Draft on the Project Proposal v4

Beyond Pattern: Designing and Implementing an Interactive Map Based Visualization for Multi-Attribute Data

Maps are probably the biggest subsection of visualization types. There are many variations on map types, such as Choropleth and pinpoint map. An article from Scribble has reviewed the major types of maps for data visualization[1], and my summary of the current US election visualization[2] also reviews several popular map based visualization. However, no matter what type of map it is, the visualization mainly serves two functions: 1. to encode the individual location based data item onto a geographic map; 2. to help users observe the pattern of the data as a whole[3].

However, both functions focus on display and presentation of the data. Except zooming and panning, few interactions are involved in the map visualization, which stops the users from further exploring the data behind the pattern. This becomes a major drawback for map vis when it comes to data with multiple attributes.

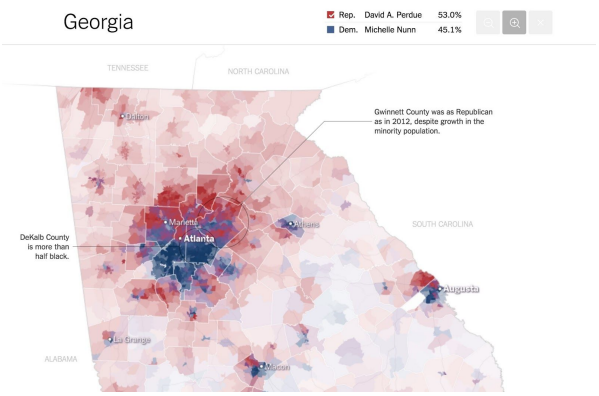

Fig. 1. NYT visualization of midterm election

Fig. 2. Visualization of NYC taxi pick up

Normally, to help users identify the pattern, map vis only shows limited attributes of the data. For example, the New York Times' Upshot[4] promises "The Most Detailed Maps You'll See From the Midterm Elections". The voting ratios are encoded in color and gradient, but users can't make sense of the anomalies in the voting patterns, as it does not allow users to interact with it to explore other data attributes, such as race and gender, of the specific county.

Another example is the well known visualization about pickup locations of NYC taxi[5], which visualizes the exact locations of the pickups by millions of dots. Users can easily identify concentration in Manhattan, but the question is what happened after the user identify the

pattern? For example, what if the user want to see the time distribution of the pickups of interest.

To overcome this drawback, most of the vis use passive "interaction" such as storytelling or hard coded text on the map to show additional information about the data, which hinders active interactions and reduces user engagement. That is why I come up with the idea for this research: "**Designing and Implementing an Interactive Map Based InfoVis for Multi-Attribute Data**".

The basic idea is to find out a set of interactive tasks/operations that support exploration with map of multi-attribute data. For example, besides zooming and panning, users may directly manipulate on the visual components on the map. In addition, users should be able to easily transform from the map based vis to another format so as to view another dimension of the data, or compare the data/attributes of interest in a more appropriate presentation. (I make a simple demo to illustrate the idea here:https://youtu.be/SAJZI5V7MuE).

Inspired by Ramik's presentation on his study of scatterplot visualization[6][7], I plan to follow the same pace of his research to achieve the "usefulness", "usability" and "desirability" of the design. Studying the existing map based visualization with of the visualization intent framework[8], a list of "primary interactions" should be identified. Then user testing will be carried out on them to ensure user experience principles such as "guessability", "learnability" and "affordance". One or two sets of data, which are location based with multiple attributes, will be used for the research.

Reference

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6. Ramik Sadana and Stasko, J. Designing and implementing an interactive scatterplot visualization for a tablet computer. Proceeding AVI '14 Proceedings of the 2014 International Working Conference on Advanced Visual Interfaces Pages 265-272

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8. Yi, J.S., Kang, Y., Stasko, J. and Jacko, J. Toward a Deeper Understanding of the Role of Interaction in Information Visualization. IEEE Trans. on Visualization and Computer Graphics. 13, 6 (Nov. 2007), 1224–1231.