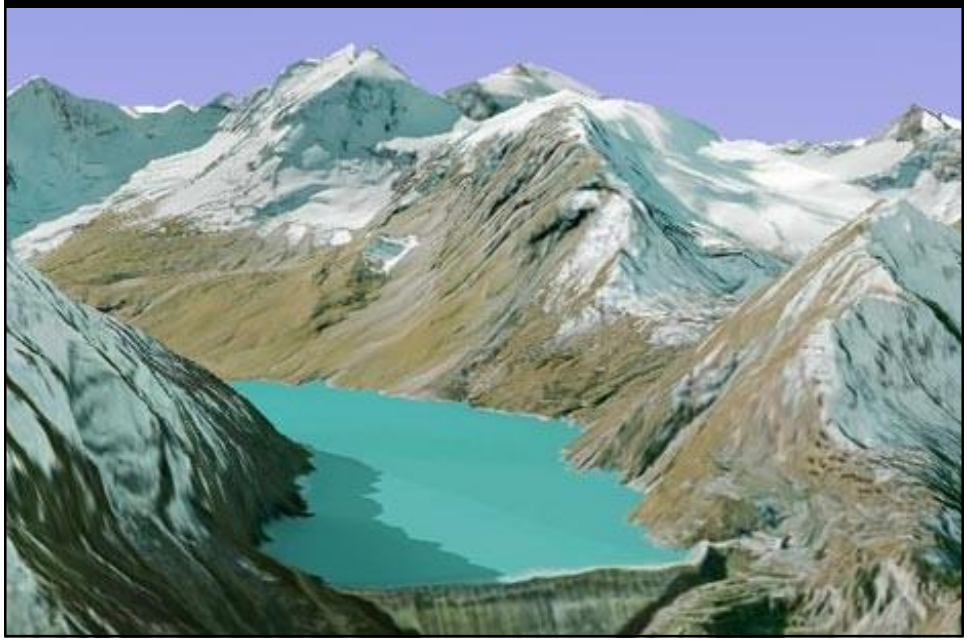
Basic Principles of Rendering



Rendering: What is it?

Definition:
The term "Rendering," in the context of Digital Terrain Visualization, refers specifically to the process of transforming a 3D space to a 2D plane in order to simulate a 3D experience graphically on a computer screen.

Process Steps

- Divide surface into a contiguous triangles*
- Transform surface from Ground Coordinate System to Image Coordinate System based on a viewpoint (location, distance)
- Determine visible\hidden surfaces from the viewpoint
- Apply an Illumination model
- Shade all visible surfaces

* ESRI and ERDAS directly interpolate 3D coordinates to ECS

(Li, et al., p254)

Ground Coordinate System (GCS) to Perspective Eye Coordinate System (ECS)

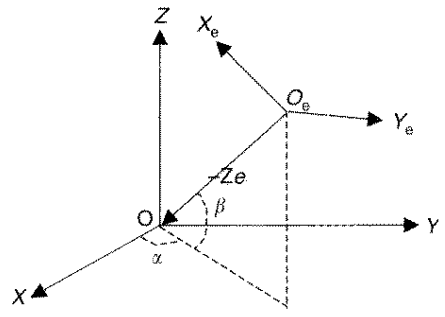
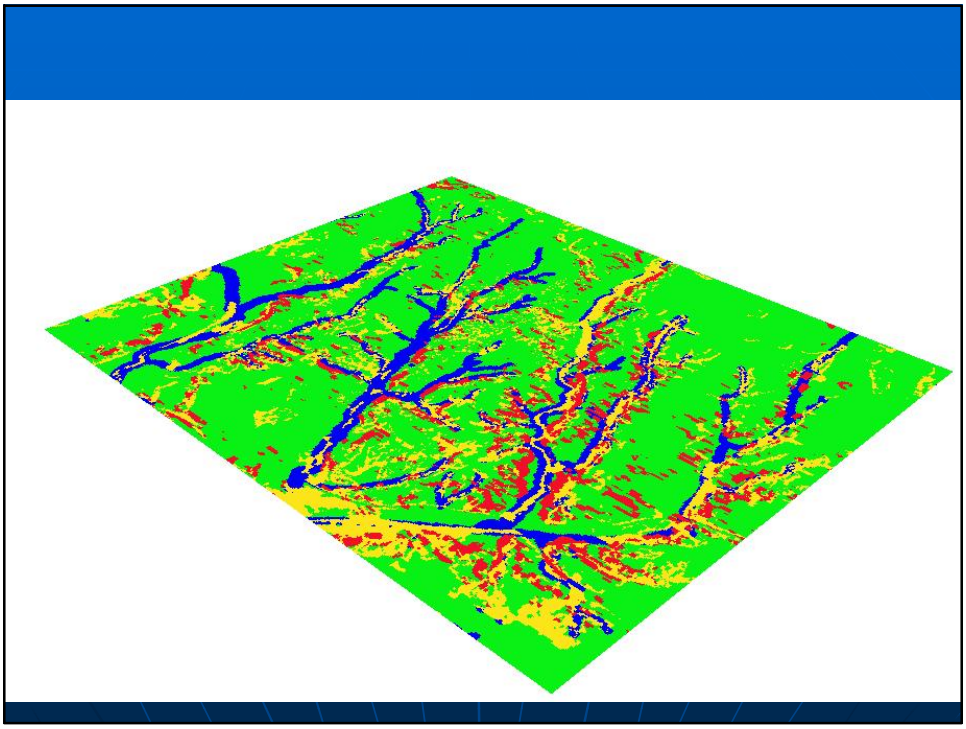


Figure 12.11 The ground coordinate and eye-coordinate systems.

(Li, et al., p255)



Visible Surfaces

- Removal of surfaces that should be hidden based on the Viewpoint perspective
- Depth Sorting Algorithm
  - Maintain 2D array of Z values in cache
  - "Paint" triangles from the furthest to the nearest

Illumination Model:

- Reflecting intensity of ground point
- Light source
- Surface features

(Li, et al., p258)

Reflection

- Types
  - Mirror – reflection in single direction
  - Specular – diffuse, equal in all directions
- Phong model considers mirror and specular for optimal realism
- Single point light source for simplification

(Li, et al., p258-259)

Shade Visible Surfaces

- Assign gray\color value to triangle points based on the Illumination model
- Assign values for each cell based on linear interpolation across triangular surface

Questions

1. **T**/F The term "Rendering," in the context of Digital Terrain Visualization, refers specifically to the process of transforming a 3D surface to a 2D plane in order to simulate a 3D experience graphically on a computer screen.

2. Rendering involves all of the following *except*:
   - Division of the surface into a set of contiguous triangles
   - Transformation of coordinates from a Ground Coordinate System to an Eye Coordinate System
   - Identification of visible surfaces based on a viewpoint in the Eye Coordinate System
   - **Application of an illumination model to the surface in the Ground Coordinate System**

3. The __**viewpoint**_____ serves as the origin of the Eye Coordinate System.

4. T/**F** Once the illumination model has been applied, a gray value is determined for each triangular facet.

Sources:

Li, Z., Zhu, Q., Gold, C. 2005. *Digital Terrain Modeling: Principles and Methodology*. CRC Press. New York.

Wikipedia. Accessed 11/2009. *3d Projection*. URL: *http://en.wikipedia.org/wiki/Perspective_projection#Perspective_projection*

ERDAS Imagine 9.3 Documentation. 1982-2008 : "Sun Positioning". ERDAS, Inc. Norcross.