Geocoding and Buffering Addresses in ArcGIS

INTRODUCTION

Geocoding is the process of assigning location coordinates in a continuous, globlal reference system (Latitude and Longitude, for instance) to street addresses. While street addresses are an easy to understand way for us to make sense of locations in a local area there are many problems will using them for distinguishing locations in the world. Street addresses are generally considered location identifiers within a local reference system; furthermore, a street address system is often discrete, meaning it is only effective for positions that fall on the street network. For this reason the US street network has been digitized and coordinates (lat/long for instance) have been determined for the two points that specify individual line segments (smallest line segments possible). In addition to the global coordinates the street address range for each side of the street is also specified for that segment of the street network. Therefore, based on the known range of street addresses and lat/long coordinates a reasonable approximation can be made of the location of an address on a street in global coordinates.

DATA and SHAPEFILES

Geocodebuffer.zip can be downloaded from the S4 tutorials section of the training page (<u>http://www.s4.brown.edu/S4/about.htm</u>) It contains:

NOSchoolsaddrs.xls: Excel file of addresses of currently open schools in New Orleans
 NOstreets.shp: a street file for all of Louisiana, the state in which you will be geocoding addresses.

3) Katrina_damage_all2.shp: a file displaying damage sustained across New Orleans from Katrina.

4) Raceethnicity.shp: census data containing race and ethnicity.

GEOCODING ADDRESSES

1) Converting addresses from excel file to Dbase file format:

Start MS Excel and open the file NOSchooladdr.xls located in your data folder. (Note: you can add some other addresses of your choice.) Save your addresses in NOSchooladdr.dbf file.
2) Creating an address locator:

Before you can geocode addresses you need to create a **geocoding service** in **ArcCatalog**. (A geocoding service generates an indexed structure of streets using which system finds an address.) **Start ArcMap**, then **click ArcCatalog icon**.



In the ArcCatalog window expand Address Locators and then double click Create New Address Locator.



In the next window, select **US Streets and Zone (File)** as address locator type and then click **OK** button.

In the **Address Locator** dialog box, type the name as **New Orleans**, add the **NOstreets.shp** file as your reference data, check **X** and **Y** coordinate boxes, and click **OK** button.



"Minimum match score"). We see these later.

There are several important variables in this dialog box that you should notice before clicking OK. When you selected "streets and zones" you told ArcGIS that you would be matching addresses from your database to the streets files based on both zip code and street address, this helps avoid the problem of having streets of the same name in different parts of the street file (in this case, a file that covers all of LA, think of all the Canal Streets, Bourbon Streets, DeCauter Streets, etc.). Also, there are several default settings we are going to accept, but notice that for three items there are tolerances that must mean something ("spelling sensitivity," "Minimum candidate score," and You will notice that a **New Orleans** address locator is now added in the **ArcCatalog**. Copy the locator file to your data directory (where you are keeping your data). Now, minimize **ArcCatalog**, and return to **ArcMap**. Add the **NOstreets.shp** shapefile.

3) Adding Address Locator: In ArcMap, click Tool menu, select Geocoding and then click Address Locator Manager. In the new window click Add button, from Look in dropdown button, double click Address Locators, now select New Orleans and click OK button, and again click Close button on Address Locator Manager dialog box.



4) Geocoding Addresses: Click **Tool** menu, point your mouse to **Geocoding** and click **geocode addresses**. You might be prompted to select Address Locator Manager dialog box, if that happens, select the New Orleans address locator you just created and click the **OK** button. In the geocoding dialog box, select **NOSchooladdrs.dbf** for as the Address Table, Street or Intersection as **ADDRESS and Zip Code** as Zone, output file name as NOSchoolAddresses and click **OK** button.

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You will notice that four records (addresses) are still unmatched in the **Review/Rematch dialog** box that pops up. You can click the **Match Interactively** button to match the unmatched addresses.

In the Interactive Review/Matching window you can make selections and edit records. There are several reasons an address might not receive a match. Spelling, address range, and name changes are all reasons a street address in our list of school address might not match the streets and maps database. In turn you can select the records (rows) from the top of the Interactive Review window and see the details of the match in the lower part of the window. For **L B Landry Ave. go to Yahoo maps** and enter that street name for New Orleans,

LA and see what that street looks like on the map. You should notice that L B Landry punctuates another street, Whitney Ave. In fact you can find the same school we are dealing with in google maps and see that it uses L B Landry as well. If you click on the name in the lower part of the window you can edit it, then click MODIFY, new results will appear. You can select the result with the highest matching score; there should be one that scores 100. For the remaining records, Carrollton Ave and Clairborne Ave, the results show a lower score than the threshold we accepted earlier (60 is the default), each of these addresses scored 51. The problem here is that the streets database doesn't have address ranges for the side of the street on which these addresss fall (odd for Carrollton, even for Claireborne). In this case we can accept the lower score by selecting it and clicking on "Match."

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Now, click **Close** button, and then click **Done** button on the **Review/Rematch** dialog box.

In the next section you will be performing an operation called **Buffering**. The buffer tool is in the ArcToolBox, you can find it in ArcToolBox \rightarrow Analysis Tools \rightarrow Proximity. If you haven't already used the ArcGIS help, right click on buffer and select "help," when the help window opens you should see a clickable line of text stating "Learn more about how Buffer works," click it to learn more about buffers.



BUFFERING POINTS

Before creating buffers it is important to display the layers in your map in a form that will allow you to make measurements in metric (Cartesian) units. Currently the data is not really in map form but is being displayed as though latitude and longitude were X and Y coordinates on a flat surface (they're not, they are coordinates for a sphere or sphere-like object, such as the Earth). **Right click on the LAYERS and select properties. The window below will appear.**

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This window shows the projection to which the data needs to be changed. Open **Predefined, select Projected Coordinate Systems, State Plane, NAD 1983, and NAD 1983 StatePlane Louisiana South FIPS 1702.** This will display the New Orleans data in a projected map form that is most accurate for the southern part of Louisiana.

Click OK

Later, when you add other data to this map (census and Katrina damage) ArcGIS will tell you that the new data is not in the same coordinate system as the current data, clicking OK will result in ArcGIS automatically converting the data to this projection. Before buffering you should think about what a reasonable buffer might be for schools. In the dataset you geocoded there is a column that identifies each school as an elementary school, high school, or middle school. There is only one middle school, so you should focus on the high school and elementary school. Right click on the geocoded layer and select **properties**, and choose the **Symbology** tab, choose **Categories** and **Unique values**, select the **school type** variable (it will look different than it does here), then **Add All Values**, changing the color scheme will probably be necessary, you can do this individually for each symbol or select different color ramps until the three categories of schools is easy to distinguish from one another.



Your maps should look something like this:



Notice that there are fewer high schools than elementary schools and that they are spread accross New Orleans more (more distributed).

Come up with a meaningful reason for the size of you buffers (the same for all schools). You can use the **distance tool** to measure distances between points to help come up with values for the buffers. Once you've selected the distance tool just click on one location with the **crosshairs** (a high school, for instance) then move to another location (the nearest high school, for instance) and you will see the distance in the lower left of the ArcGIS window.

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In order to create different buffers for the high schools and elementary schools you have to put each set of schools in its own layer. Use the **select tool** from **ArcToolbox→Analysis Tools→Extract→Select** to select the elementary schools).



In the dialog box that appears select the layer (geocoding results) and name the file (highschools, for instance), then click the SQL icon, which will bring up a **Query Builder** window.



In the query building window select the variable you want to select and output as a new layer (schtype) by double clicking (it should appear in the bottom window). Then click the **equals expression** (=). Now click **Get Unique Values**, which will display the possible types of schools and select the type of schools you want. Once the query is built you can click OK.

Again, do this for both high schools and elementary schools.

Add the new shapefiles you've created and perform the buffer operation on each layer (high schools and elementary schools.

Create circles (buffers) around each school (all schools get the same size buffer) using the buffer tool (\rightarrow Analysis \rightarrow Proximity \rightarrow Buffer). Each buffer (elementary schools buffer and high schools buffer) will be added to your current map as a new layer.

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You might end up with something like this for elementary schools:



Once you have created buffers for each type of school you can add some additional data, in the original zip file there were two layers that might be of interest, one is a layer depicting the damage from Katrina across New Orleans, the second is a census file with which you can display the % black by census tract. These two layers were used by S4 to show the disproportionate impact the storm had on New Orlean's black population.