*	A bitmap contains an exact pixel-by-pixel value of an image. Bitmaps are bound to the individual pixels that describe them.	A vector graphic contains mathematical description of objects. Vectors are bound to mathematical formulas that describe them.
3.	*Resolution*	A bitmap file is fixed in resolution. Changing size means losing information and they tend to fall apart when you make them bigger.	A vector graphic is resolution independent. Changing size does not really affect them and they tend not to be as detailed as bitmaps.
4.	*Memory Usage*	The file size of a bitmap is completely determined by the image resolution and its depth.	The file size of a vector graphic depends on the number of graphic elements it contains. They are smaller in file size.

3.4 Colour Coding Systems

The choice of appropriate colour combination to use in multimedia presentations can be cloudy and cumbersome at times. This is due to the fact that careful choice of colour involves technical and subjective competencies. We need to understand the technical compositions of colour and how it is perceived by human beings.

Colour is the frequency or wave-length of a light wave within the narrow band of

the electromagnetic spectrum (380 – 760nm) to which the human eye responds. Its perception is human physiological activities which thus involve choosing a right colour or colour combination on trial basis, and on aesthetic judgment. In true colour, each pixel represents some color shades.

3.4.1 RGB Colour Code

The RGB colour code is the most widely colour model used in computer graphics and websites. RGB is an additive coding system in which varying amount of the three primary colours (Red, Green and Blue) are added to black to produce new colours. Iimagine three light sources of the primary colours shining on a black surface. Different secondary colours can be produce by varying the intensity of the lights on the black surface as illustrated in the diagram below.

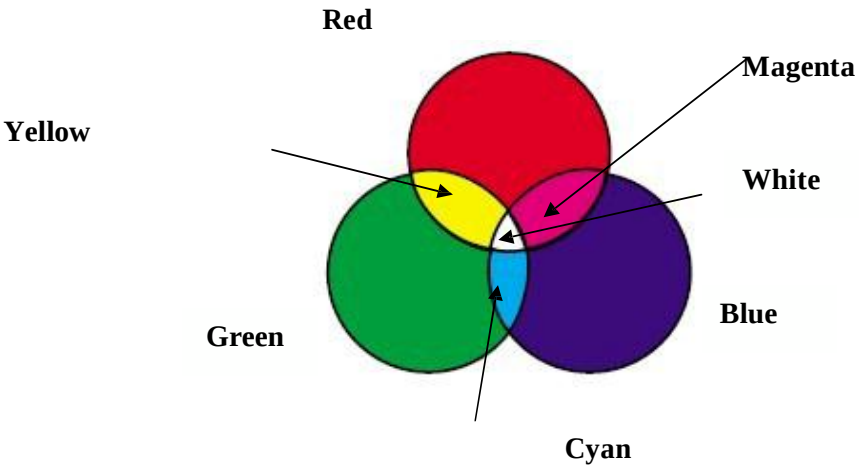


Figure …. RGB Colour Coding System

RGB code can be expressed in decimal (binary interpretation) and Hexadecimal codes. A pixel in RGB is represented by three decimal values <red, green, blue>, where each value ranges from 0 to 255 and therefore provide 256 different color shades. For example Red has a value of <255, 0, 0>, Green <0, 255, 0> and Blue <0, 0, 255>. Combination of the varying values produces different color e.g <0, 255,
255> give Turquoise, <255,255,255> gives White, <255, 0, 255 > gives Pink etc. A given colour is therefore certain mixture of red, green and blue.

The hexadecimal representation is based on the hexadecimal numbering system which comprises of numbers (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F). Each RGB colour can be uniquely represented by 6digits hexadecimal number preceded by "#". E.g. #00AEED Light Blue. There are sixteen predefined hexadecimal numbers in the RGB spectrum as illustrated in the figure below:

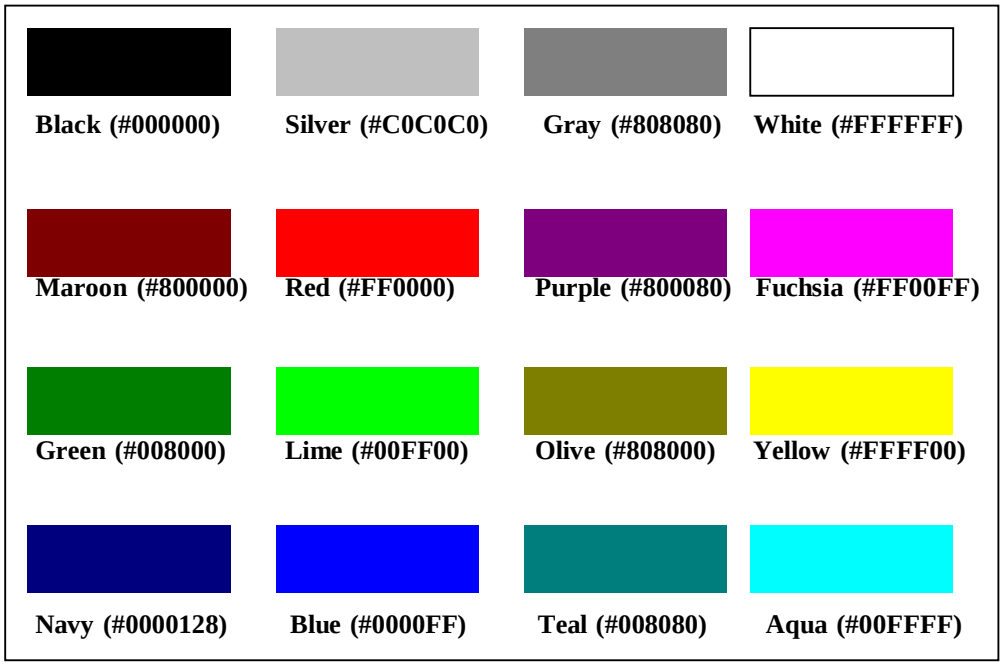


Figure. Predefined Hexadecimal Colours

3.4.1.1 Conversion from Hexadecimal to Decimal

The RGB decimal code (i.e. <255, 0, 0> for Red) is a 3-byte binary number which means <11111111, 00000000, 00000000>.

To convert this number to its hexadecimal equivalent, simply divide each binary number into two 4-bits number, e.g. <1111 | 1111, 0000 | 0000, 0000 | 0000> and then convert each 4-bits number to its decimal equivalent, and then finally to its hexadecimal equivalent. In this instance,

<255, 0, 0> *Given Decimal Color Code*
<11111111, 00000000, 00000000> *Step 1.*
<1111 | 1111, 0000 | 0000, 0000 | 0000> *Step 2.*
< 15 | 15, 0 | 0, 0 | 0> *Step3.*
#FF0000 *Desired Hexadecimal Code*

Can you try these: #B7B7B7 = <183, 183, 183>?
#0469B3 = <4, 103,179>?
#4A2885 = <74, 40, 133>?
To convert from hexadecimal to decimal, follow the outline steps above in reverse order.

3.4.2 CMYK Colour Code

The CMYK code uses three primary colour pigments, cyan, magenta and yellow and is based on the light absorbing quality of inks printed on paper. CMYK is a *subtractive* model. The value of each primary colour is assigned a percentage from the lightest (0%) to the darkest (100%). Because all inks contain some impurities, three inks actually produce a muddy brown and a black colour is added in printing process as a result of combination of the three colours.

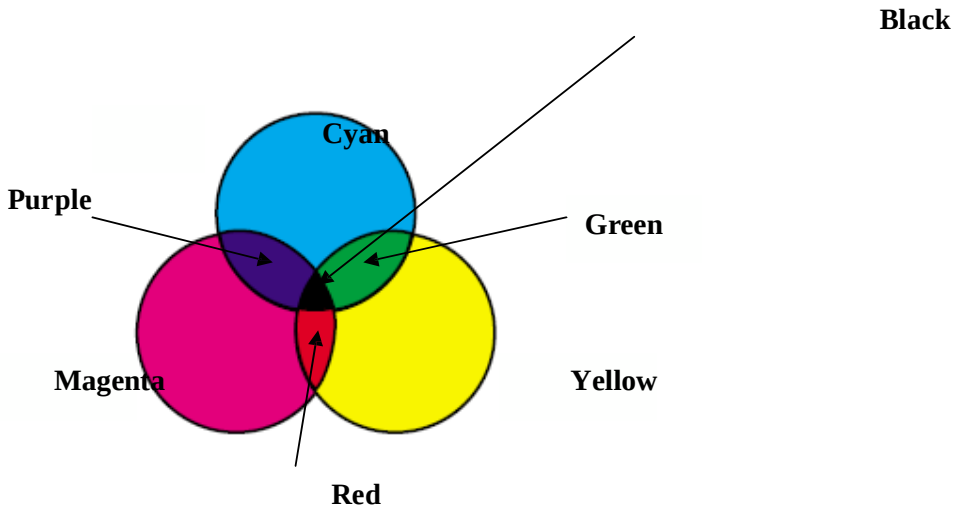


Figure The CMYK Colour Code

Some secondary colours from the CMYK as shown in the diagram above include:

a. Purple = Cyan + Magenta b. Green = Cyan + Yellow
c. Red = Magenta + Yellow
d. Black = Cyan + Magenta + Yellow

3.4.3 HSB Colour Code

The HSB colour code is based on the human perception of colour and has three fundamental characteristics.

i. **Hue**

Hue is the wavelength of the light and Hue is often identified by the name of the colour it represents. Hue is measured as a location on the standard colour wheel as a degree between 0^o to 360^o.

ii. **Saturation**

Saturation is the strength or purity of a given colour. It represents the amount of gray in proportion to the hue and is measured as a percentage from 0%(gray) to 100%(fully saturated).

iii. **Brightness**

Brightness is the relative lightness or darkness of a given colour. It is measured as a percentage from 0%(black) to 100%(white).

3.4.4 YUV Colour Model

The YUV color code is widely used in encoding colour for use in television and video. The theory behind this model is that human perception is more sensitive to brightness than any chrominance information, so a more suitable coding distinguishes between luminance and chrominance. This also produces a system that is compatible with black-and-white TV systems.

The Y-signal encodes the brightness information which is used by the black-and-white television system while the U and V channels encode the chromatic information. The resolution of the U and V channels is often less than the Y channel for the reason of reducing the size.

3.5 Gamut

The gamut of a colour code is the range of colours that can be displayed on computer monitors or printed on papers. The colour spectrum that can be viewed by human eye is wider than any method of reproducing colour. Different colour models have different gamut. The RGB code has a larger gamut than that of the CMYK code.

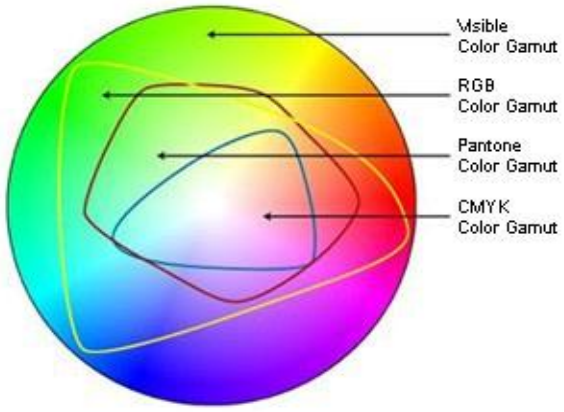


Figure ….. Colour Gamut
Source: Arts 21- Introduction to Computer for Art

3.6 Colour Palette

A colour palette is an indexed table of available colours spectrum in a given colour code. When working in 8-bit mode, a system can display only 256 colours out of a total of 16 million colours (<256, 256, 256>). The system keeps a default palette of available colours.

One major challenge in multimedia presentations is refer to palette flashing. Palette flashing is an unpleasant flash of unwanted colours that occurs on the computer monitor when working with digital images. It occurs because each graphic application has its own colour palette and may replace the computer monitor's palette with its own for the period it is active.

3.7 Dithering and Aliasing

3.7.1 Dithering

Dithering is a technique to increase the number of colours to be perceived in an image. It is based on human eye's capability for spatial integration (i.e. if you look at a number of closely placed small objects from a distance, they will look like merged together). Dithering technique groups a number of pixels together to form a cluster. When viewed from sufficient distance, the individual pixel will not be distiguishable. The cluster will look like a single block of a colour different from the individual pixel.

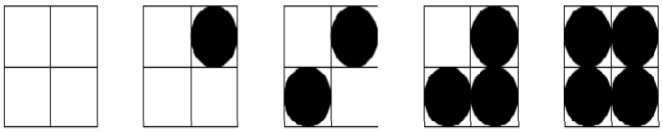


Figure Dithering
(Source: COMP3600/SCI2600 Multimedia Systems, Department of Computer Science, Hong Kong Baptist University)

3.7.2 Anti-aliasing

Aliasing is what happens when solid colors don't conform to vertical and horizontal edges. It is caused by the limited resolution of an output device that makes edges seen as staircases.

Anti-aliasing is a technique to soften the staircase effect of aliasing through color interpolation. It works by filling in pixels which should be half filled with different levels of gray or matching colours. The result is sharper edges, not blurring or smoothing them.

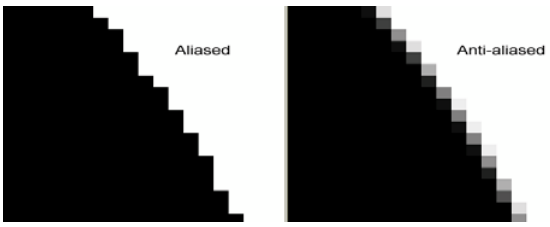


Figure ….. Colour Gamut
Source: Arts 21- Introduction to Computer for Art

3.8 Image and Graphics File Formats

A digital image stored in a computer file must conform to specific standard or format. In addition to the pixel data, the file contains some information (such as the file format, image size, image depth, colour palette and compression technique) to identify and decode the data.

Some formats are defined to work only in certain platform while other can be used for all platforms. Some formats are specific for an application. Some formats are for images, others are for vector graphics. Some formats allow compression, others contain only raw data.

Image Formats With Web Browser Support

- **GIF:** Graphics Interchange Format
- **JPEG:** Joint Photographic Experts Group
- **PNG**: Portable Network Graphics

Image Format Attributes

	GIF87a	GIF89a	JPEG	Progressive JPEG	**PNG**
Lossless Compression	**X**	**X**	-	-	**X**
Transparent Backgrounds	-	**X**	-	-	**X**
Interlacing	**X**	**X**	-	**X**	**X**
Animation	-	**X**	-	-	-
Maximum colours	**256**	**256**	**16.7MILL**	**16.7MILL**	**16.7MILL**

3.9 Compression Algorithms

Compression algorithms can reduce file size by about an order of magnitude.

Lossy schemes	**Lossless schemes**
Discard pixel information (Very high compression rates)	Do not discard pixel information
Reconstruction by approximation	Reconstruction by calculation (exact)
Range of quality / compression trade offs (The better the compression, the worse the quality. Compression usually specified within JPEG images as a percentage from 0% (low quality) to 100% (high quality))	Often suitable for digitally synthesized images (compresses well)
Often suitable for images captured from conventional camera / video (Compresses well, artefacts invisible)	Often unsuitable for images captured from conventional camera / video (compresses poorly)
Often unsuitable for digitally synthesized images (Artefacts / degradation visible)	

MODULE 3 MULTIMEDIA DESIGN AND DEVELOPMENT STRATEGIES

Unit 1 Multimedia Systems Development Life Cycle
Unit 2 Human Computer Interaction and User-Centered Design
Unit 3 Structure and Tools
Unit 4 Assembling a Multimedia Development Team
Unit 5 e-Learning , Multimedia Learning and Cognitive Principles in Multimedia Learning Design

INTRODUCTION

Multimedia applications like every other system involve management of financial, human resources, equipment and time etc. for its objective to be achieved. The success or otherwise of multimedia application would depend on the amount of knowledge put into it, the appropriateness of equipment deployed, due to consideration to critical factors (e.g. users' peculiarities, costs), and so on. Multimedia applications must be designed, developed and deployed within a given budgetary provisions and timing.

MULTIMEDIA SOFTWARE LIFE CYCLE MODELS

Multimedia applications development follows the system development life cycle that has been adopted in the software engineering over the years. A software life cycle is a process which is organized in some order or sequence, structuring activities as a whole. It involves activities (planning, design, development, testing, and deployment), constraints (e.g. time, project size, budget estimates) and resources (e.g. manpower, hardware, software) that produce an intended output. A process uses resources subject to constraints and must have entry and exit criteria. Multimedia designers must take into consideration for example, the relationship between a multimedia application's size and the time required to design and develop it; the relationship between its size and quantity and quality of manpower required.

Generally, **multimedia system development life cycle** can be broken down to the following processes or phases:

i. Preliminary Needs Assessment
ii. Analysis and Design
iii. Development
iv. Testing and Debugging
v. Deployment, Maintenance and Review

The various phases involve in development of multimedia applications are collectively refer to a s life cycle since the direction activity establishes new objectives and goals this set the cycle turning through the phases. Realignment of logical systems towards the set goals considering the constraints and available new information is done when necessary. **There a number of models that have proposed and deployed in specification and developments of software which are applicable to multimedia system. Amongst are**

1. **Classic Waterfall Life Cycle:** The designer starts from the initial phase and move on to the subsequent one on completion of the preceding phase. This model follows the principle of gravity and therefore minimizes change and maximizes predictability of costs and risks. Projects can be divided into sub-components and given to sub-team to complete within a time frame (milestones) and with specific output (deliverables). Its limitation includes the fact that software requirements are susceptible to changes even during design and development, and realistic model encourage cycles.

2. **Rapid Prototyping Model:** A prototype is a partially developed product that enables customers and developers to examine some aspect of a proposed system and decide if it is suitable for a finished product. It is an abstraction of the real system which can be subjected to series of tests in order to predict the behaviour of the proposed system in real life. Potential users and domain experts reviewed the prototype by summarizing findings and made recommendations. Multimedia authoring tools facilitate prototyping. Prototyping is useful when the

i. workability of the proposed solution is in doubt; and
ii. objective is to minimize its impact during the system implementation.

The **throwaway** prototyping is similar to rapid prototyping but when the prototype has been used to produce a kind of animated specification, it is thrown away, and the final system is designed from scratch. It is useful for producing the requirements specification.

3. **Iterative and Incremental Model:** Incremental development of functionality involves starting with small and functional subsystem, and adding additional (secondary) functionality. Iterative development of overall system delivers a full system in the first release, then changes the functionality of each subsystem with each new release. It primitive forms of all three functions in the various versions (Releases) and then enhance (making them faster, improving the interface, etc.) in subsequent releases.

4. **Formal Methods:** Formal methods rely on the use of mathematical logic to achieve the software verification and validation to prove that its meet the specification outlined in the preliminary phase. The goal is to enhance the process of transiting from the initial phase (agreed specification) to machine executable code (version) of the system through provision of better error-checking mechanism and avoidance of future errors.

3.1 Preliminary Needs Assessment

The multimedia designers in consultation with its client (project owners), subject expert and the intended users establish the general tasks which the proposed multimedia application is to performed, and the constraints on its production. This may involve the preliminary study of an existing system, be computerized or manual. The main concerns in this phase include:

a. capturing the ideas and requirements of the clients
b. identifying the potential audience and users of the application

c.finding out the benefit that will gain from developing the application
d. evaluating the feasibility and costs of the entire project, including
all tasks of production, testing and delivery

The most important thing to keep in mind during this stage is to strike a *balance* between the benefit and the cost. A checklist when capturing the ideas and requirements include the followings:

- Who will be the audience or end-users?
- What is the essence of the proposed multimedia application?
- What is the purposed message?
- How can the multimedia application be organized?
- What multimedia elements (text, sounds, and visuals) will best deliver the message?
- Would the available content material with leverage the multimedia application, such as videotape, music, documents, photographs, logos, advertisements, marketing packages, and other artwork?
- Is the idea derivative from an existing theme which can be enhanced with multimedia, or is it something totally new?
- What hardware is available for the development of the multimedia application? Is it enough?
- How much storage space do you have? How much do you need?
- What hardware will be available to the multimedia application end users?
- What multimedia software is available to the multimedia application designer?
- What are the multimedia application designer's capabilities and skills with both the software and the hardware?
- Can the multimedia application be design and develop alone by one person or will it require team work?
- How much time is available to complete the work?
- How much money is available? Would it be sufficient for the completion of the project?
- How will the final project be distributed?

The essentials are to capture the ideas and to quickly evaluate the feasibility of these ideas. The most important considerations are

i.H**ardware: i**s the most common limiting factor for both development time and final users
- very poor sound output device or even no sound device
- limited amount of storage
- very narrow network bandwidth

ii. S**oftware**
- the cost of development software is fairly high
- the cost of software required in delivering to the end users may add up to a large sum

iii. **Contents:** using existing material or producing from scratch
- existing material may not match your requirement

- they are copyrighted, permission may not be granted
- producing new material is expensive and time-consuming

iv. **Skill**: Does it require very broad skill?

- computer skill
- artistic skill
- application domain skill

It is helpful to develop a pilot project or prototype before starting a full- scale development
The deliverables should include the followings:

i. Terms of Reference;
ii. Analysis of the functional system;
iii. Summary of the software and hardware requirements;
iv. An outline description of the proposed multimedia system; and v. Estimates of costs, benefits and timeline (milestones).

3.2 Analysis and Design

The requirements identified in the earlier phase are used as the basis for constructing a more detailed description (software specification) of the functionality of the proposed system. The analysis focuses on the flow of data, and on the processes to be carried out on these data to achieve the intended output. Tools require include flowcharts, data flow diagrams, structured English etc. Succinctly, the phase can summarized as follow:

- **Overview** - description of project goals, conceptual approach
- **Storyboard** - graphic outline of project interface, navigation, and key visual components.
- **Application Flow** - textual outline of all project components, timing, and navigation options.
- **Content Description** - detailed description of all content, including: photography, computer graphics, text, video, voice- over audio, music, sound effects, animations, etc.
- **Content Acquisition Plan** - assignment of interactive multimedia, customer and third party responsibilities in gathering, altering, and creating specific content components.
- **Implementation Strategy** - plan detailing all tasks, technologies, and performance benchmarks required for remaining project phases.
- **Budget and Schedule** - detail of costs, delivery dates, and milestones associated with project deliverables.

Design involves the process of determining how the objectives outlined in the software specification would be satisfied. The specification is used to construct a design for the multimedia application including program details, files, records etc. The focus at this stage is on the logical and physical structures and the processes which access them.

Designing a multimedia application is a creative activity which requires the knowledge and skill with computer, talent in graphics arts, video and music, and knowledge of the subject area of the application.

The design phase include the use of graphical outlines (Storyboarding) which describes the project in exact detail using words and sketches for each screen images, sound, and navigational choice. Storyboarding can be very detail, sketching out every screen, right down to specific colour and shade, text contents, attributes, etc or it may just a schematic guide. It is used to help plan the general organisation or content of a presentation by recording and organizing ideas on index cards, or placed on board/wall. The storyboard evolves as the media are collected and organised: new ideas and refinements to the presentation. Storyboards can be drawn using traditional media, such paper and pencil or by using a computer tool. The concept of storyboarding has been by animators and their like for many years.

The design should follow some kind of arrangement (architecture) of the multimedia information because a well-organised document will help the user find information more efficiently and the architecture design should start early.

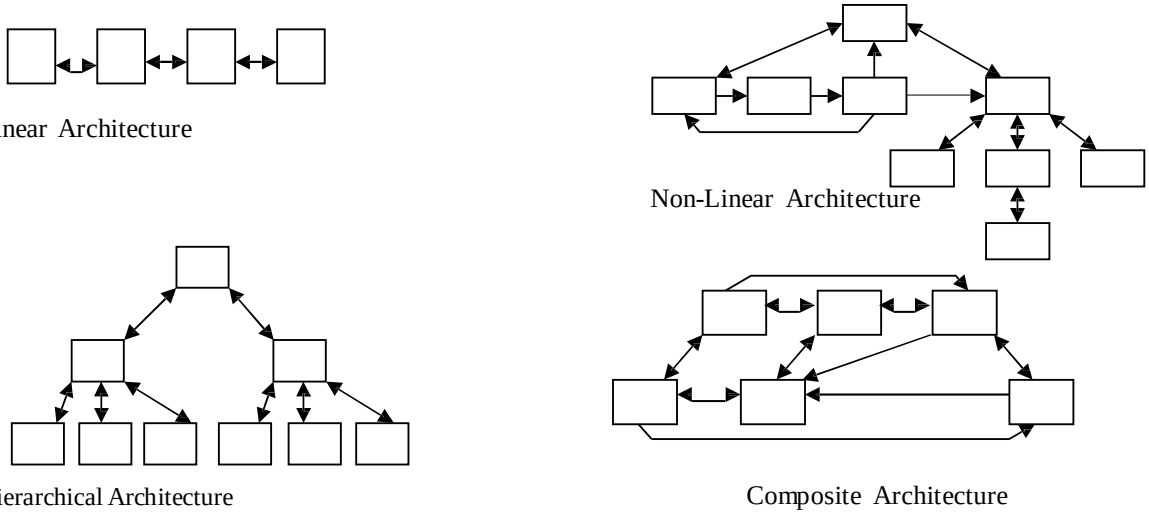


Figure Types of Design Architecture

Different navigation structure may be supported by the same document hierarchy.
For example, by subject and by time

3.2.1 Design: User Interface

The main emphasis in the design of multimedia user interface in multimedia application centers on

i. **Contents selection** is the key to convey the information to the user and the **content** can be influenced by constraints imposed by the

- size and complexity of the presentation
- quality of information
- limitation of the display hardware
- need for presentation completeness and coherence

ii. **Media** must be chosen to be "adequate"
For example, to present a course on how to play tennis, graphics and video are more suitable than text only.

iii. **Coordination** —composition of different media

3.2.2 User interface techniques

- Keyboard —fixed control commands are assigned to keys
- Buttons in a system with Graphical User Interface (GUI)
- Scroll bars—bars may be attached to the side of the application window
- Special device —joystick may be a more natural way of controlling the device
- Direct manipulation of the video window —clicking a point in the application window, the device can be manipulated

Navigation —refers to the sequence in which the application progresses

- Direct navigation—completely predefined
- Free-form navigation— the user determines the sequence of actions
- Browse navigation—the user is provided a large number of choices

An important aspect of any multimedia system is to maintain a clear perspective and the relationship between those objects

Designing user interface

- A good user interface is defined as one that is perceived to be efficient and intuitive by most users
- A good user interface can be designed by following some structured guidelines:
  - Planning the overall structure of the application
  - Planning the content of the application
  - Planning the interactive behaviour
  - Planning the look and feel of the application

3.2.2 User-friendliness

User-friendliness is the primary goal of multimedia interface. The users do not need a long period of time before they can use the system, the learning phase should be quite simple. Users should find it easy to remember instructions and the instructions for the user interface should enable effective use of the application. Logically connected functions should be presented together and in a similar way. Graphical symbols are more effective than textual input and output. Different media should be able to be exchanged and shared among different applications. Prompt feedback after a user initiates an action is necessary.

3.2 Development

The development phase is when the multimedia project is actually rendered. At this stage, the project plan (and storyboard) must be filled with all details. The tasks to be performed in this phase are acquiring all media elements and composing the elements according to the storyboard. This is the phase when the designer's artistic talent and technical knowledge are in high demand. The methods of tracking media elements and the progress of work, and also provision for solving any technical problem that may arise are put in place.

3.3.1 Copyrights

If you acquire content from somewhere, it is very important to know who has the right of the work. Some of the works protected by copyright include computer software, technical innovation and design, literary works, dramatic works, musical works, artistic works, sound recordings, cinematograph films, television broadcast, sound broadcasts and published editions of works etc.

It is necessary to license the rights to use copyrighted material before using it in a multimedia project. This may be done by negotiating the outright ownership of copyrighted material or procuring the rights to use that material. The designers must consider what rights to require:

- How will the material be used and distributed
- Is the license for a fixed period
- Is the license exclusive or non-exclusive
- Where will your product be distributed
- Does the content owner have the authority to assign right to you
- Will the copyright owner receive remuneration for the license

In summary, the design may observe the following outline steps:

- **Final Copy and Content Development**
  - Create, acquire and prepare all photographs, user interface graphics, and other illustrations
  - Model, animate and render all 3D animation components
  - Record, digitize and composite all audio and video components
  - Edit and process all textual components
  - Acquire and prepare all external components such as install software, databases, linked websites, etc.
- **Programming, Testing & Mastering**
  - Build authoring platform framework
  - Import content
  - Develop all programming components
  - Test for proper function and performance targets
  - Optimize performance for each platform
  - Burn beta version for customer content review and functional testing
  - Burn gold master for replication
- **Packaging and Support Literature Design**
  - Design and layout packaging and collateral materials
  - Proof and revise as needed
- **Produce make-ready films and/or digital files**

3.3 Testing and Debugging

A multimedia application may be used by many different users, many of who knows very little about computers, and on a variety of heterogeneous platforms and configurations. Therefore, it is important to test the product in a wide range of configurations. Like all other software, testing and debugging is an important and time-consuming phase. There are two types of testing namely

i. **Alpha testing:** an internal activity whereby the multimedia application is tested by in-house team; and
ii. **Beta testing** involves a wider range of testers (real users) and should not include persons who have been involved in the production of the multimedia application.

3.4 Deployment, Maintenance and Review

3.5.1 Deployment

There are two issues to be considered before a multimedia application is deployed and they are

i. Delivery Tools; and
ii. Deployment Strategies.

3.5.1.1 Delivery Tools

The delivery tools should be planned for early in the development process. CD-ROM and Internet are the two most popular means of delivering multimedia applications. All necessary distribution elements such as:

- **media elements:** e.g. movie clips, sound clips, external casts
- **runtime libraries**: e.g. Director runtime
- **drivers**: e.g. DirectX
- **helper programs**: e.g. QuickTime viewer, Acrobat Reader
- **installation program, compression and decompression programs**

should be included in the final package. The following steps may be following in the final packaging and distribution of the multimedia application:

- **Customization as required**
  - Prepare additional versions for specialized usage
- **CD Replication, Printing when required**
  - Manufacture CD-ROMs
  - Print and/or label CD-ROMs
- **Packaging/Distribution**
  - Print CD-ROM packaging and collateral materials
  - Assemble/stuff and prepare for distribution
  - Distribute

3.5.1.2 Delivery Strategies

According to the means of delivery and the target audience, the designer should plan how the application is to be installed and used. Delivery strategies include direct changeover, parallel running and phased changeover; however these strategies may also be combined.

1. **Direct Changeover:** This is a complete replacement of the old system by the new system in one move. It assumes that the multimedia application is well organized, well implemented, well tested and the user has well trained to effectively use the application.

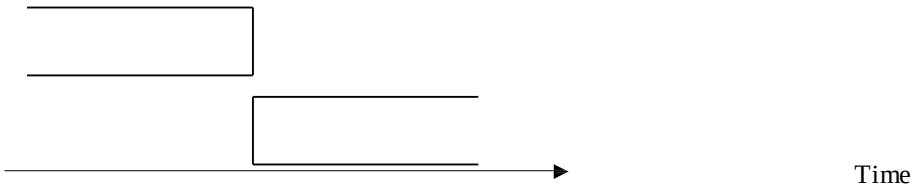


Figure Direct Changeover

2. **Parallel Running:** The old system and the new system are deploy side by side and then cross checked to ascertain the effectiveness of the new system. The old system is not discarded until the new system has been proved to be okay. Its drawbacks include the extra costs of running the two systems concurrently, and the complexity of running two different systems alongside each other.

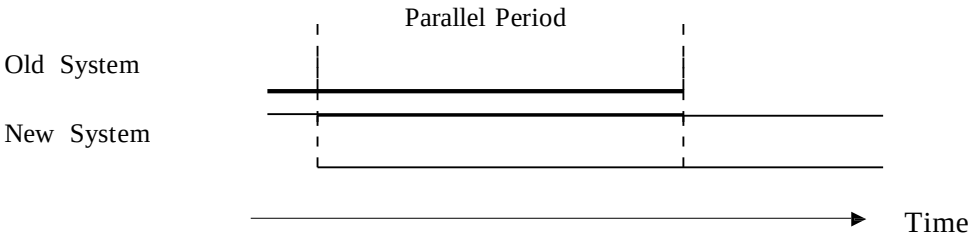


Figure …. Parallel Running

3. **Phased Changeover:** This involves a sequence of direct changeover in small proportion; the new system being introduced in piecemeal fashion. Thus, reducing the inherent risks in direct changeover and allows both the designers and end-users to learn from any mistakes that may occur during the deployment stage.

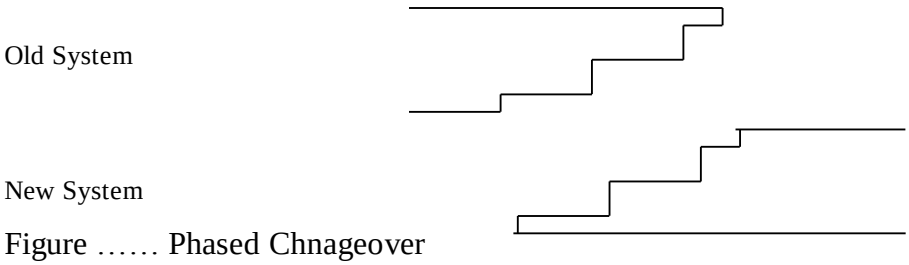


Figure …… Phased Chnageover

3.5.3 Maintenance

The ongoing development of a multimedia application to add new products, functionality, and distribution channels requires adding and revising content and functionality, and convert to additional media types (e.g. video, web, DVD, etc.).

Maintenance involves making sure that the multimedia applications runs in operational use and continues to do so for as long as it is required. It includes correcting any errors which have remained undetected, improving the implementation of system modules where necessary, and enhancing the functionality of the application whenever desired by the clients/end-users.

3.5.4 Review

The post-implementation review takes place only after the multimedia application has been running error-free for a number of cycles. Some specific aspects of the multimedia application are studied over a reasonable period and the findings are documented. These aspects will include the following:

i. **Timing**
The actual time taken to complete the various processes in the multimedia application and the time it takes for enquiries to be satisfied are studied. The aim is to obtain feedback when compared with the term of reference.

ii. **User Satisfaction**
The usefulness of the multimedia application would depend on how satisfied the end-user is with the system, especially with error-recovery and training methods.

iii. **Throughput**
This would enable the designer to measure how many transactions and enquiries the multimedia application is able to process within a given timeframe.

iv. **Error-rates**
The number and level of errors that occur during process are also considered.

v. **Gray or Problem Areas**
The designer must record any problem or gray area brought to his attention by the end-user in his evaluation report.

vi. **Actual Costs**
The total actual costs incurred in running the multimedia application are compared with the estimated running costs in the feasibility study.

vii. **Realized Benefits**
The actual benefits realized from using the multimedia application are compared with the expected benefits stated in the feasibility study.

3.6 Issues in Multimedia Applications Design

Some additional issues involved in multimedia content and technical design are discussed as follow:

3.6.1 Content Design

Content design deals with what to say and what media/tool to use. In multimedia, there are five ways to format and deliver the message, namely,

i. write the message;
ii. illustrate the message;
iii. wiggle the message;
iv. hear the message; and
v. interact with the message.

3.6.1.1 Scripting (writing) the Message

A well-scripted message would require that the multimedia application designer

1. Understand the audience of the proposed multimedia application and correctly address them.
2. Keep his writing as simple as possible. (e.g., write out the full message(s) first, and then shorten it.)
3. Make sure technologies used complement each other.

3.6.1.2 Illustrating the Message (Graphics)

The designer should make use of pictures and graphical illustrations to effectively deliver the intended messages. Visual contents are retained in the human memory longer than audio and writing message. The graphical styles such as the fonts (typeface, size, colour, style etc.) and colours (pastels, earth-colors, metallic, primary color and neon color) should be considered.

3.6.1.3 Wiggling the Message (Animation)

Sometimes, the message is better illustrated with animated objects. Objects are animated to achieve some purposes such as stressing a point, improving information delivery, enhancing emotional impact, indicating the passage of time, showing transition (motion, cut, fade, dissolve and wipes). Various animation styles include character animation (revealing emotion, stimulating movement, enhancing visual style), highlights and sparkles), moving text, and live or digitized video.

3.6.1.4 Hearing the Message (Audio)

The following constitute the various ways audio message could be created:

1. **Music:** set the mood of the presentation, enhance the emotion, illustrate points;
2. **Sound effects**: make specific points, e.g., squeaky doors, explosions, wind etc; and
3. **Narration**: most direct message, often effective.

3.6.1.5 Interacting with the Message (Interactivity)

Interacting with multimedia contents ensures that the multimedia user come into contact with two learning domains, affective and psychomotor. Interaction enhances content comprehension, retention and recall. This due to the fact that human being remembered more than
70% of what they interacts with or put into practice. Thus, interactive multimedia provides a convenient means of setting up some simulated laboratory and practical exercises in the learning environments.

3.7 Technical Design

Technological factors may limit the effectiveness of the multimedia presentation and such technical parameters that affect the design and delivery of multimedia applications include:

1. **Video Mode and Computer Platform**

There are many "portable", "cross-platform" software and "run- time modules", but many of them lose quality/performance during the translation.

Video Mode	Resolution	Colors
CGA	320 x 200	4
MCGA	320 x 200	256
EGA	640 x 350	16
VGA	640 x 480	256
S-VGA	1,024 x 768	$>$= 256
S-VGA	1,280 x 1,024	$>$= 256

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16-bit color --$>$ 65536 colors
24-bit color --$>$ 16.7 million colors

2. **Memory and Disk Space Requirement**

Rapid progress in hardware alleviates this problem, but software requirements changes more rapidly, especially the multimedia ones.

3. **Delivery Mode**

a. Live Presentation: short checking list for hardware/software requirements:

- type of graphics card
- video memory (1 MB, 2 MB, 4 MB, etc.)
- access time of hard disk (important for real-time video)
- type of sound card (support for General MIDI)
- audio-video software

b. Delivery by diskette: small in size, slow to install

c. Delivery by CD-ROM: large capacity, access time of CD-ROM drives is longer than hard-disk drives.

d. Electronic Delivery (ftp, www, etc.): depends on baud rate, network connection, bandwidth and monthly bill.

3.8 Visual Design

Here we summarize factors that should be considers in the visual design of a multimedia presentation:

1. **Themes and Styles**: A multimedia presentation should have a consistent theme or style, it should not be disjointed and cluttered with multiple themes. The choice of theme the style depends on the styles and emotions of the audience peculiarities the multimedia presentation is addressing. Some possible themes include:

a. **Traditional theme**: straightforward, simple, often informative but not as interesting;
b. **Cartoon theme**: interesting or entertaining and must be consistent with the character's personality;
c. **Technical theme**: include blueprints, 3D models of the product, e.g., start with a drawing, then transformed into a rendered image. Reveals adequate technical information and gives impression of solid design and construction; and
d. **High Tech theme:** contemporary computer art work (morphing, texture mapping, metal texture, explosions), attractive, and easy to animate.

Color schemes and art styles include:
a. **Natural and Floral:** getting back to nature (outdoor scenes, e.g., mountains, lakes, ...); and
b. **Oil paints, water colours, colored pencils, pastels.** the art styles can be combined with e.g., cartoon or high tech themes

2. **Pace and Running Length Guidelines** include:

a. Allow a block of text to be slowly read twice;
b. Transition time should be an indication of real-time.
- dissolve - time delay, scene change
- cut - two views of same scene at same time, or abrupt scene change

c. Running length
- self running presentation: 2-3 minutes
- limited interaction: 5-6 minutes
- complete analytical, hands-on demo: < 15 minutes
- with questions, discussions: > 30 minutes

d. Interlude: build in breaks for long presentations

3. **Basic Layout**

(a) Title (b) Action area (c) Narration (d) Dialog (e) Interactive controls

• make sure that the information delivery path in the layout is smooth, not irregular/jumpy
• use headlines/subtitles, additional shapes, buttons, fonts, backgrounds and textures to enhance the visual appearance.

UNIT 4 ASSEMBLING A MULTIMEDIA DEVELOPMENT TEAM

CONTENTS

INTRODUCTION

Multimedia design, development and deployment require a multi- disciplinary approach since diverse subject areas are involved in single multimedia applications. In actual fact real-life multimedia applications require pooling together teams of many skilled and knowledgeable people in different areas such as computer science, instructional technology, physics, visual and graphical arts, measurement and evaluations, science communication, voice and screen actors, management, psychology, mathematics (logic, algebra & geometry), digital content repository, film production and photography etc.

For instance, multimedia data elements such as sound require expertise in sound engineering and management; image and objects would require special skills in visual and graphics including 2D and 3D animation, video and audio production, image design and manipulation, and detailed web design; multimedia learning and e-learning systems would require expertise in curriculum design and instructional technology beside others; multimedia programming involve extensive knowledge in all web-based programming languages and techniques; and so on.

In all management plays an important role in assembling all the needed resources, and coordinating this array of personnel from diverse areas to achieve the team overall goals and objectives. Also the multimedia life cycle (analysis, design, implementation, testing, delivery and maintenance) must be effectively coordinated.

3.0 PROJECT MANAGER

Multimedia applications like every other project require someone with human, material, machine, financial resources management skills. Such a person refer to as project manager (or project consultant or producer or team leader) coordinates the entire development of the multimedia project and facilitate team-spirit, team-binding and unity among members of his team. He is responsible for overseeing project timeline and priorities, quality of the final product, allocation of funds, and the time management of the project, communicating the team's objectives and achievement to team members, assists in personnel recruitment and selection, delegating duties and supervision, maintaining conducive work environment, and documentation. He has a clear understanding of the team's roles and responsibilities, and sees to it that members remain focus on their jobs especially in times of difficulties. He is a dynamic, proactive and innovative individual with excellent team-working skills and the ability to liaise with a wide range of users.

He keeps records such as budget estimates, schedules, creative sessions, time sheets, illness, invoices, and team dynamics or personnel turnover. He provides answers to questions such as:

- Why is important to have a project timeline and set priorities?
- Why is it important to schedule meetings?
- Why is it important to keep minutes of meetings?
- Why is it important to have a project librarian?
- Where would you keep documents for your project?

Key activities of a multimedia project manager include:

- Coordinates initial start up meetings between all parties;
- Schedules additional meeting throughout the project;
- Clarify, publish, and communicate timelines and milestones (establish deadlines);
- Breakdown the allocation of tasks and ensure all agencies are aware of their schedule and responsibilities;
- Monitor the allocation of tasks and the use of resources;
- Monitor progress of work in development of the multimedia presentation;
- Manage the allocation of financial resources;
- Ensure quality control throughout the project and sign off the final deliverable;
- Evaluate the process and produce a project completion report; and
- Market the final product; ensure the product reaches the target audience.

3.1 Graphic Designer and Art Director

The ***graphic designer*** assembles together images, typography or motion graphics to create a piece of design primarily for published, printed or electronic media. He knows how to organize and communicate visual information effectively in a way that is both accessible and memorable. He is able to transform textual and mental information into visual/graphical information effectively. He is responsible for creating interactive

and creative design that stimulates user's interest in the multimedia presentations and which leaves a lasting impression on their minds. He design illustrations, user interfaces and web designs, and determines how multimedia contents are presented to the users.

Some of the skills and attributes required in a graphic designer include:

- Proficiency in one or more graphic design software programs, relevant to the job function. A web designer should understand how to work with XML, HTML and basic web programming scripts while a print designer should understand the processes involved in printing to be able to produce press-ready artwork;
- Good in solving visual communication problems or challenges.

He should be able to identify the communications issue, gather and analyze information related to the issue, and generate potential approaches aimed at solving the problem;

- Good understanding of the social and cultural norms of that audience in order to develop visual solutions that are perceived as relevant, understandable and effective;
- thorough understanding of production and rendering methods such as colour, drawing, offset printing, photography, and time- based and interactive media (film, video, computer multimedia);
- produce design solutions to communicate their clients' messages with high visual impact using production medium such as websites, advertising, books, magazines, posters, computer games, product packaging, exhibitions and displays, corporate communications and corporate identity;
- meet the end-users or client's objectives by developing creative ideas and concepts, choosing appropriate media and style, and ultimately working to an agreed brief with the end-users or clients; and
- have creative flair, up-to-date knowledge of industry software and a professional approach to time, costs and deadlines.

The graphic designer's roles within a multimedia development team include:

- meeting clients or account managers to discuss the business objectives and requirements of the job;
- interpreting the client's business needs and developing a concept to suit their purpose;
- estimating the time required to complete the work and providing quotes for clients;
- developing design briefs by gathering information and data through research to clarify design issues;
- thinking creatively to produce new ideas and concepts;
- using innovation to redefine a design brief within the constraints of cost and time and client;
- presenting finalised ideas and concepts to clients or account managers;
- working with a wide range of media, including photography and computer-aided design (CAD);
- proofreading to produce accurate and high-quality work;
- contributing ideas and design artwork to the overall brief;
- demonstrating illustrative skills with rough sketches;

- keeping abreast of emerging technologies in new media, particularly design programmes such as Quark Xpress, FreeHand, Illustrator, Photoshop, 3D Studio, Acrobat, Director, Dreamweaver and Flash, as most graphic design work is now completed on a computer;
- working as part of a team with printers, copywriters, photographers, other designers, account executives, web developers and marketing specialists; and
- working to meet tight deadlines.

The ***ART DIRECTOR*** is in charge of the overall visual appearance and how it communicates visually, stimulates moods, contrasts features, and psychologically appeals to a target audience. He makes decisions about which visual elements to use, what artistic style to use, and when to use motion.

He translates desired moods, messages, concepts, and underdeveloped ideas into imagery by brainstorming with other team members. He is ultimately responsible for solidifying the vision of the collective imagination while resolving conflicting agendas and inconsistencies between the various individual inputs.

3.2 Script / Content Writer / Science Communicator

A scriptwriter may refer to a person who writes screenplays for film and television (Screenwriter), or a person who writes scripts for live-action entertainment (Playwright) or a person who write scripts for comedy sketches, political speeches, documentaries and other presentations. He is versatile in communication and writing skills, and communicates clearly through written text. He gleaned information from subject matter experts, synthesize it, and then communicate it in a clear and concise manner.

It is duty to adapt the script to the multimedia environment and make sure that the words in the script counts by creating desire impression in the mind of end-users (audience). Computer-based multimedia requires that the scriptwriter to be knowledgeable about multimedia data elements (audio, video, text, graphics, and animation) and should adapt them appropriately for the purpose (which might be education, training, promotion, reference, entertainment, and games) of the multimedia presentation.

The scriptwriter ensures that the rules of the chosen language are responsibly adapted to suite the demands and opportunities presented by computer technology which is characterized by new media and non- traditional methods. Here are some general guidelines when writing scripts for multimedia presentations:

- keep the explanation of a concept or process concise, simpler and easier to understand;
- keep scripts in the active voice which is more direct, and usually shorter than a passive construction;
- present information in digestible chunks;
- make sure all text can be easily understood and read the scripts out loud;

• ensure the script and other multimedia data elements complement one another to allow both the ears and the eyes receive and synchronize the intended messages convey in the multimedia presentation for easier comprehension by the mind; and
• allow users some measure of control over the presentation by incorporating interactivity-led words in the script. Interactivity allows each user to actively participate in the usage (viewing) process, instead of passively watching the multimedia presentation. The nature of the material in the multimedia presentation determines the amount of interactivity that should be permitted.

3.3 Sound Designer and Sound Engineer

The *sound designer* works with the project manager to shape an overall, consistent soundtrack that exploits the expressive possibilities of the sound medium. Sound designer can also refer to a person brought on to create just one kind of sound effect. He has good ear for voice-overs and sound effects, and knows the inherent qualities and constraints of a medium which produces desire sound to the multimedia content. He chooses an appropriate sound effect that accompanies a narration. Specifically, he is responsible for designing acoustics for audio visual, audio and video conferencing, and determines the noise impact in the multimedia application.

Sound designers study the script and gather as much information as they can about any sound or music required to create the appropriate sound that would suit the theme of the multimedia presentation and as well as its content. Sound designer meet with the project manager and the design team at the very much beginning of the project in other to have good and clear understanding of the content in the multimedia presentation.

Sound designers create sound effects in multimedia presentations to:

- motivate actions during actual running of the multimedia presentation and indicate events taking place after running it;
- establish the time of day, season and weather;
- locate the action in a specific place;
- create mood and changes in mood;
- stimulate audience expectations of what is to come;
- provide information about the characters;
- build transitions between scenes; and
- offer shortcuts that rapidly advance the plot or recall past events;

The sound designer combines and varies the five controllable properties (pitch, quality, volume, direction and duration) of sound to create unique effects or music required by the production of the multimedia presentation. He makes use of planning tools such as

- *Plot:* A list of all the music and sound cues for each act/scene. It indicates where the sound of music occurs, the page number of the script where it appears, precisely when it begins and ends, and the equipment that will be used to produce it.
- *System layout:* A system layout shows the type and location of speakers on stage, on the set and in the auditorium. The system layout may also include a layout of how all of the sound equipment will be interconnected.
- *Cue sheet:* A version of the sound plot to be used by the sound technicians who will run the equipment during the performance.

The ***sound engineer*** takes the sound design by the sound designer and ensures that it can be created in a given space. This involves selecting equipment to reproduce the various sound elements required, installing and testing it, and usually running the actual multimedia presentation.

The sound engineer's roles within a multimedia team include:

- has responsibility for some aspect of the sound at during presentations;
- taking care of setting up amps, volume, equalizers, speakers;

3.4 Videographer and Video Producer

A ***videographer*** records moving images and sound on tape, disk, other electro-mechanical device, broadcasting live, or even on actual celluloid film in some cases. He has good eyes for video and makes every megabyte count by recording important details which enhance the understanding of the multimedia contents and stimulates viewers' interest in the multimedia presentation. He is usually responsible for the camera, sound, and lighting and sometimes work underneath a director. In smaller productions (e.g. corporate and event videos), a videographer often works alone or as part of a two or three person team of camera operators and lighting and sound technicians.

Videographers are distinguished from cinematographers in that they manage smaller, event scale productions (weddings, short documentaries, short fiction pieces, simple commercials, simple training videos). Due to reduced budget compared to full length feature productions, videographers typically use electro-mechanical cameras

while cinematographers record images on film. The advent of digital cinematography, however, has blurred this distinction.

Videographers maintain and operate a variety of video equipment, edit footage, and stay up to date with technological advances. The videographer is responsible for the maintenance and operation of the satellite, maintaining and repairing video walls, video tape editing in various formats, creating graphics for the cruise events and information channel, shooting and editing video tapes, programming the broadcast room such as tuning in TV, radio and playing of movies.

On the other hand, **v*ideo producer*** provides information about audio and *video* production, DVD authoring and duplication, corporate presentations and audio/visuals. Video producers work closely with all members of the multimedia development team on video productions to ensure that the process goes smoothly and is completed on time. The video producer must have a good working knowledge of all aspects of production from set design, lighting and audio through to editing, filming and working with scripts.

The video producer liaises with the project manager in making sure that all required supplies, equipment and staff are in the correct place at the correct time. Coordinating these services may be a large part of the video producer's daily responsibilities prior to the commencement of shooting. Once filming is in progress the video producer will work to coordinate the actual filming, ensuring that all aspects of filming are completed correctly.

A video producer must be creative and have an ability to work with various people and various settings, and budgets to end up with just what was wanted at the end of the project. Good communication skills as well as patience and the ability to motivate others are needed in a video producer.

The video producer's roles within a multimedia team include:

- coordinating all aspects of the filming production and confirming that all people, supplies and equipment will be available when required;
- handling all logistics of the filming including making sure that script writers, graphic designers, subject matter experts, instruction designers etc. have completed all necessary paperwork and meet all requirements in the design specification;
- editing and processing the video to produce exactly what the project manager or end-user required;

- troubleshooting issues with filming, modifying or changing scripts, or adding additional aspects to the filming to enhance the production; and
- communicating with directors or clients to determine exactly what they want and then producing that in the studio.

3.5 Subject Matter Expert

The subject matter expert is someone skilled and knowledgeable in a given topic area and has experience teaching the topic. He is versatile in tutoring, mentoring and coaching the subject matter, and therefore serves as the primary source of authoring for the multimedia content. He identifies background resources for building the multimedia contents and reviews content design for factual integrity, completeness and educational effectiveness. He is not necessarily the multimedia a designer or developer but serves a complementary role in the multimedia development team. He knows the subject matter very well and is able to use the right messaging and terminology when teaching the subject matter.

The subject matter expert is critical to the validity of the content of Multimedia presentations. Therefore, the use of subject matter experts in providing content expertise advice toward the development of the product should not be overlooked. Subject matter experts have a stake in the multimedia project because it will reflect their degree of expertise and knowledge. In most cases they don't end up as the end-users, but certainly are involved in providing the technical expertise to the content. The quality of the content will only be as good as the expertise of the contracted subject matter experts involved in the multimedia project.

Multimedia project manager must ensure that the subject matter experts are available, understand their role, and most importantly be left to provide subject matter expertise only. It is advisable to allow subject matter expert to be focus on content, rather on the development of the multimedia presentation.

The following areas of general expertise are assumed as prerequisites and provide a basis for the competencies expected of a subject matter expert:

- a good all round knowledge of the subject-matter of the course;
- the background pedagogy that underpins the course;
- a good understanding of the limits and limitations of the information and communications technology;
- a closer working and sharing relationship with the learner;
- provide learners with "positive" support and "positive" encouragement; and
- a role of mentor/counselor as well as academic advisor

3.6 Instructional Designer

The instructional designer is a very critical key to success for effective multimedia development since he can assess educational needs and design and evaluate lessons. All multimedia presentations geared towards creating a dynamic, effective learning environment must have legitimate and sound instruction design and strategy built into the presentations.
The instructional designer's roles within a multimedia team include:

- providing advice on effective and efficient learning strategies;
- working with the subject matter experts to breakdown the content and organize it into reasonable chunks;
- designing effective learning strategies and build them into the multimedia project;

•conducting needs assessment and matching design to instructional needs;
• organizing, managing, and delivering information in such a way to create an effective learning environment;
•developing introductions, main content body, review, application, an motivational segments of the multimedia presentation;
• identifying and studying the target audience and designs the level of learning appropriate to their needs;
•identifying the key components of effective multimedia development and delivery, and ensures this built into the project;
•conducting research without agencies to acquire additional resources and references;
• designing a logical and structured format to the design decision throughout the development of the project; and
•evaluating the final "pilot" product and make necessary adjustments to fine-tune the educational effectiveness of the multimedia.

3.7 Multimedia Programmers

Multimedia programmers translate the requirements of the end-users, graphic designer, subject matter expert, instruction designer, and other team members into the programming language, working out the logical steps that must be taken by the computer to do a task so that the multimedia presentation works as planned. A multimedia programmer is a software engineer who integrates all of the multimedia elements into a seamless whole using an authoring language or programming language. Multimedia programmers make computer programs that use text, sound, graphics and pictures, 2D/3D modeling and virtual reality.

The roles of a multimedia programmer within a multimedia team include:

- meeting clients' (end-users) needs in the most effective way, and ensuring that the end product is both attractive and user friendly;

- creating multimedia presentations that use more than one way to communicate information. i.e. they may combine the different media elements such as sound, text, graphics, animation and video pictures to communicate an intended message, or concept/idea;

- collaborating with other team members (e.g. script writers, artists, graphic designers, animators and sound engineers) in developing the content of the multimedia presentations;

- translating the design into a language that the computer can understand by designing and writing computer codes, testing these codes and fixing bugs;

- developing games, educational software, websites, film, television and digital video productions;

- putting the different media in logically sequential order; making animation happen at the right time; using sound effects appropriately and generally implementing the

instructions of the creative designer; and

- designing and writing web pages, program the links to databases, or create graphic effects for film studios.

Some of the relevant skills and attributes required to be a multimedia programmer include:

- the ability to mentally construct and communicate multimedia ideas;
- presenting ideas and information in writing, and explaining these ideas and information to end-users and team members;
- strong communication and interpersonal, skills to swap ideas, and to explain your work clearly and concisely to people who may not have much computer knowledge;
- have a clear understanding and appreciation of other members' role in the multimedia development team;
- enjoy solving problems, exercising logical thinking and working on a project from start to finish;
- have creative ideas about designs and styles, and the ability to create an accessible computer / user interface;
- strong interest in information technology;
- knowledge of Internet programming languages and applications;
- the ability to incorporate elements of different media into a whole presentation;
- good teamwork and co-operation with other team members;
- good organizational skills as well as ability to plan and meet tight deadlines, and ability to work well under pressure;
- preciseness, persistence, analytic, accuracy open mind to future possibilities and paying attention to minutest detail; and
- willingness to learn and improves, and be up-to-date with latest developments in a constantly changing technology industry and improving.

3.8 Quality Assurance Engineer

Quality assurance (QA) engineers are responsible for assuring that the developed multimedia presentations are effective and free from errors (defects) or operational problems by testing them to make sure they works according to design specification and meet users' need. The test is carried out under various working conditions or for verifying the information the correctness of the content in the multimedia presentation. QA engineers verify and guarantee the accuracy or performance of the multimedia presentation as well as troubleshoot the correction of any problems or issues throughout the development of the presentation through systematic quality auditing, proofing and compliancy checks at key points in the project development cycle.

The QA engineer is the tester for the product and is required to use it both as recommended and otherwise. His ability to think of how consumers may use the product incorrectly is important in liability and other legal issues for the multimedia team. The QA engineer is also expected to provide feedback on the user-friendliness (or otherwise)

aspects of the product, and should suggest ideas for modifications and improvements.

QA engineer should possess the following attributes:

- an understanding of the multimedia presentation;
- the goals of the multimedia development team for the multimedia presentation;
- good background in multimedia design and development;
- experienced in data entry, accurate record keeping and attention to detail; and
- effective communication skills and the ability to work as part of the team in developing and testing products is key;
- they are problem-solvers who like a good puzzle;
- persistence, meticulous, thorough, detail-oriented, and enjoy tinkering; and
- understand the problems that users can encounter and able to build bridge between end-users and programmers, so they must.

The roles of a quality assurance engineer within a multimedia team include:

- discussing the multimedia presentations to be tested with the development team and the end-users;
- testing and assessing the effectiveness, accuracy or safety of multimedia; presentations based on existing safety standards or performance guidelines;
- entering data entry, recording of results and completion of paperwork in a timely fashion;
- making sure that all the programs work properly and that everything in a Web site functions according to plan;
- trying and making things not work so the programmer can catch errors before they occur;
- troubleshooting inaccuracies or problems in the multimedia presentations; and
- meeting with the multimedia development team to share results and recommendations.

MODULE 4 MULTIMEDIA AUTHORING: FLASH TECHNOLOGY AND DEVELOPMENT

Unit 1 Overview of Flash Technology
Unit 2 Flash Animation
Unit 3 Introduction Dreamweaver and Cascading Style Sheets
Unit 4 Flash Development: Dynamic HTML and AJAX

UNIT 1 OVERVIEW OF FLASH TECHNOLOGY

1.0 INTRODUCTION

Flash is a tool for creating interactive and animated Web sites. **Adobe Flash** (formerly **Macromedia Flash**) is a multimedia platform originally acquired by Macromedia and currently developed and distributed by Adobe Systems.

DEFINITIONS

Flash is a multimedia graphics program especially for use on the Web and which enables a user to create interactive "movies" on the Web. It uses vector graphics, which means that the graphics can be scaled to any size without losing clarity/quality and Flash does not require programming skills and is easy to learn.

Since its introduction in 1996, Flash has become a popular method for adding animation and interactivity to web pages. Flash is commonly used to create animation, advertisements, and various web page Flash components, to integrate video into web pages, and more recently, to develop rich Internet applications.

Flash can manipulate vector and raster graphics, and supports bidirectional streaming of audio and video. It contains a scripting language called Action Script. Several software products, systems, and devices are able to create or display Flash content, including Adobe Flash Player, which is available free for most common web browsers, some mobile phones and for other electronic devices (using Flash Lite). The Adobe Flash Professional multimedia authoring program is used to create content for the Adobe Engagement Platform, such as web applications, games and movies, and content for mobile phones and other embedded devices.

Files in the SWF format, traditionally called "**S**hock**W**ave **F**lash" movies, "Flash movies" or "Flash games", usually have a. swf file extension and may be an object of a web page, strictly "played" in a standalone Flash Player, or incorporated into a Projector, a self-executing Flash movie (with the .exe extension in Microsoft Windows or. hqx for Macintosh). Flash Video files have a. flv file extension and are either used from within. swf files or played through a flv-aware player, such as VLC, or QuickTime and Windows Media Player with external codecs added.

Animated images and Java applets are often used to create dynamic effects on Web pages. The advantages of Flash are:

- Flash loads much faster than animated images
- Flash allows interactivity, animated images do not
- Flash does not require programming skills, java applets do

Flash Versions include

- Macromedia Flash, Flash MX … Flash 8
- Much better help
- New components
- Better video quality
- ActionScript 2.0
- Adobe Flash CS3, CS4
- Flash 8 is available on Lehigh LANs; trial version of Adobe Flash CS4 on web

3.3 Flash Drawing tools

Flash provides a good interface for creating graphics from scratch beside its usefulness for creating multimedia content. Graphics created in Flash can be saved in gif, jpg, png or other formats. Its vector capabilities allow for easy scaling without loss in quality or detail. Flash drawing is a **vector** graphic format, similar to Illustrator or Freehand. Vector drawings from other programs can be imported into Flash and edited or illustrations can be created directly in Flash.

There are five drawing tools in Flash, the rest are used to modify various aspects of the drawing. The drawing tools are found in **Drawing Toolbar**, which should be docked at the left side of the screen when you first start Flash. If you don't have this toolbar open, click on **Window - Toolbar...**, check the box in front of **Drawing** and click OK.

Activity 2 Draw Shapes

a. Create shapes by using the Line, Rectangle, Oval, Pen, or Pencil Tools
b. Select shapes by using the Selection Tool and the Lasso Tool c. Edit shapes by using Selection Tool and the Eraser Tool
d. View, move, copy, and delete shapes

Activity 3 Draw Rectangles and Squares

a. **To draw a rectangle:**
i. Select 
ii. Place the insertion point on the Stage iii. Drag diagonally
b. To draw a square:
i. Hold down the Shift key while dragging

Activity 4 Create Rounded Rectangles

a. Click 

b. Click the Round Rectangle Radius modifier
c. Specify the Corner Radius and click OK
d. Place the insertion point and drag diagonally

Activity 5 Draw an Ovals and Circles

a. **To draw an oval:**

i. Select 
ii. Place the insertion point on the stage iii. Drag diagonally

b. **To draw a circle:**

i. Hold down the Shift key while dragging

Activity 6 Using the Pen Tool

a. **To create a straight line:**

i. Select 
ii. Click where you want the line to start
iii. Click at a point where you want to place the end point iv. Drag the direction line

b. **To create a closed path:**

i. Click the first anchor point ii. Drag to adjust the curve

Activity 7 Using the Pencil Tool

a. Select 
b. Select an option from Pencil Mode list c. Place the pointer and drag

Activity 8 Copying and deleting shapes

a. **To copy a shape:**

i. Select the shape
ii. Choose Edit, Copy iii. Choose Edit, Paste

b. **To delete a shape:**

i. Select the shape
ii. Choose Edit, Clear

Activity 9 View Shapes

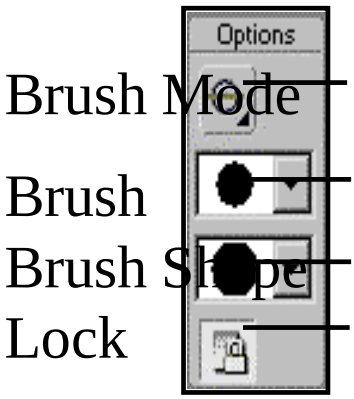
a. **The Zoom tool** 

i. Zoom In to magnify a shape ii. Zoom Out to reduce a shape

b. **The Hand tool** 

iii. To move the Stage

Activity 10 Brush Tool modifiers



Brush tool modifiers contain the Faucet modifier, the Eraser Shape modifier, and the Eraser Mode modifier (Erase Normal, Erase Fills, Erase Lines, Erase Selected Fills and Erase Inside).

3.4 Flash Tint Tweening and Animation

With tint tweening you can change the color of an object. Tweening creates frames between keyframes. Keyframes are different cel created for each action and which synchronize motion change from one stage to another. Tweening is an action which requires calculating the number of frames between keyframes and then sketching onto a cel the series of different actions. Tint changes the color values of each keyframe and with Tint Tweening you can change the color of an object.

Computer animation can imitate the classical technique, with keyframe, tweening and layers. e.g., Macromedia Director and Flash both support these concepts, letting the computer automate the tweening process where possible. But computer animation introduces new techniques, designed to conserve resources e..g, rather than reproduce an entire cel for each frame, individual objects (called **sprites** in Director) move across a background image. Authorware motions give this effect; Director animations provide finer control of sprites. **Morphing** effect can be achieved by dissolving from one image to another, e.g., from one face to another – many specialized morphing software products available.

Example: In this example you will learn how to change the color of an object.

Step 1

Load Adobe Flash.

Choose Insert > New Symbol.

Note: To add Tint effects the object must be a symbol.

Step 2

Name the symbol "changecolor" and select the Graphic option in Behavior. Click OK.

Note: You will now be taken to the symbol generator in the Flash program. Here you create symbols. Symbols can be dragged to the stage of your movie after you have created them.

Step 3

Choose the Text tool in the left toolbox. Choose Text > Size > 36 from the top menu to make the text big. Choose Text > Style > Bold to make the text thick.

Step 4

Click in the work area and write "Color Changing Text".

Step 5

Jump back to the movie. Do this by choosing

3.5 Flash Shape Tweening

With Shape Tweening you can change one object into another. In this example you will learn how to change one object into another.

Step 1

Choose the Text tool in the left toolbox. Choose Text > Size > 48 from the top menu to make the text big. Choose Text > Style > Bold to make the text thick.

Step 2

Click in the work area and write "Hello".

Step 3

Right click on the text you just wrote and choose Panels > Align from the pop-up menu.

Step 4

In the Align box select the "To Stage" button first. Then click on the "Align Horizontal Center" button and the "Align Vertical Center" button. Close the Align box.

Step 5

Select the Arrow Tool and click on the text. Choose Modify > Break Apart from the top menu.

Step 6

Insert keyframes at Frame 24, 50 and 51.

3.6 Flash Button 1

In this example you will learn how to insert an image, convert it to a button, and add a URL to it so it becomes a link.

Step 1

Choose File > Import to import an image that will become a button. Locate the image and click Open. The image will be saved in the Library.

Step 2

Select the image with the Arrow tool.

Step 3

Convert the image to a symbol. Choose Insert > Convert to Symbol from the top menu. Name the symbol "button", choose Button from the Behavior list and click OK.

Step 4

Right click on the image. Choose Actions from the pop-up menu.

Step 5

In the Object Actions box click on the + sign. Choose Basic Actions > Get URL.

Step 6

Enter a full URL in the URL field (like http://www.w3schools.com).

Step 7

Choose target in the Window field. Close the Object Actions box.

Step 8

Choose Control > Test Movie from the top menu

3.7 Flash Button 2

In this example you will learn how to create your own button and add a URL to it so it becomes a link.

Step 1

Choose Insert > New Symbol from the top menu.

Step 2

Name the symbol "button", choose Button from the Behavior list and click OK. In the Timeline area, you will now see the four states of a button: up, over, down, hit.

Step 3

Select the Rectangle tool, pick a light red Fill Color and draw a rectangle in the work area.

Step 4

Select the Text tool, pick a dark Fill Color and write "Click Me" over the rectangle.

Step 5

Select the Arrow tool and place the text in the middle of the rectangle.

Step 6

Add a keyframe to the Over State in the Timeline. The Over State indicates what should happen when you mouse over the button.

Step 7

Select the Rectangle, change the Fill color to a light green.

Step 8

Choose Edit > Edit Movie to go back to the movie.

Step 9

Choose Window > Library to locate the button. Drag the button into the work area.

Step 10

Right click on the image. Choose Actions from the pop-up menu.

Step 11

In the Object Actions box click on the + sign. Choose Basic Actions > Get URL.

There are 3 types of symbols:

- **Movie Clip**
- **Button**
- **Graphic**