3D Viewing

CS116A

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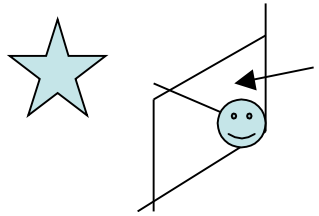
Outline

- Basic Concepts
- The 3D Viewing Pipeline
- 3D Viewing Coordinate Parameters

Viewing a Scene in 3D

- At its simplest each scene defined in terms of the surfaces bounding some object interior. (maybe for animations have skeletons).
- Many of the algorithms (ex: clipping are similar to the 2D case).
- To display a 3D scene need to set up a coordinate reference (camera location) for the viewing.
- This coordinate reference defines the **(view plane/projection plane)** for the scene



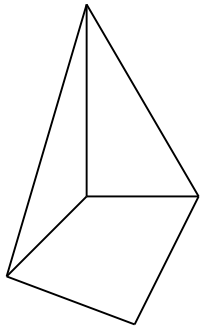
View plane

Projections

- Unlike a camera we can choose different methods for projecting a scene on the view plane:
  - Could project points on object along parallel lines (parallel projection)
  - Could project points on surface to points of view plane along a converging lines with a point at infinity (perspective projection)

Depth Cueing

- Depth info is important in 3D scenes.
- Useful to be able to identify which is the front and which is the back of each displayed object



- One simple technique is to vary the brightness of a point with the distance it is from the viewing plane

Identifying Visible Lines and Surface

- Another approach to clarify depth relationships for wireframe models is to draw visible lines in a different color then hidden ones.
- Obviously in a non-wireframe set-up back of some surfaces will be completely eliminated from the scene

Surface Rendering

- To increase realism one should figure out how lighting affects the surface characteristics of the objects in the scene being rendered.
- Example properties: transparentness/opaqueness, smoothness/roughness, surface type such as plastic/glass/wood-grain, etc., surface bumpiness.

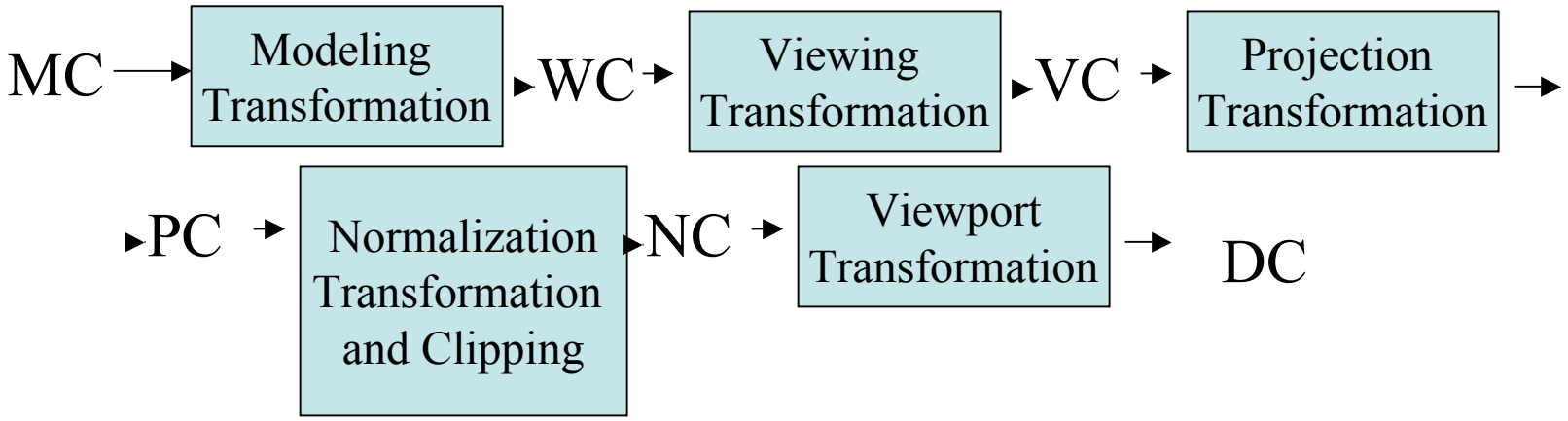
Exploded and Cutaway Views

- Some graphics packages allow objects to be stored in a hierarchical manner. Internal details of the object are also stored.
- Exploded or cutaway views allow one to see this internal structure.

Stereoscopic Viewing

- Stereoscopic viewing presents two views of a scene, slightly separated and at a slight difference in angle.
- Using special glasses one can then see the scene in 3D.
- There are also raster based techniques for 3D viewing.

The 3D Viewing Pipeline



3D Viewing Coordinate Parameters

- To set up a 3D viewing reference need: a point in world coordinates P0=(x0,y0,z0), (called a view point or viewing position), and a view-up vector (yview) and a view direction (zview)

The View Plane Normal Vector

- As viewing direction is usually along zview axis, the view plane, is normally assumed to be perpendicular to this axis. A normal vector N to this plane can thus be used to specify the zview axis.
- Might use a scalar parameter zvp along the zview axis is used to set the position of this view plane along the zview-axis.
- To specify N can use Pref point on plane as well as P0.

The View-Up Vector

- Once N has been chosen one can set the direction V of the yview axis.
- Up is usually specified by giving a point in world coordinates not parallel to N. A convenient choice is often (0,1,0).
- To get an orthogonal basis do: n =N/||N||, u=Vxn/||V|| and finally set v = nxu.

Generating 3D Viewing Effects

- By changing the viewing parameters we project different views of the object
- One can also create a composite display by drawing several views next to each other.
- To achieve a panning effect, one can keep N fixed as vary P0.