



NAME \_\_\_\_\_

DATE \_\_\_\_\_

# Crossing the Line

## A GIS investigation



### *Answer all questions on the student answer sheet handout*

Boundaries are invisible lines on the earth's surface. They divide the surface area into distinct separate political entities. In this activity, you will use GIS to investigate different types of international boundaries, explore the implications of various boundary configurations, and observe boundary changes in recent years. When you have completed the activity, you will use your knowledge of boundary dynamics to speculate on world boundaries that are likely to change in the future.

#### Step 1 Start ArcView

- a* Double-click the ArcView icon on your computer's desktop.

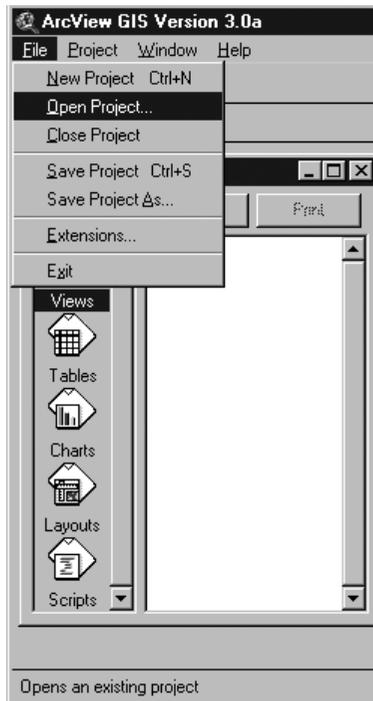


- b* If the Welcome to ArcView dialog appears (pictured below), click **Open an Existing Project** and click OK. If it doesn't appear, proceed to step 2.

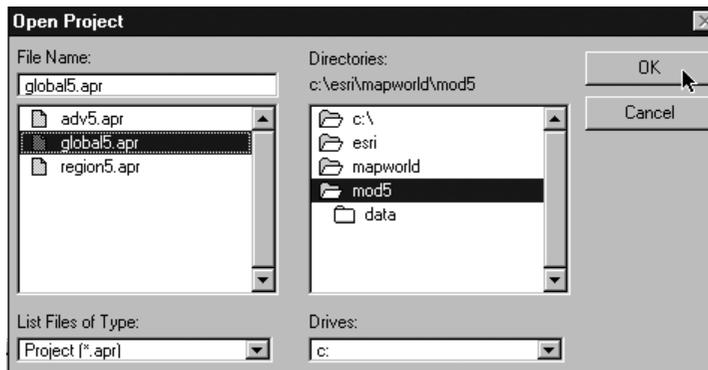


**Step 2 Open the global5.apr file**

- a In this exercise, a project file has been created for you. To open the file, go to the **File** menu and choose **Open Project**.



- b Navigate to the module 5 directory (**C:\esri\mapworld\mod5**) and choose **global5.apr** from the list.



- c Click OK.

The project opens and you see a composite satellite image of the world. The check mark next to the theme name tells you the theme is turned on and visible in the view.

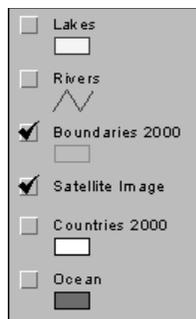


### Step 3 Explore mountain ranges as physiographic boundaries

As astronaut Russell L. Schweickart said, if you could view the world from space, you would see no boundary lines. Boundaries are human-made lines that define the world's political entities.

There are several types of boundaries between countries. One type of boundary is called a *physiographic* boundary. They are based upon natural features on the landscape such as mountain ranges or rivers.

- a Click the box next to the **Boundaries 2000** theme to turn it on. A check mark appears and the red lines display the international boundaries for the year 2000.

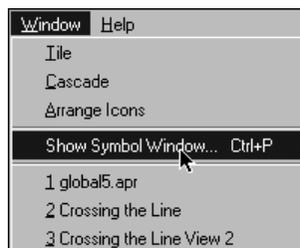


- b Click the **Zoom In** tool. Click on the map and drag a box around Europe. The view is now centered on Europe.
- c Drag another box around Europe to zoom in more so you can see the physical features in greater detail.
- d Turn off **Boundaries 2000** by clicking the check mark next to the theme name.

Locate Europe's mountain ranges in the satellite image. Notice that mountains such as the Pyrenees Mountains in northeastern Spain form a natural boundary. You will use the **Draw Line** tool to draw lines where you see a mountain range forming a natural boundary between different parts of the continent.

First, you will select a symbol type and color for drawing.

- e From the **Window** menu, select **Show Symbol Window...**

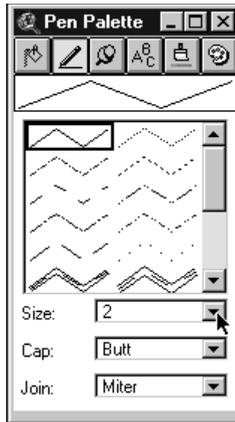


- f Click the **Pen** button to display the **Pen Palette** window.





- g** Select the solid line if it isn't already selected. Change the size to 2.



- h** Click the Paintbrush button to see the Color Palette. Click yellow. Close the Color Palette by clicking the "X" in the upper right corner of the window.

Now you are ready to draw a physiographic boundary in Europe.



- i** Select the Draw Line tool from the Draw tools menu.



- j** Click the westernmost edge of the Pyrenees Mountains to start your line. Continue clicking along the path of the mountain range until you reach its easternmost edge. Double-click to end the line. The yellow line is displayed in the view.

*Note: Sometimes, ArcView leaves colored boxes around the line. If this happens, click the Pointer tool and then click once on the map. The colored boxes disappear.*

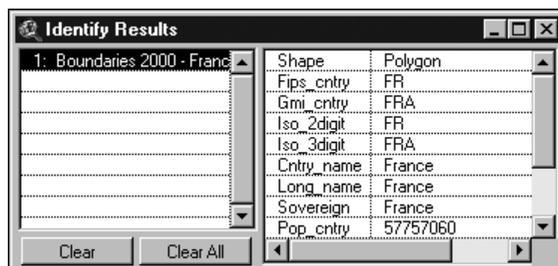
- k** Turn on Boundaries 2000 and make it active (click its name). You see that your line corresponds to a border between two countries.



- l** Click the Identify tool. Click the country that borders the Pyrenees Mountains and that is to the north.



An Identify Results window appears.



The left side of the window shows the theme name and the beginning of the country name. You can see the complete country name by looking at the right side of the window. The field “Cntry\_name” reveals the full name.

- m* Click the country on the other side of the border.



*The Pyrenees Mountains are the border between which two countries?*

- n* Use the Identify tool to find other Western European countries where physiographic boundaries created by mountains correspond to actual political boundaries. Click a country to see its information in the Identify Results window.



*Complete the table on the answer sheet.*

- o* Close the Identify Results window by clicking the “X” in the upper right corner of the window.

#### Step 4 Explore bodies of water as physiographic boundaries

- a* Turn on the Rivers, Lakes, and Countries 2000 themes.

Wherever countries have physiographic boundaries based on rivers, the red boundary line disappears beneath the blue river in the view. Look closely at Europe to see if you can find any boundaries that are rivers. The different colored countries will help you find these places.

- b* Make sure Boundaries 2000 is the active theme.



- c* Click the Identify tool. Click a country that has a river as all or part of a boundary.



*In the table on the answer sheet, record the names of three sets of countries that share a boundary that's a river.*

In order to identify the names of the rivers, you must make Rivers the active theme and then use the Identify tool.

Coastlines are also physiographic boundaries. Countries that do not have a coastline are said to be landlocked.



- d* Look at the view and name three landlocked countries in Western Europe. Use the Identify tool if you don't know the name of a specific country.

**Step 5 Explore geometric boundaries**

Another type of boundary is a *geometric* boundary. Geometric boundaries consist of straight or curved lines that do not correspond to physical features on the earth's surface.



*a* Click the Zoom to Full Extent button to see all the continents. Turn off Satellite Image.



*b* Click the Zoom In tool. Use it to zoom in on Africa.

You see many rivers that overlap boundaries throughout the African continent.

*c* Make sure Boundaries 2000 is the active theme.

*d* Look at the view and locate countries that have geometric boundaries (boundaries that are not physiographic).



*e* Click the Identify tool. Use your Identify tool to identify African countries that are separated by geometric boundaries.



*Record three sets of countries in the table on the answer sheet.*

*f* Close the Identify Results window.



*g* Click Zoom to Full Extent to see the entire world in the view.

*h* Ask your teacher if you should stop here and save this ArcView project. Follow your teacher's instructions on how to rename the project and where to save it. If you do not need to save the project, proceed to step 6.



*Write the new name you gave the project and where you saved it.*

**Step 6 Explore anthropographic boundaries based on language and religion**

A third type of boundary is an *anthropographic* boundary. This boundary marks the transition between cultural characteristics on the landscape. Anthropographic boundaries are based on characteristics such as language, religion, or ethnicity.

*a* Turn off Boundaries 2000, Countries 2000, and Rivers.



*b* Click the Add Theme button.

*c* Navigate to the data directory (**C:\esri\mapworld\mod5\data**).

*d* Select **language.shp**. Hold down the Shift key and scroll down to select **religion.shp**. Click OK.



- e Drag Boundaries 2000 to the top of the table of contents.



- f Turn on Language.shp. It displays the distribution of major language groups on the earth. Scroll down the table of contents so you can read the Language.shp legend. Drag the right edge of the table of contents to widen it.

- g Observe the pattern of anthropographic boundaries based on language in the world.

- ? h Use the Identify tool to determine the principal language groups in South America and Western Europe. (Don't forget to make Language.shp the active theme.) Record your answers on the answer sheet.

- i Turn on Boundaries 2000.

- ? j Use the Identify and Zoom tools to locate three examples in the world where political boundaries coincide with anthropographic boundaries based on language. Record them on the answer sheet.



- k Click Zoom to Full Extent. Turn off Boundaries 2000 and Language.shp.

- l Turn on Religion.shp. The distribution of major religions is displayed.

- m Observe the pattern of anthropographic boundaries based on religion throughout the world.

- ? n Use the Identify and Zoom tools to determine the principal religions in North America and Africa. Record them on the answer sheet.

- o Turn on Boundaries 2000.

- ? p Use the Identify and Zoom tools to locate three examples in the world where political boundaries coincide with anthropographic boundaries based on religion.

### Step 7 Review physiographic, geometric, and anthropographic boundaries

- ? Use your Zoom and Identify tools to find additional examples of physiographic, geometric, and anthropographic boundaries between countries and record your findings in the table on the answer sheet.

**Step 8 Explore the impact of boundary shape, cultural diversity, and access to natural resources**

Boundaries determine the size and shape, or territorial morphology, of countries. Size and shape can exert a powerful influence on the cohesiveness of a country. Small compact nations or circular/hexagonal ones, for example, are more easily united than ones that are elongated or fragmented.



**a** Click the Zoom to Full Extent button to see the whole world again. Turn off all themes except for Countries 2000 and Ocean. Make Countries 2000 the active theme.



**b** Click the Find tool.

**c** When the Find window appears, type **Chile** and click OK. Chile is highlighted yellow in the view, but may be small and difficult to see.



**d** Click Zoom to Selected Feature to get a closer look at Chile's shape.

The table on the answer sheet illustrates six types of countries based on shape and gives an example of each. Chile is listed as an example of an elongated country.



**e** Use the Find, Zoom, and Pan tools to locate another example of each type of country. Record them in the table on the answer sheet in the Example 2 column. Remember, you can use the Identify tool to find the names of countries that you do not know.

Another factor that influences cohesiveness is the extent of cultural diversity.



**f** Click the Zoom to Full Extent button. Turn on Language.shp and Boundaries 2000. Turn off Countries 2000.



(1) *By using language groups as an indicator of cultural uniformity, identify three countries that reflect cultural uniformity.*



(2) *By using language groups as an indicator of cultural diversity, identify three countries that reflect cultural diversity.*

Boundaries also influence economic activities. Earlier in this GIS Investigation, you identified landlocked countries in Western Europe. Historically, these countries were limited in their ability to trade directly with other nations because imports and exports had to pass through other countries en route to their destination.



**g** Click the Zoom to Full Extent button to see the whole world again. Turn off Boundaries 2000 and Language.shp. Turn on Countries 2000.



**h** Use the ArcView tools and buttons you've learned in this investigation to find an example of a landlocked country on each continent listed in the table on the answer sheet. For a continent that does not have a landlocked country, write "none."

Boundaries also influence economic activities by establishing a country's access to natural resources.



**i** Click the Zoom to Full Extent button. Make sure Rivers and Lakes are turned off.



**j** Click the Add Theme button. Navigate to the data directory (**C:\esri\mapworld\mod5\data**) and double-click **oil\_gas.shp**.

**k** Turn on Oil\_gas.shp. The locations of oil and gas sources around the world are displayed.



**l** Use the Zoom In tool to focus on Southeast Asia.



*m* Use the Pan, Zoom, and Identify tools to help you answer the following questions.



(1) Name two Southeast Asian countries that do not have any oil and gas resources within their borders.



(2) Name two Southeast Asian countries that have oil and gas resources within their borders.

*n* Turn off Oil\_gas.shp.



*o* Click the Zoom to Full Extent button. Turn off Countries 2000 and Ocean, and turn on Satellite Image.

### Step 9 Explore boundary changes in the 1990s

Political boundaries can change in numerous ways. Large countries may split into several smaller ones, small countries may combine to produce larger ones, territories that were once part of one country may be incorporated into another.



*a* Click the Add Theme button. Navigate to the module 5 data directory (**C:\esri\mapworld\mod5\data**) and select **cntry92.shp**.

*b* Make Cntry92.shp the active theme and turn it on. International boundaries from 1992 display as yellow lines.



*c* Click the Theme Properties button. Type **Boundaries 1992** as the new theme name. Click OK.

*d* Turn on Boundaries 2000.

 **Note: Because 1992 boundaries cover the 2000 boundaries in the view, the 2000 boundary lines are not visible if they are the same as they were in 1992. The only 2000 boundary lines that are visible are those that did not exist in 1992.**

*e* Observe the map closely to see the differences between 1992 and 2000. What kind of changes do you see? (Use your Zoom and Pan tools to get a good look at these changes.)



(1) Describe three political boundary changes you see between 1992 and 2000.



(2) Name two countries that existed in 1992 but do not exist in 2000.

*f* Ask your teacher if you need to save this ArcView project. If you do, follow your teacher's instructions on how to name the project and where to save it. If you do not need to save the project, continue to the next page.



Write the new name you gave the project and where you saved it.



Countries in groups A and B below are new countries that have emerged since 1992.

**Group A**

Czech Republic  
Slovakia  
Slovenia  
Croatia  
Bosnia and Herzegovina  
Serbia  
Montenegro  
Macedonia  
Eritrea

**Group B**

Russia  
Belarus  
Ukraine  
Moldova  
Armenia  
Azerbaijan  
Georgia  
Kazakhstan  
Uzbekistan  
Tajikistan  
Turkmenistan  
Kyrgyzstan

- ? *g* Select three countries from group A and three from group B and complete the table on the answer sheet. Use the information and skills you learned in this GIS investigation to answer the questions.

**Step 10 Exit ArcView**

In this exercise, you used ArcView to explore the various types of political boundary and their impact on the countries they define. You added themes and used the Find, Identify, Zoom, and Pan tools to investigate the maps. You observed and analyzed boundary changes between 1992 and 2000.

- a* Ask your teacher for instructions on where to save this ArcView project and on how to rename the project.
- b* If you are not going to save the project, exit ArcView by choosing Exit from the File menu. When asked if you want to save changes to global5.apr, click No.