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SOFIA UNIVERSITY
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ICT-TEX course on Digital skills

Topic 4: Computer graphics and visualization

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ICT IN TEXTILE AND CLOTHING HIGHER EDUCATION AND BUSINESS

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Introduction

- Computer graphics is a broad term, for representation of images with computers
- In ICT it deals with computer graphics in terms of animation, image processing and many others
- In this topic we are going to present in more details the basics of image representation with the help of computers

Images representation

- There exist two main methods for representation of images in computers:
 - Raster graphics
 - Vector graphics



Raster graphics

- Raster graphics systems represent images as sets of dots arranged into a matrix (or grid format), called pixels
- Each pixel represents a specific color in the final image by different hue, value and chroma.



Raster graphics

- Quality of raster images is determined by the number of its pixels, which is also denoted as resolution. The higher the number of pixels – the higher is the quality.
- Resolution of a raster image is referred to in DPI (dots per inch) or PPI (pixels per inch).
- Raster images are suitable for drawing patterns with continuous tones as well as for assigning weave and knit structures by replacing more traditional methods of drafting structures on graph paper.



Vector graphics

- In contrast to a raster graphic system, vector graphics systems utilize mathematical equations to represent geometrical primitives, which include points, lines, curves and shapes.
- In other words, in vector graphics images are defined not by coordinates, but by geometrical representations in a coordinate system.
- An advantage of a vector graphics system is that images are resolution independent and can retain quality in any enlargement or magnification. This way, vector images represent shapes more accurately when they are zoomed in.



Pros and cons

- Raster images may display a wider array of colors, and provide easier color editing
- With vector images, resolution is not an issue. They may be resized and rescaled in both directions infinitely without losing quality.
- Vector files are popular for images that need to appear in a wide variety of sizes, like a logo that needs to fit on both a business card and a billboard.



Pros and cons

- Raster images tend to be large (as each pixel is linked to color data)
- Raster images are more difficult to modify than vector images.
- However, they are needed, as they are produced by scanning and by digital photography, and raster images are required to print
- On the other hand, most of the design work, is best done using vector graphics.



Benefits of vector images

- Vector is characterized in with quantity and direction and is defined by its length and its orientation.
- Vector graphics builds up whole images in terms of vector statements, and this is the basis of most CAD drawing packages.
- Images are manipulated by changing the parameters of the vectors by mathematical processing.
- Vector graphic images are smaller than raster images.



Computer graphic formats

- In the late 1980s, when textile CAD was still in the development stage, some of the design systems were solely developed with vector graphics systems.
- Today most of the proprietary textile CAD software utilizes both raster and vector systems, and designers have choices as to which system is appropriate for which production outcome.



Popular graphic file formats

- In computers images should be represented by files
- There exist a number of file image formats, most popular of which are given in the next table

Raster image formats	Vector Image formats
PSD (Adobe Photoshop Document)	AI (Adobe Illustrator document)
JPG (Joint Photographics Expert Group)	EPS (Encapsulated PostScript)
PNG (Portable Network Graphic)	SVG (Scalable Vector Graphic)
GIF (Graphics Interchange Format)	PDF (Portable Document Format)



Representing colors

- The colors on a computer screen are technically produced as combinations of red, green, and blue light.
- Different colors are produced by varying the intensity of each type of light.
 - A color can be specified by three numbers giving the intensity of red, green, and blue in the color.
 - This way, intensity can be specified as a number in the range zero, for minimum intensity, to one, for maximum intensity.
- This method of specifying color is called the RGB color model, where RGB stands for Red/Green/Blue.
 - For example, in the RGB color model, the number triple $(1, 0.5, 0.5)$ represents the color obtained by setting red to full intensity, while green and blue are set to half intensity.
 - The red, green, and blue values for a color are called the color components of that color in the RGB color model.



RGB color model

- While other color models also exist RGB is the most common one used in most applications
- Instead of range between 0 and 1, intensity in RGB is represented by numbers between 0 and 255
- Some examples:
 - (255,0,0) is RED color
 - (255,255,0) is YELLOW color
 - (255,127,0) is ORANGE color



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