
TECHNOLOGY-ENABLED COIN FLIPS FOR JUDGING PARTISAN GERRYMANDERING

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This session, the Supreme Court heard oral arguments in a set of twin partisan gerrymandering cases, one brought by Democrats, *Rucho v. Common Cause*,¹ and the other by Republicans, *Benisek v. Lamone*.² This was not the first time the Court has considered this issue: partisan gerrymandering has now come before twenty-one Justices of the Supreme Court, without resolution. Over the history of these cases, it has remained uncontroversial that the Elections Clause in Article I, Section 4 of the U.S. Constitution gives states the right, and indeed wide latitude, to prescribe the “times, places and manner” of congressional elections. That includes the drawing of electoral boundaries. At the same time, the power of legislatures is not unfettered. And, it is the role of the Supreme Court to guard against unconstitutional legislative acts.

Akin to every other legal issue that comes before the Court, reconciling the state’s discretion and the Supreme Court’s role in judicial review requires a *judicially manageable standard* that allows the Court to determine when a legislature has overstepped its bounds. Without a judicially discoverable and manageable standard, the Court is unable to develop clear and coherent principles to form its judgments, and challenges to partisan gerrymandering would thus be non-justiciable.

In the partisan gerrymandering context, such a standard needs to discern between garden-variety and excessive use of partisanship. The Court has

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1. Transcript of Oral Argument, *Rucho v. Common Cause*, No.18-442 (U.S. Mar. 26, 2019).
2. Transcript of Oral Argument, *Benisek v. Lamone*, No. 17-333 (U.S. Mar. 28, 2019).

stated that partisanship may be used in redistricting, but it may not be used “excessively.” In *Vieth v. Jubelirer*, Justice Scalia clarified, “Justice Stevens says we ‘er[r] in assuming that politics is ‘an ordinary and lawful motive’ in districting,’ but all he brings forward to contest that is the argument that an *excessive* injection of politics is *unlawful*. So it is, and so does our opinion assume.”³ Justice Souter, in a dissent joined by Justice Ginsburg, expressed a similar idea: courts must intervene, he says, when “partisan competition has reached an *extremity* of unfairness.”⁴

At oral argument in *Rucho*, attorney Emmet Bondurant argued that “[t]his case involves the most extreme partisan gerrymander to rig congressional elections that has been presented to this Court since the one-person/one-vote case.”⁵ Justice Kavanaugh replied, “when you use the word ‘extreme,’ that implies a baseline. Extreme compared to what?”⁶

Herein lies the issue that the Court has been grappling with in partisan gerrymandering claims. What is the proper baseline against which to judge whether partisanship has been used excessively? And how can this baseline be incorporated into a judicially manageable standard?

I. THE PROMISE OF TECHNOLOGY

Fifteen years ago in *Vieth*, Justice Kennedy wrote the following:

Technology is both a threat and a promise. On the one hand, if courts refuse to entertain any claims of partisan gerrymandering, the temptation to use partisan favoritism in districting in an unconstitutional manner will grow. On the other hand, these new technologies may produce new methods of analysis that make more evident the precise nature of the burdens gerrymanders impose on the representational rights of voters and parties.⁷

Indeed, more sophisticated technology has fueled the threat of gerrymandering. With the aid of computers and advanced software, map drawers now have the ability to adhere tightly and meticulously to legal districting practices while simultaneously and surreptitiously entrenching power. Moreover, computing power and software sophistication are only improving over time—a fact certainly not lost on Justice Kagan, who last year wrote in *Gill v. Whitford*, “[t]he 2010 redistricting cycle produced some of the worst partisan gerrymanders on record. The technology will only get

3. *Vieth v. Jubelirer*, 541 U.S. 267, 293 (2004) (alteration and emphasis in original) (internal quotation marks omitted).

4. *Id.* at 344 (Souter, J., dissenting).

5. Transcript of Oral Argument, *supra* note 1, at 38.

6. *Id.*

7. *Vieth*, 541 U.S. at 312–13 (Kennedy, J., concurring).

better, so the 2020 cycle will only get worse.”⁸

In short, the threat of technology for gerrymandering is real and looms more ominously daily. However, it appears that the Justices are now seeing a possible glimmer of hope: the day of technology’s promise to help identify and curb gerrymandering may have arrived, or is, at least, *arriving*.

The Court now appears to accept the idea that in addition to aiding nefarious intent, computers may also help detect such intent in litigation through generating large numbers of maps that embody only the neutral districting criteria. When humans are drawing maps, it is difficult to enumerate all of the criteria that are considered for a particular map. However, with a computer, the criteria are well-specified and known. One must explicitly choose which criteria to include and which to exclude. At oral argument in *Rucho*, Justice Alito acknowledged as much:

If you make a list of the so-called neutral criteria—compactness, contiguity, protecting incumbents, if that’s really neutral, respecting certain natural features of the geography—and you have a computer program that includes all of those and weights them all . . . at the end, what you get is a large number of maps that satisfy all those criteria. And I think that’s realistic. That’s what you will get.⁹

The Court also seems to accept that one could use such a set of maps as some sort of “baseline.” Justice Kagan stated that “[t]he *benchmark* is the natural political geography of the state plus all the districting criteria, except for partisanship.”¹⁰

II. THE BARRIERS TO CONNECTING TECHNOLOGY WITH THE LAW

While the Court appears to be in agreement that a baseline of non-partisan maps can be created, it struggles with a way to incorporate this baseline into a judicially manageable standard that allows us to identify a partisan gerrymander. For the Justices, there is not yet a satisfactory connection between the baseline that they believe the technology can now create and the requirements of the Court for a judicially manageable standard.

There appear to be two main barriers. The first is what they see as a connection to *proportional representation* (*PR*). Justice Gorsuch seems particularly suspicious that the baseline of non-partisan maps provides

8. Gill v. Whitford, 138 S. Ct. 1,916, 1941 (2018) (Kagan, J., concurring) (citation omitted).

9. Transcript of Oral Argument, *supra* note 1, at 42.

10. *Id.* at 27 (emphasis added).

nothing more than *a test for proportional representation in disguise*. When he sees the range of partisan outcomes that emerge from the baseline of non-partisan maps, he is not seeing how one can use those maps to identify a partisan gerrymander. He envisions that there must be a “cutoff” where partisanship becomes excessive. But, to identify that point, Gorsuch asks, “aren’t we just back in the business of deciding what degree of tolerance we’re willing to put up with from proportional representation?”¹¹ Justice Alito is similarly perplexed about how one might utilize the baseline set of non-partisan maps:

[I]f you have 24,000 maps that satisfy all of the so-called neutral criteria that you put in your computer program, don’t you need a criterion or criteria for deciding which of the 24,000 maps you’re going to choose? . . . [I]mplicit . . . is the idea, is it not, that you have to choose one that honors proportional representation? You have no other criteria for distinguishing among the 24,000 maps.¹²

While large deviations from PR may raise suspicion and seem intuitively problematic to the public eye, the judiciary is unequivocal that PR is inconsistent with geographically defined single member districts. Hence, this seeming connection to PR is obviously problematic given the long history of the Supreme Court’s emphasis that our system of government is explicitly not one of proportional representation. To be sure, any judicial standard cannot simply require PR or an outcome “close to PR.”

A second issue is that *the Constitution grants wide discretion to the states in devising its electoral maps*. Neither the appellants nor the appellees in North Carolina’s redistricting case disagree. The disagreement, rather, stems from how this wide discretion affects the use and interpretation of the baseline maps.

The challengers argue that “[t]he legislature has wide discretion, as long as it does not attempt to do two things, dictate electoral outcomes, [or] favor or disfavor a class of candidates.”¹³ It is true that the legislature has wide discretion so long as it does not violate the Constitution. However, the challengers did not articulate a standard for how we would know that the legislature is dictating electoral outcomes other than to say that the legislature’s map has a partisan effect that is not one of the common effects in the baseline set of maps. The challengers’ argument, in essence, is that being on the tail of the distribution (i.e., producing an unusually uncommon

11. *Id.* at 43–44.

12. *Id.* at 30–31.

13. *Id.* at 43.

partisan effect) is de facto evidence of the state overstepping its discretionary powers. We have already discussed Justice Gorsuch's objection to this articulation—this characterization of unconstitutional gerrymander is conceptually indistinguishable from a PR standard.

Within the specific facts of the North Carolina case, the challengers also argue that statements made by the legislature show that partisanship was the predominant factor and a “material factor” in creating the map. In particular, David Lewis, a Harnett County Republican and the House redistricting leader at the time, stated that the map was drawn “to give a partisan advantage to ten Republicans and three Democrats because [I do] not believe [it's] possible to draw a map with eleven Republicans and two Democrats.”¹⁴ Chief Justice Roberts did not take issue with the particular facts present in the North Carolina case, but also did not see how they would then translate into a general principle to govern how the baseline set of maps would help identify the degree of partisanship utilized in future partisan gerrymandering cases.

The state of North Carolina, on the other hand, points out that all of the baseline maps are properly conceived of as non-partisan since they were all drawn without partisan information. Accordingly, they say, all of these maps would thus be within the legislature's discretion to enact. The state looks at the large set of baseline North Carolina maps “with partisanship taken out entirely,” and observes that “you get 162 different maps that produce a 10/3 Republican split.”¹⁵ From here, they argue that when the legislature is devising its particular map, it is “about as discretionary a government function as one could imagine.”¹⁶ In other words, the legislature cannot be dictating outcomes when no partisan information is even being utilized. Therefore, the argument goes, all of these declaredly non-partisan maps and thus their partisan effects fall within the legislature's discretion.

The dispute here is about what the tails of the distribution of partisan effects from the baseline set of maps indicate. Do they indicate “dictating outcomes” as the challengers argue or are all of the maps, tail or not, within the legislature's “discretionary powers” as the state argues? More importantly for the Court, how does one distinguish “dictating outcomes” from “discretionary power?”

In short, the Court is not skeptical about whether a baseline of non-partisan maps can be created. It is skeptical about whether it can reconcile a

14. *Common Cause v. Rucho*, 279 F. Supp. 3d 587, 604 (M.D.N.C. 2018).

15. Transcript of Oral Argument, *supra* note 1 at 30.

16. *Id.* at 29.

baseline they believe exists with the wide latitude conferred to the states in the Elections Clause and our system of representation, which is explicitly not proportional representation.

III. A JUDICIALLY MANAGEABLE STANDARD

I argue that when the application of the “new technology” is properly conceived and executed, neither the issue of proportional representation nor our commitment to states’ rights in prescribing the “times, places and manner” of congressional elections remains problematic. In fact, both are part and parcel of a judicially manageable standard.

First, let us establish the relationship of PR with the baseline set of maps. Because partisan information is necessary to determine PR and no partisan information is used in the construction of the baseline maps, we can say, unequivocally, that *PR plays no role in the construction of the baseline set of maps*. Instead, the computer-drawn maps are constrained only by the locations where the particular people in the state reside and the neutral map-drawing criteria.

If partisans are randomly dispersed throughout the state and there are roughly an equal number in each party, PR is, unsurprisingly, a natural outcome. When partisans cluster geographically, this type of political geography undermines PR in the sense that a “natural outcome” would more likely be further from the PR outcome. The size of the discrepancy between PR and the common outcomes in the baseline non-partisan maps depends on the state and the precise pattern of political geography and degree of clustering. Sometimes political geography works strongly against PR. In other cases, the political geography may have only a small impact. This concept appears to be well understood by the Court. In *Vieth*, Justice Scalia wrote the following:

Consider, for example, a legislature that draws district lines with no objectives in mind except compactness and respect for the lines of political subdivisions. Under that system, political groups that tend to cluster (as is the case with Democratic voters in cities) would be systematically affected by what might be called a “natural” packing effect.¹⁷

In other words, if Democrats tend to cluster in cities, rather than being randomly dispersed across the state, then this “political geography” that is created by their tendency toward urban clustering results in Democrats being “packed” into the same districts because the map drawer may be trying to keep cities and counties together—an objective that the Court accepts as

17. *Vieth v. Jubelirer*, 541 U.S. 267, 289–90 (2004) (citation omitted).

neutral and not partisan per se.

In addition, if the partisans are not roughly proportional, PR is less likely to be the outcome. We have long known that if a state's partisans are split, say, 70 percent Republican to 30 percent Democrat, then almost surely, the Republicans will win all of the state's seats unless the Democrats are unusually clustered so that it is possible to place them in a district where they command the majority vote. Here again is an *interactive* effect between political geography and the degree to which PR is even possible—though this time, clustering would work in favor of the minority party.

Indeed, *the reason we simulate maps is to understand how political geography and neutral map-drawing criteria affect the natural partisan outcomes when partisanship information is not present*. The effect of political geography is state-specific since it depends on the particular people in the state, where they reside, and other neutral criteria that may be based on, for example, city and county boundaries. One can think of the simulation process as procedurally fair in the sense that the process has no explicit partisan information guiding it.

The idea behind employing simulations to understand a process, map drawing or otherwise, is not new. The concept of frequentist probabilities and their interpretation has been well-established since at least the end of the nineteenth century.¹⁸ We can gain some intuition about how simulations work in the familiar context of flipping coins. Suppose we want to know what typically happens when you toss a fair coin one hundred times. Maybe in the first round of one hundred tosses, the coin lands on heads fifty-six times. In the second round, the coin lands on heads forty-eight times. We repeat this process a large number of times. These “simulations” help us understand the behavior of a fair coin. After we have properly repeated this process sufficiently many times, we have an accurate gauge of the behavior of a fair coin.

18. For the early development and discussion of these concepts, see generally A. A. CURNAT, EXPOSITION DE LA THÉORIE DES CHANCE ET DES PROBABILITÉS (1843); JOHN VENN, THE LOGIC OF CHANCE: AN ESSAY ON THE FOUNDATIONS AND PROVINCE OF THE THEORY OF PROBABILITY (1888); Robert Leslie Ellis, *On the Foundations of the Theory of Probabilities*, in MATHEMATICAL PROCEEDINGS OF THE CAMBRIDGE PHILOSOPHICAL SOCIETY (B.J. Green et al., eds., 1844).

FIGURE 1. Outcome from a computer simulation with 3 million repetitions of one hundred tosses of a fair coin.

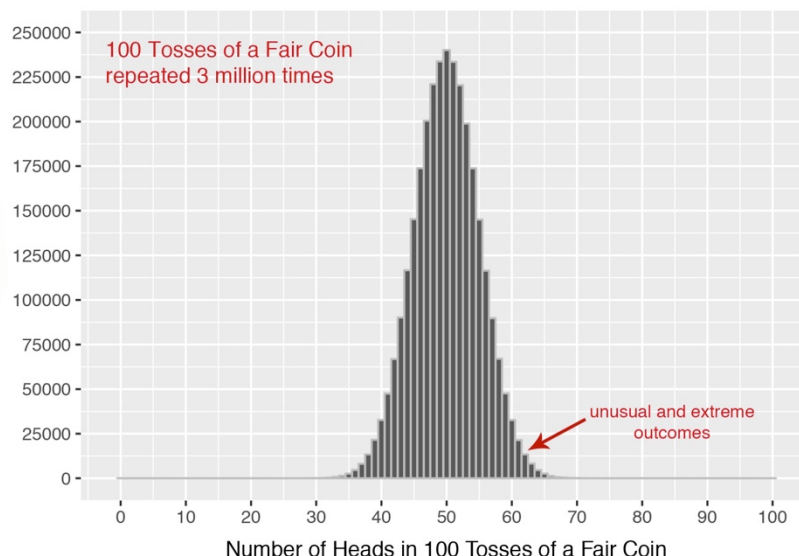


Figure 1 shows the result when a computer simulates one hundred tosses of a fair coin, and repeats the one hundred tosses three million separate times. This process illuminates that the outcome of more than sixty heads occurs less than 2 percent of the time. Indeed, for any outcome or number of heads, we can know how likely that outcome is to occur for a fair coin. To be sure, it is *possible* for a fair coin to land on heads one hundred times in one hundred tosses, but if it did, any sane person would question whether that coin was actually a fair coin. While this outcome is not *impossible*, it is an inordinately improbable outcome. Indeed, in my actual simulation, after the computer has tossed a coin one hundred times for three million repetitions, the event where all of the tosses landed on heads did not occur even once. We can see from the figure that even seventy-five heads would be an “extreme” outcome for an allegedly fair coin. In my actual simulation, seventy-five heads in one hundred tosses did not happen even once in the three million different attempts.

A similar baseline and analysis can inform judgments about maps. Of course, the mechanics of how to draw electoral maps are exceedingly more complex than tossing coins. Indeed, I have spent many years thinking and

researching about how to do this properly,¹⁹ but *the logic is the same*.

To simulate map-drawing, we repeatedly draw maps that adhere to neutral principles like equal population, preservation of cities and counties, and compactness, but do not consider partisan information. Just like for coin tosses, when properly executed, this process creates a *baseline* for understanding what types of outcomes emerge from a map-drawing process that does not involve explicit partisan information.

Of course, as we have discussed, a state is not constrained to consider only neutral map-drawing principles—many decisions go into devising a map, and a state has wide latitude to act in the interest of its people. There are any number of criteria that can be regarded as outside the set of neutral or “traditional districting principles” but still non-partisan. One example might be a claim that Representative Lynn Wachtmann, in the state of Ohio, made in the legislative record,

19. Wendy K. Tam Cho & Simon Rubinstein-Salzedo, *Understanding Significance Tests from a Non-Mixing Markov Chain for Partisan Gerrymandering Claims*, 6 STATS. AND PUB. POL’Y (forthcoming 2019), <https://www.tandfonline.com/doi/full/10.1080/2330443X.2019.1574687>; Wendy K. Tam Cho & Yan Y. Liu, *A Massively Parallel Evolutionary Markov Chain Monte Carlo Algorithm for Sampling Complicated Multimodal State Spaces*, in SC18: THE INTERNATIONAL CONFERENCE FOR HIGH PERFORMANCE COMPUTING, NETWORKING, STORAGE AND ANALYSIS (2018), https://sc18.supercomputing.org/proceedings/tech_poster/poster_files/post173s2-file3.pdf; Bruce E. Cain, Wendy K. Tam Cho, Yan Y. Liu & Emily Zhang, *A Reasonable Bias Approach to Gerrymandering: Using Automated Plan Generation to Evaluate Redistricting Proposals*, 59 WM. & MARY L. REV. 1521 (2018); Wendy K. Tam Cho & Yan Y. Liu, *Sampling from Complicated and Unknown Distributions: Monte Carlo and Markov Chain Monte Carlo Methods for Redistricting*, 506 PHYSICA A 170 (2018); Wendy K. Tam Cho & Yan Y. Liu, *Massively Parallel Evolutionary Computation for Empowering Electoral Reform: Quantifying Gerrymandering via Multi-objective Optimization and Statistical Analysis*, in SC17: THE INTERNATIONAL CONFERENCE FOR HIGH PERFORMANCE COMPUTING, NETWORKING, STORAGE AND ANALYSIS (2017), https://sc17.supercomputing.org/SC17%20Archive/tech_poster/poster_files/post211s2-file3.pdf; Wendy K. Tam Cho, *Measuring Partisan Fairness: How Well Does the Efficiency Gap Guard Against Sophisticated as well as Simple-Minded Modes of Partisan Discrimination?* 166 U. PA. L. REV. ONLINE 17 (2017); Yan Y. Liu, Wendy K. Tam Cho & Shaowen Wang, *PEAR: A Massively Parallel Evolutionary Computation Approach for Political Redistricting Optimization and Analysis*, 30 SWARM AND EVOLUTIONARY COMPUTATION 78 (2016); Wendy K. Tam Cho & Yan Y. Liu, *Toward a Talismanic Redistricting Tool: A Computational Method for Identifying Extreme Redistricting Plans*, 15 ELECTION L.J. 351 (2016); Yan Y. Liu, Wendy K. Tam Cho & Shaowen Wang, *A Scalable Computational Approach to Political Redistricting Optimization*, in PROCEEDINGS OF THE XSEDE 2015 CONFERENCE: SCIENTIFIC ADVANCEMENTS ENABLED BY ENHANCED CYBERINFRASTRUCTURE (2015) <https://dl.acm.org/citation.cfm?doid=2792745.2792751>; Douglas M. King, Sheldon H. Jacobson, Edward C. Sewell & Wendy K. Tam Cho, *Geo-Graphs: An Efficient Model for Enforcing Contiguity and Hole Constraints in Planar Graph Partitioning*, 60 OPERATIONS RES. 1213 (2012).

The community of Delphos is split with Representative Huffman and I, and let me share with you a little bit different story about what could happen with a great county like Lucas County if they care to work on both sides of the aisle. That is, they could gain more power in Washington.²⁰

She is making a claim that the splitting of this county was not done for partisan reasons, but to garner more political power for the people of Ohio. Whether this is true or not, we leave aside at the moment. It could be true, and certainly, when a map is devised, the decisions that determine the boundaries should be done in the interest of the people. In this sense, that the legislature has wide latitude to work in the interest of its people is a feature, not a flaw. Indeed, there are many non-partisan decisions that may lie behind a particular map configuration. Possibly, a representative wants her church or her family's cemetery in her district. Why a representative may want those things might be personal and completely devoid of partisan motivation. These types of decisions all fall within the wide latitude and undisputed discretionary power of the legislature to devise its electoral map.

Note that even completely non-partisan decisions have partisan effects. Every time a boundary is changed, partisans are shifted from one district to another district. This necessarily changes the partisan composition of the districts, and a partisan effect ensues. But, then, if *all* decisions, even non-partisan ones have a partisan effect, how do we know if the admittedly *many* decisions behind a map make it "excessively partisan"? It would be impossible, almost surely, and impractical, at the very least, to try to discover all the reasons and then to determine whether each one was partisan or not.

This realization that many elements influence district boundaries is not lost on the Court. In *Vieth*, Justice Breyer wrote that the desirable or legal criteria "represent a series of compromises of principle—among the virtues of, for example, close representation of voter views, ease of identifying 'government' and 'opposition' parties, and stability in government. They also represent an uneasy truce, sanctioned by tradition, among different parties seeking political advantage."²¹

Partisan effect that arises from the compromise of principles is not problematic. The need for compromise among many factors is a given. It is well established that an important role of the legislature is to bargain and compromise in the pursuit of legislation. The issue is not the compromise of principles, but rather, determining when partisanship has been injected excessively.

20. H. & S. Rep. No 319, pts. 1–2, at 28 (Ohio 2011).

21. *Vieth*, 541 U.S. at 360 (Breyer, J., dissenting).

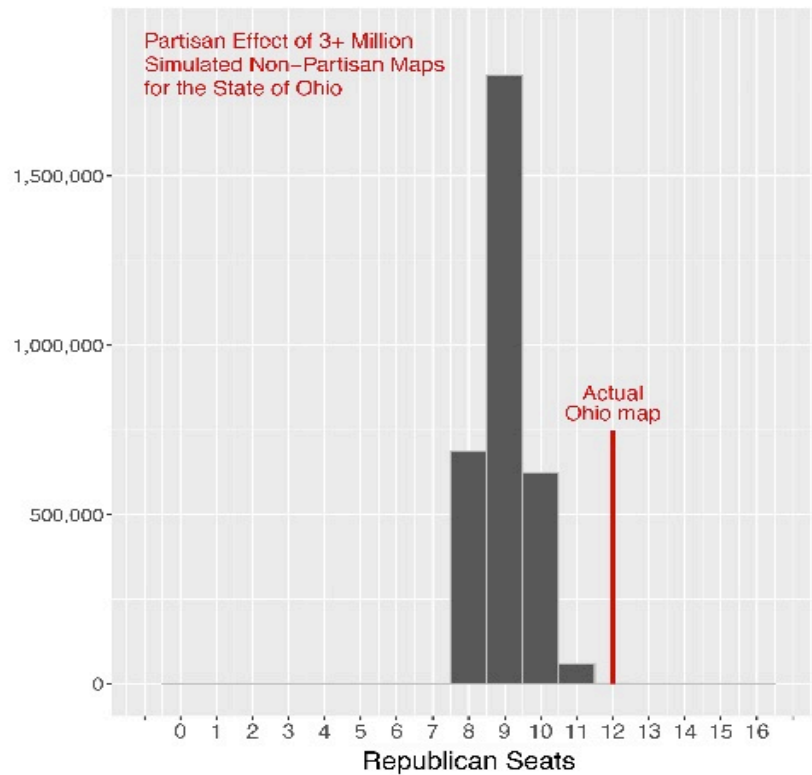
To gain some insight into this conundrum, we can think about how this works with the coin toss simulation. A fair coin lands on heads roughly half the time *because it is not biased toward heads or tails*. Likewise, non-partisan decisions, by definition, are not biased toward one party or the other. Roughly half the time (with the exact probability again depending the political geography of the state), a non-partisan decision will shift partisans in a way that makes a map more Republican. Roughly the other half of the time, it will shift partisans in a way that makes a map more Democratic. To be sure, every shift provides a more favorable effect for one party over the other. However, in the aggregate, for non-partisan decisions, there should be no systematic bias in favor of one party and at the expense of the other party.

Recall that our baseline effect emerges from only neutral criteria (the “traditional districting principles” and the law). It shows what type of partisan outcomes we expect when one employs only the neutral non-partisan map-drawing criteria. If the other motivations behind a map are non-partisan, the unintended partisan effects should wash out, just as over the course of one hundred coin flips, the tallies of heads and tails will be similar. If the partisan effects from these other decisions do not wash out (or if there are many more heads than tails), then we have evidence of partisan motivation (or unfair coins).

The stronger the cumulative partisan effect is in one direction, the greater the evidence of underlying partisan motivations. If a coin lands on heads once, no suspicion is raised. If the second flip also lands on heads, I can say that I am not bothered in the least. But if that coin lands on heads one hundred times in a row, my disbelief is boundless.

If the legislature uses only neutral criteria, then the expected effect is reflected in the baseline set of maps. Of course, the legislature will contemplate, negotiate, and compromise. No one would argue that they should “choose” one of the baseline maps that are restricted to a small set of criteria. This would be inconsistent with the Elections Clause because it would heavily constrain the legislature rather than allowing it wide latitude. Instead, many other criteria will be considered. Importantly, the political effect from non-partisan decisions should wash out if they are truly non-partisan in nature. If one non-partisan decision results in a map that leans more favorably toward the Republicans, I am not suspicious in the least. After all, every decision moves the map in one party’s favor or the other party’s favor. If a second decision moves the map more Republican, I remain unsuspicious. As the decisions pile up and they continually move the map toward the tail of the baseline distribution, my disbelief grows.

FIGURE 2. A baseline distribution for the number of Republican seats in the more than three million congressional electoral maps for the state Ohio that I produced on the Blue Waters supercomputer in my capacity as an expert witness for Ohio's gerrymandering case, *Ohio A. Philip Randolph Institute v. Householder*.



Note: ^a Ohio A. Philip Randolph Inst. v. Householder, No. 18-cv-357, 2019 U.S. Dist. LEXIS 24736, at *40–41 (S.D. Ohio Feb. 15, 2019).

IV. THE STATE OF OHIO

To see how my proposed test would work in an actual redistricting case, we can examine the congressional electoral map for the state of Ohio. I served as an expert witness in the state of Ohio's gerrymandering case, *A. Philip Randolph Inst. v. Householder*.²² Since the 2010 redistricting, each of the congressional races (in 2012, 2014, 2016, and 2018) resulted in twelve

22. Ohio A. Philip Randolph Inst. v. Householder, No. 18-cv-357, 2019 U.S. Dist. LEXIS 24736, at *40–41 (S.D. Ohio Feb. 15, 2019).

Republican seats and four Democratic seats. Figure 2 shows the seat split from more than three million computer-generated maps that I created on the Blue Waters supercomputer for the state of Ohio using only the neutral districting criteria with Ohio's population and its particular political geography. In the figure, we can see that nine Republican seats is the most commonly expected outcome. Eleven Republican seats is not common at all, and twelve seats, which did occur among the more than three million maps, is an outcome that happens so infrequently that while the histogram bar at twelve seats is present, it is sufficiently minuscule that it is not even visible.

Judging from the legislative record in Ohio, the legislature considered population equality, compactness, contiguity, minority representation, and the preservation of cities and counties in the construction of the current Ohio map.²³ My simulated maps do likewise. The legislature also took a number of other unspecified criteria into account. Once all of the legislature's criteria were taken into account, the map they produced resulted in a 12/4 Republican/Democrat seat split for every set of congressional elections run under this map.

While we do not know what each of the individual decisions behind the map were, we do know that every one of their "unspecified criteria" moved the map either toward a more favorable Republican outcome or a more favorable Democratic outcome. How did they end up on the tail of the seat share distribution? It is possible that using *only* the neutral districting criteria, they started at an extreme location. It is *possible*, but as we know, it's extremely unlikely—just like obtaining a highly disproportionate number of heads when tossing a fair coin one hundred times.

One could also argue that many other considerations went into the decision process. Indeed, many other decisions could have and should have entered the calculus. One could also make the claim that these decisions were not partisan. Some appear to be benign requests like splitting a military base across several districts. Other decisions may have involved an explicit attempt to protect constituents' interests, aimed at better representation for the people of Ohio. Each of these decisions, partisan or not, changed the partisan effect of the map. But the non-partisan decisions should have no systematic bias toward the Republicans or the Democrats. Their collective partisan effect should wash out in the aggregate. On the other hand, partisan decisions surely are intended to have a specific partisan effect and move the map in the intended direction.

23. See Wendy K. Tam Cho, Expert Witness Testimony filed in *Ohio A. Philip Randolph Inst. v. Householder*, No. 18-cv-357, 2019 U.S. Dist. LEXIS 24736, at *40–41 (S.D. Ohio), Oct. 5, 2018.

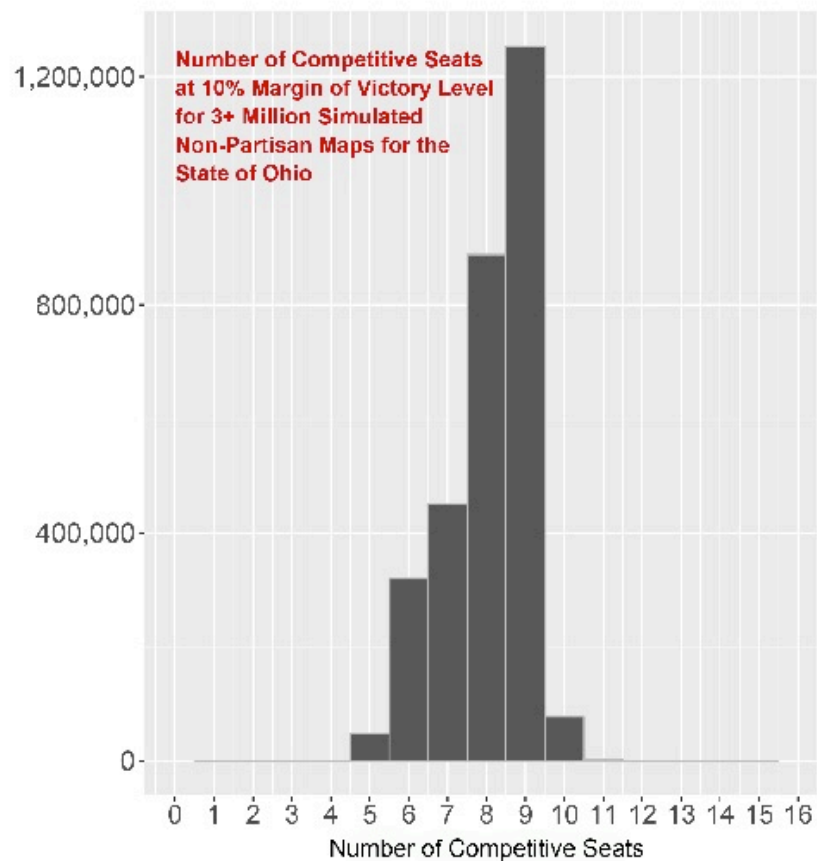
What we observe is a map that is all the way on the right end of the distribution of partisan effect. That means we either began on the tail, which is extremely unlikely, or we started in a more likely spot and then the subsequent decisions moved that partisan effect to that end of the distribution. If the subsequent decisions moved that map so far in one direction, it is like the coin that keeps landing on heads. If the first “decision” makes the map more Republican leaning, that is not bothersome since it has to have some partisan effect. If the second “decision” moves the map in the Republican direction again, that is also not so unusual. If the entire set of decisions move the partisan effect all the way to the end of the distribution, we have strong evidence that an increasingly small set of those decisions were actually non-partisan.

Importantly, note that there are different types of partisan unfairness. An electoral map can be unfair if partisanship is used excessively so that one party’s seat share or electoral outcomes are affected. This might be observed, as we have just seen, by how many seats favor one party over the other. However, this is not the only way in which a legislature may use partisan information to usurp power from the voters. Another option is to create districts that are not competitive. When districts are not competitive, the outcome is essentially pre-determined such that the voters are effectively disenfranchised because while they are still able to cast a ballot, their ability to influence elections has been non-trivially compromised.

In my capacity as an expert witness for the Ohio gerrymandering case, I produced not just the baseline distribution shown in Figure 2, but also the one shown in Figure 3. Here, I examined how many of Ohio’s congressional districts were competitive. I defined “competitive” as resulting in an outcome that was “within a 10% margin of victory” (i.e., the winning party received no more than 55 percent of the two-party vote and the losing party received at least 45 percent of the two-party vote). Recall that I have already generated more than three million baseline maps. To be sure, when we have a set of baseline maps, there are many facets of these maps that can be examined. We are not restricted to seat shares or even the number of competitive seats. Indeed, this set of baseline maps has depth and richness on many dimensions, allowing us to explore numerous and varied facets of an electoral map. When I examined the competitiveness of Ohio’s congressional seats, I found that, commonly, half of the districts in the simulated maps were competitive. In contrast, in the current Ohio congressional map, all of the districts are quite non-competitive. So, in addition to producing a highly unusual seat split, the maps also resulted in a highly unusual lack of competitive seats. To be highly unusual on *two*

partisan measures, as you can easily intuit, is even *more suspect* than if the current Ohio map was unusual in only one way. Maybe the first time you toss a coin one hundred times, the coin lands on heads an unusually large number of times. Unusual events like this do happen. If you toss that coin one hundred times again and a *second* unusual outcome occurs, the strength of the evidence is undeniably stacking up against that coin being fair.

FIGURE 3. A baseline distribution for the number of competitive seats in the more than 3 million congressional electoral maps for the state Ohio that I produced on the Blue Waters supercomputer in my capacity as an expert witness for Ohio's gerrymandering case, *APRI v. Householder*.



Surely a map can be unusual on only one dimension. For instance, in North Carolina, if the map resulted in a 7/6 seat split, just because this outcome is “close to PR” does not exonerate it from other possible

gerrymandering claims. We see clearly here that the baseline set of maps is not about some assessment of PR. Rather, they are far richer, allowing us to scrutinize many facets of partisan unfairness. If that map is 7/6 but sufficiently uncompetitive so that the voters have very little ability to change the outcome, then that map “dictates outcomes” and can be regarded as unconstitutional in that way. What makes a map unfair is not a deviation from any sense of proportional representation. What makes it unfair is the evidence that excessive partisanship was utilized.

V. RIGOROUS IDENTIFICATION OF PARTISAN GERRYMANDERING IS POSSIBLE

When subject to litigation, a state is free to protest that its legislature’s map has been improperly identified as “excessively partisan.” That state can also present exculpatory evidence. Clearly, a map drawn free of partisanship *can* have an extreme partisan effect that emanates from neutral considerations. A fair coin also *can* land on heads one hundred times, but this outcome invites incredulity. Simulations are never able to tell us definitively that a coin is not fair or that the decisions behind a map are excessively partisan with certainty. In both cases, the simulations provide evidence and give us a sense of the strength of that evidence. The greater the number of heads over tails, the greater the evidence against a fair coin. The further the partisan effect moves from the baseline maps, the greater the evidence that partisanship was used excessively.

Sometimes, one has a smoking gun. Perhaps a suspect was caught, covered in blood, standing over the victim, holding the murder weapon at the crime scene. In the case of North Carolina, one may or may not regard Representative David Lewis’s comments about purposefully drawing a 10/3 map as this type of evidence. Barring such evidence, we still have a way to develop solid, probative, and dispositive evidence through the baseline set of maps.

The ability to create a baseline set of maps, combined with a proper and theoretically sound interpretation allows us to honor the Elections Clause that provides wide latitude to the states to prescribe the times, places, and manner of its elections, support our system of geographically based single member districts, be divorced from notions of proportional representation, and maintain the Court’s oversight of the legislature by providing a judicially manageable standard that assesses whether legislative decisions are excessively partisan.

The cutoff for what qualifies as “excessive” is a legal judgment call—

the bread and butter of the Supreme Court's constitutional jurisprudence. The exact cutoff may not be clear, but the Court is the institution charged with making that judgment. What is clear is that there is a way to measure excessiveness that is consistent with the Constitution's regard for states' rights and the legislature's mandate to legislate for the people. This measure is not related to proportional representation, and it serves as the basis for a judicially manageable standard.

Whether the Court analyzes partisan gerrymandering as a matter of First Amendment viewpoint discrimination, as a matter of vote dilution under the Equal Protection Clause, or as an abuse of the power delegated to states under the Elections Clause, recent technological developments now enable the Court to put judicially manageable limits on the excessive use of partisanship in designing election districts. Technology has surely fueled the threat and growth of gerrymandering by providing a tool for the partisan majority of a state legislature to draw self-serving electoral boundaries, but it also now fulfills its promise by providing the basis for a judicially manageable standard to help judge whether electoral maps are excessively partisan.