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

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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

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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.

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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

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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

Dinesh Manocha,