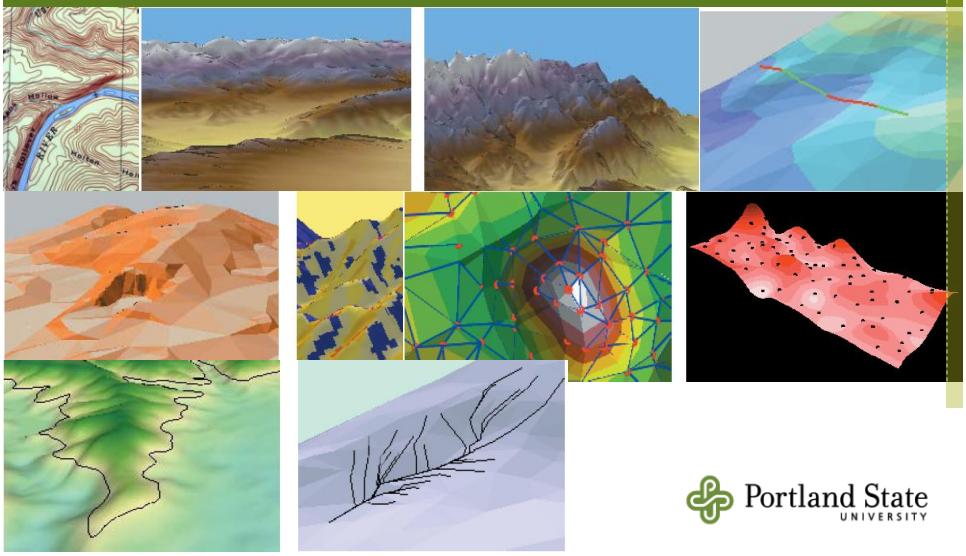
Terrain Visualization



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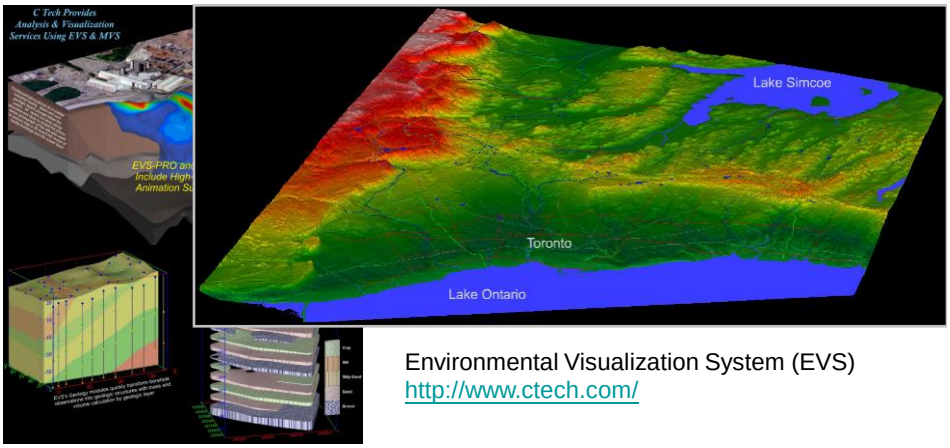
3-D Visualization & Terrain Visualization

- 3-D vis. is based on 3-D data model
- Terrain vis. can be based on 2.5 or 3-D data model



Environmental Visualization System (EVS)
http://www.ctech.com/

Visualization

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Table 12.1 Variables at the Different Stages of Visualization

Stage	Variables in Use				
Paper graphics	Visual variables	—	—	—	—
Computer graphics	Visual variables	Screen variables	—	—	—
Visualization	Visual variables	Screen variables	Dynamic variables	Exploratory acts	—
Web-based visualization	Visual variables	Screen variables	Dynamic variables	Exploratory acts	Web variables

Variables

Visual : size, shape, orientation, color, texture …
Screen : blur, focus, transparency
Dynamic : duration, rate of change, order
Exploratory : drag, click, zoom, pan, blink, highlight…
Web : hyperlink, cyberspace

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Types of Terrain Visualization

- 2D
  - Topographic symbols
  - Contours
  - Elevation coloring
  - Slope (vertical) & hill (oblique) shading
- 3D
  - Height, volume, profile
  - Perspective view & 3D rendering
  - Animation (walk-through, fly-through)
  - 3D symbol, graphics, & text

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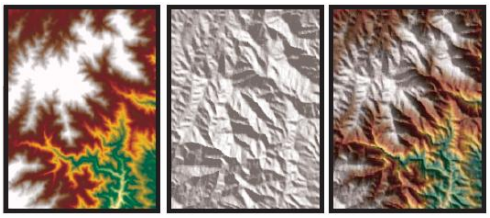
Examples of Terrain Visualization



ArcScene Fly-through

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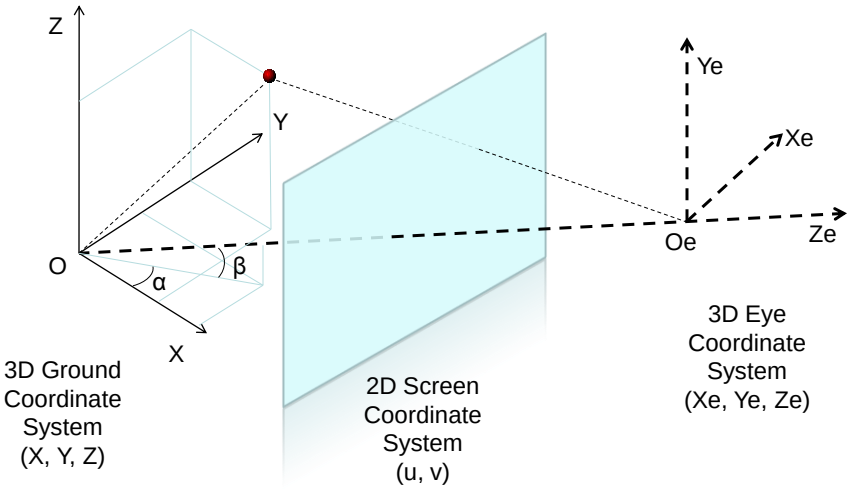
The Geometry of 3D Rendering



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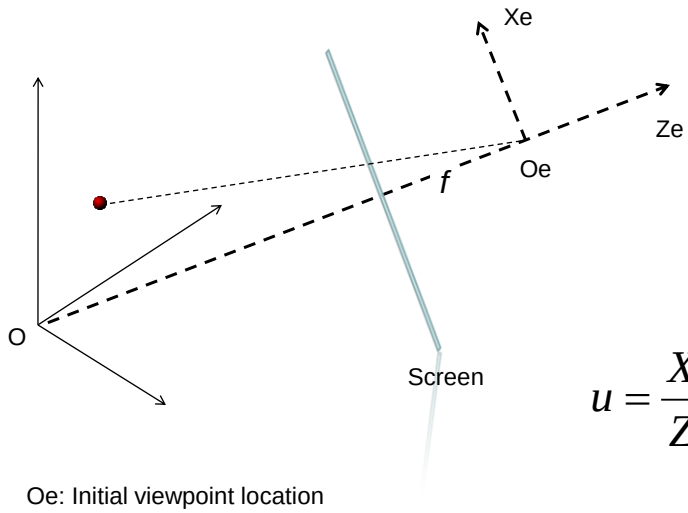
Screen Coordinates & ECS



$$u = \frac{X_e}{Z_e} \times f$$

Oe: Initial viewpoint location

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3D Rendering (Computer Graphics)

1. Construct a discrete 3D model of the surface
2. Set a viewpoint and view direction and transform 3D coord into 2D image coord
3. Determine hidden surfaces
4. Calculate illumination models
5. Shade the visible surfaces (or image draping)
6. 3D texture mapping

Animation

- Picture frame
- Duration (e.g., 30 fps)
- Rate of change
- Order
- Animation
  - Frame-by-frame
  - Bit-boundary-block-transfer (bitblt)

Terrain Animation Primitives

- Zoom
- Pan
- Rotate
- Walk-through & Fly-through

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3D Terrain Visualization Products

- Google Earth
- Microsoft Virtual Earth
- ESRI: ArcScene, ArcGlobe
- Leica: ERDAS Imagine Virtual GIS, Leica Virtual Explorer

ArcScene Interface

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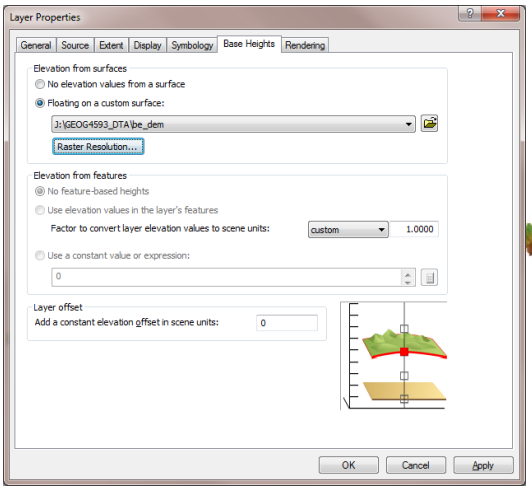
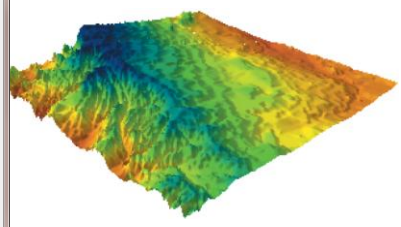
Base Heights





ArcScene Interface

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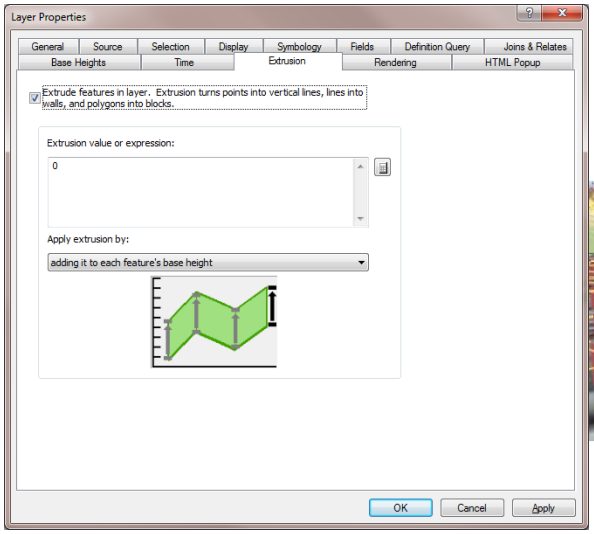
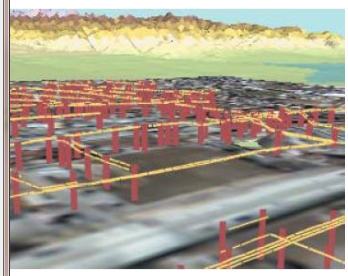
Extrusion





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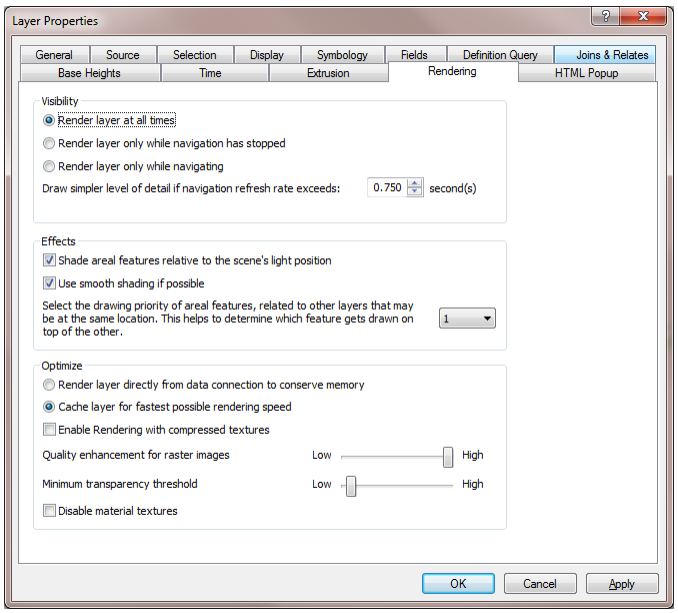
Rendering



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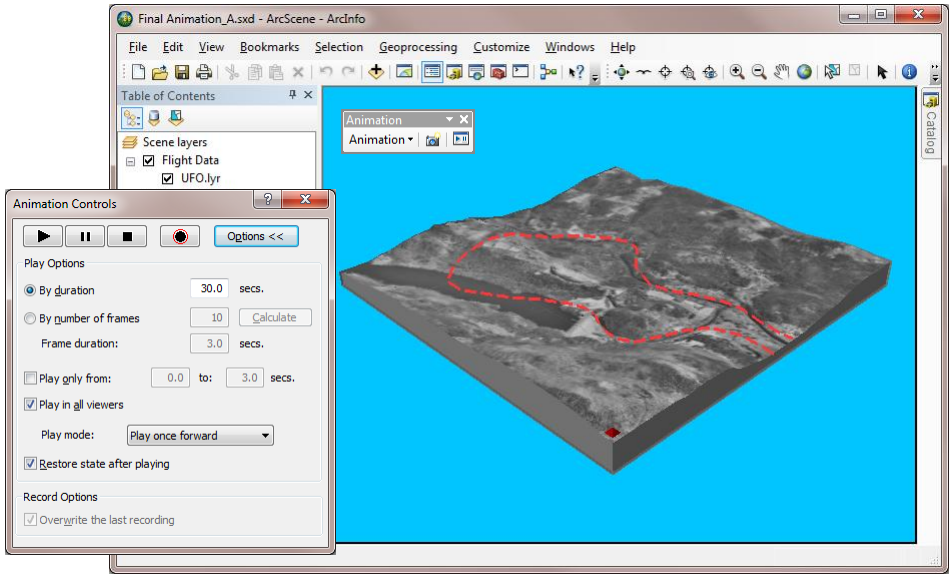
Animation



ArcScene Interface

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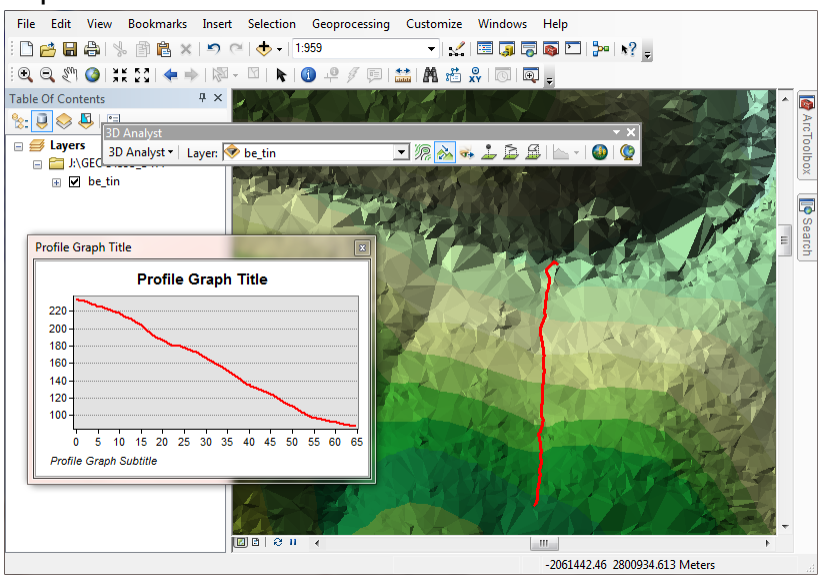
Steepest Path



ArcScene Interface

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Create 3D Features

Creating 3D features by digitizing over a surface

1. Add the 3D feature class—an existing feature class with one of the following geometries: pointZ, polylineZ, polygonZ—to which you want to add features to the map.
2. Add the surface that you want to use as the source for the features' height to the map.
3. On the Editor toolbar, click Editor and click Start Editing.
4. If you have more than one feature class on the map, identify the workspace of the feature class in which you will be creating new 3D features. Click OK.
5. Click the Interpolate Point, Interpolate Line, or Interpolate Polygon button, depending on the geometry of the feature class you are creating.
6. Click on the surface and create the edit sketch for the feature just as you would for a 2D feature.
7. When you are finished digitizing, click Editor and click Save Edits.
8. Click Editor and click Stop Editing.
9. Click Yes to save your edits.