Fundamental of Digital Media Design

Chapter 3

Introduction to Graphic

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Chapter Description

- Aims
  - To understand the fundamental of graphic
  - To identify the graphic format and their characteristic
  - To explore the use of graphic in multimedia
- Expected Outcomes
  - Understand the basic concept of graphic
  - Able to manipulate and produce a graphic design
- References
  - Savage, T.M., Vogel, K.E. An Introduction to Digital Multimedia 2nd ed. 2013. Jones & Bartlett Learning ASIN: B00LZM6ESY.
  - Screen size and resolution comparisons
    http://www.prismo.ch/comparisons/
  - Nigel Chapman and Jenny Chapman, Digital Media 2nd Ed.,2004, John Wiley & Sons, Ltd. ISBN:: 0-470-85890-7

Topics

At the end of this lesson, you will understand:

- What is graphic?
- The format of graphic
- The use of graphics in multimedia
- Characteristics of graphics

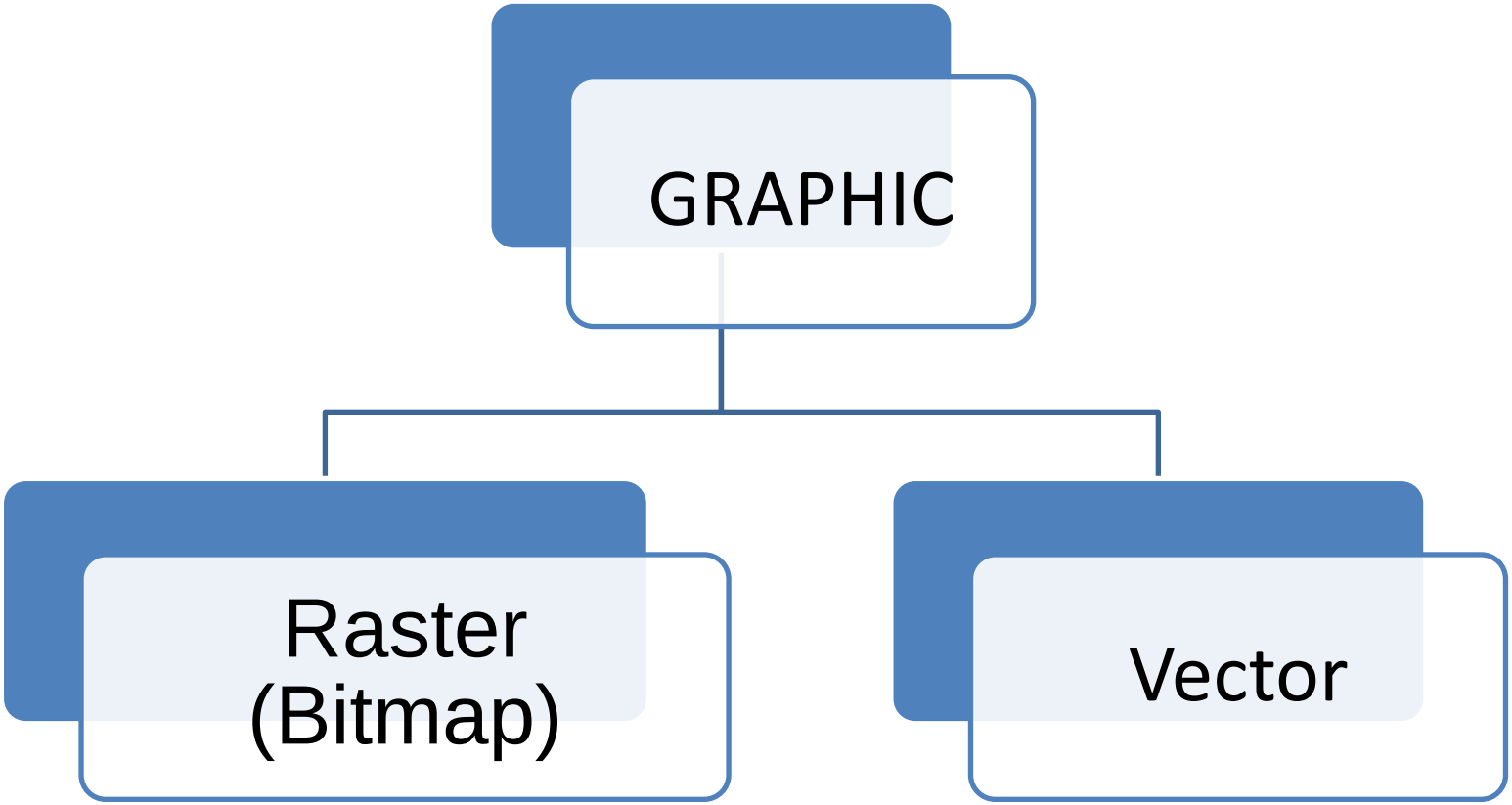
What is Graphic?

- Graphic is rectangular image displayed on a screen or printed
- Stored in a file of its own format or can be embedded in another data file
- Manipulate by graphic software/tools

What is the different between this two image?

Picture source: https://pbs.twimg.com/media/CMRlrHcU8AAqma-.jpg
https://handsontime.in/category/watches/celebrities/

Graphic Representation



Graphic Representation

RASTER / BITMAP

- The image is modelled by an array of pixel values
- Scaling up (enlarge) raster image greater than the actual size will make the image looks jagged or blurred and loss quality
- Image source: digital camera or scanner

Graphic Representation

VECTOR

- The image is stored as mathematical description of a collection of individual lines, curves and shapes making up the image
- Represent digital image with compact, scalable, resolution-independent and easy to edit.
- Scaling up vector, the image will remain smooth because it is performed by a simple mathematical operation.
- Image source: built up using shapes that can easily be described mathematically.

Graphic Properties

3 elements of graphic properties are:

1. **RESOLUTION**
   - Numbers of pixel/dot per inch
2. **COLOR /BIT DEPTH**
   - Determine numbers of colors
3. **SIZE**
   - Width and height

Graphic Properties (cont)

RESOLUTION

- Number of dots per inch (dpi) OR pixel per inch (ppi) used to display or print the image
  - E.g:
    - Computer monitor used 72 dpi
    - Printer: 600 – 2400 dpi
- Effect
  - Higher resolution >> more memory used

Graphic Properties (cont)

Standard display resolution (4:3)

Code	Width	Height	Ratio	Description
QVGA	320	240	4:3	Quarter Video Graphics Array
HVGA	640	240	8:3	Half Video Graphics Array
VGA	640	480	4:3	Video Graphics Array
SVGA	800	600	4:3	Super Video Graphics Array
XGA	1024	768	4:3	Extended Graphics Array
XGA+	1152	768	3:2	Extended Graphics Array plus
	1152	864	4:3	
SXGA	1280	1024	5:4	Super Extended Graphics Array
SXGA+	1400	1050	4:3	Super Extended Graphics Array plus
UXGA	1600	1200	4:3	Ultra Extended Graphics Array
QXGA	2048	1536	4:3	Quad Extended Graphics Array

Graphic Properties (cont)

Wide screen display resolution (16:9)

Code	Width	Height	Ratio	Description
WXGA	1280	768	5:3	Wide Extended Graphics Array
	1280	800	16:10	
	1366	768	~16:9	
WXGA+	1280	854	~3:2	Wide Extended Graphics Array plus
	1440	900	16:10	
	1440	960	3:2	
WSXGA	1600	900	16:9	Wide Super Extended Graphics Array
	1600	1024	16:10	
WSXGA+	1680	1050	16:10	Wide Super Extended Graphics Array plus
WUXGA	1920	1200	16:10	Wide Ultra Extended Graphics Array
WQXGA	2560	1600	16:10	Wide Quad Extended Graphics Array
WQUXGA	3840	2400	16:10	Wide Quad Ultra Extended Graphics Array

Graphic Properties (cont)

COLOR /BIT DEPTH

- Bit depth determine the numbers of unique colors in an image's color palette.
- An image not necessarily use all the available colors, but it can specify the precision level of colors.
- Higher bit image can encode more colors since there are more combination of 0's and 1's.

Graphic Properties (cont)

COLOR /BIT DEPTH

- Number of Colors calculation

#colors = $2^{\#bit}$ (E.g: 2^8 = 256 colors)

Picture source:
https://postproduction.emerson.edu/hc/en-us/article_attachments/211099567/Bit_Depth.gif

Graphic Properties (cont)

COLOR /BIT DEPTH

Bits Per Pixel	Number of Colors	Common Name
1	2	Monochrome
2	4	CGA
4	16	EGA
8	256	VGA
16	65536	XGA (High Color)
24	16777216	SVGA (True Color)
32	16777216 + Transparency	
48	281 Trillion	

Comparison of bits, total colors & common name

Graphic Properties (cont)

SIZE

- refers to pixel dimension of an image (often refers as resolution)
- not its file size in kilobytes (KB)
- measured in various unit such as:
  - inches
  - centimeters (cm)
  - pixels (dots)
  - picas (1/6")

Image Compression

- Process to encode or convert an image file to reduce the file size
- Compression technique reduces the image size without affecting or degrading its quality
- Two types of image compression:
  1. Lossy
  2. Lossless

Image Compression

LOSSY Compression

- Remove some data from original image file and save the image with smaller file size.
- Suitable for natural image such as photograph.
- Reducing the color space to the most common colors in image
- File format:
  - JPG / JPEG

Image Compression

LOSSLESS Compression

- Original image data will be preserved
- Widely used for archival purpose such as medical image, technical drawing and clip art.
- There are few methods for lossless compression such as run-length encoding, area image compression, entropy encoding, differential pulse code modulation (DPCM), etc.
- File format:

  - PNG
  - TIFF
  - TGA
  - BPG
  - PGF
  - PCX

Graphic File Format

JPEG (Joint Photographic Experts Group)

- Raster (bitmap)
- Primary applications:
  - Photographs
  - Web pages
- Lossy compression
- Filename extension: .jpg / .jpeg

Graphic File Format

GIF (Graphic Interchange Format)

- Raster (bitmap)
- Primary applications:
  - Diagram and clipart
  - Web pages
- Lossless compression
- Maximum of 256 colors or gray
- Special features:
  - Interlacing
  - Transparent color
  - Animated
- Filename extension: .gif

Graphic File Format

PNG (Portable Network Graphics)

- Raster (bitmap)
- Primary applications:
  - Photographs, diagrams, and clipart
  - Web pages
- Lossless compression
- Three forms:
  - Gray-scale, 16.7 million colors, 256 colors
- Special features:
  - Dual direction interlacing, variable transparency
- Filename extension: .png

Graphic File Format

BMP (Bitmap Graphic)

- Standard **raster (bitmap)** format for Windows
- 16,7 million colors
- Filename extension: .bmp

WMF (Windows Meta File)

- Standard **vector** format for Windows
- Can contain a bitmap image
- Filename extension: .wmf

Graphic File Format

PICT (Picture)

- Standard graphic for Macintosh
- Raster (bitmap) or vector (object—oriented)
- 16.7 million colors or 256 grays
- Filename extension: .pct or .pict

Image in Multimedia

Images can be:

- Drawings
- Paintings
- Photographs
- Sequences image→Video

Conclusion of The Chapter

- Graphic is widely used in digital media that consist or the real photo or drawing image.
- There are 3 properties of graphic: resolution, color and size
- Two types of image compression are lossless and lossy.
- There many types of graphic file format depends on the types of compression, such as .jpeg, .png, .bmp, .wmf and .pct