FileFormat.Info

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Wavefront OBJ File Format Summary

Also Known As: Wavefront Object, OBJ

Type	3D Vector
Colors	Unlimited
Compression	Uncompressed
Maximum Image Size	Unlimited
Multiple Images Per File	Yes
Numerical Format	NA
Originator	Wavefront
Platform	UNIX
Supporting Applications	Advanced Visualizer
See Also	Wavefront RLA

Usage
Used to store and exchange 3D data.

Comments
The Wavefront OBJ format is a useful standard for representing polygonal data in ASCII form.

Vendor specifications are available for this format.

Wavefront OBJ (object) files are used by Wavefront's Advanced Visualizer application to store geometric objects composed of lines, polygons, and free-form curves and surfaces. Wavefront is best known for its high-end computer graphics tools, including modeling, animation, and image compositing tools. These programs run on powerful workstations such as those made by Silicon Graphics, Inc.

Wavefront OBJ files are often stored with the extension ".obj" following the UNIX convention of lowercase letters for filenames. The most recently documented version of OBJ is v3.0, superseding the previous v2.11 release.

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In Wavefront's 3D software, geometric object files may be stored in ASCII format (using the ".obj" file extension) or in binary format (using the .MOD extension). The binary format is proprietary and undocumented, so only the ASCII format is described here.

The OBJ file format supports lines, polygons, and free-form curves and surfaces. Lines and polygons are described in terms of their points, while curves and surfaces are defined with control points and other information depending on the type of curve. The format supports rational and non-rational curves, including those based on Bezier, B-spline, Cardinal (Catmull-Rom splines), and Taylor equations.

File Organization

OBJ files do not require any sort of header, although it is common to begin the file with a comment line of some kind. Comment lines begin with a hash mark (#). Blank space and blank lines can be freely added to the file to aid in formatting and readability. Each non-blank line begins with a keyword and may be followed on the same line with the data for that keyword. Lines are read and processed until the end of the file. Lines can be logically joined with the line continuation character (\ ) at the end of a line.

The following keywords may be included in an OBJ file. In this list, keywords are arranged by data type, and each is followed by a brief description.

Vertex data:

> v   Geometric vertices
> vt Texture vertices
> vn Vertex normals
> vp Parameter space vertices

Free-form curve/surface attributes:

> deg   Degree
> bmat   Basis matrix
> step   Step size
> cstype Curve or surface type

Elements:

> p   Point

```
l       Line
f       Face
curv    Curve
curv2 2D curve
surf    Surface
```

Free-form curve/surface body statements:

```
parm Parameter values
trim   Outer trimming loop
hole   Inner trimming loop
scrv   Special curve
sp      Special point
end   End statement
```

Connectivity between free-form surfaces:

```
con Connect
```

Grouping:

```
g    Group name
s    Smoothing group
mg Merging group
o    Object name
```

Display/render attributes:

```
bevel          Bevel interpolation
c_interp       Color interpolation
d_interp       Dissolve interpolation
lod            Level of detail
usemtl         Material name
mtllib         Material library
shadow_obj Shadow casting
trace_obj     Ray tracing
ctech          Curve approximation technique
stech          Surface approximation technique
```

File Details

The most commonly encountered OBJ files contain only polygonal faces. To describe a polygon, the file first describes each point with the "v" keyword, then describes the face with the "f" keyword. The

line of a face command contains the enumerations of the points in the face, as 1-based indices into the list of points, in the order they occurred in the file. For example, the following describes a simple triangle:

```
# Simple Wavefront file
v 0.0 0.0 0.0
v 0.0 1.0 0.0
v 1.0 0.0 0.0
f 1 2 3
```

It is also possible to reference points using negative indices. This makes it easy to describe the points in a face, then the face, without the need to store a large list of points and their indexes. In this way, "v" commands and "f" commands can be interspersed.

```
v -0.500000 0.000000 0.400000
v -0.500000 0.000000 -0.800000
v -0.500000 1.000000 -0.800000
v -0.500000 1.000000 0.400000
f -4 -3 -2 -1
```

OBJ files do not contain color definitions for faces, although they can reference materials that are stored in a separate material library file. The material library can be loaded using the "mtllib" keyword. The material library contains the definitions for the RGB values for the material's diffuse, ambient, and specular colors, along with other characteristics such as specularity, refraction, transparency, etc.

The OBJ file references materials by name with the "usemtl" keyword. All faces that follow are given the attributes of this material until the next "usemtl" command is encountered.

Faces and surfaces can be assigned into named groups with the "g" keyword. This is used to create convenient sub-objects to make it easier to edit and animate 3D models. Faces can belong to more than one group.

The following demonstrate more complicated examples of smooth surfaces of different types, material assignment, line continuation, and grouping.

Cube with Materials

```
# This cube has a different material
# applied to each of its faces.
      mtllib master.mtl
      v      0.000000    2.000000    2.000000
      v      0.000000    0.000000    2.000000
      v      2.000000    0.000000    2.000000
      v      2.000000    2.000000    2.000000
      v      0.000000    2.000000    0.000000
      v      0.000000    0.000000    0.000000
      v      2.000000    0.000000    0.000000
      v      2.000000    2.000000    0.000000
      # 8 vertices
      g front
      usemtl red
      f 1 2 3 4
      g back
      usemtl blue
```

```
        f 8 7 6 5
        g right
        usemtl green
        f 4 3 7 8
        g top
        usemtl gold
        f 5 1 4 8
        g left
        usemtl orange
        f 5 6 2 1
        g bottom
        usemtl purple
        f 2 6 7 3
        # 6 elements
```

Bezier Patch

```
# 3.0 Bezier patch
v -5.000000 -5.000000 0.000000
v -5.000000 -1.666667 0.000000
v -5.000000 1.666667 0.000000
v -5.000000 5.000000 0.000000
v -1.666667 -5.000000 0.000000
v -1.666667 -1.666667 0.000000
v -1.666667 1.666667 0.000000
v -1.666667 5.000000 0.000000
v 1.666667 -5.000000 0.000000
v 1.666667 -1.666667 0.000000
v 1.666667 1.666667 0.000000
v 1.666667 5.000000 0.000000
v 5.000000 -5.000000 0.000000
v 5.000000 -1.666667 0.000000
v 5.000000 1.666667 0.000000
v 5.000000 5.000000 0.000000
# 16 vertices
cstype bezier
deg 3 3
# Example of line continuation
surf 0.000000 1.000000 0.000000 1.000000 13 14 \
                                15 16 9 10 11 12 5 6 7 8 1 2 3 4
parm u 0.000000 1.000000
parm v 0.000000 1.000000
end
# 1 element
```

Cardinal Curve

```
# 3.0 Cardinal curve
v 0.940000 1.340000 0.000000
v -0.670000 0.820000 0.000000
v -0.770000 -0.940000 0.000000
v 1.030000 -1.350000 0.000000
v 3.070000 -1.310000 0.000000
# 6 vertices
cstype cardinal
deg 3
curv 0.000000 3.000000 1 2 3 4 5 6
```

```
parm u 0.000000 1.000000 2.000000 3.000000 end
# 1 element
```

Texture-Mapped Square

```
# A 2 x 2 square mapped with a 1 x 1 square
# texture stretched to fit the square exactly.
mtllib master.mtl
v  0.000000 2.000000 0.000000
v  0.000000 0.000000 0.000000
v  2.000000 0.000000 0.000000
v  2.000000 2.000000 0.000000
vt 0.000000 1.000000 0.000000
vt 0.000000 0.000000 0.000000
vt 1.000000 0.000000 0.000000
vt 1.000000 1.000000 0.000000
# 4 vertices
usemtl wood
# The first number is the point,
# then the slash,
# and the second is the texture point
f 1/1 2/2 3/3 4/4
# 1 element
```

For Further Information

For further information about the Wavefront OBJ format, see the specification.

You can also contact:

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Wavefront also maintains a toll-free support number and a BBS for its customers. There are many Wavefront user groups, too.

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