GEO/EVS 423 / EVS 523
Exercise 7: 3-D Analyst

In this exercise you will create a 3-dimensional model of a portion of the Chagrin River valley/North Chagrin Reservation and use some of the 3-D effects built into ArcGIS.

Before you get started, you may find it advisable to reboot your computer, as you will need a great deal of memory available for some of the calculations in this lab. The first step is to copy the Chagrin.gdb file database from the P: drive to your X: drive. It contains all of the files you will need for the exercise. Also, make sure that the 3-D Analyst extension is turned on!

Using ArcScene to Create a TIN

The next step is to open ArcScene. Note that you will be using *ArcScene, not ArcMap*, for this exercise! ArcMap is the 2-D viewer; ArcScene is the 3-D viewer. If you have a great deal of time, you might wish to look at the contour map. More likely, you will wish to go directly to the TIN, or Triangulated Irregular Network. Choose Create Scene from the 3-D Analyst Tools -> Data Management -> TIN tool set if you use the Toolbox, or choose Search and enter "Create TIN" in the search field. Your input feature class is ChagrinContours in the Chagrin.gdb geodatabase. You should indicate that the output coordinate system is State Plane Ohio North NAD83 US Feet. You can name the output anything you want. Note that you may need to create the TIN outside of the geodatabase. It will take the computer quite a while to create the TIN and render it on your screen! Other than the hard-drive-activity light blinking Arc won't tell you that anything is happening (ArcScene isn't as forthcoming as ArcMap). When it is done, the TIN will be rendered on the screen. It is a 3-dimensional representation of the land surface in the area of study.

You probably will find the color scheme a bit much. To change it, right-click on the TIN's name and choose the Source tab. You will probably want to increase the vertical exaggeration somewhat. Try 1.25 - 2. Then choose the Symbology tab. You will note that you can deal with either "edges" or "elevation." You may wish to turn off edges altogether, but the parameter you will want to deal with is elevation. Pick out a continuous color ramp for the Elevation parameter. Before you click OK, click on the classification button and reset the highest classified elevation line to the highest elevation in the revised image. To do this, click on the highest value listed in the elevation column and reset it to the highest value shown in the histogram. Then click on the Classification Method button and choose a large number of equal-interval (or quantile or natural-breaks) classes for the image.

The cursor for your TIN will probably be something other than the arrow you're used to. It is, in fact, the Navigate cursor. Try using it to move your image around.

You should take a close look at the nature of the TIN. Use the Zoom tool to zoom into the image so that you can see how it is constructed. When you are satisfied that you see how the TIN deals with slope, aspect, horizontal surfaces, etc., click on the full-extents icon to go back to the full view.

Draping Details onto your TIN

Now let's drape some details onto the TIN. You will find roads and rivers in the region in the ChagrinRoads and ChagrinHydro shapefiles in the Chagrin.gdb geodatabase. Use the Add Data tool to add these to your scene. Note that they appear beneath the surface. Surely that isn't what you want! Right-click on each of these and open properties. Choose a suitable color and width for each item (you will probably need to make the roads and streams wider than you normally would for a 2-D rendering). Then click the Base Heights tab. Choose "floating on a custom surface" – that is the TIN – for both items.

Extruding 3-dimensional Features Onto a Scene

Next let's place the vegetation on the TIN. Add the Chagrin25 file to your Scene. At first you will see simply a blob beneath the TIN. Right-click on it and choose properties. From the Base Heights tab, choose "floating on a custom surface" to set the base height of the vegetation to the TIN. Next, from the Extrusion tab, check "Extrude Features in a Layer . . . ." Click on the icon to the right of the field below containing "0" and click on Mean_Layer. If you wish, you can emphasize the tree height by entering an equation in this field, such as *2 * Mean_Layer* (assuming, of course, that you chose to use a vertical exaggeration of 2 for your TIN). This will exaggerate the trees to the same degree as the TIN. Next, click on the "Apply Extrusion by" dropdown and choose "adding it to each feature's base height." Finally, from the Symbology layer, choose Quantities, then Mean Layer, and choose a color ramp with a suitable range of green. Again, it may take some time for the computer to render the entire scene, as a lot of computation is involved. In this lab, patience is a virtue. You should print your final map of the Chagrin Valley, showing the trees.

Navigating Through your Image

Now click on the Set Observer icon . The cursor will change to this icon. Now click on one of the flat places on your scene. The scene will move slowly to that place. It won't be very realistic, since the trees will look funny, but it will reveal some of the details of the way the image is constructed. Make sure you understand what "extrude" means. It is a tool designed for buildings, not for natural habitats.

Next, click on the globe to go back to the full extents. Click on the Target icon , and place the target in an interesting location on a hillside. Then click on the Set Observer icon to locate your observer in an equally interesting location across the river. The scene will move so that your observer is, in essence, looking across the river at the target.

Flying Through your Image

When you are satisfied that you can navigate through the image, click again on the globe to return to the full extents. Now click on the Fly icon (it looks like a bird). Click anywhere in the scene with the bird cursor, and then click again to start "flying" through the image. You can increase your flight speed by clicking the left mouse button and decrease it by clicking the right mouse button. When you are suitably breathless, end your flight by pressing the escape key on your keyboard.

You can add a second viewer to the scene by clicking the Add Viewer icon (immediately to the right of the Add Data icon). This can give you a reference image as you navigate through the main image. Note that if your mouse has a scroll wheel, you can use it to zoom in and out.

It is possible that you would like to memorialize your fly-through for posterity. To do this, right-click anywhere in a blank area of a toolbar, and choose to add the Animation toolbar. Open the Animation Controls (the rightmost icon on the Animation toolbar), and click the Record button. To do your flight, click on the Fly button (the bird) and create a fly-through anywhere in your scene. When you're done, press the Escape button on the keyboard, and click the Stop button on the Animation Controls. To play your fly-through, click the Play button from the Animation Controls toolbar. If you *really* want to save your animation, click on the Animation dropdown on the Animation toolbar, and click Save Animation File. Give it a suitable name. If you want to upload it to YouTube or some such, click on the Animation dropdown, and choose to Export Animation. This will save your animation as an .avi file.

Adding 3-dimensional Effects

There are certain effects that you can also add to your scene. For example, you might want to "see through" the trees. To do that, right-click on a blank area of a toolbar and choose to use the 3D Effects toolbar. Note that one of the layers in your scene shows in the window. If it isn't Chagrin25, click on the dropdown and choose to work on Chagrin25. Click on the Layer Transparency icon immediately to the

right of the layer window field. By default, the transparency is set to 0. Change it to 25%, 50%, and 75%. Given that you are dealing largely with trees in this image, which rings most true to you? Now try the other effects on this toolbar. When you've found a combination you like, print it. You should print your new final map of the Chagrin Valley, showing the trees in a manner as realistic as you can.

Line of Sight

The last exercise using 3D Analyst takes us back to 2 dimensions. Close ArcScene and open ArcMap. Make sure that the 3D Analyst extension is turned on. Add your TIN to the layout. Add the 3D Analyst toolbar to the set of visible toolbars, and choose the line-of-sight tool (it looks like an eye). Set the Line-of-Sight Offsets to reasonable levels (i.e. the number of feet or meters, depending on the elevation units in your TIN, at which an observer's eye is above the surface of the TIN), and click on locations for your observer and your target. The line will show green for those places that the observer can actually see along his or her line of sight and red for those that are obscured by topography. You should print the line of sight between at least two locations that you might think of as being of interest.

Portfolio

7-1 Your map of the Chagrin Valley, showing the roads, hydrology, and trees.

7-2 Your map of the Chagrin Valley, showing the roads, hydrology, and trees, where you've made the trees somewhat transparent so that they are a bit more realistic. This map should be as realistic as you can make it.

7-3 Your map of the Chagrin Valley, showing the line of sight between two points that you think of as being of some interest.