The Best Graphic File Types/Image File Formats to Use in Makerspaces

Nebraska Library Commission

Raster Graphic Files

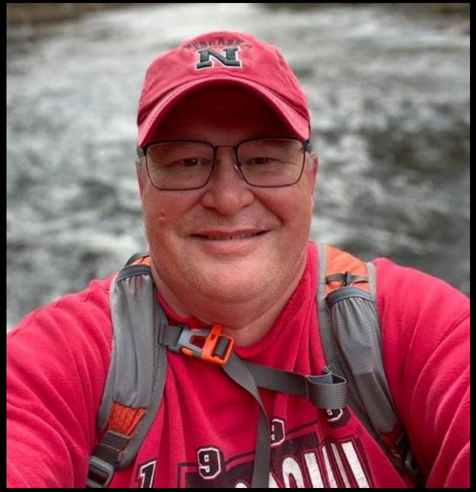
- Raster files are images built from pixels. Pixels are tiny color squares that can form highly detailed images. The more pixels an image has, the larger its file size and the better its quality will be.
- The resolution of a raster file is referred to in DPI (dots per inch) or PPI (pixels per inch). If you expand the size of a raster image, you can start to see the individual pixels resulting in a loss of image quality.
- Digital cameras commonly shoot and save photos as JPEG by default. JPEG is the most popular for static images and GIF for animated images on the Web. If you need quick snapshots for social media, JPEG is more than sufficient and storage space efficient.
- Professional photographers will likely use RAW. It provides better quality, editing flexibility, and non-destructive editing. Its file size is much larger than JPEG and specialized software for viewing or editing (like Adobe Lightroom or Capture One) is required.
- TIFF is used in printing industries where image quality is critical. Its file size is much larger than JPEG. It provides lossless image compression.
- PNG is used in graphic design due to its support for transparent backgrounds. It also provides lossless compression. It is more suitable for illustrations than photographs.
- HEIF (High-Efficiency Image Format) has emerged recently as a competitor to JPEG, especially on iOS devices. HEIF offers better compression ratios reducing file size without compromising image quality.

Vector Graphic Files

- Vector files use mathematical equations, lines, and curves with fixed points on a grid to produce an image. There are no pixels in a vector file. A vector file's mathematical formulas capture shape, border, and fill color to build an image.
- Since a Vector file's mathematical formula recalibrates automatically to any size, resolution is not an issue. You can resize, rescale, and reshape vectors without degrading image 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. (If hiring a graphic designer to create a logo, ask for an SVG file!)
- SVG (Scalable Vector Graphics) is the most common open-source file format. Adobe Illustrator's AI, Autodesk's DXF, and CorelDraw's CDR proprietary SVG files will also likely be encountered.
- PDF (Adobe's Portable Document Format) is capable of storing images with texts and hyperlinks at the same time. PDF is the standard format for e-docuements.
- EPS (Adobe's older Encapsulated PostScript) uses PostScript instead of XML coding.

Vector vs Raster Graphic Files

- Vector files are the best format for use in the Makerspace! SVG is the most popular.
- Enlarging images can be an issue with raster files when the image "pixelates".
- Can't laser cut or etch properly using a raster file? (Line width or color determines if it's a cut line. Convert colors to grayscale for etching.)
- Use the "trace" feature to convert a raster file to a vector file in the graphics design app.
- There are lots of free online raster to vector converters.
- An SVG file is much easier to clean up and declutter! I do this often after converting a JPEG to SVG. It is much easier to select and edit the lines, shapes, and fill colors in SVG compared to working with the pixels in JPEG.



CNC Machine File Formats

- The difference between CAD (Computer-Aided Design) and CAM (Computer-Aided Manufacturing) software is that CAD is used to design the digital model while CAM controls the machine used to produce the model. Many apps now combine CAD and CAM software for easy use.
- CAM software converts the CAD design into G-Code (nc, .gcode, .tap) which is standardized machine executable instructions for CNC Controllers.
- SVG (.svg) is an XML-based markup language for describing two-dimensional based vector graphics. It is the most popular file format for CNC Machines.
- DXF (.dxf, Drawing Exchange Format) is a vector-based, 2D-focused CAD format developed by Autodesk. It is the standard format for exchanging 2D data between professional CAD apps.
- STEP (.stp, .step, Standard for the Exchange of Product Model Data). It is the standard format for exchanging 3D data between professional CAD apps.
- IGES (.igs, .iges, Initial Graphics Exchange Specification) is an old CAD format originally created in the 1970s. It is still in use due to its compatibly with old CNC systems.
- Adobe Illustrator (.ai) and CorelDraw (.cdr) are very popular CAD apps so many Laser Cutter vendors provide compatible “printer” drivers so these apps can send SVG “print” jobs to the Laser Cutter.
- For beginners, Autodesk’s free Tinkercad and Canva are simple online CAD apps for creating SVG files.
- CNC Routers usually include a basic open-source and/or proprietary CAD/CAM program to get users started. Inventables’ Easel is a popular all-in-one beginner level CAD/CAM app. Autodesk’s Fusion CAD/CAM app and the open-source app FreeCAD are popular free apps for more advanced hobbyist.




3D Printer File Formats

- For 3D printing, the most popular model file format is STL. It uses stereolithography, one of the earliest methods of 3D printing created in the 1980s. Ultimaker's Thingiverse contains millions of free STL model files. Prusa's Printables is another great free STL model file resource. Autodesk's Tinkercad is a free and easy-to-use online CAD app for 3D design and editing. Blender, Meshmixer, and Microsoft 3D Builder are also free and popular.

- STL only describes shapes and does not specify color, material, scale, or any other contextual info. This makes the format unsuitable for high-precision or multicolor/multi-material 3D printing. The OBJ format, also known as the Wavefront Object, was created in the 1990s. It's capable of describing color, material, and texture information. It's the second most popular format.

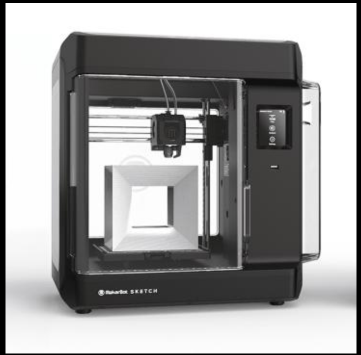
- AMF (Additive Manufacturing File), was introduced in 2011 and was positioned as "STL 2.0". It's an XML-based format designed to be faster, less error-prone, and capable of storing color, material, and texture information. Adoption has lagged and its future is uncertain.

- Microsoft introduced 3MF (3D Manufacturing Format) in 2015 and made it an open-source format. Adoption has also been slow but it has far more use than AMF.

- Has anyone tried out the AI 3D model generators to convert 2D images to 3D? Current reviews state they can create a good starting point that then requires manual clean up.

Tips For The Makerspace

- I found a brief classroom presentation and then hands on use of the equipment to be the most effective way to conduct training. Use colored construction paper to quickly train on the laser cutter/engraver.
- Use the training to “certify” the customer/patron on the use of the equipment they want to use. Require it and add it to their customer/patron account record.
- You will want to educate customers/patrons on the difference between Raster and Vector graphic files. Especially if they can print banners and posters in the Makerspace.
- When doing 3D Printer training, discuss internal and external support structures, how to use them, and when to use them. This will make for more successful printing, reduce material use, and speed up printing.
- Consider allowing customers/patrons to turn in a job form and a USB drive with their 3d printer model file if their model will have a long print time. They can start them and then return later to pick them up or Makerspace staff can start them before close to run overnight.


Questions?

- Check out these NLC NCompass Live technology presentations. Get librarian CE credit!
  - Secure Computers For Public Use
    - Windows 11, separate Admin/Patron logins, Reboot/Restore software (Faronic's DeepFreeze), and the BIOS secured with an Admin password.
  - Internet Filtering For E-Rate CIPA Compliance And Cybersecurity
    - DNS Filtering is required for federal funding and provides excellent cybersecurity!
  - WiFi In the Library
    - Upgrade to WiFi 7! Ditch the cables.
  - Purchasing Computers for the Library
    - Ensure the library's computers are using the latest technology at the best price.
  - Do You Know Your Logins? Password Best Practices for Libraries
    - How to document and keep track of the library's logins and passwords.
  - Printing, Scanning, and Faxing at the Library
    - Recommendations and best practices for library use.

Andrew "Sherm" Sherman
Library Technology Support Specialist
Nebraska Library Commission
402-471-4559
andrew.sherman@nebraska.gov