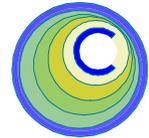


The CEDRA Corporation's COMMAND OF THE MONTH

A monthly information bulletin

March 2005

FEATURED COMMAND
CEDRA-Polygon-
Tools-2



Application Description

Users who deal with maintaining parcels have come across the application of having to reshape a polygon in order to meet some geometric condition. This sometimes includes having to split a polygon, or subtract an area from a polygon. While these are common polygon editing procedures, this month's issue of Command of the Month deals with the problem of having to reshape, or modify a side of a polygon. This is an important issue, from a topological point of view, because when two polygons share a common side, it is imperative that both polygons share the same geometry.

The CEDRA Solution

To reshape polygon features, the ArcGIS® users can employ the CEDRA-Polygon-Tools-2 toolbar, while the ArcView® GIS users can activate the CEDRA-ChangeFeatures extension. Shown in Figure 1 is the CEDRA-Polygon-Tools-2 toolbar. For ArcView® GIS users, the first three tools, starting from the left, as well as the last tool in the toolbar, are located in the CEDRA-ChangeFeatures extension.

It is these tools that the user can employ to reshape a polygon or a group of polygons. The fourth and fifth tools in the toolbar are intended to provide additional polygon manipulation functionality.

For the ArcView® GIS users, the fourth tool in the CEDRA-Polygon-Tools-2 toolbar can be found in the CEDRA-



Figure 1
CEDRA-Polygon-Tools-2 Toolbar

GridAQuadrilateral extension. This tool offers the user the capability to subdivide a quadrilateral by specifying the number of rows and columns, such as that of the United States Public Lands system. The quadrilateral can be represented by a polyline or a polygon feature.

The fifth tool appears in the CEDRA-SectorPolygons extension. It provides the user the ability to create polygons that represent sectors of concentric circles emanating from a point.

Command Of The Month bulletin

This month's issue addresses how to edit and reshape polygons.

All of the tools shown in Figure 1, regardless of the platform in which they operate, ArcGIS® or ArcView® GIS, function identically.

The Change Feature's Shape Tool

The first tool in the CEDRA-Polygon-Tools-2 toolbar is the Change Feature's Shape tool. This tool is useful when the shape of a polygon changes so dramatically that it is easier to change the entire shape of the polygon, and not just a side of the polygon. Note that

this tool will also process line and polyline features in addition to polygon features.

As an example, consider the case of an existing polygon dataset, where one of the polygons represents the northeast quarter of a square mile section (see Figure 2). In Figure 3, we see that a new subdivision has been built which di-

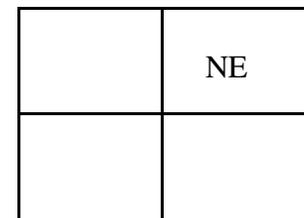


Figure 2
Square Mile w/ Quarter Sections

vides said quarter into a north half, and a south half divided into eight lots.

Furthermore, the new subdivision is available in digital format so that we are able to display the new design in ArcView or ArcMap. With both the existing polygon dataset and the new sub-

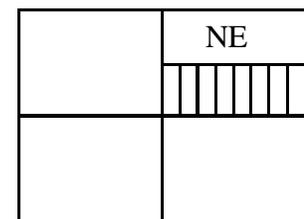
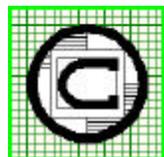


Figure 3
NE Quarter Section Subdivided

division dataset displayed, the Change Feature's Shape tool could be used to alter the shape of the polygon feature



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representing the northeast quarter section of Figure 2. Afterwards, the polygons in the new subdivision dataset, which represent the eight new lots (see Figure 3), could be copied into the existing polygon dataset. The CEDRA-AVcad command, Copy Selected Features, could be used to accomplish this task.

The approach of altering the shape of the polygon using this tool eliminates the alternative of having to cutout a portion of the original polygon. Since the new subdivision dataset contains the new shape of the northeast quarter section polygon, the Change Feature's Shape tool is an easier and faster approach in altering the original polygon's shape. Furthermore, this approach has the advantage that any existing attribute information associated with the feature is maintained.

To reshape the original polygon, the user would:

1. Select the  Change Feature's Shape tool.
2. Select the polygon which represents the northeast quarter section, (see Figure 2), and confirm the selection.
3. Select the polygon which represents the new shape of the northeast quarter section (see Figure 3).

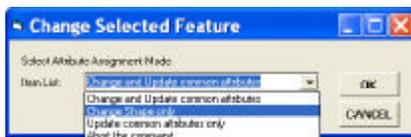


Figure 4

Change Feature's Shape Choice List

At this point, the choice list message box of Figure 4 is displayed. As can be seen from the choice list of Figure 4, the user is able to process the original polygon in one of three modes.

The *first mode* allows the user to:

- (a) change the shape of the original selected polygon to resemble that

- (b) change the attribute values of the original polygon to be those of the second polygon selected.

The attributes that are changed are only those which share the same attribute name. So that if both, the original and the second selected polygons have an attribute A, the original polygon will have its attribute A value changed to be that of the second polygon.

The exception to this rule is that the OID, FID or OBJECTID attribute of the original polygon will be left intact. That is, these special attributes are not altered by this command. This is extremely useful for users who are involved with enterprise geodatabases where it is important to be able to maintain these values.

The *second mode* is identical to the first mode with the exception that no attribute values are altered. That is, in this mode only the shape of the original polygon is changed.

The *third mode* is identical to the first mode with the exception that only the attribute values are altered. That is, the shape of the original polygon is left intact. This mode is extremely useful when it is desired to transfer attribute values from one feature to another.

The Change Feature's Course Tool

The second tool in the CEDRA-Polygon-Tools-2 toolbar is the Change Feature's Course tool. This tool should be used when the user wishes to change a side of a polygon. Note that the side of the polygon can be a polyline, and not just a two-point line.

Consider the features shown in Figure 5. The solid lines represent a rectangular polygon, while the dashed lines represent the proposed new side or edge.

To change the side or edge of the rectangular polygon, the user would:

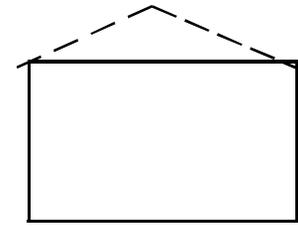


Figure 5
Polygon side to be reshaped

1. Select the  Change Feature's Course tool.
2. Select the rectangular polygon, and confirm the selection.
3. Select the line or polyline which represents the new side, and confirm the selection.

Depending upon the direction of the polygon, two different solutions are possible. Shown in Figure 6 is one possible solution, while in Figure 7 the second possible solution appears. The user



Figure 6
Proposed Solution #1

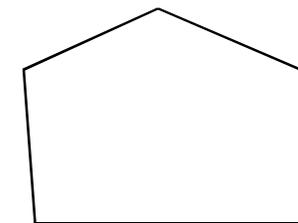


Figure 7
Proposed Solution #2

is presented with the first solution, at which point, the user:

4. Confirms or rejects the modified shape. If the solution is confirmed, the command terminates and the user is able to select another feature (polygon or polyline) for processing.

If the first solution is rejected, the second solution, as shown in Figure 7, is displayed, at which point, the user:

- Confirms or rejects the second proposed modified shape.

If the solution is rejected, the rectangular polygon is left unaltered. If the solution is accepted, the command terminates, and the user is able to select another feature for processing.

The Change Feature's Course command in its processing determines which vertices on the first selected feature, in this example the rectangular polygon, are closest to the endpoints of the second selected feature, in this example the polyline. If a match can be made for both endpoints of the second feature, the program replaces all of the vertices between the matching vertices of the first feature, with all of the vertices of the second feature.

As a further example, refer to Figure 8, in which the selected features are the same

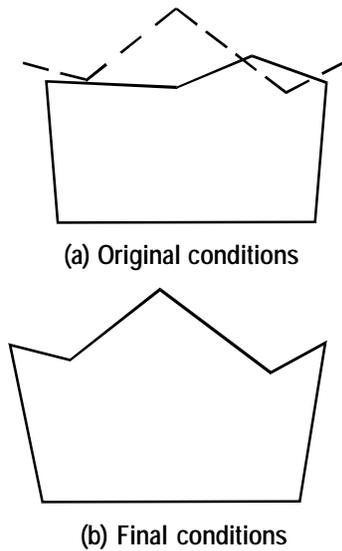


Figure 8
Polygon side to be reshaped

as those of Figure 5, except for their shapes.

The Change Selected Features Tool

The third tool in the CEDRA-Polygon-Tools-2 toolbar is the Change Selected Features tool. This tool enables the user to change the shape of a set of selected features in a theme (layer) using the

shapes of corresponding features in another theme (layer) based upon a matching attribute value. This command is similar to the Change Feature's Shape tool with the exceptions that there is no feature selection, and that a number of features can be processed at a time.

As an example, let us assume we have a theme (layer) called A containing 100 polygons. This theme (layer) also contains an attribute (field) called ID, which is used to uniquely identify each polygon in theme A.

We then export 50 of the polygons from theme (layer) A into theme (layer) B. Theme (layer) B is then given to another user, who modifies the 50 polygons in theme (layer) B, and then returns them to the first user in theme (layer) B. It is now desired to update the shape of the 50 polygons in theme (layer) A.

Rather than using the Change Feature's Shape tool on a one-by-one basis, the Change Selected Features tool can be used to update all of the polygons that have been modified at once. This approach can be taken provided the attribute (field) ID is maintained. That is, the values for ID in theme B are not changed by the user performing the modifications.

To update the shape of the polygons in theme (layer) A, the user would:

- Select the 50 polygons in theme (layer) A which are to be updated. In order for this command to work there must be some features selected.
- Select the  Change Selected Features tool. If there are no se-

lected features, a message to that effect is presented, and the command aborts. If there are selected features, the command searches the Table of Contents for all themes (layers) of the same type as the selected features, and then displays the choice list box of Figure 9. In this example, all themes (layers) which are of the polygon type will be presented in this choice list message box.

- Select the theme which contains the new shapes, which in this example is the theme (layer) B.
- Click the OK button to display the choice list box of Figure 10 prompting the user for the attribute which is to be used as the matching field.

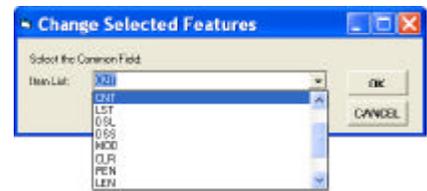


Figure 10
Matching Attribute Selection

In order to update the shapes in theme (layer) A, the command will link theme (layer) B to theme (layer) A using the attribute that is identified in this step. The list of attributes that are displayed in the choice list message box of Figure 10 represent the attributes which appear in theme (layer) B. In order for a match to be made, the attribute that is selected here must appear in the theme(s) or layer(s) containing the selected features. In this example, the user would select the attribute ID.

After the matching attribute has been identified, the user is asked if the attributes which share the same names are



Figure 9
Select Theme Containing New Shapes



Figure 11
Update Matching Attributes Query

to be updated, in addition, to the feature shape. Figure 11 illustrates the form of the query. Thus, if theme A has the same attribute name as theme (layer) B, the user is able to change the attribute value of a feature in theme (layer) A to be the same as its corresponding feature in theme (layer) B.

As can be seen from Figure 11, the user has the ability to (a) abort the command by selecting the Cancel button, (b) indicate that matching attributes are not to be updated by selecting the No button, or (c) indicate that matching attributes are to be updated, in addition to the feature shape, by selecting the Yes button.

If in its processing, the command is not able to find a match based upon the common attribute, the original feature is left unaltered. Once all of the selected features have been selected, the link is removed from theme (layer) A.

The Grid A Quadrilateral Tool

The fourth tool in the CEDRA-Polygon-Tools-2 toolbar is the Grid A Quadrilateral tool. For ArcView® GIS users, this tool can be found in the CEDRA-GridAQuadrilateral extension.

This tool is useful when the user wishes to subdivide a quadrilateral, such as the

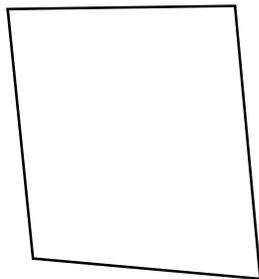


Figure 12
Quadrilateral to be Subdivided

one shown in Figure 12, by specifying the number of rows and columns the quadrilateral is to be subdivided into. The quadrilateral that is subdivided can be represented in the form of a polygon or a polyline feature. Regardless of the feature type, there can be no more than four sides comprising the quadrilateral.



Figure 13
Update Matching Attributes Query

To subdivide a quadrilateral, the user would:

1. Select the  Grid A Quadrilateral tool to prompt the user to select the quadrilateral to be subdivided.
2. Select said quadrilateral, and confirm the selection. Once the feature has been selected and confirmed, the dialog box of Figure 13 is displayed prompting the user for the number of rows and columns, as well as, the type of features that are to be created. As can be seen from the dialog box of Figure 13, the user is able to create point, two-point line, polyline and polygon features.
3. Enter in the dialog box of Figure 13 the desired information, and then click at the OK button to create the appropriate features. Shown in Figure 14 are the results of subdividing

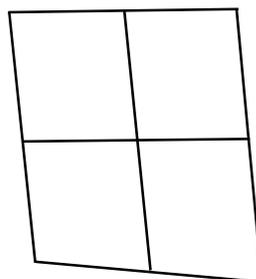


Figure 14
Subdivided Quadrilateral

ing the quadrilateral of Figure 12 into two rows and two columns.

Once the new features have been created, the user is able to select another feature for subdividing in a similar manner. For example, Figure 15 shows how

the polygon in the low left corner of Figure 14 was further subdivided into two more rows and columns.

For those who deal with quarter-quarter sections or aliquot parts, this tool is quite useful. Furthermore, the ability to create different types of features pro-

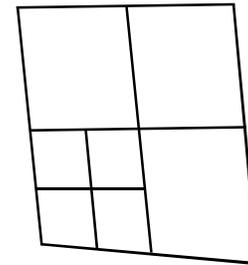


Figure 15
Subdivided Quadrilateral

vides the user great flexibility in controlling the type of features to be created during the subdivision process.

The Sector Polygons Tool

The fifth tool in the CEDRA-Polygon-Tools-2 toolbar is the Sector Polygon tool. For the ArcView® GIS users, this tool can be found in the CEDRA-SectorPolygons extension.

This tool provides the user the ability to create polygons which represent sectors of concentric circles. Each circle carries its own unique radius value. This functionality is useful when the user is interested in determining areas that emanate radially from a base point.

For example, assume that there is a hazardous waste spill where a harmful gas has been released. Based upon weather conditions at the time, the effect of the gas dissipates over a physical distance. Using this tool the user can create polygons that represent the effect of the dissipation. These polygons can then be superimposed upon a base map at which point various types of spatial analysis techniques can be used to identify locations that would be impacted the most.

To create circles that emanate from a point, the user would:

1. Select the  Sector polygon tool to prompt the user to select the point from which the concentric circles are to be centered about.
2. Select said point, and confirm the selection. Once the point has been selected and confirmed, the dialog box of Figure 16 is displayed

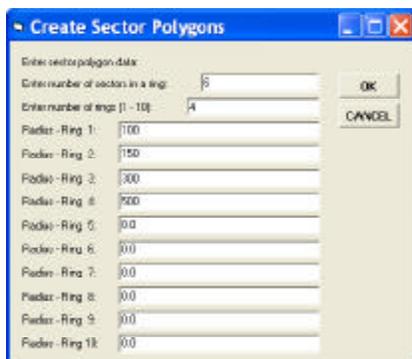


Figure 16
Subdivided Quadrilateral

prompting the user to specify the number of sectors, the number of rings, and the radius of each ring in world units (feet, meters, etc.).

3. Enter in the dialog box of Figure 16 the desired information, and then click at the OK button to create the appropriate polygons placing them in the current active theme (layer).

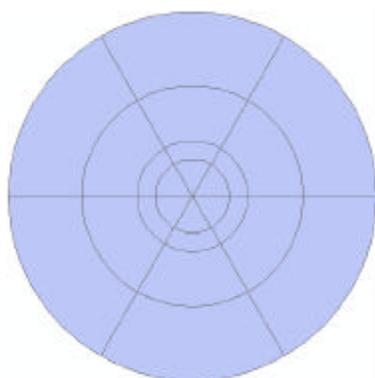


Figure 17
Polygons w/o Classification

Figure 17 shows the results using the above data (four rings with six sectors in each ring).

The polygons shown in Figure 17 reflect a theme (layer) that has not been

classified. That is, all polygons in the theme (layer) share the same symbolology.

When the Sector Polygons tool creates the polygons, it stores a unique polygon ID under the CNT attribute. Likewise, the command stores under the RING attribute the ring number with which the polygon is associated.

Figure 18 illustrates a classification based upon the unique polygon ID val-

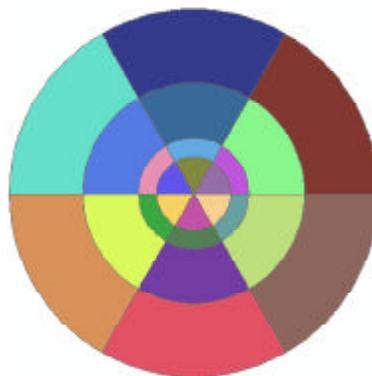


Figure 18
Polygons Classified on Unique CNT

ues. As can be seen each polygon is represented in a different color.

Figure 19, on the other hand, represents a classification based upon the ring

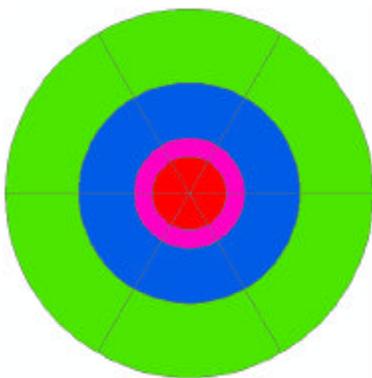


Figure 19
Polygons Classified on Unique RING

number. All polygons within a ring share the same color under this type of classification.

Native ArcView® or ArcMap® functionality can be used to generate these

types of classifications, as well as any other type that may be desired..

Perform a Topological Operation

The last tool in the CEDRA-Polygon-Tools-2 toolbar is the Perform a Topological Operation tool. This tool enables the user to reshape an existing polygon feature by performing a topological operation on the polygon. With this tool, the user is able to perform a COMBINE, DIFFERENCE, INTERSECT or UNION operation on an existing polygon.

To perform such a topological operation, the user would:

1. Select the  Perform a Topological Operation tool at which point the user is prompted to select the polygon that is to be modified.
2. Select said polygon, and confirm the selection. Once the polygon has been selected and confirmed, the user is asked to select one or more polygons which are to be used in the topological operation. These features can be selected by either making a single “pick” or by dragging a rectangle which touches the desired features.

Note that this command will process both single and multipart polygon features.

Once these features have been identified, the choice list box of Figure 20 is displayed asking the user to specify the type of topological operation that is to be performed.



Figure 20
Available Topological Operations

As can be seen from the choice list box, the user is able to perform four different types of topological operations.

3. Select the desired operation, and click at the OK or Cancel button.

Selection of the Cancel button results in the command being terminated without any modification to the polygon initially selected.

Selection of the OK button causes the command to perform the specified topological operation. Shown in Figure 21 is an illustration of the results of the various topological operations.

The features that are shown in this figure in the color :

- Blue, represent the polygon that is initially selected.
- Green, represent the secondary features which are used in the topological operation.
- Red, and which are shaded, represent the result of the topological operation.

Once the topological operation has been performed, the command displays the result in the color red, and queries the user whether the polygons that were selected second, the features used in the topological operation, are to be deleted, or not.

4. Click at either the OK, or the No button as deemed appropriate.

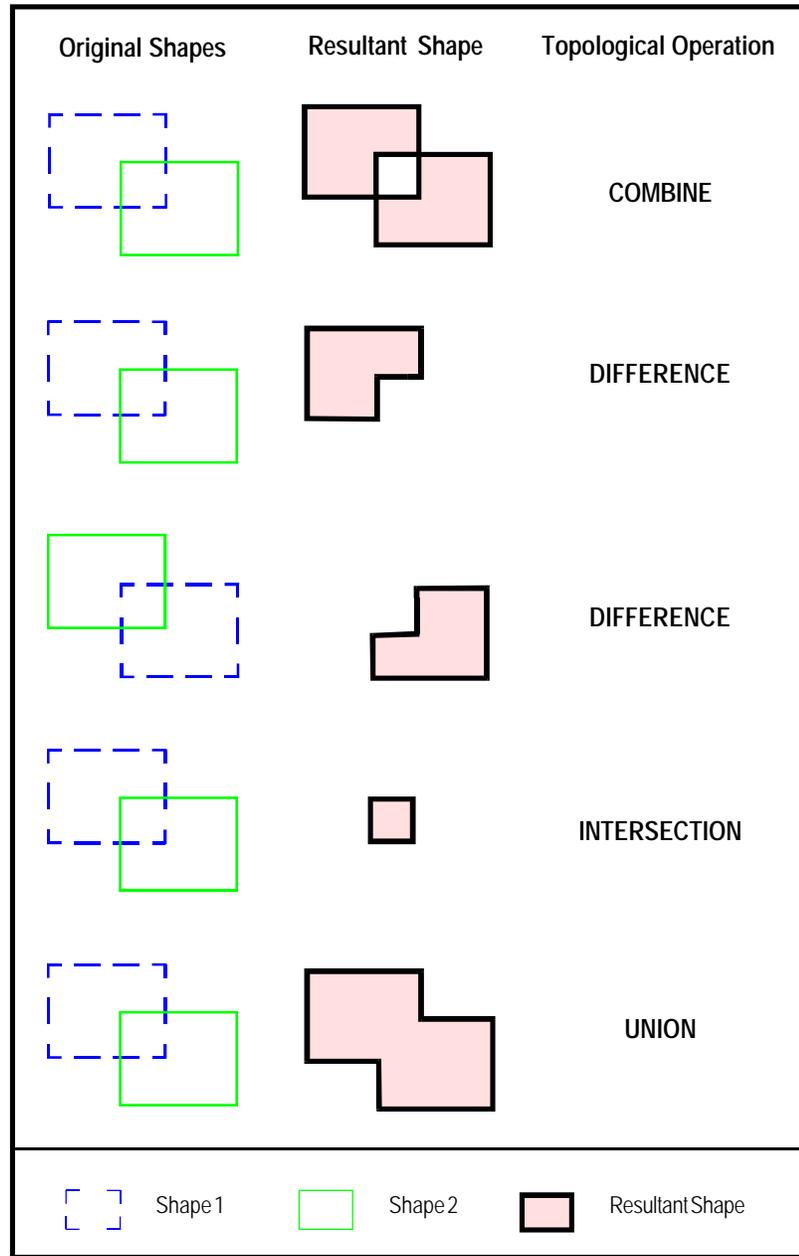


Figure 21
Topological Operations Results

If the Yes button is clicked, the features that were selected second are deleted. If the No button is clicked, these features are not deleted.

Once the appropriate response is given, the command terminates. The command remains active, so that, the user is able to select another polygon for processing.

Summary

For those users who are involved in maintaining parcel data, the CEDRA-

Polygon-Tools-2 toolbar provides excellent functionality in assisting the user in performing this type of application.

The CEDRA-Polygon-Tools-2 toolbar is available in the CEDRA-AVparcel, CEDRA-AVcad and CEDRA-AVparcel software.

As always should there be any questions in how to use this toolbar, or recommendations in additional functional-

ity that would be desirable, please let us know.

If you have a request for Command Of The Month, feel free to phone, fax or e-mail your request to The CEDRA Corporation.