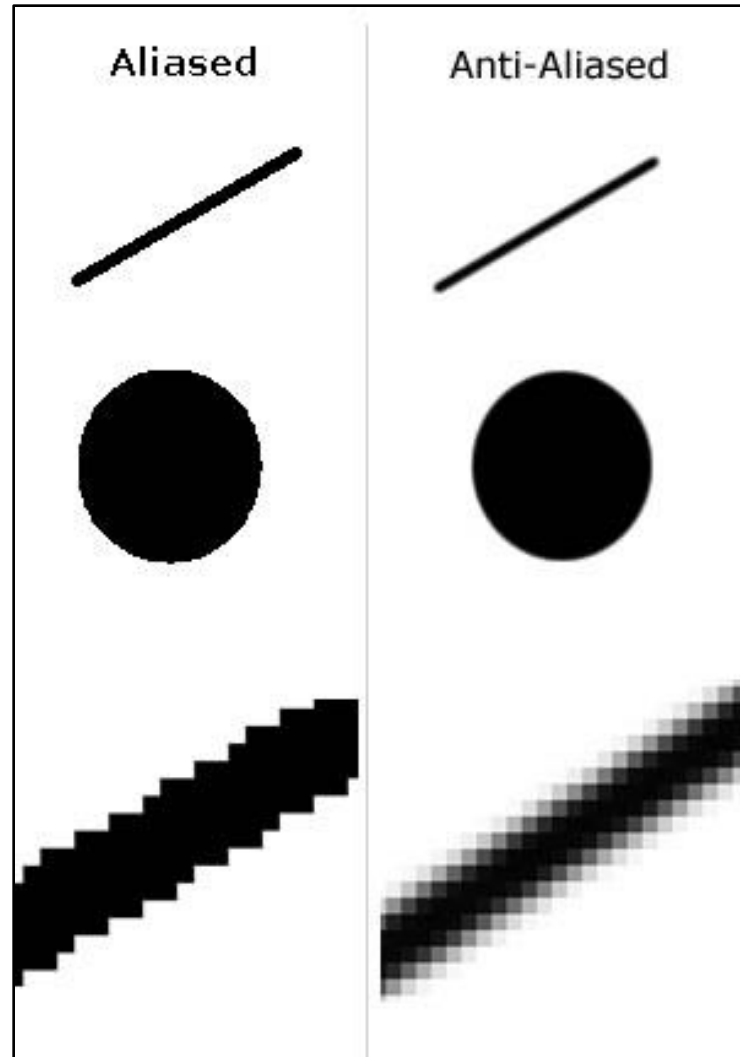


Graphics File Formats

Raster or bitmapped graphics

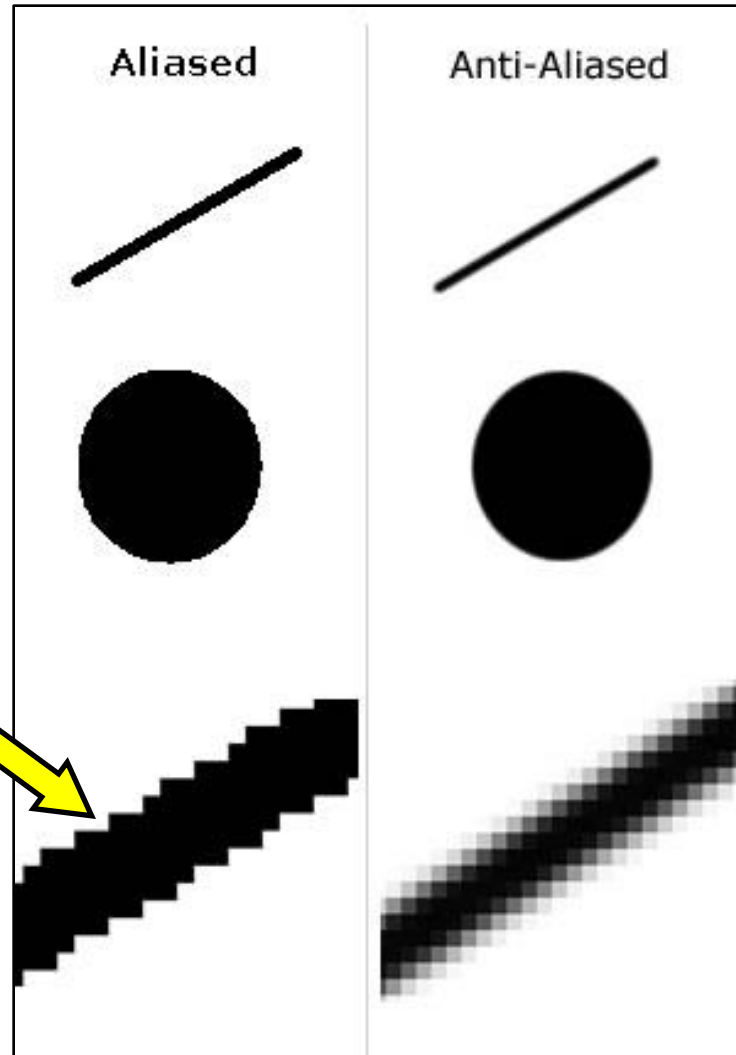
- Raster or bitmapped graphics
 - Images represented as 2-dimensional array of colored pixels.
 - Images have an implied resolution (resolution dependent).
- Examples:
 - GIF (Graphics Interchange Format)
 - JPEG (Joint Photographic Experts Group)
 - PNG (Portable Network Graphics)
 - TIFF (Tagged Image File Format)

Raster graphics: aliased vs. anti-aliased



Source: <https://commons.wikimedia.org/wiki/File:Anti-aliasing.jpg>

Raster graphics: aliased vs. anti-aliased

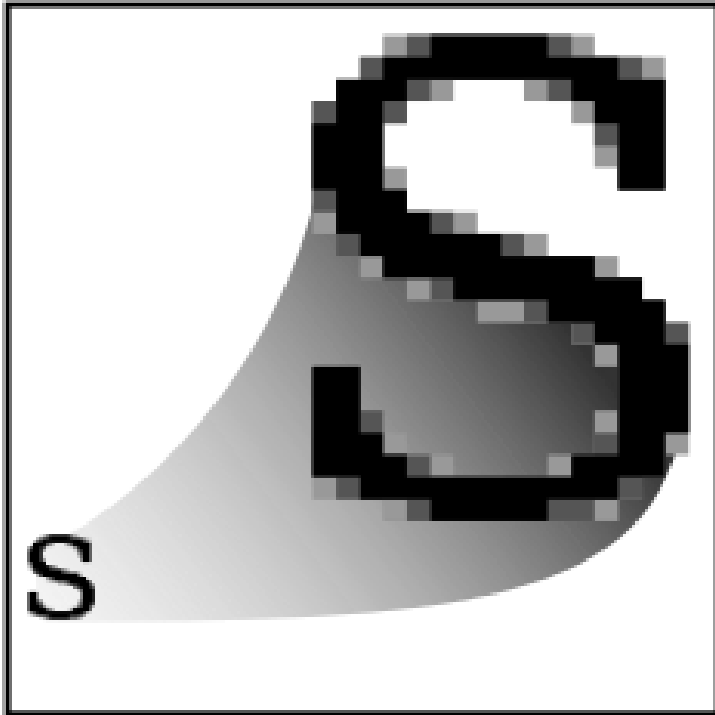


Stair step aliasing effect
also known as “jaggies”

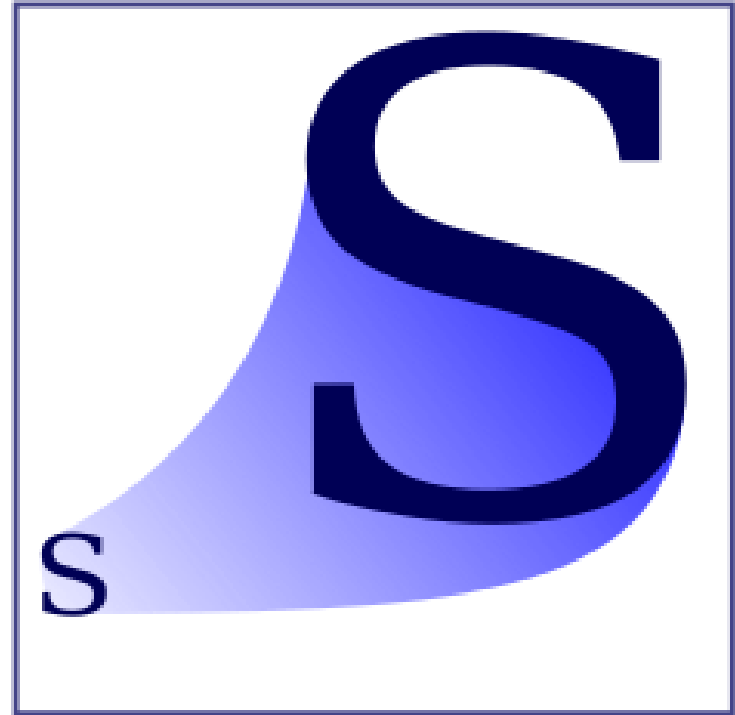
Vector graphics

- Vector graphics
 - images described mathematically as primitives such as points, arcs, and lines.
 - Images are resolution independent (scalable)
- Examples:
 - Scalable Vector Graphics (SVG). W3 standard for displaying vector graphics on the World Wide Web.
 - Flash format by Adobe.

Raster vs. vector graphics



Raster
.jpeg .gif .png



Vector
.svg

Raster / bitmap graphics: potentially **BIG**

- **Problem:** Raster or bitmapped graphics can result in large file sizes for large resolutions and/or deep color depths.
- **Solution:** Image compression!

Lossless compression schemes

- Entropy algorithm
 - Huffman compression
- Deflation algorithm
 - Lempel-Ziv-Welch (LZW) compression
- Run Length Encoding (RLE)
- Differential pulse-code modulation (DPCM)
 - Suitable for sequential images such as video.
- Chain code algorithm
 - Suitable for monochrome images.

“Lossy” compression schemes

- Chroma subsampling
 - Human visual perception is more sensitive to variations in brightness than color.
- Reduced color gamut
 - Can be used with dithering algorithm to reduce effect of image banding (posterization).
- Fractal compression
- Transform compression
 - Fast Fourier Transform (FFT)
 - Discrete Cosine Transform (DCT)
 - Wavelet compression

“Lossy” graphics compression

- JPEG File Interchange Format (JFIF)
 - A “lossy” image file format suitable for complex backgrounds such as digital photographs of nature which can achieve high compression while usually retaining visual integrity of the image itself.
- Advantages
 - Capable of compressing complex images to significantly small file size.
 - Images load fast over a network!
- Disadvantages
 - Permanent loss of image detail.
 - Not suitable for logos or anything with strong geometric lines (compression artifacts will occur in such cases).

Run Length Encoding (RLE)

- Advantages
 - Compressed format saves disk space
 - Reduced amount of data to transfer between disk and memory or over network (e.g. web server).
- Disadvantages
 - Computing overhead to encode/decode the scan lines.
 - Worst case scenario: compressed format may result in larger file size than uncompressed format (for short encoding runs).

Run Length Encoding (RLE): Example

- **Input:**

WWWWWWWWWWWWWWWWWWBWWWWWWWWWW
WWWWBWWWWWWWWWWWWWWWWWWWWWWWW
WWWWWWWWWWWWBWWWWWWWWWWWWWWWW
WWW

- **Output:**

12W1B12W3B24W1B14W

For further reading

- PNG file format / specification:
<http://www.libpng.org/pub/png/>
- *PNG: The definitive Guide* by Greg Roelofs
- *An Introduction to Wavelets* by Amara Graps
http://cs.haifa.ac.il/~nimrod/Compression/Wavelets/Wavelets_Graps.pdf
- JPEG-2000 Part-1 Open Source implementation
<http://www.ece.uvic.ca/~frodo/jasper/>