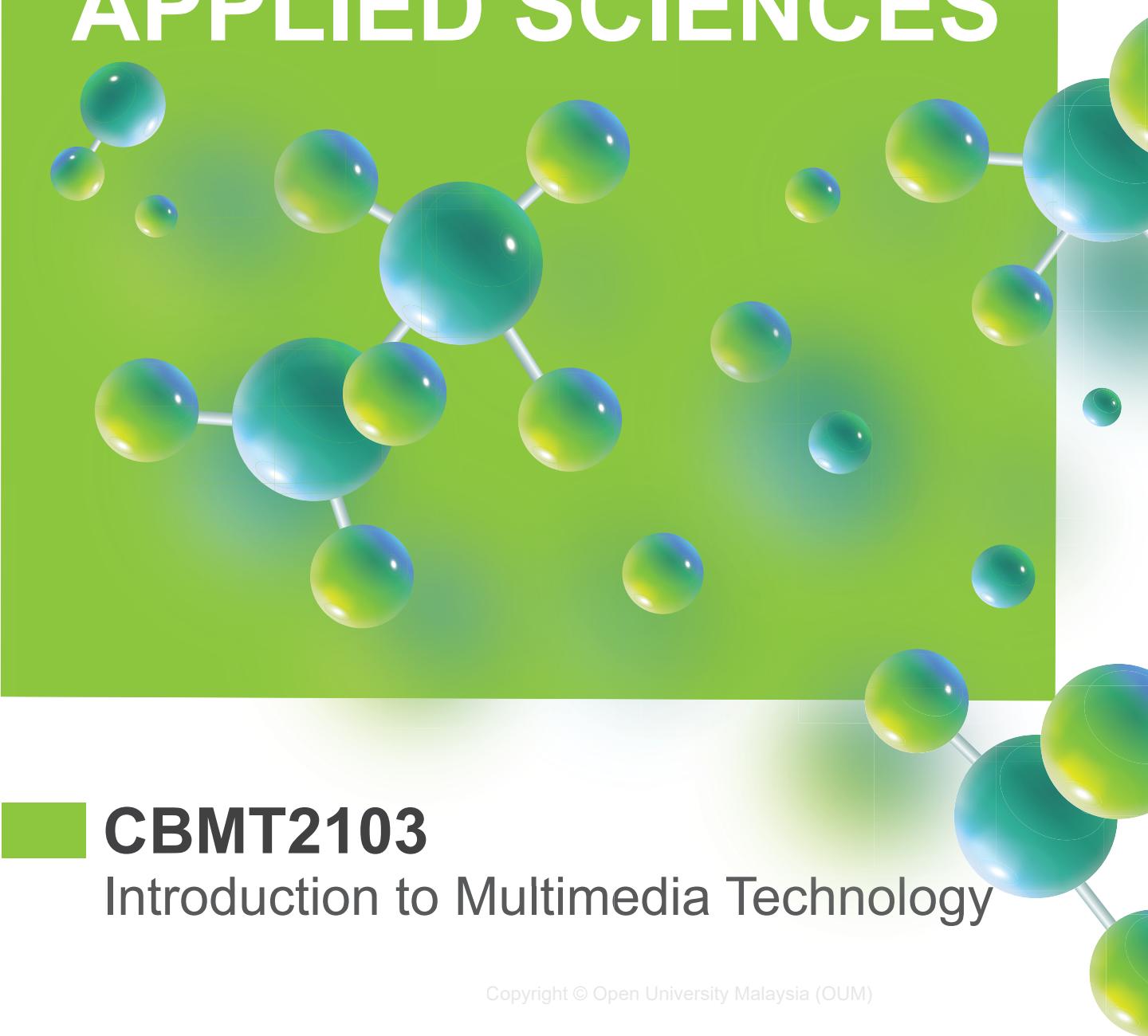


# FACULTY OF TECHNOLOGY AND APPLIED SCIENCES



**CBMT2103**

Introduction to Multimedia Technology

# **CBMT2103**

## **INTRODUCTION TO MULTIMEDIA TECHNOLOGY**

Majumin Hanum Abdul Samad



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# Course Guide

## COURSE GUIDE DESCRIPTION

You must read this *Course Guide* carefully from the beginning to the end. It tells you briefly what the course is about and how you can work your way through the course materials. It also suggests the amount of time you are likely to spend in order to complete the course successfully. Please keep on referring to the *Course Guide* as you go through the course materials as it will help you to clarify important study components or points that you might miss or overlook.

## INTRODUCTION

**CBMT2103 Introduction to Multimedia Technology** is one of the courses offered at Open University Malaysia (OUM). This course is worth 3 credit hours and should be covered over 8 to 15 weeks.

## COURSE AUDIENCE

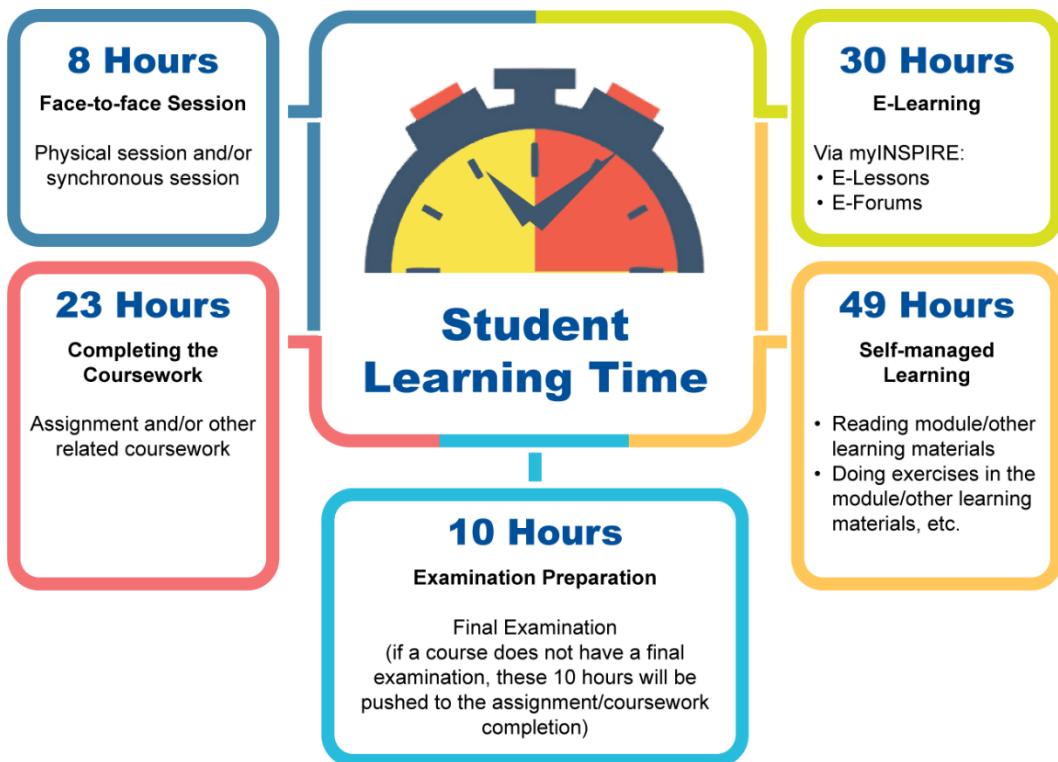
This course is offered to all learners taking the Bachelor in Information Technology programme. This module aims to impart the fundamentals of multimedia technology.

As an open and distance learner, you should be able to learn independently and optimise the learning modes and environment available to you. Before you begin this course, please ensure that you have the correct course materials, understand the course requirements, and know how the course is conducted.

## STUDY SCHEDULE

It is a standard OUM practice that learners accumulate 40 study hours for every credit hour. As such, for a 3 credit hour course, you are expected to spend 120 study hours. Figure 1 shows the student learning time (SLT).

**Figure 1: Student Learning Time**



## COURSE LEARNING OUTCOMES

By the end of this course, you should be able to do the following:

1. Explain the concepts, characteristics, hardware, and software of multimedia, as well as its applications and developments, and its significance to society.
2. Analyse the use of multimedia components, application and technology in the development of new ideas or solutions based on the provided information.
3. Adopt appropriate digital tools and software for creating various types of media in order to design a multimedia application.

## COURSE SYNOPSIS

This course is divided into 12 topics. The synopsis for each topic is listed as follows (refer to Table 1):

**Table 1: Synopsis for Each Topic**

Topic	Description
1	An introduction to the concept of multimedia, which briefly discusses the basic knowledge of multimedia, its purpose and functions, and the types of media.
2	Explains multimedia applications including the Multimedia Super Corridor (MSC). The MSC status confers certain benefits and incentives to multimedia and IT companies, provided they meet certain criteria. There are seven MSC flagship applications.
3	Explains the importance of computer hardware including input and output devices, and storage that is required for multimedia development. Although there are many kinds of computer hardware in the market, you as the multimedia developer should choose the hardware that corresponds with the concept and scope of the multimedia project that you are developing.
4	Gives us insights into several current developments in multimedia technology, its challenges and forecasts.
5	Explains the guidelines on the use of text in multimedia applications. It also discusses the appropriate use of multimedia elements that may enhance the aesthetic presentation of text.
6	Discusses the graphics component in multimedia. There are two basic categories of graphics – vector graphics and bitmap graphics. Understanding the differences between the two will help you in your work.
7	Introduces animation and identifies some of the principles and basic techniques of animation. The integration of animation into multimedia programs or software will increase the visual impact of the product because of its dynamic visual qualities.
8	Discusses computer animation. It also gives us insights into two categories of computer animation, which are two-dimensional (2D) animation and three-dimensional (3D) animation.

9	Explains the basic concepts of analogue and digital sounds and the various uses of audio in multimedia. It also discusses how sound cards can improve the sound quality played on computer.
10	Looks into audio files and the formats which are common in multimedia technology.
11	Focuses on another component of multimedia, which is video. It touches on the differences between analogue video and digital video and the basic components in the production of video. You will also learn about the methods and techniques of video compression in multimedia.
12	Focuses on several types of video formats and standards that are regularly used.

## TEXT ARRANGEMENT GUIDE

Before you go through this module, it is important that you note the text arrangement. Understanding the text arrangement will help you to organise your study of this course in a more objective and effective way. Generally, the text arrangement for each topic is as follows:

(a) **Learning Outcomes**

This section refers to what you should achieve after you have completely covered a topic. As you go through each topic, you should frequently refer to these learning outcomes. By doing this, you can continuously gauge your understanding of the topic.

(b) **Self-Check**

This component of the module is included in strategic locations throughout the module. It may be located after one subtopic or a few subtopics. It usually comes in the form of a question. When you come across this component, reflect on what you have already learnt thus far. By attempting to answer the question, you should be able to gauge how well you have understood the subtopic(s). Most of the time, the answers to the questions can be found directly in the module itself.

(c) **Activity**

Similar to Self-Check, the Activity component is also placed at various locations or junctures throughout the module. This component may require you to answer questions, explore short case studies or conduct an observation or research. It may even require you to evaluate a given scenario. When you come across an Activity, you should try to reflect on what you have gathered from the module and apply it to real situations. You should, at the same time, engage in Higher Order Thinking skills (HOTs) i.e. analysing, synthesising, and evaluating instead of only recalling and defining.

(d) **Summary**

You will find this component at the end of each topic. It summarises various important parts of each topic and helps you to recap the whole topic. By going through the summary, you should be able to gauge your knowledge retention level. Should you find points in the summary that you do not fully understand, it would be a good idea for you to revisit the details in the module.

(e) **Key Terms**

This component can be found at the end of each topic. You should go through this component to remind yourself of important terms or jargon used throughout the module. Should you find terms here that you are not able to explain, you should look for the terms in the module.

(f) **References**

A list of relevant and useful textbooks, journals, articles, electronic contents, and sources can be found in this section. The list may appear in a few locations such as in the *Course Guide* (in the References section), at the end of every topic or at the back of the module. You are encouraged to read or refer to the suggested references to obtain additional information and enhance your overall understanding of the course.

## PRIOR KNOWLEDGE

There are no specific prerequisites for this course. However, a basic knowledge on Information Technology is an added advantage.

## ASSESSMENT METHOD

Please refer to  myINSPIRE.

## REFERENCES

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## TAN SRI DR ABDULLAH SANUSI (TSDAS) DIGITAL LIBRARY

The TSDAS Digital Library has a wide range of print and online resources for learners. This comprehensive digital library, which is accessible through the OUM portal, provides access to more than 30 online databases and several of them are shown in Figure 2. As an OUM learner, you are encouraged to make full use of the resources available through this library.

**Figure 2: Among the Online Databases Available at TSDAS Digital Library**



# Topic ▶ Introduction 1 to Multimedia Technology

## LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Define multimedia;
2. List the four features or functions of multimedia that have made it very popular; and
3. Describe the five main components of multimedia and their functions.

## ▶ INTRODUCTION

Multimedia is a dynamic and interesting field to study. The rapid development of multimedia technology has played an important role in the fields of education, film, advertising, fashion and many others. In this topic, you will be introduced briefly to the history and concepts of multimedia technology. You will also learn about the various features and functions of multimedia that have caused it to gain popularity. At the end of this topic, we will discuss the main components and types of multimedia. Happy learning!

**1.1****DEFINITION OF MULTIMEDIA**

**Figure 1.1:** Multimedia components

When you look at Figure 1.1, what do you see? Can you tell the meaning of multimedia by looking at the figure? Generally, multimedia refers to the use of various types of media to create a presentation or an application which can be used for the purposes of broadcasting, entertainment, education and many others.

By using these various types of media, the presentation of information will be livelier, more dynamic and able to attract the attention of many users. Multimedia is also said to be a positive and effective medium of communication because text, audio, video and animation of various colours and patterns can be displayed simultaneously on the screen.

The word “multimedia” can be split into “multi” and “media”. “Multi” means many, whereas “media” means the tools used as the medium of communication, such as newspapers, radio and television. In brief, multimedia can be defined as many media. In other words, multimedia is the simultaneous use of data from multiple sources of elements of media.

As multimedia began to gain popularity, many parties came forward with their own definitions of multimedia, according to their respective interests, expertise, research and viewpoints. The following are a few definitions of multimedia:

**Table 1.1: Definitions of Multimedia**

“Multimedia is any combination of text, graphics, sound, animation and video delivered to you by computer or other electronic or digitally manipulated means.”

(Vaughn, 2001)

“Multimedia is the use of computers to present and integrate text, audio and video with hyperlinks and devices which enable the users to navigate, interact, create and communicate.”

(Hofstetter, 2001)

“Multimedia refers to a computer based interactive communication process that incorporates text, graphics, audio, video, and animation.”

(Shuman, 1998)

These different definitions of multimedia could confuse you, but the most important thing that you need to remember is that a good definition of multimedia should contain the following:

- (a) Multimedia is any combination of text, graphics, animation, audio and video which is a result of computer-based technology or other electronic media; and
- (b) Multimedia becomes interactive when the end-user is able to control the elements of media that are required, and subsequently obtains the required information in a non-linear way.



### ACTIVITY 1.1

You have studied the various definitions of multimedia. How do you define multimedia? Choose one of the definitions and state the reason for your choice. Discuss your answer in class.

**1.2****HISTORY AND CONCEPTS OF MULTIMEDIA**

Before we proceed further with our discussion on multimedia, let us briefly take a look at the interesting history of multimedia. Do you know why computers become obsolete so quickly? It is because a year in the life of a human can be seen as at least seven years in the life cycle of a computer and often more. Computers simply grow older sooner.

In the context of “computer age”, the history of multimedia dates back to 1972, when the first video game, ATARI, was launched. The response it received was beyond the expectations of its users.

Computers with multimedia features were introduced in the 1990s. Before that, there was no technology capable of providing informative multimedia at an affordable cost. In its early days, multimedia technology was not very well received by the masses, especially among sceptical members of the academia.

Multimedia technology was considered to be an invention gimmick of the computer industry. Nowadays, the view on the importance of multimedia is very different. For the past few decades, this technology has been studied and explored and multimedia is now one of the main components of convergent technology. Table 1.2 shows the development stages of computer technology:

**Table 1.2:** The Development Stages of Computer Technology

Year	Development
1975	The first personal computer was marketed. It had a low processing power and was used mainly for accounting and inventory.
1980	The storage capacity of the hard disk was increased. Computers could display simple graphics and were used for statistics and forecasting.
1987	Computers were capable of displaying colours, more sophisticated graphics, animation and sound. They were used in word processing and desktop publishing.
1995 – the present	Computers at this stage are capable of integrating digital video, audio, animation and text in a digital environment. As a result, it increases the emphasis on communication and sharing of information through networks such as the Internet.

Now let us look at this extract.

### The Concept

More than half a century ago, Vannevar Bush, Director of the Office of Scientific Research and Development and an advisor to US President Franklin D. Roosevelt, described a hypothetical machine that would allow users to browse through a media-rich environment making associative links between various types of information. He envisaged a device called "memex" in which an "individual stores his books, records and communications and which is mechanised so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory."

This simple yet interesting and innovative proposition forms the fundamental theoretical background upon which present-day interactive multimedia systems are based. The question that immediately comes to mind is why has it taken more than half a century for Bush's idea to be realised? In order to find a satisfactory answer to our question, the reader must note that fifty years ago, the computer technology was in its infancy. Therefore, it follows that the history of the development of Interactive Multimedia Systems is directly and closely linked to the history of the development of the personal computers.

(Mohammad Dastbaz, 2002)

## 1.3 FEATURES OF MULTIMEDIA

Multimedia technology is vastly used in many fields, especially in the designing and development of websites. Many websites today are equipped with elements of animation, graphics, sound effects, special video effects and interesting music. Figure 1.2 depicts the various features or functions of multimedia that have made it popular:

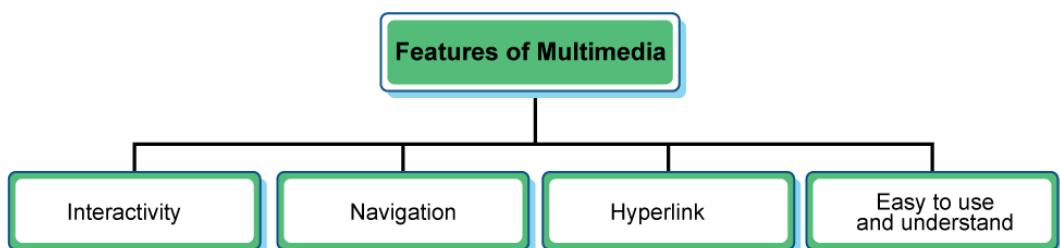


Figure 1.2: Features of multimedia

### 1.3.1 Interactivity

Each multimedia application involves interactivity with end-users. Interactivity can be simple, such as a student choosing a right or wrong answer in a computer-based test; or complex, like a user flying a jet fighter in a simulated computer warfare. In fact, when you visit a website and press a button or an icon on it, you have done a brief interactivity. In Figure 1.3, you will find some samples of interactivity.

 EXERCISE 1.1

1. Identify and discuss the five questions that should be answered by a good mission statement.

**Answer**

2. Strategic planning includes all of the following, except:

A. Establishing an organisational mission  
 B. Identifying corporate and marketing strategy  
 C. Developing a business plan for raising capital  
 D. Analysing the firm's internal and external environments  
 E. Developing marketing goals and objectives

3. The marketing plan is a particular type of \_\_\_\_\_.

A. analysis plan  
 B. strategic plan  
 C. total cost analysis  
 D. functional plan  
 E. all of the above

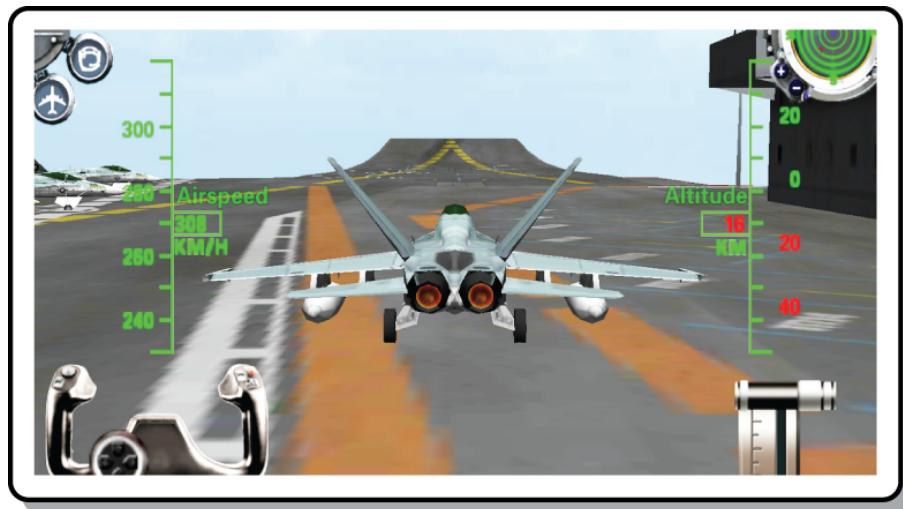


Figure 1.3: Samples of interactivity

This feature has made multimedia more popular than other components of media such as television. Users can take part actively in the multimedia applications and not passively as in the conventional components of media. This is because the users have total control over the applications.

For example, a foreign student who is learning Bahasa Malaysia can determine the phase that he wishes to review, and he can revise it as many times as he wishes. Besides that, the student can also choose the types of instructions such as listening to intonations of words, reading words displayed on screen, watching an animation and doing exercises on oral skills.

### 1.3.2 Navigation

Navigation is one of the important features in the development of multimedia applications. Navigation is closely linked to interactivity. With navigation, a user is able to use the interactive multimedia applications more effectively. If you have heard someone say, "This interface is excellent!", it probably means that the application is easy to navigate.

This easy-to-use navigation feature of an interface not only makes it easy to navigate but also provides guidance to the users about the situation or position of their web pages more effectively. The correct use of the navigation tools will enable the users to control the sequence of concepts that they wish to present. The uses of navigation tools such as hyperlinks, buttons (please refer to Figure 1.4), icons and pull-down menus enable the user to explore and navigate from one web page to another.

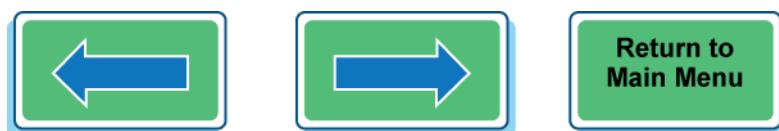


Figure 1.4: Example of the use of buttons as navigation tools

### 1.3.3 Hyperlink

Films and books are linear forms of multimedia applications. It has a beginning stage, an intermediate stage and an ending. For example, as you go through this module starting from Topic 1 as shown in Figure 1.5, you are reading the module in a **linear** way.

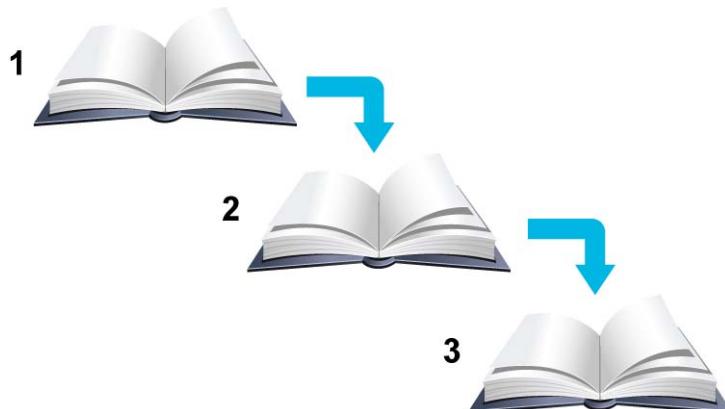


Figure 1.5: Linear reading

Even though the linear method is normally used, it is not necessarily the best way of learning. When we process information, our brains usually “jump” from one idea to another. This is because we need to store information in the context that we are able to understand. We can also “jump” to another topic if we already have prior knowledge about the information contained in that topic, as illustrated by Figure 1.6. Thus, it is totally reasonable that computer applications allow users to “jump” from one section to another. For example, after you have read the introductory topic in this module, you can “jump” to the topic on audio by clicking on its word with the hyperlink feature.

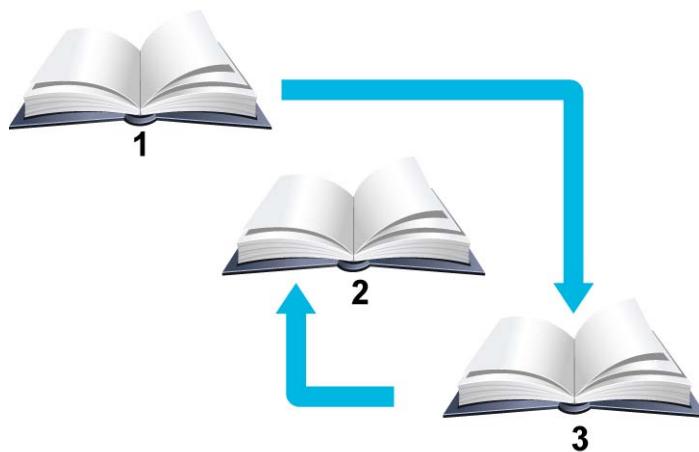
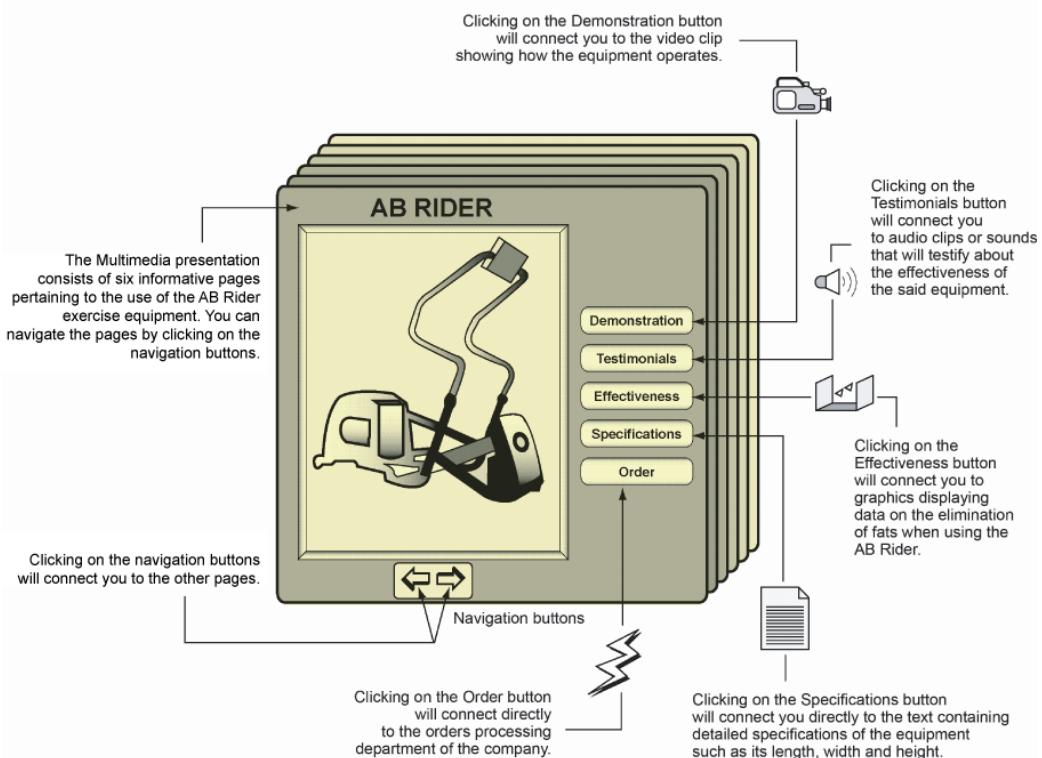


Figure 1.6: Non-linear reading

#### 1.3.4 Easy to Use, Easy to Understand

The main objective of most multimedia applications is to achieve an ease of understanding and ease of use. For example, you may not comprehend certain instructions if you only refer to the given text, but when the instructions are aided with pictures, animation or video clips, they are more easily understood.

Features of multimedia explained earlier such as interactivity, navigation and hyperlink contribute towards making multimedia applications easy to use and easy to understand. In fact, one of the main reasons why multimedia applications are favoured by many is its ease of use (please refer to Figure 1.7). For example, you only need to click on the “play” button to play a song or video, or “drag and drop” interesting video chapters to view them. You can do all these even if you do not have any knowledge of computer programming. In addition, users who do not know how to use multimedia applications can always refer to the “Help” section which contains information on its usage.



**Figure 1.7:** An example of a multimedia presentation



### ACTIVITY 1.2

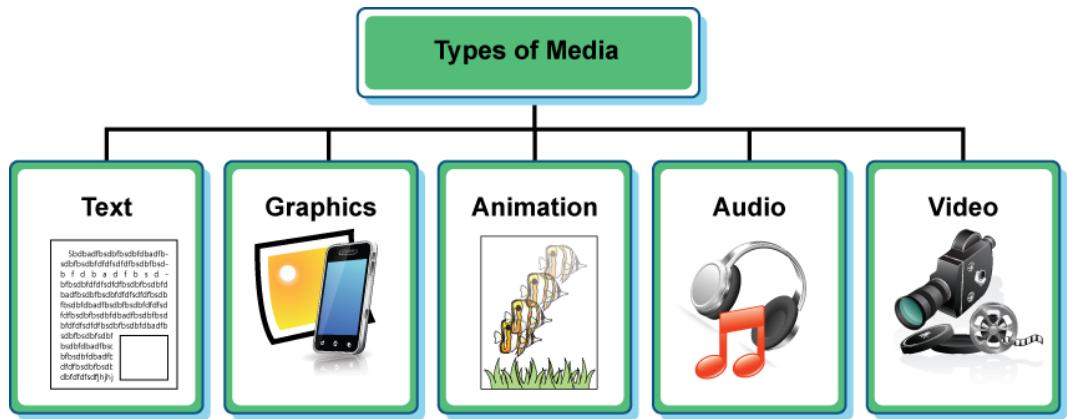
What is “hypertext”? Why is it used in the interactive multimedia presentation? Discuss.

## 1.4

### TYPES OF MEDIA

Based on the definitions of multimedia provided earlier in this topic, it was found that apart from an interactive communication process, there are five elements or main media in a complete multimedia system. Can you still remember the five elements? They are text, graphics, animation, audio and video. Each medium has its own role in the formation of an attractive and effective information presentation. These media also interact among each other in a digital environment.

You need to have a better understanding of these media if you wish to develop a multimedia system or a multimedia presentation. The following are brief explanations regarding the five main media in multimedia (please refer to Figure 1.8).



**Figure 1.8:** Types of media

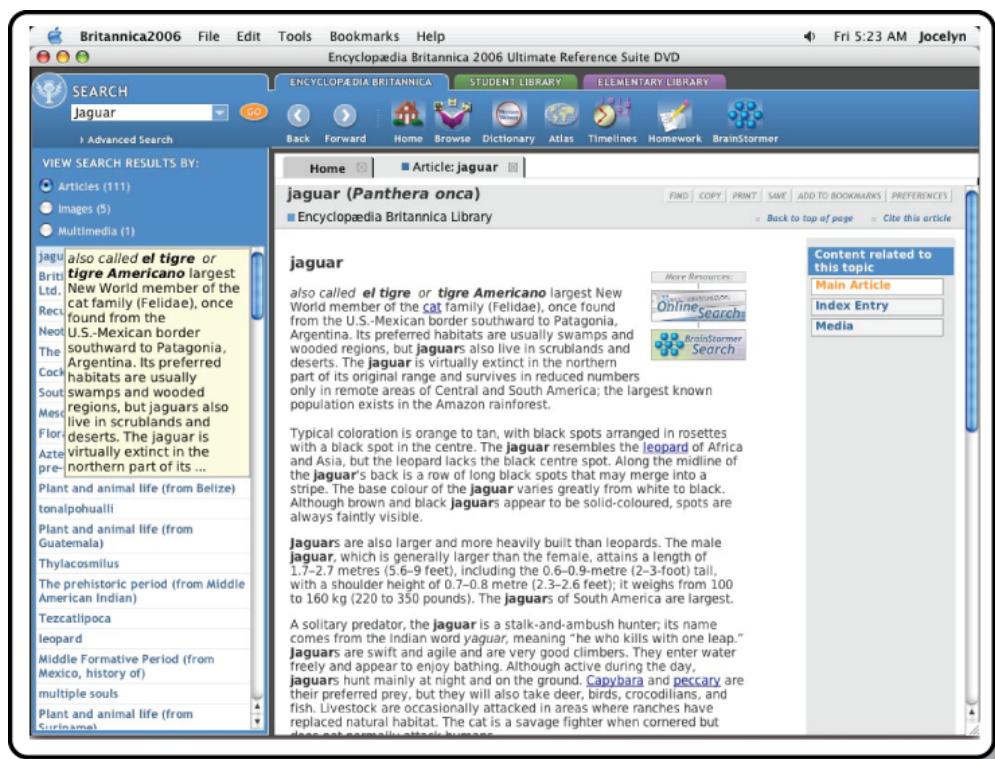
### 1.4.1 Text

Text is an important medium in multimedia. It directly informs the user about the information that it wishes to convey. It cannot be neglected no matter how advanced multimedia technology is. When you surf any website on the Internet, you will notice that almost all of them contain text media.

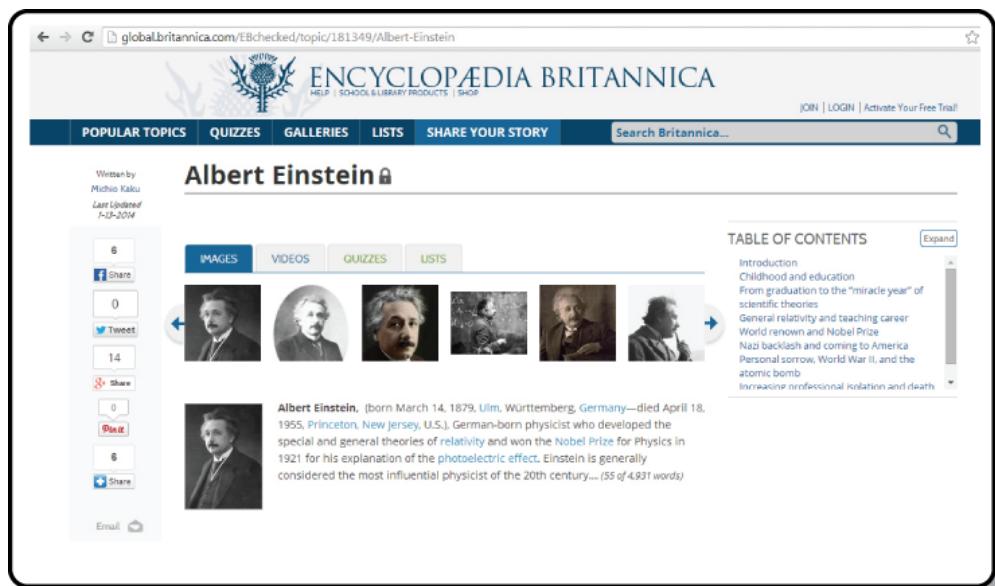
Text plays an important role in the communication of multimedia applications. The uses of text in multimedia applications tend to differ depending on its fields and objectives such as for education, entertainment or commerce. For example:

- (a) Standalone DVD of Encyclopaedia Britannica, which is aimed at providing knowledge to the masses, is made up of interfaces that are text intensive; and
- (b) Web-based or online Encyclopaedia Britannica with electronic commercial advertisements on the Internet favour graphics when compared to the use of text, which is fairly minimal.

You can compare the contents of text in the both through Figure 1.9(a) and Figure 1.9(b).



**Figure 1.9(a): Encyclopaedia Britannica DVD**  
**Source:** images.macworld.com



**Figure 1.9(b): Web-based or online Encyclopaedia Britannica**  
**Source:** www.britannica.com

Text is widely used in the world of mass communication specifically as a medium for the print media such as newspapers, magazines, books, journals and advertisements. Text is also the basic element for all multimedia applications. Without text, information that needs to be conveyed may be lost when you interpret other media elements such as graphics, sound and video. In view of the fact that there are various cultural norms that are followed, text is the safest way to convey messages.

Currently, there are many software applications in the market for writing and editing text such as Microsoft Word, LibreOffice, Google Docs and others. Besides that, we can also create text using special effects such as Shadow or Emboss using Adobe Freehand, Adobe Fireworks and Cascading Style Sheet.



### ACTIVITY 1.3

Text can be used for conveying information but it also has some limitations. In your opinion, what are the limitations of using text in websites?

## 1.4.2 Graphics

Pictures as visuals are more effective compared to the sole use of text. Graphics play an important role in multimedia presentations and are one of the popular elements used in the development of a multimedia application.

In actual fact, we are used to being exposed to images and graphics through television programmes, websites, newspapers and also advertising billboards located alongside roads. In other words, we use images and graphics to obtain information, explanations and entertainment.

In general, graphics can be categorised into two main groups, namely, bitmap and vector. It is important for you to understand both types of graphics because it influences the quality, the size of the file and the time needed to display the graphics on the computer screen.

### (a) Bitmap Graphics

Graphics or bitmap images are also known as image raster. Bitmap images are produced by dots arranged in specific ways in matrix form. These dots are known as pixels. These pixel images are known as bitmap images. Figure 1.10 shows an example of a bitmap graphic.

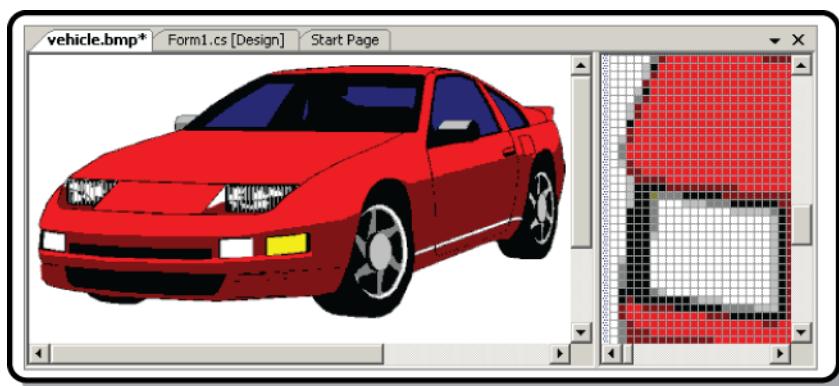


Figure 1.10: Enlarged bitmap graphic

(b) **Vector Graphics**

Vector graphics refer to any images produced by the use of specific software and computer technology. Vector graphics are made up of lines that follow the mathematical equations called vector. Figure 1.11 shows an example of a vector graphic.

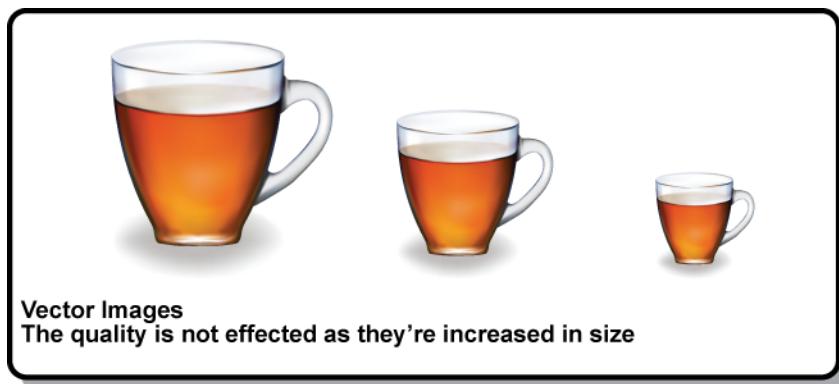


Figure 1.11: Enlarged vector graphic

Lots of graphic software are available in the market. Among the most popular and most widely used are Adobe Photoshop, Adobe Illustrator, Corel Photoshop Pro, Paint.NET, GIMP and Inkscape. Each graphic software has its own function and use.

You can surf any websites on the Internet and are bound to come across various types of graphics and images in the websites. Take note of the Open University Malaysia (OUM) website (<http://www.oum.edu.my>) such as the one shown in Figure 1.12. Reflect on how the graphic elements are used in this web page.



**Figure 1.12:** OUM website

Source: [www.oum.edu.my](http://www.oum.edu.my)

**Adobe Systems Inc** is one of the leaders in the development of powerful graphic programs. To learn more, visit its website at <http://www.adobe.com>.

### 1.4.3 Animation

Animation plays an important role in various fields such as films, advertisements, commerce, medicine and education. A presentation will be livelier with the presence of animation. Besides that, a complex concept can be presented more briefly and easily.

From a multimedia aspect, animation is one of the elements that increase the attraction of a multimedia software or program. In fact, animation in multimedia began to receive more widespread attention from the masses especially after animated movies like *Mulan* and *Small Soldiers*.

In brief, animation refers to the process of adding movements to static images through various methods. Animated movements can be measured in frame per second (fps). The higher the fps, the smoother the transition between frames.

Currently, the development of computer animation is becoming more rapid. With cheaper computers and software, and more powerful computer systems, animation technology is becoming more sophisticated. Various methods are used to produce computer animation, from the very simple animation to amazingly complex two- and three-dimensional animations.

There are many animation software in the market that one can choose from to produce various types of animation, be it two- or three-dimensional, or even to produce animation with special effects. Among them are Lightwave, Adobe Flash, Blender, Pencil and Toon Boom Studio.



### SELF-CHECK 1.1

Name three types of graphic software and three types of 3D animation software that are available in the market.

#### 1.4.4 Audio

Audio or sound is one of the most effective ways of attracting the attention of users. Audio plays an important role in the development of multimedia which has been quite static all these while. The entry of audio into multimedia is one of the most important features that have escalated the use of multimedia to maximum level.

When you want to include audio or sound in a multimedia system, there are some important areas that require attention. Among them include sound production, storage, sound manipulation and display or presentation of sound. All these aspects require careful handling in order to ensure that the quality of audio in the multimedia system is of a high level.

Do you know that sound used in multimedia is in digital form? Digital sound may be recorded directly or may be pre-recorded in an analogue form and then converted to digital form.

Sound used in multimedia applications must be in digital form.

If there are specific software for text, graphics and animation, then there are also a variety of software available in the market for audio recording or audio production such as the Audacity, Ardour and Adobe Audition software.



### SELF-CHECK 1.2

State two uses of audio in multimedia.

## 1.4.5 Video

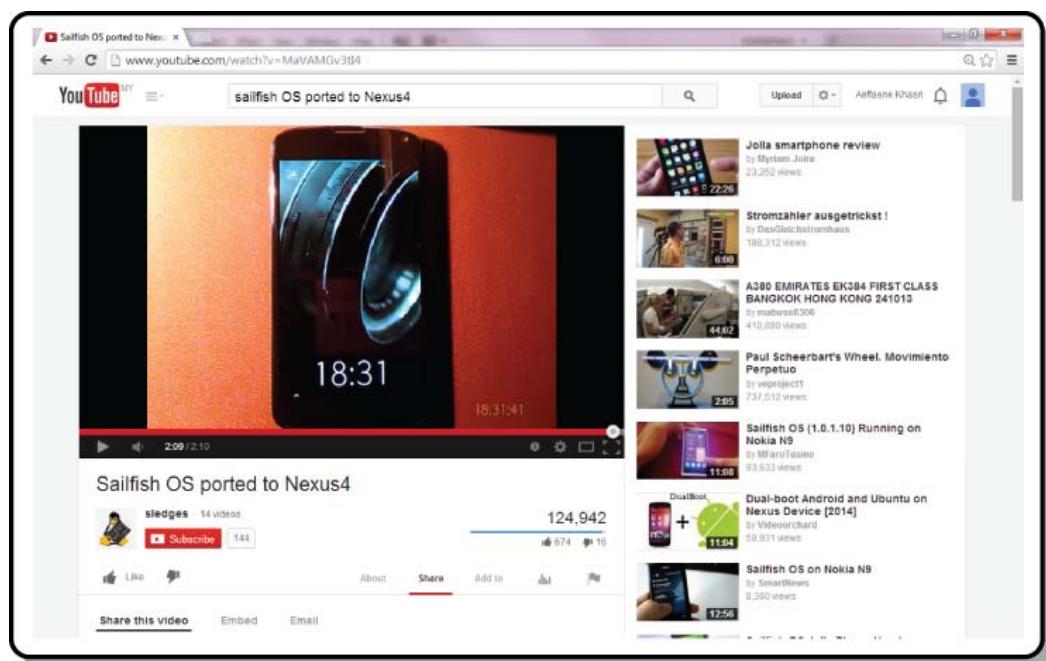
We often come across certain applications or multimedia programs that include video elements in its development. Video is an essential element because it can carry meaning or information which needs to be conveyed within a short period.

Video has been in existence for more than 50 years. During its initial stage of use, it was only played on projectors in cinemas or televisions. Today, this scenario has changed. Digital video can be viewed and displayed through the use of multimedia computers.

Digital video became popular after multimedia technology was introduced and developed. The element of video in multimedia has brought about tremendous change in the method of information dissemination. Most videos are able to present real-life situations and capable of attracting the attention and appealing to the emotions of users.

Video that is displayed through computers must be in digital form. A video capture card is an additional card which is required for the production of digital video. This card is usually required to be purchased separately and is not available in your computer. Video capture card changes analogue video into digital video and acts as an interface between the video source and the computer. Currently, Indeo Video and Cinepak are among the most popular brands of video capture cards.

Adobe Premiere, Final Cut Pro, Pinnacle Studio and Sony Vegas Pro are among the most sophisticated and highest quality video software that are available in the market. These software are rather costly and require a long period to be mastered fully. However, what is certain is that these software are capable of producing high quality digital videos. Figure 1.13 shows an example of a video streaming from YouTube.



**Figure 1.13:** A video streaming from YouTube

**Source:** [www.youtube.com](http://www.youtube.com)



#### ACTIVITY 1.4

1. Visit the website [www.youtube.com](http://www.youtube.com) and play one of the videos. Is it different from what you see on television? State the differences.
2. Explain briefly the differences between multimedia, hypermedia and hypertext.



#### SELF-CHECK 1.3

List five media components that are important in multimedia and their functions.

## SUMMARY .....

- Generally, multimedia means the use of various types of media to create a presentation or an application which can be used for the purposes of broadcasting, entertainment, education and many others.
- Developments in the computer industry favour the trend towards more multimedia functions and features in the computer which have since revolutionised information and communications technology.
- Features or functions of multimedia that have made it popular are interactivity, navigation, hyperlink and that it is easy to use and understand by the end-user.
- The five main media in multimedia are text, graphics, animation, audio and video.

## KEY TERMS .....

Animation	Internet
Audio	Multimedia
Computer age	Navigation
Graphics	Non-linear reading
Hyperlink	Text
Interactivity	Video

# **Topic ▶ Multimedia**

## **2 Technology Applications**

### **LEARNING OUTCOMES**

By the end of this topic, you should be able to:

1. State the ways multimedia technology applies in our daily lives; and
2. Name each element and application in the Multimedia Super Corridor (MSC).

### **▶ INTRODUCTION**

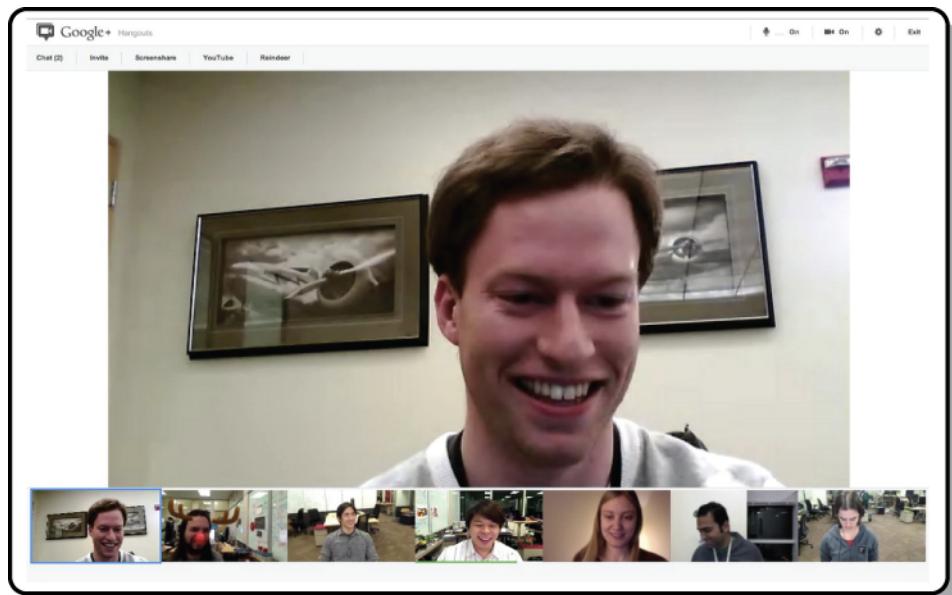
In this topic, you will be introduced to the various types of multimedia technology applications. As mentioned in Topic 1, multimedia has long been in existence in our daily lives. Whether you realise it or not, multimedia has influenced various aspects of our daily lives. Multimedia technology has many applications in various fields such as education, medicine, industries and society. Let us now look at several important multimedia applications which have become a part of our daily lives.

#### **2.1 MULTIMEDIA TECHNOLOGY APPLICATIONS**

A few years ago, multimedia technology was considered a new technology and most of its applications were used in education to assist in the teaching process. Currently, this scenario has changed. Technology has grown rapidly and its uses are increasingly widespread. Multimedia is capable of shaping how a person thinks, works, learns, socialises and others. The following are discussions on several major multimedia applications in our daily lives.

## 2.1.1 Video Teleconferencing

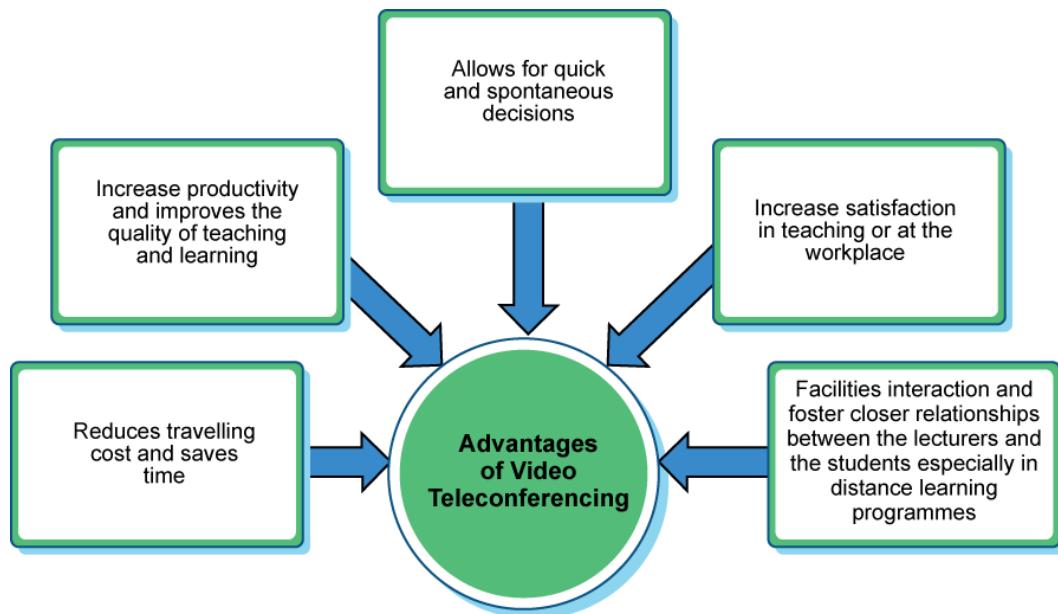
Video teleconferencing involves the transmission of video and audio in real time through computer networks and this transmission can include two or more multipoints. Examples of video teleconferencing are shown in Figure 2.1:



**Figure 2.1:** Video teleconferencing  
**Source:** 9to5google.files.wordpress.com

Video teleconferencing is tele-consulting that broadcasts video pictures of participants who are separated by locations. Each participant is usually located in a special room that is equipped with a table, microphone, camera, television and a television screen. Each participant then sits at a round table so that it can easily be recorded by a television camera. Participants from other locations will also be in specially equipped rooms. During the teleconferencing, other visuals like graphics and charts can be displayed as required. All the participants involved will be able to view the interviews or communication that takes place among themselves.

Some of the advantages of video teleconferencing are illustrated in Figure 2.2:



**Figure 2.2:** Advantages of video teleconferencing

Apart from the advantages stated above, video teleconferencing technology has also successfully found solutions for tackling several of its disadvantages such as those listed in Table 2.1:

**Table 2.1:** Disadvantages of Video Teleconferencing and Their Solutions

Disadvantage	Solution
Video requires more bandwidth than audio. Therefore, video teleconferencing costs more than normal telephone charges.	With the use of compression and decompression, videos are more sophisticated.
Video teleconferencing requires a network to support the <b>constant delay</b> because audio and video are asynchronous, and both of these media need to be synchronised with one another.	By using optimum multimedia network.
Video teleconferencing requires a network for the preparation of the <b>short delay</b> because it is a real-time application. If there is a long delay, the quality of video teleconferencing will decrease.	By using fibre optic networks or the Integrated Services Digital Network (ISDN).



### SELF-CHECK 2.1

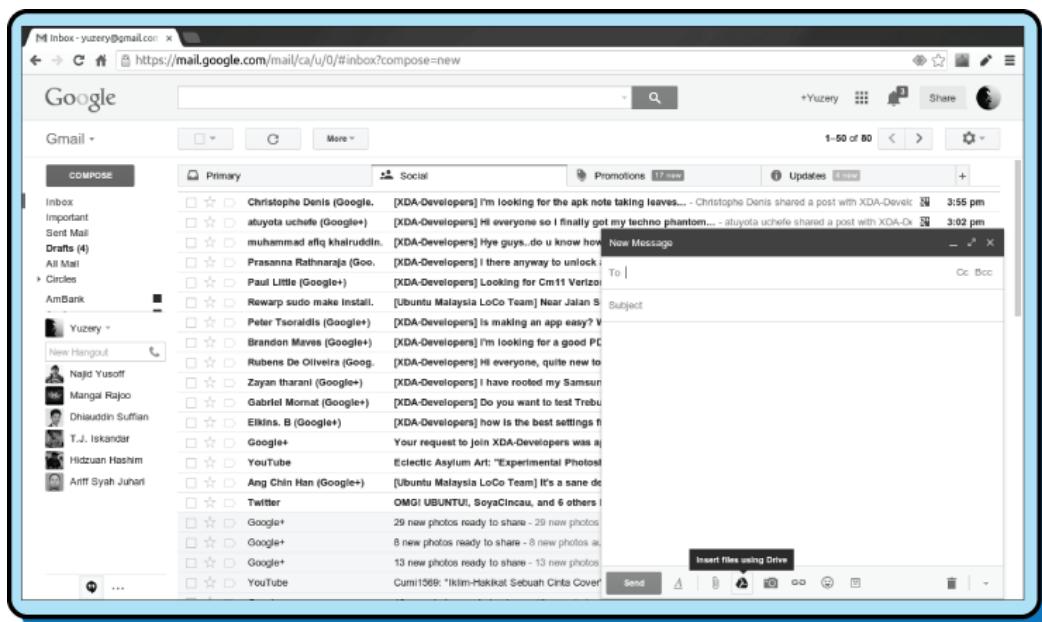
Discuss the disadvantages of video teleconferencing compared to face-to-face communication.

## 2.1.2 Multimedia via E-mail

Nowadays, people are able to write electronic mails that not only contain text but also images, audio, video and hypermedia links.

Currently, there are many free electronic mail service providers on the Internet such as Gmail, Yahoo Mail and Outlook.com. All these service providers enable the sending of multimedia mail containing pictures, songs and animation. However, most of these service providers have specific conditions. For example, Gmail has determined that the size of mail to be sent through it must not be more than 25MB. This is to prevent network congestion and to reduce delay.

Figure 2.3 depicts an example of a Gmail which is commonly used. Look at the various file types which can be utilised for email communication.



**Figure 2.3:** Gmail interface  
Source: <http://mail.google.com>

### 2.1.3 Reference Source

Has it ever crossed your mind that multimedia can be used as a reference source for obtaining the latest information? In actual fact, we can use multimedia to obtain information that we require. Among them are encyclopaedias, directories, electronic books and dictionaries.

In 1990, two of the first multimedia encyclopaedias emerged, namely, Compton's Interactive Encyclopedia and its competitor, Grolier Multimedia Encyclopedia. Other early popular encyclopaedia titles were the Canadian Encyclopedia, Guinness Book of Records, Collier's Encyclopedia and The Hutchinson Encyclopedia (McGloughlin, 2001).

In the early years, encyclopaedias were merely text elements. Gradually, other important elements such as animation, audio and video were integrated. Thus, a method of disseminating information based on the hypermedia concept was born. An example of this is Microsoft Encarta. Microsoft Encarta from Microsoft Corporation was first marketed in 1993 and was an interactive encyclopaedia which could be played on Windows-based computers. However, the production of these references has been replaced with online references such as Wikipedia and Encyclopaedia Britannica.

The Electronic Yellow Pages, which is directory-based, and PC Magazine are examples of multimedia-rich reference sources which are currently available on the Internet.



#### ACTIVITY 2.1

What do you understand by Electronic Yellow Pages? Try browsing websites on the Internet to obtain additional information about Electronic Yellow Pages. Compare the information you have obtained with that of your friends'.

### 2.1.4 Edutainment and Infotainment

You are definitely familiar with the word “entertainment” but “edutainment” and “infotainment” are most probably words that are foreign to some students. Before the development of multimedia, we had never heard of these words but nowadays these words are common.

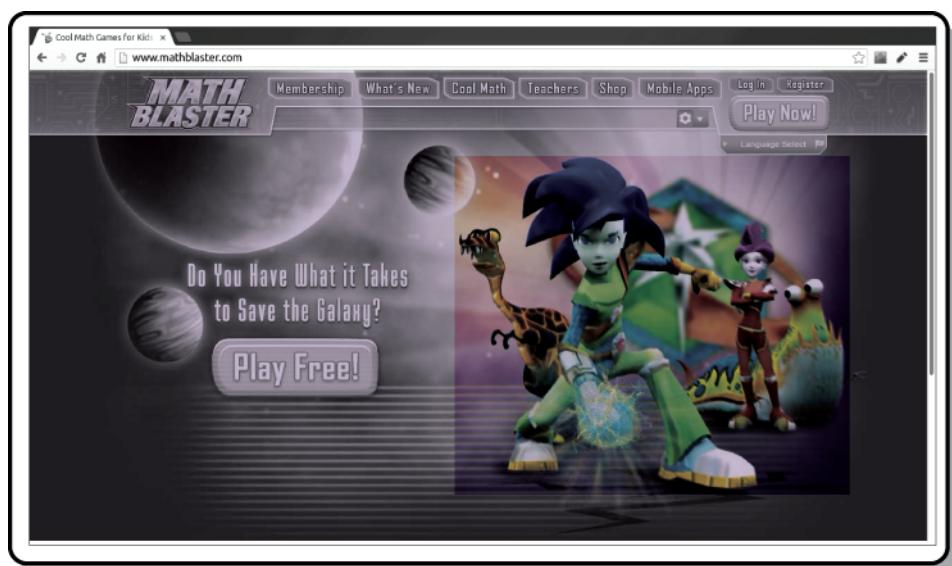
(a) **Edutainment**

The inclusion of multimedia in the field of education gave birth to edutainment. It is a new learning approach which combines education and entertainment. Hence, it has led to the emergence of many multimedia applications based on edutainment such as **Math Blaster** and **Math is Fun**. These multimedia applications teach children mathematics using fun elements. They are now more accessible on web pages to deliver the educational content effectively.

(b) **Infotainment**

Infotainment, on the other hand, is a combination of information and entertainment. Currently, there are many service providers under this category such as America Online (AOL), Microsoft's MSN and Cable News Network (CNN).

Figure 2.4(a) and Figure 2.4(b) show edutainment and infotainment applications that use multimedia technology:



**Figure 2.4(a):** Edutainment application – Math Blaster

**Source:** [www.mathblaster.com](http://www.mathblaster.com)



**Figure 2.4(b): Infotainment website – AOL**

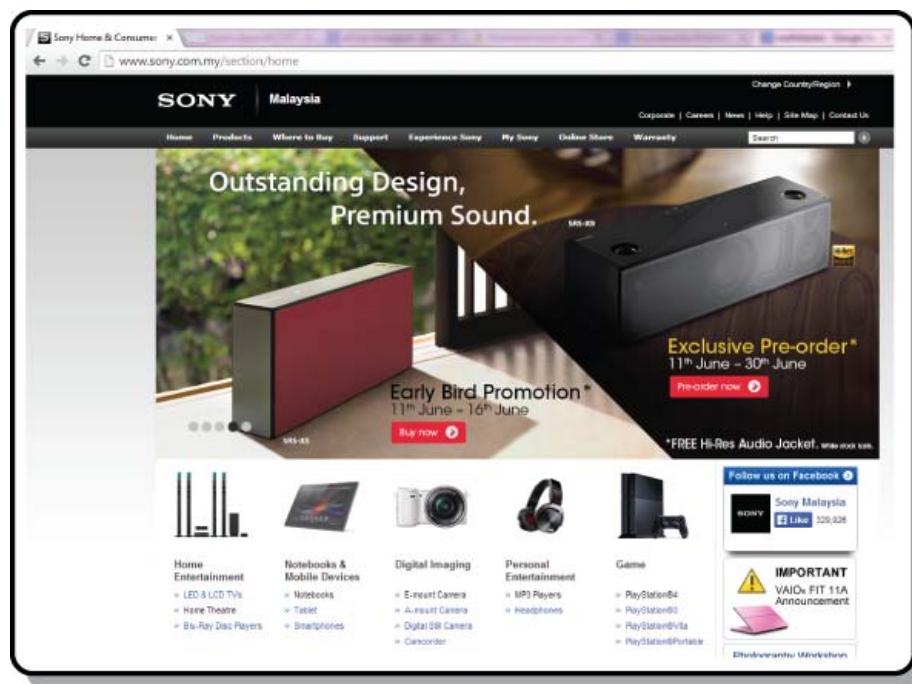
Source: [www.aol.com](http://www.aol.com)

### 2.1.5 Advertising and Purchasing

Advertising on the Internet is not a new phenomenon. Most websites have many advertisements with multimedia features with the objective of marketing merchandise or offering services online. Normally, users can use this application at home or at kiosk centres.

These two categories of advertising and purchasing involve two-way interaction. This application benefits both parties. For example:

- (a) Users will use this application to obtain information about products or services that they are interested in. They can also ask for public opinion through online forums while the advertisers can use this application to inform users about the products and services being offered; and
- (b) Users have the opportunity to ask the advertisers questions while the advertisers also have the opportunity to answer the questions more specifically and clearly. Both parties can use the application for transactions involving ordering and payment. An example of this application is shown in Figure 2.5.



**Figure 2.5:** Advertising and purchasing  
**Source:** [www.sony.com.my](http://www.sony.com.my)

The following passage provides a brief explanation of the development of interactive multimedia systems.

### News Delivery, Broadcasting and Advertising

Broadcasting and advertising has been one of the main beneficiaries of interactive multimedia systems. As early as 1992, Liebman recognised that there was increasing demand for broadcasting and advertising agencies to move towards the use of interactive multimedia. Intelligent electronic catalogues, disk-based advertising, desktop presentation systems and the multimedia advertising approach are among the areas that have benefited from the emergence of multimedia.

The launch of interactive TV and the ever-increasing capability of the World Wide Web (including web TV and webcasting) to present media-rich information have added new interesting dimensions to traditional approaches. Even traditional means of delivering news like newspapers have undergone major changes trying to embrace the new technology.

Browsing through the web, one could find thousands of newspapers in tens of different languages bringing up-to-date news to millions of web surfers. The interactive nature of the web also allows for news providers to enrich their traditional mainly text-based content by adding live reports and video clips, as well as offering their customers sophisticated search facilities and “push” technology to send users specific news on demand.

Even traditional news broadcasting corporations like the BBC and CNN are allocating enormous budgets in developing web-based news delivery and Internet channel that offers 24-hours-a-day, seven-days-a-week news to users when and where they require it.

(Mohammad Dastbaz, 2002)

### 2.1.6 Digital Library

Do you know that nowadays you no longer need to go to the library to borrow books? This is due to the existence of a digital library on the Internet.

With the existence of the digital or virtual library, students no longer need to go to libraries but can search and obtain information that they require through the Internet. Computers can access distant libraries for the contents of their services and other available resources. Information services are available to users from various libraries all around the world.

According to a Health Ministry Bulletin of April 2001, in Malaysia, Universiti Kebangsaan Malaysia (UKM) has set up a UKM Hospital Library, which is the first digital and most sophisticated medical library in this region. This library offers electronic materials encompassing books, journals and theses. Researchers can borrow, return and book items completely online. This library is a “one-stop search” which allows users to search for books and journals electronically and it is supported by a client/server web-based and multimedia-based integrated system.

Presently, there are more than 10,000 libraries reachable through the Internet. For example:

- (a) National libraries that are available worldwide such as the Library of Congress of the United States of America, the National Library of Canada and the National Library of Australia; and

- (b) The Library of Britain, which is popularly known as the British Library, is one of the oldest and most famous libraries in the world. This library can be reached at <http://www.bl.uk>.

There are some features which allow users easy access to the digital library. Among them are:

- (a) National and international telephone networks with speed and bandwidth which can transfer big and complex text files and graphic digital images;
- (b) Protocol and standards which facilitate ease of connection among computers and from one database to another; and
- (c) Automated digital instruments such as scanners and fax machines which can transfer data and information in real time.

Figure 2.6 shows the digital library which is available on the OUM website.

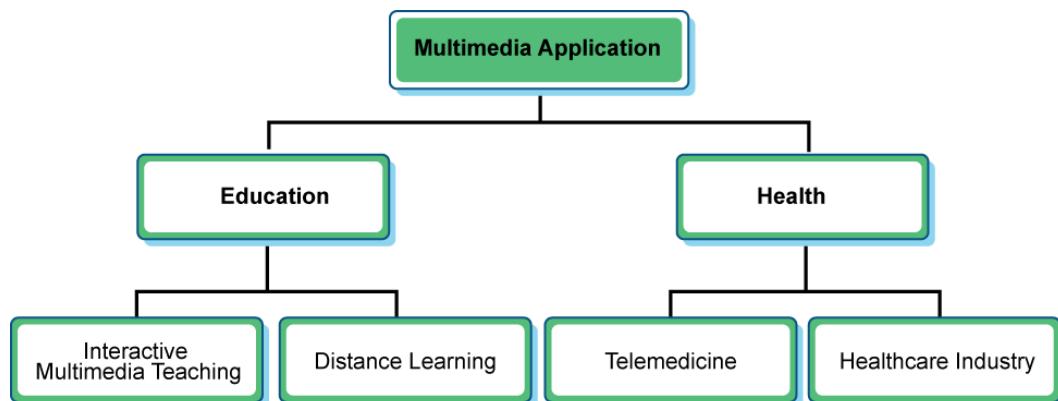


**Figure 2.6:** OUM Digital Library  
Source: [library.oum.edu.my](http://library.oum.edu.my)

Browse through the OUM website at the address stated above. Try to get information on books that you are interested in. List the information that you have successfully obtained.

## 2.1.7 Education and Health Applications

Development in multimedia technology has brought about tremendous changes in the fields of education and health. Multimedia computers are used as support tools in education and health. Figure 2.7 shows the flow of multimedia application in the field of education and health.



**Figure 2.7:** Multimedia application flow in the fields of education and health

In this modern world, traditional education such as classroom lectures might not be able to fulfil the current needs of students and not to mention its expensive cost. Distance learning or online learning is becoming more popular due to its flexibility and ease of operation. Although most online education today only uses text media, it may change to complete multimedia in the near future. Therefore, the quality of learning can be enhanced with learning materials equipped with media such as text, video, audio and animation.

In reality, schoolteachers in Malaysia have begun to use interactive multimedia in teaching. Many multimedia development companies are also utilising these opportunities by developing their multimedia training products. They are also persuading parents to purchase multimedia computers for their children. In other words, multimedia training has become the most successful commercial multimedia application.

Healthcare is gaining more attention throughout the world including Malaysia. Multimedia application is important in healthcare because information shown using various media such as pictures, video and audio will definitely make it more meaningful. Realising its importance, the Malaysian government has introduced telemedicine as one of the main applications of Multimedia Super Corridor (MSC). Its objective is to enable the public to receive online information and advice pertaining to healthcare.

Multimedia technology has been successfully used in the healthcare industry in the United States such as in radiology, pathology, cardiology, patient records information services from medical libraries and education of hospital staff.

To improve your knowledge of multimedia technological application in various fields, you may refer to Fred T. Hofstetter's book entitled *Multimedia Literacy*.



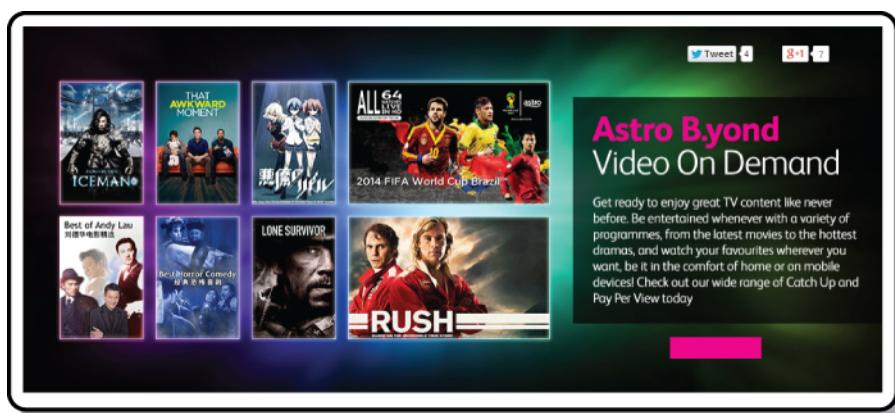
### SELF-CHECK 2.2

1. State two advantages of digital library.
2. Describe two uses of multimedia technology in the healthcare industry.

## 2.1.8 Other Applications

Apart from the applications already mentioned above, there are many other multimedia applications which have become a part of our daily lives. Can you think of such applications? Among them are video-on-demand (VOD), kiosks, hybrid applications and applications for recreation, communication, commerce and training.

Figure 2.8 shows an example of the VOD application offered by Astro:



**Figure 2.8:** Video-on-demand (VOD) application  
Source: [www.astro.com.my](http://www.astro.com.my)

You can browse through the website to view the video-on-demand (VOD) application. What information did you get?

## 2.2

## MULTIMEDIA SUPER CORRIDOR (MSC)

The Multimedia Super Corridor (MSC) project was announced by Tun Dr Mahathir Mohamad during the official opening of the Multimedia Asia Conference and Exhibition on 1 August 1996. The announcement shows that Malaysia, at that point of time, was heading towards the multimedia world and, currently, we are already in this sophisticated era of information.

The Multimedia Super Corridor is a 15km-wide-by-50km-long corridor. It starts from the Kuala Lumpur City Centre (KLCC) in the north to the Kuala Lumpur International Airport (KLIA) in the south. The two new cities that are covered in the MSC plan are Cyberjaya and Putrajaya.

If you are interested to know more about the location of the MSC, you may browse through the Multimedia Super Corridor website at [www.msc.com.my](http://www.msc.com.my)

Putrajaya is the head office of the Malaysian government and is known as the Intelligent City. This Intelligent City is equipped with all the sophisticated technological facilities. The government strives to modernise the country's administration in order to achieve the status of an electronic government.

Cyberjaya is the investment site and creative centre for some of the giant companies which are directly involved in innovative multimedia and have successfully formed their own creative centres. Therefore, these companies use sophisticated multimedia technology to produce and supply their products and services to the world market. On top of that, Cyberjaya is also the site for universities, intelligent homes and smart schools.

The Multimedia Development Corporation (MDC) was formed to manage and market the Multimedia Super Corridor. Its main mission is to create the best environment in the world for private companies to lead and develop the use of multimedia. MDC also acts as a one-stop centre to fulfil the 10 Bills of Guarantee, which is specifically aimed at speeding up the processing of visas, licences and permits.

If you are curious to learn more about MDC, you may browse through the Multimedia Development Corporation website at [www.mdc.com.my](http://www.mdc.com.my).

## 2.3 APPLICATION FOR MSC STATUS

The MSC status will be accorded to product development or multimedia service and information technology companies. A company needs to fulfil certain criteria in order to be eligible for the MSC status which then will be allowed to receive the MSC incentives. The required criteria are:

- (a) Be a provider or heavy user of multimedia products and services;
- (b) Employs a large number of knowledge workers; and
- (c) States how it is going to transfer its technology and expertise to Malaysia and subsequently contributes to the development and economy of Malaysia.



### ACTIVITY 2.2

Name three overseas MSC companies that have a subsidiary or a research centre in Cyberjaya. What are the services or research conducted by these companies?

## 2.4 MSC FLAGSHIP APPLICATIONS

When the multimedia super corridor was launched, seven major applications were identified (please refer to Figure 2.9):

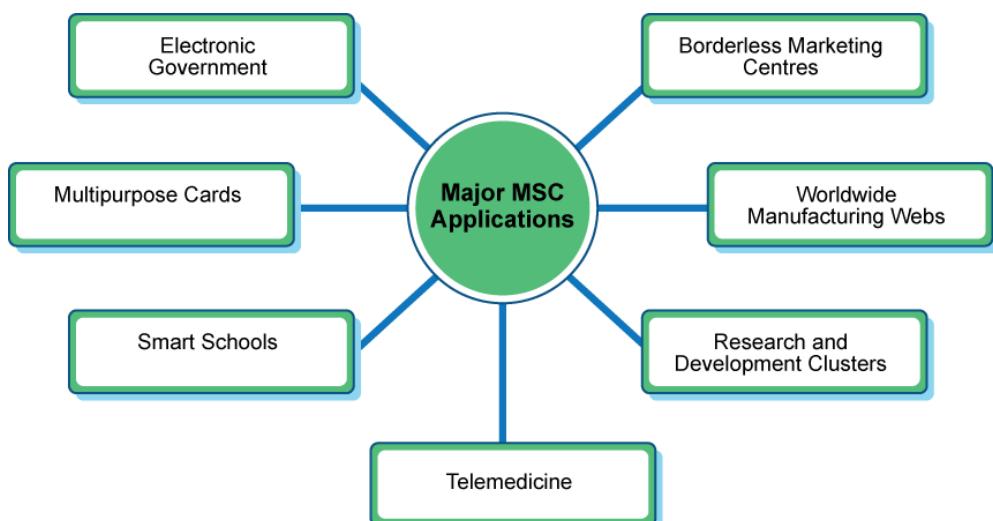


Figure 2.9: MSC flagship applications

## 2.4.1 Electronic Government

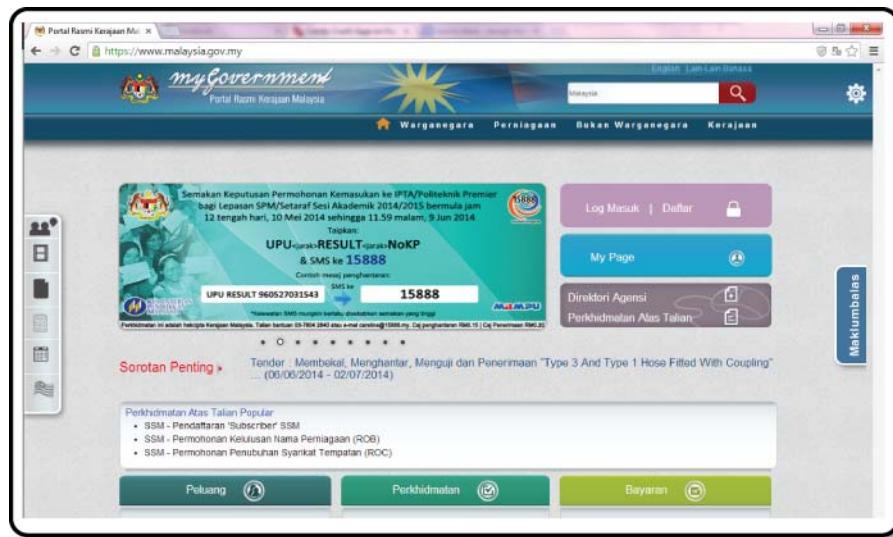
The Malaysian government introduced the electronic government in its effort to be more efficient and to provide faster services to its people. For example, the public can renew driving licences or pay their bills without having to leave their homes or by just going to the nearest kiosk.

The electronic government was introduced to fulfil the following objectives:

- To offer efficient and high quality online services and administration to the public;
- To increase the involvement of the public in governmental issues;
- To strengthen the protection and security of data; and
- To improve the internal processes of the government so that quality of service can be improved, cost reduced and productivity increased.

You can visit websites such as [www.sabah.gov.my](http://www.sabah.gov.my), [www.johordt.gov.my](http://www.johordt.gov.my) and [www.jpa.gov.my](http://www.jpa.gov.my) to view examples of an electronic government. List the types of electronic government services provided.

An example of an electronic government is shown in Figure 2.10 where the public can deal with the government through this site:

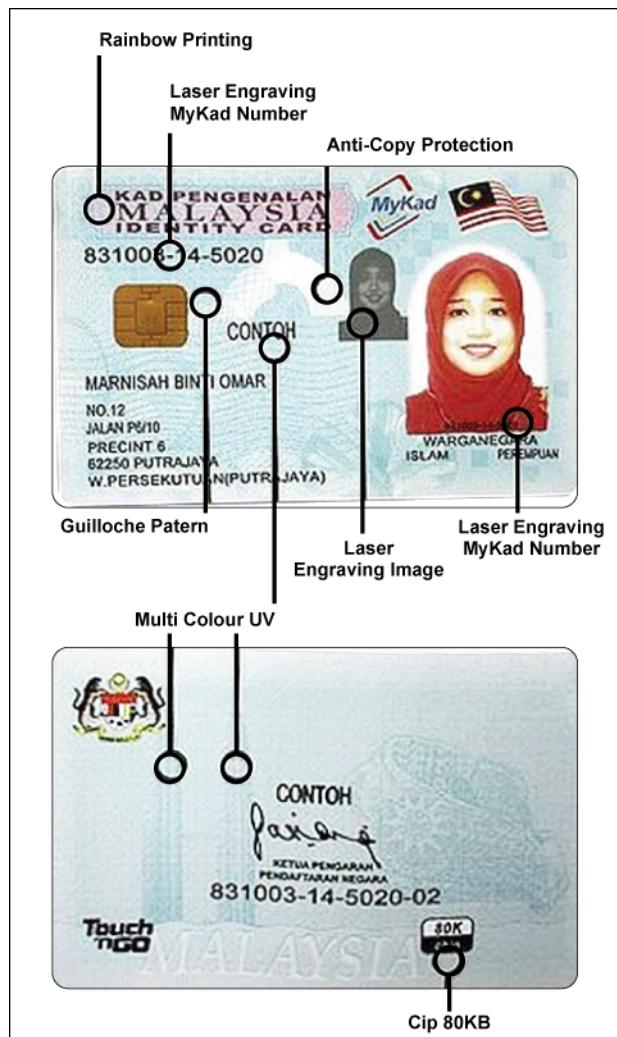


**Figure 2.10:** Example of an electronic government in Malaysia  
**Source:** [www.malaysia.gov.my](http://www.malaysia.gov.my)

## 2.4.2 Multipurpose Cards

This electronic card can store a lot of information and is used specifically for transactions or for information retrieval. This multipurpose card acts as an identity card, driving licence, health card, electronic cash card and ATM card for any Malaysian citizen who owns it.

Figure 2.11 shows an example of MyKad as a multipurpose card. It helps the public, especially when dealing with government agencies and private companies. This card also contains sophisticated safety features to curb fraud.



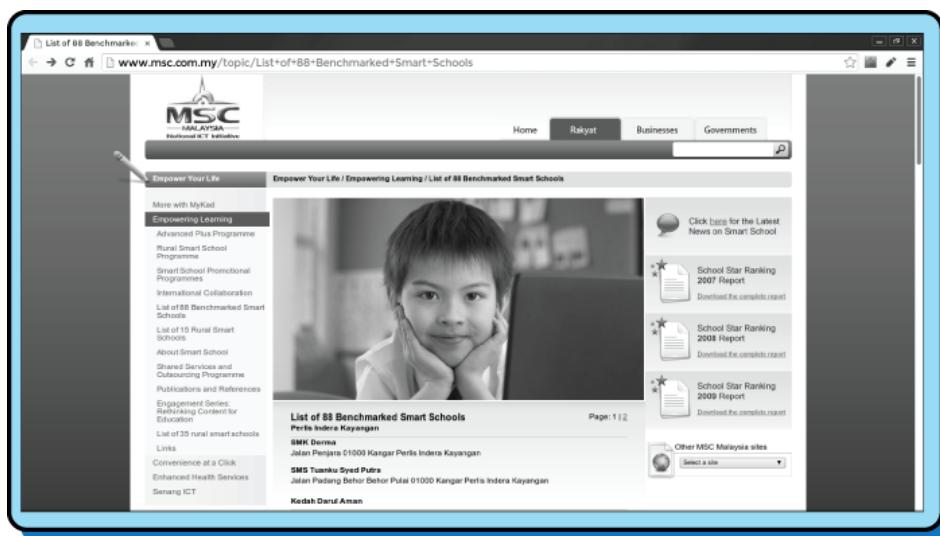
**Figure 2.11:** MyKad for Malaysians  
Source: swordie.swordbomber.com

## 2.4.3 Smart Schools

Smart schools are schools equipped with computers and multimedia equipment for new approaches to learning. Currently, these smart schools use the new school curriculum for Bahasa Melayu, English, Mathematics and Science.

The objectives of smart schools are to improve the quality of education, training, the organisation of schools and students' presentations. It is also aimed at accelerating the development of critical thinking, learning and creativity.

The list of benchmarked smart schools can be found at MSC's website as shown in Figure 2.12:



**Figure 2.12:** List of benchmarked smart schools

**Source:** www.msc.com.my

## 2.4.4 Telemedicine

The use of technology and multimedia equipment on a broader aspect is a new approach in healthcare. The public can enjoy more healthcare services through the use of this telemedicine system. The public or patients can access the healthcare system directly or via teleconsulting with medical doctors at community centres or at home.

The objectives of telemedicine are to:

- Provide medical services for the benefit of the rural population;
- Reduce delivery time;
- Save costs; and
- Be the regional centre for the development of telemedicine.

During the 7th Malaysian Plan, telemedicine was implemented in 42 health centres and 42 teleconsulting centres which are mostly located in rural areas. Figure 2.13 shows an example of a telemedicine application:



**Figure 2.13:** An example of a telemedicine application

Source: [www.knowledgeanywhere.com](http://www.knowledgeanywhere.com)

#### 2.4.5 Research and Development Clusters

The main objective of the government is to set up the best research and multimedia development centre in the world. Therefore, universities, colleges, private companies and research institutes are encouraged to work together to develop multimedia technology. A special grant has been prepared and would be granted to eligible institutes and companies. For example, computer engineers from Malaysia can collaborate with renowned scientists to create IT applications and technology to benefit the citizens of the world.

In general, the research and development cluster (R&D cluster) is aimed at encouraging the transfer of multimedia technology to Malaysia, motivating the beginning of local sophisticated technology and increasing local development and research activities so that more local products and services that are more competitive can be developed.

## 2.4.6 Worldwide Manufacturing Webs

All companies and organisations are invited to design and generate new products and multimedia services. Worldwide manufacturing webs refers to a group of manufacturing industries where these companies can receive and exchange their technological expertise in the fields of engineering, delivery, marketing, research and design.

Any international company can work together with local companies to undertake research and invent competitive multimedia products to be marketed to the world. In a nutshell, the objective of this network is to focus on research and development, product design, engineering support, distribution logistics and control centre manufacturing.

## 2.4.7 Borderless Marketing Centres

Companies that are located within the Multimedia Super Corridor are able to supply high quality products at a reasonably low cost so that these products can compete in the global market. Such products can be marketed through electronic-commerce, telemarketing and digital broadcasting.

A company that uses IT and multimedia application would be able to communicate and interact with its customers globally without being restricted by geographical factors and time. Moreover, the company can also obtain more business opportunities by just sending out product information and conducting its marketing electronically.

With this main flagship application, Malaysians from all walks of life would be able to benefit greatly, be they students, teachers, community leaders, businessmen or politicians. They would find that multimedia technology and equipment very useful in their daily lives.

The objectives can be summarised as follows (Figure 2.14):



**Figure 2.14:** Objectives of the Multimedia Super Corridor



### ACTIVITY 2.3

1. Kiosk is one of the multimedia technology applications that are frequently found. Give a brief explanation about kiosk.
2. Let us say that you are planning to go for a vacation but do not know of any travel agency in Malaysia. You can find it on the Internet. List three travel agencies in Malaysia that have advertised on the Internet.
3. State the 10 Bills of Guarantee that were prepared by the government to attract companies to operate in the MSC.



### SELF-CHECK 2.3

State three main objectives of the electronic government.

## SUMMARY .....

- Multimedia technology applications have a direct and influential effect on our lives, determining the way we live, play and work. New concepts like edutainment and infotainment are examples of this new way of doing things.
- The Multimedia Super Corridor (MSC) is a 15km-wide-by-50km-long corridor which symbolises Malaysia's growing participation in the multimedia world and the Information Age.
- The MSC status confers benefits and incentives to multimedia and IT companies, provided they meet certain criteria.
- There are seven MSC flagship applications.

## KEY TERMS .....

Advertising and purchasing	Multimedia technology applications
Borderless marketing centres	Multipurpose card
Digital library	Reference source
Education and health applications	Research and development cluster
Edutainment and infotainment	Smart schools
Electronic government	Telemedicine
Information age	Video teleconferencing
Multimedia Super Corridor (MSC)	Worldwide manufacturing webs

# Topic ▶ Multimedia

## 3 Hardware

### LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. State the importance of standardisation in the development of multimedia presentations;
2. Name the basic hardware including the input and output devices and the existing storage media in a multimedia personal computer; and
3. Discuss the specifications of a multimedia computer that you wish to buy based on price, system performance and needs.

### ▶ INTRODUCTION

Do you know why it is important for us to know the hardware required for a multimedia computer system? This is because without the hardware, we will not be able to enjoy interesting videos, animated graphics, texts or colourful pictures, etc. Besides that, knowledge about computer hardware is essential to enable us to work more confidently with multimedia elements. Therefore, this topic will explain the basic hardware including input, output and storage devices required by a multimedia computer.

**3.1**

### MULTIMEDIA COMPUTER SYSTEM STANDARDS

Standardisation is vital in a computer system. Perhaps you may be wondering why it is necessary. Let us imagine that you are a multimedia software developer and you are faced with the problem of how to determine the specifications of a program that is being developed for the current market. If there is

standardisation for the multimedia computer system, then for sure your task will be much easier to be accomplished.

To solve the above problem, in 1991, the Multimedia Marketing Council announced a standard of uniformity or guidelines for a personal computer system. This standard was known as the Multimedia Personal Computer (MPC) specifications and targeted at personal computers operating on the Windows operating system. It was later known as Level 1 Specification. Personal computer hardware manufacturers who fulfilled the required specifications prescribed by MPC were allowed to use the MPC logo.

In 1993, MPC Level 2 was introduced and, two years later, in 1995, MPC Level 3 was announced. These MPC standards emphasised on speed and the system's capacity, quality of the colour and resolution of the monitor, the speed of the CD-ROM and also the audio and video cards used.

The standard specifications became the main reference to avoid confusion among manufacturers of hardware and software, and also consumers. Table 3.1 depicts a few minimum specification differences at each level:

**Table 3.1:** Minimum Specifications of MPC Level 1, 2 and 3

Component	MPC Level 1	MPC Level 2	MPC Level 3
Processor	386SX 16MHz	486SX 25 MHz	Pentium 75 MHz
Main memory	2MB	4MB – 8MB	8MB – 16MB
Hard disk	30MB	160MB	540MB
Hard disk driver	150 Kbps rate of data transfer	300 Kbps rate of data transfer	600 Kbps rate of data transfer
Audio	8 bit digital audio	640 × 480 pixel	16 bit quality CD
Video display	640 × 480 pixel 6 colours	640 × 480 pixel 65,536 colours	640 × 480 pixel 16 million colours

Today, all new computers are MPC compliant.



### ACTIVITY 3.1

In your opinion, why is uniformity or standardisation required in a personal computer system?

### 3.2

## BASIC HARDWARE OF A MULTIMEDIA COMPUTER SYSTEM

During the 1980s, computers comprised of a few basic components or hardware, which were the central processing unit (CPU), input devices such as the keyboard and mouse, and output devices such as the monitor and printer. Since multimedia technology was introduced, computer hardware that display multimedia characteristics have increased. Among the hardware that emerged after the introduction of multimedia technology were the compact disk read-only memory (CD-ROM), sound card, speakers and video card (please refer to Figure 3.1).



Figure 3.1: Multimedia computer

The rapid development of multimedia technology has pushed multimedia hardware to be faster and more sophisticated. For example, in the past, we only needed 4MB of RAM (Random Access Memory) for a multimedia system but now we need at least 64MB for a multimedia computer system. It is the same with other multimedia equipment. Just imagine if you were to use a Level 1 multimedia computer for a multimedia display such as watching MPEG (Motion Picture Experts Group) films, this system will definitely not work.

The following contain brief discussions on several basic hardware that is required in a multimedia computer system (please refer to Figure 3.2). Further information about these hardware is available in the *Basic Concepts of Information Technology* module, Open University Malaysia.

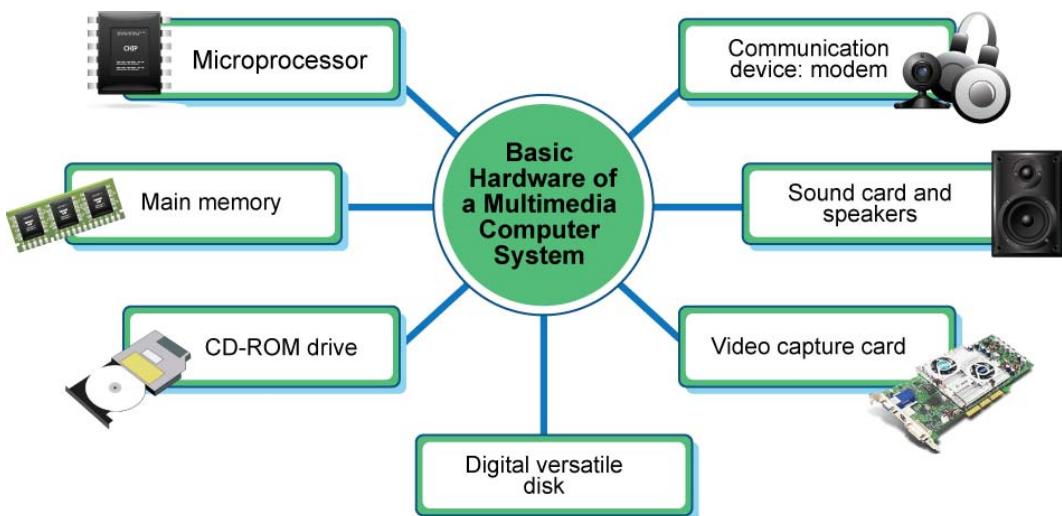
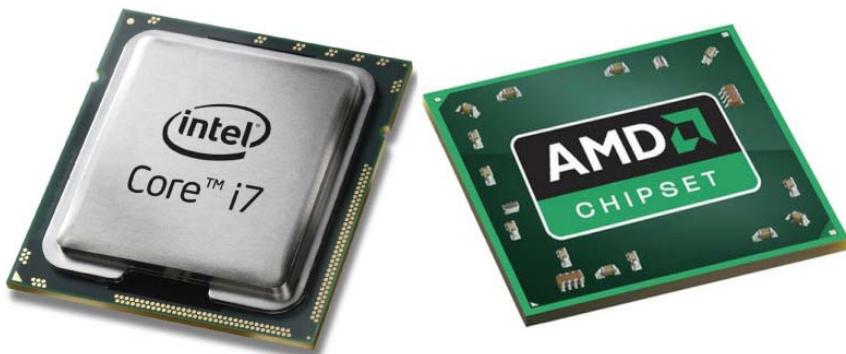


Figure 3.2: Basic hardware of a multimedia computer system

### 3.2.1 Microprocessor

The microprocessor is the most important hardware in a multimedia computer system. It is the “heart” of a multimedia computer. Without it, all data processing cannot be done and there would not be an output display. As you know, the current file size of a multimedia computer can be very large, to the extent of reaching hundreds of megabytes. This situation requires a fast and effective processor for multimedia data so that users do not have to wait long for the output display.

The need for a high capacity processor is more apparent nowadays as most multimedia software today are more orientated towards graphics and videos that require a powerful high speed processor. The increasingly powerful microprocessor will enable you to view video displays, listen to MP3 songs and play three-dimensional video games on the computer. Figure 3.3 shows the Intel and AMD microprocessors.



**Figure 3.3:** Intel chip and AMD chip  
**Source:** [www.productwiki.com](http://www.productwiki.com); [cdn4.wccftech.com](http://cdn4.wccftech.com)

Intel is the main manufacturer of microprocessors. To learn about this company, visit its website at [www.intel.com](http://www.intel.com).

### 3.2.2 Main Memory

The size of the main memory is one of the significant factors that determine the potential of a computer. The higher the size of the main memory, the higher the capacity of the computer. The size of the main memory also affects the speed of the system and the capacity of the computer system to operate more than one task simultaneously.

The main memory is usually measured in megabyte (MB). Multimedia applications require a high main memory. Therefore, 16MB of main memory is considered the minimum level, while 32MB, 64MB, 128MB and 256MB RAM are encouraged. Modern memory modules can be purchased in 256MB, 512MB, 1GB, 2GB, 4GB and 8GB sizes.

### 3.2.3 Compact Disk Read-Only Memory (CD-ROM)

CD-ROM (Compact Disk Read-Only Memory) is the basic hardware of a multimedia computer system. Compact disk technology has successfully increased the capacity of the computer for storing and retrieving data. Not too long ago, floppy disk was the main medium for the distribution of media software; now, this has been replaced by the CD-ROM.

CD-ROM's main advantage, besides its speed, is its ability to store more data. Usually a CD-ROM can store 650 megabytes of data on its single side. This makes it the main choice for software developing companies because of its ability to transfer a big amount of video, audio, graphics and animation data into their

software. For example, the majority of multimedia files such as animation, audio and video exceed 3MB and, thus, the 1.44MB floppy disk is not capable of storing such data.



**Figure 3.4:** ASUS CD-ROM  
Source: upload.wikimedia.org

The CD-ROM drive is also measured in terms of speed. The rotational speed is important to determine the speed of the data being transferred from the disk to the computer system.

The speed of the CD-ROM drive is measured in "X" unit. An "X" (1X) means the speed of data transfer is 150KB per second, which is the basic speed of a CD-ROM drive. CD-ROM drives with this basic speed were also known as Single Speed. The subsequent technology was known as Double Speed. CD-ROM drives at this stage were able to transfer data at 300KB per second, which was twice the speed of the basic CD-ROM drive. Today, the latest CD-ROM drive is 56X and it is able to transfer data at 8.4MB per second. This is one of the main reasons why the installation of programs, especially multimedia software, can be done quickly today.

1X	150KB per second
2X	300KB per second
56X	8.4MB per second

**Figure 3.5:** Calculations of CD-ROM speed

Now, let us look an extract explaining about CD technology.

### CD TECHNOLOGY

CD technology has advanced beyond read-only and now there are CD read, write and re-write devices. There are different CD standards available which relate to the type of data that can be recorded on the CD. These are: Red Book used for audio CDs as well as data CDs; Orange Book format, which is a format for recordable CDs; and White Book, a format for video CDs. CD devices are often referred to as either single or multi session. A session on a CD includes a lead-in area, a program area (data or audio tracks) and a lead-out area. Therefore, a multi-session disk is one, which has multiple sessions on one disk. Each session has its own lead-in, content and lead-out area, and is linked with other sessions.

(Mohammad Dastbaz, 2002)

### 3.2.4 Digital Versatile Disk (DVD)

The Digital Versatile Disk or DVD is relatively new and its format is still evolving. In the beginning, it was known as Digital Video Disk. However, since its technology was not only focused on video but was more versatile and capable of storing data in various forms, it was later known as Digital Versatile Disk.

DVD drive was introduced in 1996 and started to become popular at the end of 1997. DVD technology was said to be the successor of the CD-ROM technology. A DVD drive can store 4.7 gigabyte of data on a single surface of a DVD disk, which is seven times the capacity of a CD. Moreover, many DVD drives can store data on both sides of a DVD disk which doubles its storage capacity. In addition, the transfer speed of a DVD drive is much faster than a CD-ROM drive.

### 3.2.5 Video Capture Card

If your computer does not have a video capture card, you will not be able to watch videos on your computer. This is because the video data stored in a drive cannot be converted to video signals which are sent through the cable to the monitor.

Video capture card is the hardware used to support multimedia applications, especially video and graphic displays.

There are two important issues which you need to consider pertaining to video capture card, which are resolution or colour, and memory. Today, most video capture cards can display  $800 \times 600$  pixels of resolution. There are also video capture card that can display  $1,024 \times 768$  pixel and  $1,152 \times 1,024$  pixels of resolution.

The colour display of a video capture card is influenced by bits. The higher the bit, the more colour can be displayed. For example, a 24-bit video capture card can display 16.7 million types of colour whereas an 8-bit video capture card can display 256 types of colour only.

The memory in the video capture card is used to keep video data which has been processed by the microprocessor. It aims to ensure the smooth display of the video or graphics on the screen. After the video data has been processed by the microprocessor, the data would be sent via the bus before reaching the video capture card. Here, the data will be converted into video signals and is kept in the memory before it is displayed on the monitor screen. The larger the memory of the video capture card, the better the quality of the video or graphics displayed.

Technology is progressing rapidly. Now, there is a video capture card known as the Accelerated Graphic Port (AGP) that can display videos or graphics more effectively and at a very high speed. The memory of this card is currently 128MB. This AGP card is suitable for three-dimensional video games. However, since 2004, AGP has been progressively phased out in favour of PCI Express (PCIe). By mid-2008, PCIe cards dominated the market and only a few AGP models were available. By 2010, few new motherboards had AGP slots. No new motherboard chipsets were equipped with AGP support, but motherboards continued to be produced with older chipsets with support for AGP.

### 3.2.6 Sound Card and Speakers

If you wish to listen to music or songs on a multimedia computer, your computer must have a sound card and speakers.

High quality sound cards enable your computer to produce various interesting sounds for your computer games software. One of the most important aspects of a sound card is the bit rate. In the market currently, there are 8-bit, 16-bit and 24-bit sound cards. A 24-bit sound card can produce higher quality sound compared to an 8-bit sound card because more audio information can be sent through it.

There are many different types of sound cards with different specifications currently available in the market. Among the companies that are well known for quality sound cards are SoundBlaster, Audigy and Creative. Figure 3.6 shows an example of a PCI sound card:



**Figure 3.6:** Sound card  
**Source:** s192804805.onlinehome.us

Speakers used in a multimedia computer are more or less the same as other speakers. Figure 3.7 shows an example of speakers normally found in the market. Companies producing well-known speakers are Klipsch and Altec-Lansing.



**Figure 3.7:** Speakers  
**Source:** srigangothrivideo.com

The main function of speakers is to produce sounds such as music and voice.

Users will normally choose speakers based on their individual needs and preferences. If you only wish to listen to sound effects or music, then normal speakers are sufficient. However, to enjoy better quality sound, speakers that are equipped with two front and two back satellite speakers and a subwoofer are required.

### 3.2.7 Communication Device: Modem

The word “modem” is an abbreviation for modulation-demodulation. Modulation is the process of converting digital signals to analogue. On the other hand, demodulation is the process of converting analogue signals to digital. Modems allow microcomputers (digital) to communicate with each other via telephone lines. Both voice and data communication can be conveyed through the same telephone line.

Modem is a hardware you need to have in order to access the Internet. Without this hardware, multimedia technology would not have been able to progress so rapidly. This is because the information or multimedia data available on the Internet would not be able to be shared or referred to like today.

Modems can be divided into three categories, which are internal modem (Figure 3.8a), external modem (Figure 3.8b) and wireless.



**Figure 3.8:** (a) Internal modem; (b) External modem  
Source: az413224.vo.msecnd.net; kr.web.id

Apart from modem, Integrated Services Digital Network (ISDN), Digital Subscribers Line (DSL), cable modem, satellite connections, high-speed broadband and fibre optics are other technologies that can be used for connection to the Internet.



### ACTIVITY 3.1

In your opinion, what is a modem? How does it work?



### SELF-CHECK 3.1

1. Name five basic hardware that are required in a multimedia computer and state one function for each hardware.
2. Name two main brands of sound cards that are available in the market currently.
3. Apart from modem, name two latest connection technologies and give a brief explanation about them.

## 3.3

## INPUT AND OUTPUT DEVICES

The role of the input and output devices is very important when you develop a multimedia presentation. Both devices are needed when you want to interact with a computer. You require input devices such as keyboard, digital camera and scanner to enter the multimedia elements such as sound, text, graphic designs and video into the multimedia computer. This multimedia information can then be displayed anytime using the output devices such as printer, monitor and speakers.

### 3.3.1 Input Devices

Input devices collect data and programs that are readable or understandable by us and convert them into forms that can be processed by computers. There are many types of input devices such as keyboard, mouse, touch screen and voice input devices that can be used to develop and distribute a multimedia project.

If you are developing a kiosk system, you are encouraged to use touch screen (please refer to Figure 3.9) and keyboard as the input devices so that users can interact with the system. On the other hand, if you are into computer graphics, then you can use a digitising tablet as the input device. A digitising tablet allows you to draw on the tablet using a special pen and the drawings will be displayed immediately on the computer screen.

**Figure 3.9:** Examples of input devicesSource: [www.ictlounge.com](http://www.ictlounge.com)

Input devices that will be discussed in the subsequent sections are digitising tablet, digital camera, digital video camera and voice input devices.

For more information on other input devices, you are advised to refer to the *Basic Concepts of Information Technology* Module, Open University Malaysia.

#### (a) **Digitising Tablet**

This input device is frequently used in the field of computer graphics. A digitising tablet is a device that can be used to trace or copy a picture or a painting. The material that you wish to copy is positioned on top of the tablet of the digitiser. Then, a special stylus pen that is attached to the computer is used to trace the material. While the stylus moves from one position to another, the computer records its position through the digitising tablet. After the material has been traced, its image will then be displayed on screen, printed on paper or kept in the computer system for future use. A digitising tablet also provides good control during graphics editing because the elements require precision. This feature is immensely useful to graphic and interface designers.

**(b) Digital Camera**

Multimedia technology progresses into a new era when the digital camera was introduced. This technology enables images or graphics to be transferred directly from the digital camera to a computer with just a cable extension.

It is far simpler than the conventional method whereby you have to capture the picture or image on the camera first. The film then needs to be processed to obtain the pictures before it can be scanned by a scanner.

A few years ago, storing digital pictures in a digital camera was a problem. At that time, the storage capacity was only a few megabytes and it was only capable of storing a few digital images. Now, with the advent of new technology such as the secure digital card with its capacity of up to 128MB, this problem is solved. As a result, digital cameras are now widely used. Many camera phones and most stand-alone digital cameras use removable flash memory card to store image data. The majority of cards for separate cameras are in SD format; some are in CompactFlash in addition to other types. In January 2012, a faster XQD card format was announced. Figure 3.10 shows an example of a digital camera which is available in the market:



**Figure 3.10:** Digital camera  
**Source:** [www.jessops.com](http://www.jessops.com)

When choosing a digital camera, make sure you get a digital camera that is capable of producing clear quality displays and with a high resolution. However, such high resolution digital cameras are far more expensive than low resolution digital cameras.



### ACTIVITY 3.2

In your opinion, is a digital camera better than a scanner in importing graphics or images? Why? Discuss.

(c) **Digital Video Camera**

Digital video cameras record movements digitally onto a disk or in the camera's memory. Its image quality is far better but it is rather expensive compared to a traditional camera. A digital video camera can also be used as a digital camera to take still pictures. With the reduction in cost, the digital video camera has become more popular for multimedia presentations.

Digital cameras can also store data on digital video tapes which can then be directly read by the computer system with the help of the digital video drive. This tape is frequently known as Digital Video (DV).

(d) **Voice Input Devices**

The voice input device converts human speeches to digital code. The most widely used voice input device is the microphone. The microphone is the hardware needed to record sound or voice in a multimedia computer. It is usually used for online conversations or tele-consultations. Figure 3.11 shows two examples of ordinary microphones used by computer users.



**Figure 3.11:** Microphone

Source: ecx.images-amazon.com; www.logitech.com

When the microphone is combined with the sound card and suitable software, a system of voice recognition is formed. This system enables users to operate the microcomputer and construct document through instructions that are voice activated.



### SELF-CHECK 3.2

1. What does a voice input device do?
2. Briefly state the differences between the digital camera and the conventional camera.

### 3.3.2 Output Devices

Output device converts information that can be read by machines to a form that can be read by humans. The data entered and subsequently processed by the computer would remain in machine readable form until the output device converts it to a form that is readable by humans. Similarly, like input devices, output devices also play an important role in the development of multimedia presentations.

Output devices that are frequently used with your multimedia computers are the monitor, printer, plotter, projector and voice output device. However, only two output devices – the monitor and the projector – will be discussed here. To know more about other output devices, please refer to the Basic *Concepts of Information Technology* Module, Open University Malaysia.

#### (a) Monitor

The monitor is used for display. It is one of the most important hardware in a multimedia computer system. Imagine that you had successfully completed your final animation project and were looking forward to showing the results of your work to your friends. Unfortunately, your monitor broke down. Without the monitor, you would not be able to present the result of your work to your friends.

The monitor that is required to develop a multimedia project depends on the nature of the multimedia application that you are developing and the type of computer that you are using. Do you know that there are various kinds of monitors available in the market for both the PC and the Macintosh? Among them are the Cathode Ray Tube (CRT) monitor and the portable monitor commonly known as the Liquid Crystal Display (LCD)

monitor. You may find better display technology such as the organic light-emitting diode (OLED) monitors which provides higher contrast and better viewing angles than LCDs. Figure 3.12 shows the three types of monitors:



(a) Cathode Ray Tube

**Source:** [www.onlinecomputertips.com](http://www.onlinecomputertips.com)



(b) Liquid Crystal Display (LCD) monitor

**Source:** [i1-news.softpedia-static.com](http://i1-news.softpedia-static.com)



(c) Organic light-emitting diode (OLED) display monitor

**Source:** [images.dailytech.com](http://images.dailytech.com)

**Figure 3.12:** Three types of monitors

The two important features of a monitor are its size and clarity. Monitor size is determined by the diagonal length of the display area. Usually, monitors come in many sizes such as 14, 15, 17 and 21 inches. The bigger the size of the monitor, the more expensive it is. However, a larger size is capable of displaying more information at any one time.

The clarity of the monitor is determined by its resolution which is measured in pixels. Pixel is the dot or picture element that forms the image on a monitor. The resolution also indicates the density of the pixel on the monitor screen. Generally speaking, the higher the density of the pixels or

the more number of pixels, the better the quality and clarity of the image displayed.

Dot pitch is the empty space or the distance between each pixel. The smaller the value of the dot pitch, the sharper or clearer the quality of the picture. Meanwhile, refresh rate represents the speed of the monitor to display back or to refresh the image being displayed. The higher the value of the refresh rate of the monitor, the lower the disruption of the display on the screen.

NEC Technologies is the leading manufacturer of liquid crystal display monitors or flat screen monitors. To know more about this company, visit its website at [www.nec.com](http://www.nec.com).

(b) **Projector**

The projector is a tool that enables a multimedia presentation to be displayed to a large group of audience. Among the projectors available in the market are the Liquid Crystal Display Panel and the Three-Gun Video Projector.

- (i) The Liquid Crystal Display Panel projector has many interesting features such as an LCD panel, light source, computer and video input, and internal speakers that can operate computer signals and videos. This type of portable projector is suitable for use because it is cheap and has high quality.
- (ii) The Three-Gun Video Projector is capable of displaying high-quality images and is usually used in large halls. However, such projectors are very expensive.

Hewlett Packard is the leading manufacturer of printers and multi-functional devices that combine the printer, scanner and fax machine into a single product. To know more about this company, visit its website at [www.hp.com](http://www.hp.com)



### ACTIVITY 3.3

1. What is the special type of printer used for drawings and designs?
2. When do you need a plotter compared to a printer?

## 3.4 STORAGE

An important feature of every computer is its ability to store information. Computers can store information permanently even after the electrical supply is stopped. Therefore, your work can be saved to be used later, to share information with others or to modify existing information.

Each data or instruction that you want the computer to perform would be kept temporarily in the computer's main memory, which is known as the primary storage. However, it is not permanent and will disappear when the computer is switched off. Therefore, a secondary storage or second storage medium is required. Secondary storage enables data, instructions or computer programs to be kept permanently.

To estimate the memory required for a multimedia project, meaning the storage space that is required for the hard disk, floppy disk or CD-ROM, and not the random access memory (RAM), you would require prior knowledge of the content and scope of the project that you are going to develop. Integration of coloured images, text, sound elements, graphics, animation, video clips and programming codes would require storage space. The more the integration of multimedia elements, the more storage space is required. Therefore, efficient multimedia developers need to know the different kinds of secondary storage media that are available. They need to know the limits, the capacity and the use of each secondary storage medium.

Before the existence of multimedia technology, the majority of information files comprised only of text and tables. Therefore, large storage media were not required. However, after the introduction of multimedia technology, the demand for large storage media increased. This was caused by file sizes that contained multimedia information such as graphics, audio and video that could reach hundreds of megabytes. Hence, they could not be stored in floppy disks even if they were compressed (.zip). Thus, hard disks (Figure 3.13) play an important role in the storage of multimedia data.



**Figure 3.13:** Hard disk

**Source:** [www.harddriverecovery.org](http://www.harddriverecovery.org)

The two common forms of modern Hard Disk Drives (HDDs) are 3.5-inch in desktop computers and 2.5-inch in laptops. HDDs are connected to systems by standard interface cables such as SATA (Serial ATA), USB or SAS (Serial attached SCSI) cables.

As of 2012, the competition for secondary storage is flash memory in the form of solid-state drives (SSDs). HDDs are expected to remain the dominant medium for secondary storage due to predicted continuing advantages in recording capacity and price per unit of storage, but SSDs are replacing HDDs where speed, power consumption and durability are more important considerations than price and capacity.



### SELF-CHECK 3.3

1. What is the difference between the internal hard disk and the portable hard disk? State the advantages and disadvantages.
2. List the three types of interface connections for HDDs.

## 3.5

## GUIDELINES FOR CHOOSING A MULTIMEDIA COMPUTER

Have you ever faced problems when planning to purchase a multimedia personal computer? Do you know the multimedia specifications that are compatible and suitable for your needs?

A normal situation that occurs is when you go to a computer store and the salesperson proposes that you buy the most sophisticated and expensive computer available. The important issue here is, do you need to own such a sophisticated and expensive multimedia computer as proposed by the salesperson?



### ACTIVITY 3.4

<b>Processor:</b>	4th Gen Intel® Core™ i7-4770 processor (8M Cache, up to 3.9 GHz)
<b>Monitor:</b>	Dell S2440L 24" Full HD Monitor with LED, 24 VIS, Wide-viewing, DCR 8M, VGA, HDMI
<b>Memory:</b>	16GB Dual Channel DDR3 1,600MHz - 4 DIMMs
<b>Hard Drive:</b>	2TB 7,200 RPM SATA Hard Drive 6.0 Gb/s + 32GB SSD
<b>Video Card:</b>	AMD Radeon™ HD R9 270 2GB GDDR5
<b>Optical Drive:</b>	16X CD/DVD burner (DVD+/-RW), write to CD/DVD

Discuss these specifications on the online forum. Get detailed descriptions for each of the above specifications.

Apart from the computer's specifications as stated above, what are the other criteria which need to be considered when you want to purchase a multimedia computer? When you have decided to purchase a multimedia computer for your daily use, you need not follow the latest trend but, on the other hand, you should consider the following criteria:

- (a) Price;
- (b) System's performance; and
- (c) Needs.

### 3.5.1 Price

Price is the foremost criteria when choosing a multimedia computer. If you want to buy a computer, you must decide on the estimated amount of money to be used in the first place. If you require a sophisticated and modern computer with the above specifications (stated in Activity 3.4) which belong to Dell's XPS 8700, then you should set aside more money because these products are really expensive.

The price of computer hardware will decline when more sophisticated and faster hardware are marketed. The most obvious example is the Pentium Core i3 microprocessor. When this chip was marketed, its price exceeded three thousand ringgit; currently, you can purchase it for approximately less than two thousand ringgit only. Therefore, if you are planning to purchase a multimedia computer, you can get one at a reasonable price. You need not waste money unnecessarily by purchasing a sophisticated multimedia computer.

### 3.5.2 System's Performance

You might feel cheated if the multimedia computer that you purchased did not perform according to your satisfaction, such as producing a low-quality video display.

A computer's system performance can be influenced by the hardware or software but the core factor in determining its performance is the computer hardware.

The system's performance is very important for a multimedia computer, especially if you always use it to display video or online games. Therefore, you should consider these criteria when you want to purchase a multimedia computer. The computer hardware that you select must be suitable with the system performance you require. For example, you can choose the following specifications for ideal multimedia playback and multitasking:

- (a) **Processor:** 4th Generation Intel® Core™ i3-4130 Processor (3M Cache, 3.4 GHz);
- (b) **Memory:** 24GB Single Channel DDR3 1,600MHz - 1 DIMM; and
- (c) **Hard Drive:** 500GB 7,200 rpm SATA 6Gb/s Hard Drive.

### 3.5.3 Needs

Most consumers do not consider their actual needs when buying a multimedia computer. They always choose the most sophisticated and expensive computers. For example, there are consumers who buy sophisticated multimedia computers just to type word documents, and there are also consumers who buy multimedia computers that are equipped with the fastest modem even though he or she has no intention of browsing the Internet.

Remember! You should know your real needs when planning to purchase a multimedia computer so that you can get a computer that not only meets your requirements and preference, but also one with a reasonable price.



#### ACTIVITY 3.5

List the computer's specifications that you require based on your affordability and need of usage.



#### SELF-CHECK 3.4

1. Name the three hardware that you think can influence a system's performance.
2. Name the two types of microprocessors that are available in the market and their two distinguishing features.
3. List some examples where voice outputs are available.
4. State the importance of the internal communication modem in multimedia.

## SUMMARY .....

- This topic explains the importance of computer hardware including input and output devices, and storage that is required for multimedia development.
- Although there are many kinds of computer hardware in the market, you as the multimedia developer should choose the hardware that corresponds with the concept and scope of the multimedia project that you are developing.
- Choosing the right input and output devices, and storage which meet the requirement of your project will help to contribute towards the success of your multimedia project.
- Finally, several guidelines are given at the end to help you choose the most suitable multimedia computer. Do not forget to use these guidelines when purchasing a multimedia computer.

## KEY TERMS .....

CD-ROM drive	Microprocessor
Communication device	Monitor
Computer system	Multimedia computer
Digital camera	Output devices
Digital compact disc drive	Projector
Digital video camera	Sound card and speakers
Digitising tablet	Standard specifications
Input devices	Video capture card
Internal hard disk	Voice input devices
Main memory	

# **Topic ▶ Development 4 and Future of Multimedia Technology**

## **LEARNING OUTCOMES**

By the end of this topic, you should be able to:

1. Explain the factors that contribute towards the technological development of multimedia; and
2. Identify several areas of research and development and challenges of multimedia at present and in the future.

## **▶ INTRODUCTION**

In the previous topics we learnt about the various multimedia applications that are available in our daily lives. In this topic, we will discuss current multimedia technological developments. Besides that, we will look into the challenges faced by multimedia technology today.

**4.1**

## **DEVELOPMENT OF MULTIMEDIA TECHNOLOGY**

One of the signs indicating the rapid development of multimedia technology today can be seen from the number of current household occupants who own multimedia computers that are equipped with CD-ROM or DVD drives, sound cards, speakers and video capture cards. The number of household occupants

who own multimedia computers has increased tremendously compared to a decade ago.

Other than that, the increase in the number of multimedia products and applications reflect the fact that multimedia technology is not only experiencing a very rapid growth but has become a very important part of our everyday lives. In fact, many local companies have developed and distributed multimedia software that is suitable for local consumers especially in the fields of education and training.

The following sections will briefly discuss some of the factors that contribute towards the current development of multimedia technology.

### 4.1.1 Price

Economists have stated that if the price of a product drops, then demand for the product will increase. This statement is astoundingly accurate; as the price of multimedia computers drop, more Malaysians can afford to own one.

If five years ago you need to fork out RM5,000 to own a multimedia computer complete with compact-disk players and sophisticated audio and video, now you only need to pay about RM2,000 or cheaper to own a similar set.

Do you know that in 1992, a courseware was sold at RM250? Today, software prices have dropped tremendously to the extent that one can purchase a software for only RM15 to RM20. The drop in the prices of multimedia components assures us that multimedia technological development will be more rapid in the future.

### 4.1.2 Development of DVD Technology

The Digital Versatile Disk, which is more commonly known as the DVD, was introduced in 1996 and considered an important progress in the technology of compact disk. There are many DVD drives that can store data on both sides of the disk's surfaces and this undoubtedly doubles the storage capacity of the disk. The DVD disk drive can store 4.7 gigabytes of data on a single side of the disk, which is seven times the capacity of a CD. In fact, there are DVDs that can store up to 17 gigabytes. This enables full-length movies with varying audio tracks (to provide multilingual capabilities) and also different versions of the same movies (PG, PG-13 and R) to be loaded onto the same disk.

Now, DVD technology has replaced VHS technology and laser disk in the production of digital videos or films because DVD pictures are clearer, faster and of a higher quality. The lower the price of the DVD, the higher the number of household occupants that can afford to own one. The film industry and multimedia games developers who require large disk capacity also benefit from the price drop.

### **4.1.3 Software Development**

Most software benefited from the multimedia technology enables the computer systems to interact fully with the audio, video elements and compact-disk drive more effectively. This new technology enables these elements to be absorbed as an additional object for use in multimedia applications such as words-processing and spreadsheets.

Software applications for education, games and entertainment became easier to use with these various additional elements. Authoring and programming language software technology based on a visual approach was also introduced. With this technology, multimedia software development became easier, faster and increased rapidly.

### **4.1.4 Internet**

With the availability of Internet technology, multimedia software such as Adobe Director, Adobe Authorware and Adobe Flash are capable of producing sophisticated and interesting Internet-based multimedia software or applications.

Websites have also experienced positive changes. In the early stages, websites only displayed information in text forms. Now, through Internet technology and sophisticated software, websites have changed and have full dynamic and multimedia features and are also able to display graphics, audio, video, animation and others.

Internet has brought dramatic changes in the distribution of multimedia materials. In fact there are some parties who say that the Internet may cause the extinction of the DVD. It has limited storage capacity whereas the Internet is able to provide unlimited virtual information which can be easily kept up to date. However, the main disadvantage of the Internet is the availability of infrastructures and slow speed connection especially in the distribution of large files such as animation, audio and video. Therefore, the DVD shall remain the main source of distribution of multimedia files for the next few years.

### 4.1.5 Increased Usage of Computers

If you remember, sometime ago, computers were used as just a word processing tool, thus, an extension of the typewriter. Time has changed and in line with the development of multimedia technology, the role of the computer has diversified and it now acts as the source for education, publication, entertainment, games and many others.

The development of multimedia technology has added to the speciality of computers where text is not the only main medium used to disseminate information but also graphics, audio, video, animation and interactivity. This increases the use and capacity of the computer system to its maximum level. The computer is no longer regarded as a luxury item; instead, it has become an important aspect of our daily lives.

### 4.1.6 Mobile Multimedia Computing

Mobile devices are becoming the most frequently used item in our daily lives because we will be able to access information through the Internet and social networks. Multimedia content becomes an important development nowadays to be disseminated over the network of mobile devices. This area is concerned with intelligent multimedia techniques to facilitate effortless multimedia experiences on mobile devices, including media acquisition, editing, sharing, browsing, management, search, advertising, cloud computing and related user interface (Mann, 1996).

### 4.1.7 Wearable Computing

Environmental technology in the form of ubiquitous computing, ubiquitous surveillance and smart spaces has attempted to bring multimedia computing seamlessly into our daily lives, promising a future world with cameras and microphones everywhere, connected to invisible computing, always attentive to our every movement or conversation (Mann, 1996).

In response to these problems, a personal, wearable, multimedia computer, with head-mounted camera or display, sensors, and many more is proposed for use in day-to-day living within the surrounding social fabric of the individual. Examples of practical uses include face identification (memory aid for names), way-finding via sequences of freeze-frames, shared visual memory or environment maps, and other personal note-taking together with visual images.

What do you know about Google Glass? How about smart watches like Pebble Smartwatch, Sony Smartwatches 2, Qualcomm's Toq Smartwatch, or even smart wristband in many forms such as for life-monitoring, cardiac-monitoring, emotion-monitoring, audio-recording purpose or for athletic purposes? These are examples of wearable computing that will be another trend in the future especially in exploiting multimedia technology.



### ACTIVITY 4.1

Apart from the factors given, state two other factors that have helped in the development of multimedia technology.

## 4.2

## THE CHALLENGES AND THE FUTURE OF MULTIMEDIA TECHNOLOGY

Multimedia technology has undergone rapid growth and is now at a very encouraging stage. Nevertheless, there are still some important areas that need further development. In the following sections, we will discuss some of the challenges faced by multimedia technology.

### 4.2.1 Computer Equipment

If the multimedia system or multimedia software can be developed successfully, but if there is no equivalent equipment to support it, then these efforts are all in vain. Moreover, the mobility of multimedia applications is restricted by the display, the computer architecture, networks and others. Therefore, it is hoped that there would be better development in terms of equipment. The equipment issues that are the focus for research and development are the computer's performance, mobility and speed.

Do you still remember the type of coloured monitor that was first used? That was the Visibility Graphic Analysis (VGA) monitor. This display device underwent a very rapid evolution. Today, several standards have been developed to determine the capacity of a computer's resolution. There are lots of standards commonly used at this moment from SVGA, XGA, SXGA and UXGA to Full HD and 4K technology. Research and development is still carried out in order to produce monitors with high resolution, durable and economical in terms electrical consumption.

Besides the monitor, the computer's microprocessor also requires further research and development. For example, a high-powered processor is required to deal with real-time video streaming. It is hoped that future development of microprocessors will be able to produce microprocessors that are faster and cheaper, able to withstand heat and are smaller in size.

Where networks are concerned, its future development challenge is to produce high-speed and high-capacity networks that can support multimedia networking, which is currently receiving a lot of attention. If several of these technologies can be developed successfully, this multimedia equipment could then be used as mobile end points.



### ACTIVITY 4.2

Discuss the latest trends in computer display standards such as Full HD and 4K technology.

#### 4.2.2 Operating Systems

Lately, development of operating systems has progressed rapidly and the most popular operating systems are the Windows Operating System, MacOS and Linux. The Windows 8 operating system is an example of a system that can support multimedia applications. However, the development of operating systems still requires further research and progress. Efforts are being undertaken by several developers of operating systems so that consumers can receive satisfactory service at reasonable prices.

#### 4.2.3 Storage

Currently, the main focus of computer developers is to obtain a faster way of processing and a high-capacity but smaller sized storage medium. Besides all the storage media already discussed in the previous topics, other storage media such as the electronic molecule and the hologram might be able to replace the floppy disk, the compact disks or other forms of storage media of the future. Holograms and molecular magnets are two forms of storage media which may be researched and developed in the next few years.

**(a) Hologram**

When we mention holograms, most people would think of holograms as the three-dimensional pictures created by laser rays. Sometimes, it is also used as logos on credit cards. Holograms can also store a large batch of data. In the near future, holograms would not only take over the place of a hard drive but may even replace memory chips. However, the use of holograms as a storage medium still requires extensive and detailed technological research.

**(b) Molecular Magnet**

Recently, researchers successfully created a microscopic magnet. It is a molecule derived from the combination of substances such as manganese, oxygen, carbon and hydrogen. A system of data storage from this molecular magnet is expected to have a very high density and is capable of storing millions of data compared to the system that exists today. In the near future, one may be able to use the molecule magnet, in the size of a pinhead to store hundreds of gigabytes of data.

You may find interesting information from an article entitled The Future of Storage that can be retrieved from the following website:

<http://gizmodo.com/5497512/the-future-of-storage>.

#### 4.2.4 Virtual Environment

Virtual environment is a new challenge in the multimedia system. If this virtual technology can be developed rapidly, you would no longer be required to fork out thousands of ringgit for overseas tours. You only have to sit at home and visit the country that you like through virtual technology! Virtual environment is mostly used in flight training or in the military as shown in Figure 4.1.



**Figure 4.1:** Virtual environment for military and flight training

**Source:** [www.d-a-s.com/VICE](http://www.d-a-s.com/VICE)

Now, the Web3D Consortium is working hard to bring virtual environment technology to the Web. This consortium is heading the VRML (Virtual Reality Modelling Language) language development program which is an object based language that enables you to create a 3D navigational space on the Web.

Among the main requirements of virtual environment technology, apart from navigation, are the interaction and visual communication domains. Besides that, modelling such as geometric, physical or behavioural should also be considered. These requirements provide the challenges for multimedia interfaces, hypermedia document and other related fields.

To get some ideas on the future of virtual reality and multimedia computing, please read the article at this website:

<http://www.engadget.com/2014/01/18/valve-vr-steam-dev-days/>



### ACTIVITY 4.3

1. "Wireless communication is one of the fields which can assist in the development of multimedia in the future." Give your opinion.
2. "Multimedia equipment can be used as mobile end points." What do you understand by this statement? Give a brief explanation.



### SELF-CHECK 4.1

1. Name two world famous developers of operating systems.
2. Give the three current uses of the virtual environment.

## SUMMARY .....

- The factors that contribute towards the current development of multimedia technology are price, development of DVD technology, software development, Internet, increased usage of computers, mobile multimedia computing and wearable computing.
- Multimedia technology has undergone rapid growth and is now at a very encouraging stage. Some of the challenges faced by multimedia technology are computer equipment, operating systems, storage and virtual environment.
- What is certain is that technological development will continue with the advent of new ideas which will push multimedia to a new height.

## KEY TERMS .....

Digital Versatile Disk (DVD)	Operating system
Hologram	Technologies
MMX (Multimedia Extensions)	Virtual environment
Molecular magnet	

# Topic ► Text

## 5

### LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Explain the importance of using text in a multimedia application;
2. List the categories of text by giving suitable examples; and
3. State the guidelines for using text in a multimedia application.

### ► INTRODUCTION

Multimedia would not be complete without text. This is because text is one of the most important elements not only in multimedia development but also in other fields. The combination of animation, audio, video and graphics can be used to develop multimedia. However, consumers' knowledge will be greatly enhanced when text is combined with other elements. Text is still needed to provide information and explanation for images, graphics and animation.

Text is used extensively in the world of mass communication specifically as an intermediary for the print media such as the press, magazines, books, journals and advertisements. Therefore, text or hypertext is considered the main element in multimedia development. Text plays the role of a fundamental communication medium for effective information dissemination.

## 5.1

# DEFINITION AND THE IMPORTANCE OF TEXT

Text and symbols have been used since 6,000 years ago in the Mediterranean Fertile Crescent in Mesopotamia, Egypt, Sumeria and Babylon where the first meaningful marks were scraped onto mud tablets and basked under the sun to dry. During this period, only rulers and priests were allowed to read and write the pictographic symbols and cuneiforms.

Today, text and the ability to read is the gateway to knowledge and success. Reading and writing are expected and become the necessary skills within most modern cultures.

**Text** can be defined as a combination of letters that form sentences or words to explain or discuss a topic which is known as text information.

In information technology, text is a sequence of readable alphabets and constructed words that can be encoded into a computer readable format such as the ASCII format.

Text is the basic element for all multimedia applications. Without text, information that you wish to convey might be lost during your interpretation of other media elements such as graphics, sound and video. Considering that there are various cultural norms to adhere to, text is considered the best and safest form of communication medium to deliver messages effectively so that misunderstanding will not arise.

When creating an application or a multimedia presentation, text is usually typed using the texts tools found in authoring packages and presentations used. However, in packages such as Adobe Director and Authorware, text documents can be imported directly and edited into the final application.

There are many formats for text and it depends on the word processing document used. For example, when one uses the Word program in Microsoft Windows, it will produce the file format -\*.doc, whereas, the WordPerfect program will produce the file format -\*.wpd.

These file formats are not readable by many authoring packages and presentations. Table 5.1 shows the file formats that can be imported into popular authoring packages such as Adobe Authorware and Director.

**Table 5.1:** Text Files that can be Imported

File Type	Explanation	Extension
Rich Text	<ul style="list-style-type: none"> <li>This is available as a “Save As” function in most popular word processing documents. It is a character formatting file that facilitates file sharing between applications and via the Internet.</li> <li>With RTF files, all formatting done with text style (bold, italics, and underline), justification (left, right centre and full) and typeface (typeface – size and type) are retained. In other words, when imported into different applications, RTF files will appear exactly like when they were first produced in word processing documents.</li> </ul>	.rtf
ASCII (American Standard Code for Information Interchange) Text Format	<ul style="list-style-type: none"> <li>This type of text is developed as the standard text on all computers. With this type of text file, whatever format used will be lost when you “Save”.</li> <li>Text files are normally saved as unformatted text and may be accessed through the “Save As” option that is available in all word processing documents. It is also a native file format in the Windows Notepad program.</li> </ul>	.txt

**5.2****TEXT IN MULTIMEDIA PRESENTATIONS**

Text is an important element in multimedia presentations because it provides a lot of information. However, text should not be used exclusively, without the combination of other multimedia elements. It has to be combined with other multimedia elements in order to produce high quality presentations.

To improve your knowledge pertaining to text in multimedia, refer to *Chapter 2 : Text in Vaughan’s Multimedia: Making it work.*

Text can be used as a visual image to enhance the aesthetics of a multimedia presentation. Factors or ways that can make text visually attractive are:

- Use of suitable type and size of fonts; and
- How text is displayed on the screen.

Figure 5.1 depicts the many ways text is used in multimedia applications.

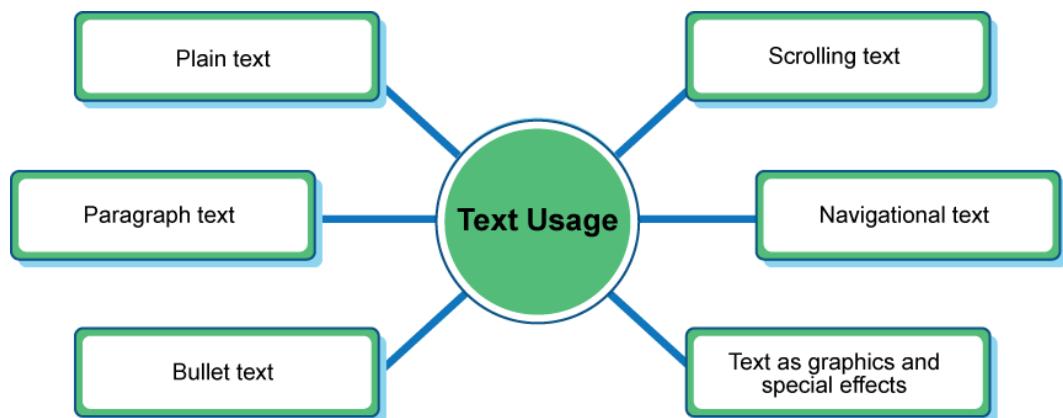


Figure 5.1: Text usage

Now, let us look at the usage of text:

(a) **Plain Text**

There are many examples of text usage that is any form plain text alphabet. Text files are developed using word processing that later can be imported into multimedia authoring programs. If an application requires a long text document, then the document can be imported in the form of Rich Text Format or ASCII text format and inserted into the presentation. Nowadays, most popular authoring packages such as Macromedia Director has its own text tools for editing and typing text.

(b) **Paragraph Text**

A paragraph is a text block usually containing more than one sentence. It is used in multimedia applications that require in-depth explanations. Many methods can be used to format paragraph text. You can choose any one of the methods described in the following.

(i) **Left-justify**

Text is aligned evenly on the left margin, as follows:

Welcome to the Introduction course in Multimedia Technology, one of the courses offered by Faculty of Information Technology and Multimedia Communication, Open University Malaysia.

(ii) **Right-justify**

Text is aligned evenly on the right margin, as follows:

Welcome to the Introduction course in Multimedia Technology, one of the courses offered by Faculty of Information Technology and Multimedia Communication, Open University Malaysia.

(iii) **Centre**

Text that is centred on a specified line length, as follows:

Welcome to the Introduction course in Multimedia Technology, one of the courses offered by Faculty of Information Technology and Multimedia Communication, Open University Malaysia.

(iv) **Full-justify**

Both margins on the left and on the right are the same, as follows:

Welcome to the Introduction course in Multimedia Technology, one of the courses offered by Faculty of Information Technology and Multimedia Communication, Open University Malaysia.

From the four styles above, the left-justified and the full-justified styles are easier to read and recommended for use. The centred style is suitable for headings and quotations; right-justified with uneven left margins can be used to create special effects. You can also use this style for text placed next to a picture.

(c) **Bullet Text**

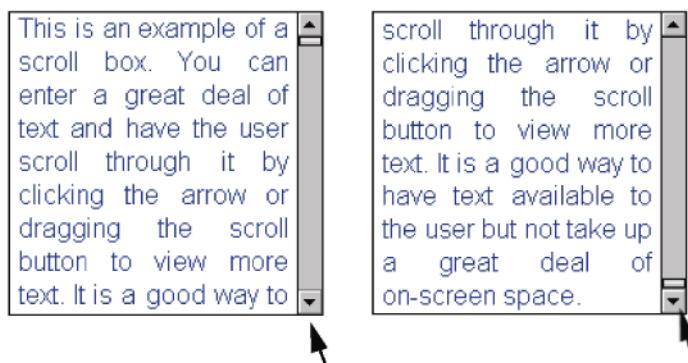
In multimedia presentations, the text presented should not be too long. You could choose important points in your topic and present them as bullet points (please refer to Figure 5.2). Bullet text is a sentence that explains concepts or as help signs and usually use the “bullet” symbol. The bullet symbols comprise graphics, symbols, numbers or letters that combine, move or explain the text.

**Figure 5.2:** Bullet text format

Source: www.indezine.com

#### (d) Scrolling Text

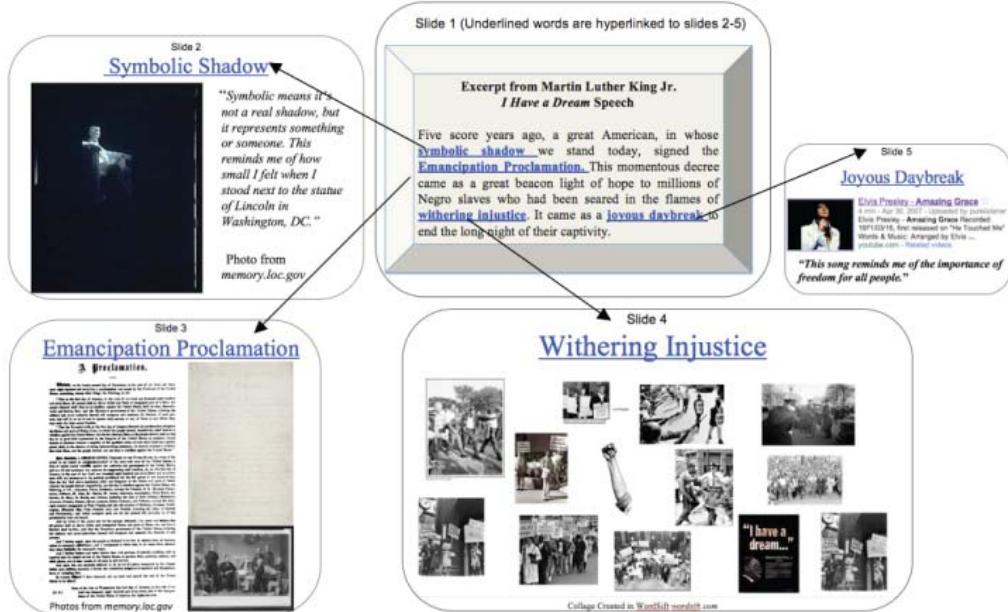
Scrolling text is a feature provided by some authoring tools to facilitate reading and control of large text blocks in multimedia applications (please refer to Figure 5.3). For example, you can use the Adobe Director software to develop scrolling text.

**Figure 5.3:** Scrolling texts for long documents

#### (e) Navigational Text

Multimedia applications currently combine interactive elements into presentations so that users have some control over the navigational parts. We can see that buttons and graphics contribute a large part of the navigational control, but do you know that users can also use text to navigate multimedia contents? Hypertext is a popular method for this purpose (please refer to Figure 5.4). Sentences or phrases in a paragraph can be made interactive. By clicking on these words users can "jump" from one location to another, within or outside the application. Hypertext can

also trigger sound effects and animation. The Internet is an example of text used as interactive navigational control.



**Figure 5.4:** An example of hypertext  
Source: literacybeat.files.wordpress.com

### (f) Animation and Special Effects

You can make text more dramatic, interesting and funny when you use graphics and text manipulation software such as **FontLab Studio** and **Fontographer** (please refer to Figure 5.5). Software packages such as Director can make text turn, rotate and zoom with relative ease. If you are assigned by your company to design a logo with text only, you can make the logo interesting by using 2D and 3D animation to create dynamic movements.



**Figure 5.5:** An example of text with special effects



### SELF-CHECK 5.1

Give two methods of how text is used in multimedia applications.

## 5.3 TYPEFACE AND FONT

A typeface is a family of graphic characters that usually include many types of sizes and styles. A font is a collection of characters of a single size and style belonging to a particular typeface family (please refer to Figure 5.6). Typical font styles are **bold-face** and italic. Other attributes such as underlining and outlining may be added by your computer software.

Typefaces refer to the types of writing whereas font refers to the style of writing.

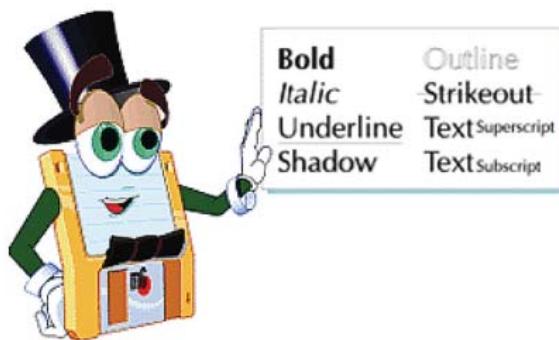


Figure 5.6: Types of fonts

Times New Roman, Courier and Arial are among the common typefaces used. Times New Roman 12 point italic is an example of a font. Figure 5.7 shows the three main types of typefaces:

**TIMES COURIER ARIAL**

Figure 5.7: Typefaces

You may be confused with the meaning of fonts and typefaces given above. This is because in everyday use, we often use the word “font” when we are actually referring to the typeface, which should be the correct word to use.



**Figure 5.8:** Different typefaces and fonts produce different moods in multimedia



### ACTIVITY 5.1

What is your favourite typeface and font when producing a document? Why?

There are many websites where you can download fonts whether as freeware or shareware. Among them are: <http://www.fontfoundry.com>, <http://www.myfonts.com> and <https://www.google.com/fonts>.

## 5.4 TEXT SIZE AND TYPEFACE CATEGORIES

It is important to select the correct typeface and font. Although text is the simplest multimedia element, it is often misused. The use of size, font, typeface and style must be consistent with the design of multimedia project you are developing. Choose the typeface that can be found on most platforms. This is because the choice of suitable typeface in terms of its size and form will have different impacts on the approach, design and meaning of the multimedia presentation display.

The text size does not reflect the actual height or width of a character. This is because the height of the lowercase letter "k" of two different typefaces may vary while the height of the capital letter "K" of those typefaces may be the same. However, word processing software will make the modification automatically to overcome this spacing problem.

Text size is usually measured in point form (please refer to Figure 5.9). A point is 0.0138 inches or 1/72 inches. In other words, there are 72 points in an inch. Size 10 to size 12 typefaces is often used to display the table of contents on the screen. Nevertheless, the selection of size is also closely linked to the target group

that will be using the multimedia application. For example, multimedia presentations for old folks will require bigger text size.

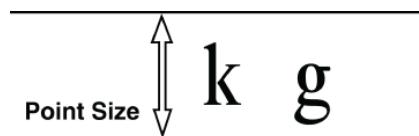


Figure 5.9: An example of point size

In terms of categories, typefaces may be divided into three common categories as shown in Figure 5.10:

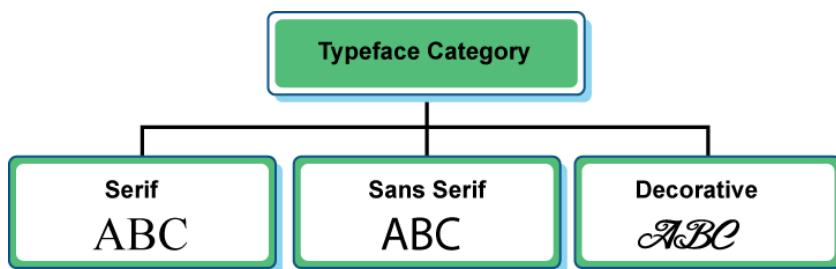
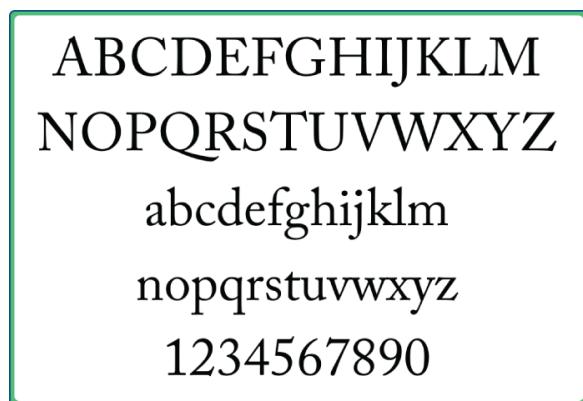


Figure 5.10: Typeface categories

There are also other categories such as **Blackletter**, **Ornamental**, **Script**, **Slab Serif** and **Transitional**.

### 5.4.1 Serif

Serif refers to the line or curve (tail) that exists at the end of a character. Examples of serif are Times New Roman, New century, Schoolbook and Palatino. For example:

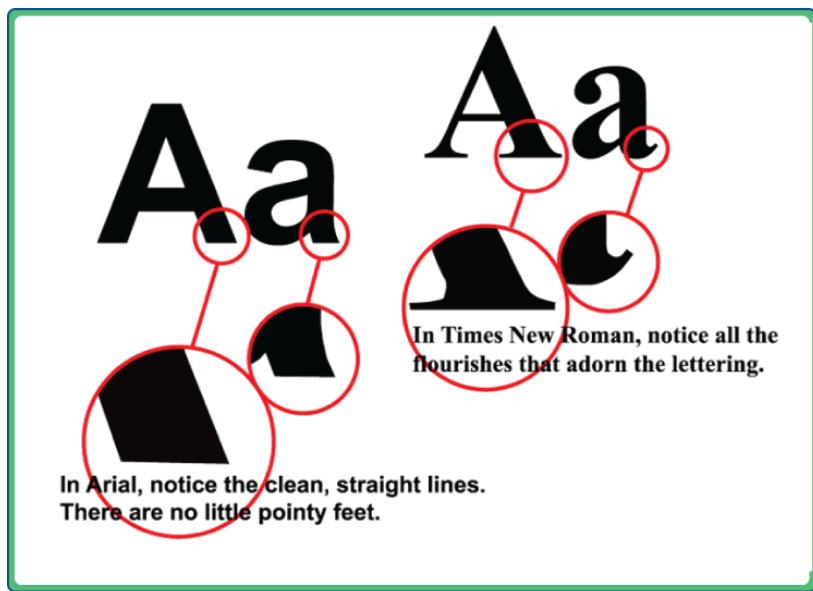


## 5.4.2 Sans Serif

“Sans” in French means “without”. Therefore, sans serif means a typeface without serif. Examples include Arial, Helvetica and Optimum. For example:



Figure 5.11 clearly shows the difference between serif and sans serif typefaces:



**Figure 5.11:** The difference between serif and sans serif  
Source: [www.digitalmediacomputing.org.uk](http://www.digitalmediacomputing.org.uk)

### 5.4.3 Decorative

Decorative refers to typefaces with old literature and flowery elements and look like ancient writings. For example:



#### SELF-CHECK 5.2

1. Give three common categories of typefaces with examples.
2. State the differences between typeface and font.

### 5.5

## GUIDELINES ON THE USE OF TEXT IN MULTIMEDIA PRESENTATIONS

As stated earlier, text is one of the most important elements in multimedia presentations. But sometimes, text fails to convey information quickly. For example, if you are given only three seconds to attract the attention of an audience in a multimedia presentation, it is somewhat difficult for text to deal

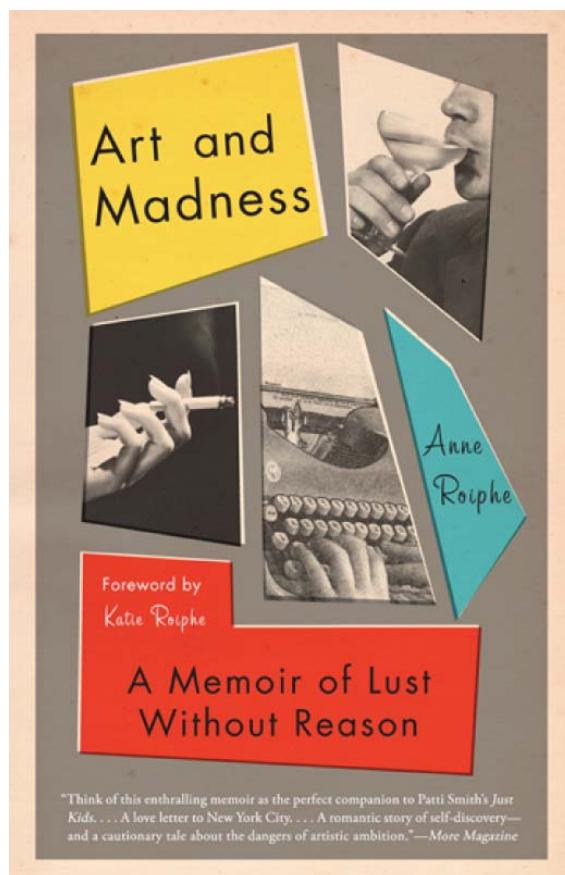
with this effectively. Nevertheless, the importance of text and its content accuracy cannot be denied.

The following are several guidelines on the use of text that you can follow during the development of your multimedia presentations.

### 5.5.1 Minimal Use of Text

Reading a lot of text on a computer screen is tiring. If possible, minimise the use of text unless it is a multimedia application such as reference titles that requires maximum use of text like encyclopaedias.

From a design standpoint, text should fill less than half the screen. Therefore, a combination of other elements is needed to reduce the dependency of multimedia applications on text (please refer to Figure 5.12).



**Figure 5.12:** Uses of text on book cover  
Source: [designobserver.com](http://designobserver.com)

## 5.5.2 Suitability of Typefaces and Fonts

Do you know that choosing the typeface and font for a multimedia application is not an easy task? This is because the selection of typeface and font must depend on the objective, content, concept and the intended audience of the multimedia application being developed. Imagine if you were to choose huge, gray blocks of text for your application. For sure it will be boring.

Therefore, typefaces and fonts are often used to draw attention to the information that is conveyed on the screen, increase readability, brighten the mood and should be in line with the concept of the application being developed. Ensure that the chosen typeface can be used in all platforms.

Figure 5.13 shows several fonts suitable for children:

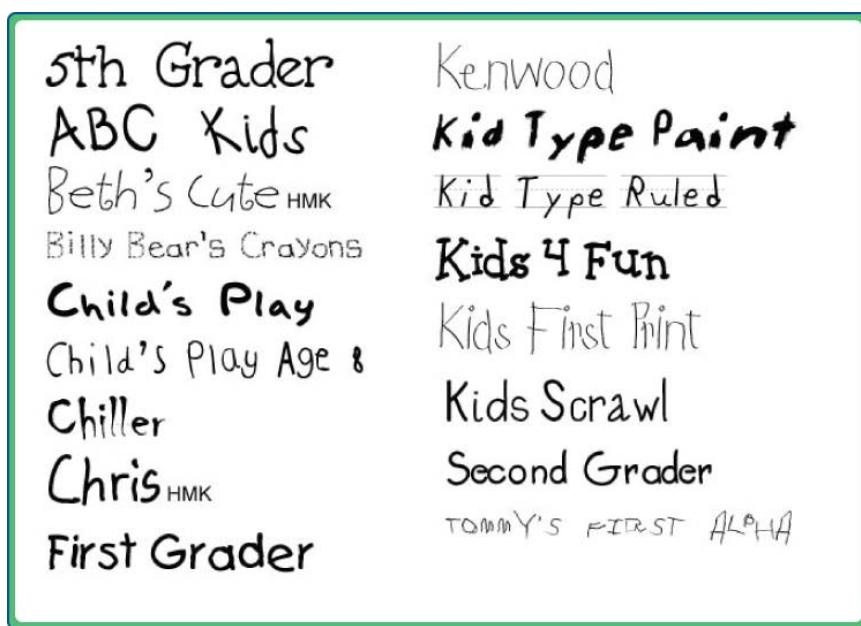


Figure 5.13: Suitable fonts for children

Source: [www.elementsvillage.com](http://www.elementsvillage.com)

Figure 5.14 shows examples of suitable fonts for a formal approach:



**Figure 5.14:** Cargo and Bandstand fonts

Source: sugarandspace.com

### 5.5.3 Choice of Text

When you are developing a multimedia application, make sure that the typeface chosen is clear and readable. For example, decorative typefaces are pretty and attractive but they are difficult to read. Table 5.2 shows the comparison between the Sans Serif and Serif typefaces:

**Table 5.2:** Comparison between San Serif and Serif Typefaces

Font Type	Display Style	Comprehension Study
Sans Serif	<ul style="list-style-type: none"> <li>• Clean, brief, objectivity, modern</li> <li>• Quite difficult for fast reading</li> <li>• Suitable for headings</li> </ul>	<ul style="list-style-type: none"> <li>• 20% – 30% level of understanding</li> </ul>
Serif	<ul style="list-style-type: none"> <li>• Old-fashioned, friendly</li> <li>• Easy to read</li> <li>• Suitable for content text</li> </ul>	<ul style="list-style-type: none"> <li>• 75% – 80% level of understanding</li> </ul>

### 5.5.4 Styles and Colour of Text

Style and text colour should be considered when developing a multimedia application (please refer to Figure 5.15). Among the common styles or writing styles are bold, italic and underline. These styles are regularly used to emphasise or to distinguish the contents from another section of the print media. Other than that, writing styles also function as hypertext in a multimedia application.

Text colour and background colour also play an important role to determine whether the words are clear and readable. If possible, avoid using text and background that have similar colours.

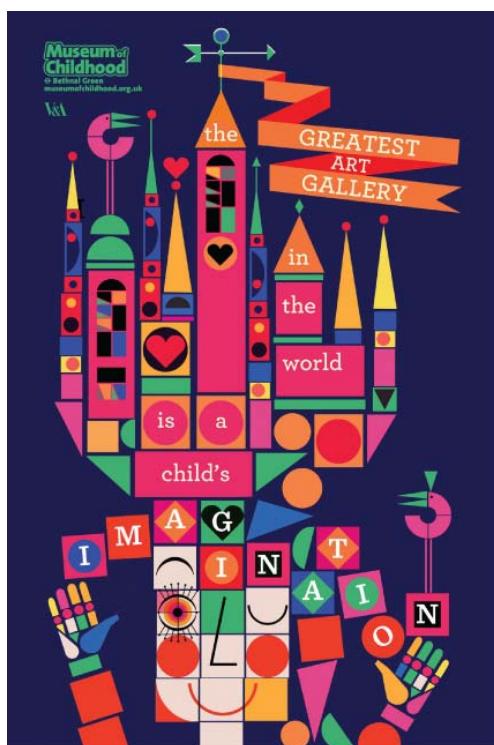


Figure 5.15: Example of a poster with suitable style and colours

Source: [theinspirationroom.com](http://theinspirationroom.com)

### 5.5.5 Consistency

Consistency or uniformity of textual use is important when developing a multimedia application. The use of size, font, typeface and style must be consistent with the design and concept of the project. For example, if the application being developed has several screens that require the use of headings

and sub-headings, the use of typeface, font, style and colour should then be consistent with each heading and sub-heading.

Another significant factor that needs to be emphasised in the selection of typeface is whether the chosen typeface is in the computer system for the purposes of playback. For example, if you use the AvantGarde typeface as the main typeface to display the contents of an application, you must ensure that other computer systems will also have this typeface. Otherwise, your display will be disastrous and will not be like the original. The computer system will change the typeface to the type that is available in its system. This will change the position and size of each character. Table 5.3 shows the typefaces normally found on Windows and Macintosh platforms:

**Table 5.3:** Typefaces Normally Found on Windows and Macintosh Platforms

WINDOWS	MACINTOSH
Arial	Charcoal
Book Antiqua	Chicago
Bookman Old Style	Courier
Bookshelf Symbol	Geneva
Century Gothic	Helvetica
Comic Sans MS	Monaco
Courier New	New York
Garamond	Palatino
Haettenschweiler	Symbol
Impact Lucida Console	Times
Marlett	
Monotype Corsiva	
Monotype Sorts	
MS Outlook	
MS Sans Serif	
MS Serif	
Small Fonts	
Symbol	
Tahoma	
Times New Roman	
Trebuchet	
Verdana	
Webdings	
WingDings	

**5.6****TEXT INTENSIVE MULTIMEDIA APPLICATIONS**

In certain circumstances, the multimedia application being developed requires a lot of text such as encyclopaedias or databases applications.

There are two methods that can be used to make a large amount of text less overwhelming or minimal:

- (a) Hypertext; and
- (b) Other methods.

**5.6.1 Hypertext**

This method only provides text as a path for users to obtain more related information. Users would be supplied with minimum text or content and additional information will only be displayed when you click or activate the word of your choice. This technique is widely used in Web pages.

Hypertext represents the access to information through text as an exploration path. Hypertext also represents a form of writing style that is non-sequential or linear. It is more a collection of text segments and not phrases that are continuous to each other. These text segments are connected by an access path which is also known as a link.

A user will be able to read the text that has been prepared and the same text can take users to other related pages that contain related information. Here, the users determine the direction of reading or information acquisition and not the writer. This hypertext concept is mostly found in Web pages. It is often represented by text in blue and is underlined like this: Multimedia.

**ACTIVITY 5.2**

Give an example of a website that uses hypertext as a hyperlink to acquire additional information.

## 5.6.2 Other Methods

Besides hypertext, you can use related graphics, audio, video or animation to replace a few paragraphs of text with the same information.

## 5.7

## TEXT AUTHORING SOFTWARES

Currently, there are many text authoring softwares in the market that enable you to build attractive typefaces and fonts. Table 5.4 introduces several text authoring softwares and the usage of these softwares.

**Table 5.4:** Text Authoring Softwares

Text Writing Software	Use
<ul style="list-style-type: none"> <li>Microsoft Word</li> <li>Word Perfect</li> </ul>	<ul style="list-style-type: none"> <li>A popular word processing software to develop an application that requires a lot of text.</li> </ul>
<ul style="list-style-type: none"> <li>Adobe Authorware</li> <li>Toolbook</li> </ul>	<ul style="list-style-type: none"> <li>Used for an application that does not require a lot of text.</li> <li>Can be used directly to type the required text.</li> </ul>
<ul style="list-style-type: none"> <li>Adobe Photoshop</li> <li>Adobe Illustrator</li> <li>Adobe FreeHand</li> <li>Fontgrapher</li> </ul>	<ul style="list-style-type: none"> <li>Can be used to form text in the form of attractive graphics.</li> <li>Normally used to create text with various special effects such as shadows, bright text and three-dimension (3D) text.</li> </ul>



### SELF-CHECK 5.3

- Give two multimedia applications that require a large amount of text.
- Why is the text element important in multimedia development?
- State five guidelines for the use of text in multimedia applications.

## SUMMARY .....

- Text has been around since ancient times. The ability to read and write text means success for the modern man.
- The appropriate use of multimedia elements may enhance the aesthetic presentation of text.
- It is important to distinguish between typeface and font, as these two terms are often confused with each other in everyday use.
- Other elements to consider when manipulating text include text size and typeface categories.
- In order to successfully use text in multimedia presentations, please bear in mind the following guidelines:
  - Minimal use of text;
  - Suitability of typefaces and fonts;
  - Choice of text;
  - Styles and colour of text; and
  - Consistency.

## KEY TERMS .....

Animation and special effects	Plain text
Bullet text	Sans serif
Centre	Scrolling text
Decorative	Serif
Font	Text
Hypertext	Text authoring software
Left/right/full justify	Text size
Navigational text	Typeface
Paragraph text	Typeface categories

# Topic ► Graphics

## 6

### LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Describe the importance of graphics in multimedia applications;
2. Discuss the two categories of computer graphics; and
3. Point out a few graphic file formats and sources of graphics.

### ► INTRODUCTION

In multimedia applications, the text element alone is not enough to convey the intended meaning. Visual images provide a higher impact compared to text. Graphics play an important role in multimedia presentations and are one of the most popular elements used in the development of multimedia applications.

As the Chinese proverb says, “a picture paints a thousand words”; thus, a visual graphical display is capable of presenting information more attractively and effectively. Graphics also accelerate the presentation of information and provide clearer, accurate and consistent information as compared to information that consists of only text.

#### 6.1

#### DEFINITION AND THE IMPORTANCE OF GRAPHICS

According to the Dewan Bahasa and Pustaka dictionary, graphics means something to do with paintings or carvings. From these definitions, we can conclude that the use of graphics in multimedia programs is not just about beautiful paintings, but also as a source of presenting highly effective information.

Graphics also refer to the use of visuals to explain concepts that cannot or are difficult to be described with the use of text.

Attractive graphics are one of the main attractions of multimedia; in fact, multimedia developers are aware that the success of a multimedia application depends on the visual impact that is successfully developed. Visualisation is an important process in the communication of information. This is because we are more inclined to study, understand and remember something that is seen as compared to something that is read or heard.

Computer graphics can be divided into two categories, which are vector graphics and bitmap graphics. When developing graphics for multimedia applications, you will use either one or both types of graphics. Before we study computer graphics in greater detail, let us look at the early history of graphics first.

The following extract relates the true experience of a famous multimedia specialist, and how he realised the importance of graphics and visuals in multimedia presentations.

“A few years ago, a large corporation asked us and one other multimedia developer to bid on a long-term contract for computer-based training. Though busy with other active projects, we didn’t want this possibly lucrative opportunity to slip by, so we spent a few days hastily putting together a demonstration of our technical skills for building nifty databases, designing tricky telecommunications systems, and integrating live video from videodisc into the computer. We even “wire-framed” a bit of a working multimedia database with the real data we got from the corporation.

We showed our demo to about a dozen management and training executives, in a fancy boardroom that had a built-in projector and sound system with mixers and light dimmers – a place where we could knock the socks off anybody. But within 30 seconds, the disaster bells started tinkling: most of our presentation was going way over their heads. Afterward, there were one or two vague questions and some thank you’s.

Our competitor's presentation, on the other hand, provided a slick series of finely rendered bitmapped screen images and elegant visuals. It was heavy on pretty menu screens and very light on how-it-is-done technology. We later learned that one of their graphic artists had worked for two solid weeks on the colour bitmaps for that demo. In the follow-up phone call, we were told by our potential clients that the competition's "incredible artwork" had won out over "excellent technology demonstration".

To cover our disappointment, we mumbled something to ourselves about not wanting to work with computer illiterates, anyway – people who could be taken to the cleaners by fresh paint. But we knew we'd missed a hefty piece of contract work because we hadn't invested serious graphic art talent in our demonstration. We decided that's why the real peas in the can are never the same bright green as the ones on the label. So we learned a marketing lesson."

Vaughn (2001)

## 6.2 HISTORY OF GRAPHICS

The early history of graphics is frequently associated with the development of the printing industry. When humans got to know about writing and print, human communication no longer focused purely on verbal statements. The use of printing machines became more widespread during the industrial revolution. At that time, graphic works and prints were made separately. For example, arrangement of letters, production of papers, printings and bindings were of different skills.

In 1880, the first press, *New York Daily Graphic*, used new graphic technology elements such as photography. In the same year, graphic designers produced illustrated posters by using full colours. The posters were displayed in several areas and towns in the United States and around Europe.

From 1890 until 1930, the Avant Garde group introduced the term "Art Nouveau". This group pioneered the art of free style lettering which was not confined to the old method. One of the prominent graphic designers from this group was Toulouse-Lautrec. Then, other graphic designers emerged, such as Charles Rennie Mackintosh, Peter Benrens and Frank Lloyd Wright with their own individual graphic creations.

The emergence of ideologies in the field of art brought a lot of changes in the creation of graphic designs. For example, a magazine's layout was no longer confined to the traditional way that emphasised symmetry. The new layout put more emphasis on free style motivational designs.

During the 1920s, the development of graphic designs progressed more rapidly with the emergence of the group called "de stijl group". This period was parallel to the Russian Revolutionary period. Graphic designs became freer and communications with the customers were considered important. Then, a group called "Bauhaus" introduced language art through fundamental designs. This group introduced formal graphics education such as lines, forms and alphabets in graphic designs.

Technological development improved the quality and ways of graphic designs. To date, graphic designs are not only presented through printing materials but in fact are more widespread in the technology of televisions, films and computers. Nowadays, computers have taken over as the medium to generate two-dimensional and three-dimensional graphic designs.

If you are interested to know more about graphic designs, please refer to the book, *Multimedia: The complete guide*, produced by Dorling Kindersley Limited, London, in 1996. You will learn the techniques used by graphic designers to produce images on computer screens and many others.

### 6.3

## COMPUTER GRAPHICS APPLICATIONS

Manual graphics, using hands and tools such as pencils, pens, colours and airbrushes, have been in existence for a long time, but the field of computer graphics is still relatively new. Computer graphics is an aspect of computer science and its use is widespread in the areas of engineering, heavy industries, animation and films. The study of computer graphics not only focuses on drawings and animation but also on mathematics (calculus, algebra and geometry), programming (C language or C++), computer algorithm and data structure. Besides that, in order to generate attractive computer graphics, a high degree of imagination is also required.

Computer graphics can visualise or depict a person's imagination on a computer screen. It aids in the manufacturing of goods or materials such as cars, buildings, humans' artificial limbs, computer games and simulations. Computer graphics can also provide a real picture of a house before it is built. In fact, it can design the interior of a house to see what furniture would be suitable to use. Thus, the time and cost in choosing furniture or renovation is reduced.

In the world of science, computer graphics can create a world which is invisible to the naked eye or beyond reachable. For example, NASA (National Aeronautics and Space Administration) has created the topography of Planet Mars, from the data sent by the Telescope Hubble. From the available data, scientists are able to see the molecular structure on the computer screen.

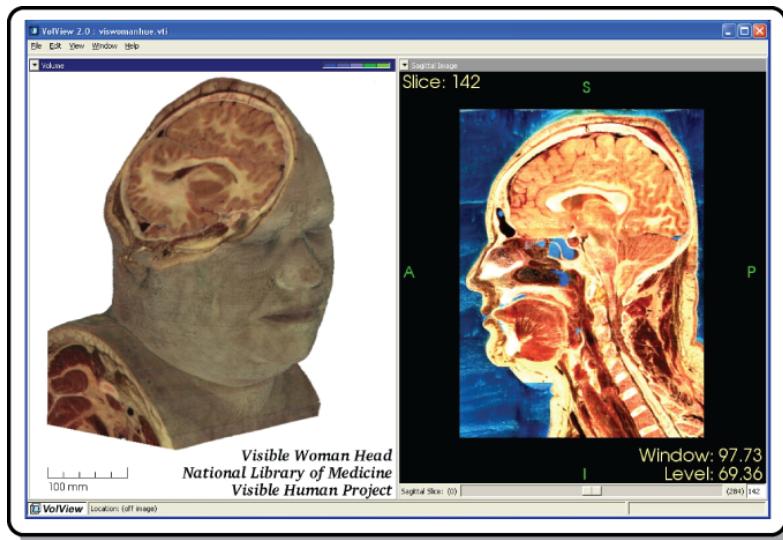
In the industrial world, computer graphics can help in the design of vehicles such as cars, vans, aeroplanes, motorcycles, marine vessels and lorries. Before production, the vehicles' level of safety, aerodynamic percentages, the suitable colours and the subsequent finished designs can be viewed via computer (please refer to Figure 6.1).



**Figure 6.1:** Computer graphics for vehicle designs

Source: [johndayautomotiveelectronics.com](http://johndayautomotiveelectronics.com)

In the medical field, computer graphics can help in the design of imitation limbs that are suitable for a particular individual. In the near future, virtual reality can aid in long-distance operations. Virtual reality is also used in simulations such as aircraft simulations used to train pilots. Besides that, virtual reality is also used by the police force to train its members on how to face a tense situation such as in a shooting scenario. Figure 6.2 shows us a computer graphic of a woman's head.



**Figure 6.2:** Computer graphics for medical field

**Source:** [www.kitware.com](http://www.kitware.com)

Computer graphics are also used in other fields such as in computer games, films, advertising and education. Now, computer graphics are not only accepted as an aspect of entertainment and knowledge, but it also gives a picture of the technological advancement of a country. In the world of computers, computer graphics is the most difficult field to explore because of the infinite imagination of the artists. The computers used are highly powered and there is no limit to the creativity of the computer graphics enthusiast. In Figure 6.3, you can see a sample of computer graphic for stimulation.



**Figure 6.3:** Computer graphics for simulation

**Source:** <https://lh5.ggpht.com>

## 6.4

# USES OF GRAPHICS IN MULTIMEDIA

In multimedia applications, the text element alone is not enough to convey the intended meaning. Graphics are not only able to present meanings but situations, feelings, intonations and sensory elements in much greater detail in any situation. Graphics are used in multimedia applications in the following circumstances:

(a) **Complementary Element**

Graphics are usually used as background and texture, whereby it acts as a complement towards the intended meaning through its display.

(b) **Main Focus**

Logos, images, paintings, figures and photographs in an application play a vital role in the delivery of the meaning or concept of the multimedia application.

(c) **Object**

Clickable graphics are considered as objects that can be used to link to other objects, pages, functions or any necessary task in a multimedia application.



### ACTIVITY 6.1

Besides the uses of graphics stated earlier, think of any other situation where graphics are used in a multimedia application.



### SELF-CHECK 6.1

1. Give two definitions of graphics according to Agnew and Kellerman (1996).
2. Describe the contribution of graphics in the medical field.

**6.5****CATEGORIES OF GRAPHICS**

Graphics can be divided into two basic categories – vector graphics and bitmap graphics. Understanding the differences between the two types can help you with your work. For example, some file formats can only accommodate bitmap images, whereas some file formats can accommodate vector graphics.

**6.5.1 Vector Graphics**

Vector graphics are also known as object oriented graphics or structured graphics. It refers to any image produced with the use of certain software and computer technology. Vector graphics are formed from lines that follow the mathematical equations called vector. For example, a bicycle tyre in a vector graphic format is built from a mathematical definition – where a circle with a given radius, set in a specific location and filled with particular colours. Although the bicycle tyre can shift its location, change its size or colour, the quality of graphic remains the same.

Vector graphics do not depend on resolution. The size of the vector image can be changed and it can also be printed on any printer no matter what is the resolution, without the loss of quality. Vector graphics are most suitable for text (especially small text) and thick graphics (bold) which, when altering its size, the quality still remains the same such as logos.

Among the applications that provide the environment based on vector graphics are Adobe Illustrator, CorelDRAW and Inkscape. Table 6.1 contrasts the advantages and disadvantages of vector graphics:

**Table 6.1:** Advantages and Disadvantages of Vector Graphics

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Requires only a small size data for image representation.</li> <li>• Quality of the Vector graphics remains the same even though the size and the position change.</li> <li>• Requires only a small storage space.</li> </ul>	<ul style="list-style-type: none"> <li>• Not realistic because of the computer technology.</li> <li>• The more complex the image created the bigger the file size and the slower the display.</li> </ul>

## 6.5.2 Bitmap Graphics

Bitmap graphics is also known as raster image or bit map image. Bitmap images are produced from dots arranged specifically in metric form. These dots are known as pixels (Pixel = picture + element). This pixel image is known as bitmap image.

Within the confines of metric, these pixels are arranged according to size, colour and location. The image created on the computer screen is the combination of all these pixels.

Each pixel or dot that forms the bitmap image consists of 3 colours: red, green and blue or is more popularly known as RGB (Red, Green, Blue). Nevertheless, these pixels may also consist of black and white (monochrome) or grey colour or have 256 colours up to 16 million colours. The more colours that are used for an image, the closer the resemblance of the image to the real image.

Bitmap images are usually not produced by computer. Instead, it is obtained from an actual source and then translated into digital form by devices such as image scanners, digital camera and others. The following are some of the ways that might be used to produce a bitmap image:

- (a) Producing the image from scratch by using computer drawing programs such as the Paint Program;
- (b) Capturing the image direct from the screen (screen capture) and then pasting the image onto your computer drawing program or application; and
- (c) Taking the image of a photograph, drawing or television image by using a scanner or a video capture card to digitise the image.

Among the applications that are used to edit or modify a bitmap image are Adobe Photoshop, Corel Paint-Shop Pro and GIMP. The bitmap image produced may be copied, modified, delivered via e-mail and used in various creative ways. Table 6.2 contrasts the advantages and disadvantages of bitmap graphics:

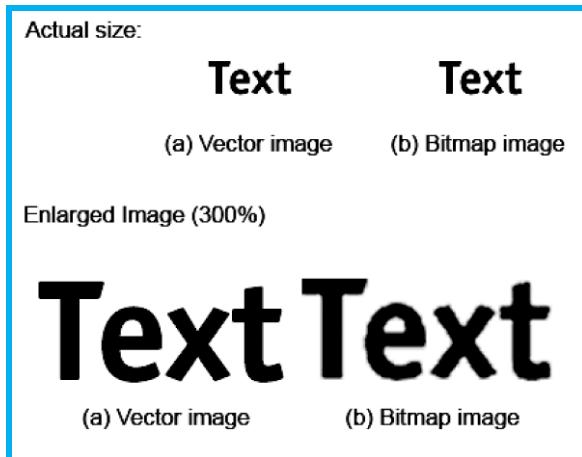
**Table 6.2:** Advantages and Disadvantages of Bitmap Graphics

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Produces real quality image.</li> <li>• Capable of storing a large amount of information.</li> <li>• Capable of being modified with a high quality modifier.</li> </ul>	<ul style="list-style-type: none"> <li>• Depends on resolution.</li> <li>• Enlargement of image size will produce a blurred image.</li> </ul>

### 6.5.3 Vector Graphics versus Bitmap Graphics

The choice of using either a bitmap image or a vector image is a creative decision. It also depends on the application software used to develop the multimedia project. An image that requires complex editing, precise and flexibility would be better drawn using a vector based application. Vector graphics are regularly used in technical areas such as CAD/CAM (Computer Aided Design/Manufacture), scientific modelling, architecture, arts design and others. On the other hand, for an image that needs to look realistic, a bitmap application is encouraged. Bitmap images include photographs, photorealistic images and background texture.

The appearance of both of these images also depends on the resolution display and capability of your graphics tools and the monitor of your computer. Both these images can be kept in various types of file formats and can be translated from one application to another or from one platform to another. Autotracing is a technique where a bitmap image is converted into a vector image. An example of the software used for this process is Streamline from Adobe. Other than that, the file image can also be compressed to save memory and disk space; in fact many image formats use this compression method in their files such as GIF, JPEG and PNG file format. Figure 6.4 shows the differences between vector and bitmap images.



**Figure 6.4:** Differences between vector and bitmap images

## 6.6 GRAPHICS CARD

The monitor or the computer screen is like an electronic canvas for computers where all multimedia images are displayed regardless whether it is a still image, an animation or a video image that moves. Therefore, the computer monitor is the most important component of the whole computer system. Through the monitor, you can view the results of your creation or your graphics' manipulation.

The monitor and the central processing unit are connected to each other through a graphics card located in the motherboard. Do you know that the image produced by graphics software is in digital format? But a computer monitor can only display images in analogue format. Therefore, there is a need for a conversion process and this is the job of the graphics card (please see Figure 6.5).



**Figure 6.5:** NVIDIA Quadro FX 4800 graphics card  
**Source:** <http://3dvision-blog.com>

The function of a graphics card is to convert digital images to analogue form and then display it on the monitor screen. The graphics card is also known as the video controller/adapter card because it also plays a role in displaying video graphics. Most importantly, regardless of what it is called, its function is still the same: that is to display your image.

A graphics card is also responsible for:

- (a) Your computer's resolution (please refer to Table 6.3); and
- (b) The number of colours that your monitor can display and the depth of colour.

**Table 6.3:** Types of Monitors and Resolutions

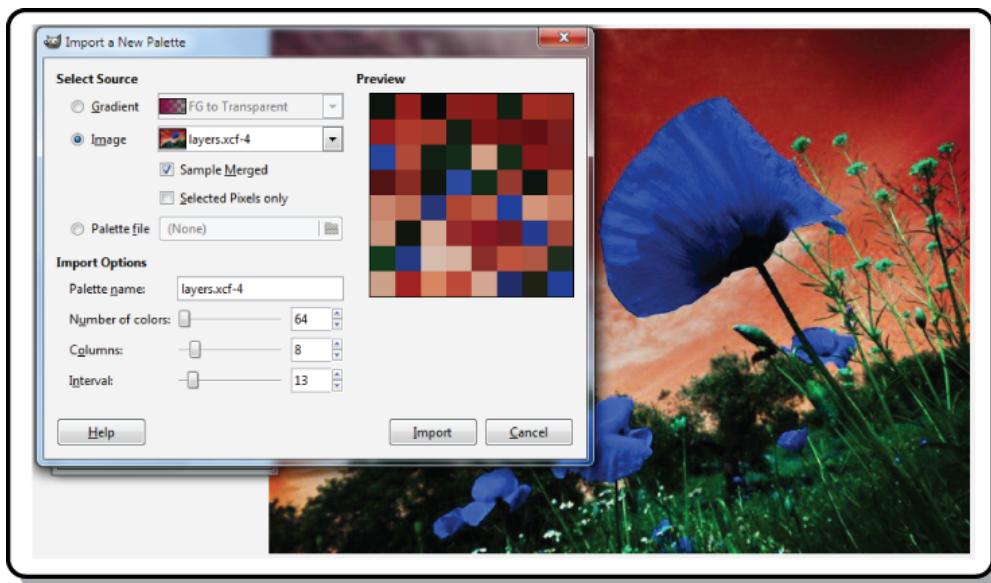
Resolutions (In Pixels)	Type of Monitor
640 × 480	VGA (Video Graphics Adapter)
800 × 600	SVGA (Super VGA)
1280 × 720	HD 720
1920 × 1080	HD 1080

The graphics card on the computer determines how many colours are available for display on a computer screen. The number of colours on the computer screen is known as colour palette and it is determined by the depth of bits of your graphics card. Each pixel is produced by a combination of the three primary colours that is red, green and blue (RGB). The bit depth or **colour depth** refers to the range of existing colours in a pixel or the number of different colours that exists on an image.

Bit is an abbreviation for Binary digit (BInary digiT) and it comprises of 0 and 1. If your pixel can only hold 1 bit of information, this means your monitor would only be able to display 2 colours, black and white (monochrome). If each pixel can hold two bits of information, each bit would have two colours and both the bits will produce four colours (2 2). A 4-bit display will give you 16 colours (2 2 2 2) and an 8-bit display will give you 256 colours. The greater the number of bits in a pixel, the more colours in the palette (please refer to Table 6.4). Therefore, the displayed image will be more colourful and realistic.

**Table 6.4:** The Colours Available in Colour Palettes

Colour Depth/ Bit of a Graphic Card	Colour Available
48-bit	281.5 trillion colours
36-bit	68.71 billion colours
30-bit	1.073 billion colours
24-bit	16,777 216 colours (photo realistic)
16-bit	65,536 colours (excellent for colour images)
8-bit	256 colours (good enough for colour images)
14-bit	16 colours
2-bit	4 colours
1-bit	2 colour (black and white/combination of any two colours)



**Figure 6.6:** The colour palette of the GIMP software  
**Source:** <http://0.tqn.com/d/create/1/0/P/2/B/-/pallettes.png>

Figure 6.6 shows the colour palette for GIMP software that can be used to manipulate the picture with realistic colours.

## 6.7 GRAPHICS FILE FORMAT

To produce graphics, you don't just require knowledge and expertise in this field but you must also be capable of manipulating the graphics by using specific equipment to add various effects. Different graphics software or packages will produce different file types. Fortunately, most authoring software today is able to import and export graphics files in various formats. This enables graphic designers to try different file formats for the different needs of the applications.

Table 6.5 shows a few graphics file format available. Each file format contains its own distinctive features, advantages and disadvantages.

**Table 6.5:** Graphics File Formats

File Formats	Explanations
.bmp	Window's Bitmap; This BMP's file is a file format that is most efficiently used in the Windows environment.
.gif	Graphics Interchange Format (GIF); developed by CompuServe to be used in computer networks. GIF is one of the most common graphics format used for images on websites.
.jpg	JPEG's image; named after the standard committee that developed it which is the Joint Photographic's Experts Group. It aimed to be a graphics format that is not platform specific (Platform Independent). This is the most popular graphics file format used on websites.
.pcd	Photo CD; based on Photo CD technology from Kodak. Consists of five types of sizes for each picture, from "wallet" to "poster" size.
.pict	Standard format for an image in the Macintosh environment. It is used for the development of cross-platform.
.png	Portable Network Graphic format; is called ping .png is developed as a patent and license-free format and is an alternative format to GIF.
.tiff	Tagged Image File Format (TIFF); is developed by Aldus Corporation and consists of many file versions. Usually used in desktop publishing software packages and is a file format favoured by printing companies.
.eps	Encapsulated PostScript; is a file format used in PhotoShop and can contain both bitmap graphics and vector graphics. It is supported by many graphics programs, illustrations and layout pages. It is also used to transfer PostScript's language artworks between applications.

A good multimedia designer should familiarise him/herself to work with various graphics file formats. For example, one can produce graphics using Photoshop first, and then export the graphics in JPEG format to be combined into a multimedia application.

The explanation about graphics file formats above may be limited. To know more about this topic, refer to *Chapter 3: Images* in the book *Multimedia: Making It Work* by Tay Vaughn (2014).

To obtain more information about PNG, visit its website at:  
<http://libpng.org/pub/png>.



### SELF-CHECK 6.2

1. State the three main methods of creating bitmap images.
2. Explain the differences between GIF and JPEG graphics file formats.

## 6.8

## SOURCES OF GRAPHICS

Using digital image or graphics in a multimedia presentation is not an easy task. You not only need to think about the kind of images (graphics and/or text) to be used in the application, but also about the legal issues involved. For example, intellectuals' property such as art works and customised image has copyright issues that may limit the usage of the images. Therefore, proper planning is required as to how to obtain graphics images for a multimedia presentation without violating any laws.

The following are some of the sources to obtain the required images or graphics for a multimedia application development (please refer to Figure 6.7).

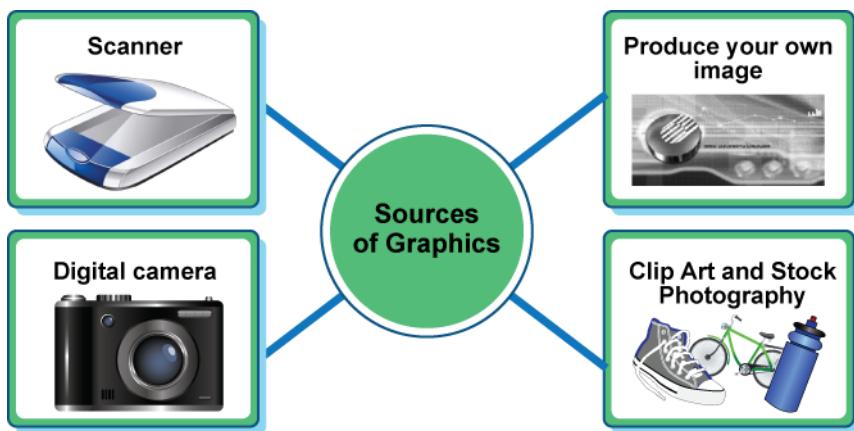


Figure 6.7: Sources of graphics

### 6.8.1 Scanner

Scanning an image or photograph for use in a multimedia presentation is one way of getting images for ready-made applications. A scanner is an equipment that is able to change images, text, drawings and photographs from analogue to digital forms. A good quality scans depend on the number of resolutions of the scanner.

A scanner can digitise and convert graphics to bitmap images on the computer. It can also convert text document to files that can be manipulated by the computer.

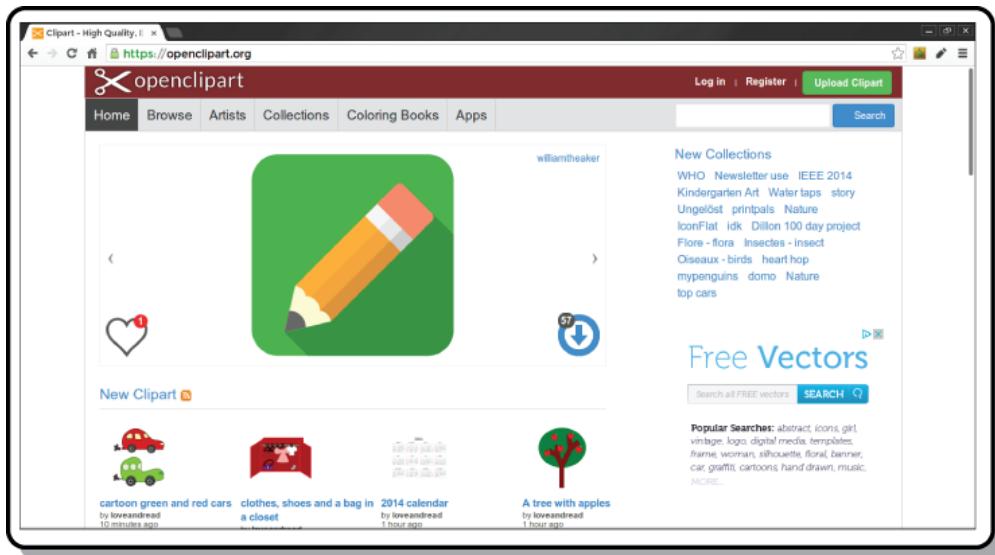
### 6.8.2 Digital Camera

A digital camera can produce a digital image quickly and easily. With a digital camera, we do not need a scanner. The captured images are in digital form and can be uploaded into a computer instantly. These images may be manipulated and kept in a popular file format and can be imported into an authoring software when needed.

Examples of available digital cameras in the market are Samsung Galaxy Camera and Canon PowerShot.

### 6.8.3 Clip Art and Stock Photography

The easiest way to obtain an image is through the use of ClipArt, and stock photography. These images can be obtained commercially and are usually royalty free (see Figure 6.8).



**Figure 6.8:** OpenClipArt  
**Source:** openclipart.org

Clip Art can be obtained from CD-ROMs and through online services. Clip Art and useful graphics are bundled together with many graphics applications; in fact many companies will send the collection once you register your purchased product. The collection of Clip Art may contain a mixture of many images or a series of graphics, photographs, sounds and videos related to a single theme or a certain topic.

For example, OpenClipArt is a website that offers a collection of free, open source graphics with creative common licence.

#### 6.8.4 Self-produced Images

You can produce your own image or hire graphic designers to create the image that you require. Graphic designers are trained to capture the images in your mind to digital reality form. With the aid of sophisticated graphics software available in the market, graphic designers can produce attractive images with unlimited creativity.

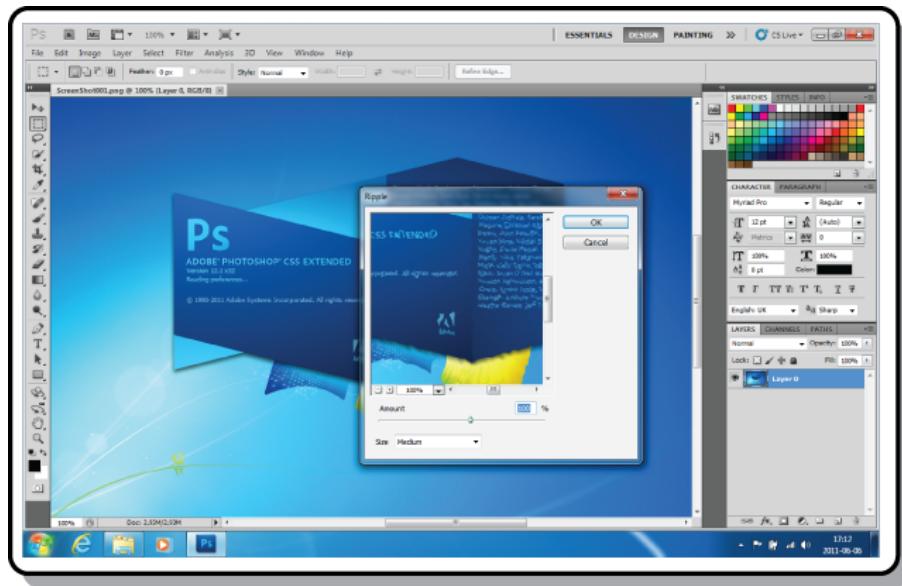
**6.9****GRAPHICS SOFTWARES**

There are lots of graphics softwares in the market. Among the most popular and regularly used are Adobe Photoshop, CorelDRAW, GIMP and Inkscape. Each of these graphics software has its own distinctive features and functions as shown in Table 6.6.

**Table 6.6:** Graphics Software

Software	Use
Adobe Photoshop	Complex graphics software and is used for editing and manipulation of images.
Adobe Illustrator	For drawing and creating simple geometric images.
GIMP	It is free and an open source software which you can download and use for free. Its functionalities are similar with Photoshop, except for commercial palettes.
Inkscape	This is also free and an open source software with similar functionalities with Illustrator which is used to manipulate vector graphics.
Paint.NET	This software is a simplified version of Photoshop and is meant for simple graphic editing

In fact, all the three categories of the graphics software are interdependent. Software such as Adobe Photoshop (please refer to Figure 6.9) are included in various categories.



**Figure 6.9:** The main interface of Photoshop

The following are some of the websites that you can visit to obtain free graphics and photos:

- <http://www.freegraphics.org;>
- <http://www.allfree-clipart.com;>
- <http://www.freefoto.com;>
- <http://www.freestockphotos.com;> and
- <http://www.goodwp.com.>



### ACTIVITY 6.2

Have you ever obtained or downloaded any image from a website? What is your view on the use of such images?



### SELF-CHECK 6.3

1. What is the use and function of the Adobe Photoshop software?
2. Give two sources of graphics that you know.
3. Why are graphic elements important in multimedia presentations? Explain.
4. State the main functions of a graphics card.

## SUMMARY .....

- Graphics is one of the most important elements of multimedia presentations because human beings are more likely to remember pictures than words.
- Graphics have been around since the introduction of the printing press. The history of graphics predates computers. The advent of computers has revolutionised and advanced the visual power of graphics.
- Computer graphics is used widely in many areas and has applications in science, industry, advertising, education, home entertainment, and many more.
- There are two basic categories of graphics – vector graphics and bitmap graphics. Understanding the differences between the two will help you in your work.

## KEY TERMS .....

Binary digit (bit)	Graphics card
Bitmap graphics	Graphics file format
ClipArt	Graphics softwares
Colour depth	Photoshop
Computer games	Scanner
Digital camera	Vector graphics
Graphics	Virtual reality

# Topic ▶ Introduction to Animation

## 7

### LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. State the importance of animation in a multimedia application;
2. Analyse the basic principles and techniques of animation; and
3. Discuss some of the main traditional animation techniques.

### ▶ INTRODUCTION

Multimedia technology has contributed a lot in our daily lives specifically in the entertainment world. Current Hollywood movies, especially action films and cartoons, use a lot of animation technology such as movies like *Star Wars: Attack of the Clones*, *Matrix*, and *Toy Story*. Such films interest the audience. In Malaysia, local animated cartoon film such as *Geng: The Adventure Begins* and animated television series such as *Upin & Ipin* and *BoBoiBoy* have captivated the hearts of the audience. Unlike normal films, almost or all of the characters and scenes in these films are produced through drawings but appeared to be real. This situation is called animation; where all static images either as drawings, statues or inanimate objects can move, talk and act like live characters.

Animation provides the visual impact for your multimedia project. Most multimedia applications, for any platforms like Macintosh, Linux and Windows, provide the tools required for animation. But before that, we need to understand the principles and techniques found in animation.

## 7.1 DEFINITION

Animation originates from the Latin word which means “bring to life”. According to the Dewan Bahasa dan Pustaka dictionary, animation is an act or process of making something seem realistic or alive.

A more complete definition of animation can be interpreted from the definition by Neo & Neo (1997) which is as follows:

**“Animation** is a technology that enables a still image to look as though it is alive, able to move, act and talk. This is made possible by cinematography graphics and plastic art techniques to create or to give the illusion of movement and life to cartoons, handdrawing, statues and three dimensional objects.”



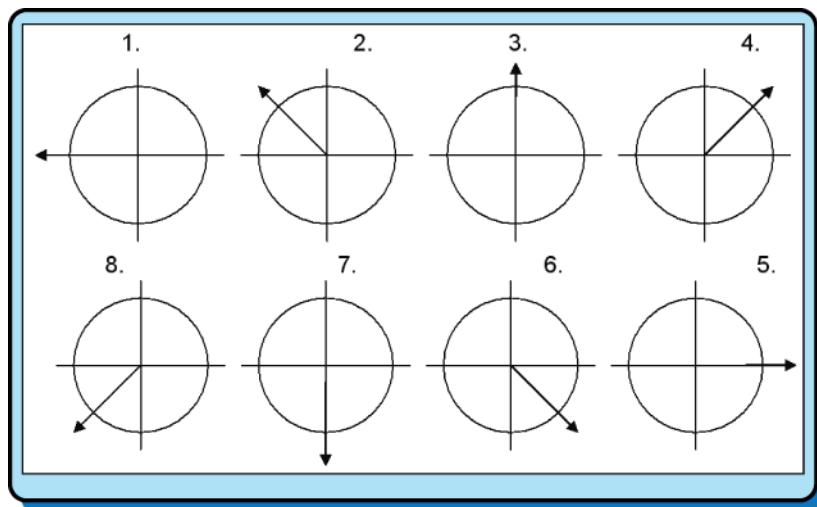
### ACTIVITY 7.1

Have you ever watched an animated action film or cartoon? In your opinion, how is animation created?

## 7.2 PRINCIPLES OF ANIMATION

Animation is made possible because of a biological phenomenon known as **“persistence of vision”**. An object seen by the human eye remains chemically mapped on the eye’s retina for a brief time after viewing. Combined with the human mind’s need to conceptually complete a perceived action, this makes it possible for a series of images that are changed very slightly and very rapidly, one after the other, to seemingly blend together into a visual illusion of movement.

The principle is explained more clearly through an illustration of circles as shown in Figure 7.1. Take note of this diagram; at each stated circle, an arrow is drawn at a different position and this position is changed towards the right-side at an angle of 15 degrees.



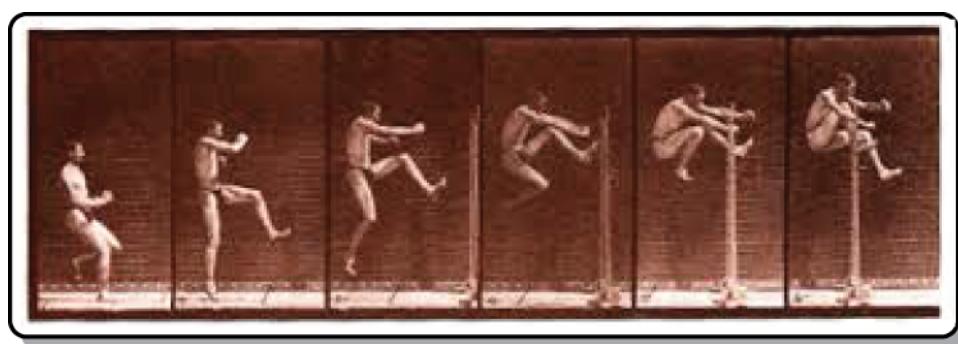
**Figure 7.1:** Picture of movement of an image

When the images are progressively and rapidly changed, the arrow is perceived to be spinning.

Television video builds 30 entire frames or pictures every second; the speed with which each frame is replaced by the next one makes the images appear to blend smoothly into movement.

For computer animation to function well, it should be built by using 12 to 15 frames per second (12 – 15 fps). Any amount of fps which is less than the stated value will produce animation that is jerky and not smooth. This is because the human eye is able to detect the changes from one frame to the next.

In conclusion, it can be said that animation is produced with the benefit of the biological phenomenon known as “persistence of vision”.



**Figure 7.2:** Stop motion photo “Humans in motion” by Edward Muybridge  
**Source:** [www.myholler.com](http://www.myholler.com)

Read the following passage regarding the device known as Zoetrope which is produced based on the “persistence of vision” concept.

### The Zoetrope

The zoetrope, or Wheel of Life, takes the Phenakistiscope's principle of using slits to view the image and folds it into a rotating drum. Invented in 1834 by William George Horner, the image was drawn on a removable strip of paper, so the animations were changeable. The slits were equally spaced around the drum, and the images were spaced along with them. The viewer spun the drum and watched the animation through the slits. This was perhaps the most popular and longest lasting of all of these toys. Horner originally named it the Daedalum, or Wheel of the Devil, but changed it before marketing.



Source: [http://minyos.its.rmit.edu.au/~rpyjp/a\\_notes/anim\\_history\\_02.html](http://minyos.its.rmit.edu.au/~rpyjp/a_notes/anim_history_02.html)



#### SELF-CHECK 7.1

1. Give one definition of animation that you have learnt.
2. Explain what you understand by the concept “persistence of vision”.

### 7.3

## THE IMPORTANCE OF ANIMATION IN MULTIMEDIA

The need to integrate animation in the development of a multimedia programs or software not only arises from the desire to increase the “oomph” in the application, but also to provide a more dynamic visual to the audience. In multimedia aspects, animation is one of the elements that are able to increase the attractiveness of a multimedia program or software. However, the decision to use animation is based on its aesthetic value and the growing importance of animation.

There is a difference between the use of digital video clips and animation. Video clips capture real live movement whereas animation is just a simulation of the real world. Digital video files are larger than animation files. Therefore, digital video clips are only used if it is proven to benefit the overall presentation.

Nowadays, computer animation is progressing rapidly. With the price of computers and software getting lower and the capacity of computer systems increasing, development of animation technology will definitely continue to progress. Animation makes a person creative in the sense that the software is user friendly and the hard disk storage can be increased to accommodate any shortfalls. This makes the production of animation easier and it is only limited by the creativity of an individual.



**Figure 7.3:** Characters of *Upin & Ipin* and *BoBoiBoy*

Source: <http://sphotos-c.ak.fcdn.net>

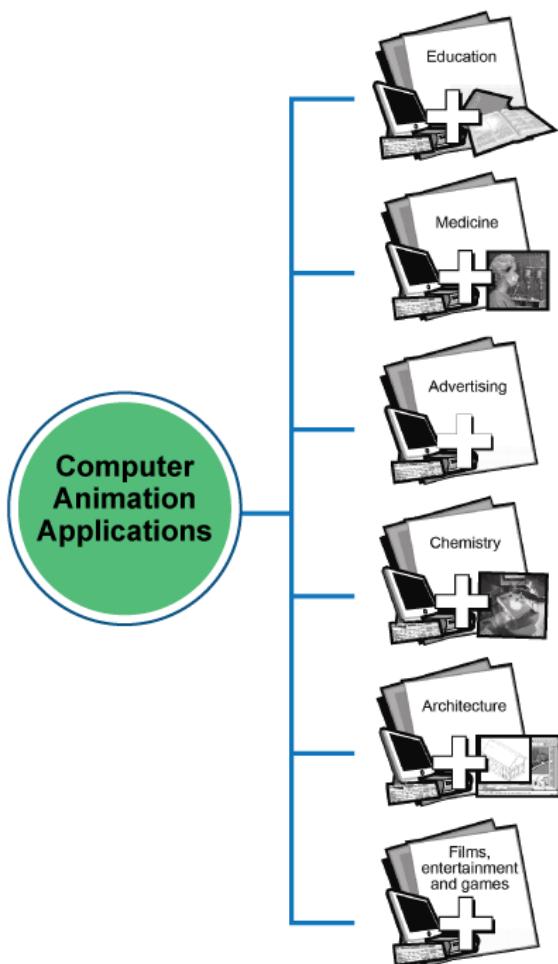
In the West, computer animated technology became a huge success with the production of animated films such as *Who Framed Roger Rabbit*, *Antz*, and *Toy Story*. In Malaysia, computer animation technology received attention with the emergence of the first computer animated cartoons such as, *Usop Santorian and Keluang Man*, *Anak-anak Sidek* and *Silat Lagenda*. Although these local animated cartoons have their weaknesses, these efforts have been relatively successful in introducing new changes in the local film industry.

Beginning from 2007, *Upin & Ipin*, the first computer animated television series was aired globally and received extremely positive feedback, not just from Malaysian, but for several countries after that such as getting huge fans from Indonesia. In 2011, another history in animation production in Malaysia when the second computer animated television series, *BoBoiBoy* was aired globally and getting popularity within a short time. Now, there are lots of developments in computer animated series with the help of Malaysia Development Corporation (MDeC) under their grants for creative industry.

## 7.4 COMPUTER ANIMATION APPLICATIONS

As we know, recently there are many uses for computer animation, more so in the era of multimedia industry development. You may think that computer animation only focuses on producing computer games, TV broadcasts or materials with multimedia characteristics. This is not necessarily true because computer animation comprises of not only entertainment but also practical elements and education.

The areas that benefited from computer animation applications are advertising, archaeology, architecture, arts, chemistry, education, engineering, film and video production, flight simulation, forensics, medicine, space probe, military and many others. Figure 7.4 shows the various fields of computer animation.

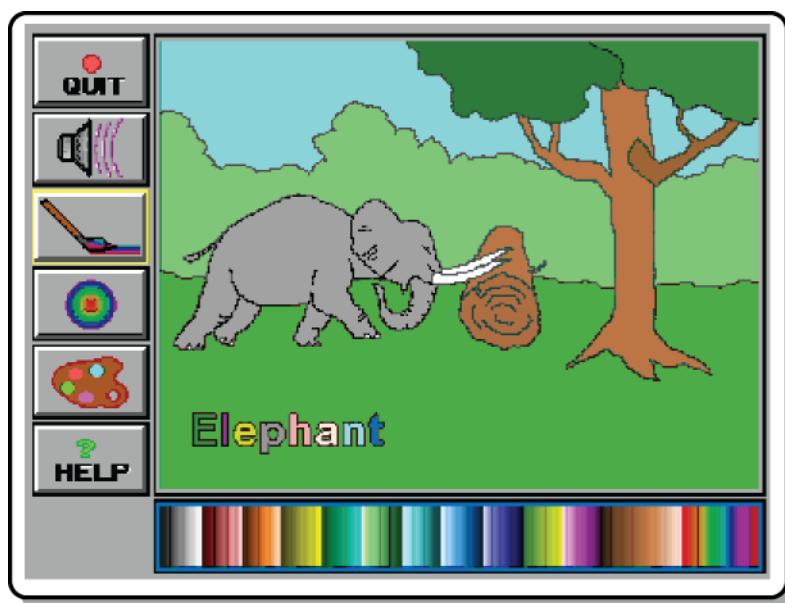


**Figure 7.4:** Computer animation applications

## 7.4.1 Education

Education and learning processes will be more effective and attractive if they are implemented in informal and pleasant situations. With the increasing development of multimedia, animation continues to contribute greatly to the field of education. Coloured and dynamic animation features not only make the educational content more lively and interesting, but it also stimulates and interests the students.

Many courseware that are available in the market use animation, for example a courseware built for the Smart School project. What interesting about this courseware is the interactive feature that is relayed through multimedia. Students who use this software don't use it passively but have active interactions with the software. Figure 7.5 shows an example of mathematics' software, "Animated Math".



**Figure 7.5:** Example of a screen display of Animated Maths' software  
**Source:** [www.flixprod.com](http://www.flixprod.com)

Flix Productions is a company that specialises in children educational software. Visit its website at: <http://www.flixprod.com/index.html>.

### 7.4.2 Medicine

Animation also plays an important role in the medical field, especially in surgery. Sophisticated computer technology enabled every organ in the human body to be modelled and animated. With the existence of such technology, the percentage of successful operations will surely increase because surgeons are able to learn and explore on model organs first before, they operate. This increases the surgeons' confidence levels and contributes to the success of operations.

### 7.4.3 Advertising

Advertising especially electronic media advertising has benefited from computer animation. The advertising field requires dynamic and attractive media such as the animation available in the film industry. High quality animation features are capable of obscuring the audience's eyes to the extent that it is difficult to differentiate between computer animation and real life. If you observe the advertisements shown on television, you will find that more and more commercials are using amazing animation techniques.

Without the use of animation, these cannot be advertised, because some movements that need to be displayed cannot be produced. For example, an aircraft that is in the heart of the city waiting to pick up a package, as in the FedEx advertisement, is made possible through animation. So is the petroleum advertisement that shows a car turning into a tiger.

### 7.4.4 Chemistry

Animation also contributes to the field of chemistry. This is because there are many chemicals such as molecules and atoms that cannot be seen by the naked eye, let alone be experimented or researched on.

Computer animation is used to help chemists with their experiments by building realistic 3D models of molecules or atoms that can be viewed from various angles. This definitely eases the difficult jobs that chemists have in real life.

## 7.4.5 Architecture

Computer animation technology helps architecture experts create animation based on the concepts of internal exploration, where a person is able to experience a real life situation while exploring and moving in a building (please refer to Figure 7.6). With this, we can experience the actual situation of a building before it is built.

This concept also enables an architect to detect any defect in the model or design at the initial stage. This will surely save cost and energy.

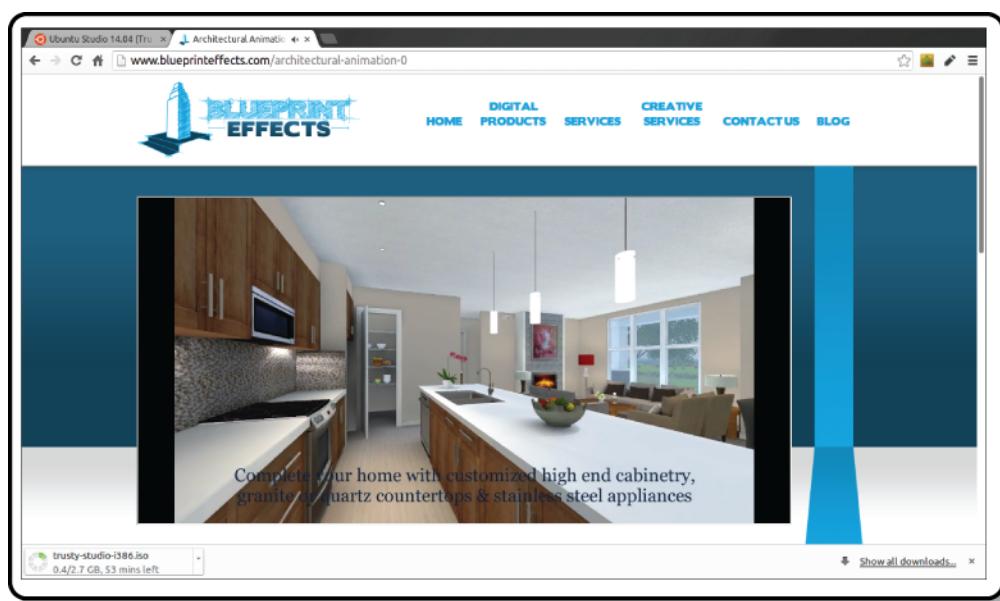


Figure 7.6: Animation and architecture

Source: [www.blueprinteffects.com](http://www.blueprinteffects.com)

## 7.4.6 Films, Entertainment, and Games

Animation is an alternative in the film industry. If in the beginning the film industry benefited from performing arts by humans and live animals, the animation has transformed the attention by including drawing or artwork to deliver a story.

Nowadays, computer animation has become a norm and increasingly popular in the area of entertainment. Do you know that *Toy Story* (1995) was the first animated movie completely produced by computer (please refer to Figure 7.7)? This movie was a joint production of Disney and Pixar. Other movies such as

*Terminator, Matrix, Star Wars, Attack of the Clones, Stuart Little, Shrek and The Lord of the Rings* have brought computer animation and special effects to a new level in the film industry.



**Figure 7.7:** *Toy Story*  
Source: <http://earnthis.net>

Computer animation can fully contribute towards games, just like in the field of education. The highly interactive features make the games software highly entertaining. Players can respond actively during play. In addition, there are also games that really challenge the players, not only in terms of physical activity but also intellectually. Take a look at Figure 7.8 that shows one of the popular games in the world of computer simulation called *The Sims*. This game teaches us to build a simulation of our own world based on the intelligent rules, emotion and many other rules and regulations.



**Figure 7.8:** One of the tasks in *The Sims*  
Source: <http://simcitizens.com>



### ACTIVITY 7.2

Think of four other fields that also benefited from computer animated applications.



### SELF-CHECK 7.2

What is the contribution of computer animation in the field of medicine?

## 7.5

### ANIMATION TECHNIQUES

There are many techniques or animation methods that you can learn. The basic method is to create animation through the stop frame cinematography method. However, to ease your understanding of animation techniques, we will divide it into two categories:

- (a) Traditional animation; and
- (b) Computer animation.

Traditional animation will be explained later in this topic. It covers techniques such as keyframes, cell animation and onion skinning. In the following topic, we will discuss computerised animation. Isn't that interesting? Therefore, clear your thoughts and it is hoped that you are ready to study the various interesting animation techniques.

## 7.6

### TRADITIONAL ANIMATION

Most of the techniques and methods of traditional animation were developed in the 1930s at the Walt Disney studio (please refer to Figure 7.9). These techniques were aimed at producing a more realistic and entertaining animation. In fact these techniques can and should be applied in the production of 3D animation.

The following are some of the animation techniques used in the traditional process of producing animation.

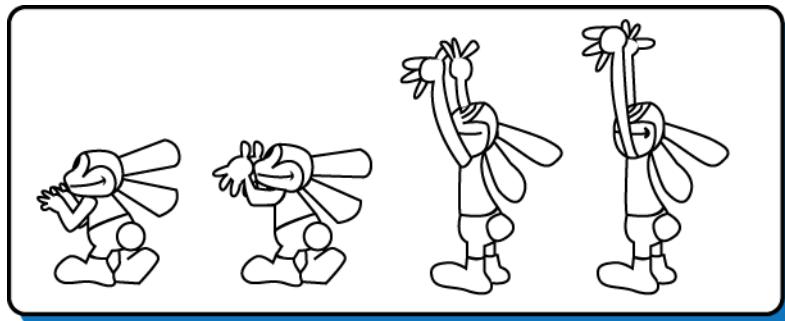


Figure 7.9: The mechanical techniques during the Disney era

### 7.6.1 Keyframes

Before the existence of animation technology, all traditional animation was done by hand. To save time and reduce the workload of the artists, the task of producing animation was distributed to more than one person. In order for this process to function smoothly, keyframes were referred to.

Before an animation is implemented; a storyboard is produced first, to show sequence of the animated story. When the storyboard is completed, the chief graphics artist or animator will draw the main frames (usually the first frame and last frame for an action). These main frames are known as keyframes. It will be the key or the reference frame for all the other frames.

After the keyframes have been completely drawn, the other graphics artists will take over the task of drawing the frames between the first frame and the last frame. The process of drawing the frames that lie between the keyframes is also known as tweening.

### 7.6.2 Tweening

Tweening is the process of producing an image or object in between the keyframes so as to give the illusion of movement. The tweening process requires prior counting of the actual number of frames that are required between the keyframes and the future path to be taken for the sequence of actions. After that, the sequence of actions will be drawn in pencil. If the end result is satisfactory and acceptable, then it will be permanently drawn in ink.

### 7.6.3 Onion Skinning

Onion skinning is another animation technique that is used in traditional cell animation. By drawing on transparent paper, the graphics artist can see the rough outline or the cell outline and use it as his guide for drawing or producing the next cell image.

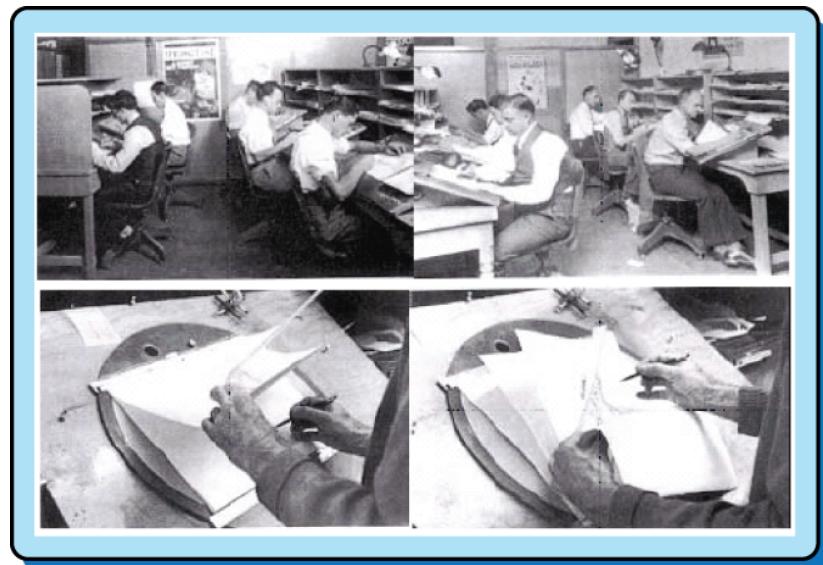
### 7.6.4 Cell Animation

The cell animation technique (please refer to Figure 7.10), popularised by Walt Disney, uses a series of drawings or pictures that overlap one frame with another frame. Cell animation employs the three major techniques which are the keyframes, tweening and onion skinning. For your information, films are normally built using 24 frames per second (fps). Therefore, to produce one minute of animation we will require 1440 different frames.

The term “cell” originates from clear celluloid sheets that are used to draw each frame. Nowadays, it has been replaced with acetate or plastic. Cell animation begins with the keyframes. For example, when a person walks across the screen, he balances his body on one leg and then on the other leg. Thus, the picture of the first keyframe will show him bending a little then straightening a little then bending a little again and so on and so forth, continuously.

The sequence of producing the frames in between the keyframes is known as tweening. Through this cell animation technique, each character or object that requires having movement, will be drawn on transparent sheets. Pictures of the background are drawn on opaque sheets.

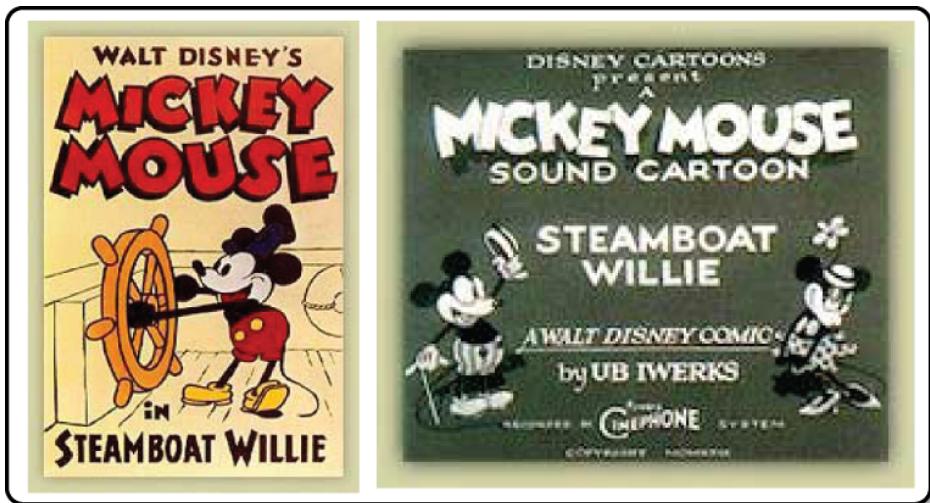
For an animation to succeed, many characters or objects will be drawn on overlapping transparent sheets that are placed on top of each other and in turn placed on top of the opaque paper with the background drawing.



**Figure 7.10:** Traditional cell animation

Source: [www.myholler.com](http://www.myholler.com)

This technique saves time and energy for the graphics artists because they do not need to draw each character or object repeatedly. Instead, these artists only need to draw certain parts of the characters that require movements. The first cartoon, *Steamboat Willie*, was produced by Walt Disney using this method (please refer to Figure 7.11).



**Figure 7.11:** *Steamboat Willie*

Source: [www.myholler.com](http://www.myholler.com)

For additional information, kindly read the following passage:

### Cell and Paper Animation Technique

By the mid-1910s animation production in the US was dominated by the techniques of cell and paper.

Cell animation was more popularised in America than in Europe because of assembly line Taylorism that had taken America by storm. Cell animation was appropriate to the assembly line style of manufacturing because it took a whole line of persons working on very specific and simple repetitive duties. On the other hand, in Europe where the assembly line style of work was not encouraged, clay animation and other forms of animation that required only a few individuals working on the set at a time was more popularised. Because the actual set could only afford a limited amount of individuals working at one time together and no more this style and other alternative forms of animation became more widely accepted.

Source: <http://www.myholler.com/155online/lectures/history.pdf>



### SELF-CHECK 7.3

1. What is the most basic technique for creating animation?
2. Give two traditional animation techniques. Explain briefly.
3. State one usage of computer animation application in each of the following fields:

Field	Usage of Animation Technology Application
(i) Advertising	
(ii) Education	
(iii) Chemistry	
(iv) Architecture	

## SUMMARY .....

- Animation is a technology that enables a still image to look as though it is alive, able to move, act and talk.
- A fundamental principle of animation is persistence of vision, which is a biological phenomenon that simulates the visual illusion of movement.
- The integration of animation into multimedia programs or software will increase the visual impact of the product because of its dynamic visual qualities.
- Computer animation has applications in various fields including education, medicine, advertising, chemistry, architecture, films, entertainment and games.
- There are two basic categories of animation – traditional animation and computer animation.

## KEY TERMS .....

Animation	Persistence of vision
Cell animation	Stop frame cinematography
Computer animation	Traditional animation
Keyframes	Tweening
Onion skinning	

# Topic ▶ Computer Animation

## 8

### LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Classify two categories of computer animation;
2. Identify the processes involved in the production of three-dimensional animation; and
3. Discuss two special effects of animation.

### ▶ INTRODUCTION

In Topic 7, you were introduced to some of the traditional techniques of animation. In this topic, we will discuss computer animation. Computer animation refers to animation developed by using sophisticated electronic and computer technology. It may be divided into two categories – two-dimensional animation (2D) and three-dimensional animation (3D). Later, we will learn about the various methods used to develop both these categories. In addition, you will be introduced to two interesting special effects of animation – morphing and warping.

### 8.1 COMPUTER ANIMATION

In general, computer animation programs are built using the same procedural and logical concepts as cell animation (traditional), such as the use of layers, keyframes and tweening. What distinguishes computerised animation from cell animation is the method used. Cell animation uses drawings arranged in frames – starting from the keyframes until all the pictures are arranged completely. The pictures on each frame are then recorded using a method called cinematography. On the other hand, computerised animation uses computer to organise the frames and records them in the computer memory.

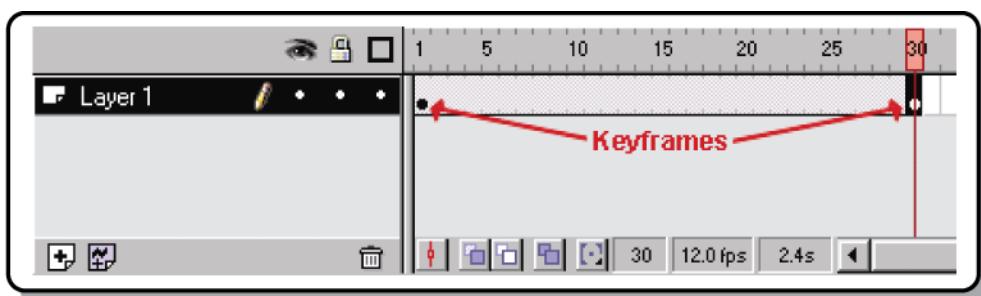
Before we discuss any further on the category of computer animation, let us reflect on two of the techniques already studied in traditional animation which are keyframe and tweening. We will briefly see how these techniques are applied to the computerised animation environment.

## 8.2

## KEYFRAMES AND TWEENING

The keyframe concept in computerised animation is almost the same as the keyframe concept in traditional animation. In computerised animation, it is no longer necessary to draw images by hand to generate the frame images between the keyframes.

Instead, computers with selected animation software will automatically calculate and insert or draw relevant images to be inserted in between the keyframes. The more the number of keyframes identified the smoother the animation produced.



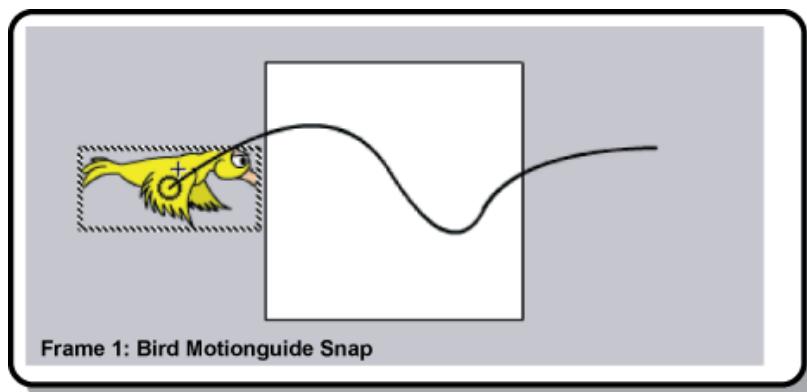
**Figure 8.1:** Keyframes for basic animation

Source: [www.echoecho.com](http://www.echoecho.com)

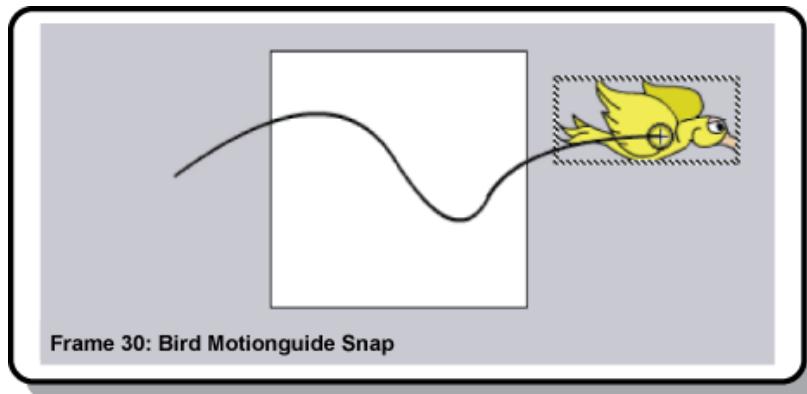
The software screen in Figure 8.1 shows two frames that made up the keyframes (frames no. 1 and 30) for a short animation. The area between both the arrows shows the process of tweening that occurs between both the keyframes.

The tweening process as explained in the previous topic is one of the famous animation techniques. Most of the software in the market has its own special ways of doing the tweening process.

Tweening reduces the workload of the animators or graphics artists. They only need to design the first and last cell of an animation, as shown in Figures 8.2 and 8.3, where only the first cell and the last cell are required to do an animation that shows a bird flying. Then, the animation software will make the calculations to determine what would happen between the first frame and the last frame.



**Figure 8.2:** First cell  
**Source:** [www.echoecho.com](http://www.echoecho.com)



**Figure 8.3:** Last cell  
**Source:** [www.echoecho.com](http://www.echoecho.com)



### SELF-CHECK 8.1

State the differences between the keyframe concepts of computer animation and traditional animation.

## 8.3

## CATEGORY OF COMPUTER ANIMATION

There are two categories of computer animation:

- (a) Two-dimensional animation (2D); and
- (b) Three-dimensional animation (3D).

Between these two categories, the two-dimensional animation (2D) is more popular and covers a variety of motion. 2D animation includes object, screen motion and animated cartoons. 2D animation is a flat animation. Meaning, the motion produced or the object being animated uses only two dimensions of space: the  $x$ -axis and the  $y$ -axis. Both these axes represent the height ( $y$ -axis) and width ( $x$ -axis) of the object or motion.

Three-dimensional animation (3D) refers to the animation that contains three-dimensional objects that are usually formed through modelling or mathematical formulas. 3D animation uses three dimensions, the height, width and depth. The  $z$ -axis represents the depth of the image involved. Three-dimensional objects seem more animated and realistic and give the illusion as if it is a real world dimensional object.

## 8.4

## TWO-DIMENSIONAL ANIMATION (2D)

2D animation is an animation that is widely used to develop multimedia applications. 2D animation is also known as linear animation. It refers to the movement of objects easily across the screen's display. Figure 8.4 shows various types of 2D animation.

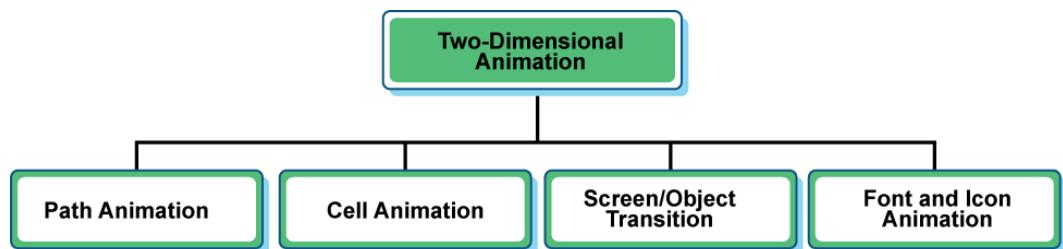


Figure 8.4: Two-dimensional animation

### 8.4.1 Path Animation

Path animation can be applied to almost all types of objects, whether text, graphics, video screens or character animation. Path animation only needs a specific path that has been predetermined. The path may be a straight line or a curve. This path is later connected to the object of choice. When the application is run, the object will move along the path which had been predetermined earlier (please refer to Figure 8.5).

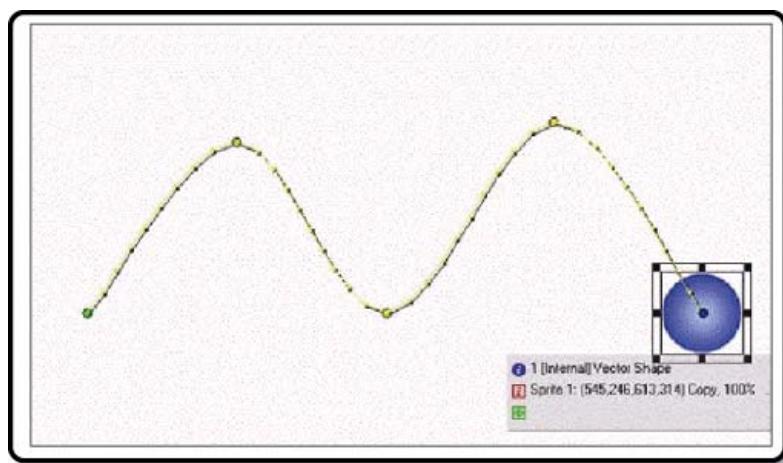


Figure 8.5: Example of path animation

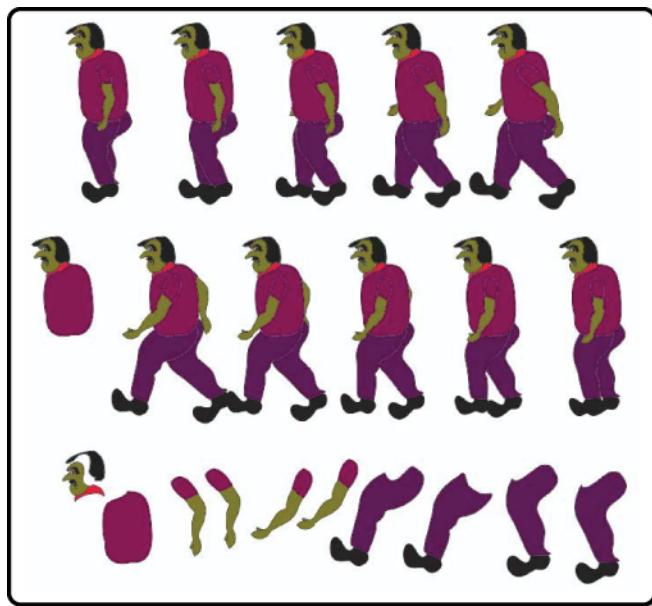
As stated in earlier paragraph, path animation can be applied to text objects. Bullet is an example of a motion. When presenting a multimedia application, you might want to click on the screen and a bullet will appear from the top of the screen and will remain on the screen until another bullet emerges. Specific bullets can also be animated to appear from the right hand corner of the screen. When this application is run, all the bullets will appear along the path, producing textual movement in the presentation. Depending on the creativity of the individuals, these bullets can appear in a straight line or as one letter at a time.

Path animation is not confined to bullet and text only but also to photographs, logos and character animation. Even though an animation may seem relatively complex, actually it may be an easy animation that uses path animation. This is because although path animation is easy to create, it gives the audience a dynamic experience to the presentation.

#### 8.4.2 Cell Animation

At one time, Walt Disney's cartoons such as Mickey Mouse and Donald Duck were the most popular cartoon shows. If you loved cartoon stories during your childhood, you will surely remember how these cartoons keep you transfixed to the television sets with its interesting and fascinating actions. If you were captivated and were wondering how characters such as Mickey Mouse, could walk, talk and act like humans. The secret is cell animation.

Computer cell animation is a continuation to the traditional cell animation technique. Usually, cell refers to the sub-object in the animation frame. For example, the feet motion of someone who is running, the feet are considered as a single cell. If the hands also move, then the hands are also considered as a cell. Therefore, in one frame there may be many cells (please refer to Figure 8.6).



**Figure 8.6:** Example of cell animation

Source: [www.umeshraut.com](http://www.umeshraut.com)

Sub-objects or the image in a cell would be drawn repeatedly with each image showing a specific minimal variation. These images are then organised according to sequence to generate an illusion of rapid motion.

Cell animation can be drawn by hand, scanned into a computer or drawn by a computer. Cells that are hand drawn can be scanned into graphics software packages, coloured and exported as suitable file formats to be animated in an animation software packages such as Adobe Director.

### 8.4.3 Screen or Object Transition

During a multimedia presentation, sometimes transitions on the screen or object are required for the audience to rest their eyes or to inform the audience visually that something is changing or going to happen on the presentation.

Transitions can be placed on the entire screen or to a particular object on the screen. In fact, in many authoring and presentation software packages, screen changes are provided in the form of slide transitions. Transitions are also used in applications that have many kinds of screen interfaces and provide the visual changes from one screen to another. For example, screen flying from one direction or screen fades away before being replaced with a new presentation screen. Transitions are included in almost all authoring and presentation software packages such as Adobe Director and Authorware, and Microsoft PowerPoint.

#### 8.4.4 Font and Icon Animation

Font animation refers to animation on fonts or selected characters. This type of animation also plays a role in producing lively and exciting multimedia presentations. Font animation is done using programming language, authoring language or any other authoring and multimedia presentation software.

In a multimedia presentation, text motion on the presentation screen can be manipulated to attract the attention of the audience. For example, the speed of the text motion to be presented on the screen can be predetermined or the text can be created to suddenly appear from any angle of the screen.

The changes that happen on the icon are known as icon or “sprite” animation. The function of icon animation is to attract attention by displaying icons that are flickering, changing its colours, moving and many others. These icons can be found in many multimedia presentation software, Internet, kiosk and others.

Toon Boom Technologies is a company that produces famous 2D animation software. Visit its website at <http://www.toonboom.com>.



##### ACTIVITY 8.1

Have you ever pressed an icon, whether in a multimedia presentation or on any website, and suddenly, the icon you are pressing transforms into another icon? What crosses your mind at that point of time?

**8.5****THREE-DIMENSIONAL ANIMATION (3D)**

3D animation brings 2D animation a step forward by adding the depth factor to the cell. Although 3D animation fills up more hard disk space compared to 2D animation, nevertheless, the sophisticated 3D animation is able to produce a more animated and amazing presentation.

If 2D animation uses only axis x and axis y, 3D animation adds another axis, that is axis z to represent depth. Depth is what enables cells to seem more realistic. In 3D packages, three-dimensional objects are drawn within the 3D coordination space.

2D images usually use bitmap images to create cells for animation; while 3D graphics use vector graphics. In other words, three-dimensional objects are usually formed by mathematical calculations. Thus, any changes or modifications that happened to the form, size or colour of the object would result in the recalculation of the overall mathematical equation.

3D animation has become the primary catalyst for the creation of various multimedia software and films for the computer animation market. Multimedia software that are games oriented like *Final Fantasy* and *Doom* and western films like *Stuart Little*, *Casper*, *Matrix* and *Toy Story* uses 3D animated images to deliver their messages and this provides new and enjoyable experiences to the consumers and audience.

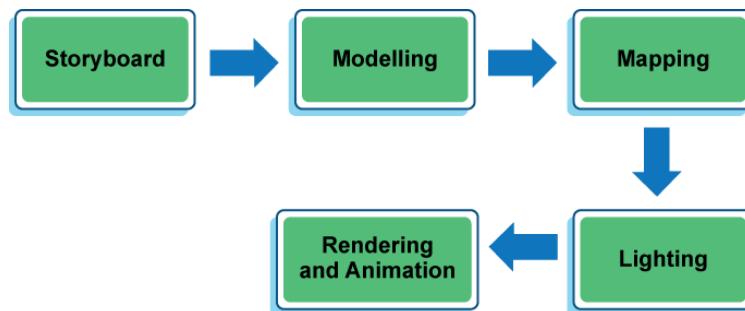
Click Grafix Sdn. Bhd. is a local company that provides various multimedia products and services, animation and digital videos. Visit its website at [www.clickgrafix.com](http://www.clickgrafix.com) to get various interesting information and the latest on digital animation.

**8.6****3D ANIMATION PRODUCTION PROCESS**

You must be wondering how three-dimensional multimedia software and computer animated films are produced. In fact, production of 3D animation is tougher and more complex compared to the production of 2D animation, and it involves a few steps or main process.

However, there are many computer animation software such as 3D Studio Max, Lightwave 3D and Autodesk Maya that can help you to create a complex animation with relative ease. But the most important factor in computer animation production besides sophisticated animation technology is your own imagination and creativity!

In this topic, we will see a few steps or main process involved in producing 3D animation. These steps are shown in Figure 8.7.

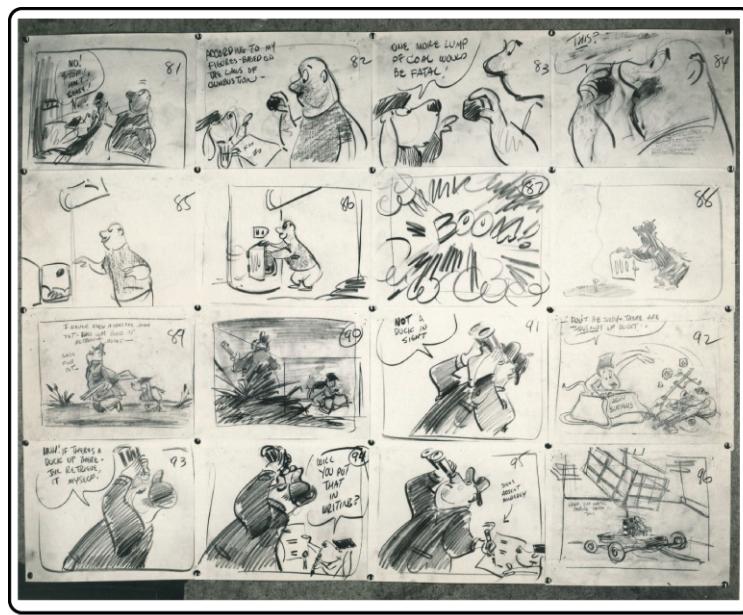


**Figure 8.7:** Main steps involved in producing 3D animation

The following are detailed explanations of each step in a 3D animation production.

### 8.6.1 Storyboard

The first step that should be done in 3D animation production is to prepare a storyboard. Storyboard has an important function because it shows the sequence of the animation story being created. It is a sketch that shows the story line and the scenes that will be included in the film or multimedia presentation. Figure 8.8 shows an example of a cartoon storyboard.



**Figure 8.8:** Example of a cartoon storyboard

Source: [www.cartoonbrew.com](http://www.cartoonbrew.com)

Having a storyboard will provide us with guidelines and references regarding the script or screens that must be produced during the animation development process. Do you know that for an animated movie to succeed, it requires more than 1,000 sketches of storyboards? For example, the animated movie, *A Bug's Life* required more than 4,000 sketches of storyboards, while the film *Toy Story* used as many as 3,800 sketches of storyboards.

## 8.6.2 Modelling

3D modelling involves the physical formation of 3D objects which would be built in three-dimensional spaces. Among the modelling often used are wireframe and solid object modelling (please refer to Figures 8.9 and 8.10).

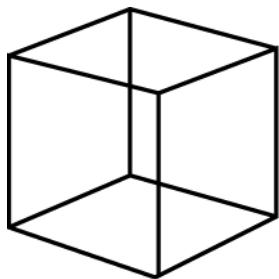


Figure 8.9: Wireframe

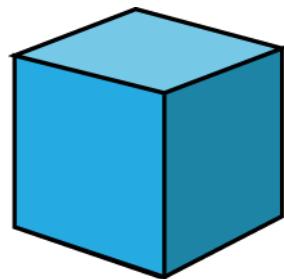
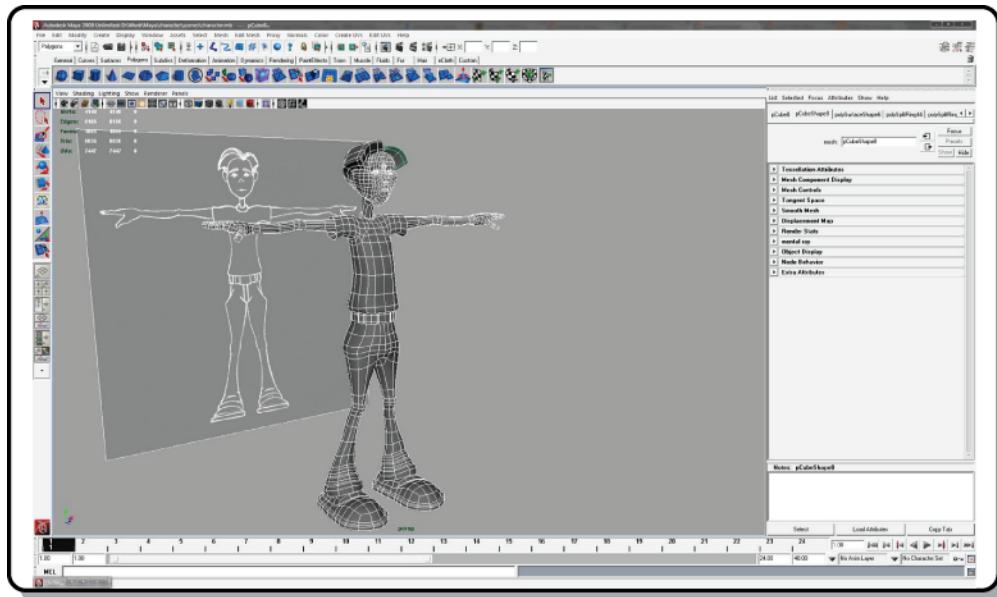


Figure 8.10: Solid object modelling

It is easier to build a virtual model by using 3D animation software, like Maya (please refer to Figure 8.11) and 3D Studio Max than to build models or objects in real life. This is because most 3D software has screen work which is divided into various points of views, such as top view, front and right. This would enable you to view and analyse the models from a variety of angles.



**Figure 8.11:** Modelling using Autodesk Maya

Source: <http://goo.gl/gGOmp1>

Computer animated films such as *Toy Story* and *A Bug's Life* used sophisticated software which is specially designed by the Pixar animation studio to build characters, sets and the films' props. Among the advantages of this software is that, it produces movement and expressions on the faces of the characters created.

### 8.6.3 Lighting

Lighting also plays a major role in the production of computer animation. It is important in creating the real situation or mood of an object. In addition it also helps by providing dimension to the objects involved. Among the main types of lighting often used are points light, spotlight, directional light and ambient light (please refer to Figures 8.12 to 8.15).

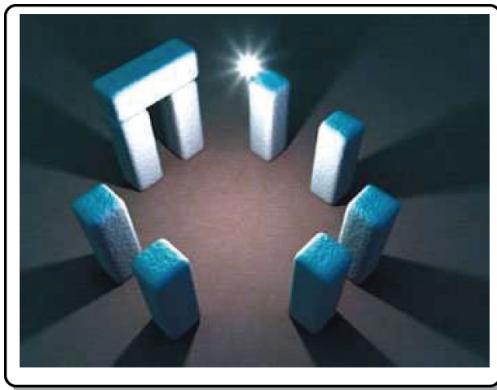


Figure 8.12: Point light

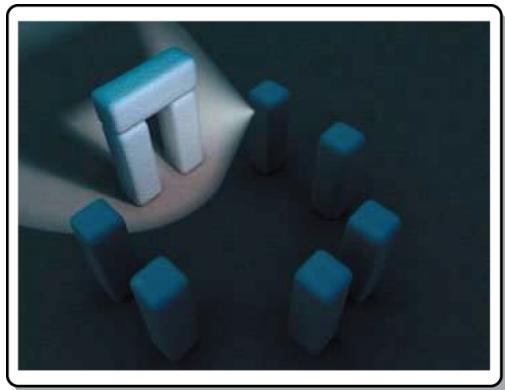


Figure 8.13: Spotlight

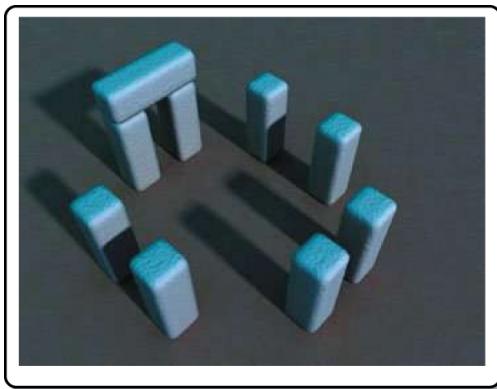


Figure 8.14: Directional light

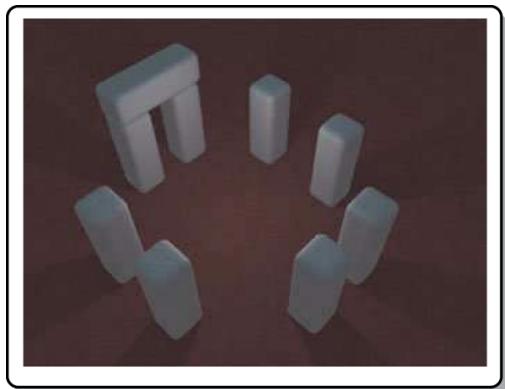


Figure 8.15: Ambient light

Source: digital-lighting.150m.com

By using digital light, each display would be adjusted with the mood and the surrounding situation of the image. The digital lighting can be done by 3D modelling software itself or by using specific software for lighting such as Lightscape (please refer to Figure 8.16).



**Figure 8.16:** Lighting by Lightscape software  
**Source:** [www.indii.org](http://www.indii.org)

The following extract explains the types of lighting sources:

(a) **Ambient Light**

Ambient light is light coming from all directions with equal intensity, like being outdoors on an overcast day. All facets of all objects receive equal illumination.

(b) **Directional Light**

Directional light is light coming from a single direction with a constant intensity, like being outdoors on a sunny day. All rays are parallel, as if the light is at an infinite distance, and light intensity does not diminish with distance. Identical objects with identical orientations are identically illuminated, regardless of their location.

(c) **Positional Light**

Positional light is light coming from a single location at a finite distance, like being in a room lit by a light bulb. All rays emanate from the light source, they are not parallel and light intensity diminishes with distance. Identical objects with identical orientations are differently illuminated, depending on their location with respect to the light source.

(d) **Spotlight**

A spotlight is a positional light source, which has a cone of effect, for instance, a desk lamp or a torch.

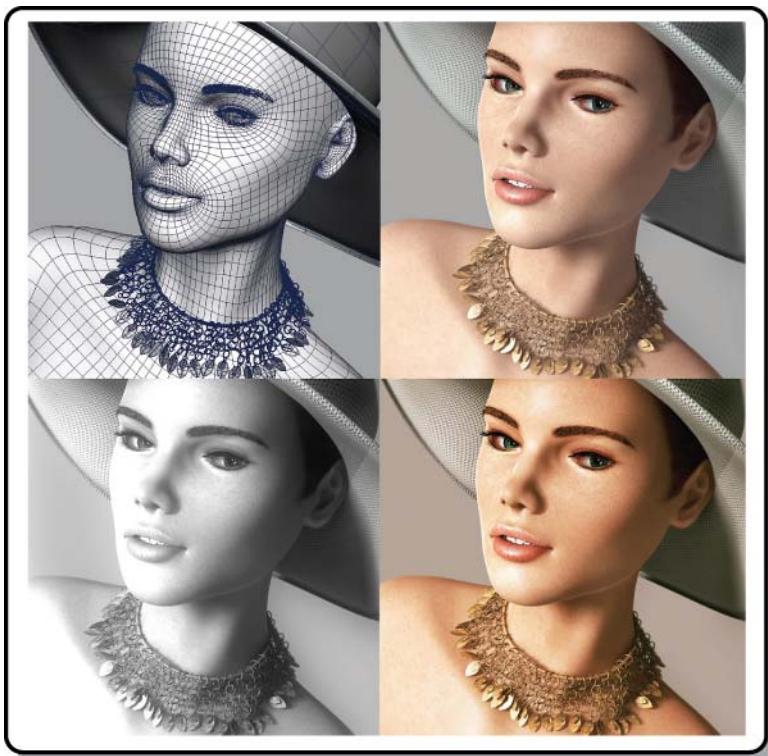
**Source:** [digital-lighting.150m.com](http://digital-lighting.150m.com)

## 8.6.4 Mapping

Mapping is the process of adding texture, colour or action to the 3D surface model and its environment.

Mapping is an important process to make sure that the model or image being created will be more realistic and suitable with the animation concept developed. Unrealistic selection of colour and texture for the model being built will spoilt the whole animation project.

Several methods of mapping that are used regularly are texture mapping, reflection mapping and environment mapping (please refer to Figures 8.17).



**Figure 8.17:** Mapping for realistic image

Source: [www.kimsojin.com](http://www.kimsojin.com)

To know the differences between texture and environment mapping and other methods of mapping, download additional information from this website: <http://www.cs.cornell.edu/Courses/cs417/2003sp/Lectures/Lecture28/28texture.pdf>.

## 8.6.5 Rendering and Animation

Rendering and the animation preparation process, is the final process that is done to create a 3D animation. In this process, all the models with the selected mapping and lighting, together with the imported environment, will be combined together at the same time in one presentation screen to form the animation as planned by the storyboard.

At the same time, the camera or the angle-of-view would be fixed to provide the motion or animation required for each object involved. Figure 8.18 shows an example of the rendering screen control.



**Figure 8.18:** Rendering screen control

**Source:** [apps.exchange.autodesk.com](http://apps.exchange.autodesk.com)

In the rendering process, the computer will do the mathematical calculations for all the effects used, so that it can be applied to the objects concerned. Rendering requires a lot of computer power; therefore, before you produce a 3D animation project, you should ensure that the computer is capable of accommodating the high demand required for the processing process.

The rendering process also requires a relatively long period of time, up to several days at times, depending on the degree of difficulty of the animation being created and the chosen quality level of the rendering. However, the result of the animation created will be more realistic.

Get to know the most popular 3D animation productions from local developers like Les' Copaque Production and Animonsta Studio, at their respective website at <http://www.lescopaque.com> and <http://www.animonsta.com>.



### SELF-CHECK 8.2

Give two types of lighting that you have learnt.

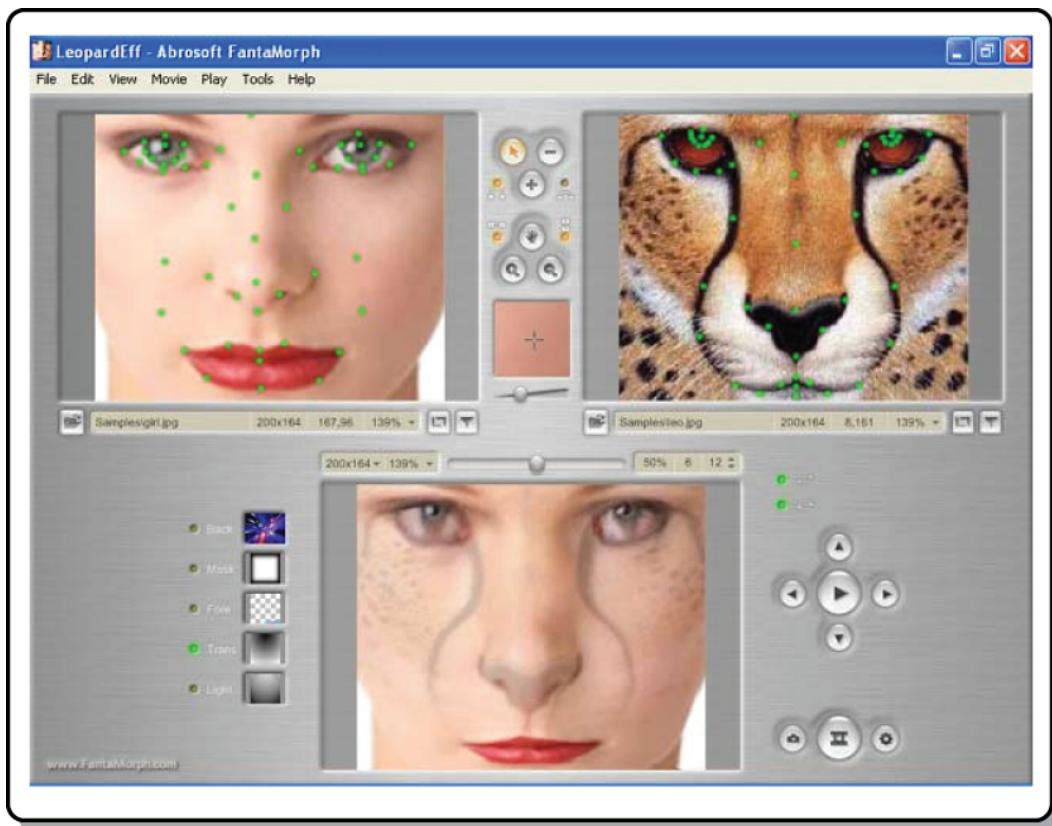
## 8.7

## SPECIAL EFFECTS OF ANIMATION

Besides 2D and 3D animation, there are also several special effects of animation that you should know, among them are morphing and warping.

### 8.7.1 Morphing

Morphing is a popular animation technique that is widely used. Morphing is the process of transforming one image into another. The morphing application and other modelling that offer this effect can transition not only between still images but often moving images as well. The products that offer this feature are FantaMorph, Morpheus Photo Morpher, and FaceMorpher.



**Figure 8.19:** Example of how the morphing effect is created

**Source:** [www.fantamorph.com](http://www.fantamorph.com)

Figure 8.19 shows that to create morphing you need to put the current image side by side with the image that you desire. By using the tools provided by the morphing software, you need to select the key points on the current image that you want to morph out and these points will appear at the corresponding points of the image that you want to morph into.

The selection of the key points is important for smooth transition between two images. The more key points selected, the longer will be the rendering process. But the resulting transition will be very smooth. This entire process may be saved as a digital video format and incorporated into your multimedia presentation.

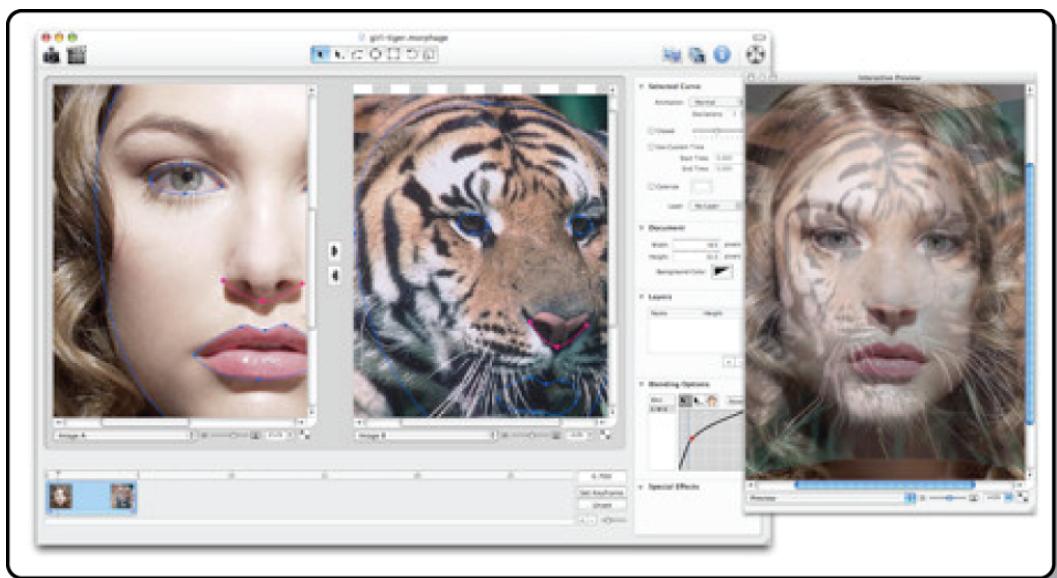
The effect of morphing is indeed enjoyable and easy to do. It is often used for the purpose of advertising, education, medical, films, and others. Films that used the effect of morphing are *Terminator franchise*, *Species* and *The Lord of the Rings*.

## 8.7.2 Warping

Warping is a special effect that is almost similar to morphing. Warping let you manipulate the images according to your taste. For example, you can stretch the facial features of a person so that a sour face becomes a smiling face. One of the famous warping software is Kai Super Goo. Figure 8.20 shows an example of an image after the warping process.



**Figure 8.20:** Example of an image after the warping process  
**Source:** screenshots.en.sftcdn.net



**Figure 8.21:** Morph Age software screen for morphing and warping  
**Source:** screenshots.en.sftcdn.net

Morph Age is an application for morphing/warping images and movies on Mac OS X, such as faces, and save the result to a QuickTime movie (please refer to Figure 8.21). Visit its website at <http://www.creaceed.com/morphage>.



### SELF-CHECK 8.3

1. *"Warping is a special effect that is almost similar to morphing."*  
Define this statement.
2. Give one type of warping software which is popular.

## 8.8

## ANIMATION FILE FORMATS

There are many file formats that are specially designed to accommodate animation and it can be exported among different applications and platforms by using suitable translators. The popular animation file formats are Adobe Director (.DIR), Adobe Flash (.FLA), and 3D Studio Max (.MAX).

File compression is an important part in the process of preparing an animation file on the web. This is because file size is a critical factor when you download animation to be played on websites. The movie *Director* file (.DIR) for example, needs to be preprocessed and compressed into Shockwave animation file (.dcr) before it can be used on the web. By using this method, the movie *Director* can be compressed until 75% or more and subsequently change its file size from 100K to 25K. The result is really obvious; the download process is much faster and time saving.

## 8.9

## ANIMATION HARDWARES

Computer animation technology has evolved rapidly in the west, especially in the United States. Therefore, it is a small wonder that most of the sophisticated and suitable computer hardwares for complex animation were first made popular there.

Among the computer hardwares frequently used in this industry are Silicon Graphic which is based on UNIX, Macintosh (Mac) which is based on MacOS and PC which is based on Windows.

To create a simple computer animation, you do not require a sophisticated computer and high powered processing. Actually, computer animation can be done by using any multimedia computer that is currently available in the market.

## 8.10 ANIMATION SOFTWARES

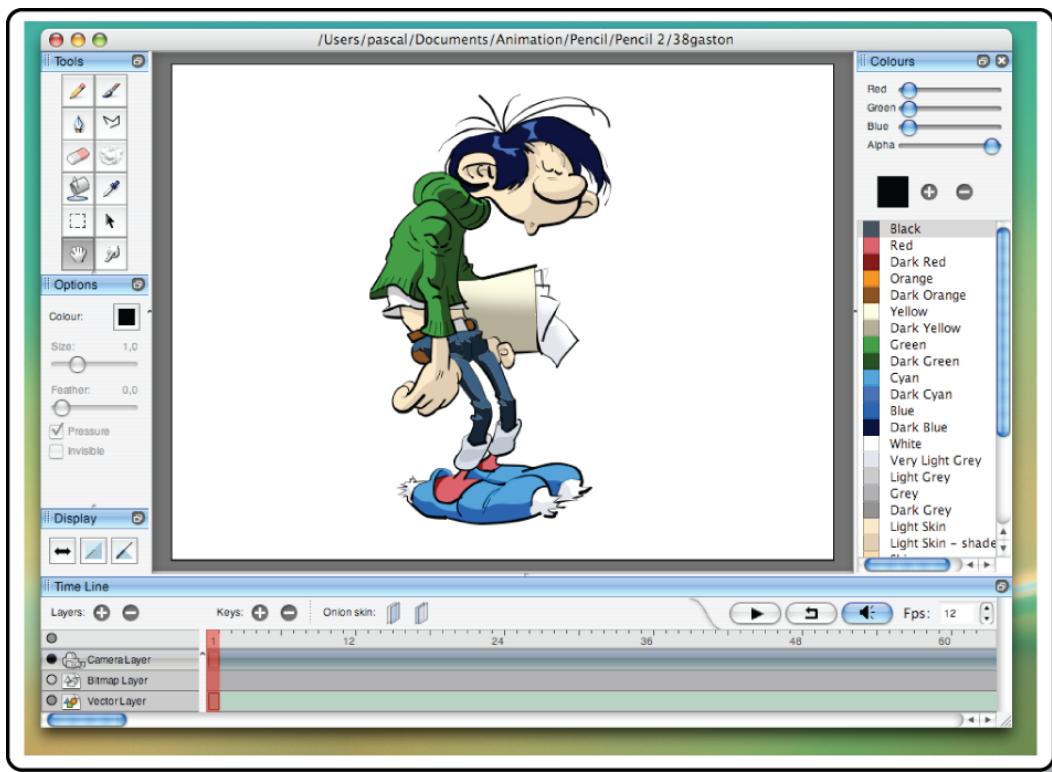
Even if you own the latest sophisticated and powerful computer, it will mean nothing if it is not equipped with a suitable animation software.

It is not difficult for you to get an animation software to develop your animation project. This is because there are hundreds of computer animation software packages available in the market for you to choose from. Among the most popular and frequently used softwares are 3D Studio Max, LightWave 3D, Adobe Photoshop, Adobe Premiere, Strata Studio Pro and Alias Wavefront.

To obtain more information about the commercial animation software that is available in the market, you may visit the website: <http://3d-animation-software-review.toptenreviews.com>.

### 8.10.1 2D Animation Softwares

2D animation software is used to develop simple computer animation and it is cheaper compared to 3D animation software. The popular 2D animation softwares in the market are ToonBoom Studio, Stopmotion Studio and Pencil (please refer to Figure 8.22). These softwares are not difficult to use and can do both path animation and cell animation.



**Figure 8.22:** Pencil – 2D animation software

Source: [www.pencil-animation.org](http://www.pencil-animation.org)

## 8.10.2 3D Animation Softwares

3D animation software is used to develop 3D animation that is more difficult and complex. We will divide 3D animation software into two categories based on free or open source and commercial products.

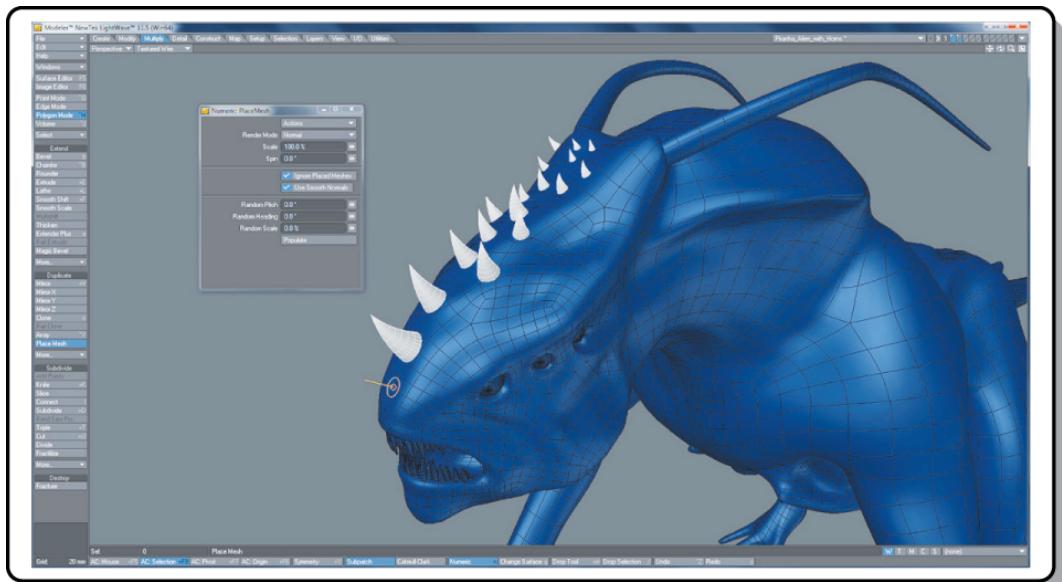
At the beginning stage, you are encouraged to use free and open source softwares such as Blender, Art of Illusion, Anim8or, and Google Sketchup. You may find these useful 3D animation softwares from <http://www.hongkiat.com/blog/25-free-3d-modelling-applications-you-should-not-miss>.

For advanced and commercial products, you can learn 3D Studio Max, Autodesk's Maya (please refer to Figure 8.23), and NewTek's Lightwave 3D (please refer to Figure 8.24). The software at this stage is capable of producing complex and sophisticated animation and special effects that can be seen in Hollywood blockbuster movies.



**Figure 8.23:** Autodesk’s Maya – 3D animation software

Source: [cdn.studiодaily.com](http://cdn.studiодaily.com)



**Figure 8.24:** NewTek’s Lightwave 3D screenshot

Source: [www.lightwave3d.com](http://www.lightwave3d.com)

To increase your knowledge regarding animation especially 3D animation, visit the following web sites:

- (a) <http://knowledge.autodesk.com/support/maya>;
- (b) <https://www.lightwave3d.com/learn>;
- (c) <http://knowledge.autodesk.com/support/3ds-max>; and
- (d) <http://www.blendernation.com/category/education/tutorials/>.



#### SELF-CHECK 8.4

1. Why is storyboard important in the process of creating a 3D animation?
2. Give three types of 3D animation softwares for the intermediate stage and two types of popular 2D animation softwares.
3. What is the main factor that differentiates between 2D and 3D animation?

## SUMMARY .....

- While traditional cell animation relies on cinematography to record the pictures on each frame, computerised animation uses the computer to organise the frame and records them in the computer memory.
- Unlike traditional keyframes, it is no longer necessary to draw images by hand to generate the frame images between the keyframes. The computer will do most of the work for you.
- There are two categories of computer animation:
  - Two-dimensional (2D) animation; and
  - Three-dimensional (3D) animation.

- Two-dimensional (2D) animation include the following animation techniques:
  - Path animation;
  - Cell animation;
  - Screen or object transition; and
  - Font and icon animation.
- Three-dimensional (3D) animation brings two-dimensional (2D) animation a step forward by adding the depth factor to the cell.
- The three-dimensional (3D) animation production process involves the following steps:
  - Storyboard;
  - Modelling;
  - Lighting;
  - Mapping; and
  - Rendering and animation.

**KEY TERMS**

Ambient light	Morphing
Animation file formats	Path animation
Animation hardware	Positional light
Animation software (2D and 3D)	Rendering and animation
Cell animation	Screen or object transition
Computer animation	Solid object modelling
Directional light	Spotlight
Environment mapping	Storyboard
File compression	Texture mapping
Font and icon animation	Three-dimensional (3D) animation
Keyframes	Tweening
Lighting	Two-dimensional (2D) animation
Mapping	Warping
Modelling	Wireframe

# Topic ▶ Audio in 9 Multimedia

## LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Describe the concept of analogue and digital sound;
2. Summarise several roles of audio in multimedia; and
3. Identify the factors that need to be considered when using audio.

## ▶ INTRODUCTION

This topic focuses on audio, its importance and role in multimedia technology. The audio element is moulded into a multimedia presentation to present information and to increase comprehension pertaining to the contents that you want to present. Audio is also an element that is able to enhance pleasure, increase interest and set the ambience of a multimedia presentation.

### 9.1     AUDIO

Audio or sound plays an important role in the development of multimedia. It has enhanced the multimedia system that has remained static all this time. The entry of audio into multimedia is an important feature whereby it has escalated the use of multimedia to its maximum level.

According to Steinmetz and Nahrstedt (1995), audio (sound) is a physical phenomenon generated by the vibrations of an object, for example, a guitar. When the object vibrates, different pressure variations would exist in the surrounding air. High and low pressures will develop within the environment and the resulting movement is called a wave. When this wave is perceived by the hearing sense, it will be heard as sound. The sound and audio technique

processes the sound waves or acoustic signals. This wave has a particular pattern called waveform that has repetitive movements.

If viewed in terms of multimedia, audio can be defined as any sound in digital form such as voice, music and narration that may be heard. With the availability of audio in multimedia, the effectiveness of a multimedia application will be better. For example, if you wish to learn a foreign language by using application software, it would be difficult if you could not hear the sound of the word that you wish to learn.

Audio, when combined with other multimedia components, will create an interesting environment, increase understanding and assist users to master an application easily.



### ACTIVITY 9.1

Have you ever played computer games such as car racing? How would you feel if the game produced special sound effects such as during a collision?

## 9.2

## SOUND CARD

Just like video, sound is also required to be in digital form to enable it to be played on a computer. Digital sound was first introduced to the consumer market in CD format or disk drive in the early 1980s. At the same time, the personal computer has already entered the market. The personal computer or PC at that time was just a business equipment to do word processing and spreadsheets. It could not produce sound. The only sound that could be heard was generated by the computer and it was not of good quality.

Not long after, the computer's capacity improved and it was able to produce sound with the help of a sound card. Sound cards, just like video capture cards, can improve the sound quality played on a computer. One of the earliest sound cards is the card from Creative Labs. Sound Blaster, the sound card from Creative Labs, received a tremendous response in the personal computer industry. The Sound Blaster became so popular that, the name "Sound Blaster" became synonymous with a sound card (please refer to Figure 9.1).



**Figure 9.1:** Sound Blaster Recon3D PCIe sound card

**Source:** [www.soundblaster.com](http://www.soundblaster.com)

Sound cards have helped to boost the computer game industry. This is because, with the availability of sound cards, computer games are enhanced and able to produce interesting sound effects. Both the computer games and the sound cards have become very popular and receive tremendous response.

Today, the sound card is an important element in a multimedia computer system. Although the capacity of the sound card has increased compared to when it was first emerged, its main purpose still remains the same, that is, to change analogue sound into digital sound.

Creative Technology Ltd is a producer of entertainment products for personal computers including Sound Blaster. Visit its website at <http://www.creative.com>.

### 9.3 SOUND FORMAT

The sounds that we hear every day is in the analogue form. It is a form of signal that moves in a continuous wave. An example is music from the radio or tape recorder. If this sound is recorded over a microphone, it is known as analogue sound. This kind of sound or analogue signal cannot be transmitted through a computer. It must be converted into digital form first. Before you learn about digital sounds, you need to understand how this is different from analogue form. Thus, in the following sections, you will be introduced to the concepts of analogue and digital.

### 9.3.1 Analogue Sound

Before you learn about the use of sound or audio in multimedia presentations, you need to understand the fundamentals of sound. Sound is produced by air vibrations. It is in analogue form. It can be shown as a wave in a graph as shown in Figure 9.2. The higher the amplitude of the sound, the louder the sound produced. The graph below shows sounds that have the same amplitude. In fact, in our daily life, the sounds produced have varying amplitudes according to the loudness of the sound generated.

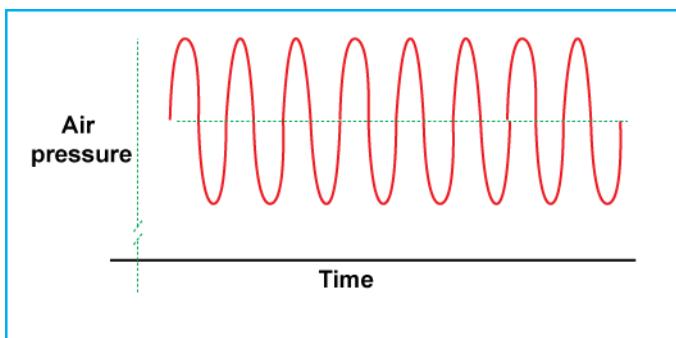
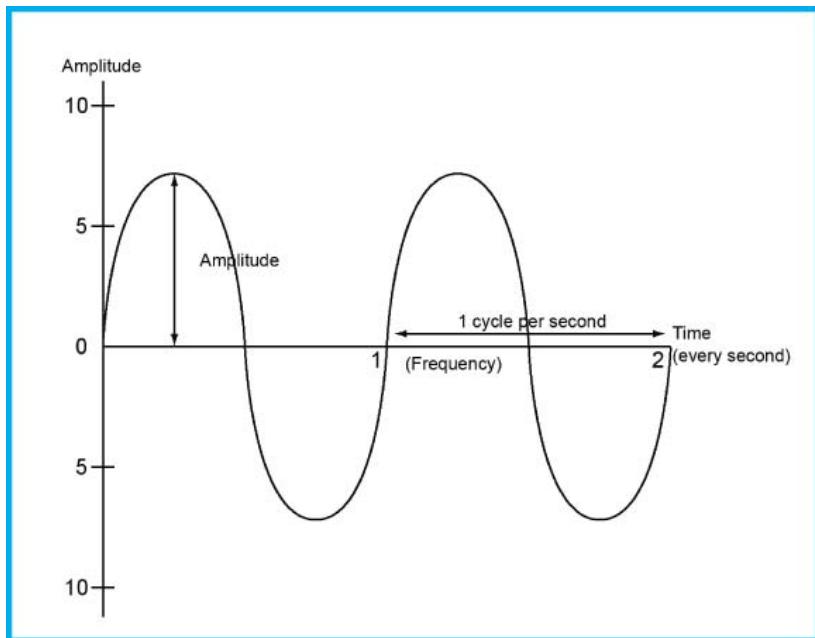


Figure 9.2: Sound waves

Two important features of sound waves are frequency and amplitude (refer to Figure 9.3). Frequency refers to the number of cycles a sound wave creates in one second. One cycle is measured based on the distance from one wave peak to another. Frequency is usually measured in the unit, Hertz (Hz). Therefore, 1 Hertz (Hz) means 1 cycle per second, 1 Kilohertz (1 kHz) means a thousand (1,000 Hz) cycles per second.



**Figure 9.3:** Features of analogue sound

Do you know that a healthy human ear can hear noise in the range of 20 Hz to 20 kHz? What is the meaning of amplitude? Amplitude is the volume or loudness of the sound being produced. The louder the sound that is being produced, the higher the amplitude. The unit that is used to measure the loudness or volume of this sound is called decibel or dB. Both the frequency and amplitude form the sound wave and affect the way people perceive and hear sounds.

### 9.3.2 Digital Sound

Computer recognises sounds in digital format. Usually the computer will process data into electronic form and not from the physical movements in the air. All of you know for sure that sounds used in multimedia applications are in the digital form. This involves the process of converting from analogue to digital format where it is captured by the sound card and stored within the audio file. To enable it to be replayed, the audio stored in numeric combinations must be converted again into analogue format.

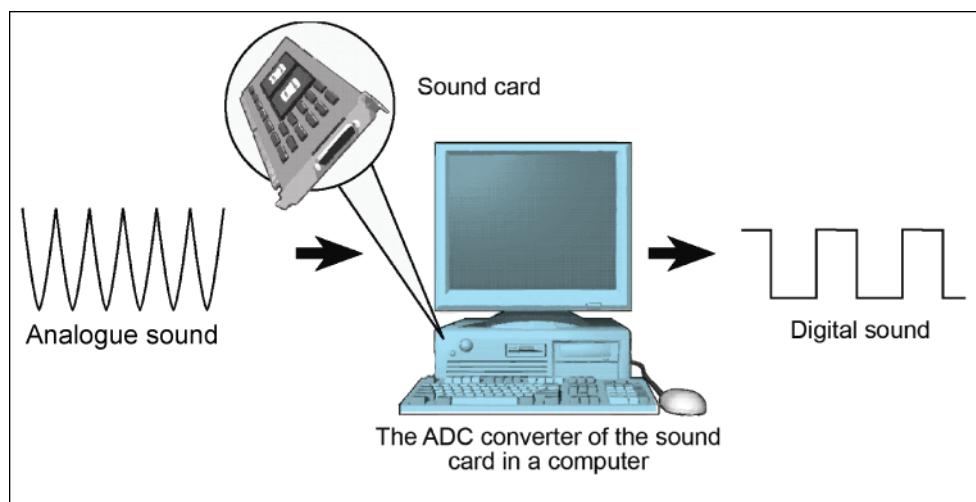
Digital sound is made up of binary codes. Binary code is represented by 0 and 1. Regardless of whether it is digital music, digital video or digital image, the computer only recognises it as bits. What happens when the analogue wave enters the computer? It will be digitised or in technical term, has been sampled.

### 9.3.3 Audio Conversion

To the computer, analogue sound is like a foreign language. Just like video, the sound also needs to be converted into digital form. This is the use of the sound card.

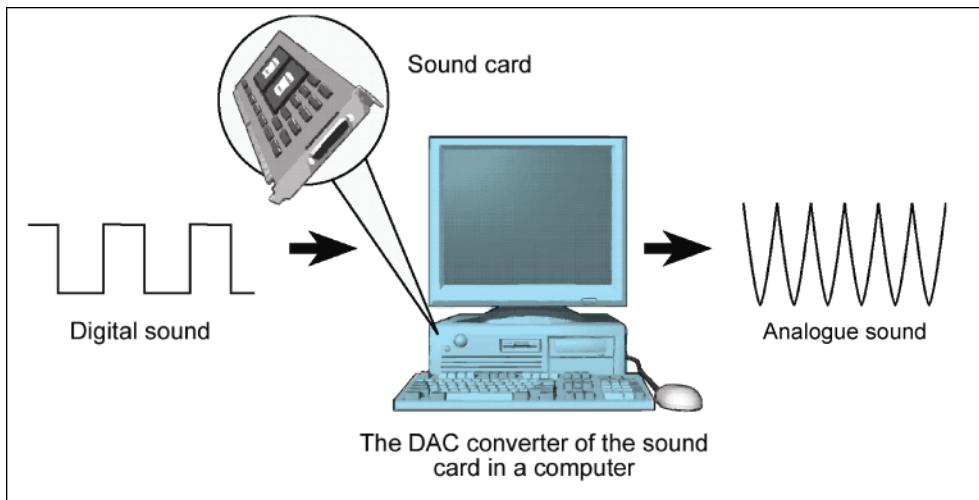
The process of transforming analogue sound into digital sound is performed by the analogue converter (Analogue-to-Digital Converter-ADC) which has been built-in inside the sound card. Analogue sound is captured by the sound card, divided into many parts and translated into precise numerical combinations. This combination is kept as data in the computer.

When the analogue sound has been converted into digital sound, only then can it be modified or edited by a computer system. Figure 9.4 shows an ADC converter converting analogue sound into digital sound when the sound is captured.



**Figure 9.4:** Converting analogue sound into digital sound

When the computer replays the digital sound, it needs to convert again the numeric combination into analogue wave form. This process is performed by the digital analogue converter (Digital-to-Analogue Converter-DAC) which is also built-in inside the sound card. Figure 9.5 shows a DAC converter converting digital sound into analogue sound when the sound is replayed on the computer.



**Figure 9.5:** Converting digital sound into analogue sound

### 9.3.4 Sampling

The process by which an analogue wave is captured by the sound card and then converted into digital format is known as digital sampling. The sound wave is divided into many sections or is sampled many times per second. When this happens, the height of the wave will be recorded. As it is impossible to measure the height of the analogue wave continuously or all the time, therefore, this process only measures a limited number of samples. Thus, the term "sample" was born.

There are two factors that influence the quality of a digital sound recording – the sampling rate and sample size. Besides that, the channel selected also tends to influence the quality and the file size of the audio being recorded. There are two choices of recording which is Mono and Stereo.

Sample rate refers to how many times or the frequency a sample is taken for the audio. The higher the sample rate, the more samples will be taken; and the better the quality of the digital sound.

Just like frequency, sample rate is measured in Hertz unit (Hz). Sampling rates that are often found are 11.025 kHz, 22.05 kHz and 44.1 kHz (please refer to Table 9.1).

**Table 9.1:** File Size for 10 Seconds of Digital Audio Recorded in Stereo Format

Sample Rate	Sample Size (Bit)	File Size
44.1 kHz	16	1.76MB
44.1 kHz	8	882KB
22.05 kHz	16	882KB
22.05 kHz	8	440KB
11.025 kHz	8	220KB

Sample size represents the total or the amount of information that can be stored by the sample taken. Among the main sample sizes are 8 bits, 16 bits and 24 bits.

Audio recorded on a 24 bits sample size is of better quality compared to audio recorded on a 16 bits sample size. This is because the higher the value of the sample size, the more information or audio information that can be stored. This will produce better quality audio. In short, the higher the value of the sample size the better the quality of the audio.



### SELF-CHECK 9.1

1. In your opinion, what is the disadvantage of using a high sample size for audio recording?
2. Give three uses of the sound card.

## 9.4

## THE ROLES OF AUDIO IN MULTIMEDIA

Imagine if a movie you are watching does not have any sound or the advertisement that is being shown is not accompanied by music. You might feel bored and unentertained. Therefore, sound or audio is very important in our lives. It gives “life” to any multimedia application and plays an important role in an effective presentation.

Audio can increase the effectiveness of other media and can attract users' awareness regarding vital information. However, audio is not suitable for providing long information. It should not be used to repeat information that has been conveyed effectively by other media. The following are several roles played by audio in multimedia.

### 9.4.1 Warnings and Reminders

You are busy typing a document when you accidentally clicked on the close button. A message box, such as the example in Figure 9.6, appears on your screen.



Figure 9.6: Message box

If a single sharp sound or a sound which can attract your attention is simultaneously heard when the message box appears, then you would pay more attention to the message. This of course will increase the effectiveness of the message being displayed. Therefore, we may say that audio is an effective tool for attracting users' attention and it is a good medium to remind users about critical information.

Other uses of audio are as “warning and reminder” tools. For example, it serves as a warning sound when something has already reached its limit, or as a panic sound to signify dangerous levels in computer games.

### 9.4.2 Background Music

Music and sound effects are needed in multimedia. It causes multimedia interaction to become more evident, and sometimes it is needed to deliver vital information. Because the nature of audio is to attract attention, thus it is very suitable for use in multimedia applications.

Music may be used for various purposes. It is used to generate an ambience or “mood” for a presentation. For example, if you wish to attract the audience’s attention, you can use fast rhythmic music as the music setting for your presentation. On the other hand, if you wish to produce a calm and soothing situation for your audience, then it is better if you use slow and melodious music as your background music.

### 9.4.3 Sound Effects

Let us say that you want to present a multimedia project which has “*Star Wars*” features, but you forgot to include sound effects in the said project. This situation is tantamount to watching a Formula One car race without sound and you will definitely not be impressed with the presentation.

Therefore, sound is also used as “sound effects” in multimedia presentations. For example, the “ping” or “ding” sound effects can be used to tell users that they have done something wrong. This method of communication is much more effective than text.

### 9.4.4 Narration

Another method of using sound is by adding narrations. Usually the narration and background music will be used simultaneously where the music is used in the background and at a particular time the narrator will provide the explanation regarding the information that he wishes to convey.

The narration is usually in the form of a narrator’s voice or speech. Narrations can be used as a guide or in the form of instructions. The narrator’s voice can instruct the users to implement a task or to provide information to the users. Narration is popularly used in Computer-based Training (CBT).

### 9.4.5 Data Related to Sound

In some applications, the audio element is needed to deliver information that cannot be provided by another medium. An example is a match commentator of a live football match. The commentator will present information such as the names of the players, commentary of the match and an analysis of the match.

In multimedia, some of the applications that use data related to sounds are medical training for medical students to distinguish the several types of breathing and heart rhythms, or providing assistance to a mechanic to diagnose an engine’s problem, and teaching students to read music or to learn the history of music. Figure 9.7 shows a website that uses sound to present information.



**Figure 9.7:** An example of a website that uses sound  
**Source:** <http://waterlife.nfb.ca/>



### SELF-CHECK 9.2

State two kinds of applications that require the use of audio.

## 9.5

### FACTORS THAT NEED TO BE CONSIDERED WHEN USING AUDIO

When you decide to include audio in a multimedia application, you should consider some of the following factors or criteria:

- (a) Compatibility;
- (b) Users;
- (c) Playback system; and
- (d) Users' control.

The following section further explains the four factors mentioned above.

## 9.5.1 Compatibility

The use of audio has indeed been proven in the sense that it increases the effectiveness of most multimedia applications. In some applications, audio is compulsory. For example, an education system that teaches foreign languages. However, the compatibility of the usage is very important. Some system developers use too much audio or include sound effects that are rather whimsical. This situation not only will distract the users' attention, but also cause the users to feel angry and disorientated.

## 9.5.2 Users

When using audio you should also take into account your target audience. This is one of the factors that should not be taken lightly. Audio has indeed been proven to assist some people in understanding certain concepts easily, however, before using audio, some prior research should be conducted regarding the users' response when using audio.

Audio can be used in the development of a system if the users' response is encouraging. For example, adults respond better than children when classical music is used as background sound. On the other hand, children will give a more favourable response when cartoon songs are used as background music.

## 9.5.3 Playback System

Playback system is one of the conditions that should be taken into account during the use of audio. This is because not all computers in the market are able to generate sound. Imagine if you wanted to present a multimedia project on a computer that has no sound card, then all the sound effects which you have included would be wasted because it could not be presented.

However, if the multimedia application is delivered via CD-ROM, then it is safe for you to assume that if the computer has a CD-ROM driver, then it is also equipped with a sound card and speakers.

## 9.5.4 Users' Control

The use of sound in a multimedia application can be very useful but it can also create problems especially if it cannot be controlled by the users. Try to imagine the impact on the users if every time an application starts, it will be accompanied by the same background music that lasts for a full minute. Usually the user will

feel bored and frustrated having to wait for the sound clip to end, particularly when the sound has been heard many times before.

Control of sound or audio includes the users' rights to start the audio, switch on or off the audio, control the volume according to desire, or provide an alternative such as using text display to replace sound. Figure 9.8 shows an icon normally used to control the volume.

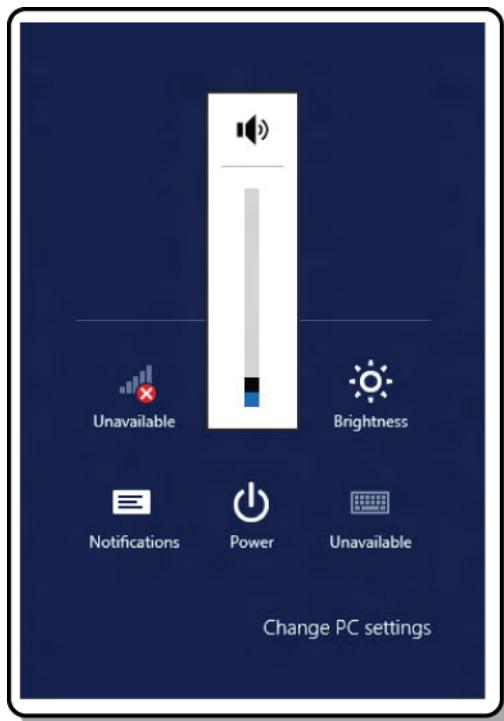


Figure 9.8: Icon to control the volume

Source: winsupersite.com

## 9.6

## ADVANTAGES AND DISADVANTAGES OF AUDIO IN MULTIMEDIA

The use of audio in multimedia has received much attention due to the fact that integration of audio in multimedia is becoming easier to accomplish. The presence of audio in multimedia can be beneficial if it is successful in presenting what is desired by the users. Instead, it might also provide negative impact to the multimedia system if it is not used accordingly. In brief, the use of audio in multimedia has its own advantages and disadvantages.

## 9.6.1 Advantages of Audio

The main advantage of audio is that it ensures the delivery of vital information. This is because sound can attract users' awareness to the information being conveyed. It also has the unique capacity to provide caution or reminder to the users about some specific information particularly because hearing is easier than reading. The other advantages of audio is that it increases the multimedia attraction where music, narration or sound effects further enhance the multimedia application that was previously quite static. Good visuals and information would not be perfect if the music that accompanies does not match what is being conveyed. Sound has made video or animation more real and memorable.

## 9.6.2 Disadvantages of Audio

Although audio use has many advantages, it also has several obvious disadvantages. One of the most obvious disadvantages is overuse. Although alarm warning sounds, sound effects, and narration are suitable to attract users' attention, this effectiveness will disappear if audio is overused.

Other disadvantages of audio are, it requires special equipment to generate high quality products. Although basic audio production is a simple task, to generate high-quality audio, it requires a studio and expensive equipment. Therefore, users must possess the right equipment to generate high quality sound.



### SELF-CHECK 9.3

1. In your opinion, what are the advantages of digital sound compared to analogue sound?
2. Give three brands of popular sound cards available in the market.
3. List four factors that must be taken into account when using audio in multimedia applications.

## SUMMARY .....

- Audio (sound) is a physical phenomenon generated by the vibrations of an object.
- Sound cards can improve the sound quality played on a computer. Sound Blaster from Creative Labs was so phenomenally popular that the name Sound Blaster became synonymous with the sound card.
- Using special converters (ADC dan DAC), you can convert audio files from analogue to digital and vice versa.
- Audio performs many important functions in multimedia such as:
  - Warnings and reminders;
  - Background music;
  - Sound effects;
  - Narration; and
  - Data related to sound.
- Several factors need to be considered when using audio in a multimedia application:
  - Compatibility;
  - Users;
  - Playback system; and
  - Users' control.
- Audio in multimedia is a double-edged knife. For example, when used properly, it can augment visuals by supporting it with ambient music, however, generating high quality audio involves the use of a studio and expensive audio equipment.

## KEY TERMS .....

Analogue sound	Narration
Analogue -to-digital converter (ADC)	Playback system
Audio	Sampling
Audio conversion	Sound Blaster
Background music	Sound card
Compatibility	Sound effects
Digital sound	Sound format
Digital-to-analogue converter (DAC)	Warnings and reminders

# Topic ▶ Audio

# 10 Formats and Software

## LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Review a few main audio file formats used in multimedia; and
2. Distinguish a few audio software in the market.

## ▶ INTRODUCTION

In this topic, you will be introduced to some types of audio file formats normally found in multimedia such as WAV, MP3, AIFF and MIDI, and their special features. You will also identify the audio file sources and copyright issues.

### 10.1 AUDIO FILE FORMATS

With the emergence of digital audio, sound or music can be recorded in a variety of formats; among them are the AIFF, AU, MIDI, MP3, SWF, OGG, FLAC and WAV formats. Most of these audio file formats involve compressing the audio files. Audio file compression is needed to save storage space. Audio that has been compressed can be replayed with just a low percentage drop in its quality. Adaptive Differential Pulse Code Modulation (ADPCM) is one of the main methods of audio compression.

Now, the QuickTime's movie (.mov) standard is often used to store audio files as this type of file can be used in most computer platforms including PC computers and Macintosh computers.

As for the use of audio on the Internet, Real Audio, Real Media and MP3 can be used in view of the fact that, their file sizes are smaller compared to other audio formats.

In the future, it is highly possible that more new audio formats will emerge, where you will be able to listen to audio with not only small file sizes but are also of high quality. The following are explanations of the common types of digital audio formats (please see Figure 10.1).

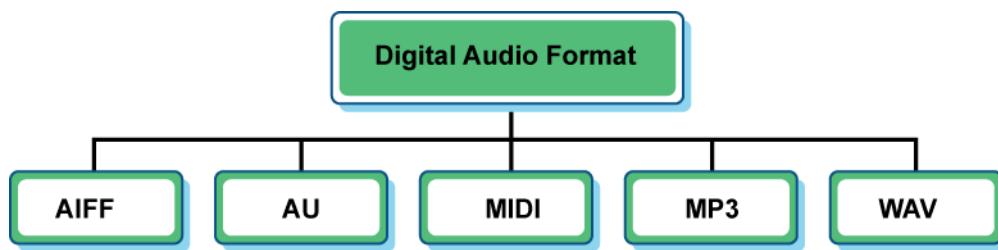


Figure 10.1: Digital audio format

### 10.1.1 AIFF

The Audio Interchange File Format (AIFF) is one of the common formats used to store and send sound samples. This format was first developed by Apple computers and is the standard format for Macintosh computers. Now, it can also be used by computers with Windows operating system.

The AIFF format is usually not able to do data compression; therefore, AIFF files are usually bigger than other formats. Nevertheless, there is another format that can support data compression and that is the AIFF-compressed (AIFF-CorAIFC) format.

The AIFF format is widely used in professional audio recording systems and digital multimedia applications that use Macromedia Director and Adobe Premiere softwares. Both softwares allow the importing and exporting of the AIFF files. One thing that you need to know is that an AIFF audio file is of high quality when it uses high resolution. However, this causes its file size to become very big. For example, a 30 second long 16 bit stereo will have a file size as big as 5.4MB.

## 10.1.2 MP3

This audio format is extremely popular now and it is often used to record a large number of songs and music onto compact discs. MP3 means MPEG audio layer III and it was created by a German company, Fraunhofer Gesellschaft, in 1989.

One of the main reasons why MP3 is so popular and favoured by music lovers is its extraordinary compression ratio of 10:1 for audio files such as WAV. The ratio of 10:1 means that if the WAV file is converted to MP3 format, its new size is only 10% of the original WAV file size, but its audio quality remains the same. Besides that, MP3 format also allows various sampling rates and bit rates, whereby it gives users more authority to control the file size and quality.

For MP3, the ordinary sampling rate is 44.1 kHz and its bit rate is 128 kbps. It is difficult to distinguish the MP3 music quality from the quality of the music that has not undergone the compression process. You can play MP3 songs or music by using a Winamp player which was created by Nullsoft. One of the main advantages of MP3 is that it is capable of storing additional textual information such as the subject, artist's name and comments. All of these can be shown on the Winamp player.

## 10.1.3 AU

The AU audio format was specially created to be used on the Sun Microsystems workstation. It is a 16 bit audio format that is compressed and used for distribution via the Internet. The AU audio format is less popular compared to the WAV format.



### ACTIVITY 10.1

You can download a free Winamp player from the Internet. Use the browser to obtain this software. List the address. What is your opinion about this music player? Does it give you the effect as mentioned earlier?

## 10.1.4 MIDI

The Musical Instruments Digital Interface (MIDI) format was introduced in 1980 as an effective method of music representation that could be used in various applications. In fact, MIDI is not an audio format. It is more of an interface to produce audio. The audio produced would then be kept in MIDI format.

MIDI is a standard language used for communications between musical instruments and computers. This means a musician can attach the electronic key, guitar and other MIDI tools to an audio synthesiser connected to the personal computer. Users can compose their own music which would then be converted into digital sound. This means a composer can use the MIDI keyboard to record notes and then can convert this information easily into the computer.

A sequence of MIDI that has been compressed makes it very useful for applications where space is an issue. For example, songs for video games, music for websites and background music are applications of good MIDI formats. MIDI has many advantages compared to other digital audio. One of the advantages is MIDI tracks require less bandwidth and processing power compared to MP3 files. For example, when you download an MP3 track using a modem, you may be disappointed because you need half an hour just to download a single music track.

On the other hand, if you download a MIDI file, you can obtain the file in less than a minute even though you use a slow speed modem. MIDI sequence or tracks are much smaller than any digital audio files. One MP3 track normally uses only 1MB of disk space for a minute of music, but a MIDI track only requires 40KB of disk space which is 95% smaller than a MP3 and its quality is not compromised!

### 10.1.5 WAV

A WAV file is the main and popular audio format in the Microsoft Windows operating system environment. It is unlike MPEG or compressed format. It stores samples without the need of pre-processing. The format of this file is similar to the AIFF format.

A WAV file is usually huge. Its file size is dependent on the length of the audio being recorded and the sampling rate used for recording. It is later replayed at a compatible rate. You can record and replay a WAV file with the Sound Recorder that is built-in in the Microsoft Windows environment.

The following passage explains the differences between MIDI files and digital audio.

## MIDI versus Digital Audio

MIDI (Musical Instrument Digital Interface) is a communications standard developed in the early 1980s for electronic musical instruments and computers. It allows music and sound synthesisers from different manufacturers to communicate with each other by sending messages along cables connected to the devices. MIDI provides a protocol for passing detailed descriptions of a musical score, such as the notes, sequences of notes, and what instrument will play these notes. But MIDI data is not digitised sound; it is a shorthand representation of music stored in numeric form. Digital audio is a recording, MIDI is a score – the first depends on the capabilities of your sound system, the other on the quality of your musical instruments and the capabilities of your sound system.

A MIDI file is a list of time stamped commands that are recordings of musical actions (the pressing down of a piano key or a sustain pedal, for example, or the movement of a control wheel or slider) that, when sent to a MIDI playback device, results in sound. A concise MIDI message can cause a complex sound or sequence of sounds to play on an instrument or synthesiser; so MIDI files tend to be significantly smaller (per second of sound delivered to the user) than equivalent digitised waveform files.

In contrast to MIDI data, digital audio data is the actual representation of a sound, stored in the form of thousands of individual numbers (called samples). The digital data represents the instantaneous amplitude (or loudness) of a sound at discrete slices of time. Because it is not device dependent, digital audio sounds the same every time it is played. But that consistency comes at a price; large data storage files. Digital sound is used for music CDs.

MIDI data is to digital audio data what vector or drawn graphics are to bitmapped graphics. That is, MIDI data is device dependent; digital data is not. Just as the appearance of vector graphics differs depending on the printer device or display screen, the sounds produced by MIDI music files depend on the particular MIDI device used for playback. Similarly, a roll of perforated player piano score played on a concert grand would sound different than if played on a honky tonk piano. Digital data, on the other hand, produces sounds that are more or less identical regardless of the playback system. The MIDI standard is like PostScript, letting instruments communicate in a well understood language.

Vaughn (2001)



### SELF-CHECK 10.1

After reading the earlier excerpt, can you state two advantages and two disadvantages of MIDI compared to digital audio?

Visit its website at <http://www.musitek.com> to see the scanner software that can read notes or musical scores and convert them into MIDI files.

## 10.2 SOURCE OF AUDIO FILES

Almost all multimedia computers today are equipped with sound cards and speakers; this indicates how important audio is as a media in our daily lives.

If you are observant, you will notice that when you open or close an application on a Windows operating system, your action is accompanied with a sound. This sound can be changed according to an individual's preference at any time. Sounds such as this are stored in a file and its source can be obtained from pre-packages, purchases or borrowings, and from your own invention.

### 10.2.1 Pre-package

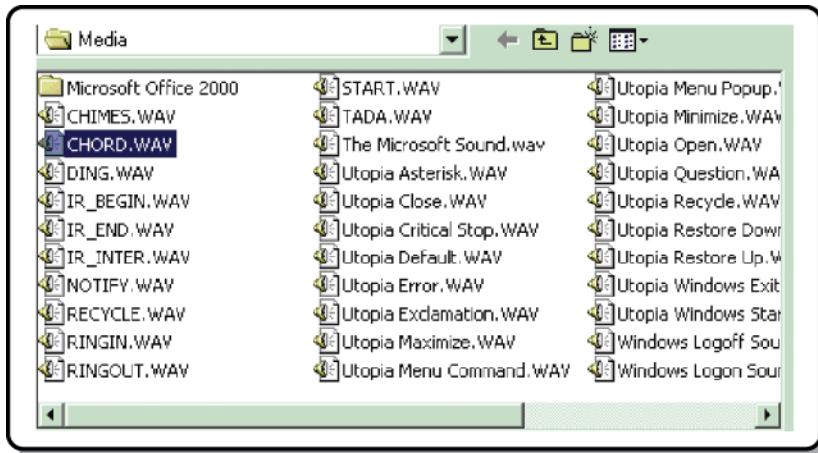


Figure 10.2: Sound file

Some sound files can be obtained from the computer's operating system or from programs that already exist in your computer. Figure 10.2 shows the sound file that is in Microsoft Office. These sound files can produce special effects such as the sound of doors opening; car braking and others.

## 10.2.2 Buying and Borrowing

Other than the pre-packages built into an operating system or application software, sound files can also be bought from companies that specialise in production of sound clips. In addition, the Internet is the right place to purchase sound clips. Sometimes you can also get it free by downloading it from the Internet.

These file resources can be very useful for background sounds, sound with special effects and also for historical events, such as speeches or conversations of the Prime Minister.

## 10.2.3 Own Invention

Sound file can also be produced through your own invention. Sound clips might be created easily by using specific program together with a microphone. One of the factors that must be considered when creating a sound file is the quality of the sound to be generated. If you want to include sound into a PowerPoint presentation, you can use a medium quality sound.

On the other hand, if you aim to produce a high quality commercial, you should consider using a recording studio equipped with instruments such as DAT (Digital Audio Tape) that can record digital sound. Additionally, sound files can also be generated by using equipment such as an audio synthesiser connected to the computer so that the sound can be recorded in MIDI (Musical Instrument Digital Interface) format.

Before we proceed to the next topic, make sure that when obtaining these sources of audio files, you did not infringe or violate the Copyright's Act, which is a critical issue concerning music. To be safe, always make sure that the music you use is royalty free.

There are several new products such as ACID from Sonic Foundry that allows users to produce sound which is not only professional, but also unique. Visit its website at [www.sonicfoundry.com](http://www.sonicfoundry.com).



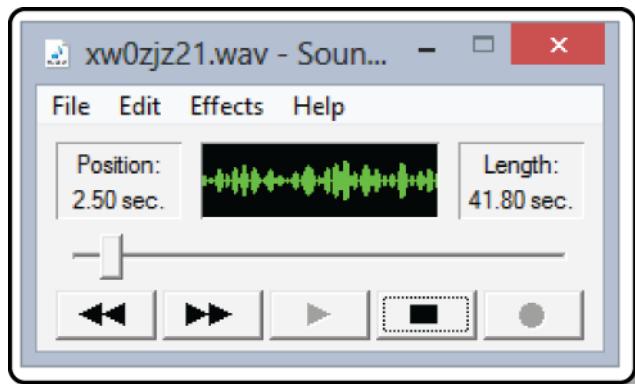
### ACTIVITY 10.2

As a multimedia developer, you should make sure that the work you produce will not be copied by other people. The Copyright's Act (Amendment) 1997 was created to solve this problem. Give a brief explanation about this Act.

## 10.3 AUDIO SOFTWARE

Just like video, attention should also be paid to audio in a multimedia system. Audio management such as recording and editing is very important to generate good multimedia products especially video clips where the audio is synchronised with the video display.

Just like video, audio requires specific software for recording purposes or for the audio production. The Microsoft Windows operating system provides audio recording facility through its software called Sound Recorder (please refer to Figure 10.3).



**Figure 10.3:** Sound recorder

For the purpose of producing better audio with attractive special effects, sophisticated audio software are required such as Sound Forge and SoundEdit 16. The following are discussions on major audio software.

### 10.3.1 Sound Forge

Sound Forge is professional audio editing software for Windows. It includes an audio processing set, equipment and special effects to manipulate audio. Sound Forge is very useful as it works well with the Windows' compatible sound cards to create, edit and record audio files. This user-friendly interface software enables the process of editing to be done quickly and easily.

Sound Forge has special features that make it so popular, as follows:

- (a) Has internal support to record video and CD. It can store a lot of video and audio file formats that include WAV, AVI and MP3;
- (b) Has excellent editing features such as cut, mute, reverse, trim, normalise and others;
- (c) Has amazing effects. This includes 20 types of DirectX audio plug-ins that can be used for microphone modelling. Other effects include chorus and distortion;
- (d) Supports many file formats such as WAV, RealAudio and MP3; and
- (e) It is easy to use. It uses the drag and drop operation in a user-friendly interface.

### 10.3.2 SoundEdit 16

This software has features that are almost similar to Sound Forge. It can do editing for more than 10 audio formats. Besides that, it also has Mixer, CD Audio Capture and others. However, it only operates under the MacOs (Macintosh) operating system.

SoundEdit 16 has many advantages. Firstly, it can import and export AU file formats from the Internet. SoundEdit 16 also supports compression such as algorithm compression 4:1 for a 16-bit voice. Other than that, users can also import CD tracks directly into SoundEdit 16; then, edit, process and give it the desired effect.

With these features, audio recording and editing has become a process that can be done by both the professionals and laymen.

**SUMMARY** .....

- The common types of audio file formats include AIFF, MP3, AU, MIDI and WAV.
- You can obtain audio files from the following sources – pre-package, buying and borrowing and own invention.
- Excellent audio sound can be produced using sophisticated audio software such as Sound Forge and SoundEdit 16.

**KEY TERMS** .....

AIFF	Mixing
AU	MP3
Audio file format	Sound Forge
Audio software	SoundEdit 16
Compressing	WAV
MIDI	

# Topic ▶ Video in 11 Multimedia

## LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Differentiate between analogue and digital video;
2. Discuss the basic components of video production;
3. Apply the methods and techniques of video compression; and
4. List several roles of video in multimedia.

## ▶ INTRODUCTION

This topic describes the video component in multimedia. Due to the shortcomings of analogue video, digital video technology emerged. Nowadays, digital video is increasingly finding its place in the development of multimedia software. Including video elements in a multimedia presentation is an effective way to present information that cannot be delivered by any other media. Most videos are capable of bringing elements that resemble actual situations, attracting the users' attention and emotions.

### 11.1 VIDEO

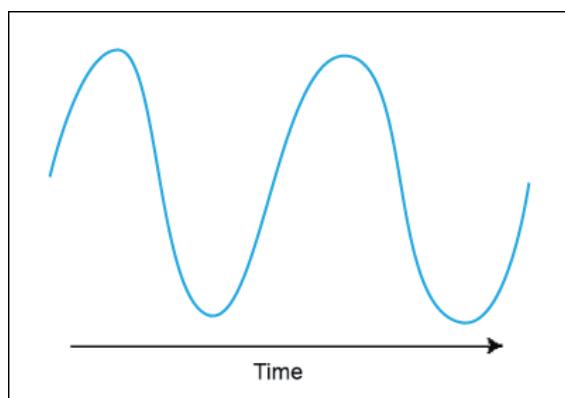
Video is one of the important elements in the development of multimedia because it can convey meaning and information in a relatively short period of time. Video has been in existence for more than 50 years, and it started with the black and white television.

According to Agnew and Kellerman (1997), video is a digital media that shows the arrangement or sequence of static pictures that give an illusion as though we are looking at moving pictures. This illusion depends on two physiological phenomena called, “persistence of vision and flicker fusion.”

Before multimedia was introduced, we often watched videos through video tapes or television broadcasts. These videos were in analogue form and could not be presented through the computer. After multimedia technology was introduced, digital video was developed and became very popular. Generally, there are two types of videos, which are analogue video and digital video.

## 11.2 ANALOGUE VIDEO

Analogue video consists of video or a sequence of images produced by continuous analogue waves. Analogue waves change in a constant manner (please refer to Figure 11.1). This means that there is no exact value at any point of the analogue image. This makes it difficult to reproduce analogue images.



**Figure 11.1:** Example of an analogue wave

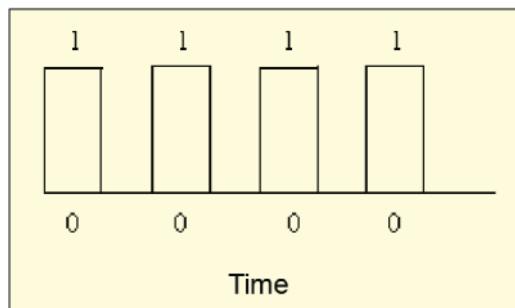
Movies played on VCR or laser disks are examples of analogue video. This is because television is an analogue device and not a digital device. On the other hand, videos played on computers are digital videos. If you wish to import an analogue video into a computer, a video capture card is required. It is used to sample the analogue video at regular intervals in order to produce a digital video.

Pictures in an analogue video can be enlarged or edited without jeopardising the image quality. This is different from digital pictures which consist of pixels that tend to lose its quality when enlarged.

We can find analog videos on television broadcasts. Where can we find digital videos? In your opinion, between analogue video and digital video, which is easier to handle? Why?

### 11.3 DIGITAL VIDEO

Digital video consists of images with discrete values (binary digit 0 and 1) (please refer to Figure 11.2). Unlike analogue video which is continuous, every point on a digital image has an accurate value. The digital image on a computer comprises of individual dots known as pixels or pictorial elements. These collections of pixels form the image which is seen on the computer screen.



**Figure 11.2:** Digital signals

Currently, digital video has become a hot issue in the computer industry and receives tremendous response especially from computer games and multimedia software and hardware developers. Digital videos are often found on websites and are usually in the form of video clips. They are used on websites to present new products, news, games and entertainment.



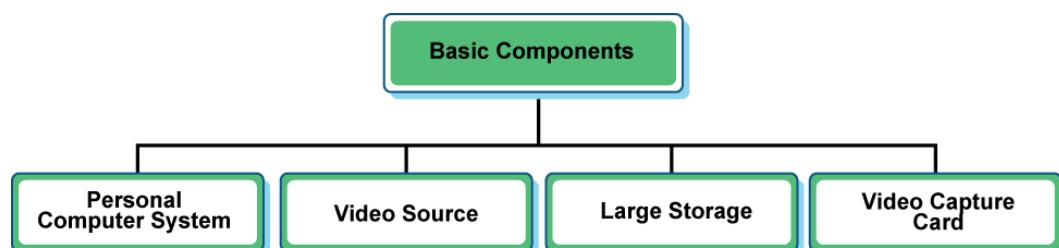
#### SELF-CHECK 11.1

Give TWO differences between analogue videos and digital videos.

## 11.4 VIDEO PRODUCTION PROCESS

Do you know that the video clips that are played on a computer are digital videos? Since computer is a digital device, analogue videos need to be converted into digital format to enable the computer to process it before it can be used in a multimedia application.

The video production process requires several basic components that will be discussed in the following sections. These components form part of the process of converting analogue format to digital format (please refer to Figure 11.3).



**Figure 11.3:** Basic components for video production

### 11.4.1 Personal Computer System

A personal computer or desktop is needed to record or to produce a digital video. Digital video production requires an efficient and powerful computer. The minimum requirement for the personal computer system is a Pentium processor with a large memory and storage. In fact, there is no limit for computer and memory in video production. The faster the processor, more video frames can be captured, and the better the quality of the digital video clip.

On the other hand, if a low quality computer is used; many frames will be eliminated during the video production process. The resulting video produced will be wobbly and not smooth. In addition, you are not encouraged to multi task while the video is being recorded on the computer.

### 11.4.2 Video Source

You should ensure that your video's source is in good condition. There are several video sources that you can choose from such as cassette recorders, Hi-Fi videos, BetaCam, Camcorders and laser disc. These sources are in analogue format. It is important to have a clear and clean analogue source. If the source is noisy and is of low quality, there is a great possibility that the digital video

captured and displayed will be of a low quality or worse. If you have good and clear video source, the chances of obtaining a high quality digital video are better.

### 11.4.3 Large Storage

You also need a hard drive with a large storage space and faster speed because video takes up a lot of memory space. If your hard disk is large, then it definitely will be able to accommodate the digital video file. Multimedia computer systems that are currently available in the market have storage space that is sufficient for digital video production. However, if you are serious about video production, you are encouraged to buy hard disks built for this purpose.

Besides a large storage space, the hard disk must also be fast. A fast hard disk is capable of storing video sequence more effectively and reduces the loss of data during the production process. Fast hard drive has an access time of eight milliseconds. Access time refers to the amount of time taken by the computer to search for data on the hard disk. In this case however, access time is the time taken by the hard disk to search for an empty space to record the data. Therefore, the lower the time, the faster the hard drive is.

### 11.4.4 Video Capture Card

A video capture card is an add-on card required for digital video production. A video capture card is an interface between the video source and the computer. The video capture card can be installed in an additional slot on your computer system. Once the video capture card is installed in your computer, you can connect the video source to the computer by using the RCA cable. There are many types of video capture card that are available in the market. There are video capture card that allow you to digitise both sound and video data together; and there are others that do not, where you need to digitise the video and the audio data separately.

All video capture cards include software to capture video sequence. This software enables you to do your own configurations to the video screen, the number of frames per second, the colour and the type of codec that you want to use for video compression. Among the popular video capture cards are, Intel Indeo, Radius Cinepak and Crucial Radeon 9800 Pro (please refer to Figure 11.4). Video cards that do not digitise the audio video data would be supplied with software that synchronises the audio video data automatically.



**Figure 11.4:** ATI Radeon HD Card

**Source:** [http://upload.wikimedia.org/wikipedia/commons/0/07/ATI\\_Radeon\\_HD\\_4770\\_Graphics\\_Card-oblique\\_view.jpg](http://upload.wikimedia.org/wikipedia/commons/0/07/ATI_Radeon_HD_4770_Graphics_Card-oblique_view.jpg)

The price of a video capture card varies depending on its quality. The higher the digitised quality, the higher its price. Companies that produce video capture card are Creative Labs, Avid Targa, Intel and ATI.

## 11.5 CAPTURING VIDEO

Once all the basic components are connected and the software installed, you must choose your video sequence on the analogue source. Press the play button and click record with the mouse (please see Figure 11.5). The computer will instantly start recording and the video will stream from the source, it gets digitised; meaning converted into a digital file by the video capture card, and then compressed by the software that has been installed in the computer. Files that have been compressed will then be in the hard-disk for future use or editing. If you want to record sequence for editing purposes, digitise it first and edit later. At the same time, the sound or audio from the video source will also be digitised (please refer to Figure 11.6).

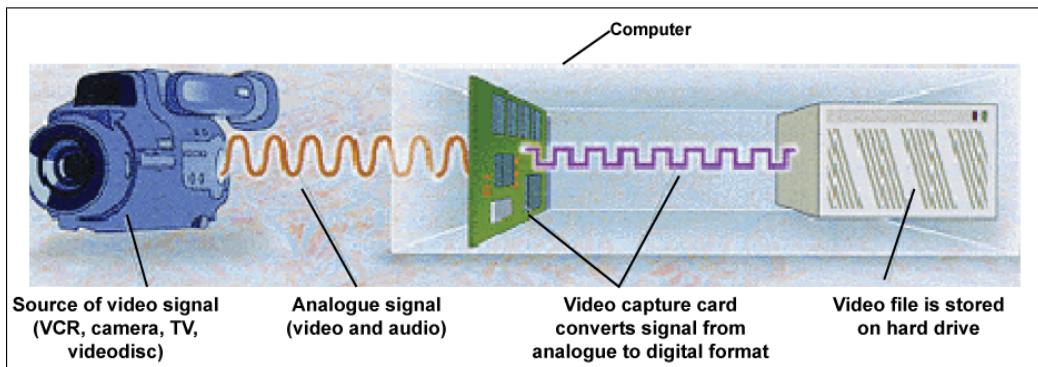


Figure 11.5: Process of digitising analogue video signals

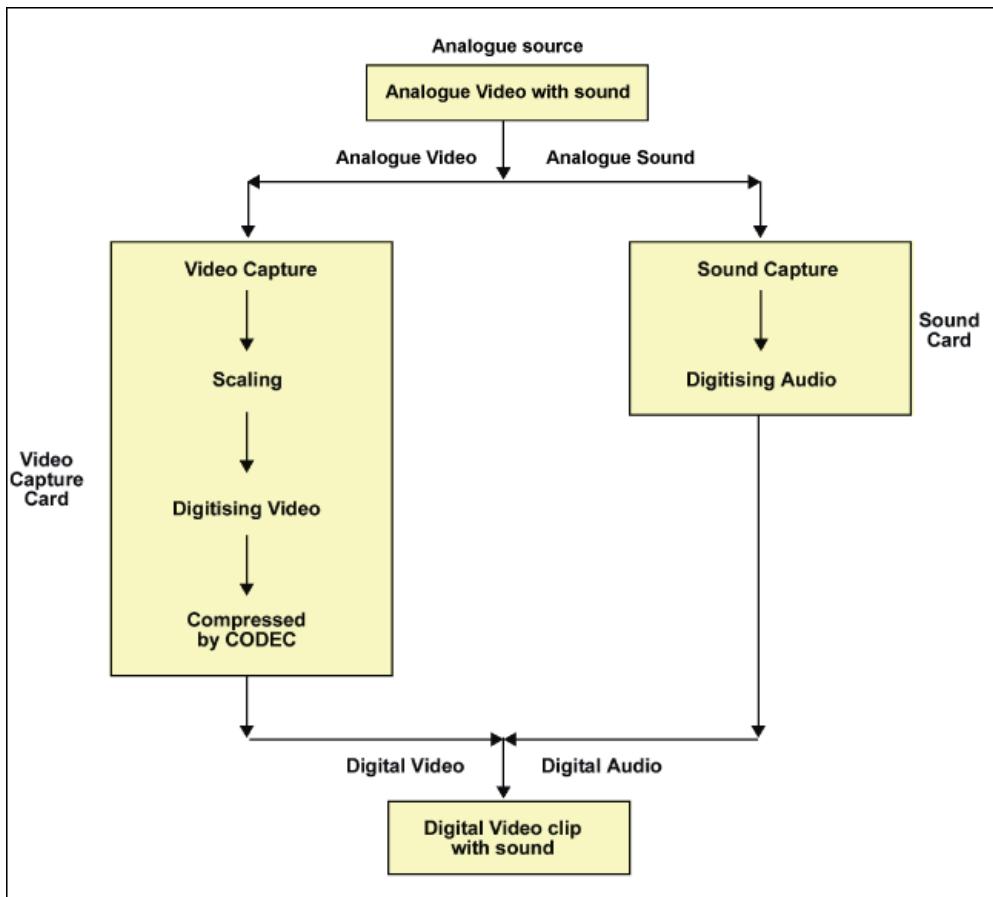


Figure 11.6: Capturing and digitising video and sound

There are digitising software that allows you to view video sequence during the digitising process. If you do not have such software, you can connect the television to the video card to view the process that is going on.

**11.6****ADVANTAGES AND DISADVANTAGES OF DIGITAL VIDEO**

The main advantage of digital video is its capability to edit and modify video sequence. Besides that, digital video can be stored and copied just like other computer files without compromising its quality. It can also be transferred through computer networks such as the electronic mail system. Most video software does not require special hardware for the purpose of playback.

Another advantage of digital video is that it provides random access or non-linear editing facilities. It also allows instructions such as copy, cut and paste to be implemented, and special effect elements to be inserted easily.

The main disadvantage of digital video is that it needs large storage equipment to store the large video file. A one-second, high quality digital video with a full screen size, may have a file size of more than 27MB before the compression process.

Digital videos also experience the problem of piracy. It is very easy for digital videos to be duplicated, and even the quality of the video copied is almost equal to the original video quality. This causes the problem of widespread piracy.

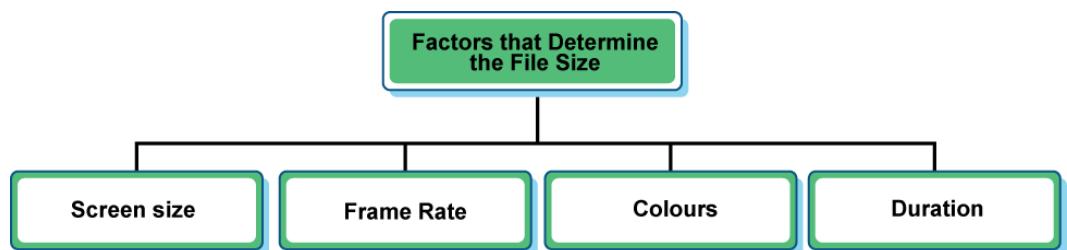
Furthermore, digital videos require a reasonably high data-transfer rate. It also requires a longer period of time for file compression and other processing tasks. Table 11.1 lists the advantages and disadvantages of digital video.

**Table11.1:** Advantages and Disadvantages of Digital Video

Advantages of Digital Video	Disadvantages of Digital Video
<ul style="list-style-type: none"> <li>• Easy to edit video sequence</li> <li>• Easy to add special effects</li> <li>• The quality of the copied file is the same as the original file</li> <li>• Better audio and image quality</li> <li>• Long lasting</li> </ul>	<ul style="list-style-type: none"> <li>• Requires a storage device with large capacity</li> <li>• Copies can be pirated</li> <li>• Requires a powerful computer system for capturing and playback</li> <li>• Requires knowledge of digital technology</li> </ul>

## 11.7 DIGITAL VIDEO FILE SIZE

The quality of a digital video is frequently associated with its file size. The higher the quality of the video, the bigger the file size required to store the video. Do you know that a video file size is large because it contains both the audio and video data? It occupies a large section of storage space in a multimedia application. Therefore, it is important for you to know how to calculate video files so you that you can estimate the amount of storage space required to store your whole multimedia project. In fact, there are several factors that determine the file size of a digital video (please refer to Figure 11.7).



**Figure 11.7:** Factors that determine the digital video file size

### 11.7.1 Screen Size

The screen size varies depending on the user's choice. Basically, the bigger the screen size, the bigger the memory and the processing power required to play back the digital video on the computer. This is because the bigger the screen, the greater the amount of pixels on the screen. For example, for a screen size of  $640 \times 480$ , there are 640 pixels displayed horizontally and 480 pixels displayed vertically. As such, the computer's processor needs to work hard to produce the digital image to fill-up the screen.

If there is insufficient processing power or memory, then the image on the screen will not be clear. In the end, the video will not be able to be viewed well. Normally, digital video is suitably displayed at the size of the screen, which is  $320 \times 240$  pixels. The video size of  $240 \times 180$  is also often used in multimedia presentations.

### 11.7.2 Frame Rates

Videos usually hold about 30 frames per second while films usually contain 24 frames per second. Although videos or films are often played in the range of 24 fps to 30 fps, digital videos require a minimum rate of 15 fps only. If it is less than that rate, the quality of the video will drop and the movement will be jerky.

The higher the frame rate of the digital video, the smoother the movement of the video and the larger the file size or the storage required for the video.

### 11.7.3 Colours

Most video clips today are colour video clips. Colours make your video more attractive and realistic. However, colours will increase the file size. In fact, digital videos are built from several series of graphics or images arranged and played quickly. Thus, the quality is also dependent on the quality or the total number of colours used for every image.

The colours that you see on television comprises of three primary colours that are, Red, Green and Blue (RGB). When these colours are used on the computer, each colour will take-up space which is equivalent to 8 bits per pixel. Therefore, in order to generate a realistic digital video, each pixel in the computer will comprise of 24 bits of colour or colour depth. This is also known as true colour. Black and white clips will take-up less storage space compared to a colour clip.

### 11.7.4 Duration

The duration of a digital video clip will add or reduce the file size. The longer the duration, the bigger the file size.



#### ACTIVITY 11.1

If you want to digitise a video clip in the form of 24-bit colour and have decided to use the following perimeters:

Size: 1/4 screen ( $320 \times 240$  pixels)

Colour

15 frames per second

Duration: 30 second

How much storage space is required?

Can you calculate the answer? If not, refer to the following steps to obtain the answer.

**Calculation steps:**

Step 1: Screen size

$$320 \times 240 \text{ pixels} = 76,800 \text{ pixels}$$

Step 2: Colour

$$76,800 \times 3 \text{ bit (for RGB colours)} = 230,400 \text{ bits}$$

Step 3: Frame Rate

$$230,400 \times 15 = 3,456,000 \text{ bits}$$

Step 4: Duration

$$3,456,000 \times 30 \text{ seconds} = 103,680,000 \text{ bits}$$

Estimated total storage: 103 MB!

You will find that to play a coloured video clip for only 30 seconds, with a speed of 15 frames per second on a 1/4 video screen display, you will need a storage space of 103MB! You must remember that this number excludes the total amount of sound data in the digital video clip. If quality CD sound is added for a 30 second duration, you will be forced to add 5.25MB to the size of the data file.

From the explanation above, it is clear that there should be a method to control this large digital video size. This method is known as video compression and will be discussed in the following topics.



**SELF-CHECK 11.2**

1. What is the relationship between frame rate and digital video?
2. Give TWO factors that determine the file size of a digital video.

## 11.8 VIDEO COMPRESSION

Just like graphics and audio, compression is very important to enable us to store digital video data. Video requires compression because video files contain more data than graphics and audio. Once the sequence of a video is digitised, the file will be compressed by software which is known as codec. CODEC stands for COmpression and DECompression. The purpose of codec is to compress the digital video file to a smaller size and then store the file in the hard-drive or other computer storage devices. Digital video compression is one of the methods used to reduce the file size so that more video can be kept in the storage space. Luckily there are currently many compression technologies for digital videos. Therefore, you have many choices to choose from.

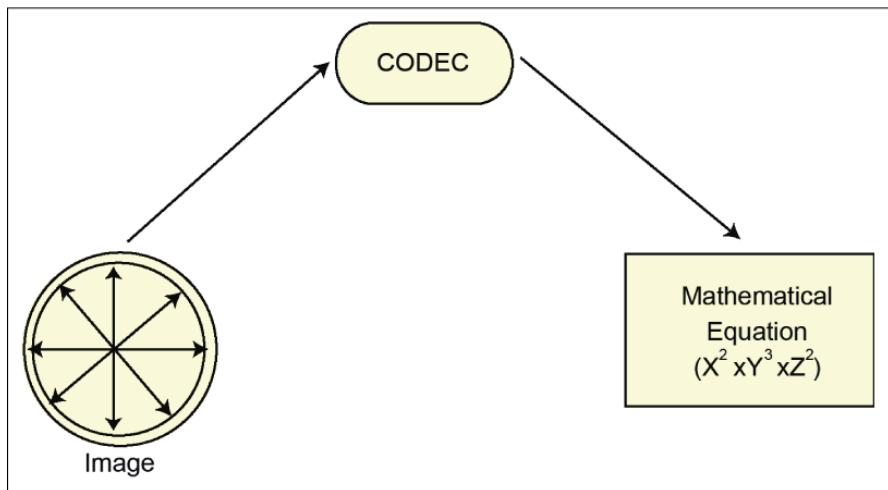
Generally, the method of compression is known as CODEC and it encompasses:

(a) **The Process of Compression**

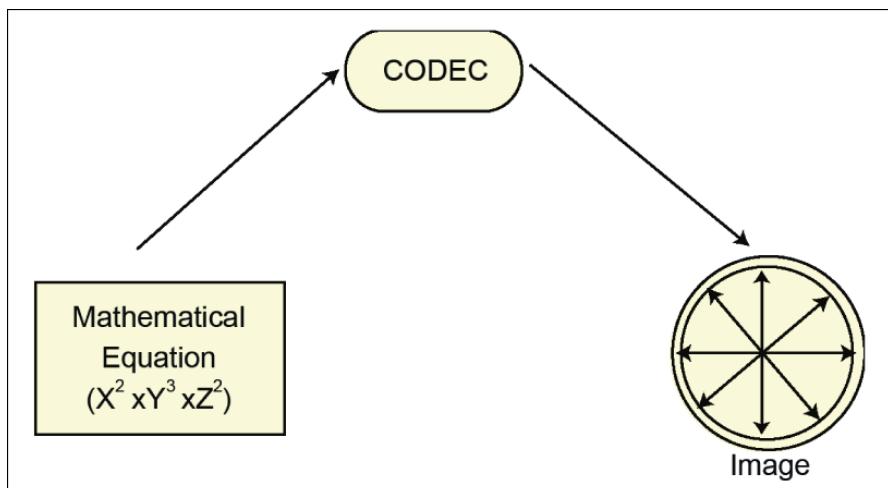
Generally, compression occurs when a video film is stored or produced. The compression process changes video sequence that has been digitised in the form of pixel into mathematical equation.

(b) **The Process of Decompression**

Generally, decompression occurs when a video is played or broadcasted. The process of decompression converts back the mathematical equation to the original digital video. When you see a video clip being played on your computer screen, you are actually viewing a video file that is decompressed and not the compressed video file (please see Figures 11.8 and 11.9).



**Figure 11.8:** Compression



**Figure 11.9:** Decompression

### 11.8.1 Lossless and Lossy Compressions

There are two main methods of compression:

#### (a) Lossless Compression

Lossless compression means that files that have been compressed can be decompressed exactly the same as the original file. This type of compression maintains the original image during both the compression process and decompression process. It is important especially if it involves

text images. Text need to appear in its original state before and after file compression.

One of the techniques for text compression is to identify repeated words and represent it in code form. For example, if the word university appears a couple of times in a text, a code will be given to the word. This technique saves storage space as compared to using the actual word. During the decompression process, the code would be converted back to the word university.

PKZIP is an example of compression software for compressing text or files.EXE to smaller storage sizes. You can also find this type of "zipped" files on the Internet. To decompress these files, you need to "unzip." The "unzip" process is done by software which is known as PKUNZIP.

(b) **Lossy Compression**

Lossy compression on the other hand, eliminates some of the data of the image. Hence, this technique has a better compression ratio than lossless compression. This method helps to reduce the digital video file size. However, the bigger the compression ratio, the lower the decompression quality of the resulting image. This type of compression is suitable for video because the small decrease in quality is hardly noticeable for moving images.

An example of lossy compression is JPEG or Joint Photographic Expert Group, a compression technique that generates a ratio of 45:1. Usually, JPEG's pictures can be obtained from the Internet and downloaded for storage in the hard-drive.

There are two more techniques of video compression:

- (i) **Intraframe compression:** occurs within its own frame.
- (ii) **Interframe compression:** occurs between frames.

### 11.8.2 Hardware Support

When a video is produced, compressed and play-back, it goes through a processing which involves a tremendous amount of information, and only high-powered and fast computers would be able to display the high-quality video with satisfactory frame rate and size.

Most codec processes only involve software and it is popular for videos with small frame rates and size. However when you want to aim for a more sophisticated level of technology, you should invest in codecs that are supported by hardware (hardware assisted codec).

Hardware support usually comprises of a video board that you can plug in into the computer. This board has a chip that processes the digital video file in codec such as MPEG or JPEG. In future, video processing chips will become standard in most computers.



### SELF-CHECK 11.3

1. Codec can have symmetrical or asymmetrical features. It refers to the balance between the compression speed and the decompression speed. Briefly explain both these features of codec.
2. Give two examples of compression software that are currently available in the market.

## 11.9

## THE ROLES OF VIDEO IN MULTIMEDIA

The role or use of video in multimedia is very wide. It can increase the effectiveness of multimedia presentations. A few years ago, it was seldom used because it is large in size and difficult to incorporate into a multimedia presentation. Now, with the emergence of compression processes and sophisticated hardware, video is becoming increasingly popular especially on the Internet.

It cannot be denied that video has given a visual touch to multimedia applications. Video is the best media to show realistic and exact physical actions, but it is also the most difficult media component compared to other media. The following are several roles of video in multimedia.

### 11.9.1 Attracting Attention

Video is a media that attracts the users' attention immediately because it provides visual satisfaction with colourful displays and attractive videos. Therefore, video is very useful for advertising products and services.

For example, while surfing web sites on the Internet, a window suddenly appears with a brief video displaying a new-product of a company. Our attention will immediately be redirected to this advertisement and generally this window would have a "click here for further information" button to carry us to further linkage of this advertisement.

### 11.9.2 Display of Physical Procedure

Have you ever experienced a situation where you were unable to understand a procedure or direction by just referring to the text? Instead, when this procedure is shown step by step through a video display, you are able to understand it immediately. This shows that video is the media that deserve our attention in multimedia especially when you want to show a sequence of complex actions and needs accurate descriptions. Besides that, video can also be used to show procedures or operation manuals that cannot be described by text or graphics alone.

### 11.9.3 Scenario Presentation

Sound and movement has made video a good and effective tool to depict a real-life situation or scenario in our daily lives. For example, it can be used to display an "acting" of an emergency situation to train doctors and nurses to familiarise themselves and act in a calm manner during a real emergency situation.

### 11.9.4 Movement Analysis

One of the special qualities of video, that is not available in other media, is its ability to pause an action, show an action in slow motion and fast mode. This quality makes video very useful for analysis. Figure 10.10 shows an example of the movement analysis by video.



**Figure 11.10:** Movement analysis using video

Among the commonly found movement analysis is body movements analysis to increase the performance of a sportsperson whereby his or her body movement patterns can be seen in slow motion. For example, the movements of a swimmer in a swimming pool can be analysed through this movement analysis.

In addition, video can also be used to make long-term weather analysis by studying cloud movements in an area, and analysis of expected traffic-flow in certain places.

## 11.10

## ADVANTAGES AND DISADVANTAGES OF VIDEO IN MULTIMEDIA

Video play an important role in multimedia applications. It can stimulate emotions, convey messages, provide directions and shows specific techniques. However, moderation of use is very vital, where you should know the appropriate situation and time to utilise video. Other things that must be remembered are, you must use high-quality videos supported by microprocessors and storage. The following are some advantages and disadvantages of video in multimedia.

### 11.10.1 Advantages of Video

Appropriate use of video will bring positive outcomes. There are several advantages of using video in multimedia applications. They are:

(a) **Video Can Captivate the Users**

In this aspect, there is no other media that is comparable to video, because video comprises of various combinations of colour, movements and sounds. Thus, it is very useful for marketing materials and promoting applications.

(b) **Video Can Increase the Memory of Users**

Research has shown that human beings can remember information better and longer if they are able to see the materials compared to reading or hearing them only. Video has the ability to improve users' memory compared to other media.

(c) **Video Can Explain Physical Actions and Complex Relationships**

Video can show realistic physical actions in a situation. The video's ability to show real-time movements enables users to have a clear picture regarding a relationship or physical action compared to what is conveyed through descriptions or illustrations.

(d) **Video Can Combine with Other Media**

Video can be merged with other media, especially with audio. Sounds, text, graphics and movements, can all be combined together with video, for use in a presentation. This is a core factor, as to why video is the most suitable media, for delivering complex information.

### 11.10.2 Disadvantages of Video

Video have many advantages in multimedia applications, but it also has several obvious disadvantages:

(a) **Video Production Involves Higher Cost**

Video production requires more time and resources compared to other media. You may require a few weeks to plan and shoot a video. To produce a short video clip, you may require the help of a trained technician. Furthermore, many resources are required to edit videos and combine it into a multimedia application.

(b) **Video Requires a Large Memory and Storage Space**

Video uses more system memory and storage space compared to other media. For example, a one-minute video uses more storage space than thousands of pages of text. Therefore, video is only suitable for use in situations that absolutely requires its use, such as in advertisements and demonstrations.

(c) **Video Requires Special Equipment for Production and Presentation**

Instruments such as cameras, lights and equipment for editing are required to produce a video. Your investment in equipment for use in video production is far greater compared to the equipment used by other media. In addition, users must possess suitable hardware and software, in order to watch a video, such as video cards and Quick Time or Media Player software.

(d) **Video is Not Able to Visually Explain Abstract Concepts or Static Situations, Effectively**

Video is specially used to show movements but it is not suitable for illustrations of abstract concepts, showing objects or static situations. In these circumstances, text or graphics can convey the abstract concepts more effectively than video.

The quotation below explains the use of audio and video in the website.

**When to Use Audio and Video on the Web**

When HTML allowed Web designers to incorporate images compressed for Web pages (e.g. JPEG and GIF images), the issue raised was that there were too many Web pages that included too many images, many of which were not necessary. The concern was that images were used because they needed to be included, and not for gratuitous use. The use of audio and video in Web pages may not suffer as intense scrutiny as with images simply for the reason that using these media elements requires more bandwidth than images, making their use somewhat limited.

That said, there are Web sites that need to use audio and video. These include sites in the music and music video industries, sports and radio industries and the movie entertainment industry. Some examples of the entertainment industry using technology to display audio and video are the MTV site (<http://www.mtc.com>) which features live reports from the music industry and the Oscar site (<http://www.oscar.com>) which has video clips of the winners' acceptance speeches. News and sports sites include the ESPNet Sportszone site (<http://espnet.sportszone.com>) which features video clips of some of the key moments in sports and the National Public Radio (NPR) site (<http://www.npr.org>) which allows cyber surfers to listen to their shows and even download interviews. Depending on the type of industry that is featured on the Web, using audio and video can be a great attraction.

**Source:** The Multimedia Sourcebook: Volume 2 Multimedia authoring and Web publishing, Neo Mai & Ken Neo TK, 1999: ms 204



#### SELF-CHECK 11.4

1. State two examples of physical procedure presentations that use video.
2. Why does video attract more attention from users compared to other media?
3. Give two examples of problems faced by using digital video.
4. What do you understand by the interframe and intraframe compression techniques? Explain.

**SUMMARY**

- Video is a digital media that shows the arrangement or sequence of static pictures that give an illusion as though we are looking at moving pictures.
- Analog video consists of video or a sequence of images produced by continuous analog waves.
- Digital video consists of images with discrete values (binary digit 0 and 1).
- The video production process comprises the following basic components personal computer system, video source, large storage and video capture card.
- A video capture card will digitise your video and compress it for hard-disk storage. Once stored in digital form, you can edit your video in future.
- There are pros and cons to using digital video. On one hand, the user has the freedom to edit and modify video sequences using digital video. On the other hand, digital videos are easily copied, leading to rampant piracy.

**KEY TERMS**

Analogue video	Lossless compression
CODEC (COmpression and DECompression)	Lossy compression
Digital video	Persistence of vision
Digital video file size	Personal computer system
Flicker fusion	Screen size
Frame rates	Video
Interframe compression	Video capture card
Intraframe compression	Video compression
Large storage	Video source

# Topic ▶ Video Formats and Software

## 12

### LEARNING OUTCOMES

By the end of this topic, you should be able to:

1. Identify the four main types of video formats and standards; and
2. Adopt several codec formats and video file formats that are currently available in the market.

### ▶ INTRODUCTION

In the previous topics, you have learned about video components in multimedia. In this topic, we will focus on some of the video formats and standards that are regularly used. You would also be given explanation regarding the types of codec formats and video file formats that are currently available in the market.

#### 12.1

### VIDEO FORMATS AND STANDARDS

As discussed earlier, video broadcasts are based on frame rate per second or fps. Do you know that video is played on different frame rate per second depending on the country? For example, in the United States, video is played at a rate of 30 frames per second. This is based on the guideline or standard prescribed by the committee of the country, which is the National Television Standards Committee (NTSC). Meanwhile countries like the United Kingdom, Australia and most countries in Asia, use the PAL broadcasting system or Phase Alternation Line. Unlike the NTSC system, the PAL system uses 25 frames per second for videos and television playback. Hence, the majority of the television sets and video recorders have multiple systems capability (multi system ready). This gives the audience the opportunity to enjoy the benefits of both the systems.

The four main formats and standards for broadcasting and video are NTSC, PAL, SECAM and HDTV. These standards may be converted or interpreted among each other but, usually, the conversion process causes the quality to drop, and there are some processes that require specific hardware. Therefore, it is important to understand each of these standards, and identify where your multimedia project will be played or presented.

The following are brief discussions on the video formats and standards that are currently available:

(a) **NTSC**

The NTSC or National Television Standards Committee is a standard based on specifications fixed by the National Television Standards Committee, established in 1952. It is used in the United States and Japan. These standards define a method for encoding information into the electric signal that ultimately creates a television picture. According to NTSC standards, a video frame consists of 525 horizontal scan lines that are produced every 1/30 of a second.

NTSC is also known as Never Twice the Same Colour.

(b) **PAL**

PAL or Phase Alternate Line is a standard that is used in the UK and other European countries as well as most of the countries in Asia. According to Vaughan (2001), PAL is an integration method that adds colours to black and white television signals. It produces 625 lines at a frame rate of 25 frames rate per second (fps); each line requires 1/50 per second to be produced (50 Hz).

(c) **SECAM**

SECAM or *sequential couleur avec memoire* is a standard that is used in France, Russia and a few other countries. Although it is almost the same as PAL and NTSC, the broadcasting technology and method of SECAM distinguishes it from the other standards. To tackle this problem, the majority of television sets sold in European nations have components that can accept both the PAL and SECAM systems.

**(d) HDTV**

HDTV or High Definition TV is a new standard of television technology. HDTV provides clear and quality sounds and pictures just like 35mm movies. The main difference between the old television standard and HDTV is its high resolution. HDTV consists of 1080 active lines compared to the current television pictures standard of only 486 active lines.

To obtain more information regarding video formats and standards, refer to <https://library.rice.edu/services/dmc/guides/video/VideoFormatsGuide.pdf>

The Advanced Television Systems Committee is an International Organisation involved in the development of standards for digital television. Visit its website at <http://www.atsc.org>

## 12.2 CODEC FORMATS

Codec format is defined as an algorithm to compress and decompress. It is a mechanism that is used to compress digital video. In the previous topics, you have learned about the methods and techniques of compression. In this topic, we will view several digital video formats that are currently available in the market. Among them are CinePak and Indeo, which can be used in various platforms such as Macintosh, Windows and Unix. Examples of other codecs are JPEG, MPEG and Sorenson. You can choose any of the codecs that are available in the market to produce videos.

### 12.2.1 CinePak

The CinePak format was formerly known as Compact Video. It is the most popular codec for the Quick Time file. CinePak is a lossy compression format. If you use the CinePak format, you must ensure that the original video source that has yet to be compressed is of high quality.

CinePak can support frame differencing. It is asymmetrical whereby it requires a longer time for compression. For example, a video that is only 15 seconds will take up to an hour to be compressed. However, the video produced is smooth and its file size is satisfactory.

## 12.2.2 Indeo/DVI

Besides CinePak, Indeo (also known as DVI) is a codec format developed by Intel. Generally, Indeo can be in lossy or lossless compression forms and can support frame differencing. However, it is less asymmetrical compared to CinePak.

Indeo requires more processing time for decompression. This causes the video produced to be less smooth compared to CinePak. Indeo is a special codec format for the VfW (Video for Windows) file, but Quick Time 2.0 can also support this format. Therefore, it has become the second most popular codec format for digital video.

## 12.2.3 JPEG

When you view a JPEG format, you may think that it is one of the file formats for graphics or images. In fact, it is the same as the JPEG graphics format. Sometimes, it is dubbed JPEG motion. You must remember that video comprises a set of frames, where each image in a frame can be compressed using JPEG compression. JPEG assumes each of these video frames as static images. This produces a rather large file size and a sizeable drop in terms of quality with a corresponding large compression ratio.

Compression using JPEG entails specific hardware, but the process of decompression can be implemented without hardware, but with software support particularly QuickTime for Apple and Video for Windows.

Choosing a suitable codec is not an easy task. Figure 12.1 gives a comparison of codec formats to help you make the right decision.

Name of Codec	Purpose of Codec
AppleAnimation, AppleNone	Lossless storage but inefficient, see Photo JPEG
Cinepak	Medium quality CD ROM video, works on older computers; the most universal choice
H.261	Low quality videoconferencing
H.263	Medium quality videoconferencing
Intel Indeo 3	Medium quality CD ROM video, works on older computers
Intel Indeo Interactive	High quality CR ROM video, requires faster computers
Motion JPEG	General purpose video editing and storage
Photo JPEG	When used at 100% as a storage/transfer format, it creates significantly smaller files than animation
MPEG-1	High quality CD ROM video, requires special hardware or fast computers
MPEG-2	High quality DVD ROM video, requires special hardware or fast computers
MPEG-4	High-quality Web based video
Sorenson	High quality video intended for publication on the Web and CD-ROM on newer computers

**Figure 12.1:** Different video compression codec formats

Source: Hofstetter (2001)

To obtain more information about video codec, visit <https://library.rice.edu/services/dmc/guides/video/VideoFormatsGuide.pdf>



### SELF-CHECK 12.1

Give one difference between Indeo and CinePak.

## 12.3 VIDEO FILE FORMATS

After the video has been digitised and converted into a digital video file, you should choose a video file format to store the video clip. For use on the computer, the main choice is the Microsoft's Video for Windows (.AVI), QuickTime and some versions of MPEG. Although there are many file formats such as the AutoDesk's FLC, most of the digital video files comprise formats from MPEG, AVI or QuickTime (please see Figure 12.2).

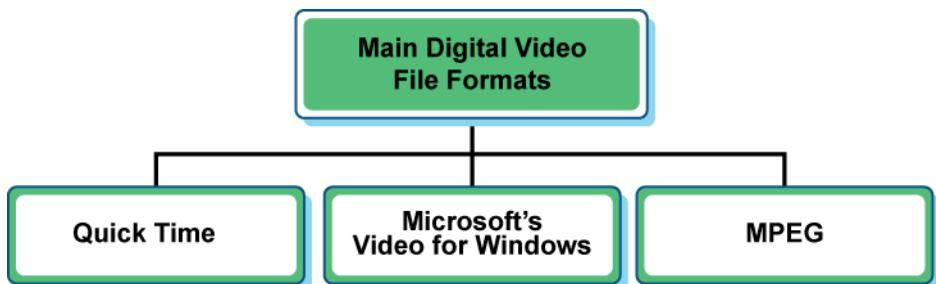


Figure 12.2: Main digital video file formats

### 12.3.1 QuickTime

QuickTime is among the best video file formats and is developed by Apple Computer. Both the Macintosh and Windows support this file format extensively. Most of the Windows' 95/98 systems can play the QuickTime video, but it may require a device installation software if the version of QuickTime needed to play the video is later than the version supported by the computer system.

Although, you may be forced to equip your computer with the required QuickTime installation software, QuickTime is still the main choice for cross platform multimedia development.

QuickTime does not require a high cost as the files required to replay video clips in QuickTime format are circulated free of charge by Apple.

### 12.3.2 Microsoft's Video for Windows

Microsoft first introduced Video for Windows in 1992. Its aim was to prepare a standard for video under the Windows' operating system. Although the AVI format is not the best format in the market, it is the most widely used. This is because most of the personal computer owners in the world use the Windows'

operating system. Therefore, you do not require any additional software to play AVI files in the Windows' system environment. For systems that are not in the Windows' environment such as the Macintosh computer that does not support the AVI format, you need special software that can be obtained from Microsoft to view the video clips.

The Microsoft's Video for Windows program is based on the .AVI (Audio Video Interleave) file format where the audio and video are "interleaved." This enables audio and video to be played simultaneously.

### 12.3.3 MPEG

MPEG (Motion Picture Expert Group) is gaining popularity in tandem with the increase in computer systems. MPEG-1 encodes video-clips on  $352 \times 240$ ,  $320 \times 240$ ,  $176 \times 112$  and  $160 \times 112$  screen sizes only, but it can be played on full screen at 30 fps with neat frame rate and satisfactory image quality.

There are many MPEG versions in the market such as MPEG-1, MPEG-2 and MPEG-4. MPEG-1 is the original format designed for quality VHS pictures at CD-ROM data rate. It is a cross platform format supported by both Macintosh and Windows. MPEG's main problem is that its compression method is asymmetrical and, thus, needs expensive software to encode this format.

MPEG-1's compression standard usually has a compression ratio within the range of 26:1. It supports random access, meaning that the users can play the video clip at any part that is required.

MPEG-2 was introduced in the middle of the 1990s and has better quality compared to the MPEG-1 format. It enables data to be transferred at a speed of 5MB per second for quality multimedia broadcasting, and up to 10MB per second for studio quality. MPEG-2's standard also enables basic video modes to be used such as fast forward, reverse play and slow motion.

Now, a new format has emerged, which is the MPEG-4 that promises good quality at a low data rate and the capacity to encode playback at a different data rate. Adobe Premiere supports the coding format of MPEG-4.

Before using MPEG, make sure that the system you are using can support MPEG's version. Just like AVI and QuickTime formats, you probably need an installation device. Besides that, for some versions of MPEG such as MPEG-2, users may need to install encoder hardware to the computer system.

The explanation above about MPEG may be limited. Visit its website at <http://www.mpeg.org> to obtain more information. The website at <http://www.digitalvideosolutions.com/index.htm> contains many interesting topics on digital video including Codec, formats and video standards.

According to Mohammad Dastbaz (2002), streaming audio is the sound that is delivered to the user as it is being received from the website that you are visiting. The audio file is broken up into small pieces (streams) and then sent from the server to the client's machine; the browser on the client's machine uses a helper application (like Real Audio) to reassemble the audio stream. This is different from downloading a file to a hard drive and then playing it after the entire file has been downloaded.

The advantage of streaming is that there is usually no (or very little) waiting time from the time the mouse is clicked until the the sound starts playing. The same approach can be used to stream video files across the Web. According to recent reports published, the streaming technology industry is the fastest growing industry on the Internet and this trend is expected to continue and grow. The key providers, as far as streaming technology is concerned, are Real Networks, Apple and Microsoft.

RealAudio is streaming audio technology developed by Real Networks. The RealAudio player (the client software) is available for free from Real Networks' Website. RealAudio is capable of sending audio files in two different formats.

- (a) Stereo 8KHz sampling rate for 28.8 kbs connections (-2.5 KB/sec.); and
- (b) Stereo 16KHz sampling rate for 56+ kbs connections (~5 KB/sec.).

Another emerging technology in creating audio content for the Web is the use of compression techniques, namely, MP3. In order to create streaming audio or video files, the multimedia designer firstly needs to create the digital audio or video file format (acceptable file formats are .Wav, .aif, avi, .rnov, .mpg); then, using a RealAudio producer or similar software, the digital file format is broken into streams ready for broadcasting over the Internet.



### SELF-CHECK 12.2

1. Explain the differences between MPEG-1 and MPEG-2.
2. State two advantages of QuickTime.

## 12.4 VIDEO SOFTWARE

Lately, the role of video has been receiving a lot of attention in multimedia systems. Incorporating the video element in multimedia presentations is one of the effective ways to deliver information that other media fail to do. The reasons for this development are:

- (a) Demands from users for video;
- (b) Multimedia technology has progressed to a stage where video is easily integrated into multimedia systems; and
- (c) The emergence of sophisticated hardware such as video capture cards, video RAM and AGP cards.

According to Tannenbaum (2001), there are three basic levels in the use of moving images in the interactive multimedia applications such as capturing, editing and presenting. There are various software that can help you to implement these basic functions. Depending on the difficulty levels of the equipment and the functions offered, these software are probably expensive. Professional video clips require a studio, cameras and professional sound engineers. In fact, in large multimedia project cases, contracts are usually given to professional film studios to produce videos.

Most of the video capture cards also provide several basic software that can capture and store digital videos. Videos for Windows and Apple's QuickTime are among the earliest videos that are available in Macintosh and Windows. For more professional results, Adobe Premiere provides more choices and functions. Other than Adobe Premiere, you can also try other video software such as Video Fusion and Ulead's Media Studio Pro. Although these video software are expensive, each has its own advantages and uses in producing high quality digital videos.

Have you watched a computer using support software such as MPEG or viewed a short video clip on websites such as CNN? If you have never viewed video clips on websites, visit CNN's website at: [cnn.com](http://cnn.com).

Besides Adobe Premiere software, Lumiere and Ulead's Media Studio are also popular video editing software. Visit Ulead's Media Studio's website at [www.ulead.com](http://www.ulead.com) to obtain more information.

Now, we will discuss one of the popular video software that is available in the market, which is the Adobe Premiere.

## 12.5 ADOBE PREMIERE

Adobe Premiere is a popular video application software in desktop computer platforms. The new premiere interface supports professional video work, audio equipment with studio quality and editing tools with long formats.

With Adobe Premiere, users can edit long or short video formats, online or offline more productively and effectively for the purposes of broadcasting, film production, storyboards or preparation of Web-based videos.

Another productive feature of this software is that it has good media management tools such as palette transition that is used during the transition process. In addition, this software also offers extensive hardware and software support where it allows users the flexibility to carry out their tasks. This is because Adobe Premiere integrates very well with other Adobe's family such as Photoshop, After Effects and Illustrator. With this integration, users can carry out the task of developing videos more efficiently where the project being developed can be transferred among these applications.



### SELF-CHECK 12.3

1. In your opinion, what are the advantages of digital video editing?
2. Which of the following video file formats utilise the least storage space: AVI, QuickTime or MPEG?
3. List four types of codec formats that you know.

## SUMMARY .....

- There are currently four video formats:
  - (i) NTSC (National Television Standards Committee);
  - (ii) PAL (Phase Alternate Line);
  - (iii) SECAM (*Sequential couleur avec memoire*); and
  - (iv) HDTV (High Definition TV).
- There are several codec formats available in the market, such as CinePak, Indeo/DVI and JPEG.
- The most popular video file formats include:
  - (i) QuickTime;
  - (ii) AVI (Audio Video Interleave); and
  - (iii) MPEG (Motion Picture Expert Group).
- Video software are now widely used because of increasing demands from video users, the emergence of sophisticated video hardware, and the ease by which video may easily be integrated into multimedia systems.
- Adobe Premiere is one of the popular video application software in desktop computer platforms.
- Adobe Premiere allows the user to capture videos, add clips to timelines, insert transitions and many more. Use your imagination to experiment and explore various functions of the software.

## KEY TERMS .....

Adobe Premiere	PAL (Phase Alternate Line)
AVI (Audio Video Interleave)	Project area
CinePak	QuickTime
Codec format	SECAM ( <i>Sequential Couleur Avec Memoire</i> )
HDTV (High Definition TV)	Timeline area
Indeo/DVI	Transition area
JPEG	Video file format
Monitor area	Video format
MPEG (Motion Picture Expert Group)	Video software
Navigator area	
NTSC (National Television Standards Committee)	

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