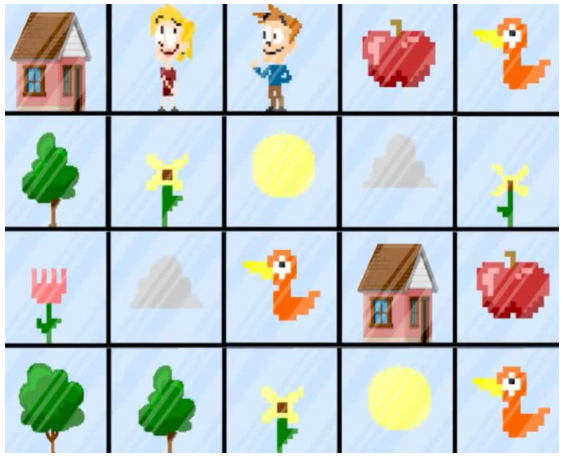
Representing Objects

Sprites

- Image or animation of object

Sprites

- Layer many to generate scene

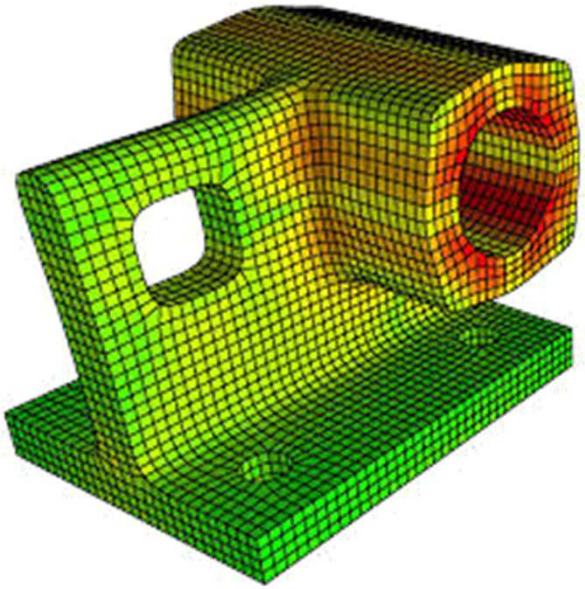


3D Objects

- Graphics scenes contain
  - Solid geometric objects
  - Trees, flowers, clouds, rocks, water
- Creation of models
  - Surface ↔ interior models
  - Explicit ↔ procedural models
  - Heuristically ↔ physically based models

Polygon Surfaces

- set of surface polygons enclose object interior



= ***Boundary Representation***

("B-Rep")

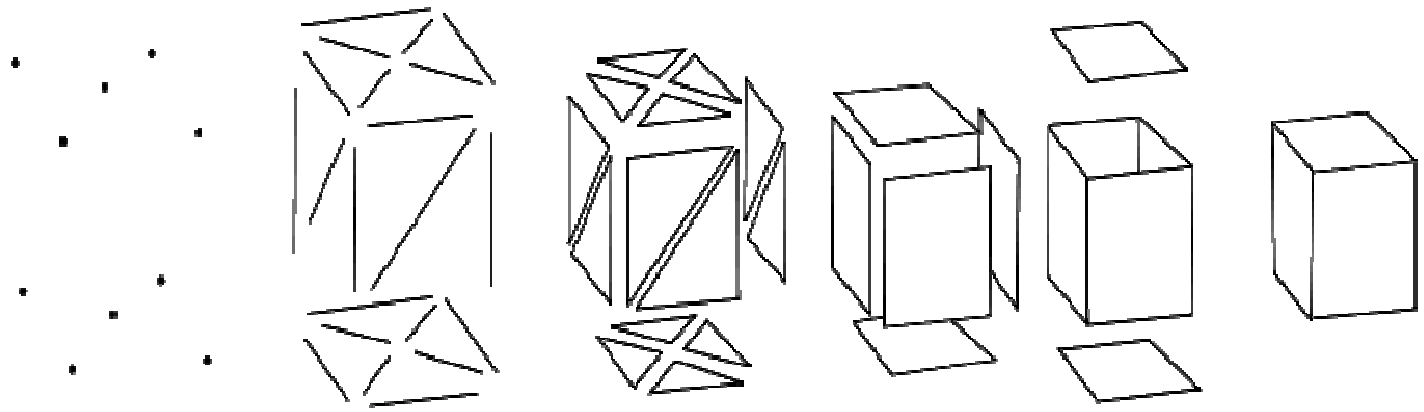
example:
machine part surface
represented by quadrilaterals

Polygon Surfaces

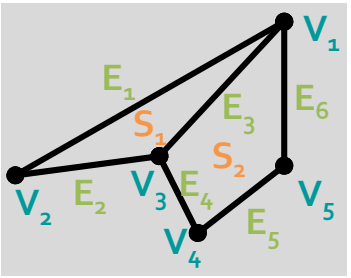
- More polys = better approximation

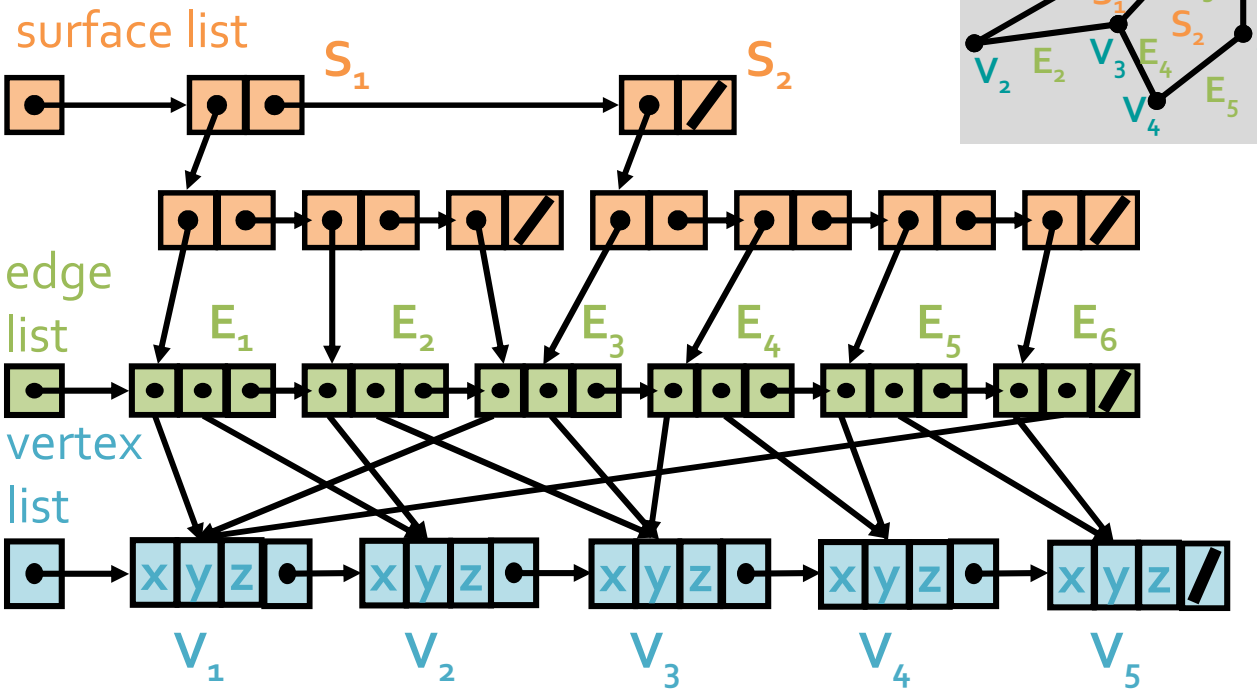
10,108 polys 1,383 polys 474 polys 6 polys

B-Rep (Boundary Representation)



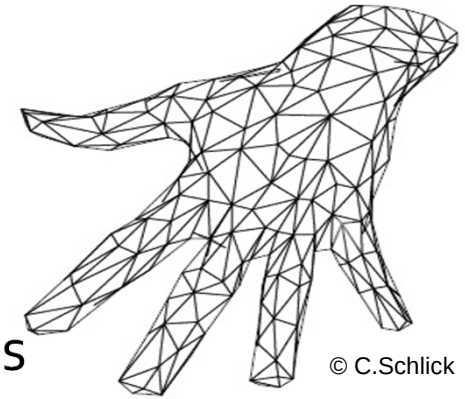
Lists for B-Reps

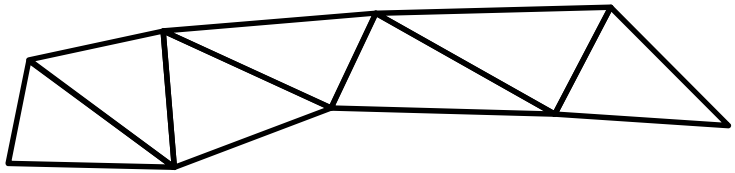




Triangle Meshes

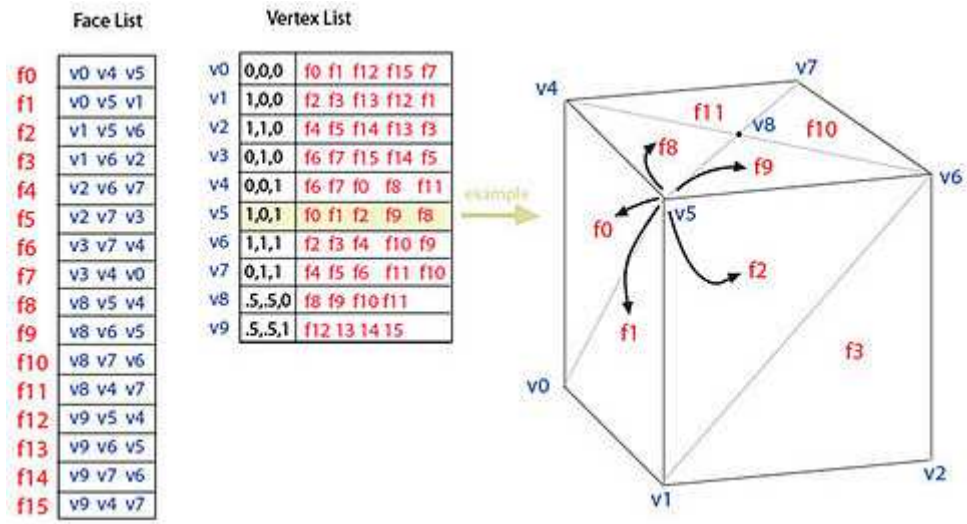
- Most often used (directly rendered by hardware)
- Why triangles?
  - Simplest polygon
  - Always on a plane
- ***Triangle mesh*** = connected triangles



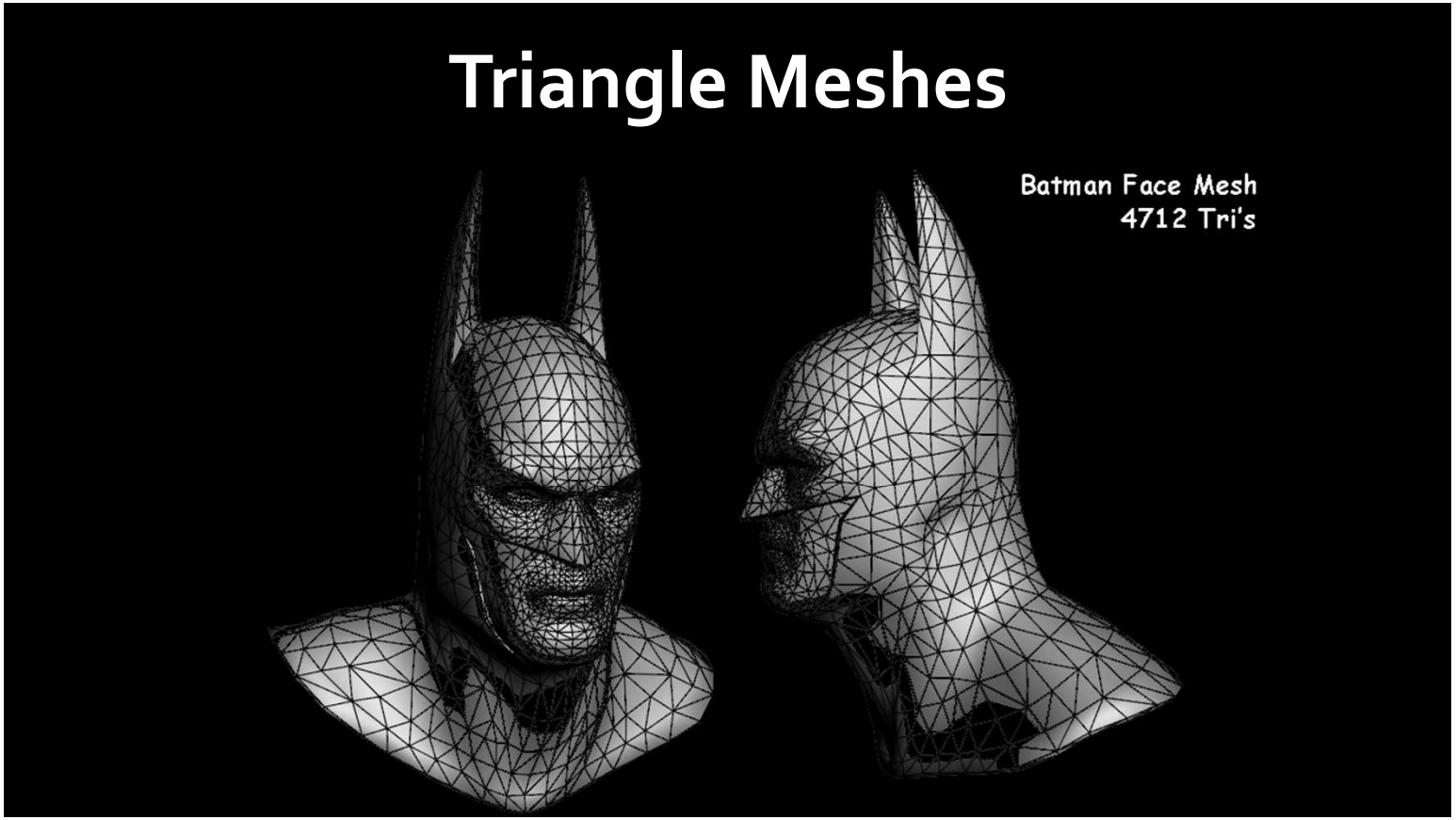


Face-Vertex List

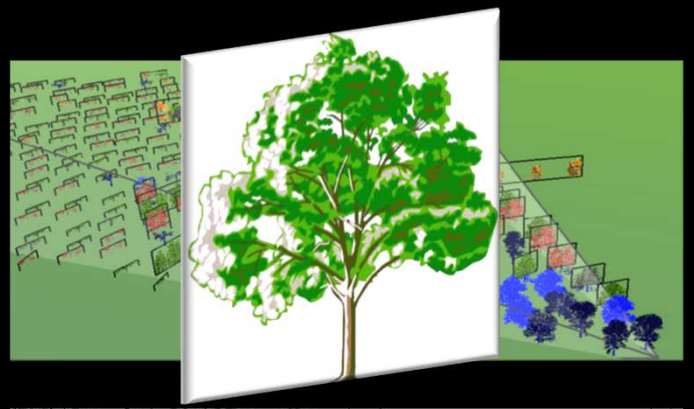
- Supported by graphics hardware

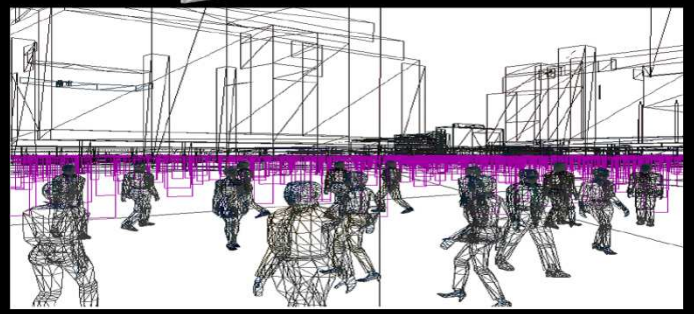


Triangle Meshes



Impostor



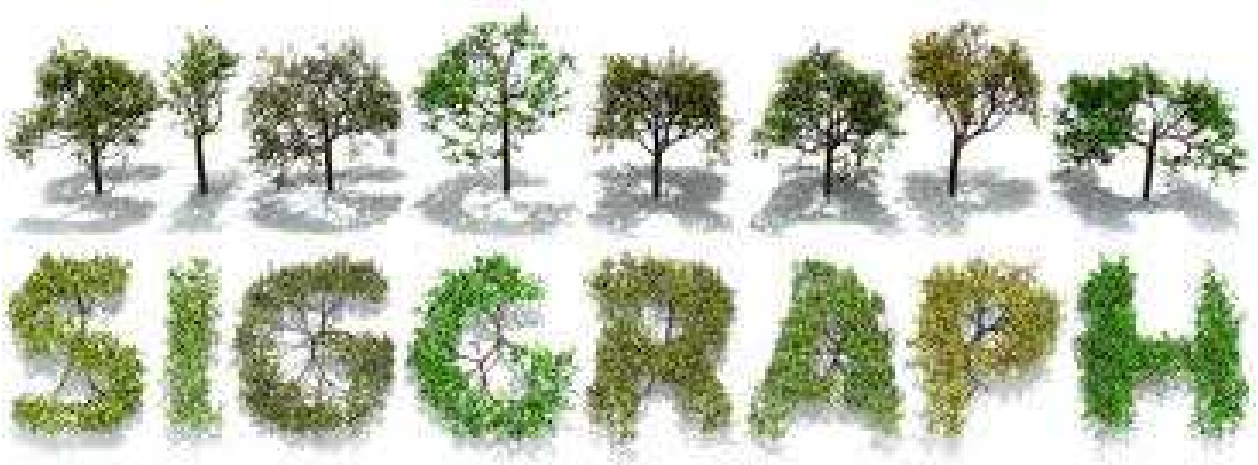



Impostor

Impostor

Procedural Modeling

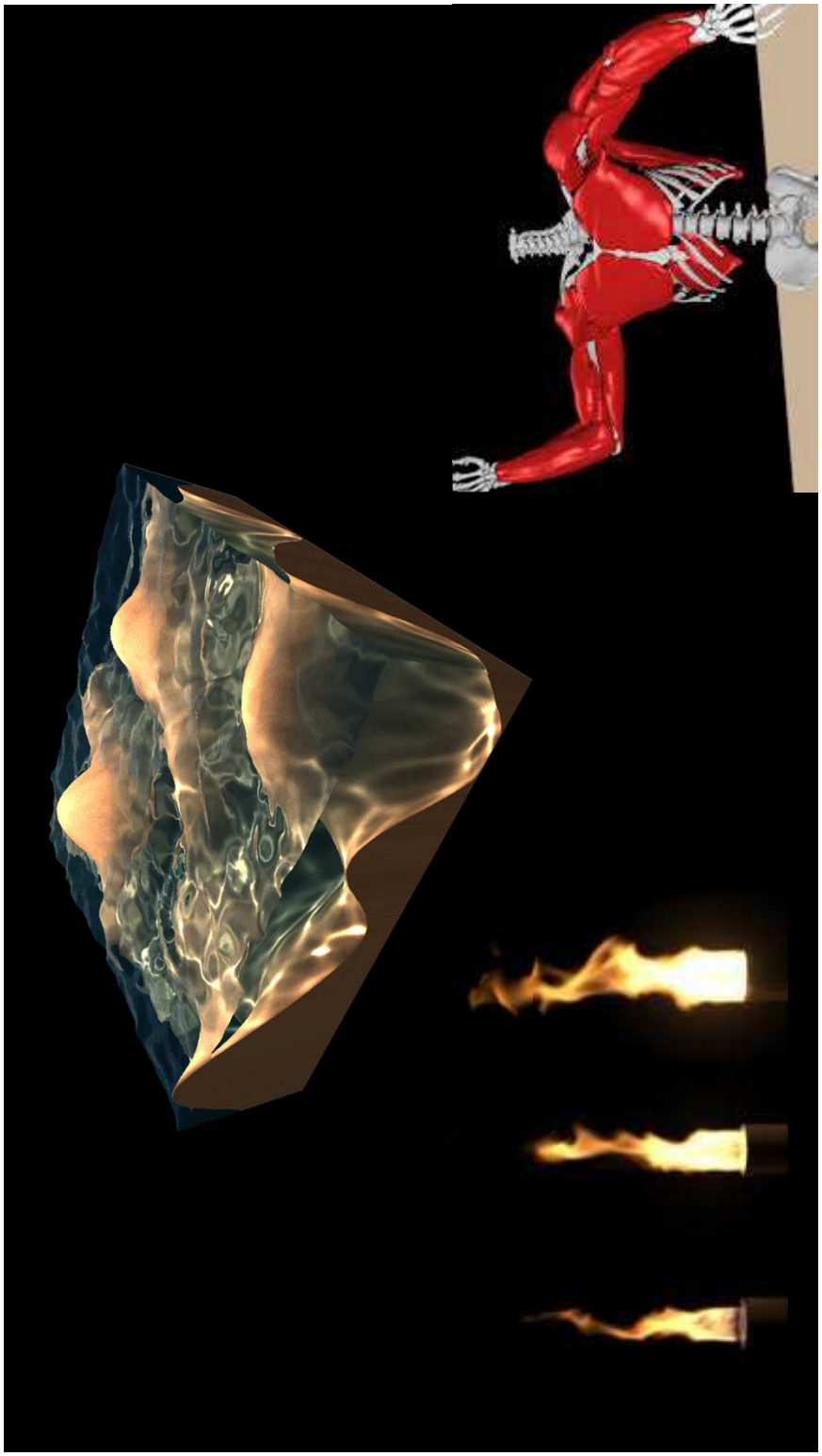
- Use algorithm/rule to produce models




guided tour
fly
walk
Settings
Environment
Snapshot
Exit
FPS: 17

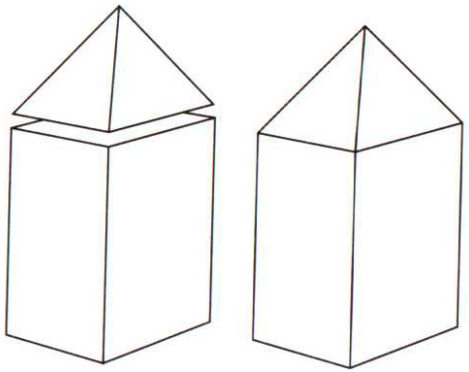
Physically Based Modelling

- Procedural modeling with physically based rules

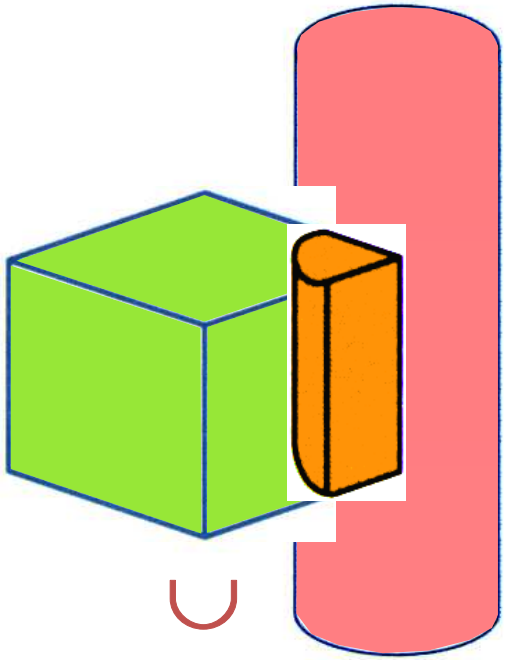


Constructive Solid Geometry

- Constructive Solid Geometry (CSG)
  - boolean set operations on 3D objects
  - union, intersection, difference operation



CSG: Different Set Operations



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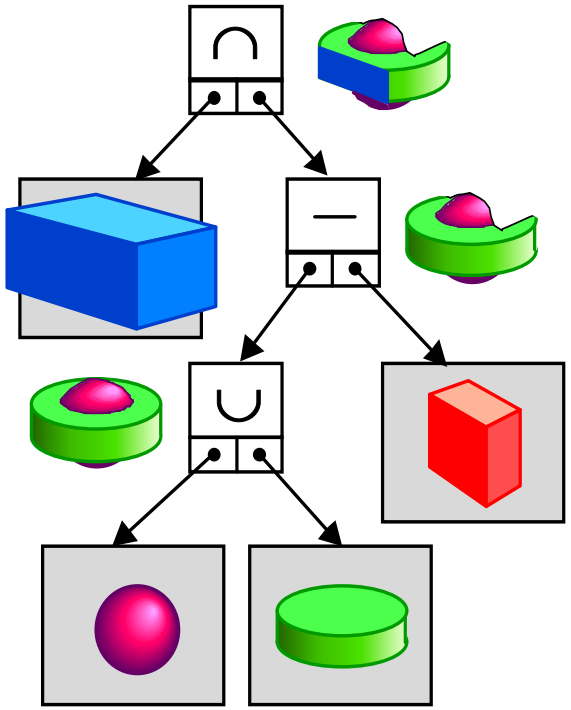
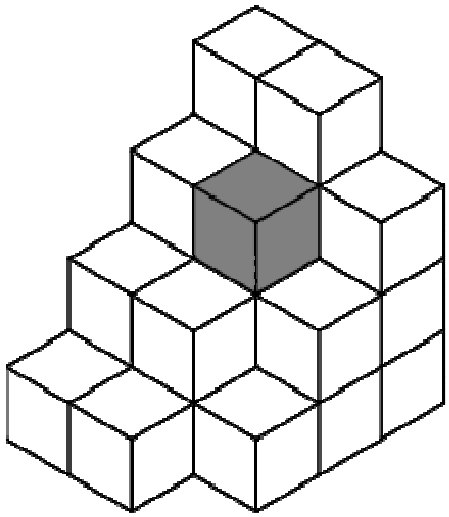
CSG Data Structure

- Object assembled from simple solids with **set operations**
- data structure **binary tree**
- recursive evaluation



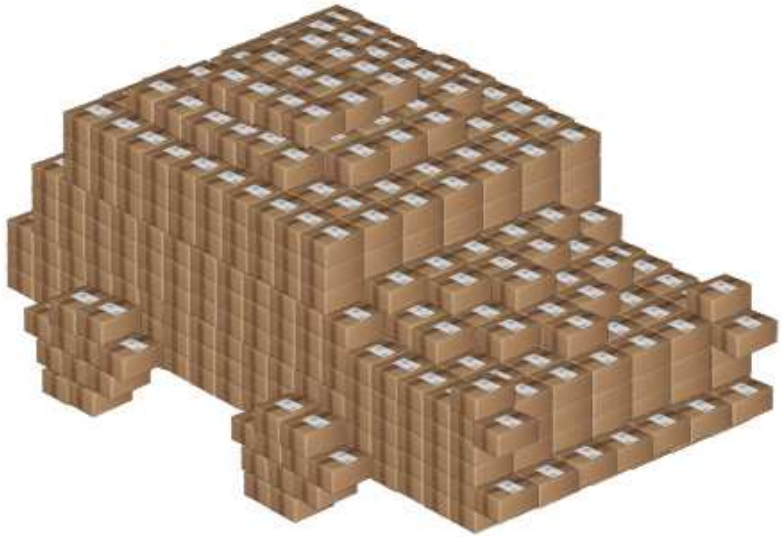
Voxels

- Name is a combination of “volume” and “pixel”



Real World

Real World



Surface vs Solid Voxelization

Voxels

- Not directly renderable by hardware
- Bad if lots of free space (memory!)
- But "fast" algorithms exists
  - Volume rendering
  - Ray casting
  - Marching cubes