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The practice of gerrymandering has long cast a shadow over electoral politics in the United States. The US Constitution relegates the power to draw the boundaries of the districts for the House of Representatives to the states, and in most cases – 42, to be precise – this falls primarily to the state legislator. With the ability to shift geographical lines between their state's federal congressional districts, these legislators have enormous power to entrench their party's political base, diminish their opposition, and disenfranchise minority votes.

Visually identifying extreme cases of gerrymandering is not difficult. Most casual observers could look at a map and quickly identify North Carolina's 12<sup>th</sup> or Illinois's 4<sup>th</sup> congressional district as long, narrow, meandering attempts to influence demographic representation. Indeed, both are cases of packing ethnic minorities into districts where they wield the majority, thereby diminishing their influence in other districts. This tactic, often referred to as *packing*, is often complemented by *cracking*, where an ethnic or partisan minority is spread among all of the congressional districts, guaranteeing victories for the majority in every district, but also maintaining a thin margin of victory that puts those seats at risk with smaller changes in voter behavior. A quick example:

Party A holds a 55% majority across a state apportioned 5 districts. Party B holds 45% of the vote. Party A can divide the districts uniformly so they win all five seats by a ten-point margin. This guarantees them all of the seats, but puts each of the congressional representatives in somewhat competitive seats. Alternatively, they can pack as many Party B voters into one congressional district, guaranteeing party B one safe, non-competitive seat and Party A the other 4. Both outcomes are less equitable than a system of guaranteed proportional representation, where the minority party would hold 2 of the 5 seats.

Despite the influence gerrymandering has had on the political system, there are few measures that accurately capture the extent to which it diminishes partisan competition and representation of particular demographics. Common methods of measuring gerrymandering use a district's geometric compactness as a proxy. A brief overview of how these methods measure the irregularity of a district:

*Polsby-Popper Method:* The ratio of the district's area to the area of a circle with the same perimeter. A district can range from 0 to 1, with higher values indicating less compactness and greater gerrymandering.

*Reock Test:* Similar to the Polsby-Popper method, the Reock test measures compactness by the ratio of a district area to the area of the smallest circle that can completely enclose the district geometrically.

*Convex Hull:* Compares the area of a district to the area of the smallest convex polygon that can enclose it.

*Schwartzberg*: Similar to the Polsby-Popper method, the Schwartzberg measure takes the ratio of the perimeter of a district to the area of a circle with the same perimeter.

These methods can be useful indicators of gerrymandering, but each has distinct drawbacks that will be covered in more detail in my final project. The greatest flaw to the general approach of these measures is that they do not serve as indicators of malapportionment across demographics and party lines and therefore cannot be used in courts of law by plaintiffs who attempt to litigate the most egregious cases of gerrymandering. In a *University of Chicago Law Review* Article published in 2014, Nicholas Stephanopoulos & Eric McGhee posit that the Supreme Court's may consider measures of partisan intent in assessing the constitutionality of some gerrymandering. They suggest measuring gerrymandering by calculating the efficiency gap for a given state's congressional districts. The efficiency gap is measured by the difference in each party's wasted votes – those votes in excess of the simple majority in districts they won and all of the votes in districts that they lost. The gap is then measured by the difference in the two parties' wasted votes and divided by the total number of voters. Stephanopoulos provides an example in an article he wrote in the New Republic:

*Suppose, for example, that a state has five districts with 100 voters each, and two parties, Party A and Party B. Suppose also that Party A wins four of the seats 53 to 47, and Party B wins one of them 85 to 15. Then in each of the four seats that Party A wins, it has 2 surplus votes (53 minus the 51 needed to win), and Party B has 47 lost votes. And in the lone district that Party A loses, it has 15 lost votes, and Party B has 34 surplus votes (85 minus the 51 needed to win). In sum, Party A wastes 23 votes and Party B wastes 222 votes. Subtracting one figure from the other and dividing by the 500 votes cast produces an*

The number of misapportioned congressional seats in a state is then simply the product of the efficiency gap and the number of districts. Stephanopoulos and McGhee argue that that courts should then hold states' districting to a maximum of two misapportioned seats.

Deliverables: For my project, I would like to use this concept of the partisan efficiency gap to measure gerrymandering across states and compare it to the the Polsby-Popper and Schwartzberg indexes based on geometric measures. To this end, I hope to provide an interactive map that delivers this data in a visually efficient manner. In addition, I hope to measure the total effect of misapportionment that gerrymandering has in terms of party and demographic representation in Congress.

Article Sources:

[“Here’s how we can end Gerrymandering Once and for All”](#) by Nicholas Stephanopoulos

[“Partisan Gerrymandering and the Efficiency Gap”](#) by Nicholas Stephanopoulos and Erin Mchee