



Preservation Handbook

Vector Graphics

Author	Keith Westcott
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Definition

Vector graphics represent objects as exact geometric entities rather than as a set of pixel values arranged approximately in a raster. Lines are stored as co-ordinates and mathematical formulae describing the path the line takes between or relative to these points. This makes them truly scalable and also suitable for a range of mathematical transformations.

Vector graphic files may describe objects in a two- or three-dimensional geometry. Many are hybrid and may contain both vector and bitmap data.

CAD files are vector graphics and are covered in detail in the Computer Aided Design (CAD) Preservation Handbook.

Description

A vector graphics file may be a database of object definitions or a sequence of instructions that are 'played' by an interpreter. The latter are often referred to as metafiles and are generally designed to be interchange formats.

Additional Information

- TASI: Advice - Vector and Animated Graphics
< <http://www.tasi.ac.uk/advice/vector/vector.html> > Last checked 04/03/2005
- Vector graphics
< http://en.wikipedia.org/wiki/Vector_graphics > Last checked 04/03/2005
- JISC Report on File Format Information
< http://www.jisc.ac.uk/uploaded_documents/FileFormatsreport.pdf > Last checked 04/03/2005



Technical Environment

Common Formats

Format	File Extension	Notes
Autodesk 3D Studio	3ds	A 3D modelling, rendering and animation format produced by Autodesk. Other software cannot read the format. Not suitable for preservation.
Adobe Illustrator	ai	A 2D layer-based raster/vector format based on PostScript. Not suitable for preservation.
Computer Graphics Metafile	.cgm	A 2D raster/vector format of some vintage and a documented standard format (ISO/IEC 8632). Not suitable for preservation.
CorelDraw	cdr	A proprietary layer-based 2D format which can hold both raster and vector data. Not suitable for preservation.
Encapsulated PostScript	.eps, .epsf	EPS is a PostScript file embedded into another document. It may contain vector, bitmap and fonts. A preview image at 72 dpi is normally included. EPS headers often contain a version number. Some programmes reject the files if the version number is absent. Not suitable for preservation.
Hewlett-Packard Graphics Language	plt, prn	A control language to drive Hewlett-Packard plotters but many programmes can render the contents to screen. Files are largely ASCII and thus human readable. Not suitable for preservation.
Macintosh PICT	pict	A meta-format developed by Apple in 1984 that can store both bitmap and vector images. The file contains all the QuickDraw commands used to draw the image. PICT files containing only one bitmap are supported under Windows using QuickTime for Windows. Not suitable for preservation.
Macromedia Flash	fla, swf, swd, flv, swc, swt, flp	A 2D vector-based animation format optimised for web delivery. The format specifications are freely available. Not suitable for preservation.
Macromedia Freehand	af	A popular illustration package that uses a bitmap vector hybrid file



		type. The file format has changed substantially, resulting in some problems when migrating early versions. Not suitable for preservation.
Micrografx Designer	drw, dsf	A vector/bitmap-based programme aimed more at technical than artistic drawing. Not suitable for preservation.
Microsoft Windows Metafile	wmf, emf	A vector-based file format that uses Graphics Device Interface (GDI) commands to render an image. EMF is an enhanced version of the WMF standard for 32-bit architectures. Not suitable for preservation.
Portable Document Format	pdf	A subset of Postscript. The content is ASCII text unless compressed (which is normally the case). See also Binary Text / Word Processor Documents Preservation Handbook. Not suitable for preservation.
PostScript	ps	A programming language, developed by Adobe, to describe the appearance of text and images in a device-independent manner. Suitable for preservation.
Scalable Vector Graphics	svg	An emerging, open standard to describe 2D vector graphics in XML. Suitable for preservation.
Surfer	srf, grd	A contouring and 3D surface mapping package. It interpolates irregular xyz data onto a regular grid that can then be used to create various maps and surface models. ASCII grd files are suitable for preservation.
Virtual Reality Modeling Language	wrl, wrz	A text-based standard (ISO/IEC 14772) for representing 3D interactive vector graphics. Suitable for preservation.
Wavefront Object files	obj	A 3D graphics format stored in Unix format ASCII. Closely related to VRML. It is used in the animated film industry and favoured by some 3D laser scanning practitioners. Suitable for preservation.
WordPerfect Graphics Metafile	wpg	A 2D graphics meta format capable of storing bitmapped, vector graphics or EPS data. WordPerfect 5.0 and earlier can store either bitmap or vector image data, but not both at once. Not suitable for preservation.



Additional Information

- Autodesk 3D Studio File Format Summary
< <http://www.fileformat.info/format/3ds/egff.htm> > Last checked 04/03/2005
- Adobe Illustrator File Format Summary
< <http://www.fileformat.info/format/ai/egff.htm> > Last checked 04/03/2005
- CGM File Format Summary
< <http://www.fileformat.info/format/cgm/egff.htm> > Last checked 04/03/2005
- Encapsulated PostScript File Format Summary
< <http://www.fileformat.info/format/eps/> > Last checked 02/03/2005
- Macintosh PICT File Format Summary
< <http://www.fileformat.info/format/macpict/egff.htm> > Last checked 02/03/2005
- Digital Formats for Library of Congress Collections : Macromedia Flash SWF File Format, Version 7
< <http://www.digitalpreservation.gov/formats/fdd/fdd000130.shtml> > Last checked 07/03/2005
- Macromedia Flash (SWF) File Format Specification Version 7
< http://download.macromedia.com/pub/flash/flash_file_format_specification.pdf >
Last checked 04/03/2005
- Microsoft Windows Metafile File Format Summary
< <http://www.fileformat.info/format/wmf/egff.htm> > Last checked 04/03/2005
- Digital Formats for Library of Congress Collections : PDF (Portable Document Format)
< <http://www.digitalpreservation.gov/formats/fdd/fdd000030.shtml> > Last checked 07/03/2005
- PDF information: overview
< <http://www.prepressure.com/pdf/info/overview.htm> > Last checked 04/03/2005
- Adobe PostScript 3
< <http://www.adobe.com/products/postscript/main.html> > Last checked 04/03/2005
- Digital Formats for Library of Congress Collections : SVG, Version 1.1
< <http://www.digitalpreservation.gov/formats/fdd/fdd000020.shtml> > Last checked 07/03/2005
- Scalable Vector Graphics
< <http://www.w3.org/Graphics/SVG/About.html> > Last checked 07/03/2005
- VRML Virtual Reality Modeling Language
< <http://www.w3.org/MarkUp/VRML/> > Last checked 04/03/2005
- Web3D Consortium - VRML97 and Related Specifications
< <http://www.web3d.org/x3d/specifications/vrml/> > Last checked 04/03/2005
- GFF Format Summary: Wavefront OBJ
< <http://netghost.narod.ru/gff/graphics/summary/waveobj.htm> > Last checked 04/03/2005
- WordPerfect Graphics Metafile File Format Summary
< <http://www.fileformat.info/format/wpg/> > Last checked 04/03/2005



Ingest Checklist

Level 1 (Essential)

- Title or caption describing the graphic
- Creator
- Purpose
- Relationship to other documents
- Externally referenced files must be present
- No embedded material for which the depositor does not hold copyright.

Level 2 (Preferred)

- Software and version used to create image/model
- Creation/completion date
- Explanation of all conventions used in the document (colours, layers, line styles, line weights, etc.)
- Scale (i.e. what distance does a unit length of 1 represent).
- Externally referenced material should be imported (bound) where possible.
- Relevance of hidden material (in frozen / off / invisible layers)



Preservation

Significant Characteristics

Vector graphics programmes are often used as a convenience for creating high quality line drawings or illustrations and represent a final product or the source for a hardcopy version. When this is the case then a bitmap version will probably be suitable for preservation and the depositor should be asked to export the graphic to a suitable format and size (see the Bitmap (raster) image Preservation Handbook).

In many cases the image is unlikely to have been created in isolation but as an illustration associated with some text. It is important that the document(s) the image is associated with is recorded plus the location within that document to which it relates. The caption or a description of the contents and purpose of the image is also important.

Any meaning incorporated into conventions used in the drawing must be explained, i.e. the significance of colours, layers (including invisible layers), object types, line styles, line weights, text styles, fill and hatch styles, dimension styles.

Technique

Check the graphic for hidden information (invisible layers, etc.) and the relevance or suitability of this material for archiving, i.e. does it consist of construction lines, text paths, etc., does the depositor have copyright.

Ensure that any linked data (e.g. other image files, fonts) are present. These should be embedded into the graphic.

If necessary export the graphic to a suitable archive format(s). This may be dependant on the nature of original, whether pure vector or vector and raster data. Mixed formats may require the separation of the vector and raster data. DXF is generally a good preservation medium for the vector content. Use a suitable preservation format for the raster content (see the Bitmap (raster) image Preservation Handbook). It may be possible to archive mixed content as SVG.

Vector data should be archived at a suitable level of precision, preferably that used when collecting the original data. Exporting to an excessively low level of precision will degrade the data. Exporting to an excessively high level of precision will cause file bloat and may imply a false degree of precision for the data.

Validation of Exported Data

There is no objective way to compare the original file and an exported version. The best that can be done is to use programmes that can be trusted to give an accurate rendering of each format, either to paper or screen, and to compare the results by eye.

Problems and Issues

File migration to newer formats or to different packages can result in significant degradation of the image quality. This can be exacerbated, particularly if the migration is across platforms (e.g. from Mac to MS Windows), where the availability of fonts may differ. Programmes will usually substitute a font if the originally specified font cannot be found but the substitute may be inadequate and the resulting image spoiled.