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Chasing Elbridge's Ghost: The Digital Gerrymander

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Gerrymandering has been with us for centuries, but now it's digital and out of control.

Elbridge Gerry's most lasting legacy may be the electoral abuse that bears his name: gerrymandering. A gerrymander is the manipulation of voting district boundaries for partisan effect. Although the term originated with Gerry's bid for the Massachusetts governor's office in the early 1800s to favor his Democratic-Republican party, the tactic it describes dates back at least as far as 1701.[1] Gerry's gerrymander failed to get him reelected, but its potential for manipulating election results was immediately recognized by the electoral-victory-at-any-cost partisans as a boon to oligarchy, and it's been used to great effect ever since.[2,3]

Recently, gerrymandering has been most successfully demonstrated in Republican redistricting efforts in selected states (including Arizona, Florida, Texas, North Carolina, Pennsylvania, New York, and Ohio) after the 2010 census. To illustrate the effect, in 2012, 1.4 million more Americans voted for Democrats than Republicans, and yet the Republicans won 33 more seats in the House of Representatives. As David Daley points out, "This was the first time since 1972 ... and only the second time since World War II that the party with the most votes did not also win the most seats."[2] And the consensus is that it's very likely to stay that way until 2022![3,4]

To some, including a few recent members of the Supreme Court, gerrymandering is politics as usual. But to others, it's a shift further away from our democratic ideals in that it violates the principle of one person, one vote—a proposition recognized by the Court since *Reynolds v. Sims* in 1964 that many of us hold dear. Regardless of political persuasion, all agree that gerrymandering is an effective way to manipulate election outcomes and circumvent the will of the majority. This is relevant to computer science, because computer programs are now available that can either make gerrymandering worse or mitigate against its harmful effects.

In our profession, we might think of gerrymandering as an insidious application of an exact cover algorithm: Given a state S consisting of k subsets (congressional districts), find a cover such that each element (voter) is in exactly 1 subset. Now, if you're a partisan tribalist who never really bought in to the one-person, one-vote business, you'd be tempted to find an exact cover such that your party receives the most seats even though it receives the least votes. That's where computer-based gerrymandering

comes in. There are computer programs that find such covers, and politicians that use them to redistrict to suit their parochial interests. There are also computer programs that can minimize the effects of gerrymandering that for the most part go unused. This column is about these programs and the political environment in which they arise.

THE LAW

Partisan politicians and special interests have always found the gerrymander intoxicating; it reduces the discomfort accompanying free and fair elections that can undo their efforts toward domination. In this regard, gerrymandering shares common cause with Plato's "noble lies" and Martin Heidegger's postmodern definition of truth as "that which makes a people certain, clear, and strong." These positions attempt to thwart the untidy side of democracy where majority rules (also known as "mob rule"). Our republic is in essence an outgrowth of the Founding Fathers' concern with this untidiness. Unfortunately, their preoccupation with the possibility of majority tyranny meant that they ignored other forms of oppression like oligarchy. That is, they addressed tyranny by majority, but not tyranny by minority.

The real question is: whose opinion matters in elections? Universal suffrage was never seriously considered by the Constitution's Framers, and no mention of it is made in the Constitution, therefore, the precise makeup of the electorate is fuzzy. So we're left with this loophole for sundry types of election manipulation, whether through voter disenfranchisement, voter suppression, vote nullification, or vote dilution.[5,6] Of these, the gerrymander is but one special type. The Constitution only insists that states should apportion seats based on the national census, but it's silent on how this should be accomplished. Not surprisingly this loophole translated into selective representation by ethnicity, gender, wealth, property ownership, taxes paid, and so on; this situation remained until 1964 when the Court ruled in *Reynolds* that the equal protection and due process clauses in the Bill of Rights demanded that each vote must be given roughly equal weight.[7] That can't happen when voting districts are dramatically malapportioned. Although *Reynolds* introduced the concept of one person, one vote into law, it did little to prevent gerrymandering because it failed to take into account the fact that American politicians are allowed to choose their electorate. As *Miami Herald* columnist Fred Grimm poignantly remarked, "[politicians] can't be trusted to put the public interests over their own job security" (www.miamiherald.com/news/local/news-columns-blogs/fred-grimm/article1978425.html). We'll return to this observation in the conclusion of this column.

The Supreme Court determined in *Davis v. Bandemer* (1986) that partisan gerrymandering was justiciable, but remained silent on what standards might be applied by the courts and legislatures. The only guidance the Court provided was the observation that "unconstitutional discrimination occurs only when the electoral system is arranged in a manner that will consistently degrade a voter's or a group of voters' influence on the political process as a whole."

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In 2004, judicial confusion increased when the Court ruled 5–4 to deny claims of gerrymandering in *Vieth v. Jubelirer* on the basis that while such claims aren't in fact justiciable without reasonable standards to determine unconstitutional electoral discrimination in place, it was possible that satisfactory standards might emerge in the future. In fact, it was in this case that four members of the Court sought to overturn *Davis* outright, but they failed to get a majority. However, in *League of United Latin American Citizens v. Perry* (2006), five justices expressed willingness to adopt a gerrymandering standard if a sound one could be found. In particular, they looked positively on the proposed standard of "partisan symmetry" proposed by Bernard Grofman, Gary King, and others.[8,9]

John Mackenzie, as well as Nicholas Stephanopoulos and Eric McGhee, further quantified partisan symmetry by calculating an "efficiency gap"; this measurement determines the efficiency with which votes are translated into seats—inefficient votes don't lead to victory.[10,11] The degree of inefficiency is the ratio of wasted votes to total votes in any election, and a vote is considered wasted when it's: cast for a winning candidate in excess of what was needed to win (accomplished through packing); cast for a losing candidate (cracking); or canceling out minority votes even though electoral outcomes are assured (stacking). In this way a gerrymander is essentially redistricting to force one party to waste more votes than another.[12] Plotting the efficiency gaps for both state and congressional districts from 1972 to 2012, Stephanopoulos and McGhee found that the Republican dominance since 2012 is due to "extreme gerrymandering," with the "highest levels recorded in the modern era."[11]

An update on the nebulous law principle of one person, one vote is in order. In 2016, the Court began to seriously consider judiciable gerrymandering standards in *Evenwel v. Abbott*, but even then the court waffled. *Evenwel* held that states can redistrict based on total population, but it didn't rule out other alternatives

such as voter population or number of citizens for state and local elections. This is an important issue because these elections determine the bias of congressional districts (read: the extent to which they are gerrymandered). However, the very standard that's used for measuring a district's "size" is highly partisan—because Republicans tend to be more successful at improving voter registration and turnout than Democrats (www.scotusblog.com/2016/04/opinion-analysis-leaving-a-constitutional-ideal-still-undefined), apportionment by numbers of registered voters rather than total population will produce a Republican advantage. This is even more critical since the Court overturned Section 4 of the Voting Rights Act of 1965 in *Shelby County v. Holder* (2013) (supreme.justia.com/cases/federal/us/570/12-96/#).

The practice of gerrymandering is widespread, although the effects are in some cases subtle. However, as can be seen in the references mentioned above, social scientists and legal scholars have made considerable progress on measuring whether and to what degree redistricting plans gerrymander. They might not be optimal, but they're reasonable.

ENTER ALGORITHMS

I've set a legal framework for the most significant gerrymander in history: the Republican State Leadership Committee (RSLC)'s REDMAP (Redistricting Majority Project), which was the Republican party's effort to dominate state governments and the House of Representatives in 2010.[3,4,13] Let there be no confusion over this—this was a national gerrymander to avoid as many competitive elections (that is, waste as many non-Republican votes) as possible. It worked. The party that had the most votes for House of Representatives candidates in both 2012 and 2014 lost control.

Because of this gerrymandering, FairVote claims that the majority party (Democrat) would have to win the 2016 national vote by more than 12 percent to earn a one-seat majority (www.fairvote.org/monopoly_politics). FairVote has successfully predicted congressional election outcomes two years prior to the elections for many years.

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What makes this possible? In a word, computers. That is, geographic information system (GIS) tools like Maptitude, Redisticter, iRedistrict, and MapInfo Pro. The tool most often associated with REDMAP is Maptitude (Caliper Corporation); of course, it isn't the tool per se that causes the gerrymandering, but partisan users who seek to subvert the will of the majority. GIS redistricting tools are the nuclear option for geopolitical mapping analysts. As Daley documented in his recent book, the capability exists for designing districts by race, ethnicity, gender, political affiliation, demographics, party registration, voter turnout, previous election behavior, and so forth.[3] This data is primarily, but not exclusively, driven by current census data. By combining and layering such data, answers to "what if?" questions become trivial. Partisan analysts pack, crack, and stack their way to gerrymandered nirvana as they maximize their opponents' wasted votes. In this manner, election outcomes are easily predicted. In 2012 for example, FairVote's Monopoly Politics project predicted 2014 congressional district outcomes with 99.7 percent accuracy—all due to the proliferation of noncompetitive districts in the US. Thus, FairVote concluded, "In the vast majority of cases, the particulars of candidates and campaigns have little impact on the end result. Uncompetitive races mean that outcomes are essentially predetermined, leaving voters without meaningful choices or a compelling reason to go to the polls" (www.fairvote.org/monopoly_politics).

This is how the notoriously distorted districts in Maryland, Pennsylvania, Ohio, New York, Wisconsin, North Carolina, Florida, Michigan, Iowa, Arizona, and Texas came to look the way they do.[3] By aligning the electorate into gerrymandered voting districts, the relationship between votes cast and number of seats taken might be severed for a decade at a time.

So although gerrymandering has been with us since the country's founding, 2010 marked the watershed in vote nullification and dilution by manipulating efficiency gaps with redistricting software. In the hands of partisan political operatives, this software puts an electoral twist on the social sorting that has characterized American life since the Europeans first arrived here.

What can be done? Once again, we look to computers. What's needed is serious software development in two key areas: the ability to recognize the gerrymander, and the ability to redistrict without the gerrymander. As a search of any computer science digital library will confirm, there have been a variety of attempts to automate redistricting over the past 40 years. However, they share a common weakness: they aren't tuned to recognize and prevent computer-based partisan gerrymandering, which only went viral in 2010. This is a new grand challenge for computing professionals (read more about software development in this area in the "Redistricting Research" sidebar).

Although there might be complexity in full automation of redistricting,[14] semi-automated programs should be able to *remove* partisan bias from redistricting because they've been used

REDISTRICTING RESEARCH

Research and development in redistricting tools has been ongoing since 2010. The following projects take interesting approaches in this area.

- Brian Olson's "optimally compact" equal-population system for impartial automatic redistricting. The site illustrates the results for all 50 states (http://bdistricting.com/2010).
- Kevin Baas's Auto-Redistrict program is based on genetic algorithms (http://autoredistrict.org).
- The Center for Range Voting's shortest splitline algorithm geographically splits state populations in halves, fourths, eighths, and so on, until a given number of districts are created (http://rangevoting.org).
- James Case's isoperimetric approach (www.siam.org/pdf/news/1237.pdf).
- Gregory B. Lush, Esteban Gamez, and Vladik Kreinovich's iterative clustering algorithm (www.cs.utep.edu/vladik/2007/tr07-51a.pdf).

for a decade to *inject* partisan bias into it. In addition, various voting systems reduce the impact of gerrymandering such as ranked choice voting with automatic runoffs (fairvote.org/rcv). There's no reason not to attack the gerrymander from two fronts. Although I've no solutions to recommend at this point, my hunch is that most if not all of the proposed solutions are better than what we have. If society will accept that optimal redistricting ensures outcomes consistent with the will of the majority, I'm confident that computer professionals could handle the rest.

There are many ways to characterize an election, from illegitimate or fraudulent at one extreme to transparent, fair, and open at the other. I'm not sure that we'll ever completely achieve the latter, but with modern computer technology we're in a position to move a lot closer by reducing the harmful effects of vote nullification and dilution through gerrymandering. All we lack is the will.

One major problem is that the public doesn't appreciate the extent to which gerrymandering corrupts government. Nor do they completely understand technology's role in the corruption. It doesn't help that journalists and scholars try to pin the problem on elusive algorithms. For example, a recent *InformationWeek* column led with "Why can't a simple formula replace the politically charged gerrymandering that's skewing our election processes?" (www.informationweek.com/government/open-government/wanted-honest-algorithms-for-voter-redistricting/a/d-id/1297859). A simple formula can be found, but this misses the point entirely.

The business of the gerrymander is to prevent competitive elections. The reason it persists is that it serves those in power and the special interests that put them there. In the 2010 Republican gerrymander, it served one party. But in the case of incumbents, it serves all parties. The fact is that those who hold "safe" (read: noncompetitive) seats—despite their public proclamations to the contrary—are willing supporters of gerrymandering, maybe more so than the wannabes. Where might we find one willing to lose a seat to uphold democratic principles? Politicians don't think that way, as Grimm so wisely noted.

Thus, any viable gerrymandering solution must include the proposition that elected officials are forever prevented from determining their own constituents. Further, it must prevent political operatives from manipulating independent redistricting commissions. Although these are admirable goals, realistically, any attempt to remove bias from politics defies experience. Therefore, the low-hanging fruit is to enlist committed computing professionals to the cause.

One straightforward approach is to build an academic consensus for the courts to consider that would spell out what optimal redistricting and gerrymandering identification algorithms might look like. Although current literature reveals a foundation, it doesn't convey any urgency. For that to happen, redistricting algorithms need to be drawn into mainstream computing curriculum and research. One of our grand challenges in computing should be to develop digital technology in support of free, open, and fair elections. It's a concept of global importance and application. Unfortunately, the art and science of digital gerrymandering currently is no more popular in computer science curricula than control fraud is in business schools—both topics appear resilient to rigorous study in the academy, and for much the same reasons.

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