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Drawing Voting Districts and Partisan Gerrymandering: Preparing for 2020
A Statement endorsed by the American Statistical Association and the Council of the American Mathematical Society

January 25, 2018[1]

The act of drawing voting districts is vital to the functioning of American democracy. To comply with societal desires and legal mandates, voting districts must adhere to certain political and geographical requirements—such as geographic compactness, respect for city and county boundaries, and compliance with the Voting Rights Act—as well as one-person-one-vote principles.

Specifying the requirements for districts is a matter of policy and law, and is largely left to the states' discretion. However, once those requirements are set, making voting districts that comport with them is fundamentally a problem in mathematics and statistical science: one quantifies the requirements and ensures the drawn districts have acceptable values. Policymakers and courts decide what constitutes acceptable values.

Policymakers, the press, and American citizens have increasingly challenged the way some voting district plans are created. Recently—and in part due to the 2017 Supreme Court case *Gill v. Whitford*—they are concerned that voting district plans are designed purposefully to unfairly favor partisan outcomes, a practice called partisan gerrymandering. Deciding partisan gerrymandering claims is ultimately a political and legal matter. However, there is widespread agreement that claims of partisan gerrymandering should be based, in part, on quantitative evidence. To help policymakers and the courts marshal and understand such evidence, the mathematics and statistical science communities have developed standards and methods for measuring the fairness of voting district plans.

Because of the fundamental role of mathematical and statistical science in drawing voting district plans, the American Statistical Association (ASA) and American Mathematical Society (AMS), two of the leading associations in the world for statisticians and mathematicians, attest to the following facts:

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[1] *An old (and therefore not approved) version of this statement was posted on January 24.*

FACT 1: Existing requirements for districts generally do not prevent partisan gerrymandering.

In most states, a large number of voting district plans satisfy existing political and legal criteria, such as equal population size and compactness. Typically, some of these plans give one party a large advantage in the number of election seats it is likely to win, while other plans are neutral (i.e., they do not give unfair advantage to any party). These statements are supported by many peer-reviewed papers and scientific reports, including those listed in the references below. We note that some states, for example California, are required by law to create neutral district plans.

FACT 2: It has become easier to design district plans that strongly favor a particular partisan outcome.

Current predictive techniques and computing power, coupled with detailed data on voters, make it possible to predict the likely seat outcomes of proposed districting plans with high confidence. This fact is reflected in the growing use of big data and the increased role of predictive modeling of voting outcomes by election campaigns (e.g., Gelman and King, 1994; Nickerson and Rogers, 2014; Imai and Khanna, 2016). Using these tools, legislators easily can draw district plans that satisfy political and legal criteria, yet also are highly likely to result in one party winning a disproportionate share of the elections relative to the number of people who voted for that party.

FACT 3: Modern mathematical, statistical, and computing methods can be used to identify district plans that give one of the parties an unfair advantage in elections.

The same capabilities that allow legislators to make gerrymandered district plans can be used to identify voting district plans that give one of the parties an unfair advantage. A key step is to specify metrics that illuminate the partisan nature of proposed plans. This can be done using the standard of partisan symmetry (King and Browning, 1987). Conceptually, we ask what would happen to seat allocations (i.e., the number of seats each party wins) for a proposed or actual voting district plan under a wide variety of plausible scenarios for voters' decisions. For example, consider a district plan where Party A would win 17 out of 20 contested seats when 55% of votes are for Party A and 45% are for Party B. The plan is considered fair (symmetric) when Party B also would win 17 out of 20 seats when (e.g., in another election under the same redistricting plan) it gets 55% of the vote. But, the plan is considered unfair (also called asymmetric or biased) when, for example, Party B would win only 10 out of 20 seats when it gets 55% of the vote.

The scientific literature has established multiple measures of the partisan asymmetry in voting district plans (Grofman and King, 2007); the efficiency gap is one example (McGhee and Stephanopoulos, 2015). To compute measures of partisan asymmetry, one approach is to use data from previous elections and statistical modeling to estimate the seat allocations for plausible scenarios. A second approach is to generate a wide range of viable alternative voting district plans, each of which satisfies existing political and legal requirements such as equal population, compactness, etc. One then computes one or more measures of partisan asymmetry for each alternative plan using, for example, voting data from recent elections. A proposed plan is considered to have partisan bias when its values of the fairness measures are highly unusual compared to values for the alternative plans. The references listed below offer additional approaches and metrics. These methods also have been used to determine deviations from partisan symmetry from the plan alone, before the election has been held.

The AMS and ASA do not endorse any one approach or metric for measuring fairness of voting district plans. The appropriate measure, or measures, should be determined by policymakers and the courts. We do urge, however, that mathematics and statistical science be employed to evaluate the fairness of district plans. Further, we note that open and transparent research practices have facilitated more robust, reliable, and accepted findings involving mathematics and statistical science. We believe such openness and transparency could benefit the processes for evaluating and drawing voter districts.

Final Remarks

As Americans continue this deeply important conversation about gerrymandering, the AMS and ASA stand ready to offer our collective expertise however it can help American citizens, the courts, and policymakers to strengthen our democracy.

The **American Mathematical Society,** founded in 1888, is a non-profit membership organization that promotes interest and research in mathematics through its publications, meetings, programs, services, advocacy, and outreach activities. The AMS has 28,000 individual and 550 institutional members worldwide. For additional information, please visit the AMS website at www.ams.org. Contact: Office of Government Relations Director Karen Saxe kxs@ams.org

The **American Statistical Association**, founded in 1839, is the world's largest community of statisticians and the oldest professional science society in the United States. Its members serve in industry, government and academia in more than 90 countries, advancing research and promoting sound statistical practice to inform public policy and improve human welfare. For additional information, please visit the ASA website at www.amstat.org. Contact: ASA Director of Science Policy Steve Pierson, pierson@amstat.org.

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