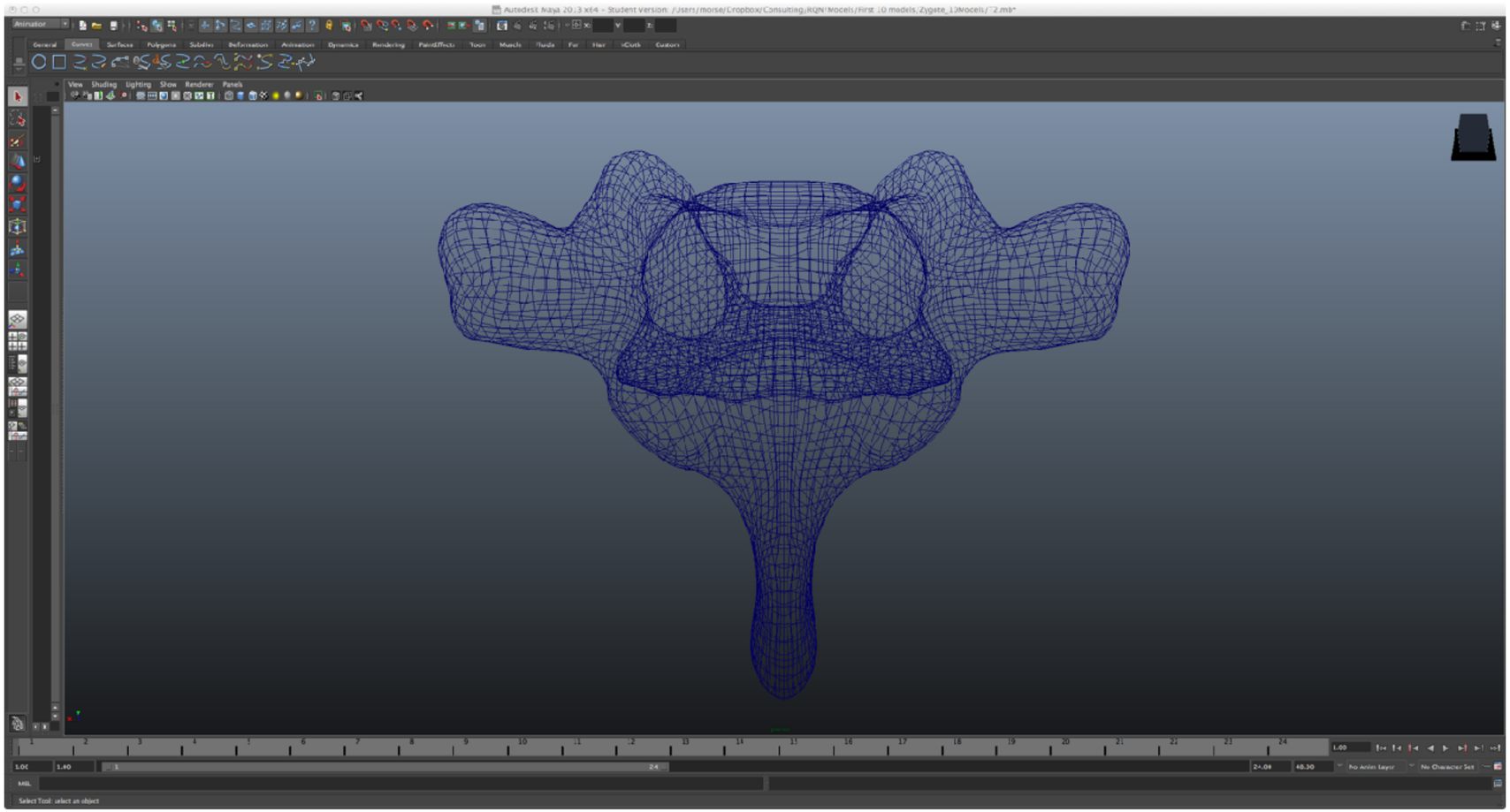
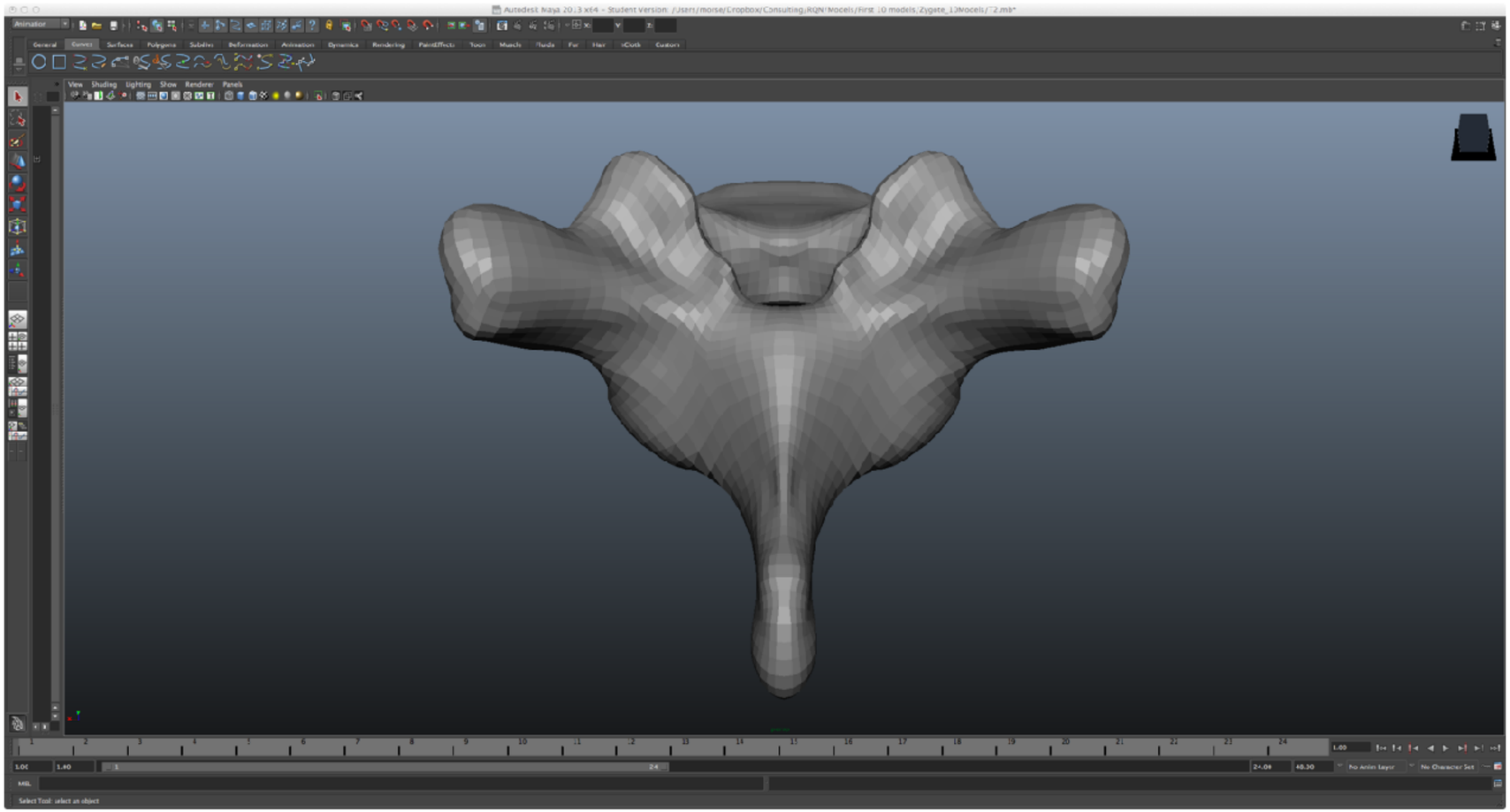
Points, Lines, and Polygons

CS 355: Introduction to Graphics and Image Processing

Wireframe Meshes



Polygonal Faces

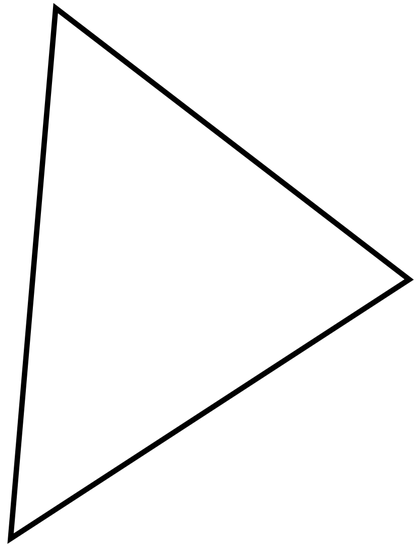


Primitives

- Vertex:
  A 3D point (X,Y,Z)

- Edge:
  A line connecting two vertices

- Face:
  A polygon defined by a set of “adjacent” (connected by edges) vertices



Storage

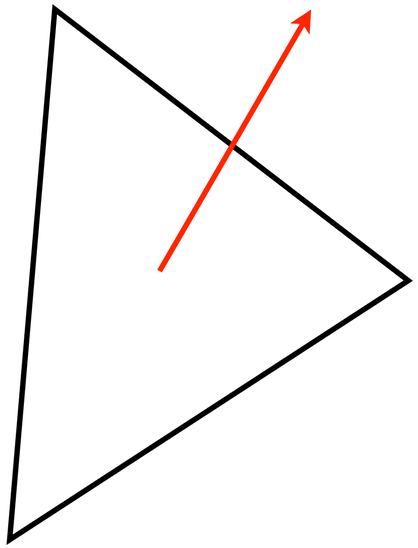
- Common way to store models:
  - List of vertices
  - List of faces bound by vertices (by index)
  - Other information about vertices or faces
- Avoids duplication of redundant data

Storage Example

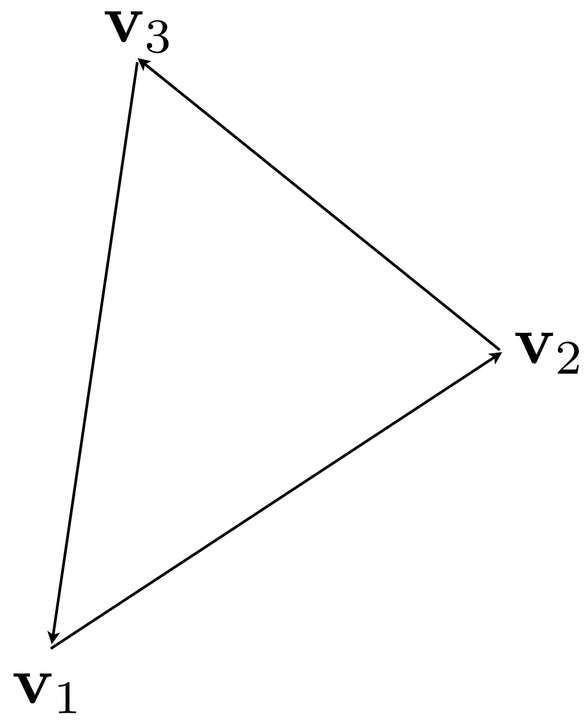
```
# List of Vertices, with (x,y,z[,w]) coordinates,
# w is optional and defaults to 1.0.
  v 0.123 0.234 0.345 1.0
  v ...
  ...
# Face Definitions (see below)
  f 1 2 3
  f 3 4 5
  f 6 3 7
  f ...
  ...
```

Normals

- It's useful to determine the *normal* to the polygonal face
  - Visibility
  - Lighting
  - …
- Be consistent—usually go with outward facing



Calculating Normals



$$\hat{\mathbf{n}} = \frac{(\mathbf{v}_2 - \mathbf{v}_1) \times (\mathbf{v}3 - \mathbf{v}2)}{\|(\mathbf{v}_2 - \mathbf{v}_1) \times (\mathbf{v}3 - \mathbf{v}2)\|}$$

Assumes a consistent
winding order

Coming up...

- 3D rendering geometry
- Introduction to OpenGL
- Hierarchical transformations
- Visibility
- Lighting