Module 5, Lesson 1

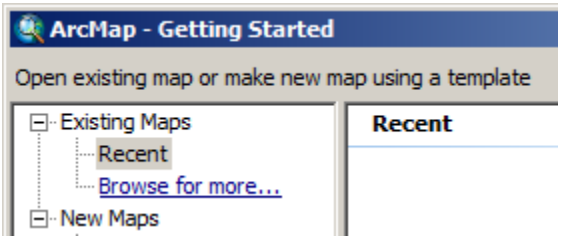
Crossing the line

Boundaries are invisible lines on Earth's surface. They divide the surface area into distinct 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 that occurred in recent years.

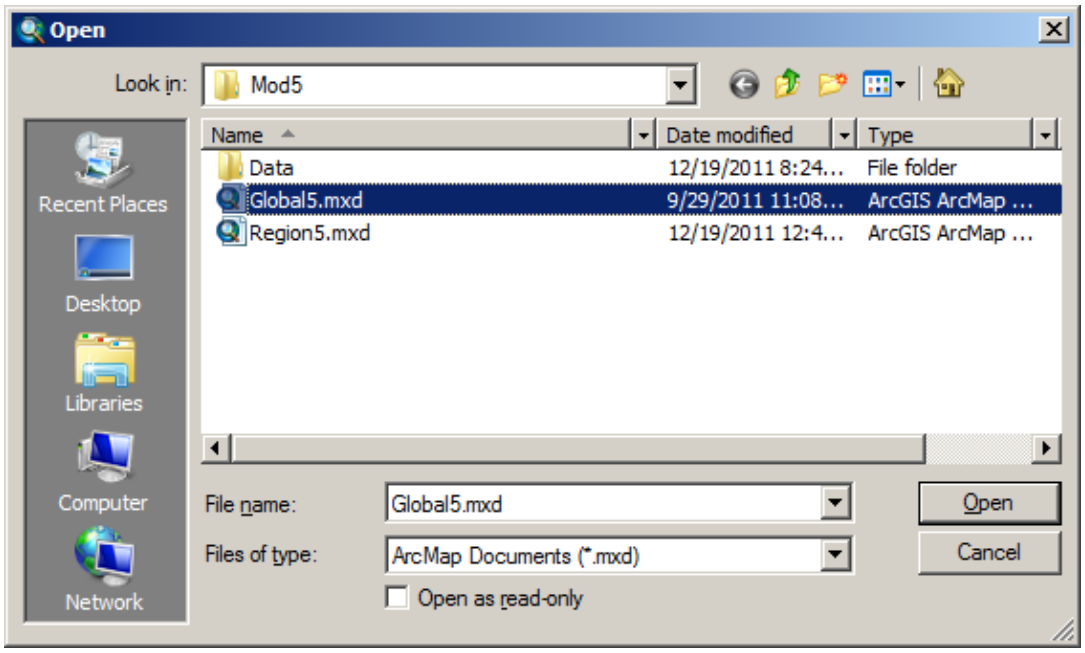
Step 1: Open a map document

1. Double-click the ArcMap icon on your computer's desktop.

2. When the ArcMap start-up dialog box appears, click Browse for more...



3. Navigate to the Module 5 folder (**OurWorld2\Mod5**) and choose **Global5.mxd** (or **Global5**) from the list.



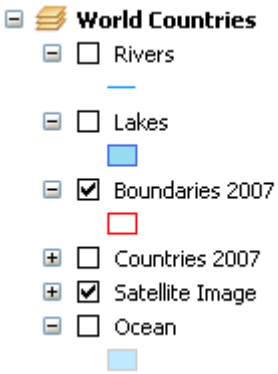
4. Click Open. The map document opens, and you see a composite satellite image of the world. The check mark next to the layer name tells you the layer is turned on and visible on the map.

Step 2: 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. For example, physiographic boundaries follow landscape features such as mountain ranges or rivers.

1. Click the box next to the Boundaries 2007 layer to turn it on. A check mark appears, and the red lines show the international boundaries for the year 2007.



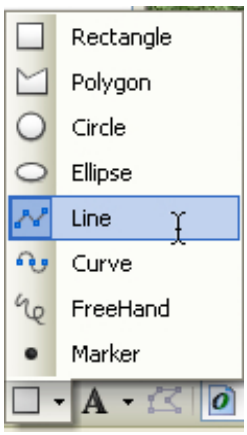
2. Click the Zoom In tool. On the map, click and drag a box around Europe. The view is now centered on Europe.

3. Drag another box around Europe to zoom in more so you can see the physical features in greater detail.

4. Turn off Boundaries 2007 by clicking the check mark next to the layer name.

Locate Europe's mountain ranges in the satellite image. Notice that ranges such as the Pyrenees Mountains in northeastern Spain form a natural boundary. You will use the Draw Line tool to draw a line 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.

5. On the Draw toolbar click the drop-down arrow to the right of the Rectangle tool and select the Line tool.



If the Draw toolbar is not visible, click the Customize menu, select Toolbars and click Draw to turn it on. A good place to dock it is at the bottom of the ArcMap window.

6. On the Draw toolbar click the drop-down arrow to the right of the Line Color button and change the color to yellow.

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

7. 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 (you will see only a faint gray line as you are clicking). Double-click to end the line.

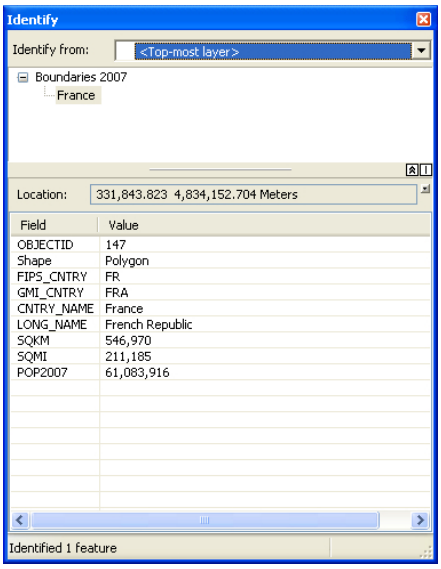
8. The yellow line is displayed in the map. If you don't like your line, you can press the Delete key on your keyboard to delete the line and draw another. When you're finished, click on the map away from the yellow line to make the blue selection box disappear.

9. Turn on the Boundaries 2007 layer. You see that your line corresponds to a border between two countries.

10. Click the Identify button.

11. Click the country that borders the Pyrenees Mountains to the north. Move the Identify window so you can see the map.

The left side of the window shows the layer name and below it the country name. You can also see all the attributes for that country that are in the attribute table.



12. Click on the country to the south of the border

Answers to questions in this activity should be recorded on the answer sheet.

Q1 ***The Pyrenees Mountains are the border between which two countries?***

13. Click the Select Elements tool. Click and drag a box over the boundary line you previously the Delete key on your keyboard to delete the line.

14. 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 window**.**

Q2 ***Complete the table on the answer sheet. Consult an atlas to learn the names of mountain ranges you don't know***.

Step 3: Explore bodies of water as physiographic boundaries

1. Turn off the Satellite Image layer and turn on the Rivers, Lakes, Countries 2007, and Ocean layers.

Wherever countries have physiographic boundaries based on rivers, the red boundary line disappears beneath the blue river on the map. Look closely at Europe to see if you can find any boundaries that are rivers.

2. In the Identify window click the “Identify from” drop-down menu and change <Top-most layer> to Countries 2007 as the reference layer (if the Identify window is closed, click the Identify button to open it).

3. Click a country that has a river as part of a boundary (you may want to zoom or pan the map). Click the Identify tool again when you have found such a country.

Q3 ***In the table on the answer sheet, record the names of three pairs of countries that share a boundary that’s a river (to identify the names of the rivers, make Rivers the reference layer in the Identify window).***

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

4. Zoom or pan so that Western Europe is in your full view.

Q4 ***Name three landlocked countries in Western Europe. Use the Identify tool if you don’t know the name of a specific country (remember to set Countries 2007 as the reference layer in the Identify window).***

Step 4: Explore geometric boundaries

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

1. Click the Full Extent button to see all the continents.

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

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

3. Look at the map and locate countries with a shared geometric boundary.

4. Make Countries 2007 the reference layer in the Identify window.

Q5 ***List three pairs of countries with a shared geometric boundary.***

5. Close the Identify window.

6. Click Full Extent to see the entire world.

7. Ask your teacher if you should stop here and save this map document. Follow your teacher’s instructions on how to rename the map document and where to save it. If you do not need to save the map document, proceed to the next step.

Q6 ***Write the new name you gave the map document and where you saved it.***

Step 5: Explore anthropographic boundaries based on language and religion

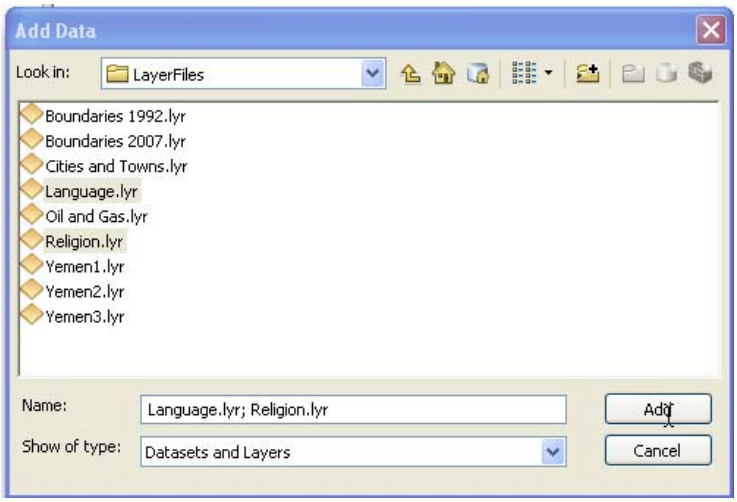
A third type of boundary is anthropographic. Anthropographic boundaries are based on societal characteristics such as language, religion, or ethnicity.

1. Turn off Rivers, Lakes, Boundaries 2007, and Countries 2007.

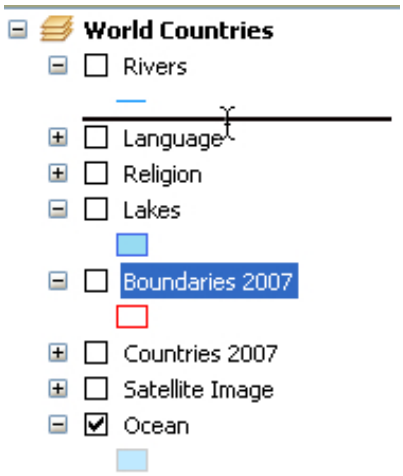
2. Click the Add Data button.

3. Navigate to the LayerFiles folder within the module 5 Data folder (**OurWorld2\Mod5\Data\LayerFiles**).

4. Select **Language.lyr**. Hold down the Ctrl key and click **Religion.lyr**. Click Add.
5.



5. Drag the Boundaries 2007 layer above the Language and Religion layers in the table of contents.



6. Turn on Language and click the plus sign next to it to expand the legend. The distribution of major language groups in the world is displayed. Drag the right edge of the table of contents to widen it if you need to.

7. Observe the pattern of anthropographic boundaries based on language.

Q7 ***Use the Identify tool to determine the principal language group in South America and Western Europe (don't forget to make Language the reference layer in the Identify window).***

8. Turn on Boundaries 2007.

Q8 ***Use the Identify and Zoom tools to locate countries separated by an anthropographic boundary based on language. List three pairs of such countries on the answer sheet.***

9. Click Full Extent. Turn off Boundaries 2007 and Language. Click on the minus sign next to Language to collapse the legend.

10. Turn on the Religion layer and expand its legend. The distribution of major religions is displayed.

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

Q9 ***Use the Identify and Zoom tools to determine the principal religions in North America and Africa. Record them on the answer sheet.***

12. Turn on Boundaries 2007.

Q10 ***Use the Identify and Zoom tools to locate countries separated by an anthropographic boundary based on religion. List three pairs of such countries on the answer sheet.***

Step 6: Review physiographic, geometric, and anthropographic boundaries

Q11 ***List additional examples of countries separated by physiographic, geometric, or anthropographic boundaries for each continent in the table on the answer sheet.***

Step 7: Explore the effects of boundary shape, cultural diversity, and access to natural resources

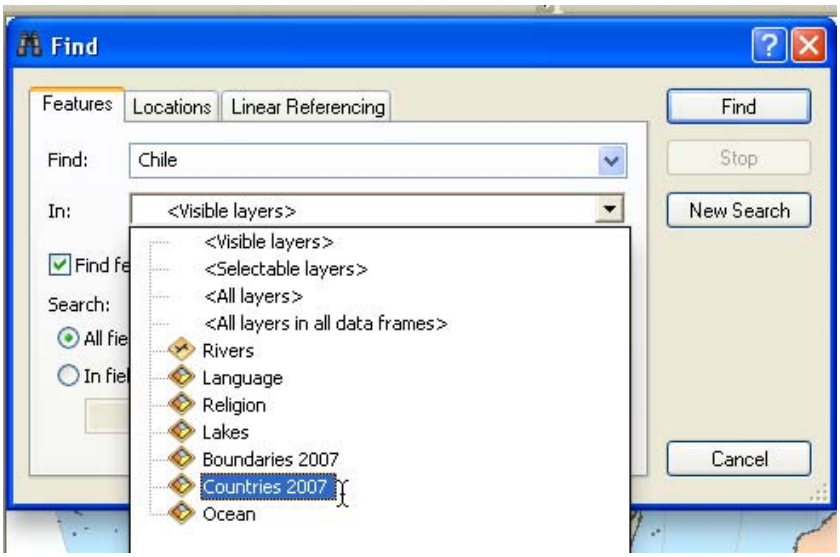
Boundaries define a country's size and shape, or territorial morphology, which may be related to the cohesiveness of that country. Small compact nations or ones that are circular or hexagonal, for example, are likely to be more united than ones that are elongated or fragmented.

1. Close the identify window it it's still open.

2. Click the Full Extent button to see the whole world again. Turn off all layers except for Countries 2007 and Ocean and collapse the Religion legend in the table of contents.

3. Click the Find button.

4. In the Find dialog box type **Chile**. Select Countries 2007 from the "In" drop-down menu.



5. Click Find. A results box appears at the bottom of the Find dialog box, and Chile is listed. Move the Find dialog box to the side so you can see the map.

6. Right-click on the highlighted row for Chile and click Zoom To. Then right-click again and click Flash to locate Chile in the map.

Q12 ***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. Use the Find, Zoom, and Pan tools to locate another example of each type of country. Record the countries 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 cultural diversity.

7. Click the Full Extent button. Turn off the Countries 2007 layer. Turn on Boundaries 2007 and Language.

Q13 ***Identify three culturally uniform countries on the basis of language group.***

Q14 ***Identify three culturally diverse countries on the basis of language groups.***

Boundaries also influence economic activities. Earlier in this activity, 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.

8. Click the Full Extent button. Turn off Boundaries 2007 and Language. Turn on Countries 2007 and Lakes.

Q15 ***Record an example of a landlocked country for each continent listed in the table on the answer sheet. For a continent that does not have a landlocked country, write "None."***

9. Close the Find dialog box if it is still open.

Boundaries also influence a country's economic activities dependent on access to natural resources.

10. Click the Full Extent button.

11. Click the Add Data button. Navigate to the LayerFiles folder within the module 5 data folder (OurWorld2\Mod5\Data\LayerFiles). Double-click Oil and Gas.lyr. The locations of oil and natural gas sources around the world are displayed on the map.

12. Use the Zoom In tool to focus on Southeast Asia.

Q16 ***Name two Southeast Asian countries that do not have any oil and gas resources within their land borders (use the Pan, Zoom, and Identify tools).***

Q17 ***Name two Southeast Asian countries that have oil and gas resources within their land borders.***

13. Turn off the Oil and Gas layer.

14. Click the Full Extent button. Turn off Countries 2007 and Ocean, and turn on Boundaries 2007 and Satellite Image.

Step 8: Explore boundary changes that occurred in the 1990s

Political boundaries can change in many ways. A large country may split into smaller ones, small countries may combine to form a larger one, and territories that were once part of one country may be incorporated into another.

1. Click the Add Data button. Navigate to the LayerFiles folder within the module 5 data folder (OurWorld2\Mod5\Data\LayerFiles) and add Boundaries 1992.lyr.

2. The international boundaries from 1992 are displayed as yellow lines.

3. Because the 1992 boundaries cover the 2007 boundaries on the map, the only 2007 boundary lines (red) that are visible are those that did not exist in 1992.

Q18 ***Describe* three political-boundary changes between 1992 and 2007 (use the Zoom and Pan tools to get a closer look, and the Identify tool to identify countries).**

Q19 ***Name two countries that existed in 1992 but do not exist in 2007.***

4. If you already saved this map document earlier, click the Save button to save your work. Otherwise, ask your teacher for instructions on where to save this map document and how to rename it. If you do not need to save the map document, continue to the next step.

Q20 ***Write the new name you gave the map document and where you saved it.***

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

Group A	Group B
Czech Republic	Russia
Slovakia	Belarus
Slovenia	Ukraine
Croatia	Moldova
Bosnia and Herzegovina	Armenia
Serbia	Azerbaijan
Montenegro	Georgia
Macedonia	Kazakhstan
Eritrea	Uzbekistan
	Tajikistan
	Turkmenistan
	Kyrgyzstan

Q21 ***Select three countries from group A and three from group B and complete the table on the answer sheet. Use the map and your GIS skills to obtain the information.***

5. Click the File menu and click Exit. When asked if you want to save changes to the map document, click No.

In this exercise, you used ArcGIS to explore the various types of political boundaries and their impact on the countries they define. You added layers and used the Find, Identify, Zoom, and Pan tools to investigate the maps. You observed and analyzed boundary changes between 1992 and 2007.