AC3D Modeler Overview

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What I'll talk about

- **AC3D terminology**

- **AC3D features**

- **Things to be careful of**

I will *not* talk about all the keys or buttons to press for every imaginable operation. See the html documentation!

AC3D Terminology

Vertex: 3D position, possibly with texture coordinates

Surface: a linked list of vertices, which may be displayed as a **polygon**, a **polyline** (closed, piecewise linear curve), or a **line** (open, piecewise linear curve)

Object: a collection of surfaces

Group: a collection of objects that can be organized hierarchically

Terminology Note

AC3D's definitions for surface, polyline, and line DO NOT correspond to the usual definitions of these terms:

Surface: a smooth or piecewise-linear 2-manifold, with every point homeomorphic to an open disc (e.g. a sphere, torus, polygonal mesh, etc)

Polyline: a piecewise linear curve

Line: either an infinite, linear curve or a bounded linear curve (i.e. a **line segment**)

Views

3 orthogonal views

- pan around
- zoom, either current view or all orthogonal views

3D view

- spin mode
  - —vertical mouse spins about horizontal axis
  - —horizontal mouse always spins about y-axis
- walk mode
  - —forward/back, left/right, up/down
  - —turn head left/right

Creating Basic Objects

- **Polygon, polyline, line, ellipse, rectangle**

- **Cylinder, sphere, box**

- **Disk**

- **Rectangular mesh**

More advanced object creation

Extrude a polygon, polyline, or line

- **Extruding a polygon yields a closed object**

Revolve a polyline or line

- **Revolving a line touching the axis at both ends can yield a closed object**

- **Revolving a polyline that does not touch the axis yields a closed object**

Take the convex hull of a set of points

- **Useful for joining two objects**

Selection, move, resize, rotate

- *Select* either vertices, objects, or groups
  - click on vertex or edge
  - use selection box

- *Move* in coordinate plane

- *Resize* along coordinate axes (i.e. *non-uniform scaling*)

- *Rotate* about coordinate axis

Snapping

- **Grid snapping available during vertex placement**

- **Vertices may be snapped together after the fact**

- **Objects may be automatically shifted to make certain vertices line up**

Shading properties

- **Render as polygons, polylines, or lines**

- **Flat or smooth shade (where possible)**

- **Backface culling on/off**

  - **If rendering is rasterization bound, backface culling speeds things up**

  - **Usually used for closed objects, where back faces are not typically seen anyway**

Normals

Polygon vertices on basic, closed shapes are created in CCW order when viewed from outside

Normals are created to be pointing outward

Surfaces of revolution may be created with wrong orientation

- check with backface culling

- use flip normals to fix

Shared vertices

Shared vertices allow adjacent polygons to *know* that they are adjacent

- also allow vertex normals to be computed across adjacent faces for smooth shading

Basic mesh shapes created with shared vertices

Exactly coincident vertices may be shared later

- Grid snapping or vertex-vertex snapping can make them coincident

Output formats

AC3D's format preserves all model info

- several formats also exported, and a few imported (importing is harder!)

Eventually, you'll need to export to a format your program can read (not until 2nd homework)

Raw triangle format probably easiest

- but throws away hierarchy, object and shared vertex information
- save individual objects to separate files to preserve object information and allow animation

Watch out!

- **Avoid using too many triangles or hidden triangles**

    - **more triangles = longer rendering time**

    - **revolving polygon or object creates hidden, internal polygons (wasteful)**

    - **the same goes for extruding closed objects**

- **If you want to use backface culling in your HMD application, check for proper normal orientation**

Watch out! (continued)

Save often

- Program sometimes crashes

Keep separate files for different versions

- Some operations are hard to undo, even manually

- File system errors could cause corrupt file to overwrite your current, good file