Design and Applied Technology

Secondary 4 – 6

[Learning and Teaching Resources]

Simplified Version

Elective Module 2

Creative Digital Media

Resource Materials Series
In Support of the Design and Applied Technology Curriculum
(S4 – 6)

Technology Education Section
Curriculum Development Institute
Education Bureau
The Government of the HKSAR

Preface

The Simplified Learning and Teaching Resources is edited by Mr. LAM Chi Lap, the retired panel head of technological subjects, based on the learning and teaching resources established by the Institute of Professional Education And Knowledge (PEAK), Vocational Training Council in 2009.

Teachers should read the "EDB S4-6 Design and Applied Technology – Learning and Teaching Resources: User Guide" before using the learning and teaching resources.

All comments and suggestions related to the resource materials may be sent to:

Chief Curriculum Development Officer (Technology Education)
Technology Education Section
Curriculum Development Institute
Education Bureau
Room W101, 1/F, West Block, Kowloon Tong Education Service Centre,
19 Suffolk Road, Kowloon Tong, Hong Kong

The copyright of the materials in this resource, other than those listed in the acknowledgements section and the photographs mentioned there, belongs to the Education Bureau of the Government of the Hong Kong Special Administrative Region.

Duplication of materials in this resource may be used for non-profit making educational purposes only. In all cases, proper acknowledgements should be made. All rights are reserved by the Education Bureau.

No part of these materials may be used for publications or any other purposes without the prior permission of the Education Bureau.

© All rights reserved 2019

CONTENTS

Chapter 1	Media Literacy	
1.1	Communication via Digital Media	3
1.2	Digital Media Products and Related Industries	5
1.3	Social, Economic and Technological Factors	9
Chapter 2	Digital Media Design	
2.1	Conceptual Development	13
2.2	General Rules of Visual Composition	15
2.3	Basic Principles of Communication Design in Creating Digital Media	22
Chapter 3	Digital Media Production	
3.1	Project Planning and Idea Presentation Methods	31
3.2	Manipulation of Visual and Audio Equipment	40
3.3	Application Software	53

Chapter 1 Media Literacy

1.1 Communication via Digital Media

In different scenarios, communication exists in different forms, such as human-computer interaction and interpersonal communication.

1.1.1 Human-computer interaction

Human-computer Interaction (HCI) focuses on the communication between human beings (users) and machines (computers). An example is computer games.

HCI involves many areas, including the interface, the hardware, the software, instructions, as well as the user's background and characteristics.

HCI usually consists of three parts: Input, process, and output. The user inputs data, which is processed by the computer and then output for the user. This cycle goes on and on via interaction.

Certain items of human or computers can be both input and output channels, such as touch screens.

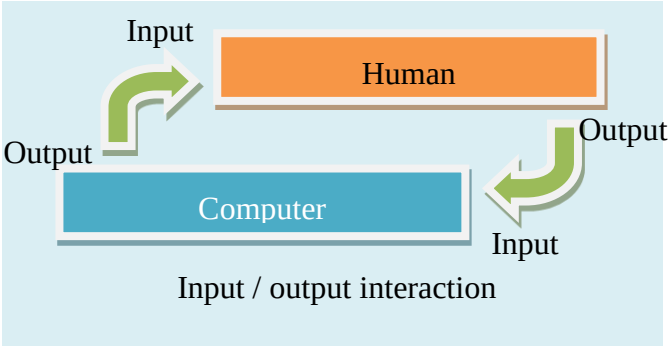


Figure 1.01 Human-computer Interaction, HCI

1.1.2 Interpersonal communication

Generally people have six senses, namely sight, hearing, touch, smell, taste and balance.

Human beings can communicate with each other through different senses, more commonly through sight and hearing.

The communication process can be divided into different components and stages, such as source vs. destination, sender vs. receiver, message carriers/channels/media, encoding vs. decoding, etc.

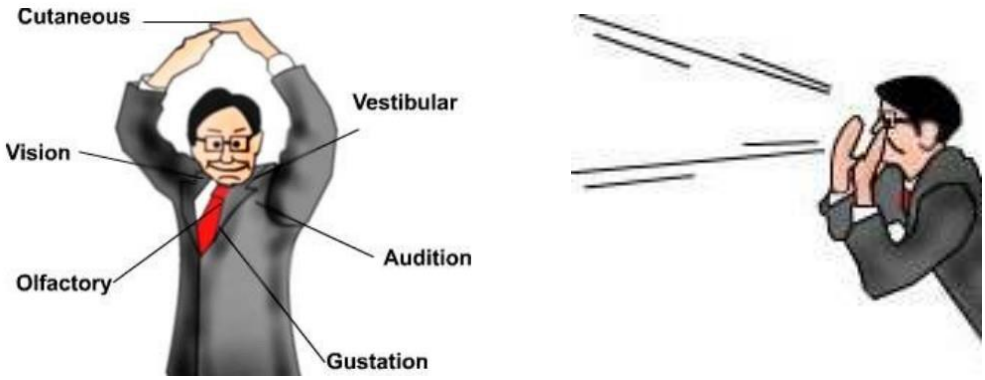


Figure 1.02 Six senses of human

1.1.3 Source vs. Destination

The source refers to the origin of a message. For example, the loudspeaker can be the source of a sound message.

The destination is the receiver of the message or information. For example, ears are the destination of a sound message.

We should consider both the source and the destination when choosing the communication medium. For example, the sound tends to spread and weaken when being transmitted outdoors. Therefore, it may not easily reach a faraway destination.

1.1.4 Sender vs. Receiver

The sender converts messages and information and transmits them to one or more receivers through a channel.

The receiver refers to the receiving end of the communication channel. It receives messages and information from the sender.

In the case of television broadcasting, the TV station is the sender, while viewers are the receivers.

1.1.5 Information Carriers/ Channels/ Media

(a) Information carrier

An information carrier or storage is the entity on which the information is carried. It is used to record, transmit, accumulate and save information.

Information carriers can be either intangible (such as sound, light and electric waves) or tangible (such as paper, films, negatives, tapes, and disks).

(b) Channel

A channel is the path between two ends.

In the context of digital media, a channel may refer to a communication channel, an image channel or a media channel.

In a communications system, a channel is the path through which a media entity transmits information from the sender to the receiver.

For example, an image from a digital camera has three different channels, namely red, green and blue, while a monochrome image has only one channel.

Medium

A medium is the means of communication, such as the paints on a canvas, the ink on a paper, and the binary codes on a disc.

Media can be divided into analogue (such as the traditional vinyls) and digital (such as DVDs) ones.

1.1.6 Encoding vs. Decoding

Codes are the conversion of a piece of information (such as letters, words or phrases) into another form for convenient transmission.

Encoding refers to the process of converting the source information into codes.

On the contrary, decoding is the reverse process of coding, where the codes are converted back into information that the receiver can understand.

Example: In the Morse code, dots and dashes (equivalent to three points) are used to represent different English alphabets and numbers.

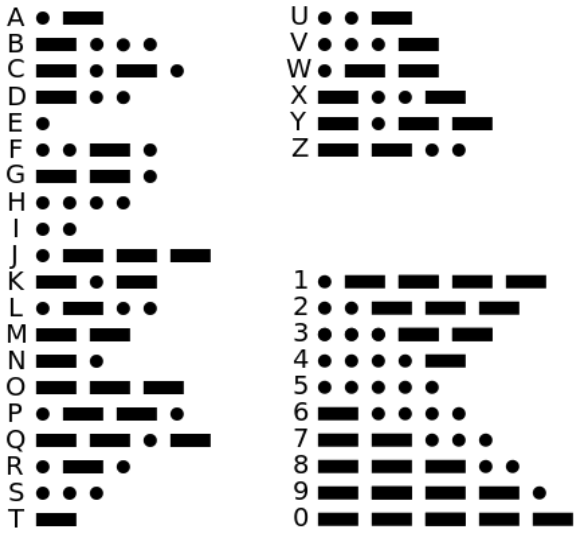


Figure 1.03 Morse code

Example: The ASCII (American Standard Code for Information Interchange) system

In the ASCII system, multiple bits (i.e., 1 or 0) are used to represent different characters (such as English alphabets, numbers, symbols, and control codes).

USASCII code chart

b_7 b_6 b_5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_4	b_3	b_2	b_1	Row ↓ / Column →	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	–	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Figure 1.04 ASCII table in the 1970s

1.2 Digital Media Products and Related Industries

Digital media products are widely used both locally and globally, including:

(a) Electronic games
(b) Digital television
(c) Electronic books
(d) Mobile phones
(e) World wide web (www)

1.2.1 Electronic games

Electronic games include a variety of games on electronic devices, such as games on handheld or large consoles, video games, computer games, online games and mobile games.
Most electronic games are played on the screen, with colours and sound effects to enhance the appeal.
Instead of physical products or services, electronic games can be considered as "virtual products" or services.

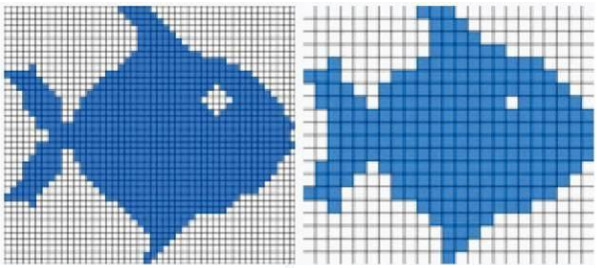
Electronic games usually have four common factors:
1. Representation: The theme is related to the reality in different forms and extents, such as driving and sports.
2. Interactions: The games enable interactions with the players and even among the players themselves.
3. Conflicts: Players must overcome conflicts or obstacles to achieve the goals.
4. Safety: The conflicts or obstacles are only psychological experiences and would not harm the players directly.
5. Rewards: Players are encouraged with different rewards (such as scores, virtual coins or virtual gifts).

However, electronic games may have some undesirable side effects, such as wasting time, hurting our eyes when we gaze at the screen for a long time, and affecting our life and health if we are obsessed.

Figure 1.05 A famous electronic game

1.2.2 Digital television

- A traditional television broadcasting system sends and receives images and sounds with analogue signals.
- Analogues signals can only provide standard definition ("SD") TV effects and are also susceptible to interference.
- Digital signals are used for digital television broadcasting to improve the quality of images and sounds, enabling high definition ("HD") effects.



Resolution of HDTV **Resolution of SDTV**

Figure 1.06 Comperasion on the revolution of HDTV and SDTV

- HDTV provides twice the linear resolution of traditional television systems and images more refined than DVD ones.
- The aspect ratio of traditional TV is 4:3. It is 16:9 for HDTV, offering more spacious pictures.
- Tuners (either stand-alone or built-in) are needed for digital TV sets to process digital broadcasting signals.

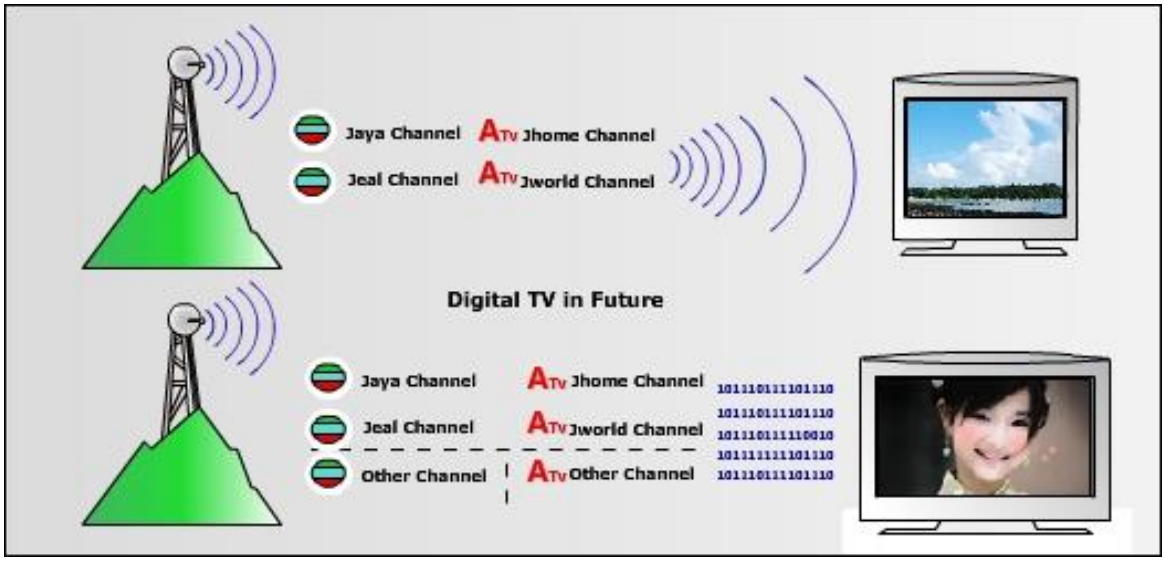


Figure 1.07 Comperasion on the broadcasting signals of HDTV and SDTV

- Cable companies often provide users with tuners (set-top boxes) for receiving HD digital broadcasting services.
- HD signals can be output to digital TV sets from many electronic devices, including game consoles (such as PlayStation and Xbox), Blu-ray Discs, and digital media boxes (such as Apple TV).
- Images from computers can be output to HDTV sets with the video card via the HDMI/DVI interface.

Figure 1.08 A TV card

1.2.3 Electronic books

Electronic books, or "e-books", are electronic documents similar to printed books. They can be stored on digital media (such as read-only discs).

E-books can be read on personal computers, PDAs or dedicated devices (such as Kindle).

Traditional paper books feature sequential presentation, while e-books feature non-sequential/hyperlink representation.

Advantages of e-books

(a) There are many different formats for readers to choose from based on their devices or preferences.
(b) A variety of auxiliary functions can be added, such as page jump, text search and dictionary references.
(c) It is possible to add multimedia effects (such as sounds and animations) and interactive features (such as quizzes, mini-games).
(d) Less space of physical storage is required, since a built-in memory can store thousands of e-books.
(e) Compared with printed books, the reproduction features lower costs, a shorter time and fewer restrictions on the quantity.
(f) They can be transmitted over a long distance by electronic means (such as E-mails and downloads from website), in a fast, convenient and affordable manner.

Figure 1.09 Reading e-books on a dedicated device

1.2.4 Mobile phones

Mobile phones are moveable electronic devices for voice and data communication.

Data communication includes Short Message Service (or "SMS"), E-mails, Internet access, etc.

Apart from communication, many mobile phones are equipped with other functions, such as camera, video and sound recording, calculator, calendar, etc.

Smartphones enable the use of mobile applications ("Apps") with many different functions, such as maps, games, social networking, information, online transactions, online payment, etc.

Some smartphones can also be used with other electronic devices, such as tablets, smart watches, smart glasses, etc.

Figure 1.10 A smartphone

1.2.5 World Wide Web (WWW)

- Thanks to the Internet, the World Wide Web enables the display of text, images and multimedia information on web pages.
- Users can easily "travel" from one website to another, without geographical restrictions.

When designing a website, we need to take three factors and the related talents into consideration:

1. Contents (writers): Firstly and most importantly, whether the contents are what the target readers want.
2. Display (designers) - To display contents of the website (such as images, text, videos, etc.) in a compelling way.
3. Technology (Technicians) - How to facilitate users' access to the website and its contents.

New digital media are emerging on the Internet, including blogs, YouTube, Facebook, Twitter, online radio and TV stations, etc.

Figure 1.11 A lot of information can be obtained from webpages

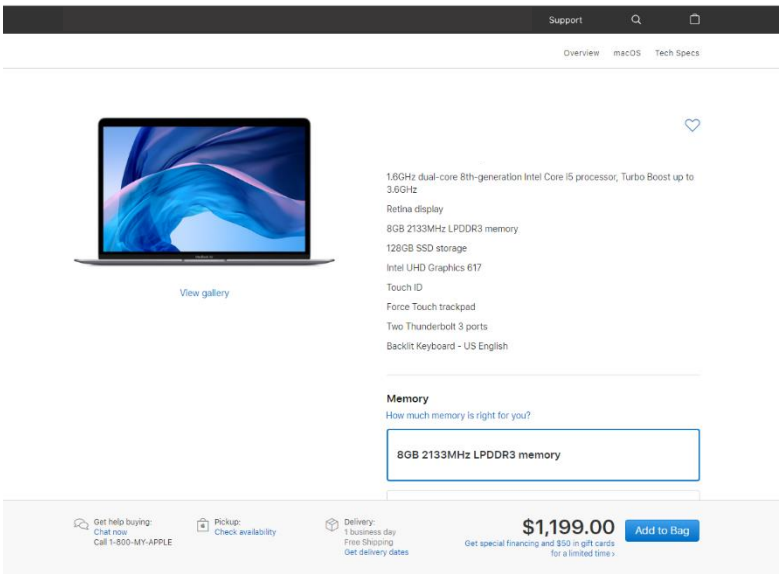


Figure 1.12 A typical online shop

1.3 Social, Economic and Technological Factors

The development of media business has a tremendous impact on human life, in terms of social, economic and technological aspects, among others.

1.3.1 Traditional media

Print publishing: It includes books, newspapers, flyers and posters. It is a common medium of mass communication.

(a) Radio: Radio signals are transmitted wirelessly and are then received and played on radio sets.

(b) Films: They are carefully shot and produced and are shown in cinemas.

(c) TV: Image and sound signals are transmitted wirelessly and are then received and played on TV sets.

(d) Phones: They can transmit sounds bi-directionally over a long distance, so that users can communicate with each other.

1.3.2 Digital media

- "Digital" refers to the use of digits "0" and "1" to represent different electronic signals.
- Digital media devices can encode signals for transmission or storage.
- Digital media players then decode the signals and restore them into appropriate forms, such as images and sounds.

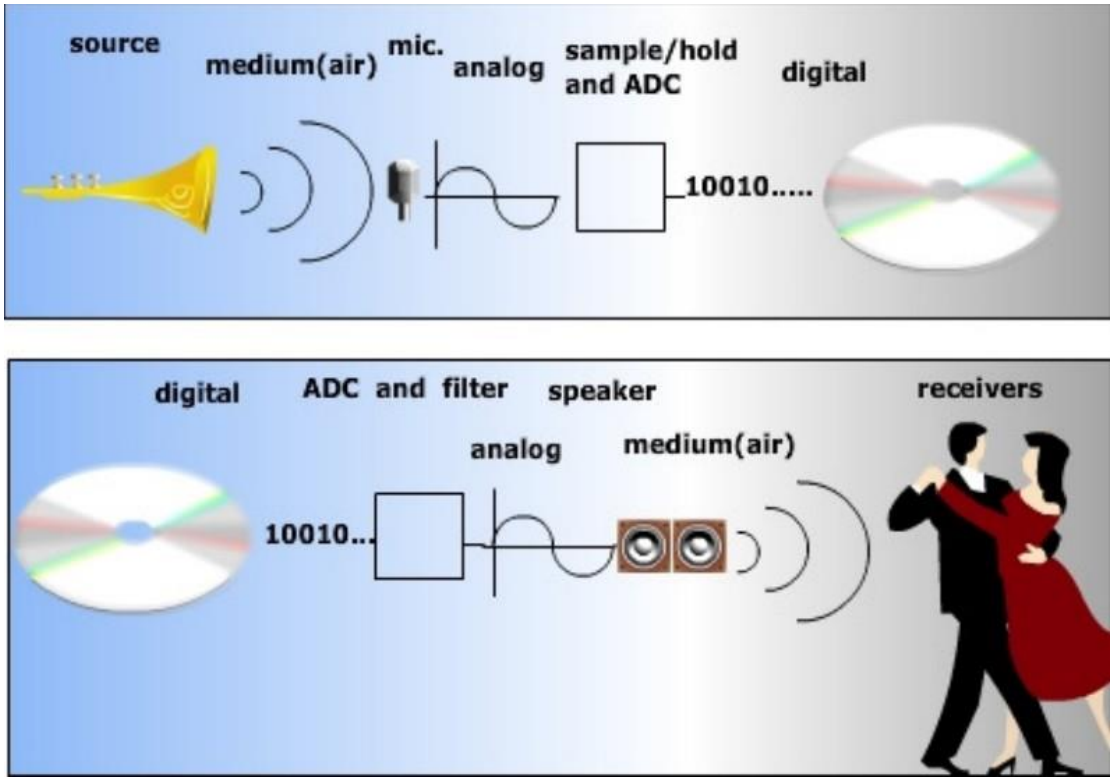


Figure 1.13 Recording and playing of audio signals

1.3.3 Traditional media vs. digital media

Digital media are constantly displacing or replacing traditional media in all aspects, but traditional media still have their market space.

(a) Print publishing

- The emergence of free online news affects many traditional newspapers, with their sales and revenue on the decline.
- E-books are published at lower costs and some can even be downloaded free of charge. They are gradually replacing traditional books.
- The content of digital media can be easily copied. It becomes easy to place copyright works (including books, music and films) on the Internet for illegal downloading, affecting the royalty incomes of their creators.
- Computers are used together with printers to print documents and even books (print-on-demand).

(b) Radio / TV stations

- Compared with their traditional counterparts, online radio / TV stations are established and operated at very low costs and are subject to much fewer restrictions. Therefore, their number is on the rise.
- Online radio stations do not require much manpower. Many people can voice their opinions very easily.
- Online digital media capture a lot of advertisements, affecting the related incomes of traditional radio and television stations.
- With the popularisation of webcasting, live broadcasting (such as that of international football matches) is no longer the privilege of traditional television stations.

(c) Films / videos

- Digital media adds many features to cinematography, such 3D films and multichannel audio.
- Transmission over the Internet becomes faster and faster. We can now watch films at home instead of in the cinema.
- Some films / videos are made exclusively for premium online users and are no longer shown in cinemas.
- With the photography and video recording functions of mobile phones becoming more and more popular, many personal and social events are made into short videos and shared on the Internet. They become alternative historical information apart from news coverages.

(d) Phones / communication

- In many big cities, the number of mobile phones has surpassed that of landline phones and the charges are lower.
- Long-distance toll calls across cities are being replaced by free-of-charge communication over the Internet.
- Internet communication provides free-of-charge video and voice calls.
- When travelling outbound, many people rent portable devices which can be connected to the Internet (such as local calling cards or WiFi devices).
- Mobile phones can be used for a wide range of purposes, such as searching for information and shopping.

Advantages of digital media

Compared with traditional media, digital media has their advantages in technological, economical and social terms.

(a) In technological terms

- User-friendly and infinite data replication without quality loss;
- Easy generation, storage, editing and transmission of data; and
- Greater interactivity, such as watching a goal in a football match on TV with different camera angles.

(b) In economical terms

- Modification of digital media products and information at low costs; and
- Access to up-to-date information at low costs.

(c) In social terms

- Easy interpersonal communication around the globe through chat rooms, instant

messaging, online video games, video conferencing, etc.;
- Rapid globalisation of knowledge; and
- Decentralisation of working locations, such as working at remote offices, or simply at home.

The traditional mechanic printing machine

The digital printer used by general consumers at the office or at home

The 12-inch vinyl single for recording music

The digital CD used in the music industry since the 1980s

Restrictions of digital media

(a) In technological terms

- High-tech hardware devices (such as computers and smartphones) is required for the use of digital media;
- The hardware devices for storing digital data are more vulnerable to damages, and their service lives are generally shorter; and
- With the development of science and technology, the original hardware and software are soon outdated and even obsolete.

(b) In economical terms

- High-tech R&D requires a lot of funding and manpower, which increases the average cost of digital media;
- Digital media threatens traditional industries, causing salary cuts and unemployment; and
- Digital media are easy to copy, thus reducing the revenue from copyright works.

(c) In social terms

- Digital media generally do not require handwriting and feature more abbreviations or symbols, which leads to a decline in language proficiency;
- Digital media are often used to share video or information, which easily infringes on personal privacy; and
- Digital media (such as online games) consume many users' energy, time and productivity.

1.3.4 Major technological advances in digital media

Given the popularity of digital media, many industries (such as retail) need to reconsider their business models.

Computer, Communication, and Consumer Electronics are converging and collectively called "3C".

(a) Handheld game consoles

- They are lightweight, portable and all-in-one (with the touchscreen and the speakers integrated in a single device).
- They can incorporate many functions, such as photo taking, expandable external memory, larger screens, improved speakers, online game purchasing (and downloading) and audio playing.

Figure 1.14 A Handheld game consoles

(b) Wearable computers

- Some computers can be put on like helmets, goggles and wristbands.
- Wearable computers have been applied in medical, entertainment and other areas.

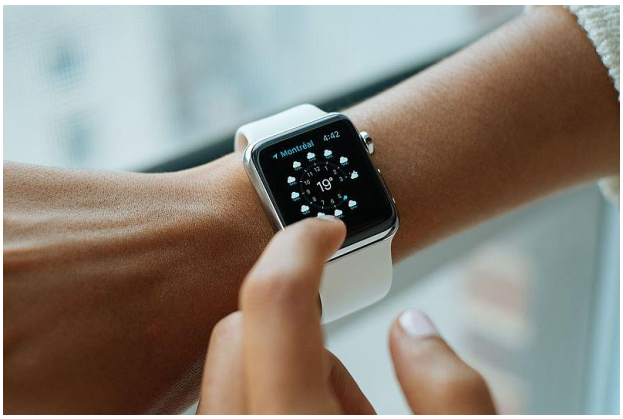


Figure 1.15 A Wearable computer

(c) Multi-touch displays

- The touch screen technology has been applied to many mobile phones and tablets.
- A more recent application is the Microsoft PixelSense, which enables interactions among several users.

Figure 1.16 Multi-touch displays

(d) E-paper

Scientists are studying the possibility of displaying text and images on ultra-thin electronic materials similar to a paper. Such materials are also lightweight and flexible, being more convenient than electronic reading devices at present.

Figure 1.17 E-paper displays

Chapter 2 Digital Media Design

2.1 Conceptual development

Thanks to the computer and the Internet, "digital media" designers can improve their work efficiency and facilitate the exchange of ideas.

2.1.1 Design process and concepts

The design process is part of problem solving.

Designers develop solutions with their creativity and innovation to address their clients' needs.

A solution can be a product, a service, a logo or something else.

A design concept is a preliminary solution without particular details yet.

A high-quality design concept provides a viable framework that takes both practical and aesthetic issues into account.

2.1.2 Semiotics

Semiotics is the use of signs to deliver messages to the audience. Each sign has its specific meaning.

There are three types of signs, namely symbolic signs, iconic signs and indexical signs.

- Symbolic signs (Symbols)

  Symbolic signs are signs of which the meanings are generally determined by the users, such as mathematical symbols.

  Symbols often change over time, as in the case of mathematical symbols.

$$+ = \neq \quad > \infty \sum \pi$$

Figure 2.01 Mathematical symbols

- Iconic signs (Icons)

  An icon is a sign that has similar graphical characteristics to the item it represents.

  For example, the icon of an apple should carry the major characteristics of the fruit.

Figure 2.02 Icon of a cartoon star and Icon of a hand-drawn star

- Indexical sign (Indexes)

  An indexical sign is a sign that shows a fact or condition. It is usually indicative.

  For example, "red" is a more emotional colour than "amber", so "red rainstorm" is heavier than "amber rainstorm".

Figure 2.03 Rainstorm warnings

Major principles in semiotics

(a) The uses of signs may vary from culture to culture. There is not necessarily a fixed meaning or definition.

(b) Signs can carry more than one level of meanings.

2.1.3 Signifier and signified

(a) Signifier

Signifier means the form of a sign. The form might be a graphic, a sound, a word or a photograph etc, that will trigger someone's conceptual thinking with association to a specific thing. A signifier is created for the conceptual or symbolic implication of a symbol.

(b) Signified

Signified means the concept, the message or the symbolic meaning that a sign represents. A signifier may carry several meanings or refer to several things.

For example, the "STOP" sign on a road asks drivers not to advance, but the same sign in a classroom indicates students should stop talking.

Figure 2.04 A STOP sign

2.1.4 Denotation and connotation

A graphic symbol and its referent are connected through denotation and connotation.

Denotation refers to the meaning of the symbol itself. For example, the dictionary defines "red" as a specified colour.

Connotation refers to the implied and hidden meaning derived from the symbol. For example, the colour "red" implies danger, blood, etc.

The denotative and connotative meanings of a word can coexist.

For example, the denotative meaning of "rose" is a kind of flower, while its connotative meaning can be passion and love.

2.2 General rules of visual composition:

Design is a presentation of organised and selected elements for a specific purpose.

Common rules of visual composition include proportion, framing, cross lines, laws of grouping, shape recognition, colours, textures, and patterns.

2.2.1 Proportion - golden ratio

Proportion measures the relative sizes and positions among various visual elements.

The golden ratio is a specific ratio between the length and the width, at the value of about 1.618. It is mathematically denoted by "φ".

In art and design, the golden ratio is seen as a ratio of aesthetics.

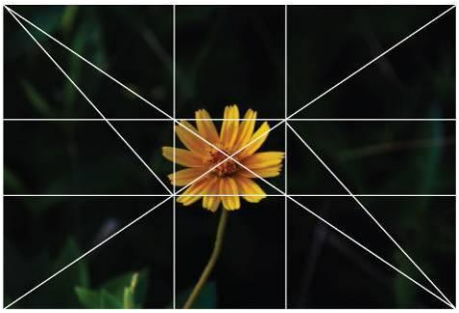


Figure 2.05 Golden mean grid applied to a single image

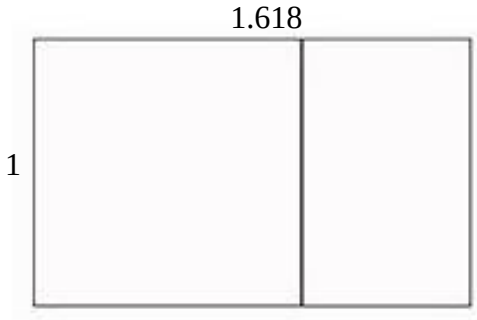


Figure 2.06 A rectangle conforming to the golden ratio (golden rectangle)

2.2.2 Proportion - Rule of Thirds

According to the Rule of Thirds, each picture is preferably divided by four grid lines, namely two vertical and two horizontal ones.

Major elements should be placed at the intersection points of these lines. It is a simplified version of the golden ratio.

Figure 2.07 This photograph of sunset was taken at Qiandao Lake in China, in accordance with the Rule of Thirds.

2.2.3 Framing

Each image is limited and controlled by a frame.

Framing endows an image (whether still or moving) with a new perception or idea.

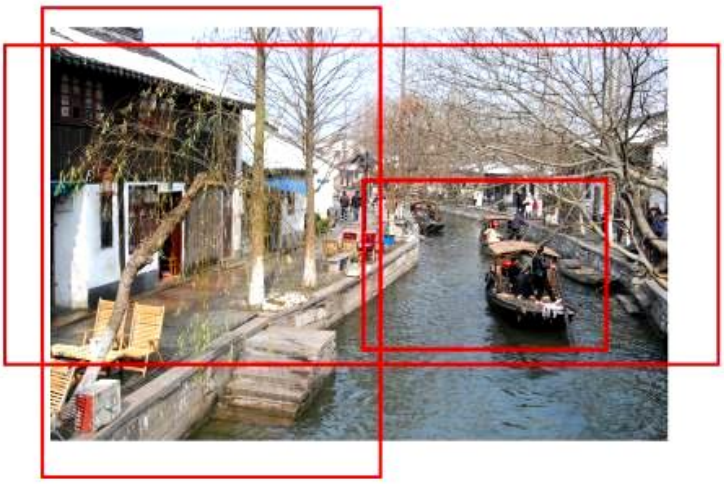


Figure 2.08 Framing a picture from different angles

If a single or a series of still images moves quickly in front of the eyes, the brain will combine them and form a moving picture.

Similarly, in digital media production, all images are constructed with a series of still frames.

With proper colours, graphics, images, spacing and words, the frames can display a 3D concept, such as depth.

A frame can draw attention to the focal point and minimise distraction from unimportant objects around it.

Figure 2.09 An arch is a natural frame of attention

Figure 2.10 The rock is highlighted by the water around it

2.2.4 Cross lines

Cross lines can be used to draw the audience's attention.

A cross line starts or ends at a far edge of the picture.

(a) Cross lines – Horizontal, vertical, diagonal, converging and curved

- Cross lines can be straight (horizontal, vertical, diagonal and converging) or curved lines.
- With cross lines, pictures can be more dynamic and vivid.
- Cross lines can be arranged in a specific pattern to create a visual focal point, define space, form a visual hierarchy, and suggest the direction.

Figure 2.11 Using diagonal lines (left) and curved lines (right) to draw audience's attention to the centre spots.

(b) Cross lines – Dynamic image sequences

- Cross lines are often used in motion graphic design, such as films, videos and animations.
- Cross lines may also be used along with other effects (such as different shapes, colours and dimensions).

2.2.5 Laws of grouping

Grouping of items helps readers to classify items in a logical way. Common techniques include alignment and proximity with whitespace.

Laws of grouping are often used in printed materials, TV pictures and websites.

Besides, grouping of items is often used in news programmes and computer games to display information.

Figure 2.12 Grouping of items in a news programme and a computer game

Laws of grouping - Grid systems

A grid system divides the presentation space into grids. Each grid becomes a mini-area of design.

The system is suitable for designing documents with multiple pages. For example, in a newspaper, similar contents (such as finance) are placed on the same page.

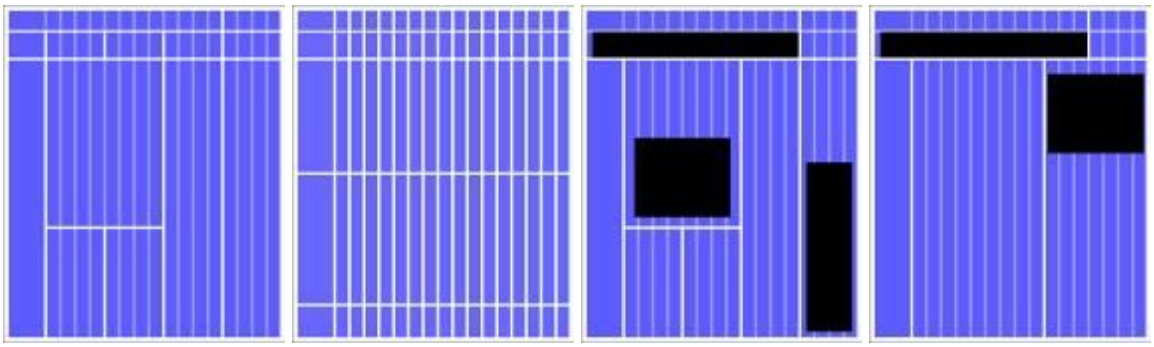


Figure 2.13 Grid systems are suitable for all types of design

2.2.6 Shape recognition

The shape is a “carrier” conveying the underlying message or “form” to the audience. The “form” is a tool for the brain to identify a specific object. Shape recognition applies spatial construction and background relations, such as the shape, the size and the surrounding space.

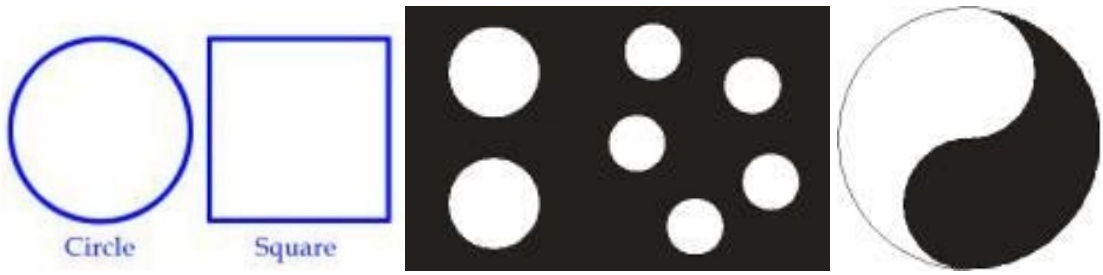


Figure 2.14 Different combinations of shapes may convey different messages

2.2.7 Colours

Human eyes have only visual cells that sense darkness and three colours (red, green and blue), but they can recognise a great variety of colours.

Colours give rise to different feelings (such as harmony and excitement) that can be used to represent different design effects.

Different colours can be combined in two different ways: Addition and subtraction.

Addition (overlay)

The additive method features the use of RGB colours, i.e, Red, Green, and Blue, to create a variety of other colours.

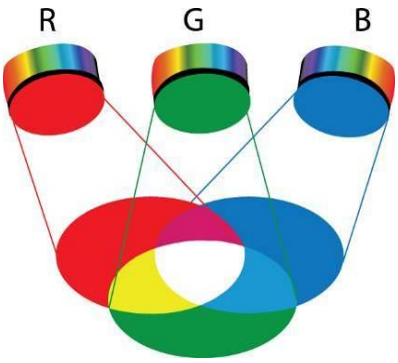
For example:

Red + Green = Yellow; Green + Blue = Cyan;

Blue + Red = Magenta or Purple;

Red + Green + Blue = White

The colour system using the additive method is often referred to as the "RGB" system.



Figutr 2,15 Additive colours (RGB, Red, Green, Blue)

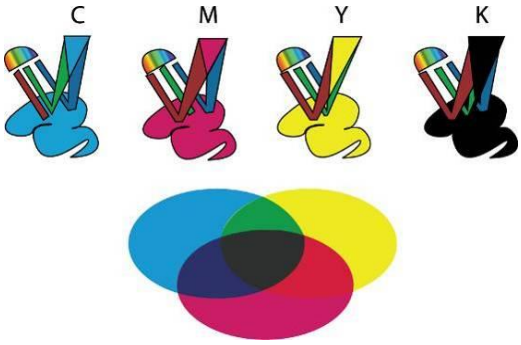


Figure 2.16 Subtractive colours (CMYK, Cyan, Magenta, Yellow, Black)

Subtraction

The subtractive method is often used in pigments (such as printing inks).

When white light shines on a pigment, certain wavelengths of the light absorbed, while the others are reflected and become the visible colour of the pigment.

For example: Yellow pigment (absorbing the blue wavelength); cyan pigment (absorbing the red wavelength); magenta pigment (absorbing the green wavelength).

When different colours of pigments are mixed, more wavelengths are absorbed and accordingly more colours are subtracted from the white light.

For example:

Yellow (absorbing the blue wavelength) + Cyan (absorbing the red wavelength) = Green

Yellow (absorbing the blue wavelength) + Magenta (absorbing the green wavelength) = Red

Cyan (absorbing the red wavelength) + Magenta (absorbing the green wavelength) = Blue

Yellow (absorbing the blue wavelength) + Cyan (absorbing the red wavelength) + Magenta (absorbing the green wavelength) = Black (theoretically)

In fact, when the three primary pigments (Cyan, Magenta, Yellow) are mixed together, they only result in grey. Therefore, the colour Black (K) is added.

The colour system using the subtractive method is often referred to as the CMYK system.

2.2.8 Textures and patterns

- Texture is the details of a 2D or 3D model.
- Pattern is the repetitive shapes or units of texture in a 2D or 3D model.
- Symmetry, repetition, contrast, afterimages and negative afterimages are some common applications of textures and patterns.

(a) Symmetry

Symmetry or equilibrium refers to the visual balance or opposition of the elements of a composition. It provides the audience with a sense of balance, stability and order through equal and visual balance of forms and/or colours.

Figure 2.17 Symmetry is the oldest known form of arrangement

Figure 2.18 Radial symmetry in three dimensions

(b) Repetition

Repetition is a recurrence of a design element in a planned, uninterrupted and regular fashion. Repetition endows a sense of quiescence and stillness.

Figure 2.19 Repetition is the recurrence of a design element.

Repetition is often applied in animation design and character modelling. For example, the hair of a character is formed by repetition.

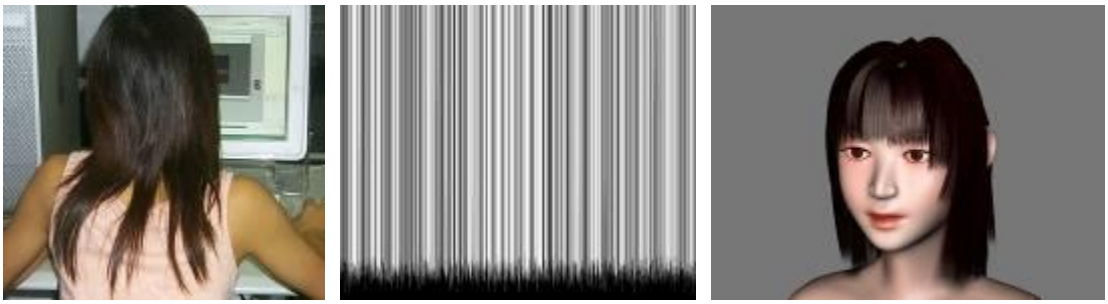


Figure 2.20 Reference image(L); Reference texture(M); 3D character model(R)

(c) Contrast

Contrast is the use of the effect of difference. Contrast can be created with sizes, colours, fonts, etc.

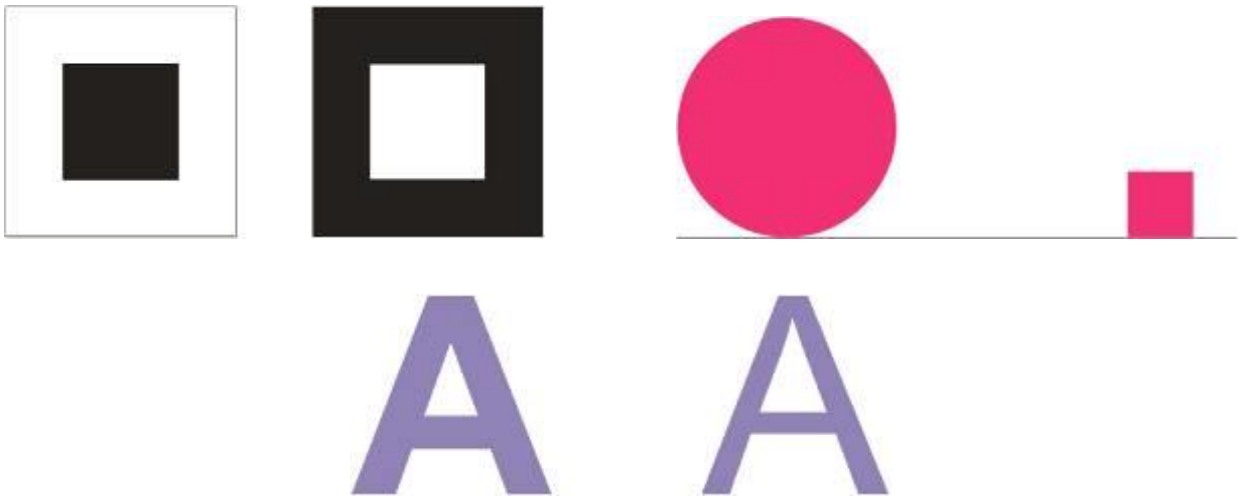
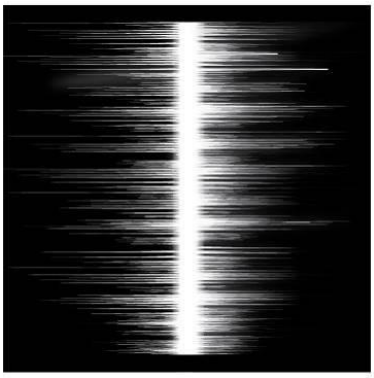


Figure 2.21 Contrast applied in different aspects

(d) Afterimages



An afterimage ("ghost image") is an image that continues to appear in the vision after the exposure to the original image has ceased.

A similar principle is often applied in animations and films. It is called "persistence of vision".

Steps to experience an "afterimage":

(i) Look at an object;

(ii) Close your eyes;

(iii) Open your eyes again.

Look at the central line in the picture on the right, and blink. The line should "become" bigger.

(e) Negative afterimages

In many cases, when being exposed to over-stimulation, our eyes move slightly away from the image "automatically" and the movement may be unconscious to the viewers.

If the image is too large or the slight movement is not sufficient, some visual cells of the eyes may stop sensing any colour.

On the contrary, the neighbouring visual cells will send stronger signals, which are interpreted by the brain as opposite colours, thus forming a negative afterimage.

Example: Stare at a red square for some time (more than two minutes). Then quickly turn your eyes to a piece of white paper. You will see a green square.

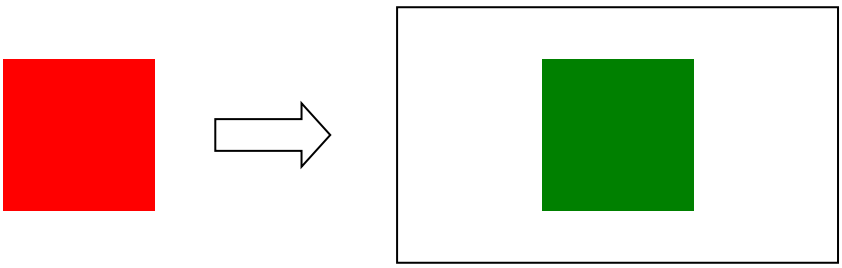


Figure 2.22 Experiment to test for Negative afterimages

2.3 Basic Principles of Communication Design in Creating Digital Media

It is a common practice for business and even non-business organisations to deliver their corporate messages with graphic design.

Designers must create designs that can convey these messages in a well-organised and impressive manner.

To this end, designers must understand the basic principles and be equipped with the skills and intuition of communication design.

2.3.1 Text

Messages with a good text combination (of words, phrases or sentences) can draw the audience's attention.

In a dialogue script, hints can be added to remind the speakers of the time when they have to adjust their tones (or any other voice or action).

Adding images to a full page of text gives the audience some respite and the time to digest the message.

Figure 2.23 A dull poster full of text

Figure 2.24 Text with photo and images

2.3.2 Sounds

Sounds can be classified as concrete and abstract.

Concrete sounds convey specific meanings to the audience. For example, human voices and ambient sounds are concrete.

Abstract sounds are used to evoke and enhance the audience's emotions

2.3.3 Images and graphics

Images can express messages effectively.

Graphics and animations are common types of images.

(a) Conceptual elements of images

A design is composed of basic elements, i.e., points, lines, planes and volumes.

Points: They are the most basic unit of images and graphics. Conceptually, they are zero in length, width and height.

Lines: They can be straight, curve or segments, and are formed by joining countless points. Conceptually they are zero in width and height.

Planes: They can be an open or closed surface. Conceptually they are zero in height.

Volumes: They indicate the space occupied by objects.

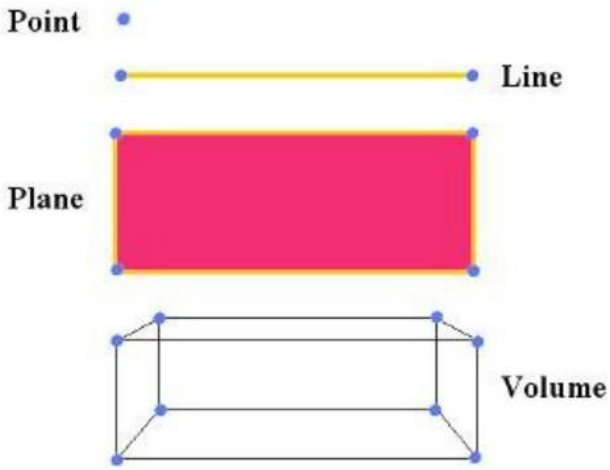


Figure 2.25 Conceptual elements from 2D to 3D images

(b) Introduction to computer graphics

(i) Raster images

Raster images are composed of multiple points. It can be viewed on a computer screen, a paper or other media.

Raster images can be saved in computer files in different formats (such as BMP and JPEG).

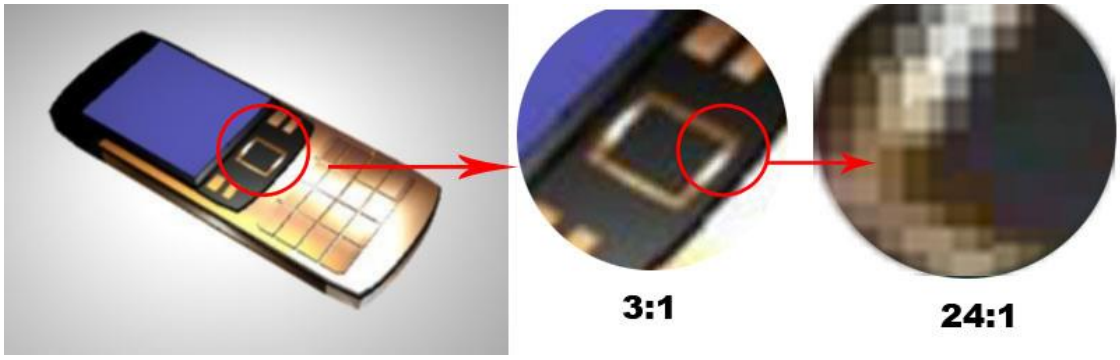


Figure 2.26 A raster image at different levels of magnification

(ii) Vector graphics

Vector graphics are composed of geometric shapes (such as lines, squares, rectangles, circles, etc.). They are combined with mathematical formulae.

Each element of a vector graphic is appropriately recorded. Thus, it can be selected, modified and resized independently.

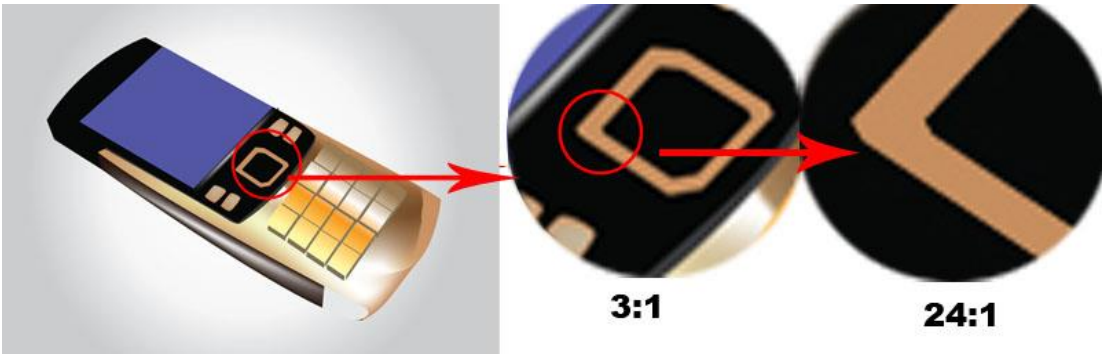


Figure 2.27 A vector image at different levels of magnification

(c) Computer graphics manipulation

(i) Image cropping and adjustment

Images can be cropped or adjusted appropriately to produce specific visual effects.

They can be cropped into different forms (such as rectangles, circles, squares and triangles) and sizes for the presentation.

Figure 2.28 ***Original photo***

Figure 2.29 Photos after going through different cropping and adjustment

Image adjustment

Appropriate adjustment can enhance the value of images and endow the entire design with life.

For example, we can add a frame to the image, add a shadow to the object, colour the background or tilt the picture.

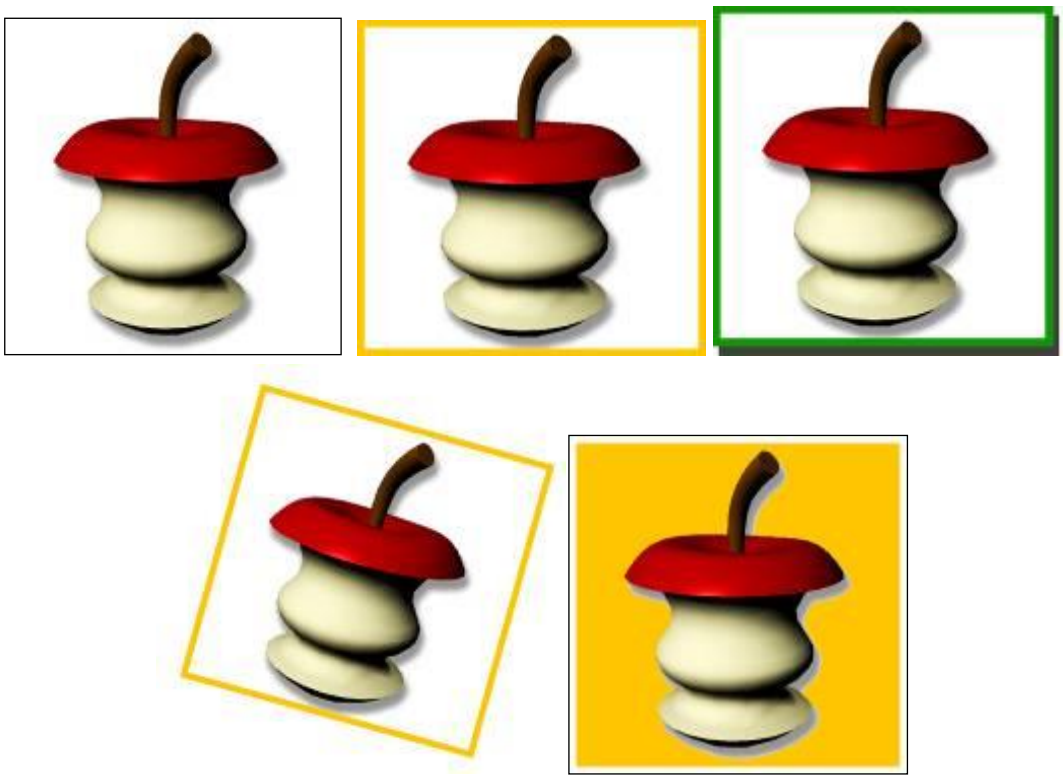


Figure 2.30 Images after going through different adjustment

(ii) Surface and dimensionality

Images can also be manipulated by shadowing, extruding and simulating.

Shadows can simulate direct light or fill light.

An extruded object provides the audience with a floating effect, which is created with light sources from different directions.

Example: The following logos (of Hong Kong Cable Television Limited) show different effects.

Figure2.31 Flat image(L); and image after manipulated by shadowing(M) and extruding(R)

2.3.4 Videos

Digital video technologies are used to create a sequence of pictures that show motions dynamically by capturing, recording, processing, storing, transmitting, and restructuring.

(a) Standard definition vs. high definition

Before making a video, we should firstly consider the clarity of playback, i.e., standard definition (SD) or high definition (HD).

Traditionally, there are two common SD systems for transmitting analogue video signals, namely NTSC and PAL.

HD is a newer format of digital videos.

Item	NTSC	PAL	HD
Video signals	Analogue	Analogue	Digital
Frames per second (FPS)	30	25	24 or 60
Aspect ratio	4:3	4:3	16:9
Highest resolution	720×480	720×576	1920×1080

(b) Video editing

Video editing involves the activities of cropping, rearranging and consolidating video pictures. It determines the results of the final video.

Refer to Chapter 3.3.3 for the skills and technological details of video editing.

(c) Video compositing and blending

Compositing, or "matting", is a term in the film-making industry. It refers to combining two or more images into a single frame.

Compositing is commonly done with masks or mattes. A mask is a stencil-like, grey-scale image used to protect part of a picture.

"Image blending" combines images without masks. There are different types of blending, such as addition and difference.

Figure2.32 Composition of video using mask

(d) Video with special effects

Special effects in videos usually involve computer-generated images, particularly 3D computer-generated elements.

To create a video with good special effects, we have to consider the sizes of objects, the lighting quality, the ambience (or the mood), the camera angles, etc.

Successful special effects require good planning, which means at least a detailed storyboard.

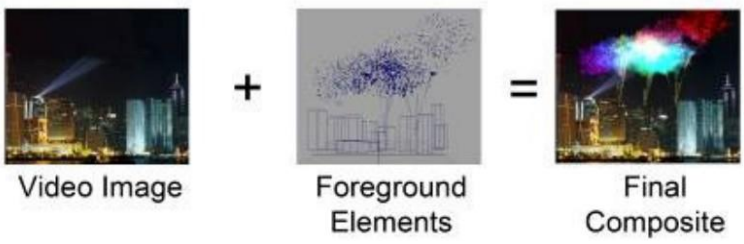


Figure2.33 Composition of video using special effects

(e) Video colour correction

Colour correction refers to the adjustment of colours (or the colour temperature), aiming to enhance the quality of the video or to achieve a specific purpose.

It can be applied in photography, television, cinematography and other digital media.

Many post-production software packages come with filters for adjusting the colour balance, saturation and hue of videos.

Figure2.34 Comparison of images before and after colour correction

(f) Blue screen shooting

Blue screen shooting (or chroma keying) refers to the technique of "keying" an image into a flat colourful background, so as to combine two or more images.

Any evenly coloured background can be used for chroma keying, but a green or a blue one is more common (with greater contrast to the human complexion).

Figure2.35 Blue screen shot and the virtual image after combine

2.3.5 Animations

(a) Introduction

Animations are created mainly with the principle of the persistence of vision.

Persistence of vision refers to the phenomenon where the visual perception of an object remains for some time after the rays of light proceeding from it have ceased to enter the eye.

The principle is also commonly used in handicrafts such as thaumatropes, flip books, as well as line and cell animations.

Refer to Chapter 3.3.4 for more animation skills and techniques.

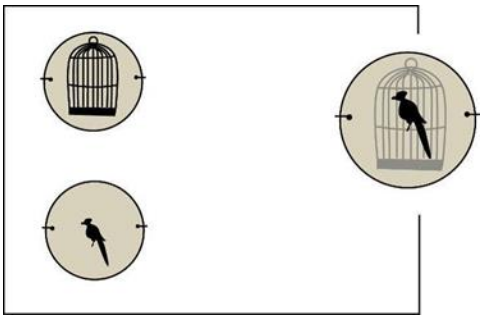


Figure2.36 Flipbook animation

(b) Different types of animation production

(i) Stop-motion animation

For stop-motion animation, pictures are taken frame by frame, with each frame being only slightly different from the previous one.

The stop-motion technique is suitable for clay animation, cut-out animation, object animation, etc.

An example is *King Kong*, a film made by Willis O'Brien in 1933.

Figure2.37 Stop-motion film King Kong

Figure2.38 Clay animation

(ii) 2D animation

Similar to stop-motion animation, 2D animation films are hand-drawn or computer-made frame by frame.

There are two types of animation software packages, namely bitmap and vector-based animations.

Figure2.39 A sequence of 2D animation pictures

(iii) 3D animation

Featuring 3D images in place of 2D ones, it is now used extensively in feature films, videos, computer games and TV advertisements.

Figure2.40 A sequence of 3D animation pictures

(c) Advanced 3D animation technologies

(i) Motion dynamics in animation

A 3D animation system works by simulating the movements of objects.

Firstly, the physical properties of an object, such as the mass and the density, are defined in the software.

The software then simulates the required movements by exerting external forces (such as wind and gravity).

For example, the scenario of a ball falling downstairs can be simulated as a type of collision.

Motion dynamics can also be used for "soft objects", such as changes of the shapes of clothing and hair.

In *Monsters, Inc.*, produced by Pixar, more than 2 million hair strands were computer-animated for a single character.

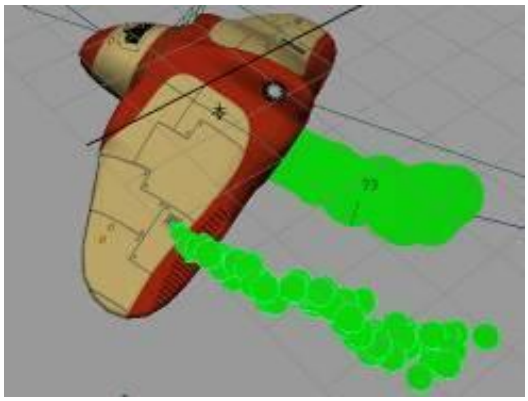


Figure2.41 Example of applying motion dynamics in animation

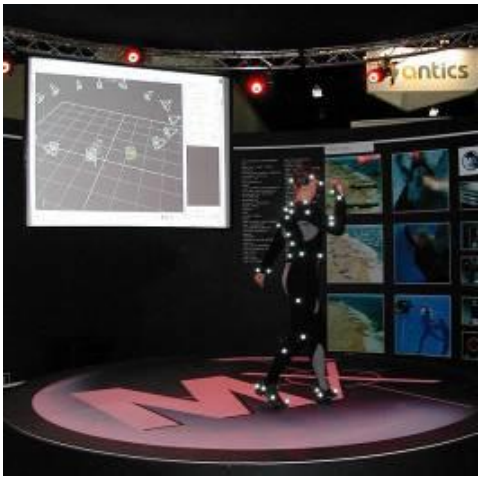
(ii) Motion capture

It refers to the process of recording the movements of the actor/actress for later animation.

The actor/actress has to put on a suit attached with sensory devices. When he/she moves, his/her movements are recorded with the 3D coordinates of the body parts.

A sensory device can be a magnetic device that emits magnetic pulses, or an optical one that makes use of reflection.

A motion capture system produces a large number of frames, thus resulting in a significant amount of data storage.



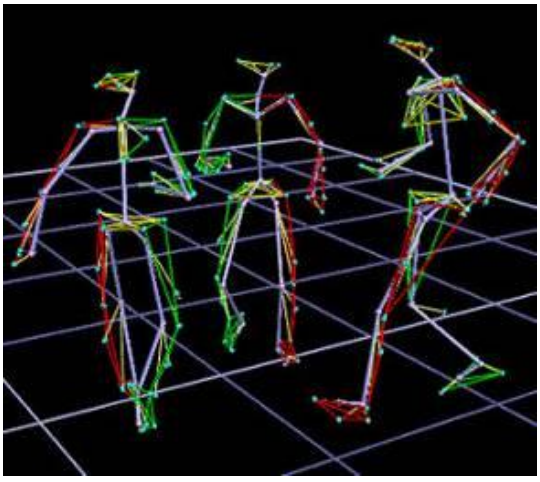


Figure2.42 Applying motion capture in animation

Chapter 3 Digital Media Production

3.1 Project Planning and Idea Presentation Methods

3.1.1 Production timeline

The designer should develop a production timeline, which shows project milestones and deliverables with due dates.

The following is an example for a website development project:

Table 1 Production Timeline of Website Development Project

Due Date	Action
30 May 20xx	Circulate Contact Information of Project Team Members
26 Sep. 20xx	Arrange Project Execution Office
17 Jun. 20xx	Schedule Project Meetings with Client and/or Team, and Collect Preliminary User Requirements
03 Jul. 20xx	Compile Strategic Brief and Work Chart
03 Jul. 20xx	Compile Timeline
15 Jul. 20xx	Analyse User Requirements
15 Jul. 20xx	Produce Storyboard
16 Jul. 20xx	Identify Deliverables Required
20 Jul. 20xx	Develop Project Production Standards and Compile Technology Brief
22 Jul. 20xx	Draft Contract, Compile Cover Sheet and Website Proposal
24 Jul. 20xx	Submit Proposal to Client for Review and Arrange Proposal Sign-off with Client
25 Jul. 20xx	Compile Template Explanation
10 Aug. 20xx	Convert Templates into Web Pages
15 Aug. 20xx	Discuss Compatibility Concerns with Creative Director
20 Aug. 20xx	Compile Programme
20 Aug. 20xx	Write Screens
28 Aug. 20xx	Conduct System Test
05 Sep. 20xx	Conduct User Acceptance Test
08 Sep. 20xx	Submit Testing Reports
20 Sep. 20xx	Submit Training Documents
20 Sep. 20xx	Submit User Manual
30 Sep. 20xx	Launch Website
01 Oct. 20xx	Celebrate Product Launch

3.1.2 Gantt charts

A Gantt chart is a graphical project schedule, which shows the start and finish dates of a project and the related sequence of tasks.

The following is an example for a game development project:

Table 2 Example of a Gantt charts

ITEMS	Week No.														
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Literature Review															
Design															
Level															
Character															
Scene															
Tool															
Modelling															
Animation															
Programming															
Testing															
Project Presentation															

3.1.3 Project resources plans

A project resources plan documents what resources are required in project execution. The following is an example:

Equipment	4 PCs with game engine and development kit & environment
Software and tool	(a) Maya for modelling (b) Virtools for game design (c) C++ and Virtools SDK for game development (d) Body scanners for 3D model digitalisation (e) Motion capture system for animation design and development

3.1.4 Logbooks

A logbook helps the project manager to monitor and to eventually manage the progress of the entire project.

Project team members must complete their own sheets regularly (such as weekly or fortnightly).

A logbook may contain the following information:

(a) Tasks completed in the last reporting period

(b) Tasks to be completed, or the "To-do List"

(c) Findings in background research information (optional)

(d) Documents and reference materials collected (optional)

(e) Ideas generated (optional)

Table 3 Sample Logbook

Project Log Sheet

Project Title:	
Project Supervisor:	
Team Member:	
Week No.:	
Date:	

Activities and Progress:

3.1.5 Scriptwriting

A good script is important in digital media production. It gives readers a thorough understanding about the production.

Scriptwriting involves detailed planning that combines pictures, sound effects, dialogues, narration and textual descriptions (video and audio).

The contents and words of a script should be reader-centred and reader-friendly.

(a) How to do research

Research is the process of collecting information in order to enrich the whole story and the production details.

Literature review refers to the process of collecting information from documents, such as books, magazines, newspapers and newsletters.

Real-life research refers to daily observations, interviews, etc. The following are some common terminologies:

Shot	A continuous sequence of images
Scene	A single part of a film for a particular place and time
Act	A series of scenes of a film, comprising a major part thereof
Plot point	A turning point in the story of a film, which affects the fates of the characters

The following example is the script of a film:
Name of film: *The Mad Phoenix* (《南海十三郎》)
Original work/Screenwriter:TO Kwok-wai (杜國威)
Director: KO Chi-sum (高志森)

According to the Best Hong Kong Movie Script Collection of 1997-98: The Mad Phoenix (published by Hong Kong Screenwriters' Guild)

Table 4 Organised according to the script of "The Mad Phoenix"

Item	Content	Scene
Act 1	(i) Born in Nanhai, KONG Yu Kau (江譽鏐) is a Cantonese opera playwright of genius and a temperamental personality. (ii) The young KONG studies at the Faculty of Medicine of the University of Hong Kong. He meets Lily, a fellow student, at a ball and falls in love with her. After Lily returns to Shanghai, KONG even goes to the city to pursue his true love. (iii) But Lily's parents oppose the relationship, much to KONG Yu Lau's frustration. (iv) KONG returns to Guangzhou and gets fascinated with Cantonese opera. He later meets SIT Kok Sin (薛覺先), a famous Cantonese opera actor. (v) KONG presents his work, the manuscript of "Fishing in the Snow on a Wintry River".	Scenes 1 to 16
Plot Point 1	SIT Kok Sin visits KONG Yu Kau and his father and is warmly welcomed. SIT praises the junior KONG's talent and invites him to write Cantonese opera manuscripts. KONG Yu Kau gladly accepts the offer and takes the pseudonym of "Naam Hoi Sap Saam Long"(南海十三郎) literally meaning "the Thirteenth Gentleman of Nanhai".	Scene 16
Act 2	(i) Sap Saam Long writes manuscripts for SIT Kok Sin and becomes greatly popular in Guangdong, Hong Kong and Macao. (ii) He finds his niece, Siu Yee, working as a hostess at a nightclub. So he helps her leaving the place and becomes a film star. (iii) Sap Saam Long is eccentric and never finds a good assistant, until he meets TONG Tik-sang(唐滌生), who becomes his friend and disciple. (iv) After the outbreak of World War II, Sap Saam Long goads TONG into developing his career in Hong Kong. TONG eventually becomes a famous Cantonese opera screenwriter. (v) Sap Saam Long organises free performances for the Chinese army. But he has conflicts with others and gets squeezed. He also gets fewer and fewer jobs. (vi) Mui Sin, a Cantonese opera actress, recommends Sap Saam Long to be a film screenwriter. Sap Saam Long is unhappy that his works are tampered with and clashes with others. His career goes from bad to worse and comes to a dead end.	Scenes 17-36
Plot Point 2	(i) Sap Saam Long is down and out. Worse still, he is upset to find that his first love Lily is now married to a rich businessman. (ii) Sap Saam Long becomes half-crazy and jumps off a running train. He gets wounded in the head and seriously injured. (iii) Sap Saam Long recovers from his physical wounds. But he is still delirious from time to time.	Scenes 37-39
Act 3	(i) Sap Saam Long's aged parents can no longer take care of him. So they send him to Hong Kong. (ii) Sap Saam Long meets SIT Kok Sin again but refuses SIT's help. (iii) Sap Saam Long meets TONG Tik-sang again, who is willing to take care of him. Unfortunately, TONG dies unexpectedly. Sap Saam Long becomes distraught and is sent to the mental hospital. (iv) When he is discharged, he lives in a temple and learns that his parents have passed away. (v) Sap Saam Long's mental illness gets worse. He becomes a tramp and eventually dies on the street.	Scenes 40-56

3.1.6 Storyboarding

Films and/or animations can be a visual language that conveys messages to the audience.

Producers (such as designers/film producers/directors) should make good use of every shot within the scene to convey messages.

Before starting the production, a storyboard can be used to set the scene, the shots and related details.

(a) Basic structure of a single frame storyboard

A storyboard has to clearly demonstrate the following elements:

(i) Camera framing, angles and movements [refer to Section 3.2.3 ("Video Shooting") for more information]

(ii) Shot duration

(iii) Sounds and dialogues

Image	Shot description Describe actions, as well as camera angles and movements
	Sound Indicate the ideas of key effects, such as ambient sound, narration and music
	Shot duration How long will the action, movement phrase or shot be?

Figure 3.01 An example of storyboard

(b) Basic structure of a storyboard sheet

A multi-frame storyboard can be used to describe the process of the entire script (or story), as in the example below:

Project title: _____ Page: _____

Shot: _____

Sound

Duration

Shot: _____

Sound

Duration

Shot: _____

Sound

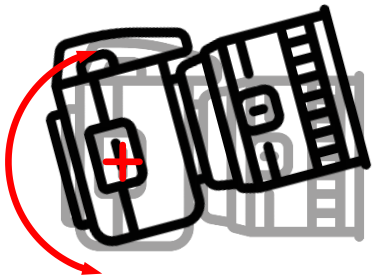
Duration

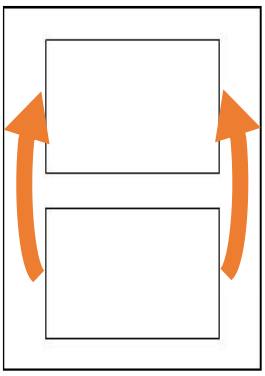
(c) Indication of camera movements

The producer can use arrows on the storyboard to indicate the expected camera movements and scheduling details.

Tilt shot

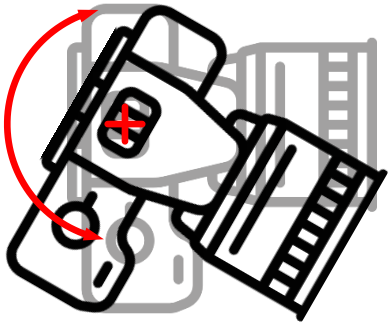
Moving the camera's lens up or down while keeping its horizontal axis constant.

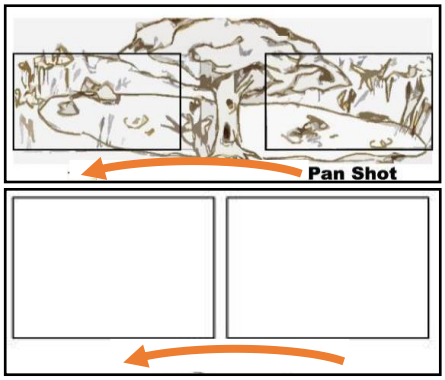




Pan shot

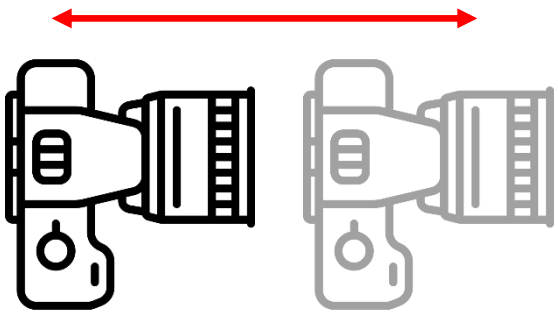
Moving the camera's lens left or right while keeping its vertical axis constant.

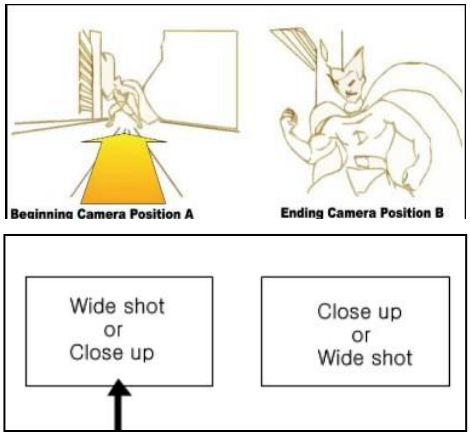




Dolly shot

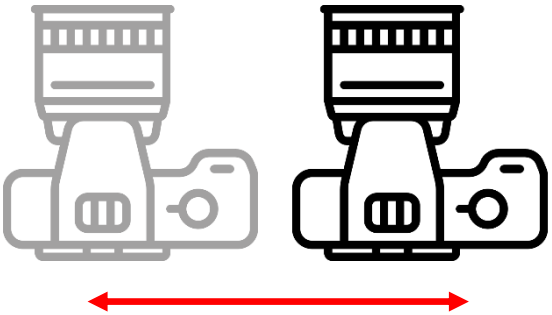
It refers to the movement of a camera moving either towards (dolly in) or away from (dolly out) of a subject.

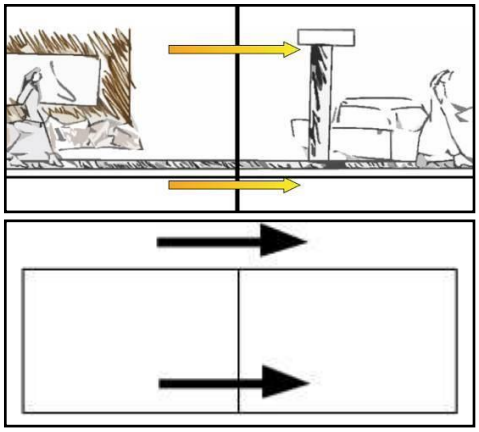




Track shot

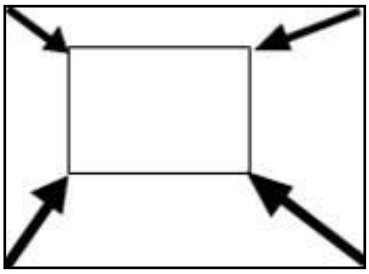
It refers to the movement of an object or a person in lateral direction. (left to right or opposite)

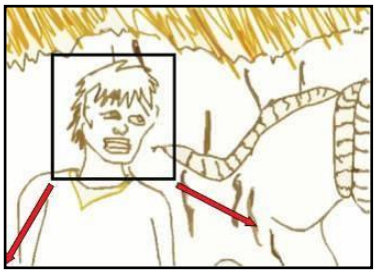




Zoom shot

A zoom-in shot narrows the area shown on a shot (a wider area), using the zooming function of the lens, to a particular part (focus). A zoom-out shot does the opposite.





3.1.7 Scenic design

(a) Purposes of scenic design

- To provide the audience with a visual clue, a historical backdrop or hints of an event happening;
- To reflect the mental status or minds of the actors or actresses through a geographical location;
- To smooth over the transition between scenes;
- To reflect the social status of the characters; and
- To provide additional information for the play

(b) How is scenic design conducted?

(i) Visual research

- Before starting the scenic design, it is necessary to study the theme and style of the play first, in order to ensure art integrity.
- For example, in the film *Divergence* (2005), the assassin's house is mainly decorated with old-fashioned furnishings, in order to reflect his primitive and vagabond life.

(ii) Scenic visualisation

- It facilitates the understanding and exchanges among project team members before the actual production.
- There are four common methods of scenic visualisation, namely freehand sketching, photo collage, miniature and computer-generated imagery (or "CGI").

The advantages and disadvantages of different scenic visualisation methods:

1. Freehand sketching – It is the most flexible method and suits designers with good drawing and designing skills.
2. Photo collage – It saves production time, and is supported by a number of software packages (such as Photoshop).
3. Miniature – It is time-consuming but is capable of presenting scenes of natural disasters for live shooting.

4. CGI (computer-generated imagery) – It requires advanced equipment and technologies, but it enables 3D virtual scenes and clear visual effects. It is especially suitable for an action scenes and large-scale productions.

(iii) Lighting

- The use of lighting colours is important in scenic design since it can stimulate human emotions.
- Designers can create the appropriate dramatic atmosphere by means of colours. For example, green lighting is often used in horror stories.

(iv) Mise-en-scène

- It means "arranging scenes" or "designing and arranging frames".
- It covers blocking, props, costume design, and additional props for supplementary character information.
- The film *Election* (2005) is a good example of furnishing arrangement.

Mise-en-scène helps to provide:

1. Sufficient camera angles for shooting;
2. Sufficient room for shooting equipment;
3. Visual layers for composition; and
4. Foreground and background depth of field.

Figure 3.02 A CGI scene in the film *Star Wars*

3.1.8 Props set-up

(a) What are props?

Props are small items (such as glasses) used in a film or a play. Larger objects (such as desks and chairs) can be considered as part of the set.

Figure 3.03 Prop foods and prop guns

(b) Why is prop design important?

Props are considered as "silent actors". They help to tell the story to the audience.

For example, a pistol is a symbol of justice when it is in a cop's hand, and of crime when it is used by a robber.

Props may have complicated implications. For example, guns play an important role in the film *Infernal Affairs* (2002).

Figure 3.04 ***Reference film: Infernal Affairs (2002)***

(c) How props are designed?

(i) Ergonomics

- Ergonomics is the science of designing the right equipment by considering the characteristics of the human body.
- It aims at minimising fatigue and discomfort by means of appropriately designed equipment, so as to enhance human productivity.
- Before the equipment designing, consideration is given to human-related information, such as the object, the system, the environment and other factors.

(ii)Colours and textures

- When designing props, we must consider the expected roles of colours and textures.
- For example, the Buddha sculpture in the film *A Chinese Tall Story* (2005) was actually made of styrofoam. With the colour and texture effects, however, it looked like an old and weathered bronze statue.

(iii) Materials

- For safety purpose, dangerous weapons are usually replaced by dummies in films or plays, such as fake guns.
- For example, knives may be made of wood or EVA foam, which is a lightweight, shockproof and rigid material.

(iv) Simplification

- Making props too fancy and meticulous may delay the production process. Therefore, we should consider:
  1. Making props with ready-made products;
  2. Applying the modular design concept to simplify the workflow; and
  3. Separating props into different parts and assign the manufacture to craftsmen with related expertise.
- For example, in the film *Purple Storm* (1999), there is a protective tank for biochemical weapon, which was actually made of modular pieces sprayed with silver paint.

3.2 Manipulation of Visual and Audio Equipment

There are various types of visual and audio equipment available in the market. Designers should have the related know-how and manipulation skills.

3.2.1 Sound recording

- In films, videos and animations, sounds and voices can be used to create an atmosphere where the audience's moods will be led towards desired directions.
- Sounds and voices can be added to works with computer software or from a well-prepared sound library in post-production.
- For sync sound recording (i.e., live recording), suitable recording equipment should be used and the appropriate volume (dB) and quality selected.

Figure 3.05 Digital recorder

(a) Sound recording equipment

For sync sound recording, appropriate sound equipment and basic manipulative skills are required.

Figure 3.06 Recording microphones used in Beijing Olympic Games 2008

(b) Microphone placement

Microphones, or "mics", should be placed in appropriate positions for the best recording input. For example:

(i) Overhead

(iii) Clipped on clothing

(ii) Underneath

Figure 3.07 Allocation of Microphones

(i) Mics are placed overhead in most occasions, so as to enable easy and quick movements.

(ii) They may also be placed underneath (on the floor). But the space will be limited if the actors or actresses need to move around.

(iii) Microphones can also be hidden in the actors' or actresses' clothes.

The sound level must be constantly monitored during recording to keep it between the lowest (silence) and the highest (saturation point) levels.

Tip: Mobile phones and other alarming devices on site should be switched off during recording.

3.2.2 Photography

"Photography" means "drawing with light". The related products are photographs or 'photos' in short or simply 'pictures'.

There are various types of photography equipment available in the market. Photographers should have the related know-how and manipulation skills.

(a) Compact digital cameras

Compact (or mini) digital cameras are small and easy to carry.

In many cases, digital photos are stored in the JPEG compression mode.

However, such cameras often lack advanced features (such as long-range shooting), and the image quality is generally low.

Most of them have built-in flashlights, which, however, are low in power and are only sufficient for nearby subjects.

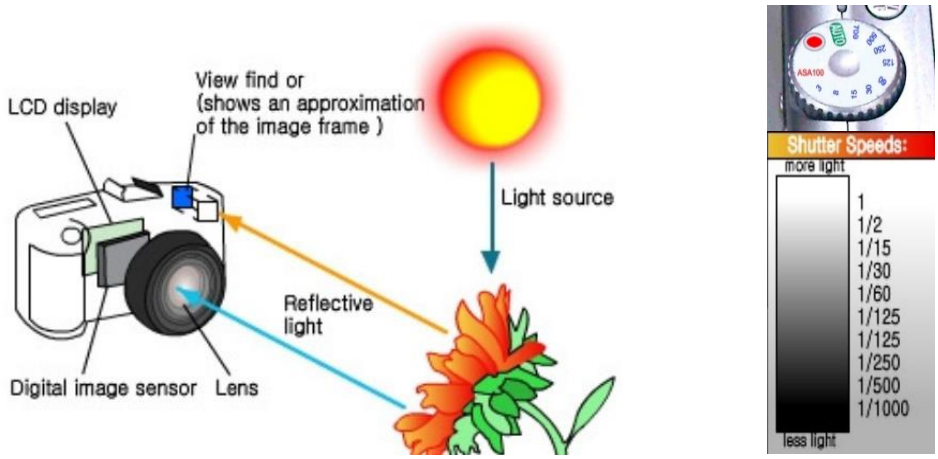


Figure 3.08 Operation of digital camera

(b) Camera operations

(i) Shooting modes

Among a variety of shooting modes, the two fundamental ones are automatic and manual.

In some cases, compact digital cameras also provide a wide range of shooting modes, such as "close up", "night", "party", "sports", etc.

(ii) Shutter (shutter speed)

The light enters the camera through the shutter (which is opened) and then produces an image on the sensor.

The speed at which the shutter is opened affects the time it takes for the image sensor to receive light.

The shutter speed is measured in seconds.

(iii) Aperture/depth of field

Depth of field (DOF) is the distance between the nearest and farthest objects in a scene that appear sharp in an image/a photo.

Objects within the DOF appear sharp (in focus), while those beyond this range become blurry.

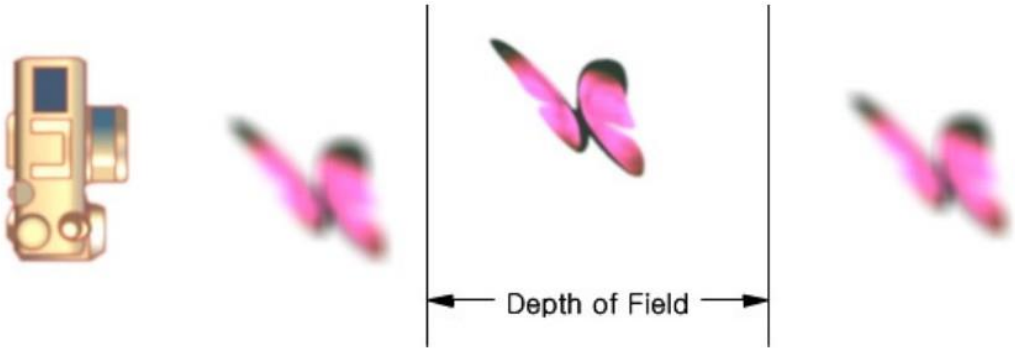


Figure 3.09 Depth of field

(iv) Exposure

Exposure refers to the quantity of light reaching a photographic film, as determined by its sensitivity to light.

Exposure value is the extent (as determined by the aperture) and the time (as determined by the shutter speed) of a photosensitive material exposed to light.

Aperture + Shutter Speed = Exposure Value

(v) White balance

To digital cameras, "white" is a value related to the ones with which other colours are recognised.

Some digital cameras have the function of automatic white balancing, but others require manual tuning.

(vi) Colour temperatures

The colour temperature measures the quality of a light source based on the ratio of blue light to red light (excluding green light).

The colour temperature is measured in Kelvin (K). For example, the colour temperature of sunlight is about 5,000K.

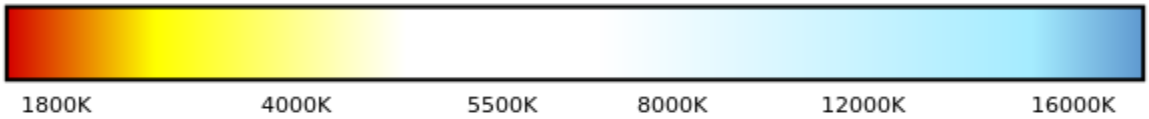


Figure 3.10 Schematic diagram of colour temperatures

Light with different colour temperatures can be broadly divided into three types, namely warm, cool white, and cool.

Name	Descriptions
Warm light	Its colour temperature is below 3,300K, with more red. It gives a warm, healthy, comfortable and sleepy feeling.
Cool white light	Also known as neutral light, it has a colour temperature between 3,300K and 5,300K. It emits gentle rays and offers a pleasant, comfortable, serene feeling.
Cool light	Also known as daylight, it has a colour temperature of over 5,300K. The light source is close to the natural light. The brightness keeps people awake and concentrated.

3.2.3 Video shooting

Digital camcorders come in many models, but most of them support high definition videos (HDVs).

There are different storage means, such as video tapes, burned DVD discs, memory cards and hard drives.

Figure 3.11 Camcorders for different users

(a) Storytelling in video shooting

Successful storytelling relies heavily on the size and placement of the shots.

Well-composed shots can create a logical and dynamic sequence, paving the way for later video editing.

(b) Size of shots

The six stationary camera shots below have their respective inherent narrative and psychological effects.

- Extreme Long Shot (ELS)
- Long Shot (LS)
- Medium Long Shot (MLS)
- Medium Close-up (MCU)
- Close-up (CU)
- Extreme Close-up (ECU)

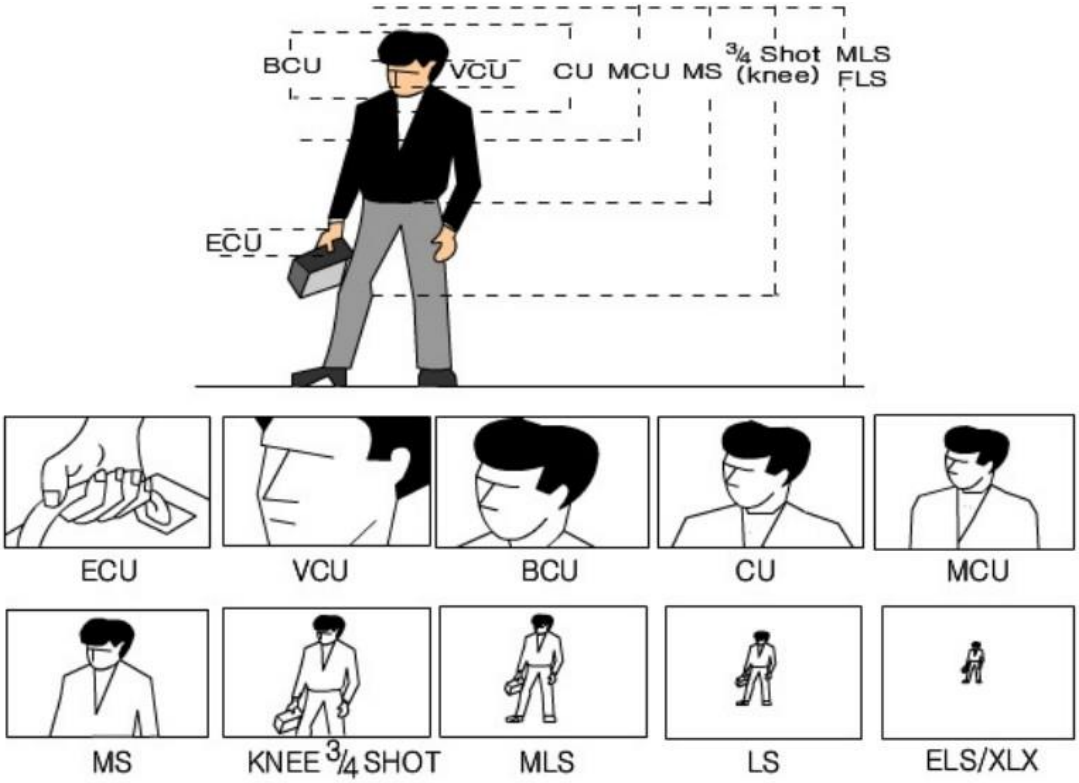


Figure 3.12 Different size of shots

Extreme Long Shot (ELS)

An ELS screen is usually full of buildings, landscapes or people, which are all small in scale.

It is often used as the beginning or the end of a sequence, serving as the establishing shot.

ELS/XLX

Long Shot (LS)

The objects in an LS screen are small. The height of a person is about that of the screen. It is commonly used for a full body action.

The shots are relatively stable, enabling movements without reframing.

LS

Medium Long Shot (MLS)

An MLS framing is usually able to show an object of four to five feet high, with little space left.

MLS

Medium Close-up (MCU)

Objects in an MCU framing are fairly large and almost fill the whole screen.

It is a common shooting size.

MCU

Close-up (CU)

Objects in a CU framing are relatively large.

Human head or objects of a similar size can fill the entire frame.

CU

Extreme Close-up (ECU)

Objects (such as small items or the face) in an ECU framing are very large. They can generally fill the entire screen.

ECU

(c) Camera angles

Shots can be taken at a level similar to the subject, or else at a lower/higher level (at a low/high angle). The angle of view can reflect the relationship between the subject and the object.

Normal/eyelevel

The camera is placed at the viewer's eye level.

High angle

The camera is placed at a level significantly higher than the subject.

Low angle

The camera is placed at a level slightly below the object.

(d) Camera movements

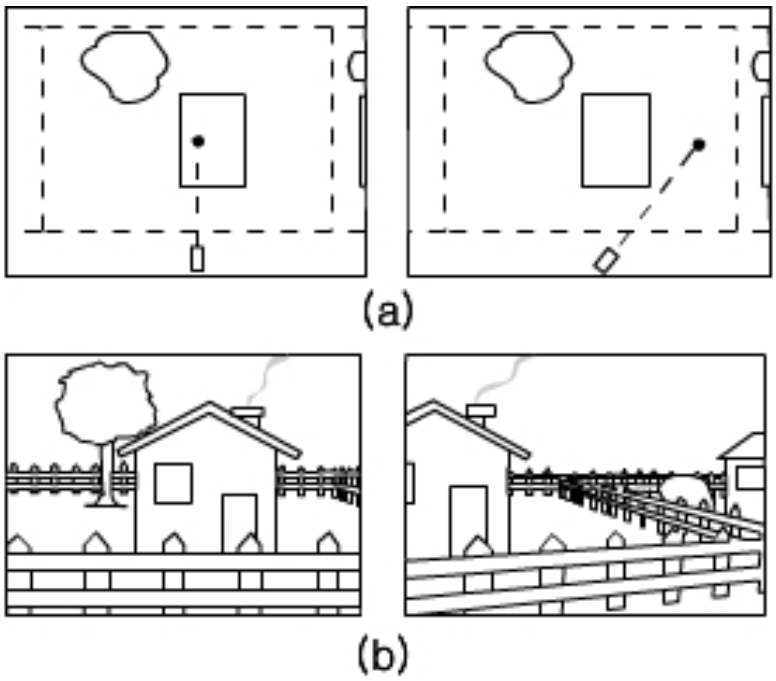
Camera movements change the viewer's angle of view.

Such movements can represent the movements of the subject or those of the viewer.

They can also create changes in the distance and position between the camera and the object, by means of techniques such as panning, tilt shot, tracking shot and zooming.

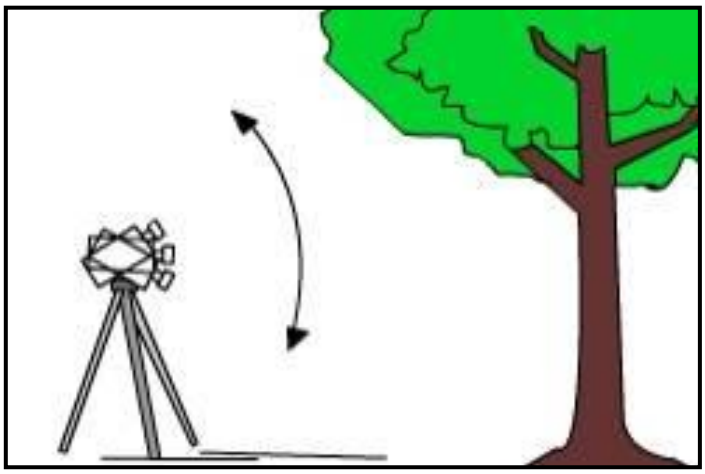
Pan shot

Pan shot means a position-fixed camera rotates around horizontally.



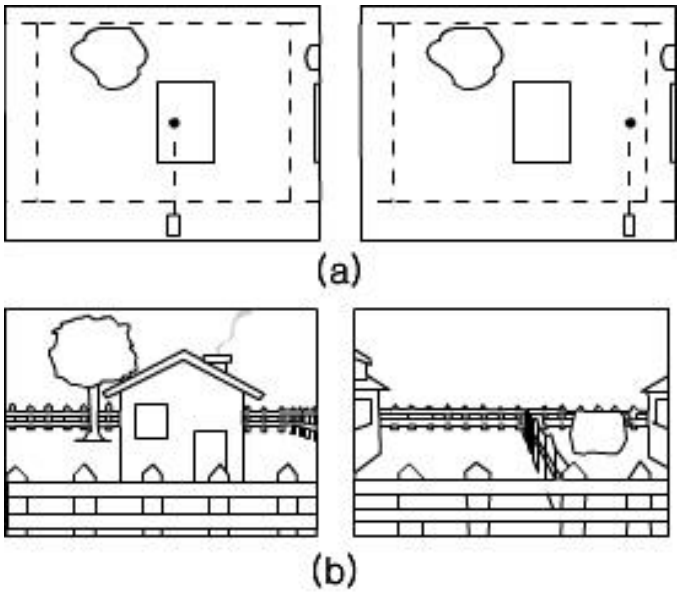
Tilt shot

Tilt shot means a position-fixed camera rotates around virtically.



Tracking

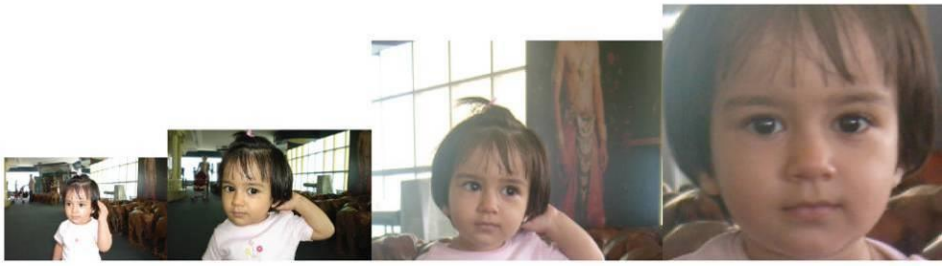
"Tracking" means the camera moves along with the subject.



Zooming

Zooming brings the object from a faraway position to a near one (zoom in), or vice versa (zoom out). It also enables exaggeration of a scene.

A zoom-in shot causes greater perspective distortion effect, while a zoom-out shot does the opposite.



(e) Composition and framing

Composition is the appropriate arrangement of various elements of the scene to convey information and concepts.

(f) Headroom

Headroom is the space between the top of the character's head and the upper edge of the frame.

The size of the space will affect the visual effect of the screen.

(g) Looking space

The looking (or talking) space is the space between the head of the character and the edge of the frame.

The space should be large enough so that the character seems to be looking at something or someone, or to be talking with someone.

(h) Reverse shots

For a reverse shot, the camera is positioned behind the characters. It is commonly used to present the scenario of a conversation between two people.

(i) Point of view

A point of view (POV) shot is taken from the character's point of view.

It creates a subjective viewpoint that puts the audience into the character's shoes.

3.2.4 Lighting equipment

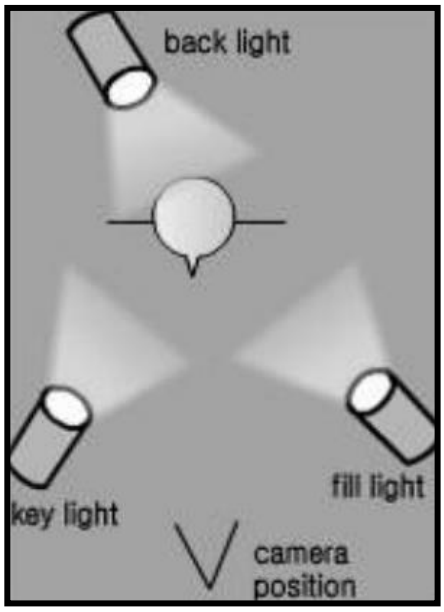
Lighting creates a desirable atmosphere or mood for photography or video taking.

Three-point lighting

Three-point lighting creates a sense of depth with three light sources. It is the standard lighting technique for classical narrative cinemas.

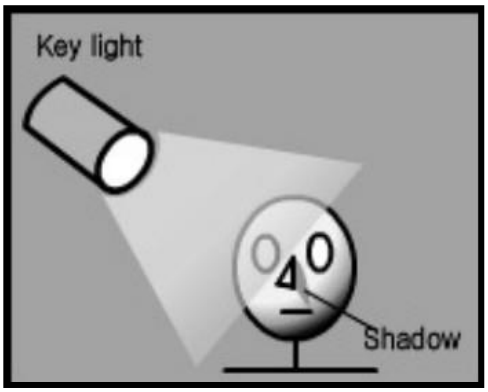
The backlight differentiates the subject from the background, creating a sense of depth.

The key light accentuates the subject, while the fill light minimises the faint shadows created by the key light.



Key light

A key light is the key or primary light source that draws the audience's attention.



Backlight

A backlight is a light source from the back.

It brings up the subject from the background to the audience.

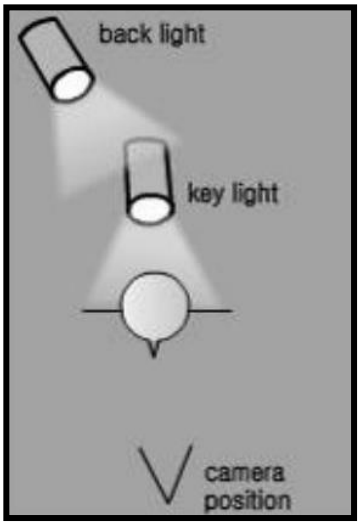
Fill light

A fill light source fills light in, and thus softens the shadows created by the key light.

It should be more diffuse, less intense and less focused than the key light.

Rim light

A rim light is a member of the back light family. It outlines the object and emphasises the edges.



(a) Lighting contrast

"Contrast" is the proportion and difference produced when the bright and the dark sides are put together.

"High contrast", or a larger difference, is often used in horror films. It can be created by using low-key lighting in a dark scene.

"Low contrast", or a smaller difference, is often used for more naturalistic lighting.

(b) Lighting colours - Meaning of colours

Coloured lights are often used to show different scenes, times or atmospheres, creating appropriate effects.

For example, blue is mostly used for a cold winter, and yellow for a hot summer.

(Refer to Section 3.2.2 – Photography – Colour temperatures)

Figure 3.13 Different colour can create different effects

Interview shooting tips

(a) Remind the interviewee to look at the interviewer, not at the camera;

(b) Shoot the interviewee from an angle slightly to either left or right, without straight-on shots;

(c) Move the camera closer to the interviewee for a larger image, instead of using the zooming feature for close-up shots;

(d) Arrange a chair without wheels for the interviewee to avoid squeaky noise;

(e) Ask persons on the scene to keep silent during shooting and avoid making any noise, such as jangling of keys;

(f) Discuss the topics briefly with the interviewee beforehand, but do not conduct a pre-interview, as the responses may become stilted in the actual interview;

(g) Allow the camera to roll for several seconds before asking the first question, for fear that the camera is not yet ready; and

(h) The interviewer should relax and listen during the interview, without nodding or any other gesture.

Figure 3.14 Points to be aware of during an interview shooting

3.2.5 Storage and formats

Digitally recorded images and videos must be saved with reliable storage devices.

(a) Image storage devices

A variety of mobile storage devices can be used to store digital images.

With the technology advancement, the physical sizes of storage devices become smaller and smaller, while the storage sizes become larger and larger.

USB flash drive **CompactFlash** **SD card** **xD card**

MiniSD card **microSD (right)** **Mini CD (left)**

Figure 3.15 Different kinds of storage device

(b) File formats and resolution

Storage devices can keep an image in a variety of file formats.

Generally, images in these files can be viewed on a computer (or a connected TV set).

Images captured by cameras can be of different degrees of clarity (measured in pixels), which is called "resolution".

An image with a higher resolution consists of more pixels and shows more detail.

Figure 3.16 Using different kinds of file format to save digital images

(c) Video storage devices

Many digital camcorders support HDVs and have different storage means.

The more common ones included burned DVD discs, video tapes, memory cards, hard drives, etc.

(d) Video formats

Video footages taken by digital camcorders come in different storage formats.

The more common ones include:

1. Quicktime (MOV) – A multimedia format developed by Apple Inc.
2. Window Media Player (AVI) – A multimedia format developed by Microsoft Corporation
3. MPEG2（mpg2）– A format of high image quality and suitable for high-resolution displays, such as the DVD format.

3.3 Application software

This section will go through some software applications for processing images, sounds, animations and videos.

3.3.1 Image editing

Common raster image design software: Photoshop, PhotoImpact, Paint Brush

Common vector design software: CorelDraw, Illustrator

(a) Image file formats

Many image files are stored in raster formats, while others are in vector ones.

However, vector images should be firstly converted into raster ones if they are to be displayed on the screen.

(b) Sizes of image files

The sizes of image files are measured in bits.

A raster is made up of multiple dots called pixels, which consist of different numbers of bits.

A 1-byte (1B) pixel has 8 bits and can store up to 256 colours.

A 3-byte pixel (24 bits) can store about 16 million colours, which is called “true colour”.

In general, the size increases as the number of pixels and the colour depth increase.

Figure 3.17a 1 bit (black and white)

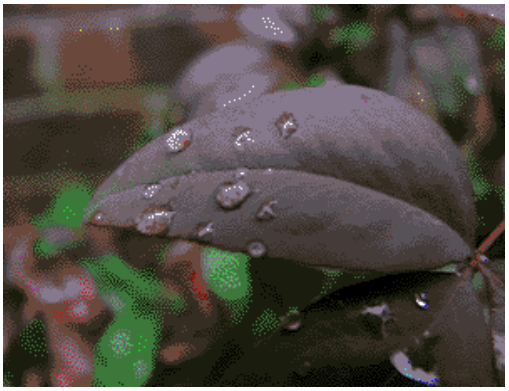


Figure 3.17b 4 bits (16 colours)

Figure 3.17c 8 bits (256 colours)

Figure 3.17d 24 bits (about 16 million colours)

(c) Image manipulation

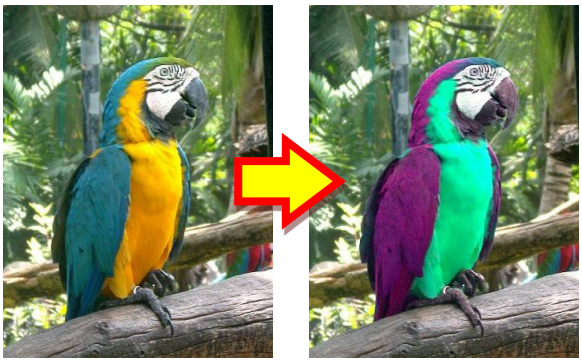
Image editing is to alter the images in digital photographs, traditional analogue photographs or illustrations.

In digital image editing, digital photos taken or scanned are processed on the computer.

(i) Selective colour change

Image editing enables changing the colour of a certain part.

Some image editing tools even enable colour swapping for specific items in an image.



(ii) Colour adjustment

Image editing enables change of colours, such as fade-in and fade-out effects, or else change of tones with curves or other tools.

The colour balance value can also be modified, especially for photos taken with incorrect white balance.

(iii) Contrast correction and brightening

The contrast of an image can be altered as well, so that the image becomes brighter or darker.

Some software can brighten only pixels below a specified value, leaving the rest unaffected.

(iv) Special effects

Special effects can be added to images, in terms of distortion, combination, or else artistic, geometric or texture effects.

3.3.2 Graphic design and desktop publishing

Desktop publishing (DTP) refers to the use of the computer to arrange the page layout of a document to be published.

Newspapers, posters, magazines and books can all be digitised with a DPT software.

(For more information, refer to the user manuals of common image design software, such as Adobe Photoshop.)

(a) Layout design

(i) Page

- A page refers to a paper-like plane which can be viewed and edited with software.
- A3, A4, B4 and letterhead are common page sizes.

(ii) Printing components

- Text, photos and images are the three major elements in page design.

(iii) Layout

- Layout is the process of laying elements appropriately on a page, usually in line with aesthetic and graphic design principles.

(iv) Graphic design

- Graphics are usually drawn by graphic designers, who may also take care of typesetting at the same time.
- Many DTP applications also provide users with some commonly used images or photos.

(v) Typesetting

- Typesetting means placing the contents (text, photos and images, etc.) approximately on the page.
- There are several factors to consider in typesetting:
  - Text – Size, font, line spacing, paragraph spacing, tables, superscript/subscript, etc.
  - Photos – Size, resolution, colour, brightness, etc.
  - Graphics – Size, resolution, colour, line thickness, combination, etc.

(b) Digital media

- Digital media are electronic media available to viewers (or users).
- On the contrary, traditional print media do not require electronic equipment, but they can be made with computer software as well.

(c) Web design

- Similar to DTP, web design is intended to put multiple design elements together.
- However, web design often involves animations, hyperlinks and various interactive elements.
- There are computer software packages for the purpose, such as Dreamweaver.

(d) Tracing artwork

- Some illustration software has a variety of features. For example, in Illustrator, we can draw with the Pen tool, create a new image based on a bitmap, or convert a photo into a vector (with the Live Trace tool).

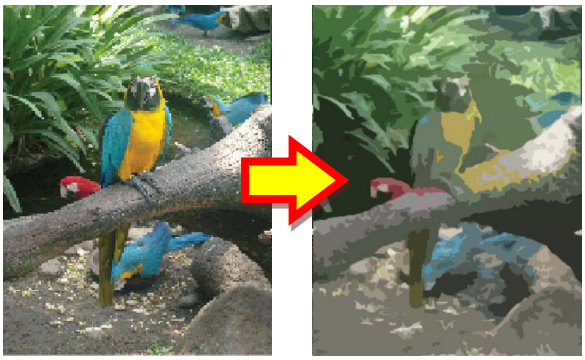


Figure 3.18 Images before and after tracing

(e) Symbol creation

- Some illustration software (such as Illustrator) enables the creation of symbols by combining different objects (such as text, images, etc.).

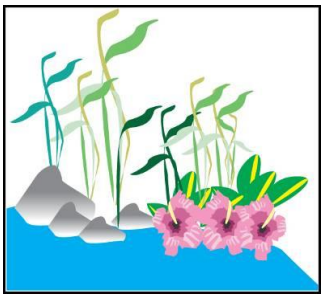


Figure 3.19 An illustration created with symbol tools

(f) Text

- DTP software enables many different ways of text processing. For example, columns and rows of text can be created. And text fonts and spacing can also be chosen.
- Unlike word processing software, DTP applications generally allow text to be placed in a framework and to be moved around like an image.

3.3.3 Video editing software

Video editing software can be used to manipulate videos, such as importing and exporting, editing, adding transitions and special effects, etc.

Some packages even enable the creation of DVDs, online videos, mobile videos and video podcasts.

(For more information, please refer to the user manuals of related software, such as Ulead Video Studio and Microsoft MovieMaker.)

A video can be regarded as a sequence of multiple pictures, but it can be processed by related software in a non-sequential manner.

Basic video editing techniques include Cut, Dissolve and Wipe.

Cut

A cut removes an unnecessary part from the sequence.

Start **End**

Dissolve

A dissolve is a gradual transition from one image to another by controlling their exposure.

Start **End**

Wipe

A wipe refers to the spatial transition from one image to another with a distinct edge. Expanding circles are the most common edges.

Start **End**

Start **End**

(a) Sound editing

Sound editing refers to the edition of music, voices and other sound effects, including addition of echo, amplification and noise reduction.

(b) Waveforms

Sound can be represented visually as "waveforms": The louder the sound, the higher the waves.

Waveforms help editors to locate the segments to be edited.

For a stereo sound, the waveform is generally divided into the left and the right channels.

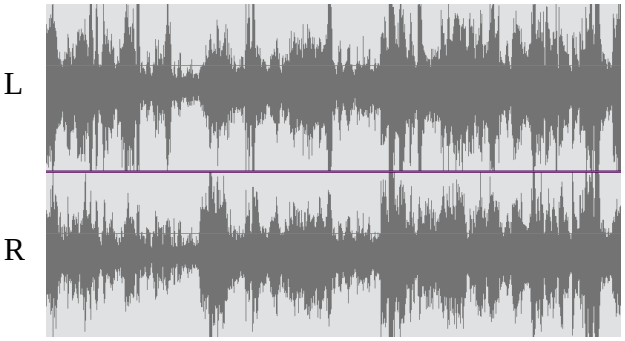


Figure 3.20 A Soundwave

3.3.4 Animation software

Animation software is mainly used to create and move animations of images.

Computer animations can be divided into two categories, namely those of 3D models, and those of 2D illustrations.

Objects or models in 3D animations are created firstly on the computer screen.

Objects or illustrations in 2D animations, on the other hand, can be created on separate transparent layers.

The features of an animated character (such as the limbs, the body, the eyes, the nose, the mouth, etc.) are decided by the animator.

The character appears in a frame, and the ending is shown in another frame.

The transition between two key frames can be handled by software. The process is called "tweening" or "morphing".

(For details, please refer to the user manuals of related animation software, such as Autodesk 3DS Max and Adobe Flash.)

(a) Animation – 3D workflow

1. Design precise 3D models: Set up basic 3D models for characters, props or objects.
2. Add basic colours: Add basic surface colours to the models.
3. Add various attributes: Set different attributes, such as materials, textures, etc.
4. Create the scene: Place the models in an environment with cameras and lighting effects.
5. Conduct refinement and testing: Finalise the images after refinement and testing.

Step 1: Design precise 3D models

Step 2: Add basic colours

Step 3: Add materials and textures to the models

Step 4: Create an environment with cameras and lighting effects

(i) Pre-production Stage

The pre-production phase involves detailed planning before the actual production of the animation.

It includes conceptualisation and planning that cover research, script writing, project planning (cost, scope and time), storyboarding, initial scenic design, characters, etc.

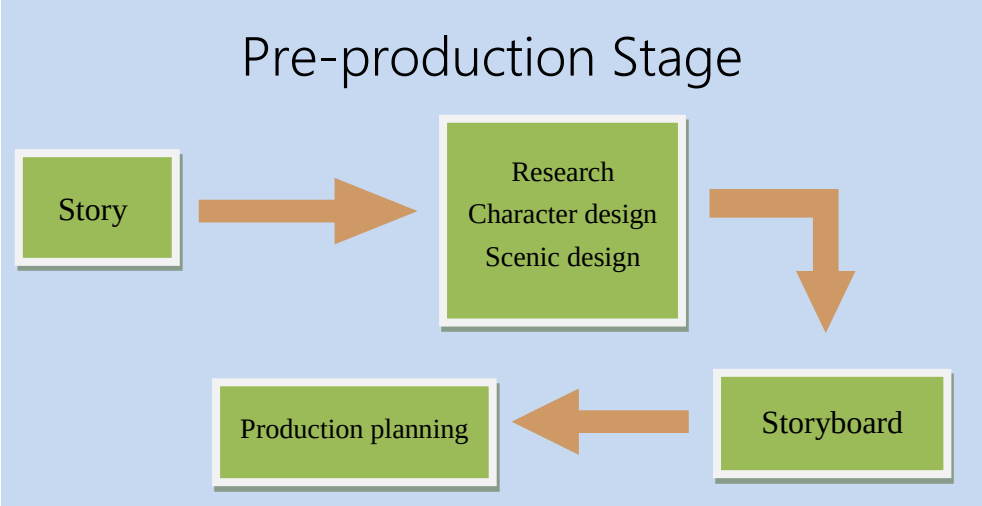


Figure 3.21 Pre-production process

(ii) Production stage

The production stage consists of modelling, rigging, animation, shading and rendering.

Modelling means setting up models for characters, objects, scenes and the environment.

Virtual modelling tools can be used to sculpt objects, while 3D digitizers can be used to scan the 3D shapes of physical objects.

After modelling, 3D characters are rigged with virtual skeletons for animation.

"Skeletal animation" or "rigging" is a technique in computer animation.

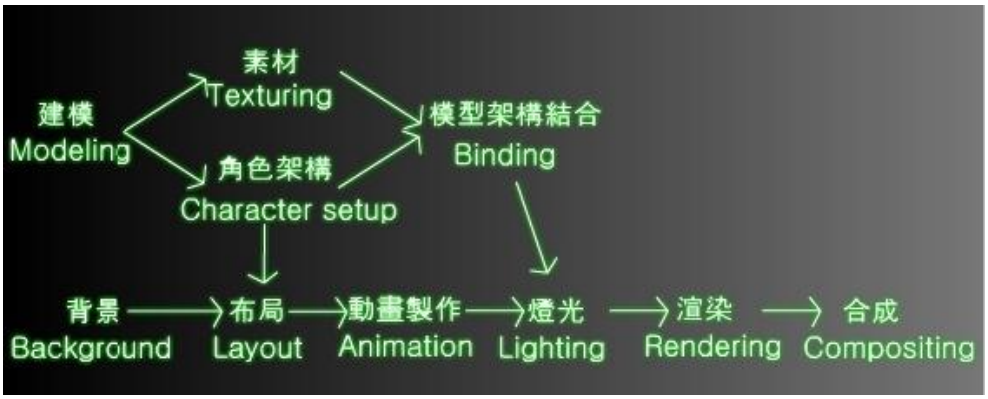


Figure 3.22 Production workflow

(iii) Post-production stage

Post-production refers to the processing and finishing work upon the completion of basic animation.

It includes retouching, distortion, colour correction, dubbing and adding sound effects among others.

(b) Production methods

(i) Working environment of 3D animation

A fundamental difference between 3D and 2D animation productions lies in their working environments.

When drawing a 3D model, we should generally take into account multiple directions such as the Top, the Front, the Left, and the Perspective.

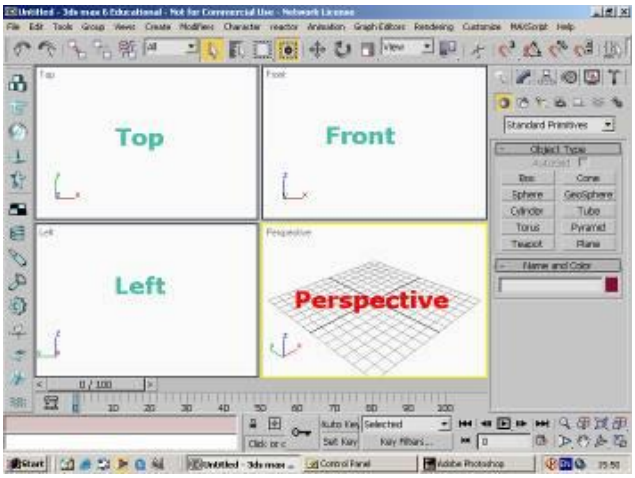


Figure 3.23 To create 3D animation, we have to move, rotate and scale the object by changing scales along the X, Y and Z axes.

(ii) Geometric primitives

3D animation software generally provides drawing elements (primitives) of simple geometric shapes for modelling.

Such primitives include cubes, spheres, cylinders, cones and etc.

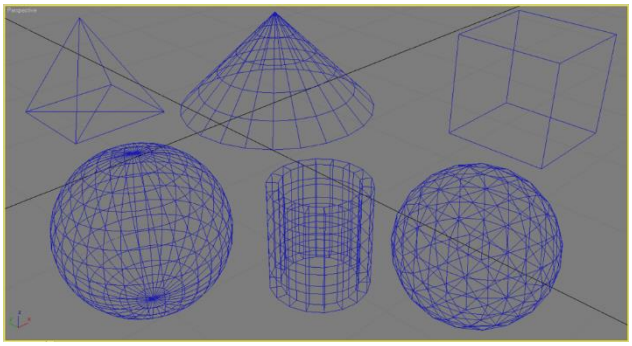


Figure 3.24 Geometric primitives: Cylinder, cube, sphere and cone

(iii) Polygonal modelling

Polygon modelling refers to the drawing of polygons to shape the surface of an object, usually starting from the vertex.

A vertex is a point in the 3D space. Two vertices form a front line (edge).

Three edges form a triangle, while several triangles form a polygon.

Multiple polygons form the surface of the model, and then complete the entire 3D model.

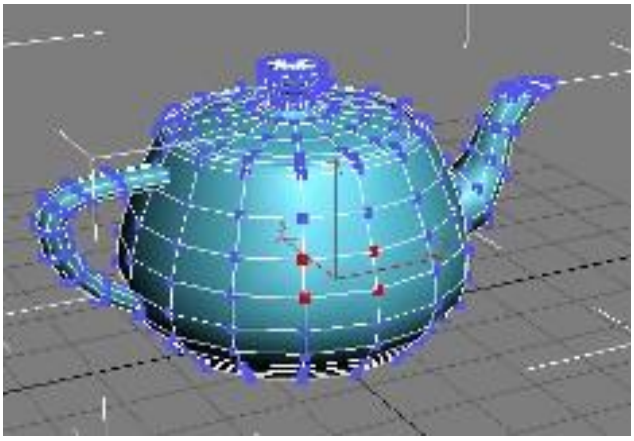
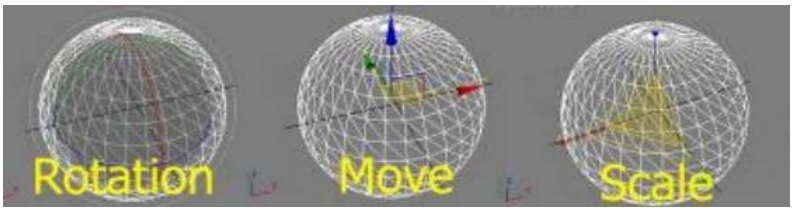


Figure 3.25 Polygon modelling: Polygons defined by vertices and edges

(iv) Transformations in 3D

A 3D coordinate system is generally defined by three axes (X, Y and Z). The X and Y axes form a plane, to which the Z axis is perpendicular. With the coordinate system, an object can be "transformed", by means of moving, rotating and scaling.



F3.26 Basic 3D transformations

Moving: It refers to positional changes of an object, including in terms of the distance and the direction.

Rotation: It refers to directional changes in the surface of an object. It requires the user to provide a rotation axis.

Scaling: It refers to dimensional changes of an object along the three axes (X, Y, and Z).

(1) Transformations in 3D - Key frames and in-betweens

- Key frames (or key poses) are the starting and ending frames of an action or a change.
- In-betweens are the frames between key frames.
- Many digital animation software packages (such as Flash, 3DS Max and Maya) can complete an action based on in-betweens provided by users.
- A sequence consists of multiple actions or changes, so it contains many key frames.

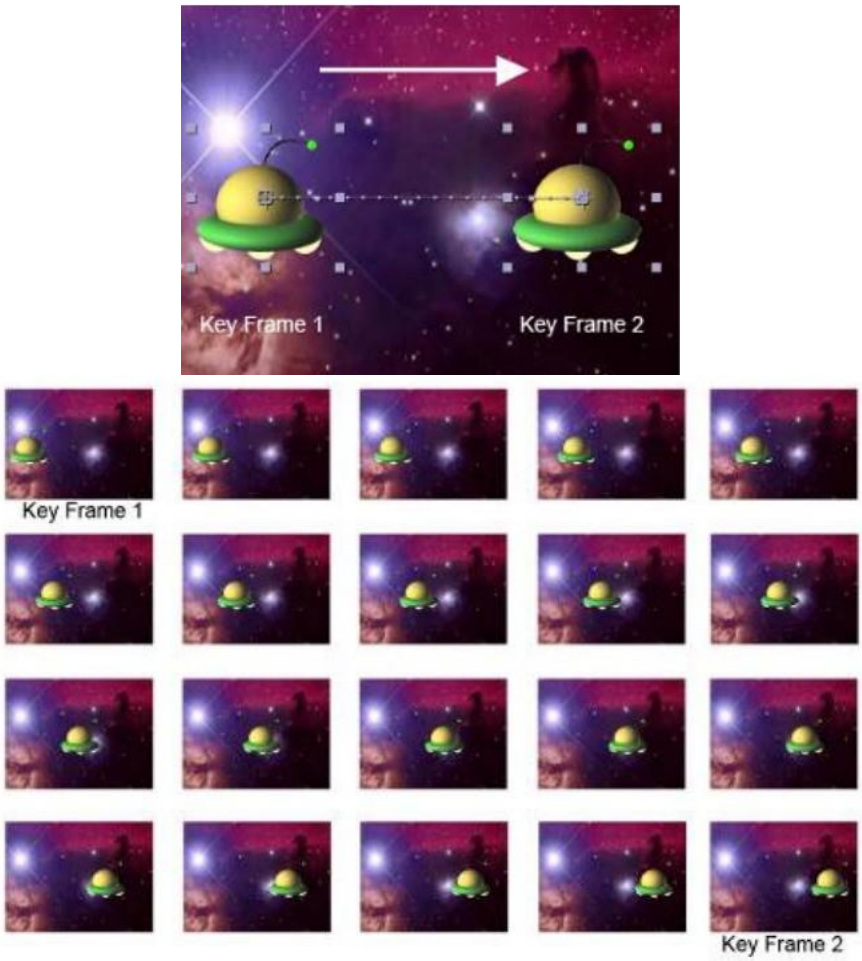


Figure 3.27 Keyframes and in-betweens of an action

(2) Transformations in 3D - Motion path and frame rate

- An animation can be as simple as moving an object along a path, i.e. a linear "motion path".
- The frame rate is the number of frames played within an assigned period of time (such as 1 second).

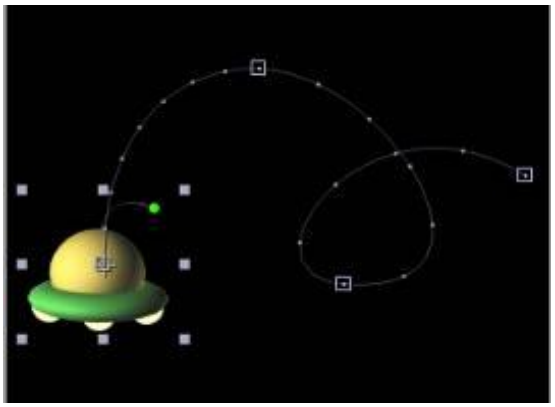


Figure 3.28 Path animation

(v) Shading: Materials and textures

Shading is to apply attributes such as the material and the texture to an object, making it more realistic. Materials refer to attributes on the surface, such as colour depth, reflection, refraction and transparency.

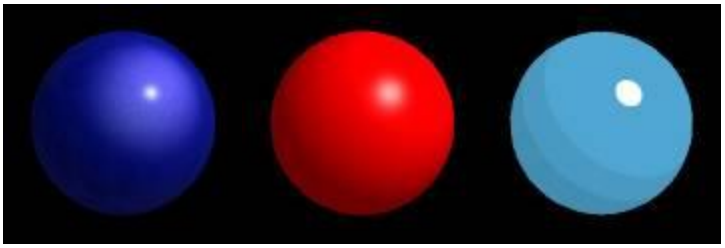


Figure 3.29 Three different materials applied to the same 3D model

Sometimes, for a more realistic appearance, photos or other patterns are applied to the object, which is called "texture mapping".

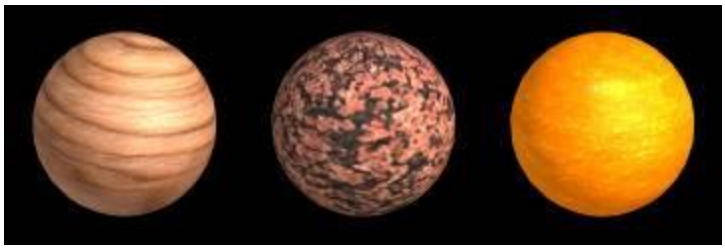


Figure 3.30 Three different materials and texture mappings applied to the same 3D model

(vi) Lighting

Lighting is an important element in 3D scenes. It enables clear display of 3D shapes and sets the mood for the scene.

Figure 3.31 3D effect can be enchanced by lighting, it also sets the mood for the scene

Lighting source in 3D production include point, directional and spot lights. A point (or omni) light casts rays in every direction from a single source.

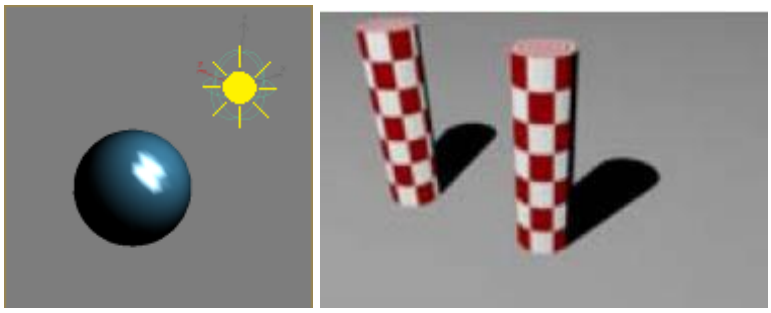


Figure 3.32 Rays from a bulb cast in all directions

A directional (or parallel) light casts parallel rays to the same direction, like the sun or a distant light source.

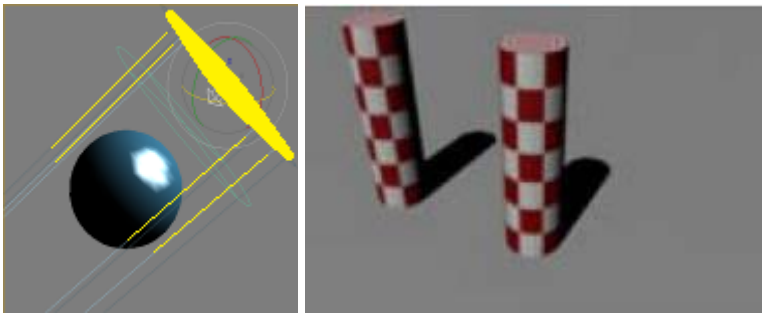


Figure 3.33 Parallel rays towards a single direction

A spot light is similar to a point light but its rays form a cone towards a particular direction.

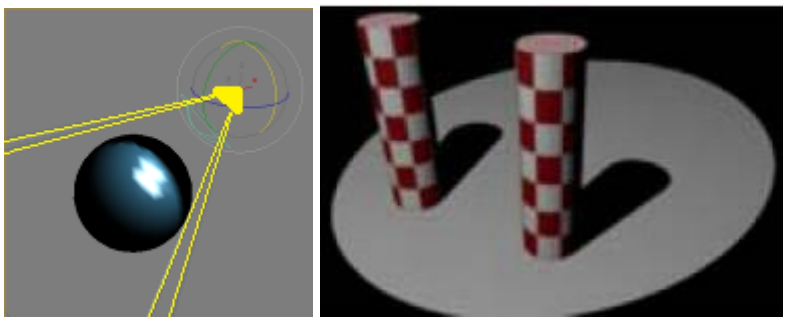


Figure 3.34 Rays of a spot light forming a cone

(vii) Rendering

Rendering refers to converting the wireframe view of a 3D model into a photo-realistic 2D image.

Rendering is an important technique of 3D animation and are often used along with others.

Rendering can also be used in film and TV production for special effects and visualisation.

The production process starts with conceptualisation, goes through modelling, lighting and animation setup, and ends with rendering.

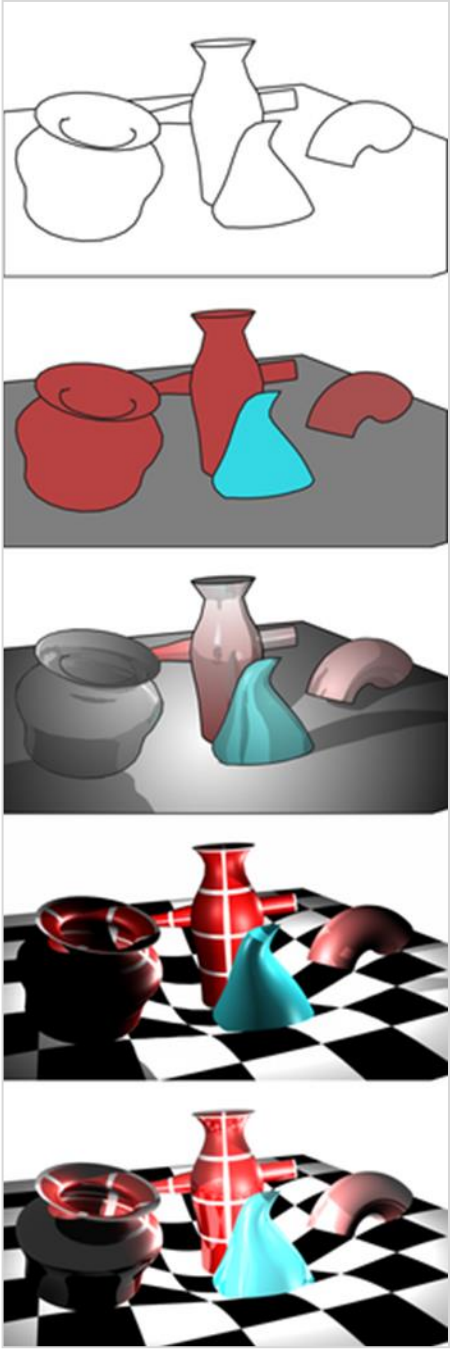


Figure 3.35 Rendering process

Figure 3.36 Rendering of the European Extremely Large Telescope

Figure 3.37 Rendering of a man-made satellite