

Demo 13: Three-Dimensional Analyses and Visualization

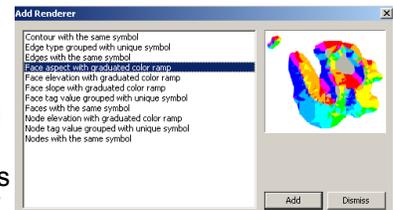
Geography has always emphasized the x and y position of features on a Cartesian grid, but GIS allows the easy incorporation of the vertical (z) axis as well. Because people experience the world from a non-vertical perspective, three-dimensional visualization allows the presentation of landscapes in ways that are more intuitively grasped. In Demo 13, you will be introduced to basic 3D visualization, learn to interactively move through virtual landscapes, and produce 2D scenes and digital video for publication and presentation.

I. Prepare the Demo data

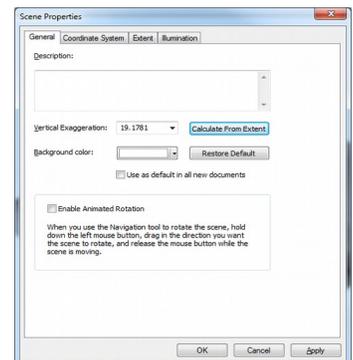
- a. There is a Demo13_Data.zip file
 1. You will need it for the Demo, but probably not for the assignment.
- b. Before you start, make sure the 3d Analyst extension is enabled by going to **Customize** → **Extensions** → **3d Analyst**
 1. You may have to load an ArcMap document just to do this.
- c. Launch ArcScene by clicking the next to last button on the **3D Analyst toolbar** ().
 - i. You can turn on the toolbar by right-clicking at a blank spot at the top and choosing Toolbars
 2. Add a terrain model of your study area from Week 07
 - i. This can be either the DEM or the TIN
 - ii. In this setting the TIN may be a better choice because it can be visualized more quickly and uses less computer power
 - iii. Here, add **tin_notredame**

II. Modify the display of the TIN

- a. If the TIN appears as a solid color, it may only be displaying the faces.
 1. To display elevation, open the TIN layer's properties and go to the Symbology tab. If on the left, it is only showing Edge types and Faces, click Add...
 2. Select **Face elevation with graduated color ramp**, click Add, and then click Dismiss.
 3. Back on the layer's Symbology tab, uncheck Edge types and Faces (or you could remove them), and set the color ramp and number of classes for the Elevation. Click Apply to see how your choices look, and click OK when you are finished.



- b. It may also appear very flat because the vertical dimension is much smaller than the horizontal. To exaggerate the vertical dimension so that you can see the topography
 1. Go into layer properties by double-clicking on **Scene layers** in the **Table of Contents**
 2. On the General Tab you can change Vertical Exaggeration to a series of predefined values.
 3. Alternatively you can click on **Calculate from Extent** to make the topography very clear at the current extent
 4. In making figures, you should always pick a standard value and report it with your data.



III. Navigating in ArcScene

- a. The navigation tools in 3d are by necessity different than in 2d

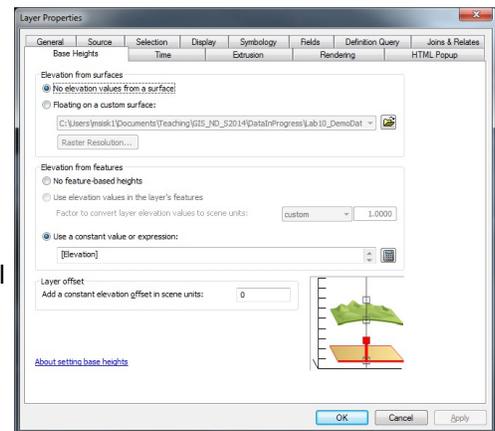


- b. Even most of buttons on the Standard Toolbar are different

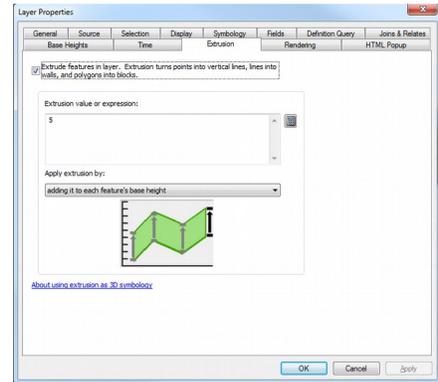
- c. The first button () is the main navigator used to change the perspective:
 1. Hold down the left mouse button to rotate around the vertical plane by moving the cursor up and down;
 2. Hold down the left mouse button and move the cursor right and left to rotate around the horizontal plane;
 3. Zoom in and out by holding down the right mouse button and moving the cursor up and down.
- d. The second button, Fly (): is also a little complicated
 1. Click on the scene to start flying
 2. Use the mouse to control the direction of flight.
 3. Left-click to accelerate and right-click to decelerate or back up.
 4. Only click once or twice because it will keep going in indefinitely if you click too many times.
 5. Note that if you hold down the Shift key, you will maintain a constant elevation but you can still change the viewing angle with the mouse.
 6. It is easy to get lost because you cannot stop unless your speed is 0.
 - i. Note that your speed is in the bottom left corner of the viewer.
- e. Center on Target (): moves the viewer to center on where clicked
- f. Zoom to Target (): Zooms in on where you click on a surface
- g. Set Observer (): Rotates the viewer to resemble someone standing at the clicked point
- h. The rest of the tools function like their ArcMap correlates.
- i. Click the Full Extent button to return the view to the default.
- j. Explore with these tools and when finished save your ArcScene document if you like.

IV. Putting new Layers Into 3d

- a. If a shapefile already has Z values you can assign them to the features
 1. Add **NotreDame_GPSPoints.shp**
 - i. This layer is just for the demo.
 2. Enter the **Layer Properties** by double-clicking on it in the Table of Contents
 3. Go to the **Base Heights** tab
 4. Under **Elevation From Features** choose **Use a Constant Value or Expression**
 - i. You can enter a standard value and all the features will be at the same height
 - ii. But to project them based on a field click on the Calculator button
 - a. Choose the relevant field, here is it **Z**
- b. To drape the features over another surface
 1. Add in your Drainage Paths shapefile from last week.
 - i. Here it is **Michiana_drainagepaths.shp**
 2. To view it at the correct elevation
 - i. Enter the Layer Properties by double-clicking on it in the Table of Contents
 - ii. Go to the **Base Heights** tab
 - iii. Under **Elevation from Surfaces** choose **Floating on a Custom Surface**
 - iv. Make sure that your TIN is the selected layer.
 - a. Here, **tin_notredame**
 - v. Click OK and your layer should now be raised to the level of the terrain
- c. You can also extrude features, or stretch them vertically
 1. Enter the Layer Properties by double-clicking on it in the **Table of Contents**



2. Go to the **Extrusion** tab
 3. Check the box
 4. Enter a number in the box. Here put 5
 5. You could again click the calculator button to choose a specific field.
- d. You can also do this for raster layers
1. Add one of your satellite images (Landsat ETM or ASTER for your study area)
 - i. Here, add **NotreDame_Landsat2000.tif**
 2. Initially it will appear below the TIN in the viewer, again because its base height source has not been indicated.
 3. Enter its Layer Properties and go to the **Base Heights** tab
 4. Under **Elevation from Surfaces** choose **Floating on a Custom Surface**
 5. Make sure that your TIN is the selected layer.
 - i. Again, **tin_notredame**
 6. ArcScene reduces the resolution of the image to speed processing. You can increase the resolution on the Rendering tab of the layer properties. At the bottom of the tab, slide the Quality enhancement slider further to the right (toward "High") and click OK.
 7. Sometimes TIN "bleeds through" the image a little bit; to solve this problem uncheck the display of the TIN layer.
- e. Part of the assignment involves manipulating both the base heights and extrusion of the same layer
1. To see what this looks like add NotreDame_Castle.shp to the ArcScene Document
 2. Go to its Layer Properties
 3. On the Base Heights tab, set it to use the heights from **tin_notredame**
 4. On the Extrusion tab use the calculator button to set it extrude to the **Height** field



V. Exporting 3d views for publication or PowerPoint presentations This section is mostly an appendix, you do not have to follow along with everything that is listed.

- a. Exporting a flat 2D image of a 3D scene
 1. After arranging the view in the desired way, choose File→Export Scene→2D...
 - i. Give the file a name and select the type (JPEG is recommended for presentations, TIF is recommended for printing);
 - ii. For Options, on the Format tab, select 24-bit Color or 8-bit grayscale;
 - iii. On the General tab, you can disregard the Resolution, Width and Height boxes; set the Scene Size to 1280 for presentations or at least twice that for print publication.
 2. Click Save.
- b. Creating Animations
 1. Continuous rotation around the scene's center
 - i. To set up rotation, open the Scene Properties and check Enable Animated Rotation on the General tab. Click OK. The Navigation tool will now look slightly different.
 - ii. Holding down the left button, rotate the scene in to the left or the right and release the mouse button. You must release the mouse button while the scene is rotating. The scene should continue to rotate independently now.
 - iii. To increase or decrease the speed, press Page Up or Page Down.
 - iv. To increase or decrease the viewing angle, press the Up Arrow or the Down Arrow.
 - v. To stop rotation, press the Esc key.
 2. Custom Animations by capturing views
 - i. You can create custom animations where the "camera" (the viewing position) smoothly moves between defined viewpoints. These can be exported as several different types of video files. To set this up, first enable the Animation toolbar by selecting View→Toolbars→Animation.