

9 Computer Graphics and Design

Topic

Graphics software, raster graphics, vector graphics and its use

Learning objectives

Students will be able:

- to use vocabulary related to graphics software
- to identify the function of different graphics tools
- to describe graphics software
- to discuss applications of computer graphics

Key words

raster graphics, bitmap, vector graphics, resolution, scale up, distorted, equations, filters, composite, CAD, wireframe, solid modelling, rendering, texturing, fractals, GIS Toolbox, marquee select tools, move tool, crop, paintbrush, eraser, paint bucket, eyedropper, zoom, colour palette, applet, fractal, frame, pie charts, bar charts, line graphs, x-y graphs or scatter graphs, desktop publishing

Abbreviations: JPEG, GIF, TIFF, CAD, GIS

Graphics software

Computer graphics are pictures and drawings produced by computer. There are two main categories:

- **Raster graphics** represent images as **bitmaps**; they are stored as a collection of pixels. The density of dots is known as a **resolution** (in dots per inch) and determines how sharp the image is. When a picture is scaled up, the number of pixels stays the same, they move apart and the image can become distorted. Popular raster formats are **JPEG**, **GIF** and **TIFF**. This software is used in digital cameras.
- **Vector graphics** represent images through the use of geometric objects, such as lines, curves and polygons, based on mathematical **equations**. They are expressed in a vector format, so they have a starting point, a length and a direction. They are easy to change or enlarge without any loss of resolution.

When a vector graphics image is enlarged, the number of pixels used to make up the image increases in proportion, so the detail remains the same. It is ideal for high-resolution output.

There are many types of graphics software:

- **Image manipulating programs** let you edit your favourite images – scanned or from your digital camera; and add various filters (special effects) or **composite** images – combine parts of different images to create a single image. An example – Photoshop, Zoner Photo Studio.



- **Painting and drawing programs (illustration packages)** offer good facilities for freehand drawing, with a wide choice of pens, brushes, shapes, colours and patterns. Choices are made mainly with a mouse and icons. An example is Windows Paint.
- **Business graphics programs (presentation software)** let a user import data from a database or a spreadsheet and create pie charts, bar charts, line graphs, x-y graphs or scatter graphs. It offers a range of colours and formats to make a presentation impressive. Typical application is presenting statistics.
- **Computer-aided design (CAD)** is used to design everything from cars, buildings, engineering drawings to furniture and fashion design. It can generate very accurate drawings which can be reduced in size or enlarged without losing accuracy. Designers start a project making a **wireframe** – the shape of the object is presented by a layer of joined up triangles or polygons, so the object looks as if it is made of wire. Then they specify and fill the surfaces to give it the appearance of a 3D solid object with a volume – this is called **solid modelling**. Next **texturing** follows – adding colour and filters to achieve the desired look and finally **rendering** which includes lighting and shading and effects which make the object look real.
- **Desktop publishing** is based on a page layout program which lets you import text from a word processor, clip-art /ready-made pictures) from graphics packages, and images from scanners or cameras, and arrange them on a

page. It is used to design and publish books, newspapers, posters, advertisements, etc.

- **Digital art (computer art)** is used in adverts and TV programmes. Artists and scientists use special graphics applets that use mathematical formulae to create beautiful bright shapes called **fractals**. A fractal is a geometrical figure with special properties. It is also used to model real objects like clouds or landscapes.
- **Computer animation** uses graphics programs to create or edit moving pictures. Each image in a sequence of images is called a **frame**.
- **Geographic information system** allows cartographers to create detailed maps.

Vocabulary

	Definition	Translation
bar charts	a graph with bars whose lengths are proportional to quantities	sloupcový diagram, graf
bitmap	an file format for digital images where an image is made up of a large number of dots or pixels	bitmapa
CAD	Computer Aided Design, a software package allows a designer to create technical drawings and schematics	CAD
colour palette	the collection of colours available in a system	paleta barev
compositing	combining parts of different images to create a single image	fotomontáž
crop	to cut down the dimensions of a picture	oříznout
desktop publishing	the use of computer system for all steps of document production, including typing, editing, graphics and printing	počítačová sazba
equation	a mathematical statement that two expressions are equal	rovnice
eraser	a tool used to delete a part of a picture	nástroj guma
eyedropper = colour picker	a tool used to select a specific colour in a photo	nástroj kapátko
filters	special effects that can be applied to pictures	filtry
fractals	geometrical patterns that are repeated at small scales to generate irregular shapes, some of them describe objects from nature	fraktál
frame	a single picture in a film	okénko, políčko
GIF	Graphic Interchange Format used for image files, especially suitable for images containing large areas of the same colour, for example, clipart.	GIF formát

GIS	Geographic Information System, a type of graphic software able to analyse geographic data and make maps, predict natural disasters, etc	geografický informační systém
JPEG	Joint Photographic Experts Group, a common format suitable for photographic images	JPEG formát
line graph	a graph consisting of dots linked with lines	spojnicový graf
marquee select tools	tools used to select a particular part of an image	nástroj výběr
move tool	a tool used to move a part of a picture	nástroj přesun
paint bucket	a tool used to fill in an area with a colour	
paintbrush	a tool used to paint lines	nástroj štětec
pie charts	a circular chart divided into triangular areas proportional to the percentages of a whole	kruhový, výsečový graf
raster graphics	an file format for digital images where an image is made up of a large number of dots or pixels	rastrová grafika
rendering	a technique that generates realistic reflections, shadows and highlights	vytváření rastrového obrazu stínováním, využitím přiřazených barev a povrchových materiálů, s aplikací pozadí scény
resolution	a number of pixels per inch	rozlišení
scale up	to enlarge	zvětšit
scatter graph		bodový diagram
solid modelling	a technique for representing solid objects, including specifying and filling the surfaces to give the appearance of a 3-D object	prostorové, 3D modelování
texturing	adding paint, colour and filters to an object	vytvoření povrchové struktury objektu
TIFF	Tagged Image File Format, often used for images to be printed	TIFF formát
toolbox	a collection of drawing and painting tools	panel nástrojů
vector graphics	images represented through the use of geometric objects such as lines, curves and polygons base on mathematical equations	vektorová grafika
wireframe	the drawing of a model by tracing features like edges or contour lines	drátový model
zoom	a tool used to magnify areas of an image	nástroj lupa

Tasks and Questions

1) Complete the text about with the following words.

resolution CAD raster 3-D wireframes texturing
vector rendering solid modelling computer animation

Computer graphics

There are two types of computer graphics: (1) _____ graphics, where each pixel is separately defined, and (2) _____ graphics, where mathematical formulae are used to draw lines and shapes. Using this second type of graphic results in sharper graphics with no loss of (3) _____ when the object is scaled up.

During the late 1970s, personal computers became more powerful, capable of drawing more complex shapes and designs. In the 1980s, artists and graphic designers started using personal computers as a serious and exciting new design tool. (4) _____ (Computer Aided Design) allowed designers to make (5) _____ to show the edges of an object, and then add colour and filters to make it look more realistic, a process known as (6) _____. They could even add light and shadow, known as (7) _____.

Three-dimensional, or (8) _____, computer graphics became possible in the late 1980s with the invention of powerful SGI computers, which were later used to create some of the first (9) _____ films at the Pixar movie studio. 3-D graphics became more popular in the 1990s, in gaming, multimedia and animation.

Computer graphics continue to become even more detailed, due to more advanced computers and better (10) _____ software applications – the tool which allows designers to make graphics appear in 3-D.

http://www.cambridge.org/servlet/file/store7/item620180/version1/Infotech4ed_WS_U20GraphicsAndDesign.pdf

2) Watch the video tutorial and try to form a few questions and tasks for the other students. Watch it twice. Write the tasks on the blackboard.

- a) http://www.youtube.com/watch?v=mw_KZb8jmNc
- b) <http://www.youtube.com/watch?v=CzesxYUk090>

3) Decide which type of graphics software is best for the following users and explain why; use conditionals or the phrases from the box.

For that task I would recommend.....because

For that task the best thing would be It allows you to...

I would definitely choose because

- a) A newspaper publisher
- b) A scientist who wants to make fractal shapes of natural phenomena
- c) A family who want to edit their own photos
- d) An illustrator who wants to make freehand drawings for a book
- e) A presenter preparing slide shows for training sessions or conferences
- f) A company manager who wants to present statistics
- g) An architect designing buildings
- h) A geographer making 3D virtual models of the Earth surface
- i) An expert creating dynamic simulations and special effects for films, advertisements and games
- j) An electrical engineer designing circuits

4) Listening: The toolbox: Infotech p. 103

Graphics programs usually have a *toolbox* – a collection of drawing and (1) _____ tools that enable you to type, (2) _____, draw, paint, edit, move, and view images on the computer.

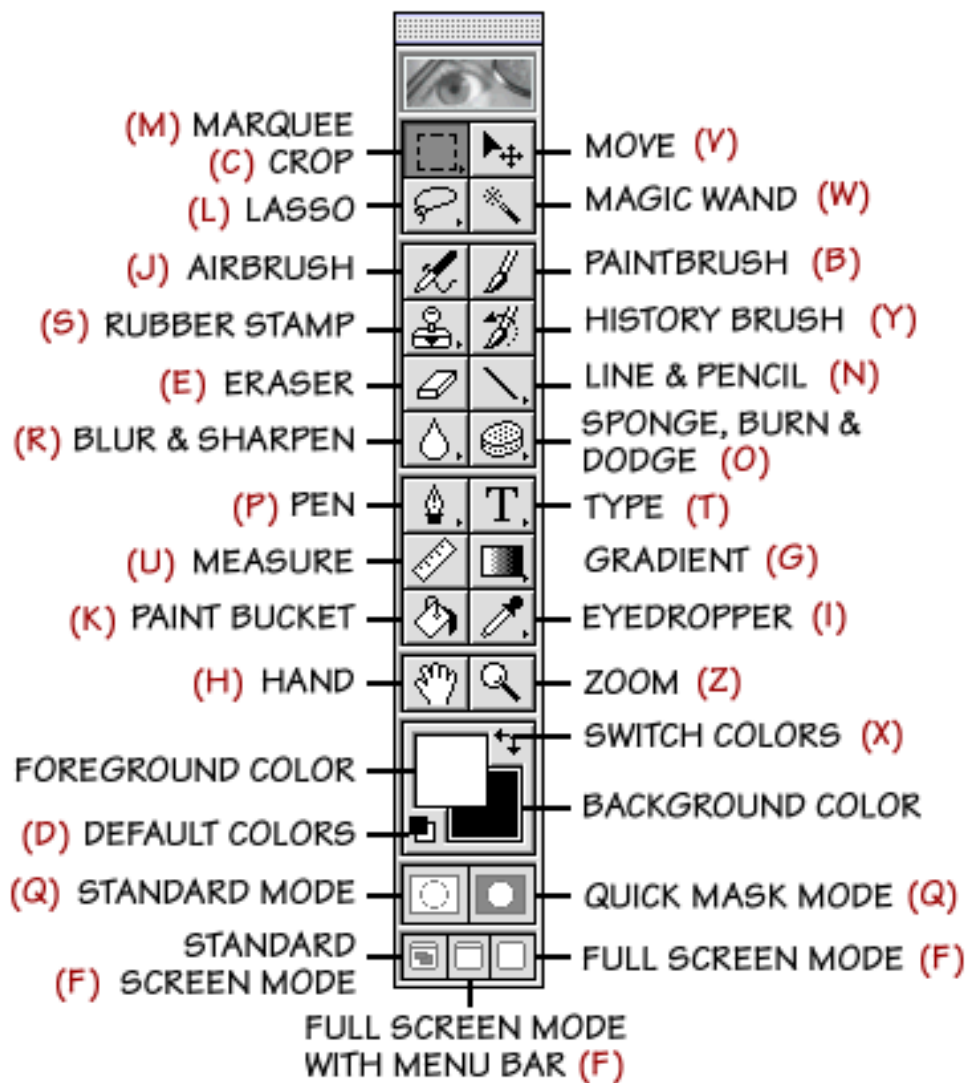
The basic shapes which are used to (3) _____ graphical objects are called *primitives*. These are usually geometric, such as lines between two points, arcs, circles, polygons, ellipses and even text. Furthermore, you can specify the *attributes* of each primitive, such as its colour, line type, fill area, interior style and so on.

The various tools in a toolbox usually appear together as pop-up icons in a menu or palette. To use one, you

activate it by (4) _____ on it. For example, if you want to (5) _____ a rectangle, you activate the rectangle tool, and the pop-up options give you the possibility of (6) _____ rectangles with square or rounded corners.

You can transform an object by translating, (7) _____ or scaling it. *Translation* means moving an object to a different location. *Rotation* is (8) _____ the object around an axis. For example, you may need to rotate an object 90 or 180 degrees to fit the drawing. (9) _____ is making the object larger or smaller.

5) Study the Photoshop toolbox, which tools would you use for the following functions?



1. Cut down the dimensions of a picture
2. Select a part of a of an image in a particular shape
3. Fill in an area with a colour
4. Change the foreground and background colour
5. Select a specific colour in a photo
6. Magnify areas of an image when you are doing precise, detailed work
7. Delete a part of a picture
8. Insert text into your document
9. Draw and paint in a different shapes and patterns
10. Move a selection or entire layer by dragging it with the mouse
11. Increase contrast in the areas where you paint.
12. To paint hard-edged lines

6) Watch the tutorial and answer the following questions:

<http://video.about.com/graphicssoft/The-Magic-Eraser-Tool.htm>

- a) What is the man in the video doing?
- b) What is the magic eraser tool used for?
- c) Is it possible to do the same another way? Compare the two ways.
- d) Where is the magic eraser tool located?
- e) How does the magic eraser tool operate?
- f) What was the problem after the first use of the magic eraser tool?
- g) How did the man solve the problem?
- h) What did the man do finally? What was the final result?

7) Describe stages involved in drawing a plane using a computer software.
Use pictures in exercise 5, page 104 Infotech.

Summary

Computer graphics are pictures and drawings produced by computer.
There are two main categories:

- **Raster graphics** represent images as **bitmaps**; they are stored as a collection of pixels.
- **Vector graphics** represent images through the use of geometric objects, such as lines, curves and polygons, based on mathematical equations.

There are many types of graphics software, for example: Image manipulating programs, painting and drawing programs, business graphics programs, computer- aided design (CAD), desktop publishing, digital art (computer art), computer animation programs, geographic information system.

Questions:

1. What are the differences between raster graphics and vector graphics?
2. What is a bitmap?
3. What are filters?
4. What is compositing?
5. What types of graphs do you know?
6. What does CAD stand for?
7. Describe stages involved in drawing an object using CAD software.

8. Name some tools used in graphics programs and describe their use.
9. What is a clipart?
10. Name as many practical applications of CAD programs as possible.

Literatura

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