Rectifying the John Smith Map of 1612

A brief overview of the process

I. Initial Steps

The first step of the process was to create a digital layer of the coastline and point features (houses, crosses, etc.) represented on John Smith's map. This part of the process was completed before applying any spatial adjustments to the map. Once all of the points and linework had been created the next step was to match the map/layers to today's coastline. Using a process called "Affine Transformation" we scaled, rotated and shifted the full map and layers to provide an approximate fit to the current coastline.

II. Create Manageable Pieces

We first attempted to correct the Smith Map in one transformation. This, unfortunately, was unsuccessful as the geometric errors were too severe to overcome mathematically. Therefore, we extracted each river, its tributaries, and point features to separate them into more manageable pieces. Once each river was separated from the whole, they were broken down further into sections where a "match" between Smith's coastline and today's coastline was realized.

III. Finding Reference Points

The method of finding "matching" points of reference was a task with varying degrees of difficulty. In some sections the match could be seen very easily, where as the matching of other sections was not visible until we began rotating and scaling the pieces. The primary river features used when identifying reference points were meanders. In many instances, the bends of the river formed similar patterns between Smith's representation and the current boundary. Other features used to find matches were islands, ox-bow lakes, braiding, and other adjoining tributaries. Once all of the possible matches between Smith's representation and the current water layer were identified and marked, the process of rectifying could begin.

IV. Rectifying Methods

There are two primary methods used to transform the coordinates of Smith's original features into the coordinates of current day. The first, rubbersheeting, is a transformation method which stretches a feature to match a known source. While rubbersheeting gives the analyst a high degree of control on the movement of features, using rubbersheeting alone can create a substantial amount of distortion in the original representation. The result of this distortion is that some of the original identifying features can be lost.

The other primary method used when adjusting features is affine transformation. This method creates adjustment in four dimensions: scaling, skew, rotation, and translation or shifting. One advantage of using an affine transformation is that all of the parts of an adjusted feature are moved together. This insures that the original identifying features are kept consistent. The disadvantage to using affine transformation is that often aligning a feature in one location causes distant locations to be misplaced.

Since Smith's map matched very well in particular sections and not as well in other sections, we decided to combine the two transformation methods in order to rectify the layers. Wherever possible, only affine transformation methods were used and rubbersheeting was used mostly to mend those sections together. This was especially necessary in locations where Smith's map portrayed features closer together or further apart than they are in actuality. The procedure for each river was as follows:

- Identify all reference points
- Break apart “sections” containing reference points
- Rectify the sections using the affine transformation method for the entire river
- Rectify the sections connecting each reference point using a combination of affine and rubbersheeting transformation methods.
- Clean and append each section back together.

Once this process had been completed for each river, all of Smith’s features had to be appended using the same process used for the individual rivers.