Visibility Computations

- **Visible Surface Determination**
- **Global Visibility Computations**
- **Visibility Culling**

Visible Surface Determination

Given a set of 3D objects and a viewing specification, determine the lines or surfaces of the object that are visible

- Hidder-line or hidden-surface elimination
- Visible-line or visible-surface determination

Visible Surface Determination

No best solution

- Fast algorithms for interactive computer graphics
- Detailed realistic solutions: shadows, transparency and texture effects
- Computer animation: reflections and refractions

Trade-off between speed and detail

Use of Sorting

All visible surface algorithms involve sorting [Sutherland et al.74]

- Sort based on the geometric distance of a volume, edge or surface from the viewpoint
- Use of coherence to improve its efficiency: the tendency for the characteristics of a scene to be locally constant.

Object Space Algorithms

Implemented in the physical coordinate system in which the objects are described

for *each object in the world* **do**
begin
determine those parts of the object whose
view is unobstructed by other parts of it or any or any other object;
draw those parts in the appropriate color
end

Image Space Algorithms

Implemented in the screen coordinate system in which the objects are viewed

for *each pixel in the image* **do**
begin
determine the object closest to the viewer that is pierced by the projector through the pixel;
draw the pixel in the appropriate color
end

Visibility: Too Bloody Difficult [Whitted' 93]

A difference classification of visibility

- Back-end accumulator (e.g. Z-buffer)
- Middle-end accumulator (scan-line conversion)
- Front-end accumulator (e.g. ray tracing)

Secondary Visibility [Whitted' 93]

- Shadows
- Environment Mapping
- Ray Tracing
- Radiosity

Visibility Partitioning Preprocess [Whitted' 93]

- Is a very expensive process
- Only limited to static scenes

Cookie Cutter Algorithms

General object space approaches that involve geometric partitioning

- **Sutherland 1971-72**
- **Weiler/Atherton 1977**
- **Abram 1986**

Area Visibility or Global Visibility

Visibility from a region or space

- **A region is a collection of points in 1D, 2D or 3D space. Compute the visibility from each point and take the union!**

Visibility Culling

Eliminate a subset of the model not visible from the current viewpoint

- **View-frustum culling**
- **Backface culling**
- **Occlusion culling**