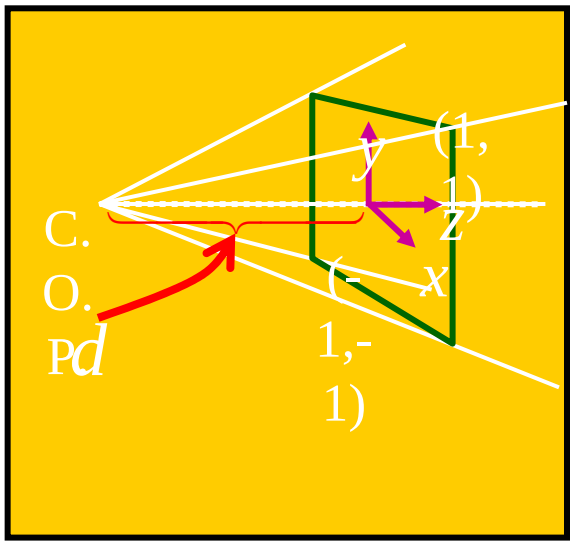
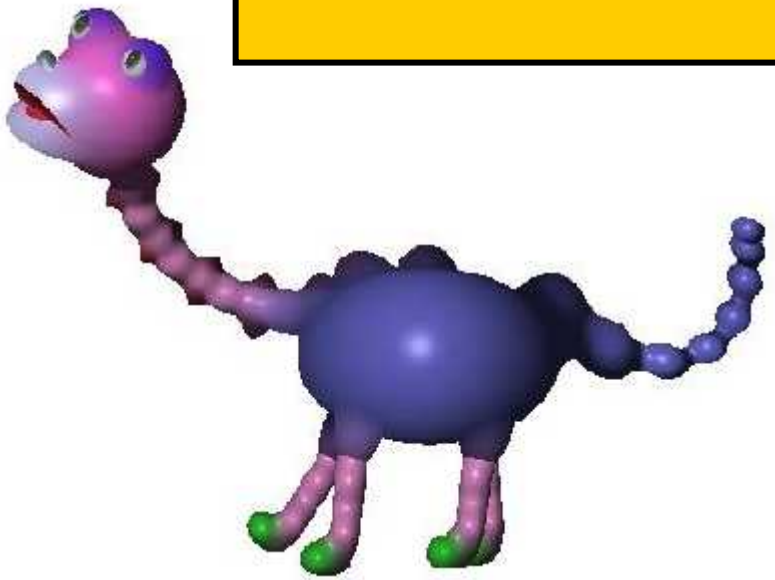
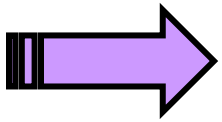


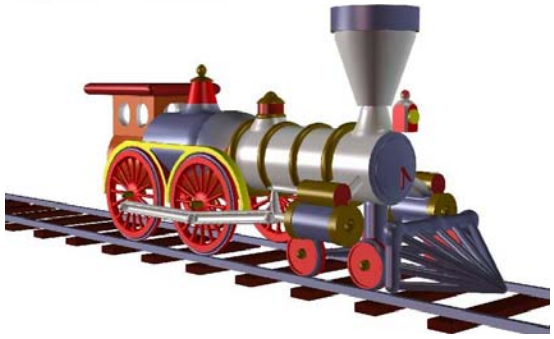
CSC 405
Modelling Overview

by Brian Wyvill

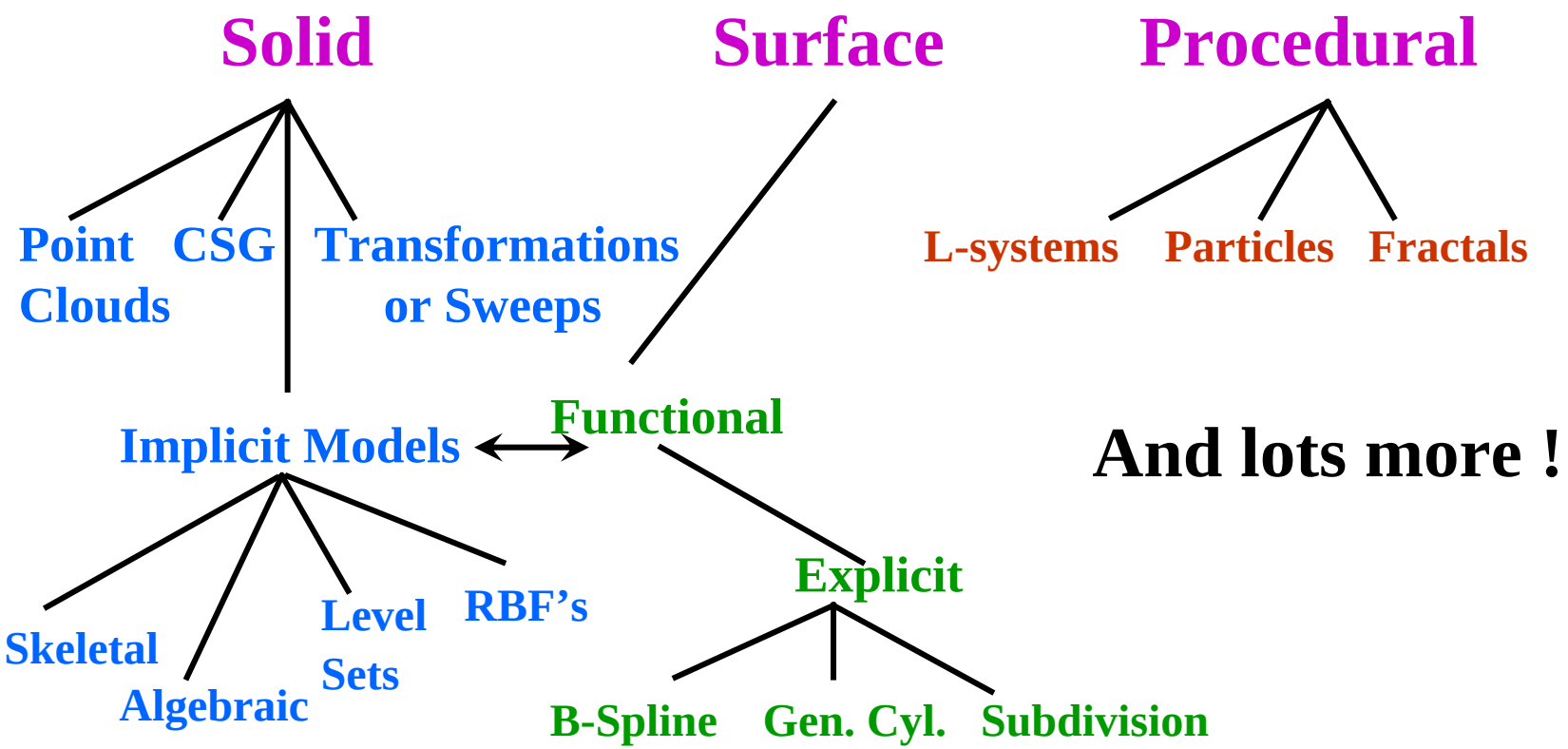


The University of Victoria
Graphics Group





Modelling Methods for Computer Graphics

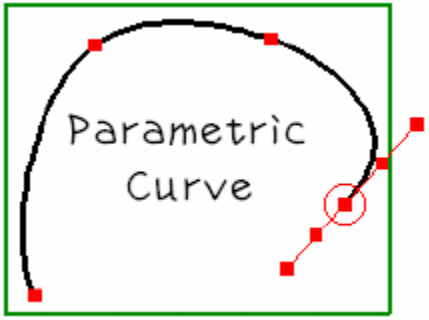


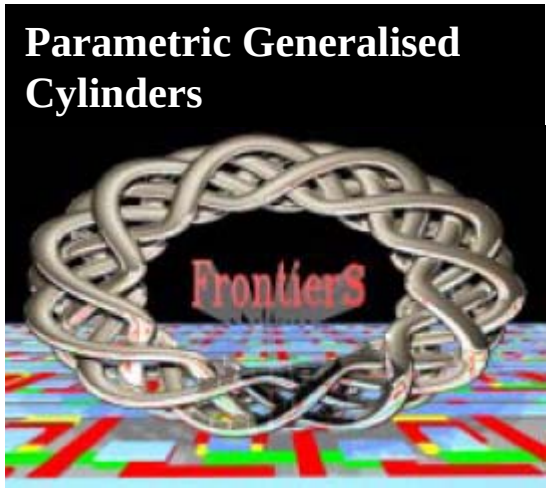

L-System plant


Fractal Terrain


CSG


Parametric Patches

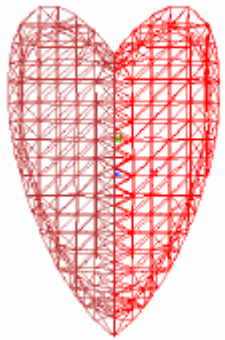

Parametric
Curve


Parametric Generalised
Cylinders
Frontiers


Stanford Bunny
(mesh)

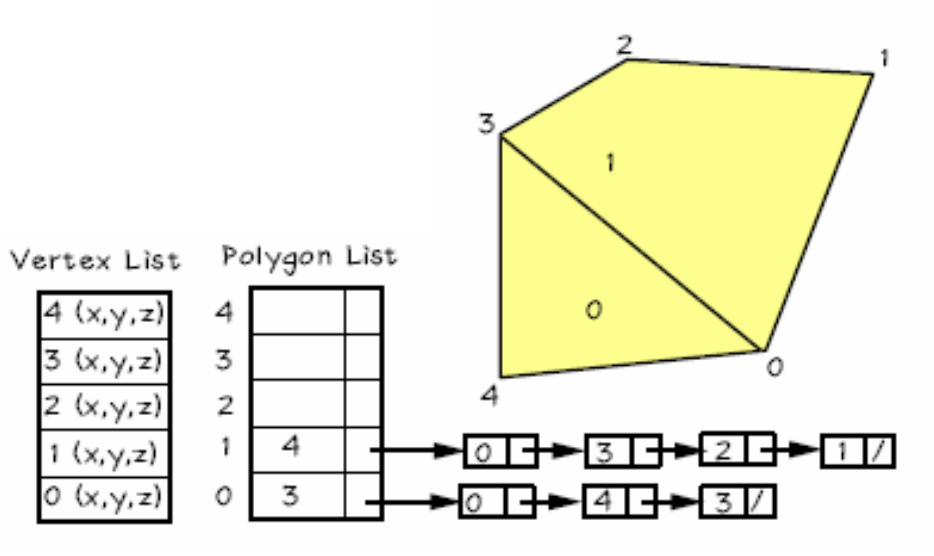

Implicit Model

Polygon Meshes



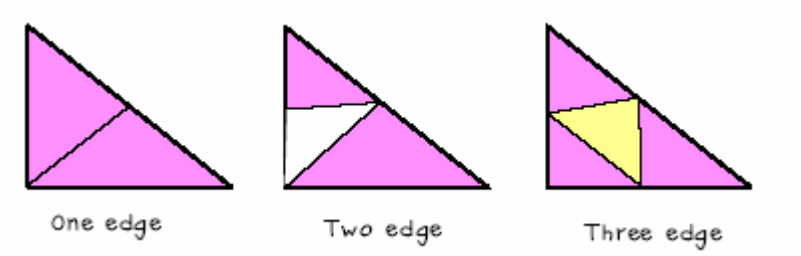
Mesh Consistency

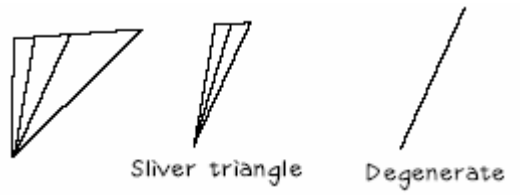
All polygons closed, all edges used once but less than n-times. Each vertex is referenced by at least two edges (closed mesh). Some applications require planarity, no holes etc.



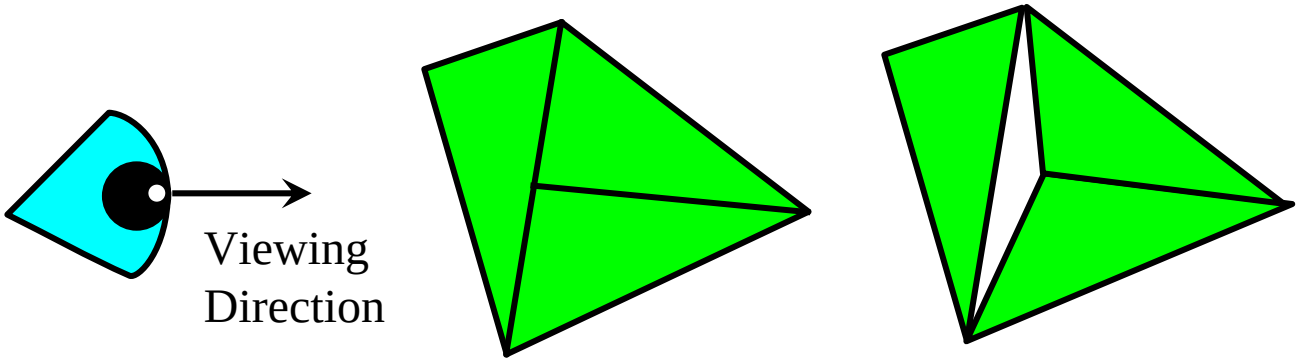
vtx 1 vtx 2 poly1 poly2

Subdividing Triangles

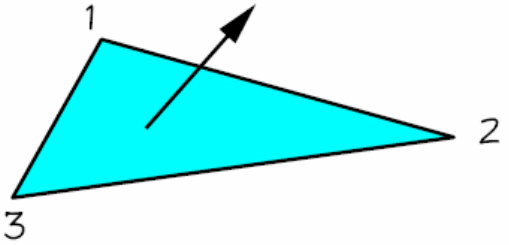




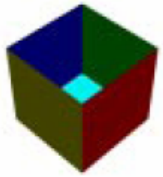
subdivide triangle cracks or T-intersection Problem



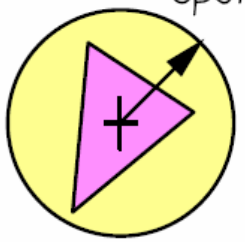
Using Triangle Meshes



1. Make sure triangles defined in a consistent direction, e.g. counter-clockwise indicates outwards normal.



epsilon=radius

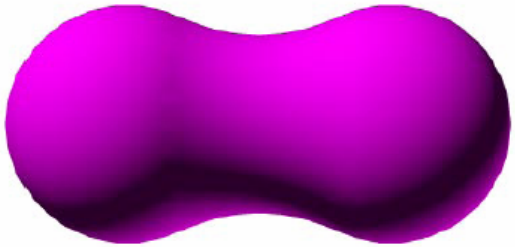


circle of "confidence"

2. Check for co-linear vertices or all vertices within epsilon of each other.

3. Rendering speed (few triangles) Vs. Smooth curved surfaces.

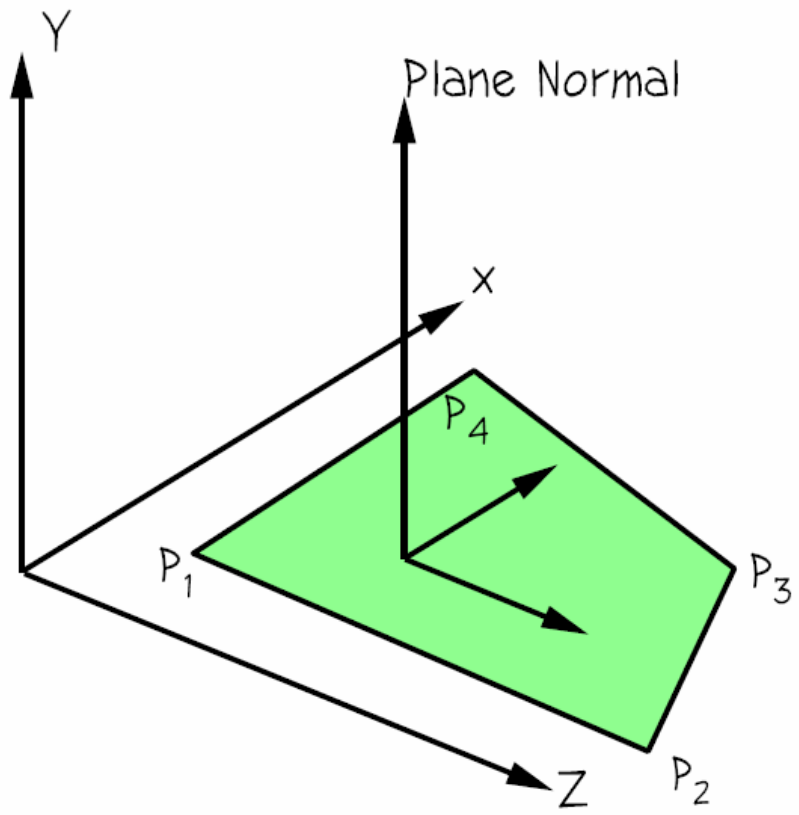
3016 polygons



408 polygons

4. Silhouette Edges.

Plane Equation and Normal



A=C=0 for this plane

$$Ax + By + Cz + D = 0$$

A, B, C, D can be computed from 3 non-colinear points, 4th equation is the plane equation. (Write it as determinants and expand by cofactors).

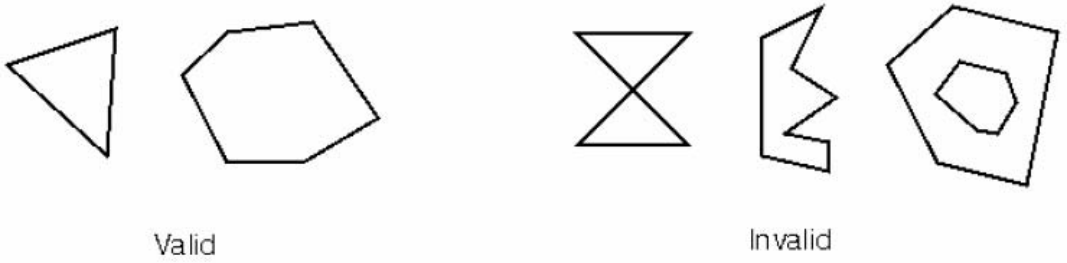
Normal to the plane is given by coeficients [A B C]

Can also compute normal as cross product of 2 edges:

$$P_1P_2 \times P_1P_4$$

Zero cross product indicates colinear vertices.

OpenGl Polygons and Triangle Meshes



OpenGL allows convex polygons to be specified:

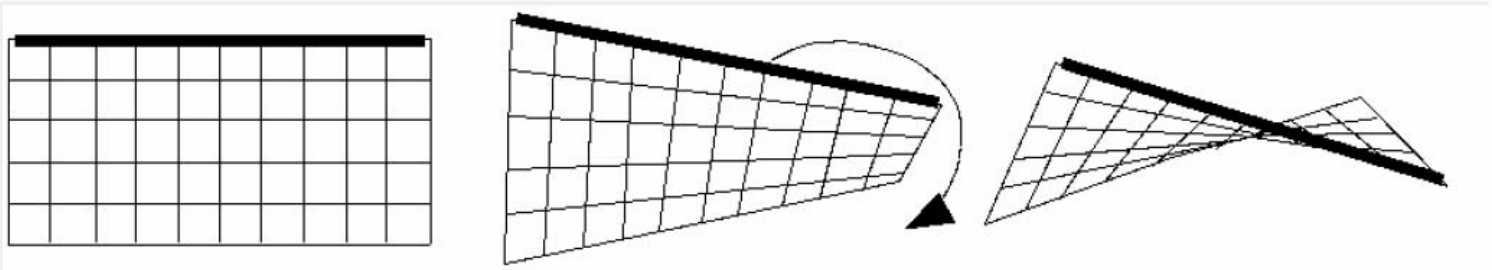


Figure 2–3 Nonplanar Polygon Transformed to Nonsimple Polygon

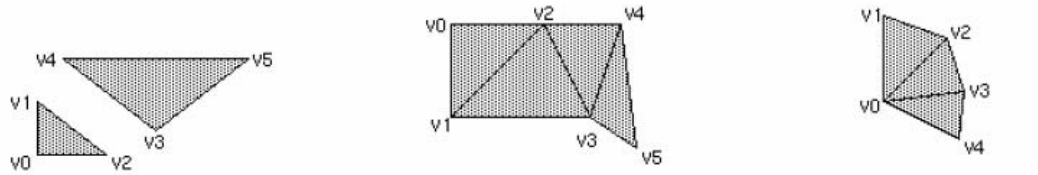


Figure 2–6 Geometric Primitive Types