Chapter 3: Images

Overview

- Creation of multimedia images
- Creation of still images
- Resolution
- Colors and palettes in multimedia
- Image file types used in multimedia

Creation of Multimedia Images

- Before commencing the creation of images in Multimedia, you should:
  - Plan your approach
  - Flow charts, storyboards, note cards, pencil and paper, script
  - Intended audience/target market
  - Look at examples and templates (templatemonster.com)
  - Organize the available tools
  - Clip art, stock art, presets, buttons, software
  - Window/pallet layout and arrangement
Still images may be the most important element of a multimedia project.

The type of still images created depends on the output/display resolution, and hardware and software capabilities.

Types of still images
- Bitmaps
- Vector-drawn graphics
- 3D drawing and rendering

Bitmaps
- “bit” - the simplest element in which only two digits are used
- “map” - a two-dimensional matrix of these bits
- A **bitmap** is a data matrix describing the individual pixels of an image.

Bitmaps are suitable for creating:
- Photo-realistic images
- Complex drawings
- Images that require fine detail
- Painterly graphics
• Bitmaps
  – A bitmap is made up of individual picture elements known as pixels or pels.
  – Can have varying bit and color depths.

<table>
<thead>
<tr>
<th>Bit Depth</th>
<th>Number of Colors Possible</th>
<th>Available Binary Combinations for Describing a Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-bit</td>
<td>256</td>
<td>F3, F5, F7, F9, F11, F13, F15, F17, F19, F21, F23, F25, F27, F29, F31</td>
</tr>
<tr>
<td>16-bit</td>
<td>65,536</td>
<td>0000 0000, 0001 0000, 0010 0000, 0011 0000, 0100 0000, 0101 0000, 0110 0000, 0111 0000, 1000 0000, 1001 0000, 1010 0000, 1011 0000, 1100 0000, 1101 0000, 1110 0000, 1111 0000</td>
</tr>
</tbody>
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Creation of Still Images (continued)

• Bitmaps can be inserted by:
  – Using clip art
  – Licensing restrictions may apply
  – Using bitmap software (PS, FW)
  – Capturing images (digital camera, video, screen)
  – Cmd Shift 3 for screen, Cmd Shift 4 for selection
  – Grab
  – Scanning images
  – Copying to clipboard
• Using clip art galleries
  – A clip art gallery is an assortment of graphics, photographs, sound, and/or video.
  – alternative for users who do not want to create their own images.
  – Collections available on CD-ROMs and the Internet.

The industry-standard programs for bitmap painting and editing are:
  – Adobe Photoshop, Illustrator and Fireworks
  – Corel Painter and CorelDraw.
Image editing programs enable the user to:
- Enhance and make composites.
- Alter and distort images.
- Add and delete elements.
- Morph (manipulate still images to create animated transformations).

Morphing software was used to seamlessly transform the images of 16 kindergartners. When a sound track of music and voices was added to the four-minute piece, it made a compelling video about how similar children are to each other.

Users can scan images from conventional sources and make necessary alterations and manipulations.

Exposure from Alien Skin allows users to manipulate bitmapped images. Here a digital color image has been processed to look like it came from a darkroom.
Creation of Still Images (continued)

- Vector-drawn graphics
  - Applications of vector-drawn images
  - How vector-drawn images work
  - Vector-drawn images versus bitmaps

- Vector-drawn images are used in:
  - Computer-aided design (CAD) programs
  - Graphic artists designing for the print media
  - 3-D animation programs
  - Applications requiring drawing of graphic shapes

Drawing software such as Adobe Illustrator can save vector graphics in PDF, SVG and SWF format.
How vector-drawn images work

- A vector is a line that is described by the location of its two endpoints.
- Vector drawing makes use of Cartesian coordinates.
- Cartesian coordinates are numbers that describe a point in two- or three-dimensional space as the intersection of the X, Y, and Z axes.
- Appropriate for lines, rectangles, ellipses, polygons, and graphic shapes that can be mathematically expressed in angles, coordinates and distances.

Vector Images

Pixel coordinates

Real coordinates and axes

Vector Images cont.

The displacement between two points is a vector whose components are obtained by subtracting the x and y coordinates of the two points.
• Vector Images cont.

Approximating a straight line

Anti-aliased line

\[ (x, y) \]

\[ r = (x, y) \]

\[ c = (x, y) \]

\[ w = x - x \]

\[ y = y - y \]

A cubic Bézier curve
• Vector Drawing Guidelines
  – Rule of 1/3’s: for any given curve, the direction handles should come out 1/3 of the distance of the curve in the direction of the tangent line at the current end point.
  – Tangent Lines: to make a curve, always click and drag in the direction that you would be going from the end point.
  – Change of Direction: when changing to a different direction (no longer a smooth curve), opt/alt click and drag in the new desired direction.
• Vector-drawn images versus bitmaps
  – Vector images often use less memory and have a smaller file size as compared to bitmaps.
  – Web vector graphics often download and draw faster than bitmaps when used for animation.
  – cannot be used for photorealistic images.
  – require a plug-in for Web-based display.
  – Bitmaps are not easily scalable and resizable.
  – Bitmaps can be converted to vector images using autotracing (LiveTrace in Illustrator)
  – Vector images can be filled, stroked, and selected.

• 3-D drawing and rendering
  – 3-D animation tools
  – Features of a 3-D application

• 3-D animation, drawing, and rendering tools include:
  – 3DSMax/Maya
  – Blender
  – Lightwave
  – SketchUp
  – Cinema 4D
  – Animation Master
  – Zbrush/Modo

3-D applications provide x, y, and z axes and adjustable perspective views.
**Features of a 3-D application**

- Modeling (primitives) - Placing all the elements into 3-D space.
- Extrusion - The shape of a plane surface extends some distance.
- Lathing - A profile of the shape is rotated around a defined axis.
- 3D in 2D via Directional lighting, Motion, Perspective and Depth (Z)
- Color, Textures, Lighting, Rigging, Animation, Dynamics, and Rendering

**Creation of Still Images (continued)**

- Rendering - Use of intricate algorithms to apply user-specified effects
  
a. Gouraud shading
b. Flat shading
c. Ray Tracing
d. Phong shading
Creation of Still Images (continued)

- **Panoramas**
  - Panoramic images are created by stitching together a sequence of photos around a circle and adjusting them into a single seamless bitmap.
  - QuickTime VR
  - CubicConverter
  - Pano2VR
  - Krpano.com

Resolution

- **Resolution**
  - A measure of how detailed a device recreates a pixel based representation of an original image.
  - Scanner & Printer Resolution
    - Dots per inch
  - Video & Monitors
    - Based on pixel dimensions (WxH, 720x1280)
    - 72 dpi
  - Digital Cameras
    - Mega Pixels (5616 x 3744 = 21 MP)

Resolution cont.

- Actual size of displayed image depends on pixel density of output device.

*Device resolution and image size*
Resolution cont.

- Downsampling: Reducing pixel dimensions
- Upsampling: Increasing pixel dimensions
- Both usually lead to a visible loss of quality
- Interpolation
  - Nearest neighbor – quick, but poor quality
  - Bilinear – middle of the road
  - Bicubic – Slowest, but good results
Compression

- Images may be losslessly compressed using various methods.
- Lossy compression is possible because high-frequency information can often be discarded due to people not perceiving it accurately.
  - JPEG 8x8 pixel blocks
    - Lower quality settings discard more information.
    - May cause blurring and visible edge artifacts at lower settings.

Compression cont.

Original (left) and JPEG (right)

Compression cont.

- GIF
  - LZW, 256 color max, 1 color = transparent
  - Suitable for graphics with areas of flat color.

A GIF with transparent areas
Compression cont.

• **PNG**
  - Developed to surpass GIF
  - 8 or 24 bit
  - supports alpha channels for transparency

Compression cont.

• **TIFF**
  - Cross platform standard
  - Often used for uncompressed digital pictures

Compression cont.

• **BMP**
  - Windows, often uncompressed
  - Often used for uncompressed digital pictures

• **PDF**
  - Can include bitmapped images both compressed or uncompressed

• **RAW**
  - When complete control of image processing is required
  - Supports meta data
Image Manipulation

Compositing layers

Image Manipulation cont.

• Mask
  – A Mask is an area that is not selected
  – Masked areas are protected from changes

Magnetic lasso selection and mask

Image Manipulation cont.

• Alpha Channels
  – Saved selections are called Alpha Channels

Constructing a vignette with an alpha channel
Image Manipulation cont.

- Curves
  - Full control over original and new values
  - Sigmoid curve often used to increase contrast

A sigmoid curve for enhancing contrast

Colors and Palettes in Multimedia

- Understanding natural light and color
- Color palettes

Color pickers allow you to select a color using one or more different models of color space.
• Understanding natural light and color
  – Light comes from an atom where an electron passes from a higher to a lower energy level.
  – Each atom produces uniquely specific colors.
  – Color is the frequency of a light wave within the narrow band of the electromagnetic spectrum, to which the human eye responds.

• Additive color
  – In the additive color method, a color is created by combining colored light sources in three primary colors - red, green, and blue (RGB).
  – TV and computer monitors use this method.
**Colors and Palettes in Multimedia (continued)**

- **Subtractive color**
  - Color created by combining colored media such as paints or ink.
  - Colored media absorb (or subtract) some parts of the color spectrum of light and reflect the others back to the eye.
  - Subtractive color is the process used to create color in printing.
  - The printed page consists of tiny halftone dots of three primary colors: cyan, magenta, and yellow (CMY).

**Colors and Palettes in Multimedia (continued)**

- **Monitor-specific colors**
  - Colors should be used according to the target audience's monitor specifications.
  - The preferred monitor resolution is >= 1024 x 768 pixels.
  - The preferred color depth is 32 bits.

**Models used to specify color in computer terms are:**

- **RGB model** – In 24-bit, color is specified in terms of red, green, and blue values from 0 to 255.
- **HSB and HSL models** – Color is specified as an angle from 0 to 360 degrees on a color wheel.
- Other models include CMYK, CIE, YIQ, YUV, and YCC.
• Color palettes
  – Palettes are mathematical tables that define the color of pixels displayed on the screen.
  – Palettes are called "color lookup tables," or CLUTs, on the Macintosh.
  – The most common palettes are 1, 4, 8, 16, and 24-bit deep.

• Dithering:
  – Dithering is a process whereby the color value of each pixel is changed to the closest matching color value in the target palette.
  – Accomplished using a mathematical algorithm.

These images were dithered in Photoshop to best fit the 8-bit palettes of GIF files (Adaptive, System, or Custom 216 Netscape).
Also shown are JPEG files compressed with highest and lowest quality and their actual file sizes.
Note the subtle differences among palettes and systems, especially in the gradient blue background.
• Macintosh formats
  – PICT: a complicated and versatile format developed by Apple.
  – Almost every Mac image app can import/export PICT files.
  – In a PICT file, both vector objects and bitmaps can reside side-by-side.

• Windows formats
  – Commonly used image file format is DIB, aka BMP.
  – DIB stands for device-independent bitmaps.
  – Other common Windows Bitmap formats:
    • BMP - A Windows bitmap file
    • TIFF - Extensively used in DTP packages
    • PCX - Used by MS-DOS paint software
Image File Types Used in Multimedia (continued)

- Cross-platform formats
  - JPEG, GIF, and PNG – Most commonly used formats on the Web
  - Adobe PDF (Portable Document Format) – Manages multimedia content
  - PSD, AI, CDR, DXF – Proprietary formats used by applications

Summary

- The computer generates still images as bitmaps and vector-drawn images.
- Images can be incorporated in multimedia using clip art or bitmap software, or by capturing, editing, or scanning images.
- Creating 3-D images involves modeling, extruding, lathing, shading, and rendering.
- Color is one of the most vital components of multimedia.