Georectifying images in ArcGIS 9.x

Georectifying is a tool that allows you to transform paper maps or other images into an ArcGIS layer. It is not always possible to find maps or aerial photos (raster images) that are digitized and orthorectified. Historic maps, aerial photos, and other maps found online or in print are often not available digitally, and you may not have the necessary information to georeference the image. This process allows you to manually match up raster data with vector data in an ArcGIS map.

Related Guides:
- Georeferencing a raster dataset in ArcGIS 9.x

Requirements:
- ArcGIS
- Maps or aerial images saved as .tif, .jpg, or .bmp. The Bibliotheque National du Quebec is a great source for historic maps.
- Shapefile(s) of the same extent as the image file

Procedure:
1. Open ArcMap and create a new empty map.

2. Click on the Add Data button and add shapefiles and images to the map.

A dialogue box will appear asking if you want to build pyramids. Choose "yes".
Do not worry if you get an error message saying that the image lacks projection information. That's what you're about to do.

3. Go to View, Toolbars, and add "Georeferencing."

In the drop-down menu of the Georeferencing tool, make sure your raster file is referenced.
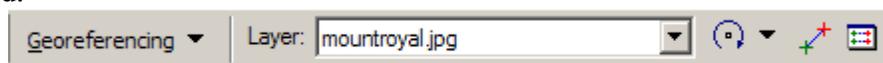
Within this toolbar are several georeferencing tools that can be used to move and stretch your image to fit with your shapefile.
- Under the drop-down menu, "fit to display" will transpose your image on top of your shapefile.
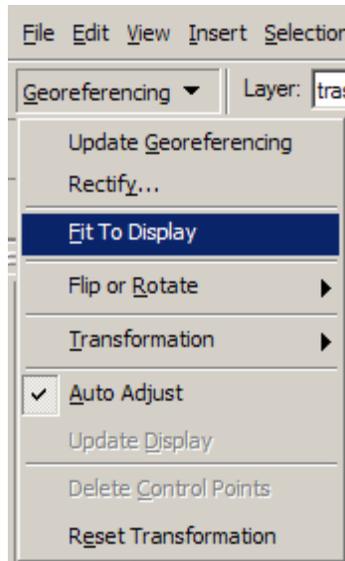
If necessary, rearrange the order of your files so that your image to be georectified is either on top or visible under the shapefile. If both the image and the shapefile are not visible, make one of the layers transparent (Properties→Display tab, and make the image transparent. This will allow you too see both the image and your target.

- This tool will rotate your image. Clicking on the arrow can change it to this tool to the move tool which will allow you to move the image independently of the shapefile.

- This tool adds control points.

The process of rectifying an image is sometimes called rubbersheeting because you are stretching the image like a sheet of rubber. Control points act like anchors on the rubber sheet. Find readily identifiable landmarks on both maps (like an intersection, benchmark, visible land form). Click on the object in the image, and then click on the same object in the shapefile. The image should move to align with the shapefile. Continue adding control points (always clicking on the image first) until the image is closely aligned with the shapefile. It may not be possible to have a 100% match. Focus on the portion of the map that is most important.

If you make a mistake or want to delete a control point, click on this icon: . A table of control points will appear. Delete those points you do not want.

When you are satisfied with the image, choose "rectify" from the drop down menu. The image will now be saved as a new file. Add this file to your project. Right click on the layer, select "properties" and under the "extent" tab, you will see that your image now has spatial information to align it with your shapefile.

Example: Georectifying an historic map image with a current shapefile.

This exercise will overlay an historic map with a current shapefile. We will compare the streets around the McGill campus and Mount Royal have changed in the last 100 years.

Download the 1890 Goad Atlas of Montreal image from the Bibliotheque Nationale du Quebec. http://www.banq.qc.ca/. Choose the "Collections" tab, and then the "Collection numerique" or "Digital collection." The example in this tutorial uses this Goad Map of Montreal from 1903: http://bibnum2.banq.qc.ca/bna/cargeo/high/trba0164_n.jpg. Save the high-resolution .pdf file as an image file (.jpg, .tif, or .bmp).

Download and unzip the Quebec from this site (you will need a McGill IP address): http://www.edrs.mcgill.ca/GIS/dmti/routelog/webpage/routelog_data.html

Add the QCrte shapefile (in the streets folder, this shapefile contains the roads of Quebec) and the Goad map image to a new, empty map. Make sure the image is visible either over or under the shapefile by adjusting transparencies, etc. In this example, the image can be seen through the street grid. To make finding the intersections of the streets easier, add labels to the file (Properties→Labels→Label features in this layer).

If it is not already listed, add the Gorereferencing toolbar by going to View→Toolbars→Georeferencing.

Zoom to the area on the shapefile that cover roughly the same extent as your image.

Choose "fit to display" from the georegistering menu.

Use the "rotate" and "move" tools to align the map image. In this example, the St. Lawrence was the easiest feature to compare:

Zoom in closer and begin adding control points. Find the intersection of Pie IX and Notre Dame on each map (or some other intersection in Montreal). With the Control Points tool activated, click first on the intersection on the old map, and then click on the same intersection in the new map. Choose other intersections along Notre Dame and Pie IX and add more control points until the street grid for each map matched.

Note: many street names in Montreal have changed over the last 100 years!
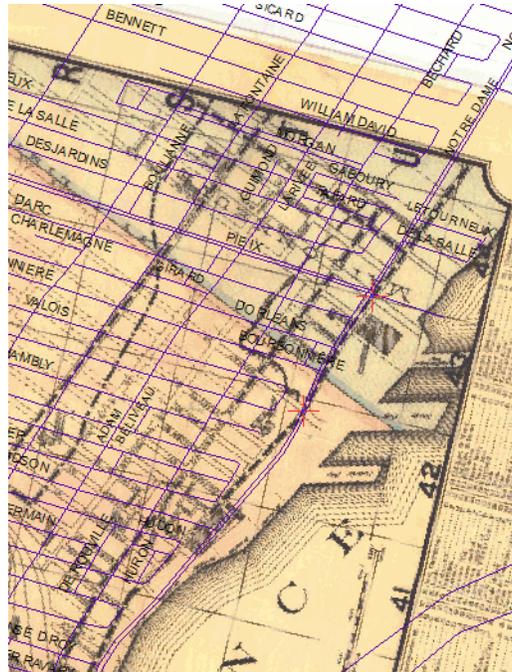
Move to another part of the map and check the alignment. You may wish to add more control points, especially if there is a certain area in which you are interested. The McGill campus, for example, looks like this after some more control points:
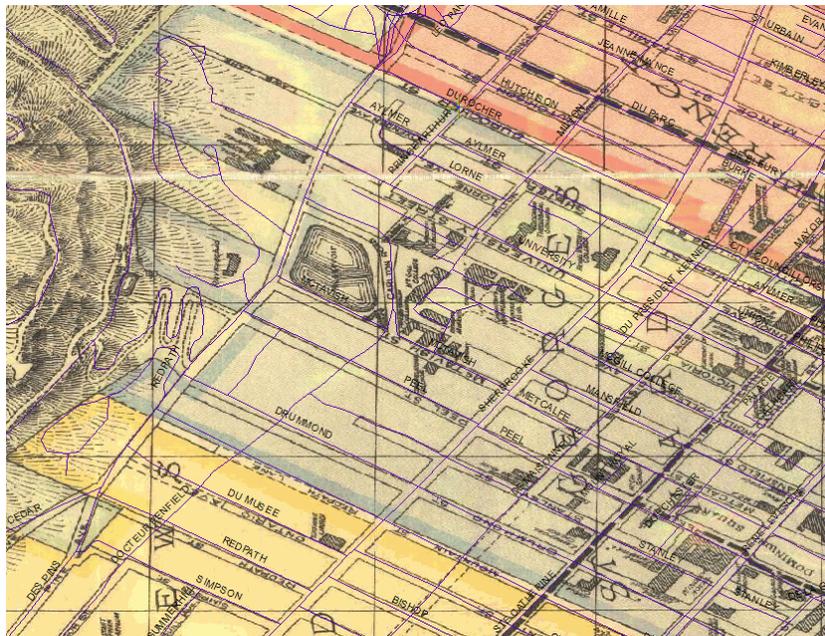
Zooming out to the full extent of the image shows that the alignment may be off in parts of the map without control points. You can decide whether or not to do this depending on your needs.
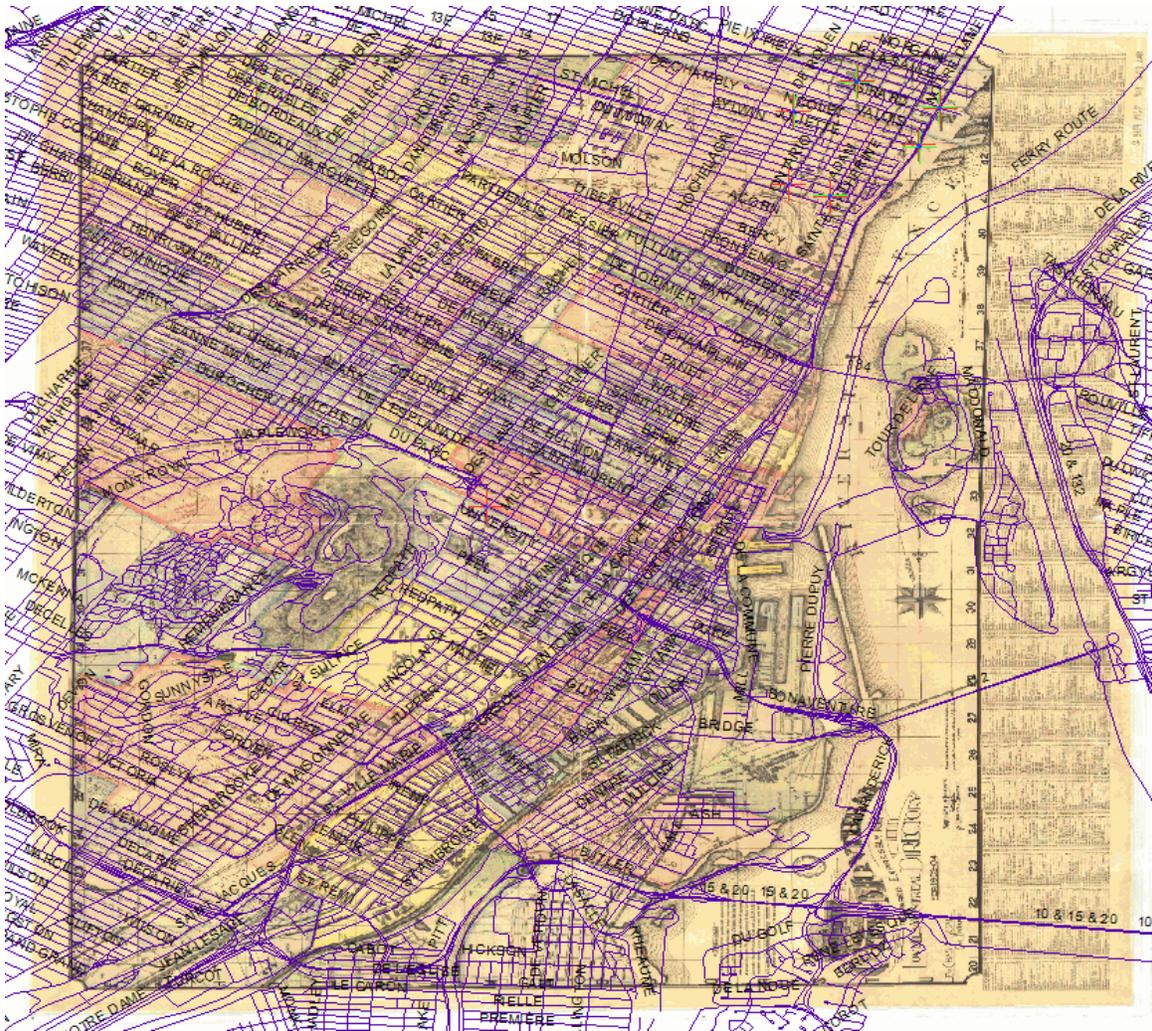
Choose rectify from the Georeferencing menu. You will be given the option to change the name of the new, rectified image.

After the image has been rectified, add it to the map and remove the original image file.

You can now compare how this portion of the city has changed in the past 125 years. Roads like Docteur Penfield, for example, were not yet built. See what else you can find that has changed in Montreal. Have fun!

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