ACCURACY ASSESSMENT OF HISTORICAL MAPS FROM THE LOWER ROANOKE RIVER WATERSHED, NORTH CAROLINA

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The art of cartography has evolved and progressed over since the first world maps were created in Babylonian thousands of years ago. Looking at early maps has made me realize that you can talk a lot about the cartographer from just looking at one of his works. These maps tell us things such as his perspective of the world, where he is from, and even his religion. Early maps makers such as Polo, Mercator, and Burton wanted and sought out to do the same thing that every cartographer wants to do in modern times. Make their masterpiece as accurate as possible. Accuracy will always be the most important aspect of cartography for the simple fact that they are used for location reference.

Unfortunately, most cartographic technology was not at today's qualities. Most cartographic errors were made in transcription or digitizing. This makes sense due to the fact that most early cartography was done at sea while on voyages. I have been motivated to find out just how accurate these tools served early cartographers. While at my internship at UNC-Chapel Hill, I was provided with a ton of early maps of the Roanoke watershed. As I glanced through these beautiful maps, I thought to myself, "Even though these maps are rich in aesthetic value, they really don't mean much if they are not accurate." Thus sprang, the purposes of my research to find out how accurate are these historic maps are.

Creating "Old Map" Points

After all my maps were georeferenced and recorded in my spreadsheet, the next step was to create "Old Cities" marks that would hold the location for each map. For this task, I first had to create a new feature layer in ArcMap. As stated earlier, I named the layer "Old Cities". After this layer was created, I went through each map, plotting and recording the map year and city name for each study city. I plotted the points as close as I could to where it was on the map but some of the previous dots that were created would overlap with the ones I was trying to plot. After the old cities layer was created and the attribute table was completed, I had to add a layer which held the location coordinates for the old city map locations and the actual city location. These coordinates were used to calculate the distance from the actual city location using the distance formula.

Results

As expected, many of the maps were very inaccurate. To calculate the most accurate map, I took the distance from actual value and added them together for each city. The map was then normalized with the lowest value was given. 65% of all the "old city" points were over 2000 meters off their mark of the city. Unfortunately, only 5% of the points were under the mean distance. All of my hypotheses were wrong.

Future Research

I plan to try to make my maps more consistent by choosing maps from one specific cartographer at a particular time period. Once I find a somewhat flawless way to replicate this process, I will repeat this process to find the most accurate cartographer of the Renaissance Era.

References


What is RMS Error?

A measure of the difference between locations that are known and locations that have been interpolated or digitized. RMS error is derived by squaring the differences between known and interpolated or digitized. RMS error is derived by squaring the differences between known and interpolated or digitized. RMS error is derived by squaring the differences between known and interpolated or digitized. RMS error is derived by squaring the differences between known and interpolated or digitized. RMS error is derived by squaring the differences between known and interpolated or digitized. RMS error is derived by squaring the differences between known and interpolated or digitized.

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\text{RMS Error} = \sqrt{\frac{1}{n} \sum_{j=1}^{n} (y_j - \hat{y}_j)^2}
\]

Methodology

I received most of my maps from my supervisor under the mean distance.

Hypothesis

Most of the "Old City" points will be under 2000 meters off.

Data

I received most of my maps from my supervisor from UNC-Chapel Hill. As I looked through the lower Roanoke watershed maps, I recognized that there were 3 cities that were on most of the maps. These cities were Windsor, NC, Wintson, NC, and Jamestown, NC which is now Jamesville, NC. Fortunately, the maps I acquired were already dated by year. All of these cities were portrayed the clearest in maps from 1798 to 1862. Since I now have my 3 study cities for each map. For the cities actual locations, I used the United States Atlas cities SDC feature database from 2004. Next, I obtained the most important part of my data. The Roanoke River. I used the United States Rivers and Streams SDC feature database which was also from 2004. Last, to mark where the cities were on the old maps, I had to create a new data layer in which I named "Old Cities". This layer consists of the points in which where the cities was in a particular year after being georeferenced by the Roanoke.

Computing the Accuracy

Accuracy was computed by taking the most accurate map and document all the distances from actual values in my spreadsheet.

Georeferencing

After transforming the maps, I began to georeference the maps. The georeferencing process is key because this is the basis of your cartographic calculations and analyzing. Most of my control points are major curves of the Roanoke River. I also used smaller streams and rivers and even some of the earlier cities. After georeferencing each map, I recorded the RMS error, exported a JGP file of the control points, how many control points were used to georeference the map. The JGP was created to uphold the integrity of my JPEG of the control points, how many control points were used to georeference the maps.

Normalizing the Data

Next, I normalized the Distance from actual column in my spreadsheet by dividing each city by its mean. Last, I created a bull’s eye representation of my data by using the multiple ring buffers in ArcMap. My ring distances were the greatest distance from actual value and the mean of my distance from actual values

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