Towards an Atlas of Gerrymandering

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Motivation

Recent Supreme Court cases highlight a growing concern that partisan redistricting may be substantively diminishing the voice of American citizens in our democracy. We seek to visualize the effects of gerrymandering on political outcomes. Our visual framework is framed around one central question: does party representation in a given state congressional delegation reflect the voter composition in that state? To answer this question, we develop a web-based mapping system designed to facilitate an informed comparison between vote and seat counts in each state.

We are motivated by Stephanopoulos and McGhee's (2015)'s efforts to devise a metric of gerrymandering that could be fashioned into a workable judicial doctrine. Our objective differs, however, in that we attempt to visualize outcomes of gerrymandering and partisan bias to inform public opinion rather than influence judges. By comparing vote and seat percentages for the major parties in U.S. congressional elections, our project aims to make legible disparities between voter intent and election results and to visually illustrate packing and cracking on a map.

The project aims to provide an unbiased framework for visualizing actual election results in terms that illustrate the influence of partisan redistricting by both parties. Results are entirely data-driven, and narrative elements are intentionally avoided.

Design

Layout

The layout is designed to focus attention on the relationship between voter intent and election results (Fig. 1). To emphasize this comparison, side-by-side maps compare vote proportions (left) with the winning party in each district (right). The left-to-right map layout is designed to reflect the direction of the causal relationship, with votes determining seats.

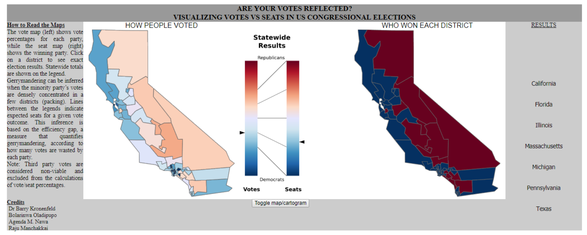

Figure 1: Preliminary website design highlighting votes vs. seats.

Legend

A bivariate color scheme is designed to allow comparable visual perception of statewide totals for both votes and seats. Gerrymandering can be inferred when the seat minority party's votes are densely concentrated in a few districts (packing), while the seat majority's party wins with lower vote concentration (indicative of cracking of the minority party's voters). Side-by-side legends are shown for each state (Fig. 2) with arrows representing each party's vote and seat percentages.

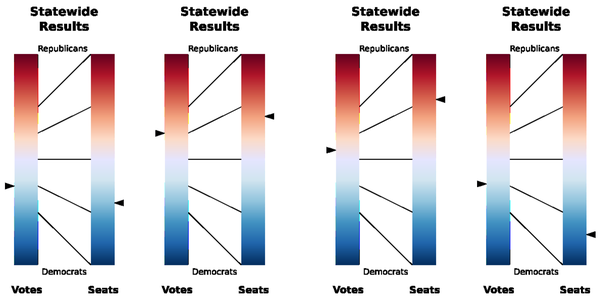

Figure 2: Legends allow visual comparison of votes vs. seats, with connecting lines denoting expectations according to the efficiency gap measure. Left two legends show outcomes where majority party's seats do not exceed expectations; right two legends show outcomes where majority party's seats exceed expectations.

Theory suggests that the party with the vote majority should win an even greater majority of seats, so that equal vote and seat percentages should not be expected. To indicate this visually, lines between legends indicate expected seats for a given vote outcome. These reflects the efficiency gap which is based on the difference in wasted votes by each party. Wasted votes include all votes for the losing party as well as votes for the winning party in excess of 50%. The efficiency gap implies that each 1% of votes in excess of 50% will lead to a 2% advantage in the seat count.

Cartograms

Interpretation of election maps is hampered by the fact that many congressional districts are small in area, despite being approximately equal in population. Discerning the effects of partisan bias in the districting process requires equal perceptual stimulus for each district; otherwise, it will be difficult to visually interpret overall vote and seat totals within a state as well as the packing and cracking decisions that that are used to influence the latter.

To overcome this challenge, we are creating cartograms of the congressional districts in each state (Fig. 3). Each district is the same size on these cartograms, so that proportional color dominance across a state is indicative of vote and seat percentages. For example, the map in Fig. 3 shows that Democrat candidates are favored by the majority in only a small region of the state of Michigan, whereas the cartogram highlights the large support for Democrats in densely-populated Detroit, thus better capturing the nearly equal number of votes for Democrat and Republican candidates statewide. In addition, the larger size of the deep blue districts on the cartogram better communicate the packing of Democrat voters in portions of Detroit, and concomitant cracking throughout the rest of the state.

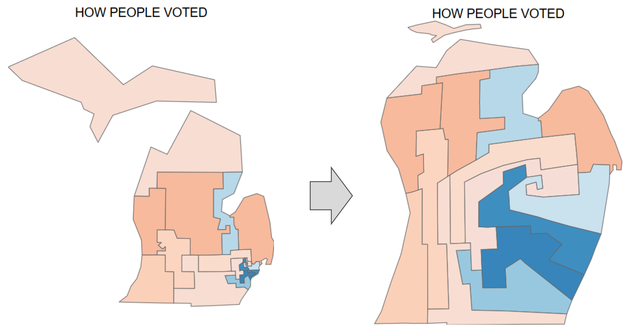

Figure 3: Base map (left) and district cartogram (right) showing vote percentages by party in Michigan congressional districts in 2016.

View the working atlas at:

https://pen.eiu.edu/~boladipupo/Gerrymandering.html

Implementation

We have begun implementing our conceptual framework with an online atlas of results of the 2016 U.S. Congress elections. The data was primarily collected from the website of the Federal Election Commission of the United States, which publishes a compilation of official, certified federal election results every two years. We have also referred to MIT election data + science lab, which is a clearinghouse for data sets that can fuel studies on elections and how they are conducted.

Legends were created using InkScape, with a color scheme adapted from Color Brewer 2.0 (Harrower and Brewer 2003). Cartograms were designed in Cartogram Studio, a visual environment for manual cartogram construction (Kronenfeld . Emphasis was placed on reducing unnecessary detail, capturing only the essential visual landmarks necessary to recognize a state's boundary. Animated transitions between map and cartogram were accomplished using the D3.js javascript library. The current prototype of the atlas can be found here:

Discussion

At present, due to time limitations the atlas includes only a few states selected for their large population and relevance to recent gerrymandering cases. The greatest obstacle is the construction of high-quality cartograms that will engage the public. We are working on an improved workflow to speed up the cartogram design process. Other aspects of the protocol are well developed and easily extensible.

One limitation of our current procedure is that only percentages of Democrate and Republican votes are included in calculations. The issue of determining partisan bias is complicated by the existence of third party candidates, elections with only one candidate on the ballot, and differences in voter turnout between districts. Future work will investigate statistical models to estimate the number of disenfranchised voters that are not accounted for in simple rep/dem vote percentages.

References

Nicholas O. Stephanopoulos & Eric M. McGhee (2015). Partisan Gerrymandering and the Efficiency Gap, The University of Chicago Law Review, 82, 831-900.

Mark Harrower & Cynthia A. Brewer (2003). ColorBrewer.org: An Online Tool for Selecting Colour Schemes for Maps, The Cartographic Journal, 40:1, 27-37, DOI: 10.1179/000870403235002042

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