

Year/Period	Important Development	Significance
1940s–1950s	Early computers displayed simple points, lines, and symbols	Computers began presenting information visually instead of through printed numbers alone
1950s	Whirlwind and SAGE computer systems	Introduced real-time information displayed on computer screens
1963	Ivan Sutherland developed Sketchpad	Allowed users to draw and manipulate objects directly on a screen using a light pen
1960s–1970s	Development of computer-aided design or CAD	Computers became useful in engineering, architecture, and product design
1970s	Growth of raster graphics, shading, and 3D modeling	Digital objects began to appear more detailed and realistic
1980s	Personal computers and graphical user interfaces became popular	Icons, windows, menus, and the computer mouse made computers easier to use
1990	Adobe Photoshop 1.0 was released	Digital photograph editing became more accessible to artists and photographers
1990s	Rapid development of CGI, video games, and multimedia	Computer graphics became widely used in entertainment and communication
1995	Pixar released <i>Toy Story</i>	It became the first feature-length film created entirely through computer animation
2000s	Powerful graphics cards, digital cameras, and web graphics	High-quality images and animations became available to ordinary users
2010s	Mobile applications, augmented reality, virtual reality, and 3D printing	Computer graphics became more interactive and immersive
Present	AI-assisted imaging, real-time rendering, and cloud-based design tools	Images can be created, enhanced, and shared more quickly

3. Important People and Contributions

- **Ivan Sutherland** – developed Sketchpad, one of the earliest interactive computer-drawing systems.
- **Ed Catmull** – contributed important techniques in 3D computer graphics and helped establish Pixar.
- **John and Thomas Knoll** – developed Photoshop, which became an important digital image-editing application.
- **John Lasseter and Pixar artists** – helped advance computer-generated animation through films such as *Toy Story*.

Importance of Computer Graphics

Computer graphics are used in:

- education and multimedia lessons;
- medicine and medical imaging;
- engineering and architecture;
- advertising and product design;

- movies and animation;
- video games;
- websites and mobile applications;
- maps and scientific simulations; and
- social-media communication.

historical footprints of Computer Graphics

Detailed Discussion Topics

1. Introduction to Digital Imaging

Digital imaging is the process of creating, capturing, processing, editing, storing, and displaying images through electronic devices.

Common examples include:

- digital photographs;
- scanned documents;
- posters and advertisements;
- logos and illustrations;
- social-media posts;
- website graphics; and
- digital artworks.

2. Pixels and Resolution

A **pixel**, or picture element, is the smallest unit of a digital image. Thousands or millions of pixels combine to form a complete image.

Resolution refers to the amount of detail an image contains. It may be described using:

- image dimensions, such as 1920×1080 pixels;
- pixels per inch or PPI for digital displays; and
- dots per inch or DPI for printed outputs.

Generally, more pixels can produce a clearer and more detailed image, provided the image is displayed or printed at an appropriate size.

3. Raster and Vector Graphics

Feature	Raster Graphics	Vector Graphics
Composition	Made of pixels	Made of mathematical paths, lines, and shapes
Best used for	Photographs and detailed images	Logos, icons, diagrams, and illustrations
Resizing	May become pixelated when enlarged	Can be enlarged without losing quality

Feature	Raster Graphics	Vector Graphics
Common formats	JPEG, PNG, GIF, BMP	SVG, AI, EPS
Applications	Paint, Photoshop, GIMP	Illustrator, Inkscape, Affinity Designer

4. RGB and CMYK Color Models

Feature	RGB	CMYK
Meaning	Red, Green, Blue	Cyan, Magenta, Yellow, Key/Black
Type	Additive color model	Subtractive color model
Main use	Digital screens	Printed materials
Examples	Websites, presentations, videos	Books, posters, brochures
How colors are produced	Light is added	Ink absorbs or subtracts light

RGB should normally be used for outputs viewed on screens, while **CMYK** is more appropriate for materials intended for printing.

5. Basic Principles of Design

- **Balance** – distributes visual elements evenly.
- **Contrast** – shows noticeable differences between elements.
- **Emphasis** – highlights the most important element.
- **Alignment** – places elements in an orderly arrangement.
- **Proportion** – maintains an appropriate size relationship among elements.
- **Repetition** – repeats colors, shapes, or styles to create consistency.
- **Movement** – guides the viewer's eyes through the design.
- **Unity** – makes all parts of the design appear connected.
- **White space** – provides empty space to prevent a crowded layout.

1. Image Processing and Image Editing

Image processing refers to changing or improving an image using computer applications. It may involve resizing, adjusting colors, improving image quality, or applying effects.

Image editing refers to modifying the appearance or content of an image. Common editing tasks include:

- cropping and resizing;
- rotating and flipping;
- adjusting brightness and contrast;
- correcting colors;
- removing unwanted objects;
- adding text and shapes;
- applying filters; and
- combining multiple images.

2. Raster Image-Editing Applications

Raster applications edit images composed of pixels. They are commonly used for photographs and highly detailed images.

Application	Description	Common Uses
Microsoft Paint	A basic raster drawing and editing application included in Windows	Simple drawings, cropping, resizing, adding text, and basic image editing
GIMP	A free and open-source image-editing application	Photo enhancement, background removal, layers, filters, and advanced editing
Adobe Photoshop	A professional raster graphics and photo-editing application	Photo manipulation, digital painting, graphic design, and image enhancement
Canva/Affinity Photo	Applications with tools for editing photos and creating visual layouts	Posters, social-media graphics, advertisements, and image enhancement

Important Raster Tools

- Selection tools
- Crop tool
- Brush and eraser
- Fill tool
- Text tool
- Color adjustment
- Filters and effects
- Layers

3. Vector Image-Editing Applications

Vector applications create and edit graphics using paths, points, lines, curves, and shapes. Vector images can be resized without becoming pixelated.

Application	Description	Common Uses
Adobe Illustrator	A professional vector graphics application	Logos, icons, illustrations, typography, and packaging designs
Inkscape	A free and open-source vector graphics editor	Logos, diagrams, illustrations, posters, and scalable graphics
Affinity Designer	A design application that supports vector and raster workspaces	Logos, digital illustrations, branding materials, and layouts

Important Vector Tools

- Shape tool
- Pen or Bézier tool
- Node tool
- Text tool
- Fill and stroke
- Path operations
- Alignment tools
- Layers

Comparison of Applications

Feature	Raster Applications	Vector Applications
Image composition	Pixels	Paths, lines, curves, and shapes
Best for	Photographs and detailed images	Logos, icons, and illustrations
Effect of enlargement	May become pixelated	Maintains image quality
Common applications	Paint, GIMP, Photoshop	Illustrator, Inkscape, Affinity Designer
Common formats	JPEG, PNG, GIF, BMP, PSD	SVG, AI, EPS, PDF

Choosing the Correct Application

Task	Recommended Application
Correcting the brightness of a photograph	GIMP or Photoshop
Making a simple drawing	Microsoft Paint
Removing the background of an image	GIMP or Photoshop
Designing a school logo	Illustrator or Inkscape
Creating a scalable icon	Illustrator, Inkscape, or Affinity Designer
Creating a social-media poster	Canva or Affinity
Retouching a portrait	GIMP, Photoshop, or Affinity Photo

1. Review of Raster and Vector Images

Feature	Raster Image	Vector Image
Composition	Pixels	Paths, points, lines, and shapes
Best for	Photographs and detailed images	Logos, icons, diagrams, and illustrations
When enlarged	May become pixelated	Remains clear and sharp
Common formats	JPEG, PNG, GIF, BMP, PSD	SVG, AI, EPS, PDF
Editing applications	Paint, GIMP, Photoshop, Affinity Photo	Illustrator, Inkscape, Affinity Designer

2. Raster Image-Editing Tools

Raster tools modify individual pixels in an image.

Tool	Function
Selection Tool	Selects a specific part of an image
Crop Tool	Removes unwanted areas
Resize Tool	Changes the image dimensions
Rotate/Flip Tool	Changes the image orientation
Brush Tool	Adds strokes, colors, or details
Eraser Tool	Removes parts of an image
Text Tool	Adds words or captions

Tool	Function
Fill Tool	Fills an area with color
Brightness and Contrast	Improves the image's light and dark areas
Filters	Adds visual effects
Layers	Separates image elements for easier editing

Basic Raster-Editing Procedure

1. Open or import a raster image.
2. Duplicate the original image or layer.
3. Crop and straighten the image.
4. Resize it according to the required output.
5. Adjust brightness, contrast, and color.
6. Remove unwanted parts when necessary.
7. Add text, shapes, or effects.
8. Save the editable project.
9. Export the finished output as JPEG or PNG.

3. Vector Image-Editing Tools

Vector tools modify paths, points, shapes, and curves.

Tool	Function
Selection Tool	Selects and moves an object
Node Tool	Adjusts the points and curves of a path
Shape Tool	Creates rectangles, circles, stars, and polygons
Pen or Bézier Tool	Draws straight and curved paths
Text Tool	Adds and formats text
Fill Tool	Changes the color inside an object
Stroke Tool	Changes the outline of an object
Align Tool	Arranges objects evenly
Group/Ungroup	Combines or separates objects
Path Operations	Joins, subtracts, or intersects shapes
Layers	Organizes different design elements

Basic Vector-Editing Procedure

1. Open or create a vector document.
2. Draw objects using shape and pen tools.
3. Resize, rotate, and arrange the objects.
4. Modify the nodes and paths.
5. Apply fill and stroke colors.
6. Add and format text.
7. Align and group related objects.
8. Save the editable project.
9. Export the output as SVG, PDF, or PNG.

4. File Formats

Format	Appropriate Use
JPEG	Photographs and small online files
PNG	Images requiring transparency or clear text
SVG	Scalable logos, icons, and vector illustrations
PDF	Printing and document sharing
PSD/XCF/AFPOTO	Editable raster projects
AI/AFDESIGN	Editable vector projects

Tools and Uses in Canva Affinity

The current Canva Affinity combines **Vector, Pixel, and Layout tools** in one application. The available tools may change depending on the selected Studio or customized workspace. [Canva describes the three workspaces as Vector for scalable designs, Pixel for raster and photo editing, and Layout for multipage and print design.](#)

A. Basic and Navigation Tools

Tool	Use
Move Tool	Selects, moves, rotates, and resizes an object or layer.
View Tool	Moves the document around the workspace without moving the objects.
Zoom Tool	Enlarges or reduces the view of the document.
Color Picker Tool	Samples a color from an image or object.
Measure Tool	Measures the distance and angle between objects.
Artboard Tool	Creates separate design areas or pages in one document.

B. Vector Tools

Vector tools are used for creating **logos, icons, illustrations, diagrams, and other scalable designs.**

Tool	Use
Node Tool	Selects and modifies the nodes or points of a vector shape or path.
Pen Tool	Creates precise straight lines, curves, and custom vector paths.
Pencil Tool	Draws freehand vector lines and paths.
Vector Brush Tool	Draws editable vector strokes that resemble painted lines.
Shape Tool	Creates rectangles, circles, triangles, stars, arrows, and other shapes.
Corner Tool	Rounds or changes the corners of vector shapes.
Contour Tool	Expands or contracts the outline of a vector object.
Fill Tool	Applies a solid color or gradient inside an object.
Transparency Tool	Makes all or part of an object transparent.
Stroke Tool	Changes the color, width, and style of an object's outline.
Knife Tool	Cuts a vector shape or curve into separate parts.
Shape Builder Tool	Combines, subtracts, or divides overlapping vector shapes.
Point Transform Tool	Rotates or transforms vector objects around a selected point.

Tool	Use
Warp Tool	Bends or distorts vector objects and text.

C. Pixel and Photo-Editing Tools

Pixel tools are used for modifying **photographs and raster images**.

Selection Tools

Tool	Use
Rectangular Marquee Tool	Selects a rectangular area of an image.
Elliptical Marquee Tool	Selects a circular or oval area.
Freehand Selection Tool	Selects an area by drawing around it manually.
Selection Brush Tool	Selects an object by painting over it.
Flood Select Tool	Selects areas containing similar colors.
Smart Selection Tool	Helps identify and select objects or areas automatically.

Painting and Coloring Tools

Tool	Use
Paint Brush Tool	Paints color directly on a pixel layer.
Pixel Tool	Draws hard-edged, pixel-by-pixel strokes.
Eraser Tool	Removes pixels from an image or layer.
Flood Fill Tool	Fills an area containing similar colors.
Gradient Tool	Creates a gradual transition between two or more colors.
Color Replacement Brush	Replaces one color with another while maintaining image details.

Retouching and Correction Tools

Tool	Use
Crop Tool	Removes unwanted outer areas and improves image composition.
Clone Brush Tool	Copies pixels from one part of an image to another.
Healing Brush Tool	Repairs small marks, blemishes, or damaged areas by blending nearby pixels.
Inpainting Brush Tool	Removes unwanted objects and automatically replaces them using surrounding details.
Blemish Removal Tool	Quickly removes spots, pimples, and small imperfections.
Red Eye Removal Tool	Corrects red-eye effects in photographs.
Patch Tool	Repairs a selected area using pixels from another area.
Dodge Brush Tool	Lightens selected parts of an image.
Burn Brush Tool	Darkens selected parts of an image.
Sponge Brush Tool	Increases or decreases color intensity.

Effects and Blending Tools

Tool	Use
Blur Brush Tool	Softens image details and edges.
Sharpen Brush Tool	Makes selected details appear clearer.
Smudge Tool	Pushes and blends pixels to create a smeared effect.
Median Brush Tool	Reduces small amounts of noise while preserving edges.
Mesh Warp Tool	Distorts or reshapes an image using a movable grid.
Liquify Tools	Push, pull, twist, enlarge, or shrink parts of an image.

D. Text Tools

Tool	Use
Artistic Text Tool	Creates titles, headings, labels, and decorative text.
Frame Text Tool	Places paragraphs inside a text frame for brochures, reports, or magazines.
Text Style Controls	Change the font, size, color, spacing, alignment, and appearance of text.
Text on a Path	Places text along a line, circle, or custom vector path.

E. Layout and Publishing Tools

These tools are used to create **brochures, magazines, reports, posters, and other multipage publications.**

Tool	Use
Picture Frame Tool	Creates a frame where an image can be inserted and resized.
Place Image Tool	Imports an external picture into the document.
Table Tool	Creates tables made of rows and columns.
Page Tool	Adds, removes, duplicates, or arranges pages.
Master Page	Applies the same design elements to several pages.
Guides and Grids	Help align and position objects accurately.
Link Text Frames	Allows text to continue automatically from one frame or page to another.

F. Layer and Object Commands

Command	Use
New Layer	Creates a separate layer for an object or image element.
Group	Combines several objects so they can be moved or resized together.
Ungroup	Separates previously grouped objects.
Duplicate	Makes a copy of the selected object.
Lock	Prevents accidental changes to an object or layer.
Hide/Show	Controls whether an object or layer is visible.
Mask	Hides parts of a layer without permanently deleting them.
Opacity	Controls how transparent or visible a layer is.
Blend Modes	Change how the colors of one layer interact with the layers below it.
Arrange	Moves an object forward, backward, to the front, or to the back.

Command	Use
Align and Distribute	Arranges objects evenly and accurately.

G. Saving and Exporting Tools

Tool or Command	Use
Save	Keeps the document in an editable Affinity format.
Export	Produces a copy in formats such as JPEG, PNG, SVG, PDF, PSD, or TIFF.
JPEG	Best for photographs and small online image files.
PNG	Best for clear graphics and images requiring transparency.
SVG	Best for scalable vector logos, icons, and illustrations.
PDF	Best for documents intended for printing or sharing.
PSD	Used when the document must remain compatible with Photoshop.