

THE PROMISE OF COMPUTATIONAL REDISTRICTING: A PRACTICAL GUIDE TO UN-GERRYMANDERING

*Jessica Ring Amunson, Amariah Becker, Dara Gold,
Sam Hirsch, and Arjun Ramamurti**

The post-2020 redistricting cycle was likely the last one in which political mapmakers drew electoral maps manually, one district at a time. After the 2030 Census, mapmakers may rely instead on the emerging science of computational redistricting, using algorithms to generate and evaluate statewide maps that attempt to optimize compliance with multiple redistricting criteria simultaneously. This new approach permits mapmakers to sift through billions of high-performing alternatives in search of the best available options—far outstripping what any previous mapmaker could do by hand.

This Article aims to identify the strengths and limits of computational redistricting. It does so with an eye to both theory and practice. The Article first outlines the basic theoretical parameters of a computational approach. Then, drawing on the coauthors' experience as counsel and consulting experts in the recent litigation challenging Wisconsin's state-legislative maps, the Article describes how a particular version of a computational approach was used to address Wisconsin's extreme partisan gerrymandering. In so doing, the Article offers practical guidance to future litigators and mapmakers who will face similar challenges across the United States in the post-2030 redistricting cycle.

* Amunson, Hirsch, and Ramamurti are attorneys in the Washington, D.C., office of Jenner & Block LLP, and Becker and Gold served as their computational-redistricting expert consultants. The authors thank Micah Altman, Mitch Berman, David Bradford, Nina Chang, Nancy Combs, Daryl DeFord, Anuj Desai, Nick Gladstone, Karin Green, Rick Hasen, Charlotte Hirsch, Steven Hirsch, Sam Issacharoff, Justin Levitt, Sophie Montgomery, Chad Oldfather, Spencer Overton, Todd Proebsting, Alec Ramsay, Paul Smith, Nick Stephanopoulos, John Stephens, Kayla Swan, Adam Unikowsky, Rob Yablon, Emily Zhang, and Sarah Zylstra for helpful comments and conversations.

This Article is dedicated to the memory of J. Gerald Hebert (1949–2023), who taught countless attorneys and expert witnesses how to fight for voting rights, fair districting, and democracy. Without Gerry's leadership and inspiration, the Wisconsin Legislature might still be severely gerrymandered today.

The Article concludes that computational redistricting has significant advantages over prior approaches because it meaningfully advances mapmakers’ ability to balance the various redistricting criteria set forth in federal and state law. Moreover, the improved quality of maps that a court may adopt to correct a constitutional violation may drive political actors to reach their own settlements—as occurred in Wisconsin. As the Wisconsin litigation also reveals, however, computational redistricting cannot produce a singularly “neutral” or “apolitical” map with the push of a button. Computational redistricting still requires numerous judgment calls about how best to construe, measure, and weight the various criteria. More fundamentally, redistricting implicates normative considerations bearing on the relationship between the electors and the elected in a republican form of government. Those issues are not “solvable” by applying increased computational power.

TABLE OF CONTENTS

INTRODUCTION.....	981
I. A FRAMEWORK FOR APPLYING COMPUTATIONAL TECHNIQUES TO DISTRICTING.....	985
A. <i>The Old Way: Drawing Maps by Hand</i>	985
B. <i>The New Way: Computational Redistricting</i>	986
II. WISCONSIN STATE-LEGISLATIVE REDISTRICTING, 2011–2025.....	994
A. <i>Wisconsin Gerrymandered, 2011–2023</i>	994
1. <i>The 2011 Gerrymander</i>	994
2. <i>The 2021–2022 Johnson Litigation</i>	997
B. <i>Wisconsin Un-Gerrymandered, 2023–2025</i>	1001
1. <i>The 2023 Supreme Court Election</i>	1001
2. <i>The 2023 Clarke and Wright Petitions</i>	1002
3. <i>The Clarke Court’s December 2023 Decision</i>	1005
4. <i>The Parties’ 2024 Proposed Remedial Maps</i>	1008
5. <i>The Legislature’s About-Face</i>	1009
III. CREATING THE WRIGHT MAP FOR WISCONSIN	1011
A. <i>The Mapmaking Algorithm’s Constraints:</i> <i>Preserving Non-Negotiable Map Features</i>	1012
1. <i>Nesting</i>	1012
2. <i>Population Equality</i>	1013
3. <i>Bounded by Ward Lines</i>	1014
4. <i>American Indian Tribal Reservations</i>	1017
5. <i>Contiguous Territory</i>	1019
6. <i>Equal Protection and the Voting Rights Act</i>	1021
7. <i>Compactness</i>	1023
B. <i>The Mapmaking Algorithm’s Objectives:</i> <i>Pushing Toward the Pareto Frontier</i>	1025

1. <i>Maximizing Compactness</i>	1025
2. <i>Minimizing County Splits</i>	1026
3. <i>Minimizing Municipal Splits</i>	1027
4. <i>Minimizing Partisan Impact</i>	1027
C. <i>The District-Numbering Algorithm</i>	1039
IV. THE STRENGTHS AND LIMITS OF COMPUTATIONAL REDISTRICTING	1042
A. <i>The Strengths of Computational Redistricting</i>	1042
1. <i>Creating Better Maps</i>	1042
2. <i>Refocusing on the Maps and Their Effects</i>	1045
3. <i>Altering Real-World Incentives</i>	1049
B. <i>The Limits of Computational Redistricting</i>	1050
1. <i>Better Maps—Not Perfect Maps</i>	1050
2. <i>The Inevitability of Human Judgment</i>	1052
3. <i>The Illusion of Neutrality</i>	1056
CONCLUSION.....	1058

INTRODUCTION

Political mapmaking is at an inflection point. For the last several decades, mapmakers across the country have used traditional mapmaking software to manually adjust district boundaries to generate new electoral maps after each decennial census. But that manual approach will soon be overtaken by the new, emerging science of *computational redistricting*: the use of algorithms to generate and evaluate statewide maps that attempt to optimize compliance with multiple redistricting criteria simultaneously. Unlike a manual approach, computational redistricting permits mapmakers to consider billions of maps to identify the best available options.¹ Modern forms of computational redistricting are a technology so powerful that they almost certainly will render their predecessors obsolete—just as newly developed mapping software in the 1980s rendered obsolete the practice of drawing proposed districts with crayons or color markers on large paper maps laid out on conference tables.²

The promise of computational redistricting lies in its ability to address a central difficulty facing mapmakers: redistricting requires balancing multiple criteria set forth in federal and state law. Creating a map that performs well across all redistricting criteria can be difficult to accomplish manually because strong performance on one criterion tends to constrain opportunities to perform well on other

1. See Wright Petitioners’ Brief in Support of the Wright Map at 12, *Clarke v. Wis. Elections Comm’n*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 12, 2024) [hereinafter Jan. 12 Br.].

2. See Micah Altman, Karin MacDonald & Michael McDonald, *From Crayons to Computers: The Evolution of Computer Use in Redistricting*, 23 SOC. SCI. COMPUT. REV. 334, 334–36 (2005).

criteria. Computational redistricting can aid in this effort because it encourages, and sometimes requires, users to think more precisely, more systematically, and more rigorously about both individual districting criteria and the all-important tradeoffs among those criteria.

Thus, computational redistricting can help policymakers achieve the goals and satisfy the requirements of federal and state law more effectively than mapmakers can do by drawing districts one by one. Given these strengths, computational redistricting will likely become central not only for the state legislators and redistricting commissions charged with drawing new districts after each decennial census, but also for state and federal judges in the remedial phase of future redistricting litigation. And as computational techniques become more widely understood and used, members of the public who deploy these techniques may be better able to resist public officials' attempts to adopt unfair maps.

Even so, it is essential that policymakers and judges recognize the limits of what computational redistricting can achieve. Computational redistricting is not a tool for "solving," or even avoiding, the most difficult questions surrounding redistricting. Those questions involve the relationship between the electors and the elected in a republican form of government, implicating delicate questions about political power, electoral outcomes, and representation.³ These issues are not "solvable" by applying increased computational power; rather, they are, and always will be, reserved for human judgment and human deliberation. Computational redistricting may help *clarify* those issues, but it is no more capable of *resolving* them than was the color crayon of the 1960s or the redistricting software of the 1980s.

This Article aims to identify the strengths and limits of computational redistricting—a topic that has received surprisingly little attention in legal scholarship. The Article does so with an eye to both theory and practice. It outlines the basic theoretical parameters of a computational approach and then describes how that approach was used in the context of recent litigation to address the extreme partisan gerrymandering in Wisconsin's state-legislative maps. In that litigation, the coauthors of this Article participated as counsel and consulting experts for the Wright petitioners, one of two sets of parties who filed original actions asking the state supreme court to

3. See *Gaffney v. Cummings*, 412 U.S. 735, 754 (1973) (describing redistricting as "essentially political processes of the sovereign States"); Robert G. Dixon, Jr., *Fair Criteria and Procedures for Establishing Legislative Districts*, in REPRESENTATION AND REDISTRICTING ISSUES 7, 7–8 (Bernard Grofman et al. eds., 1982), *quoted in* *Davis v. Bandemer*, 478 U.S. 109, 129 n.10 (1986) (plurality opinion), *abrogated by* *Rucho v. Common Cause*, 139 S. Ct. 2484 (2019).

“un-gerrymander” Wisconsin.⁴ The Wisconsin litigation is an ideal case study for understanding the new computational approach because it occurred at a moment when the old, manual approach confronted the newer, computational approaches to redistricting. The Wisconsin Supreme Court’s consideration of proposed remedial maps—a process that surprisingly culminated in Wisconsin Republicans enacting Democratic Governor Tony Evers’s proposed map—highlighted the differences between the old and new ways, permitting comparisons to be made about the relative merits and downsides of a computational approach.⁵

Overall, although computational redistricting has much to offer, it cannot do everything. The Wright petitioners’ computational-redistricting approach yielded an excellent map in the Wisconsin litigation. Computing power allowed the Wright team to consider, and select from, many thousands more high-performing maps than any mapmaker could have drawn manually in the limited time available. This meant that the Wright team could more intentionally target the multi-dimensional “Pareto frontier,” where the various mandatory and traditional redistricting criteria are optimized and the tradeoffs among them become clear.⁶

The Wright Map, which used algorithmic techniques to both draw and number districts, appears to have had significant real-world consequences. According to press reports, after seeing how the Wright Map would have immediately and fully undone Wisconsin’s partisan gerrymandering in both the Assembly and the Senate in the 2024 election if Democrats won a majority of the statewide vote, Wisconsin Republicans took the unprecedented step of enacting the Democratic Governor’s proposed map into law instead.⁷ As one Republican Senator explained at the time: “It was a matter of choosing to be stabbed, shot, poisoned or led to the guillotine. We chose to be stabbed, so we can live to fight another day.”⁸

Despite the appeal of viewing computational redistricting as a “neutral” tool to solve redistricting problems, this technology in fact confronts many of the same issues requiring human judgment and

4. See *Clarke v. Wis. Elections Comm’n*, 2023 WI 79, ¶¶ 2, 7, 998 N.W.2d 370, 378, 380.

5. See *id.* ¶ 77, 998 N.W.2d at 401; see also Scott Bauer, *Wisconsin’s Democratic Governor Signs His New Legislative Maps into Law After Republicans Pass Them*, ASSOCIATED PRESS (Feb. 20, 2024), <https://perma.cc/6LFR-U8YD>.

6. See Cory McCartan, *Finding Pareto Efficient Redistricting Plans with Short Bursts*, ARXIV, at 2 (May 27, 2024), <https://perma.cc/6JSE-9KZE>.

7. See, e.g., Patrick Marley, *Wisconsin Republicans Vote to Weaken Their Lock on the Legislature*, WASH. POST (Feb. 13, 2024), <https://www.washingtonpost.com/politics/2024/02/13/wisconsin-legislature-maps-gerrymandering/>; Alice Herman, *Wisconsin Adopts New Legislative Maps, Giving Democrats Chance to Win State*, GUARDIAN (Feb. 19, 2024), <https://perma.cc/SE3U-UHYG>.

8. Bauer, *supra* note 5 (quoting State Sen. Wanggaard).

discretion that arise in the manual-redistricting context. These include, for instance, questions about how best to measure the various districting criteria that a court has identified and how to operationalize prior judicial pronouncements interpreting those criteria. They also include questions about which criteria should be viewed as constraints that must be followed, and which should be viewed (instead, or in addition) as objectives to be optimized. Finally, these issues raise questions about how to balance the unavoidable tradeoffs among criteria. Moreover (and somewhat counterintuitively), computational redistricting also raises *additional* judgment calls as to how best to design the algorithms—questions that do not arise with manual redistricting. Policymakers and courts therefore should not view computational redistricting as a panacea that can produce the single “best” map with the push of a button.

Part I of this Article provides a theoretical account of both manual and computational approaches to redistricting. In particular, it outlines the basic features of the computational approach and provides examples showing how that approach tackles some common redistricting challenges.

Part II then turns to practice, providing an “insider’s view” of the Wisconsin redistricting litigation, to set up the subsequent discussion of how computational redistricting can be applied in real cases. This Part explains how the Wisconsin assembly and senate maps came to be severely gerrymandered and how original actions were brought in the Wisconsin Supreme Court in 2023 to redress those gerrymanders. This Part also describes the court’s decision to strike down both chambers’ maps as unconstitutionally noncontiguous, and the remedial process adopted by the court to address those violations.

Part III explains exactly how the Wright team applied computational redistricting in the remedial stage of the Wisconsin litigation. It identifies the particular districting criteria that the Wright team treated as non-negotiable constraints (nesting, population equality, respect for wards, respect for Indian reservations, contiguity, and equal-protection and Voting Rights Act requirements) and the criteria that the Wright team viewed as objectives (maximizing compactness, minimizing county splits, minimizing municipal splits, and, crucially, minimizing partisan impact). With respect to each criterion, this Part explains the relevant law, what the Wright team did, and how the resulting Wright Map performed relative to the other submissions before the court. Part III also describes an additional, novel use of an algorithm to renumber districts for the State’s staggered senate elections in a manner that would have achieved partisan balance more quickly than any of the other submissions. Overall, by setting forth in concrete terms the Wright team’s methods, this Part provides a reference for future litigators and mapmakers seeking to use a computational-redistricting approach.

Finally, Part IV steps back from the Wisconsin example to derive broader lessons about using computational redistricting in the post-2030 redistricting cycle. This Part seeks to untangle the precise ways in which computational redistricting permits the drawing of better maps, and to caution that many of the intractable issues endemic to redistricting may persist even under a computational approach. Though a computational approach appears to have meaningfully altered the outcome in Wisconsin, this Part ultimately warns against viewing computational redistricting as a perfect solution. There is no avoiding the value-laden choices that mapdrawers inevitably must make in designing electoral districts.

I. A FRAMEWORK FOR APPLYING COMPUTATIONAL TECHNIQUES TO DISTRICTING

A. *The Old Way: Drawing Maps by Hand*

Mapmakers seeking to draw fair maps face a fundamental challenge: the maps they draw must comply with all of a state's mandatory districting criteria, and also should respect additional districting principles that, although not legally mandated, promote sound public-policy goals. For decades, most mapmakers have tackled this problem by drawing districts one at a time.⁹ Although this was once a truly manual task accomplished with crayons and markers on large paper maps, since the 1980s mapmakers generally have used proprietary geographic mapping software programs—and more recently, free, browser-based tools such as Dave's Redistricting and Districtr—that incorporate on-screen line-drawing capabilities, datasets of population for each census block or precinct, and often datasets of precinct-level election returns.¹⁰ Based on these datasets, a mapmaker assigns territory to districts until all districts are drawn and every piece of territory in the state is assigned.¹¹ The mapmaker can check the districts' population deviations, compactness, partisanship, racial demographics, and other factors throughout the drawing process. As the mapmaker shifts or swaps territory between districts, she can check to see how these tweaks affect performance on the various criteria. But all too often, a step forward for one criterion triggers steps backward on other criteria.

9. See Sam Levine, *'From Dark Art to Dark Science': The Evolution of Digital Gerrymandering*, GUARDIAN (Aug. 22, 2021), <https://perma.cc/3DZG-V8E3>.

10. See Altman, MacDonald & McDonald, *supra* note 2, at 334–36, 339–40. This latter method, from the 1980s onward, is the primary point of comparison for the remainder of this Article.

11. See *id.* at 339–40; see also Micah Altman & Michael McDonald, *The Promise and Perils of Computers in Redistricting*, 5 DUKE J. CONST. L. & PUB. POL'Y 69, 78–79 (2010).

B. *The New Way: Computational Redistricting*

The advent of computational redistricting has given mapmakers a powerful alternative. Though the emergent field encompasses a wide range of methods, this Article uses the term to refer specifically to the set of approaches that use computers and algorithms to generate and evaluate maps that attempt to optimally comply with multiple redistricting criteria simultaneously.¹² Furthermore, the focus here is *not* on the use of computational redistricting for ensemble-based outlier analysis, which uses sampling algorithms to generate an ensemble or collection of many statewide maps in the hope that it reflects the universe of potential maps, deploys summary statistics to describe the (sometimes bell-shaped) distribution of the maps in the ensemble, and then compares a specific proposed or enacted map with that distribution to determine whether, for example, the map is a partisan or racial outlier and thus arguably an unlawful gerrymander. Rather, the focus in this Article is on using computational redistricting to search for a small number of maps that perform exceptionally well on multiple districting criteria and thus should be considered for adoption by a court, a redistricting commission, or a public-spirited legislature. While ensemble-based outlier analysis is primarily a tool for evaluating and criticizing an already-drawn map, the type of computational redistricting featured in this Article aims for a more constructive role: creating a statewide map that, if adopted, will promote fair and effective representation for all citizens.¹³

Even with this restriction, countless varieties of computational redistricting still exist.¹⁴ Mathematics literature in recent years has considered a range of theoretical problems arising under these different approaches. These problems include arcane-sounding topics, like whether or how best to combine multiple objectives into a single optimization function,¹⁵ how to deploy genetic algorithms to target

12. An *algorithm* is a set of instructions that a computer follows in problem-solving operations. This Article uses the words *optimal*, *optimize*, and so on in the descriptive sense that mathematicians often use, not in the normative sense.

13. See, e.g., H.R. Res. 55, 2025 Gen. Assemb., Reg. Sess. (Pa. 2025) (directing a study on the feasibility of constraining gerrymandering by using computational redistricting to draw legislative maps).

14. For general background on computational redistricting, see Amariah Becker & Justin Solomon, *Redistricting Algorithms*, in *POLITICAL GEOMETRY: RETHINKING REDISTRICTING IN THE US WITH MATH, LAW, AND EVERYTHING IN BETWEEN* 303–40 (Moon Duchin & Olivia Walch eds., 2022). For a peer-reviewed article applying a sequential heuristic-optimization algorithm somewhat resembling that used by the Wright team, see Amariah Becker et al., *Computational Redistricting and the Voting Rights Act*, 20 *ELECTION L.J.* 407 (2021).

15. See Eric Alfredo Rincón-García et al., *A Multiobjective Algorithm for Redistricting*, 11 *J. APPLIED RSCH. & TECH.* 324 (2013); Federica Ricca & Bruno

Pareto-optimal plans,¹⁶ whether common misconceptions about county splitting hold true in multi-objective optimization,¹⁷ and how to incorporate political-fairness metrics into mixed-integer linear programs.¹⁸

The purpose of this Article is not to attempt to translate that complex literature for a legal audience. Rather, this Article seeks to offer practical guidance as to how computational redistricting actually can be used in a legal setting by focusing principally on the particular computational-redistricting approach taken by the Wright team (named after the team’s lead petitioner in the litigation, University of Wisconsin computer-science professor Steve Wright).¹⁹ The premise behind the Wright team’s approach to computational redistricting is simple: given that “good maps are needles in a haystack of bad or at least worse maps,” redistricting search algorithms can help explore “the astronomical number of ways in which a state can be partitioned” and “identify possible configurations of districts and zero in on the maps that best meet the redistricting criteria,” which results in “sort[ing] through the haystack more efficiently and more systematically so that the needle[s]—the better maps—can be found.”²⁰ Computational-redistricting search algorithms can generate thousands of high-performing statewide

Simeone, *Local Search Algorithms for Political Districting*, 189 EUR. J. OPERATIONAL RSCH. 1409 (2007).

16. See Alejandro Lara-Caballero et al., *Multiobjective Genetic Algorithms for Reinforcing Equal Population in Congressional Districts*, 2019 MATHEMATICAL PROBS. ENG’G 1 (2019).

17. See Austin Buchanan et al., *A Widespread Belief About County Splits in Political Districting Plans Is Wrong*, 24 ELECTION L.J. 1 (2025), <https://www.liebertpub.com/doi/10.1089/elj.2024.0040>.

18. See Rahul Swamy et al., *Multiobjective Optimization for Politically Fair Districting: A Scalable Multilevel Approach*, 71 OPERATIONS RSCH. 536 (2023).

19. See *Clarke v. Wis. Elections Comm’n*, 2023 WI 79, ¶ 2 n.3, 998 N.W.2d 370, 378 n.3.

20. Emily Rong Zhang, *Bolstering Faith with Facts: Supporting Independent Redistricting Commissions with Redistricting Algorithms*, 109 CALIF. L. REV. 987, 1013 (2021) (footnote omitted) (quoting Wendy K. Tam Cho & Bruce E. Cain, *Human-Centered Redistricting Automation in the Age of AI*, 369 SCI. 1179, 1179 (2020)). A state’s “haystack” of all possible districting maps is so “astronomically” large that computers not only lack the power to completely enumerate them today, but likely will never be able to do so, as the problem is computationally intractable. See Brief of Computational Redistricting Experts as Amici Curiae in Support of Appellees and Respondents at 2, 4–6, *Allen v. Milligan*, 143 S. Ct. 1487 (2023) (Nos. 21-1086, 21-1087) [hereinafter *Computational Experts Br.*], cited in *Allen*, 143 S. Ct. at 1514; see also *id.* at 5 (“As the number of districts and the number of building blocks used to construct them increase, the number of distinct districting maps rises exponentially—a phenomenon known as *combinatorial explosion*. This means not only that we lack the computing power to enumerate all plans today, but that computers likely will never be able to do so.”).

maps in the time it might take a mapmaker using traditional redistricting software to manually draw a single district.

The fundamental pieces of the Wright team's search algorithm were constraints and objectives. A *constraint* is binary, like an on/off switch: the algorithm is configured to ignore any map that fails to satisfy a constraint.²¹ The algorithm does not address the *extent* to which a constraint is (or is not) satisfied; it simply differentiates maps that satisfy all constraints from maps that do not (and thus can be ignored).²² By contrast, an *objective* is a trait that the mapmaker finds especially desirable (or undesirable) and therefore seeks to maximize (or minimize).²³ Unlike with a binary constraint, the *extent* to which an objective is realized is all-important. Whether to treat a particular districting criterion as a constraint or as an objective is often a difficult judgment call. But once the mapmaker determines which criteria are constraints and which are objectives, the point of the search algorithm is to find maps that perform best on the objectives, given the constraints that are in place. The search algorithm thus gravitates toward maps that only barely satisfy each constraint, while pushing toward ever-better performance on the objectives.

How does the search algorithm sort through the gargantuan universe of maps that satisfy the constraints that the mapmaker has specified? The basic approach is to allow the algorithm to "see" many new maps to get to ones that satisfy all constraints while performing better on the objectives—a task that requires generating numerous new maps.²⁴ There are many ways to generate redistricting maps computationally, but one common style of map generation (and the one used by the Wright team) is called "Recombination," or ReCom, a procedure used to propose successive modifications to districting maps.²⁵ At each step of the search algorithm, ReCom randomly chooses two adjacent districts, combines them into one double-sized "super-district," and then repartitions the super-district into two new contiguous districts with roughly equal populations.²⁶ Figure A

21. See Lara-Caballero et al., *supra* note 16, at 3.

22. See *id.*

23. See *id.* at 2–3.

24. See Daryl DeFord et al., *Recombination: A Family of Markov Chains for Redistricting*, 3.1 HARV. DATA SCI. REV. 1, 3 (2021), <https://perma.cc/J388-EB7P>.

25. See *id.* at 4; see also, e.g., Becker et al., *supra* note 14, at 418–19 (using ReCom to generate maps with better electoral opportunities for minority voters); Jowei Chen & Nicholas O. Stephanopoulos, *Democracy's Denominator*, 109 CALIF. L. REV. 1019, 1037 & n.95, 1040 & n.113 (2021) (using ReCom to study potential consequences of altering population-equality standards).

26. If the algorithm uses precincts as "building blocks" for legislative districts and tolerates larger population deviations than federal and state law permit, mapmakers may select a map generated by the algorithm and then reduce some of the districts' population deviations by hand.

illustrates an example of ReCom in practice.²⁷ Two districts (green and mustard yellow) are merged into a super-district (dark gray), which is then repartitioned into two new districts (again, green and mustard yellow). This is the only change made to the map in that “step” of the search algorithm, as all other districts are left untouched. But the step is not a tiny one, as it typically reassigns dozens of precincts into the two new districts. “By iterating this transformation hundreds of times per minute, the map soon loses any resemblance to its starting configuration”; so, “[o]ver thousands or millions of iterations, this simple method can undertake far-reaching exploration of the universe of possible plans.”²⁸

FIGURE A²⁹

The Wright team incorporated ReCom into a generalized multi-objective search procedure that can be roughly summarized as follows.³⁰

- Step 1.** Choose the constraints. Each map must comply with all constraints. These might include some degree of population equality, contiguity, the fundamental geographic “building blocks” that can never be divided when creating new districts, etc.
- Step 2.** Choose the objectives. These are map traits that the algorithm attempts to optimize (and metrics to measure each of those traits). They might address the number of

27. The figure shows congressional districts for visual clarity, as they are larger than state-legislative districts.

28. Becker et al., *supra* note 14, at 418.

29. This example illustrates the use of “ReCom” with Wisconsin congressional districts. It starts with eight sample districts (left panel). ReCom randomly selects two adjacent districts and combines them into one double-sized “super-district” (middle panel). The algorithm then re-partitions the super-district into two new contiguous, roughly population-balanced districts (right panel).

30. See Becker et al., *supra* note 14, at 418–19.

county splits, mean (average) district compactness, some measure of partisan fairness, etc.

- Step 3.** Choose an initial “seed” map. Like all maps accepted by the algorithm, the seed map must satisfy all constraints.
- Step 4.** Randomly generate a sequence (or “short burst”) of N maps starting from the seed map, using ReCom to alter districts in each step.³¹ For each map in the sequence, compute the metrics for each objective from Step 2.
- Step 5.** Using the same metrics from Step 2, discard all maps that are “dominated” by, or inferior to, another map. This step requires an understanding of the concept of a Pareto frontier. The Pareto frontier here has as many dimensions as the algorithm has objectives, as defined in Step 2. Tradeoffs among optimal values for the various objectives establish, at least in theory, a Pareto frontier. For any map on this theoretical Pareto frontier, it is impossible to improve on any objective without worsening performance on at least one other objective. Conversely, for any map not on the Pareto frontier, it is possible, at least in theory, to improve on an objective without suffering a setback on any other objective. Any map not on the Pareto frontier is inferior to, and thus “dominated” by, a map on the Pareto frontier. At this step, the algorithm discards any map for which there is another map generated that “beats” it on all the objectives. The remaining maps form an “observed” (or pseudo) frontier that gradually moves closer to the actual Pareto frontier. But it would be infeasible to find the actual Pareto frontier in practice.³²
- Step 6.** Select a map on the observed frontier to serve as the new seed for the next sequence of maps.
- Step 7.** Repeat Steps 4, 5, and 6 until improvements to the observed frontier become negligible and tradeoffs among the

31. See Sarah Cannon et al., *Voting Rights, Markov Chains, and Optimization by Short Bursts*, 25 *METHODOLOGY & COMPUTING APPLIED PROBABILITY* 1, 6–7 (2023) (searching for outliers by using “short bursts,” a sequence of a small number of steps that start from the most extreme map encountered in the previous burst); see also McCartan, *supra* note 6, at 1 (extending the short-bursts single-criterion optimization method to handle the multi-criteria case).

32. See Computational Experts Br., *supra* note 20, at 2 (arguing that enumeration of all possible maps is “computationally intractable”).

objectives become clear. This can take thousands or millions of steps.

Step 8. Select a map on the observed frontier and undertake hand touch-ups to the map to make final adjustments that the algorithm did not identify.

This description makes clear that computational redistricting is not a turnkey operation.³³ Rather, it requires extensive human input to set parameters that guide the search algorithm.³⁴ There are many parameters in this protocol that mapmakers can customize to broaden or narrow their search, target different map features, or otherwise explore a state's vast array of possible maps. For example, the choice of N in Step 4 controls how far the algorithm strays from a seed map before discarding the dominated maps (in Step 5).³⁵ This choice can have significant effects on how many maps the algorithm ends up "seeing."

How to choose a new seed in Step 6 is also subject to design choices. Because multiple criteria are being optimized, should the algorithm choose the map that does the best on one particular criterion or a map that balances performance across several criteria? Should all maps on the observed frontier be equally likely to be picked as the next seed map or should unexplored regions of the frontier be given priority? Though other algorithms could perhaps be designed to assist in answering these questions, at bottom these are all human decisions that can affect the algorithm's progression, in ways that sometimes are not obvious at the outset.

Step 4 is a delicate piece of the search algorithm to design, as it is in some ways the heart of the exploration. Although ReCom makes a new map by changing two adjacent districts, the algorithm does not automatically accept the new map as the base for taking the next step in a sequence.³⁶ Rather, the mapmaker must instruct the algorithm how to decide whether to accept or reject the new map. When a map is rejected, the algorithm uses ReCom to keep proposing new maps until one is accepted. Only accepted maps are added to the sequence.

To explore as freely as possible, the mapmaker might instruct the search algorithm to accept every map proposed, so long as it satisfies the constraints. This would have the benefit of allowing the algorithm to "see" a wide variety of maps but could also suffer from not directing the algorithm toward maps that improve on any (or all) of the objectives. Another approach would be to accept a new map only if it

33. See Becker et al., *supra* note 14, at 415–23.

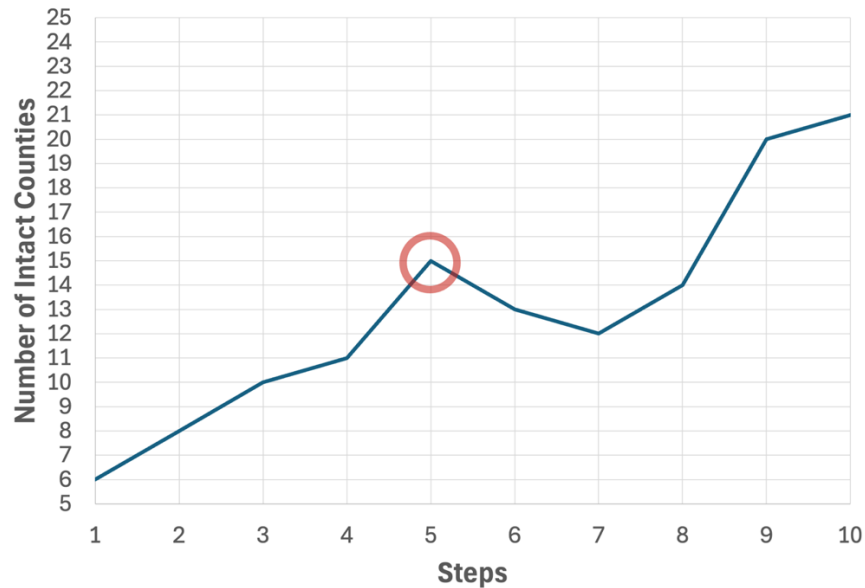
34. See *id.*

35. See Cannon et al., *supra* note 31, at 7.

36. See Becker et al., *supra* note 14, at 418–19.

is deemed “better” than the previous map.³⁷ This would greatly restrict the algorithm but could prevent it from wandering toward poor-performing maps. However, it is often the case that there are maps superior to a current map that can be reached only by stepping “through” worse maps. In other words, the search algorithm might need to accept some poor-performing maps into its sequences so that it can build from them and eventually propose even better maps. See Figure B for an example where the algorithm accepts maps that keep fewer counties intact and thus eventually finds maps that keep far more counties intact.

FIGURE B³⁸



37. Determining what makes a map “better” than another map is yet another human decision. For example, “better” could be defined as, among other things, improving on some combination score that considers all objectives, improving on a single objective, improving on a single objective without a setback on any other objective (i.e., Pareto superiority), or improving on all objectives.

38. This schematic example shows the number of intact counties (i.e., counties not split by district lines) in each map in a sequence, as the algorithm tries to maximize that number. The red circle represents a “local maximum.” At this point, the next step would be a map with fewer intact counties. But if the algorithm accepts the worse map and continues, it eventually can find an even better map, with a larger number of intact counties.

To use an analogy: almost no hikers could summit California’s Mount Whitney, the tallest mountain in the contiguous United States, by walking only uphill. Although the last part of the journey will be uphill, other parts almost certainly will be downhill, regardless of one’s starting point. Walking only uphill would strand the hiker on the highest nearby peak (a “local maximum”) and thus deprive her of any chance to reach, or perhaps even come close to, Mount Whitney’s peak.

In practice, this means the search algorithm should be programmed to accept, with some probability, a map even if it is “worse” than the preceding map. Increasing that probability allows the algorithm to prioritize exploration; decreasing the probability allows the algorithm to prioritize improvement.

Because some parameters—like the search algorithm’s likelihood of accepting a “worse” map into a sequence—act as “dials” (i.e., the impact can be scaled up or down continuously), a mapmaker using this type of computational-redistricting approach confronts seemingly endless design choices. But by experimenting with targeted algorithm runs that explore different parts of the “state space” (the set of all maps that satisfy the constraints³⁹), a mapmaker can focus on specific regions of the observed frontier and get a picture of the true tradeoffs among redistricting objectives.

In that same vein, parameters need not be set in stone. Rather than perform one long optimization run, computational redistricters can perform series of shorter searches. After each iteration, they can identify features to refine and target in subsequent runs. For example, once the algorithm starts identifying maps that meet some threshold for a given metric, subsequent runs could add or tighten constraints related to that metric, to avoid wasting time searching among maps with a worse score on that metric. And if maps with specific undesirable properties are identified, constraints that prohibit those traits can be added to subsequent iterations.

Additionally, the iterative process allows a mapmaker using this type of computational-redistricting approach to alternate between searching for statewide improvements and focusing on specific geographic regions by freezing all districts outside the region. These iterations can enable mapmakers to exercise judgment and discretion in redirecting the algorithmic search to reveal excellent maps.

39. See Duane Q. Nykamp, *State Space Definition*, MATH INSIGHT (2025), <https://perma.cc/TQE8-78FK>.

II. WISCONSIN STATE-LEGISLATIVE REDISTRICTING, 2011–2025

This Part and the following Part together provide a case study of computational redistricting's strengths and limits in the context of specific recent litigation. This Part first provides some historical context for how Wisconsin became so severely gerrymandered in 2011 and again in 2022, as well as a detailed recounting of the 2023 litigation that eventually led to the State's "un-gerrymandering" in 2024 and the seating of a more representative Legislature in 2025.

Wisconsin presents an ideal case study because its electorate is so well balanced, rendering it the paradigmatic "purple" state in which gerrymandering can meaningfully distort electoral outcomes. Indeed, until 2025, Wisconsin's politics—and public policies—were warped by one of the nation's most notorious gerrymandering schemes.⁴⁰ This discussion of Wisconsin's un-gerrymandering provides the necessary backdrop for Part III's summary of how the Wright team used computational redistricting to promote fair and effective representation for all Wisconsinites.

A. *Wisconsin Gerrymandered, 2011–2023*

1. *The 2011 Gerrymander*

For more than a decade, gerrymandering generated a massive mismatch between the partisan composition of Wisconsin's statewide electorate and the partisan composition of the Wisconsin Legislature—what some scholars have labeled a "manufactured majority."⁴¹ Wisconsin's electorate is extraordinarily closely divided. In the last four presidential general elections (2012, 2016, 2020, and 2024), Wisconsin was one of only three states that voted twice for a Democrat and twice for a Republican.⁴² And Wisconsin was the only state where each of the last three presidential elections was decided by less than one percentage point.⁴³ In the U.S. Senate, Wisconsin has had one Senator from each major political party since 2011—longer

40. See generally DAN KAUFMAN, *THE FALL OF WISCONSIN: THE CONSERVATIVE CONQUEST OF A PROGRESSIVE BASTION AND THE FUTURE OF AMERICAN POLITICS* (2018).

41. Miriam Seifter, *Counter-majoritarian Legislatures*, 121 COLUM. L. REV. 1733, 1762–63 & n.205 (2021); see also NICHOLAS O. STEPHANOPOULOS, *ALIGNING ELECTION LAW* xi–xv, 189–90, 361–73 (2024) (citing Wisconsin as the paradigmatic example of a state where popular preferences and governmental outputs are "misaligned").

42. See *United States Presidential Election Results*, DAVE LEIP'S ATLAS OF U.S. PRESIDENTIAL ELECTIONS (2025), <https://perma.cc/9M73-YSS5>. The others are Pennsylvania and Michigan. See *id.*

43. See *id.* Indeed, in this century, Barack Obama is the only presidential candidate to win Wisconsin by more than one percentage point. See *id.*

than any other state.⁴⁴ And for Wisconsin’s state executive offices, such as Governor and Attorney General, votes have been split almost evenly between Democrats and Republicans in recent years.⁴⁵ Of course, none of those statewide offices is subject to gerrymandering.

By contrast, the Wisconsin Legislature was overwhelmingly Republican for more than a decade. Wisconsin’s legislative power is vested in a thirty-three-member Senate and a ninety-nine-member Assembly. Every two years, about half the Senators are elected for staggered four-year terms from senate districts, and all the Representatives are elected for two-year terms from assembly districts that are “nested,” three to one, in senate districts.⁴⁶ Prior to 2011, for nearly half a century, every Wisconsin legislative map had “reliably translated the people’s aggregate statewide voting preferences into legislative majorities,” as no political party had ever “won control of both the Assembly and Senate despite winning only a minority of the total statewide votes.”⁴⁷

During the post-2010 redistricting cycle, however, Wisconsin’s Republican-controlled Legislature passed, and its new Republican Governor Scott Walker signed, one of the most extreme partisan gerrymanders in American history.⁴⁸ The Republican legislative gerrymanders shifted 2.3 million Wisconsin residents—more than 40% of the State’s population—into new districts, to create and then entrench Republican legislative majorities or even supermajorities.⁴⁹

The first two elections following adoption of the Wisconsin Legislature’s 2011 Map illustrate the consequences of this gerrymandering: the two elections were dissimilar in their voting, yet similar in their outcomes. In 2012, “Democrats received 51.4% of the statewide vote” in assembly elections; and in 2014, the tables turned, as Republicans received a similar majority of the statewide vote.⁵⁰ Despite a shift in Wisconsinites’ voting behavior that should have triggered a shift in party control of the Legislature, Republicans carried lopsided majorities of the assembly seats in *both* elections: a

44. See Petition to Commence an Original Action at 35, *Wright v. Wis. Elections Comm’n*, 2023 WI 67, 995 N.W.2d 699 (No. 2023AP1412) (Aug. 4, 2023) [hereinafter *Wright Pet.*].

45. See *id.*

46. See WIS. CONST. art. IV, §§ 1–5; WIS. STAT. §§ 4.001, 4.009 (2023).

47. Non-Party Brief of Amicus Curiae Legal Scholars in Response to Expert Report at 8–9, *Clarke v. Wis. Elections Comm’n*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Feb. 8, 2024).

48. S.B. 148, 2011–2012 Leg., Reg. Sess. (Wis. 2011); see *Whitford v. Gill*, 218 F. Supp. 3d 837, 923 (W.D. Wis. 2016) (three-judge court) (noting Republicans’ “highly successful” efforts “to achieve a substantial, if not maximal, partisan advantage”), *vacated*, 138 S. Ct. 1916 (2018).

49. See Robert Yablon, *Gerrylaundry*, 97 N.Y.U. L. REV. 985, 998 (2022); see also *Baldus v. Members of Wis. Gov’t Accountability Bd.*, 849 F. Supp. 2d 840, 844–46 (E.D. Wis. 2012) (three-judge court) (describing redistricting procedures).

50. *Whitford*, 218 F. Supp. 3d at 853, 901.

60-to-39 Republican advantage in 2012 and a 63-to-36 Republican advantage in 2014.⁵¹

The pattern persisted for the entire decade. “[E]ven in the blue wave of 2018, a whopping 15-point vote swing from two years prior managed to flip just one seat, and Republicans still won 63 of 99 [assembly] seats with only 47 percent of the votes.”⁵² From 2012 through 2020, in both the Assembly and the Senate, Republicans won a majority or supermajority of the seats, while Democrats were consigned to a minority.⁵³ Because the maps contained relatively few competitive districts, the Legislature was not responsive to shifts in public opinion or voters’ partisan preferences.⁵⁴

The 2011 Map therefore was not only severely Republican-favoring, but durably so. Gerrymandering entrenched Republican power to such a degree that “even when Republicans [we]re an electoral minority, their legislative power remain[ed] secure.”⁵⁵ With no practical opportunity to displace the Republican gerrymanderers by defeating them at the polls, Wisconsin voters found themselves “caught up in a legislative strait jacket.”⁵⁶

The straitjacket was loosened briefly when a federal district court in *Whitford v. Gill*⁵⁷ ruled in 2016 that Wisconsin’s 2011 assembly map was so severely gerrymandered that it violated the Federal Constitution.⁵⁸ But the U.S. Supreme Court stayed the judgment,⁵⁹ and then vacated it on the ground that the plaintiffs had failed to demonstrate standing.⁶⁰ The very next Term, in *Rucho v. Common Cause*,⁶¹ a sharply divided U.S. Supreme Court held that partisan-gerrymandering claims present political questions beyond the reach

51. *See id.*

52. Benjamin Plener Cover, *Two-Party Structural Countermandering*, 107 IOWA L. REV. 63, 65 (2021).

53. *See id.*

54. In non-redistricting years from 1974 to 2010, Wisconsin’s assembly seats were more than four times as likely to change hands between the parties as from 2014 to 2020. *See* John Johnson, *Wisconsin State Assembly: Statistics on the Number of Flips, Incumbent Defeats, and Open Seats in Past Elections*, MARQ. UNIV. L. SCH.: FAC. BLOG (June 3, 2024), <https://perma.cc/KEV2-C84W>.

55. *Whitford*, 218 F. Supp. 3d at 901; *see id.* at 896 (concluding that the map was intended “to secure Republican control of the Assembly under any likely future electoral scenario for the remainder of the decade, in other words to entrench the Republican Party in power”).

56. *Baker v. Carr*, 369 U.S. 186, 259 (1962) (Clark, J., concurring).

57. 218 F. Supp. 3d 837 (W.D. Wis. 2016) (three-judge court), *vacated*, 585 U.S. 48 (2018).

58. *See id.* at 843.

59. *See Gill v. Whitford*, 137 S. Ct. 2289 (2017) (mem.).

60. *See Gill v. Whitford*, 138 S. Ct. 1916, 1923, 1926–33 (2018).

61. 139 S. Ct. 2484 (2019).

of the federal courts.⁶² But the *Rucho* Court took pains to explain that it was not “condon[ing] excessive partisan gerrymandering,” that states could “actively address[] the issue,” and specifically, that “state constitutions can provide standards and guidance for state courts to apply.”⁶³

2. *The 2021–2022 Johnson Litigation*

Although Wisconsin Democrats remained locked out of power in the Legislature, they won the governorship in 2018, when Tony Evers defeated Governor Walker, the two-term Republican incumbent.⁶⁴ Three years later, after the U.S. Census Bureau issued updated data from the 2020 Census, the Republican leaders of the Senate and Assembly introduced a new redistricting map for both legislative chambers.⁶⁵ After passing on party-line votes, the Republican map was vetoed by Governor Evers, and the Legislature failed to override his veto.⁶⁶

With the executive and legislative branches deadlocked, voters petitioned the Wisconsin Supreme Court to establish redistricting maps for the 2022 election, asserting that the Legislature’s 2011 Map could no longer be used because the new census data revealed it to be malapportioned in violation of the “one person, one vote” principle.⁶⁷

62. *See id.* at 2493–508; *see also id.* at 2509–25 (Kagan, J., dissenting). While this Article focuses on using computational redistricting to *draw* maps, the *Rucho* case presented one of the first examples of courts relying on computational-redistricting evidence to *evaluate* maps. In that context, too, issues arise with respect to the inevitability of human judgment when programming the algorithm. *See infra* Part IV (discussing those issues); *see also* Allen v. Milligan, 143 S. Ct. 1487, 1512–14 & nn.6–8 (2023) (describing difficulties with relying on competing computer programs to assess districting maps).

63. *Rucho*, 139 S. Ct. at 2507; *see also* Chad M. Oldfather, *Rucho in the States: Districting Cases and the Nature of State Judicial Power*, 1 FORDHAM L. VOTING RTS. & DEMOCRACY F. 111, 115, 123 (2023) (arguing that state-court judges who “must stand for periodic reelection” may be better situated to invalidate extreme partisan gerrymanders because elections provide state judges with “a democratic pedigree their federal counterparts [lack]”).

64. *See* Scott Bauer, *Democrat Tony Evers Defeats Wisconsin Gov. Scott Walker*, ASSOCIATED PRESS (Nov. 7, 2018), <https://apnews.com/gubernatorial-elections-8ba8b7cd0cf14082a11741b74ae752d6>.

65. *See* Associated Press, *Wisconsin Republicans Release Redistricting Plan*, WUWM 89.7 FM (Oct. 21, 2021), <https://perma.cc/QU9F-FDKS>.

66. S.B. 621, 2021–2022 Leg., Reg. Sess. (Wis. 2021); *see* Johnson v. Wis. Elections Comm’n (*Johnson I*), 2021 WI 87, ¶17, 967 N.W.2d 469, 477. Governor Evers issued more vetoes than any governor in Wisconsin history. *See* Scott Bauer, *Wisconsin Republicans’ Large Majorities Expected to Shrink Under New Legislative Maps*, ASSOCIATED PRESS (Jan. 15, 2024), <https://perma.cc/75DD-AR6M>.

67. The “one person, one vote” principle prohibits districts that are too unequal in population, typically based on total resident population as reported in

The court agreed to break the impasse and commenced an original action, *Johnson v. Wisconsin Elections Commission*.⁶⁸ But although the *Johnson* court agreed to take on the task of establishing maps for the 2022 election, the court was bitterly split on what the criteria should be for judicially imposed maps.⁶⁹

Most significantly, four of the seven Justices rejected the argument that judicially imposed redistricting maps must be free of partisan bias.⁷⁰ The *Johnson* majority instead prioritized a “least change” approach, promising to select the proposed remedial map that made the minimum changes necessary to remedy the population imbalances in the 2011 Map, regardless of partisan skew.⁷¹

After the *Johnson* court’s initial judgment, which adopted the new maps,⁷² was summarily reversed by the U.S. Supreme Court for unjustified racial predominance,⁷³ the same four-Justice majority of the Wisconsin Supreme Court adopted the 2022 Map that the Republican-controlled Legislature had earlier passed on party-line votes and the Democratic Governor had vetoed, effectively overriding that veto.⁷⁴ The dissenters argued that the court’s approach “served only to entrench the prior—and blatantly partisan—district maps.”⁷⁵

Applying established metrics to assess partisan fairness, University of Wisconsin law professor Rob Yablon concluded that the *Johnson* court’s newly adopted plans were “by far the most politically skewed state legislative maps adopted by a court anywhere in the country over at least the past three decennial redistricting cycles.”⁷⁶ In the 2022 election, Republicans carried fully two-thirds of the senate seats (twenty-two of thirty-three) and nearly two-thirds of the

the most recent federal decennial census. *See generally* *Evenwel v. Abbott*, 578 U.S. 54, 58–60 (2016).

68. *Johnson v. Wis. Elections Comm’n*, 2022 WI 91, 991 N.W.2d 704 (issued Sept. 22, 2021; amended Sept. 24, 2021).

69. *See Johnson I*, 2021 WI 87, ¶¶ 80–81, 967 N.W.2d at 492–93.

70. *See id.* ¶ 39, 967 N.W.2d at 482.

71. *Id.* ¶ 81, 967 N.W.2d at 493; *see also id.* ¶¶ 64–79, 967 N.W.2d at 488–92.

72. *Johnson v. Wis. Elections Comm’n (Johnson II)*, 2022 WI 14, ¶ 52, 971 N.W.2d 402, 419.

73. *See Wis. Legislature v. Wis. Elections Comm’n*, 142 S. Ct. 1245, 1248–51 (2022) (per curiam) (addressing majority-Black assembly districts in the Milwaukee area).

74. *See Johnson v. Wis. Elections Comm’n (Johnson III)*, 2022 WI 19, ¶¶ 3, 22, 73, 972 N.W.2d 559, 565, 569, 586.

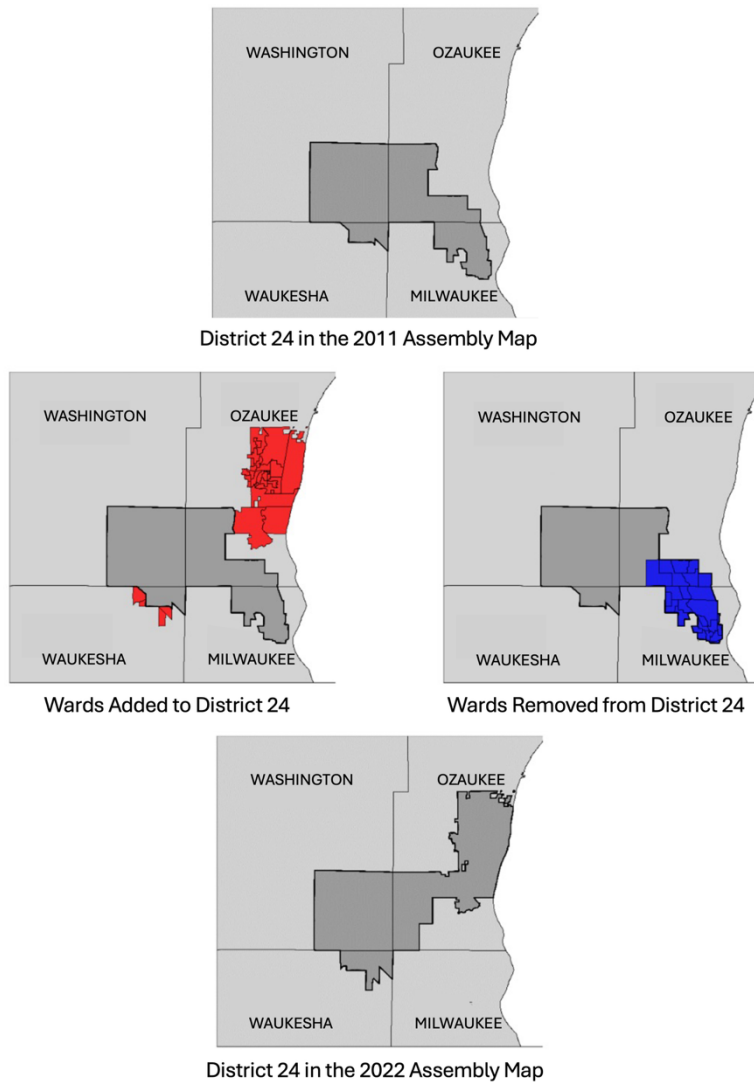
75. *Id.* ¶ 159, 972 N.W.2d at 611 (Karofsky, J., dissenting). For Nick Gladstone’s insightful analysis of *Johnson*, see Recent Case, *Wisconsin Supreme Court Adopts New Election Maps That Change Existing Districts Least, Regardless of Partisan Bias*, 136 HARV. L. REV. 998, 1005 (2023) (explaining how the *Johnson* majority “tilt[ed] the legal playing field against arguments for unwinding a gerrymander and toward arguments for perpetuating it”).

76. Yablon, *supra* note 49, at 998, 1053 n.317.

assembly seats (sixty-four of ninety-nine).⁷⁷ This represented an increase in the partisan skew from the 2011 Map, due not to a pro-Republican shift in Wisconsin's electorate in 2022,⁷⁸ but rather to specific anticompetitive decisions made by the Legislature and adopted by the court. The 2022 Map's revisions to Assembly District 24, shown in Figure C, provide a good example of this type of manipulation.

77. See *Election Results Archive*, WIS. ELECTIONS COMM'N (2025), <https://perma.cc/9HLZ-FPFA>.

78. At the top of the ticket, the Governor and the Attorney General, both of whom are Democrats, got higher percentages of the statewide vote and won by larger margins in 2022 than in 2018. See *id.*

FIGURE C⁷⁹

79. After Republican Representative Dan Knodl's winning margin declined to seven points in 2018 and then to four points in 2020, the Republican-led Wisconsin Legislature added to his assembly district a set of voters who had preferred President Trump over President Biden by a 57%-to-43% margin (shown above in red) and removed from the district a set of voters who had preferred President Biden by a 66%-to-34% margin (shown above in blue). The resulting 21-point net swing in the district's partisanship kept the district in Republican hands. See *Wright Pet.*, *supra* note 44, at 39–42.

These manipulations suppressed electoral competition and fortified the Republicans' stranglehold on the Legislature. Indeed, the maps increased the Republican percentages in eight of the nine assembly districts that had been most closely contested in 2020, and in all four of the senate districts that had been most closely contested in 2018 and 2020.⁸⁰ These manipulated districts were instrumental to building Republican legislative supermajorities in arguably the nation's most politically competitive state. Even in years when their party's public support was relatively weak statewide, Republicans could rely on these gerrymanders to invert popular minorities into governing majorities in the Wisconsin Legislature.

B. Wisconsin Un-Gerrymandered, 2023–2025

1. The 2023 Supreme Court Election

The Legislature's gerrymandering of its own maps in two consecutive decennial redistricting cycles did not go unnoticed by the people of Wisconsin. Along with reproductive rights, the crusade against partisan gerrymandering became one of the two dominant issues in the 2023 election for the Wisconsin Supreme Court seat vacated by the most senior of the court's four conservatives.⁸¹ Wisconsin was seen as a national test for both reproductive rights and fair districting.⁸² Money poured into the campaigns, breaking the record for the most expensive judicial election in American history.⁸³ All told, more than \$50 million was raised and spent, including \$9.9 million that the Democratic Party of Wisconsin donated to the campaign of then-Judge Janet C. Protasiewicz.⁸⁴ The three Justices who had dissented in *Johnson* backed Judge Protasiewicz,⁸⁵ who beat

80. *See id.* at 50.

81. *See* Scott Bauer, *Wisconsin Supreme Court Justices Pick Sides in Race*, ASSOCIATED PRESS (Feb. 7, 2023), <https://perma.cc/259F-W3D9>.

82. *See id.* (“[W]hoever controls the court will be in position to rule on issues ranging from whether the state’s 1849 abortion ban should remain in effect to whether gerrymandered legislative district maps ought to be redrawn.”); *see also* Kaul v. Urmanski, 2025 WI 32, ¶¶ 2, 34, 22 N.W.3d 740, 742, 752 (holding that Wisconsin’s abortion-banning statute was impliedly repealed).

83. *See* Clarke v. Wis. Elections Comm’n, 2023 WI 79, ¶ 102 & n.47, 998 N.W.2d 370, 412 & n.47 (Ziegler, C.J., dissenting) (citing *Wisconsin Supreme Court Race Cost Record \$51M*, WIS. DEMOCRACY CAMPAIGN (July 18, 2023), <https://perma.cc/PU6W-DKV7>).

84. *See* Wright v. Wis. Elections Comm’n, 2023 WI 67, ¶ 26 & n.16, 995 N.W.2d 699, 707 & n.16 (citing *Wisconsin Supreme Court Race Cost Record \$51M*, *supra* note 83).

85. *See* Bauer, *supra* note 81 (describing endorsements by Justices Ann Walsh Bradley and Rebecca Dallet); *see also* Frederica Freyberg, *Jill Karofsky on the 2023 Wisconsin Supreme Court Election*, PBS WIS. (Mar. 31, 2023) (quoting Justice Jill Karofsky defending then-Judge Protasiewicz’s campaign statements), <https://perma.cc/Q3HE-DLS9>.

conservative former Justice Daniel Kelly by more than eleven points in the April 2023 election.⁸⁶

2. *The 2023 Clarke and Wright Petitions*

In August 2023, within days of Justice Protasiewicz taking office, two sets of Wisconsin voters filed petitions for leave to commence original actions in the Wisconsin Supreme Court challenging the 2022 Map under the Wisconsin Constitution.⁸⁷ The Clarke petitioners—former Democratic assembly candidate Rebecca Clarke and eighteen other Wisconsin Democratic voters—filed a five-count petition the day after Justice Protasiewicz’s swearing-in ceremony.⁸⁸

Two days later, another petition was filed by the Wright petitioners: Professor Wright, the chair of the computer-sciences department at the University of Wisconsin–Madison and past chair of the Mathematical Optimization Society, along with a group of Wisconsin’s leading mathematicians, data scientists, and computer scientists (all represented by, among others, three coauthors of this Article from Jenner & Block LLP).⁸⁹ The Wright petitioners advocated drawing fair districts for Wisconsin by deploying computational redistricting, as described in Parts I and III.⁹⁰

All four counts in the Wright petition focused on partisan gerrymandering, alleging that severe distortion of the voters’ will violated multiple state-constitutional provisions, including the Equal

86. See *WEC Canvass Reporting System County by County Report*, WIS. ELECTIONS COMM’N (2025), <https://perma.cc/H9QC-FWAT> (showing election returns).

87. See Zachary D. Clopton & Katherine Shaw, *Public Law Litigation and Electoral Time*, 2023 WIS. L. REV. 1513, 1523–24 & nn.45–46 (2023) (citing the first of the two Wisconsin petitions and explaining why there is nothing “inherently wrong with litigants filing original actions . . . immediately following a change in judicial personnel”).

88. Cf. *Clarke v. Wis. Elections Comm’n*, 2023 WI 70, 995 N.W.2d 779, 782–83 (Ziegler, C.J., dissenting) (asserting that the Clarke petition was “filed only because of a change in the court’s membership”); Jack Kelly, *Liberal Law Firm to Argue Gerrymandering Violates Wisconsin Constitution*, CAP TIMES (Apr. 6, 2023), <https://perma.cc/BHK6-X54P> (two days after Justice Protasiewicz’s election, and nearly four months before her investiture, Clarke petitioners’ counsel announced their plan to challenge the 2022 Map); Steve Schuster, *Lawsuit to Challenge Wisconsin’s Legislative Maps to Be Filed*, WIS. L.J. (Apr. 6, 2023), <https://perma.cc/A5EK-VYNQ> (same).

89. Wright Pet., *supra* note 44, at 4–12.

90. See *supra* Part I; *infra* Part III.

Protection Clause,⁹¹ the Free Speech Clause,⁹² the Right to Assemble and Petition Clause,⁹³ and the Free Government Clause.⁹⁴ The Wright petition thus sought to establish binding precedent that the Wisconsin Constitution prohibits extreme partisan gerrymandering.

The Clarke petition raised three partisan-gerrymandering claims as well, and supplemented them with two unique counts. The first of those two counts challenged the 2022 Map on the ground that dozens of assembly and senate districts violated the Wisconsin Constitution because they did not consist of “contiguous territory.”⁹⁵ The Clarke petition’s other unique count alleged that the *Johnson* court’s adoption of maps that the Governor had vetoed (with no legislative override) violated the Wisconsin Constitution’s separation of powers.⁹⁶

Before the Wisconsin Supreme Court could address the merits of any of these claims, however, the Wisconsin Legislature moved to recuse Justice Protasiewicz from hearing the cases because the Democratic Party of Wisconsin had contributed heavily to her campaign and because she had publicly criticized the gerrymandered 2022 Map adopted by the *Johnson* court.⁹⁷ On the same day the recusal motion was denied,⁹⁸ a four-Justice majority consisting of

91. WIS. CONST. art. I, § 1 (“All people are born equally free and independent, and have certain inherent rights; among these are life, liberty and the pursuit of happiness; to secure these rights, governments are instituted, deriving their just powers from the consent of the governed.”).

92. *Id.* art. I, § 3 (“Every person may freely speak, write and publish his sentiments on all subjects, being responsible for the abuse of that right, and no laws shall be passed to restrain or abridge the liberty of speech or of the press.”).

93. *Id.* art. I, § 4 (“The right of the people peaceably to assemble, to consult for the common good, and to petition the government, or any department thereof, shall never be abridged.”).

94. *Id.* art. I, § 22 (“The blessings of a free government can only be maintained by a firm adherence to justice, moderation, temperance, frugality and virtue, and by frequent recurrence to fundamental principles.”).

95. *Id.* art. IV, § 4 (requiring assembly districts “to consist of contiguous territory”); *id.* art. IV, § 5 (requiring senate “districts of convenient contiguous territory”); see *Clarke v. Wis. Elections Comm’n*, 2023 WI 79, ¶ 7, 998 N.W.2d 370, 380.

96. See *Clarke*, 2023 WI 79, ¶ 7, 998 N.W.2d at 380.

97. See Motion to Recuse Justice Protasiewicz by Proposed Intervenor-Respondent the Wisconsin Legislature at 1–2, *Wright v. Wis. Elections Comm’n*, 2023 WI 67, 995 N.W.2d 699 (No. 2023AP1412) (Aug. 22, 2023).

98. See *Wright v. Wis. Elections Comm’n*, 2023 WI 67, ¶ 93, 995 N.W.2d 699, 720. Both before and after the motion was denied, Assembly Speaker Robin Vos and other Republican legislators repeatedly threatened to impeach Justice Protasiewicz for failing to recuse. See, e.g., Rich Kremer, *Robin Vos: Impeachment of Janet Protasiewicz Still on the Table*, WIS. PUB. RADIO (Oct. 12, 2023), <https://perma.cc/6PNA-2ZMU>; Scott Bauer & David A. Lieb, *GOP Threat to Impeach a Wisconsin Supreme Court Justice Is Driven by Fear of Losing*

Justice Protasiewicz and the three *Johnson* dissenters ruled that the court would focus solely on the Clarke petition's contiguity and separation-of-powers claims.⁹⁹ The claims of unlawful partisan gerrymandering—that is, the first three counts in the Clarke petition and all four counts in the Wright petition—could, the majority explained, require “extensive fact-finding” and thus were dismissed.¹⁰⁰

The court proceeded to adjudicate the case as *Clarke v. Wisconsin Elections Commission*,¹⁰¹ with Professor Wright and his group, as well as Governor Evers and a group of five Democratic Senators, all participating as parties on the side of petitioners. On the respondents' side, twelve Republican Senators and the Wisconsin Legislature participated jointly, alongside ten Wisconsin voters known as the Johnson intervenors, most of whom had participated in the prior *Johnson* case.¹⁰²

The decision to adjudicate only the contiguity and separation-of-powers claims simplified the case but came at a cost: it failed to conclusively establish precedent that partisan-gerrymandering claims are cognizable and justiciable under the state constitution. Such precedent could have been used to challenge Wisconsin's gerrymandered congressional districts (which have repeatedly elected six Republicans and only two Democrats),¹⁰³ could have been used in Wisconsin in future decades to thwart extreme partisan gerrymanders crafted by either major political party, and could have added to the growing nationwide body of state constitutional law requiring fair districting.¹⁰⁴

Legislative Edge, ASSOCIATED PRESS (Sept. 10, 2023), <https://perma.cc/8J7Q-HPXY>.

99. See *Clarke v. Wis. Elections Comm'n*, 2023 WI 70, 995 N.W.2d 779, 781.

100. *Id.*; see *Wright v. Wis. Elections Comm'n*, 2023 WI 71, 999 N.W.2d 262, 262.

101. 2023 WI 79, 998 N.W.2d 370.

102. For ease of reference, this Article refers to all parties who challenged the Legislature's 2022 Map as “petitioners” and all parties who defended the status quo as “respondents.” The respondent Wisconsin Elections Commission took no positions on the merits of petitioners' claims or on potential remedies, but did advocate concluding the litigation by March 2024, nearly five months before the primary election.

103. *But see Bothfeld v. Wis. Elections Comm'n*, 2025 WI 38, 24 N.W.3d 452 (tbl.) (text order denying petition for leave to commence an original action challenging the congressional map as a partisan gerrymander under the Wisconsin Constitution).

104. See, e.g., *Grisham v. Van Soelen*, 2023-NMSC-027, ¶¶ 21–68, 539 P.3d 272, 281–93 (N.M. 2023); *In re 2021 Redistricting Cases*, 528 P.3d 40, 92, 101 (Alaska 2023); *League of Women Voters of Ohio v. Ohio Redistricting Comm'n*, 192 N.E.3d 379, 414–15 (Ohio 2022); *Carter v. Chapman*, 270 A.3d 444, 462, 470–71 (Pa. 2022); *League of Women Voters of Pa. v. Commonwealth*, 178 A.3d 737, 814, 818, 821 (Pa. 2018); *League of Women Voters of Fla. v. Detzner*, 172 So. 3d

Moreover, eliminating all partisan-gerrymandering claims from the case presented a recurring problem for all four sets of petitioners: each had sought a remedy that would unwind the 2022 (and 2011) partisan gerrymanders. But requiring partisan fairness in a remedial map could (and did) give rise to questions about whether the court was overreaching by imposing a remedy not directly tied to the remaining liability theories (contiguity and separation of powers).¹⁰⁵ This issue persisted throughout the litigation.

3. *The Clarke Court's December 2023 Decision*

On December 22, 2023, the Wisconsin Supreme Court issued a four-to-three decision invalidating the 2022 Map, enjoining its use in future elections, and setting in motion the process for selecting a remedial map for the 2024 elections.¹⁰⁶ The invalidation was based solely on the fact that at least fifty (of the ninety-nine) assembly districts and at least twenty (of the thirty-three) senate districts were not contiguous, as each contained “territory completely disconnected from the rest of the district.”¹⁰⁷ The root cause of the problem was that municipal annexation had created noncontiguous municipalities (with municipal “islands”) and thus noncontiguous municipal “wards” (Wisconsin’s term for voting precincts), which were then used as the building blocks to form legislative districts.¹⁰⁸ The resulting contiguity violations in the 2022 Map were so pervasive that the court enjoined the assembly and senate maps as a whole, not merely their noncontiguous districts.¹⁰⁹ The court declined to address petitioners’ separation-of-powers theory.¹¹⁰

363, 416 (Fla. 2015); *see also* *Rucho v. Common Cause*, 139 S. Ct. 2484, 2507 (2019) (approving partisan gerrymandering challenges brought under state constitutions in state courts); *cf.* *Moore v. Harper*, 143 S. Ct. 2065, 2083 (2023) (recognizing that even congressional redistricting “remain[s] subject to constraints set forth in the State Constitution”).

105. *See Clarke*, 2023 WI 70, 995 N.W.2d at 785 (Ziegler, C.J., dissenting) (accusing the Clarke petitioners of “raising the contiguity argument as a means to indirectly re-litigate [at the remedial phase] the . . . issues of political fairness and political gerrymandering”); *id.* at 802 (Hagedorn, J., dissenting) (accusing the majority of leveraging the contiguity issue “to get this court into the business of being the supreme guardian of ‘partisan fairness’ in map-making” during the remedial phase).

106. *See Clarke*, 2023 WI 79, ¶ 3, 998 N.W.2d at 379.

107. *Id.* ¶ 1, 998 N.W.2d at 377; *see id.* ¶¶ 34, 56, 77, 998 N.W.2d at 389, 395, 401.

108. *See id.* ¶ 18 & n.9, 998 N.W.2d at 382–83 & n.9. As early as 1880, the Wisconsin Supreme Court had recognized that noncontiguous towns “would most unquestionably restrict” efforts to draw constitutional, contiguous assembly districts. *Chi. & Nw. Ry. Co. v. Town of Oconto*, 6 N.W. 607, 609 (Wis. 1880). See Figure D for an example of a noncontiguous assembly district.

109. *See Clarke*, 2023 WI 79, ¶ 56, 998 N.W.2d at 395.

110. *See id.* ¶ 3 n.8, 998 N.W.2d at 379 n.8.

parties' maps.¹¹⁵ Then two consultants selected by the court for their expertise in redistricting—political-science professors Bernie Grofman of the University of California, Irvine, and Jonathan Cervas of Carnegie Mellon University—would analyze and evaluate the competing proposals.¹¹⁶ Each party could respond to the consultants' report, and then the court would pick the best map.¹¹⁷ While the court held open the possibility that it (or its consultants) could draw a map if none of the parties' proposed remedies was lawful,¹¹⁸ the procedure was designed to keep the court out of the map-drawing business. Instead, the process would provide the court all the data and analysis needed to compare the parties' competing maps and to choose the best from among them.

As for substance, the court identified a set of redistricting principles to guide the parties in developing their proposed maps. These principles, which formed the basis for the Wright team's computational-redistricting methodology, are described in detail below.¹¹⁹ Significantly, the court did not limit the criteria to fixing the invalidated maps' contiguity problems,¹²⁰ or even to complying with federal law and the state constitution's express redistricting rules.¹²¹ The court stated that it would also consider "traditional" districting criteria not mandated by or even "derived from" the state or federal constitutions or statutes.¹²² Moreover, the majority held that the court, as "a politically neutral and independent institution," must "consider partisan impact when evaluating remedial maps" and avoid selecting any map that "privilege[s] one political party over another."¹²³ And the court expressly rejected the "least change" approach that the *Johnson* court had adopted and applied in 2022.¹²⁴

115. *See id.* at 3.

116. *See id.* at 1–2.

117. *See id.* at 1–4.

118. *See id.* at 4 ("Only if no [party's] submission meets the criteria identified in the court's December 22, 2023 opinion should Dr. Grofman and Dr. Cervas submit their own proposed remedial map. Dr. Grofman and Dr. Cervas may, however, suggest technical corrections or minor changes to the parties' submissions as required. Any such technical corrections or minor changes shall be explained in their report.").

119. *See infra* Part III.

120. *See Clarke v. Wis. Elections Comm'n*, 2023 WI 79, ¶ 59, 998 N.W.2d 370, 396.

121. *See id.* ¶¶ 64–67, 998 N.W.2d at 398–99 (citing WIS. CONST. art. IV, §§ 3–5).

122. *See id.* ¶¶ 62, 68 & n.29, 998 N.W.2d at 397, 399 & n.29.

123. *Id.* ¶¶ 69–71, 998 N.W.2d at 399–400.

124. *See id.* ¶¶ 60–63, 998 N.W.2d at 396–97. Here, the "least change" approach would have required minimizing alterations to the Legislature's 2022 Map adopted by the *Johnson* court, while curing the discontiguities that led the *Clarke* court to invalidate the 2022 Map.

4. *The Parties' 2024 Proposed Remedial Maps*

In January 2024, the parties proposed six remedial maps. Two maps came from Republican litigants: the Legislature and the Johnson intervenors. The Legislature proposed a map that made the “least change” possible to the 2022 Map while fixing the adjudicated contiguity violations, thereby retaining that map’s severe pro-Republican bias.¹²⁵ The Johnson intervenors proposed a map that radically redrew districts to make them highly compact and respectful of political subdivisions such as counties and municipalities; but the Johnson map also retained most of the 2022 Map’s pro-Republican bias.¹²⁶

The other four maps were proposed by the Wright petitioners, the Clarke petitioners, Governor Evers, and five Democratic Senators, respectively. All four maps, to somewhat varying but significant degrees, unwound the invalidated 2022 Map’s gerrymandering and eliminated most of its pro-Republican bias. But only the Wright petitioners’ map was generated with the assistance of computational redistricting. As described below in detail, for the Assembly, the Wright Map, along with the Clarke Map, did the best job of eliminating the prior pro-Republican skew; for the Senate, the Wright Map, along with the Democratic Senators’ Map, did the same.¹²⁷

Importantly, the Wright Senate Map had an additional feature that set it apart from the other remedial proposals. Because Wisconsin Senators serve staggered four-year terms, with even-numbered districts (i.e., Senate Districts 2, 4, 6, . . . 32) voting in presidential-election years and odd-numbered districts (i.e., Senate Districts 1, 3, 5, . . . 33) voting in midterm-election years, even a perfectly unbiased senate map could need four years to fully unwind a prior gerrymander. During the first two years after such a redraw, about half the Senators would be “holdovers” elected under the prior (severely skewed) map.¹²⁸ Applying algorithmic techniques described below,¹²⁹ the Wright Map’s senate districts were numbered to ensure that in 2025 and 2026 not only the Assembly but also the Senate would likely be controlled by whichever political party’s legislative candidates won the most votes statewide in the November 2024 election. So, if 2024 turned out to be a reasonably strong Republican year, Republicans could continue controlling both legislative

125. See Peter Miller & Arlyss Herzig, *What States Can Learn from Wisconsin’s Win for Fair Maps*, BRENNAN CTR. FOR JUST. (Mar. 6, 2024), <https://perma.cc/VBZ8-PP2X>.

126. See *id.*

127. See *infra* Section III.B.4.

128. Because the *Clarke* court had declined “to order special elections in 2024 for senators [elected in November 2022 from] odd-numbered districts,” they could serve as holdover Senators until January 2027. See *Clarke*, 2023 WI 79, ¶¶ 72–74, 998 N.W.2d at 400.

129. See *infra* Section III.C.

chambers in 2025 and 2026. But if 2024 turned out to be a reasonably strong Democratic year, Democrats could translate that popular support into a majority of seats in *both* chambers and thus gain unified control of Wisconsin’s government—a so-called Democratic “trifecta” (Governor, Assembly, and Senate).

5. *The Legislature’s About-Face*

The Wright Map was the only remedial proposal that promised to unwind the extreme Republican skew in both legislative chambers as early as the 2024 election.¹³⁰ Threatened with the imminent loss of their manufactured majority, the Legislature’s Republican leaders concocted a startling strategy: supporting the map that Democratic Governor Evers had submitted to the court. The Governor’s Map appeared likely, when compared with the Wright Map, to give Republicans a roughly two-to-six-seat edge in the Assembly (i.e., plus one, two, or three seats for Republicans; minus one, two, or three seats for Democrats). And the Governor’s Map appeared certain, given how its proposed senate districts were numbered, to ensure that Republicans would continue to hold the Senate until at least January 2027, after all thirty-three senate seats had cycled through elections under the new senate map in November 2024 and November 2026.¹³¹ As one commentator who evaluated all the proposals reported at the time: “The fear that the left-leaning court [would] choose the [Wright Map] and . . . the potential of state government completely flipping may be leading Republicans to announce they would consider enacting maps by the governor. It might be the best they can get.”¹³² Indeed, this reality eventually led to a scenario that seasoned observers previously had dismissed as unimaginable: “Having had

130. See, e.g., Peter Cameron, *Even with More Competitive Maps, Dems Unlikely to Win Full Control of State Government in 2024, Experts Say. With One Exception*, BADGER PROJECT (Feb. 8, 2024), <https://perma.cc/CKB8-WGLL> (concluding that only the Wright Map could “deliver a majority for [Democrats in both chambers] if they win a majority of the vote” in November 2024). Cameron referred to the Wright Map as the “Boardman Clark map,” *id.*, because the Wright petitioners were represented by Boardman & Clark LLP (as well as by Jenner & Block LLP).

131. See John Johnson, *A Closer Look at the Partisan Implications of Gov. Evers’ Proposed Maps*, MARQ. UNIV. L. SCH.: FAC. BLOG (Feb. 17, 2024), <https://perma.cc/6QJ7-8C8N> (“Because only even-numbered [senate] districts will hold elections in 2024, I see essentially no chance of Democrats winning a [senate] majority this November [under the Governor’s Map].”); Dan Shafer, *2024 Wisconsin State Legislature Voter Guide: The State Senate*, CIVIC MEDIA (Sept. 17, 2024), <https://perma.cc/ZSX2-G8DX> (stating that the Governor’s Map could not “put the [senate] majority in play” until November 2026).

132. Cameron, *supra* note 130; see Marley, *supra* note 7 (explaining that Republican legislators approved Governor Evers’s senate and assembly maps “out of fears that the state’s top court could impose ones that are even worse for them”).

the chance to review all the proposals and fearing what the Court's new liberal majority might do, Republican legislators suddenly found themselves in the unexpected position of supporting [Democratic Governor] Evers' own proposal."¹³³ As Marquette University political-science professor Phil Rocco explained, the Governor's Map became Republican leaders' "last, best, and final opportunity to avoid" a worse alternative.¹³⁴

On February 13, 2024, the Legislature passed the Democratic Governor's map almost entirely with Republican votes: seventy-nine of the eighty-six Republican legislators (from both chambers) but only two of the forty-five Democratic legislators voted to enact the Governor's Map.¹³⁵ Only one Democrat in each chamber voted for the map proposed by their own party's governor.¹³⁶

The Senate's Democratic Minority Leader, Dianne Hesselbein, called the Republican legislators' motives in passing the Governor's Map "ill-intentioned and self-serving."¹³⁷ *The Washington Post* reported that, while Republicans complained that they had passed Governor Evers's map under duress, Democrats "appeared no happier than Republicans. Nearly all of them voted against the maps and privately fumed over a missed chance to get a better deal."¹³⁸

The Republicans' gambit presented Governor Evers with an awkward dilemma: either suffer the political embarrassment of vetoing the very map that he had submitted to the court, or forgo any realistic chance of enjoying a Democratic-controlled Legislature, and thus unified Democratic state government, during his current term in office.

On February 19, 2024, Governor Evers—proclaiming "a new day in Wisconsin" and "a beautiful day for democracy"—signed into law

133. Johnson, *supra* note 131; see Scott Bauer, *Wisconsin Governor Doubts Republican Legislature Will Approve His Maps*, ASSOCIATED PRESS (Feb. 7, 2024), <https://perma.cc/H72N-VCPM> (stating that the Republican legislative leaders' support for the Governor's Map showed that "Republicans are worried about other alternatives" that the Wisconsin Supreme Court could order).

134. Phil Rocco, *One Year After a Watershed Election, Wisconsin's Supreme Court Is at the Center of the Battle for Democracy*, RECOMBOBULATION AREA (June 5, 2024), <https://perma.cc/CZ5U-FF89>.

135. See WIS. S. JOURNAL, 106th Reg. Sess., at 801 (Feb. 13, 2024); WIS. ASSEMB. JOURNAL, 106th Reg. Sess., at 664 (Feb. 13, 2024). The total number of legislators was only 131 because one senate seat was vacant; also, in the Assembly, two Republicans and one Democrat did not vote. See WIS. S. JOURNAL at 794; WIS. ASSEMB. JOURNAL at 664.

136. See WIS. S. JOURNAL at 801; WIS. ASSEMB. JOURNAL at 664.

137. Scott Bauer, *GOP-Led Wisconsin Legislature Passes Democratic Governor's Legislative Maps*, ASSOCIATED PRESS (Feb. 13, 2024) (quoting Sen. Hesselbein), <https://perma.cc/SA8T-AC29>.

138. Marley, *supra* note 7.

the map that he had proposed.¹³⁹ By passing the legislation instead of risking the possibility that the Wisconsin Supreme Court would select the Wright Map, Republican legislators effectively ensured control of the Senate for themselves for at least another two years and somewhat improved their chance (relative to other submissions that the court might have chosen) of controlling the Assembly as well.¹⁴⁰ By signing his map into law, Governor Evers rendered the *Clarke* case moot before the Wisconsin Supreme Court could announce its preferred remedial map.¹⁴¹

III. CREATING THE WRIGHT MAP FOR WISCONSIN

This Part provides a practical guide for future computational redistricters by explaining how the Wright Map was made. Creating the Wright Map was a complex task. It required not only minimizing the map's partisan impact, to avoid privileging one political party over another, but also satisfying all the districting principles mandated by state or federal law, as well as other traditional but nonmandatory districting criteria that the *Clarke* court had articulated. These principles and criteria had to be translated into instructions for the mapmaking search algorithm, either as constraints that were non-negotiable map features or as objectives that the Wright team sought to optimize as it pushed ever closer to the Pareto frontier. And once the map's district boundaries were complete, the team used a separate algorithm to number the districts.

For each districting criterion, this Part summarizes the legal parameters, explains how the Wright team operationalized those parameters within the search algorithm, and describes how the resulting Wright Map performed relative to the competing maps that other parties presented to the Wisconsin Supreme Court. Though the discussion here focuses on the Wisconsin litigation context, many of the constraints and objectives discussed in this Part would matter in nearly all states. Showing in detail how the Wright team applied its

139. WIS. S. JOURNAL, 106th Reg. Sess., at 828–29 (Feb. 19, 2024) (Governor Evers's signing statement for 2023 Wis. Act 94). Only four of the nearly four dozen Democratic legislators joined Governor Evers at the bill-signing ceremony. See Molly Beck et al., *Gov. Tony Evers Signs New Election Maps, Ending Wisconsin Republicans' Grip on Legislative Power*, MILWAUKEE J. SENTINEL (Feb. 19, 2024), <https://perma.cc/H92U-EWW3>.

140. For descriptions and analyses of the August and November 2024 primary and general election results under the Governor's Map, see *infra* notes 270–280 and accompanying text. For a former Wisconsin state Senator's take on how replacing the 2011 and 2022 Maps with the Governor's Map will leave “the people of Wisconsin, and democracy, . . . far better off,” see TIM CULLEN, WISCONSIN GERRYMANDERING: THE FIGHT FOR PERMANENT FAIR MAPS AND WHY IT MATTERS 104–06 (2024).

141. See Order, *Clarke v. Wis. Elections Comm'n* (No. 2023AP1399) (Sept. 24, 2024) (dismissing *Clarke* as moot).

approach in Wisconsin therefore offers practical guidance to future mapmakers who will face similar challenges across the United States in the post-2030 redistricting cycle.

A. The Mapmaking Algorithm's Constraints: Preserving Non-Negotiable Map Features

The constraints that every map generated by the Wright team's search algorithm was required to satisfy were the following: nesting ninety-nine assembly districts in thirty-three senate districts, maintaining population equality, keeping wards and Indian reservations intact, ensuring that districts consist of contiguous territory, freezing prior senate districts composed entirely of contiguous wards, complying with the federal laws governing race and redistricting, and exceeding a desired minimum threshold for compactness. Although each of these criteria may sound relatively straightforward, implementing them into algorithmic instructions required many tough judgment calls. The Wright team does not contend that its approach to selecting and defining constraints is necessarily the "right," or only, way. But explaining the Wright team's approach helps illustrate the kinds of choices that must be made in any given case.

1. Nesting

The Law. The *Clarke* court's remedial instructions explained that Wisconsin's Constitution and statutes require that assembly districts "be 'nested' within a senate district—that is, 'no assembly district shall be divided in the formation of a senate district'"—and that "there be '33 senate districts, each composed of 3 assembly districts.'"¹⁴² A lawful map thus divides Wisconsin into thirty-three single-member senate districts, each composed of three undivided single-member assembly districts.

The Algorithm. Wisconsin's nesting requirement ties the assembly map to the senate map. But ReCom, the map-generation technique for the search algorithm deployed by the Wright team, typically is applied to one map at a time, not two. To address nesting, the Wright team developed a two-level ReCom variant that generated assembly/senate map *pairs*. At each step in the sequence, the algorithm first performed standard ReCom at the assembly-district level: two adjacent assembly districts were merged into a double-sized super-district, which was then repartitioned into two new assembly districts. If the two assembly districts had come from the same senate district, the senate map was unaffected. But if the two assembly districts had come from different senate districts (in which a total of

142. *Clarke v. Wis. Elections Comm'n*, 2023 WI 79, ¶ 65 n.27, 998 N.W.2d 370, 398 n.27 (quoting WIS. CONST. art. IV, § 5; WIS. STAT. § 4.001 (2023)); see WIS. STAT. § 4.009 (2023).

six assembly districts had to be nested), the algorithm then chose how to assign the six assembly districts (two new ones and four old ones) to form two new senate districts.

The search algorithm was configured to propose only map pairs that satisfied all the constraints for both the Assembly and the Senate. And the algorithm analyzed objectives (discussed below¹⁴³) for both the new assembly map and the new senate map when deciding whether to accept the new map before proceeding to the next step in the sequence. Computing both the assembly map's and the associated senate map's scores at each step effectively doubled the algorithm's number of objectives (and thus the Pareto frontier's number of dimensions), which made the program slower to run. But this configuration also ensured that the algorithm would eventually create a properly nested map that performed well for both the Assembly and the Senate.

The Results. The Wright Map satisfied Wisconsin law's relatively straightforward nesting requirement.¹⁴⁴ The same was true, not surprisingly, for every remedial map proposed to the Wisconsin Supreme Court.¹⁴⁵

2. Population Equality

The Law. As the *Clarke* court held, article IV, section 3 of the Wisconsin Constitution and the Equal Protection Clause of the Fourteenth Amendment to the Federal Constitution require that Wisconsin's population "be distributed equally amongst legislative districts with only minor deviations."¹⁴⁶ Wisconsin legislative districts have long satisfied an unusually stringent population-equality standard, with every district's deviation from perfect equality being "[b]elow 1 percent."¹⁴⁷ So Wisconsin expects maps to have a "maximum population deviation"—the population difference between the map's largest and smallest districts—that is less than 2% of the ideal (or average) district population.¹⁴⁸

The Algorithm. Conscious that even relatively trivial population deviations can sometimes matter to courts, the Wright team opted to apply a stricter population-equality rule than federal and state law mandated. To ensure that the Wright Map would have lower maximum population deviations than the map that the

143. *See infra* Section III.B.

144. *See* Report of the Court-Appointed Consultants at 2 n.2, 21, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Feb. 1, 2024) [hereinafter Grofman/Cervas Rpt.].

145. *See id.*

146. *Clarke*, 2023 WI 79, ¶ 64, 998 N.W.2d at 398; *see also id.* ¶ 67, 998 N.W.2d at 399.

147. *Id.* ¶ 64, 998 N.W.2d at 398 (quoting *Prosser v. Elections Bd.*, 793 F. Supp. 859, 866 (W.D. Wis. 1992) (three-judge court) (per curiam)).

148. *See id.*

Johnson court initially selected in 2022 (before the U.S. Supreme Court reversed that judgment), the Wright team’s search algorithm required districts for the Assembly and the Senate to vary from their ideal population by less than 0.935% and 0.596%, respectively.¹⁴⁹

The Results. The Wright Map complied with the state and federal constitutional requirements of population equality. As confirmed by the *Clarke* court’s expert consultants, Professors Grofman and Cervas, all the Wright Map’s districts stayed within 1% of the ideal population.¹⁵⁰ The Wright Map’s maximum population deviations between a chamber’s smallest and largest districts—1.83% in the Assembly, 1.19% in the Senate—were not only below Wisconsin’s 2% standard but also lower than the current levels in 46 states.¹⁵¹ The Wright Map had lower deviations than the maps proposed by the Governor and by the Democratic Senators, but higher than those proposed by Clarke, the Johnson intervenors, and the Legislature.¹⁵² That the latter group of parties chose to go even further than the Wright team did in reducing population deviations—when the Wright team itself had already gone beyond what the law required—illustrates how mapmakers make different value choices when designing their maps.

3. *Bounded by Ward Lines*

The Law. The Wisconsin Constitution requires assembly districts to “be bounded by county, precinct, town or ward lines.”¹⁵³ Today, Wisconsin has no precincts,¹⁵⁴ and the lines defining every county and every town (as well as every city and village) are also considered ward lines.¹⁵⁵ Furthermore, Wisconsin law requires every ward to be located within one and only one county and within one and only one municipality (i.e., city, village, or town) and to comport with

149. Cf. Expert Report of Dr. Daryl Deford in Support of Wright Petitioners’ Map at 10, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 12, 2024) [hereinafter DeFord Rpt.] (reporting figures for the Wright Map).

150. See Grofman/Cervas Rpt., *supra* note 144, at 4.

151. Only Iowa’s lower house and both houses in Illinois and Washington have smaller population deviations. See Wright Petitioners’ Response Brief on the Proposed Remedial Maps at 13, 14 fig.2, 15 fig.3, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 22, 2024) [hereinafter Jan. 22 Br.].

152. See Wright Petitioners’ Appendix at 6 tbl.2, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 22, 2024) [hereinafter Jan. 22 App’x].

153. WIS. CONST. art. IV, § 4.

154. Wisconsin “precincts” ceased to exist in the nineteenth century. See *Clarke*, 2023 WI 79, ¶ 66 n.28, 998 N.W.2d at 398 n.28.

155. Wisconsin towns (like townships in other states) are unincorporated municipalities nested within counties. Wisconsin cities and villages are incorporated municipalities usually, but not always, nested within counties. If a very small municipality opts not to divide itself into wards, the municipality is deemed to consist of a single “ward.” See WIS. STAT. § 5.15(2)(a) (2023).

neighborhoods and other communities of interest.¹⁵⁶ So the Constitution’s “bounded” requirement can be satisfied if every ward is kept intact and can be violated only if part or all of an assembly-district boundary does not sit atop a ward line.

The Wisconsin Supreme Court has explained that

gratuitously break[ing] up wards, the smallest political unit in the state, makes little sense because they are the basic unit of Wisconsin state government for voting purposes. You vote by ward. For voters in the same ward to have different ballots is an inconvenience to the administration of elections and provides, at most, nominal gain[s] in population equality.¹⁵⁷

The Algorithm. Although the case law interpreting the Wisconsin Constitution’s “bounded” requirement is complex, compliance is simple if one is willing to go slightly further than the law requires and keep every ward in the state perfectly intact—meaning not only that a district boundary could not cut through the middle of a contiguous ward (that much is required by the Wisconsin Constitution) but also that a district boundary could not place one component of a noncontiguous ward in one district and another component of the same ward in a different district. Fully respecting wards in this manner yields additional benefits because ward lines relate to counties, cities, villages, towns, neighborhoods, and communities of interest; so all things being equal, fully respecting Wisconsin wards comports with preserving all these socially meaningful geographic units.

The Results. As Professors Grofman and Cervas confirmed, all the Wright Map’s districts were bounded entirely by county, town, or ward lines.¹⁵⁸ Every district boundary sat atop a ward line, some of which were also county lines, town lines, or both.

Professors Grofman and Cervas found that, except for the Clarke Map, none of the other proposed remedies matched the Wright Map on this front.¹⁵⁹ By contrast, the Legislature’s Map contained

156. *See id.* §§ 5.02(25), 5.15(1)(a), (b), (d) (2023); *see also* MICHAEL GALLAGHER ET AL., WIS. LEGIS. REFERENCE BUREAU, REDISTRICTING IN WISCONSIN 2020: THE LRB GUIDEBOOK 24–29 (2020) (describing the nature of wards and their role in redistricting).

157. *Johnson v. Wis. Elections Comm’n (Johnson III)*, 2022 WI 19, ¶ 66, 972 N.W.2d 559, 585 (citation and internal quotation marks omitted); *see also* Brief of Amici Curiae Wis. Just. Initiative, Inc. & Wis. Fair Maps Coal. re: Submitted Maps at 7–10, 15–19, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 22, 2024) (explaining that preserving wards constrains mapmakers’ discretion, promotes fair districting, and fosters efficient election administration); *see also* Petitioners’ Response Brief at 42 n.11, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Oct. 30, 2023) (stating that splitting wards can compromise voter privacy).

158. *See Grofman/Cervas Rpt., supra* note 144, at 21–22 tbl.11.

159. *See id.*

seventeen senate districts and forty-six assembly districts that were not bounded entirely by county, town, or ward lines, and split sixty-one wards in the senate map and one-hundred-twenty in the assembly map.¹⁶⁰ The Johnson Map likewise fared poorly on this criterion.¹⁶¹ As Professors Grofman and Cervas put it, neither the Legislature nor the Johnson intervenors “took literally” the Wisconsin Constitution’s express mandate that ward, town, and county lines “*must* be used as district boundaries.”¹⁶²

The Wright Map also completely avoided splitting both contiguous and noncontiguous wards.¹⁶³ It was the only proposed remedy with this attribute.¹⁶⁴

160. See Jan. 22 App’x, *supra* note 152, at 7 tbl.3, 8 tbl.4.

161. See *id.*

162. Grofman/Cervas Rpt., *supra* note 144, at 8 & n.15 (citing *Clarke*, 2023 WI 79, ¶ 11, 998 N.W.2d at 381).

163. See Jan. 22 App’x, *supra* note 152, at 8 tbl.4.

164. See *id.* The Clarke Map split a single ward in the former Town of Madison by placing the ward’s noncontiguous pieces in separate districts; the Governor’s and Democratic Senators’ Maps likewise split this ward. This type of ward-splitting does not violate the Wisconsin Constitution’s “bounded” mandate. See Jan. 22 Br., *supra* note 151, at 16 & n.4, 17 tbl.3, 18.

4. American Indian Tribal Reservations

The Law. The *Clarke* court explained that it would “consider other traditional districting criteria not specifically outlined in the Wisconsin or United States Constitution,” including “preserving communities of interest.”¹⁶⁵ The court’s consultants accordingly directed the parties to account for “[c]ommunity [c]onsiderations” by “[p]reserving communities of interest,” and to “specify the size and geographic location of any communities of interest identified and the degree to which these communities of interest have been split across multiple districts.”¹⁶⁶

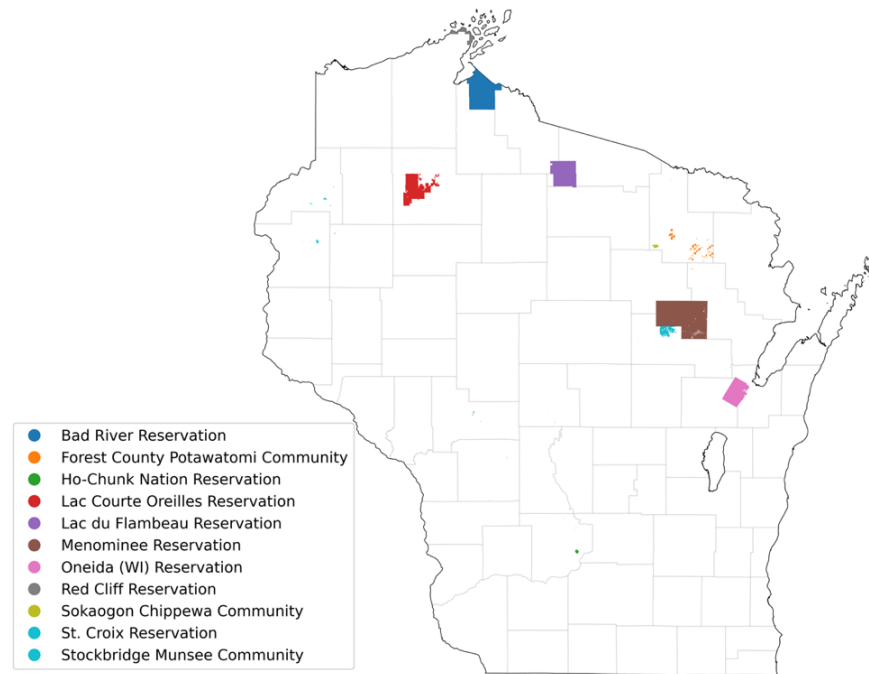
American Indian reservations are communities defined by actual shared interests, with exceptionally clear geographic boundaries. As the Midwest Alliance of Sovereign Tribes and the Lac du Flambeau Tribe stated in their amicus brief, a court that “strives to preserve and keep intact local governments and political subdivisions such as counties and municipalities surely should pay the same respect to Tribal governments and their American Indian reservations.”¹⁶⁷

The Algorithm. The Wright team chose to respect American Indian Tribes’ reservations wherever possible, even though doing so was not legally mandated. Forcing ReCom to take either all or none of each reservation into a new assembly district ensured that these reservations would stay intact.

165. *Clarke*, 2023 WI 79, ¶ 68, 998 N.W.2d at 399; *see also* *Baldus v. Members of Wis. Gov’t Accountability Bd.*, 849 F. Supp. 2d 840, 856–57 (E.D. Wis. 2012) (three-judge court).

166. Memorandum to the Ct. re: Tech. Specifications and Data Requirements for Proposed Remedial Maps Submission at 2, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Dec. 26, 2023).

167. Brief Amici Curiae for Non-Parties Midwest Alliance of Sovereign Tribes & Lac du Flambeau Tribe in Support of Wright Map at 6, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 22, 2024) [hereinafter Tribal Amici Br.]; *cf. Clarke*, 2023 WI 79, ¶¶ 35, 62, 68, 998 N.W.2d at 389, 397, 399 (identifying “preserving communities of interest” as a traditional districting criterion worthy of court consideration because districts reflecting “a reasonably homogeneous slate of interests” are preferable to “districts with scattered pockets of isolated communities”).

FIGURE E¹⁶⁸

The Results. The Wright Map was the only proposed remedy that kept Tribes’ reservations intact to the maximum extent possible. Of Wisconsin’s eleven federally recognized Indian Tribes, ten had reservations situated entirely within one assembly district (and thus one senate district) in the Wright Map (see Figure E).¹⁶⁹ The only exception was the Ho-Chunk Nation, whose Tribal lands are scattered across seven counties and could not be brought into a single reasonably compact district.¹⁷⁰ By contrast, the other proposed maps each splintered four, five, or six reservations.¹⁷¹

Professors Grofman and Cervas concluded that the Wright Map “stood out” in minimizing “reservation splits,” while the other proposed maps raised “issues related to protection of the boundaries of Native American reservations.”¹⁷² Likewise, after reviewing all the

168. The Wright team constrained their search algorithm to consider only maps that kept Indian reservations intact wherever possible. In the figure, the colored areas are reservations, and the thin black lines are county boundaries.

169. See Tribal Amici Br., *supra* note 167, at 5 tbl., 6.

170. See Jan. 12 Br., *supra* note 1, at 33.

171. See Jan. 22 App’x, *supra* note 152, at 17.

172. Grofman/Cervas Rpt., *supra* note 144, at 10, 22; see *id.* at 10 (“Native Americans represent a distinct, cognizable, and geographically definable community of interest.”); see also *id.* at 22 n.30.

remedial proposals, the Tribal amici concluded that the Wright Map was, “hands down, the best map” for “Wisconsin’s Indian people and communities.”¹⁷³

5. *Contiguous Territory*

The Law. The Wisconsin Constitution’s contiguous-territory requirements had formed the basis for the *Clarke* court’s December 2023 invalidation of the 2022 Map. Section 4 of article IV of the Wisconsin Constitution mandates that assembly districts “consist of contiguous territory,”¹⁷⁴ and section 5 likewise mandates senate districts “of convenient contiguous territory.”¹⁷⁵ For a district to be composed of contiguous territory, the *Clarke* court held, “its territory must be touching such that one could travel from one point in the district to any other point in the district without crossing district lines.”¹⁷⁶ Territory detached or “completely disconnected from the rest of the district” violates the Wisconsin Constitution.¹⁷⁷ The court also held that the fact that a district’s territory includes pieces of land that are separated by water or that touch at only a single point, like the red squares on a checkerboard (known as “touch-point contiguity”), does not, by itself, violate the Constitution’s contiguous-territory requirements.¹⁷⁸ However, a district with only touch-point contiguity might violate the Constitution’s compactness mandate.¹⁷⁹

Contiguity typically is one of the least contentious redistricting criteria.¹⁸⁰ But in Wisconsin, legislative districts are built from municipal wards. And under Wisconsin law, incorporated cities and villages annexing land from unincorporated towns can create municipalities (and thus municipal wards) containing “island territory”—“noncontiguous territory which is separated by the territory of another municipality . . . from the major part of the municipality to which it belongs.”¹⁸¹ When legislative districts are built from noncontiguous wards, they too can be noncontiguous.¹⁸²

173. Tribal Amici Br., *supra* note 167, at 3; *see also* Jan. 22 Br., *supra* note 151, at 25–26 tbl.8 & fig.6; DeFord Rpt., *supra* note 149, at 19–20; Expert Report of Dr. Ryan Weichelt in Support of Wright Petitioners’ Map at 1, 7, 9 fig.3, 10–11, 18, 24, 26–27, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 12, 2024).

174. WIS. CONST. art. IV, § 4.

175. *Id.* art. IV, § 5.

176. *Clarke*, 2023 WI 79, ¶ 66, 998 N.W.2d 370, 398; *see id.* ¶ 16, 998 N.W.2d at 382.

177. *Id.* ¶¶ 1, 3, 27, 998 N.W.2d at 377, 379, 386.

178. *Id.* ¶¶ 27–29, 998 N.W.2d at 385–86.

179. *See id.* ¶ 29 n.15, 998 N.W.2d at 386 n.15 (citing WIS. CONST. art. IV, §§ 4–5).

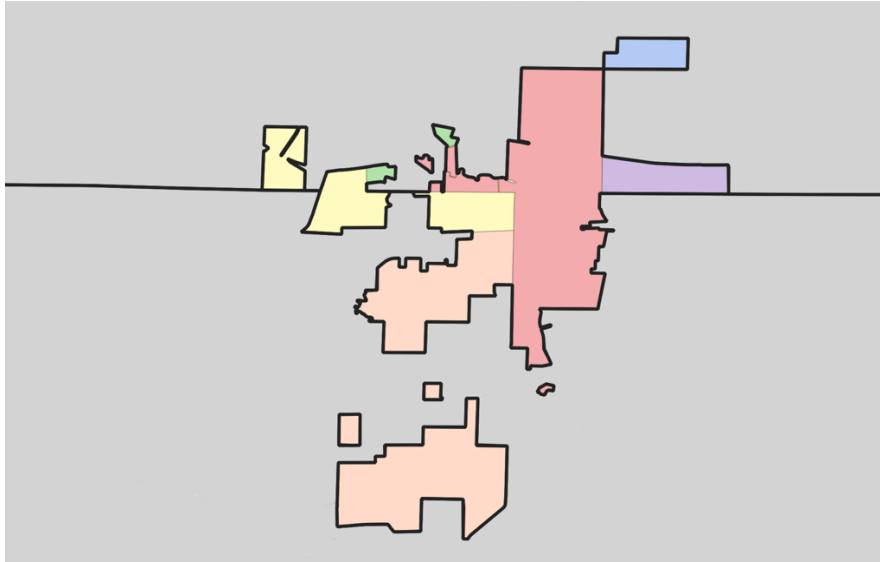
180. *See id.* ¶ 25, 998 N.W.2d at 384–85.

181. WIS. STAT. § 5.15(2)(f)(3) (2023); *see also* Town of Blooming Grove v. City of Madison, 81 N.W.2d 721, 723 (Wis. 1957).

182. See Figure F for an illustration.

That was the constitutional defect that formed the basis of the *Clarke* court’s decision, as the court found scores of districts in the 2022 Map where ward “islands” gave rise to violations of the Constitution’s “contiguous territory” districting requirements.¹⁸³ These problems were widespread across the state, except in Milwaukee County, which has no towns.

FIGURE F¹⁸⁴



The Algorithm. When ReCom merges and repartitions two adjacent districts, it seeks out contiguous alternatives. So typically there are no additional contiguity constraints to incorporate in the search algorithm. But ReCom guarantees that new districts will be contiguous only if every building block (in this case, every ward) is contiguous. Because this is not true in Wisconsin, the Wright team took additional steps to construct contiguous building blocks for legislative districts by “gluing” wards with disconnected pieces to wards that could “bridge” those pieces. Each of these larger “mega-wards” was contiguous and thus a suitable building block for ReCom. The Wright team also opted to prohibit districts that are touch-point

183. See *Clarke*, 2023 WI 79, ¶¶ 18 & n.9, 21 & n.10, 998 N.W.2d at 382 & n.9, 383 & n.10.

184. Dousman is a noncontiguous village in Waukesha County containing six wards (portrayed here with different colors). Each of the four westernmost wards is noncontiguous. Building a legislative map from wards like these can result in noncontiguous legislative districts with “island territories.”

contiguous, even though such districts sometimes might be lawful under Wisconsin law.

Significantly, while the *Clarke* court did not prohibit redrawing all thirty-three senate districts in the 2022 Map—whether they contained noncontiguous wards or not—the Wright team prohibited its search algorithm from redrawing any of the four senate districts that had been built entirely from contiguous wards or any of the twelve assembly districts nested within those four senate districts. These four senate and twelve assembly districts were all located in Milwaukee County.¹⁸⁵ None of these sixteen districts was infected by the state-constitutional infirmities that led the court to invalidate the 2022 Map. As explained below, the Wright team’s decision to “freeze” these sixteen Milwaukee County districts had important consequences for the Wright Map’s compliance with the federal laws governing race and redistricting.¹⁸⁶

The Results. Professors Grofman and Cervas confirmed that all ninety-nine assembly districts and all thirty-three senate districts in the Wright Map consisted of contiguous territory.¹⁸⁷

Although the *Clarke* court’s liability holding had focused on contiguity, three of the six proposed remedial maps (specifically, the ones proposed by the Legislature, the Johnson intervenors, and the Democratic Senators) contained at least one district that did not consist of contiguous territory.¹⁸⁸

6. *Equal Protection and the Voting Rights Act*

The Law. The *Clarke* court acknowledged that remedial maps “must comply with the [Federal Constitution’s] Equal Protection Clause and the Voting Rights Act of 1965.”¹⁸⁹ Federal law prohibits both racial gerrymandering and minority vote dilution.¹⁹⁰ Under the Fourteenth Amendment’s Equal Protection Clause,¹⁹¹ a district is presumptively unconstitutional and thus subject to strict scrutiny as a racial gerrymander if “race was the predominant factor motivating the . . . decision to place a significant number of voters within or

185. These sixteen districts were Senate Districts 3, 4, 6, and 7, and Assembly Districts 7 through 12 and 16 through 21.

186. See *infra* Section III.A.6.

187. See Grofman/Cervas Rpt., *supra* note 144, at 9.

188. See Jan. 22 App’x, *supra* note 152, at 5; Wright Petitioners’ Response to Consultants’ Report at 9 n.3, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Feb. 8, 2024) [hereinafter Feb. 8 Br.]; see also Grofman/Cervas Rpt., *supra* note 144, at 9 (referring to the “technical contiguity issues in the Democratic Senators’ plan”). The Governor’s Map and the Clarke Map had no noncontiguous districts. See Jan. 22 App’x, *supra* note 152, at 5.

189. *Clarke*, 2023 WI 79, ¶ 67, 998 N.W.2d at 399.

190. See *Allen v. Milligan*, 143 S. Ct. 1487, 1503 (2023).

191. U.S. CONST. amend. XIV, § 1 (“No State shall . . . deny to any person within its jurisdiction the equal protection of the laws.”).

without [the] district.”¹⁹² And section 2 of the Voting Rights Act, as amended, prohibits districting maps that dilute citizens’ voting strength on account of race or membership in a language minority group.¹⁹³

Under the 2022 Map, the only heavily minority districts were in Milwaukee County, mostly in the City of Milwaukee: three senate districts and eight of the nine assembly districts nested within them.¹⁹⁴ These eleven minority districts had been approved by the *Johnson* court in 2022 as complying with the Federal Constitution and the Voting Rights Act,¹⁹⁵ had nominated and elected minority-preferred candidates in the 2022 primary and general elections, and had never been challenged in court as racially motivated or as racially discriminatory in purpose or effect.

The Algorithm. Ordinarily, the stringent and sometimes opaque federal rules on race and redistricting present stiff challenges for computational redistricters.¹⁹⁶ Here, however, those challenges were bypassed because rectifying the contiguous-territory issue identified by the court did not require making any changes to the four senate districts in Milwaukee County that were entirely composed of contiguous wards.¹⁹⁷ These four senate districts (and the twelve assembly districts nested in them) included all the minority districts that the *Johnson* court had deemed compliant with federal law, as well as one senate district and four assembly districts that were majority-white.¹⁹⁸ The Wright team simply left these districts unchanged.

Because the Wright Map adopted a rule based on contiguity rather than race and did not single out the 2022 Map’s minority districts for differential treatment, there could be no credible suggestion that racial considerations predominated in the Wright Map in violation of the Equal Protection Clause.¹⁹⁹ And because the

192. *Miller v. Johnson*, 515 U.S. 900, 916 (1995); *accord* *Alexander v. S.C. State Conf. of the NAACP*, 144 S. Ct. 1221, 1234 (2024); *Cooper v. Harris*, 581 U.S. 285, 291 (2017).

193. 52 U.S.C. § 10301 (2025); *see Allen*, 143 S. Ct. at 1502–04; *see also Louisiana v. Callais*, Nos. 24-109 & 24-110 (U.S. argued Oct. 15, 2025).

194. These eleven minority districts were Senate Districts 3, 4, and 6, and Assembly Districts 8 through 12 and 16 through 18.

195. *See Johnson v. Wis. Elections Comm’n (Johnson III)*, 2022 WI 19, ¶¶ 3, 48 & n.8, 52–59, 972 N.W.2d 559, 565, 578 & n.8, 580–83.

196. *See* Becker et al., *supra* note 14, at 408–39 (demonstrating how an algorithm can be adapted to generate maps that satisfy the Voting Rights Act while avoiding racial gerrymandering).

197. *See supra* Section III.A.5.

198. These five majority-white districts were Senate District 7 and Assembly Districts 7, 19, 20, and 21.

199. *Cf. Wis. Legislature v. Wis. Elections Comm’n*, 142 S. Ct. 1245, 1248 (2022) (per curiam) (summarily reversing the Wisconsin Supreme Court’s *Johnson II* judgment for legal error in applying U.S. Supreme Court decisions

Wright Map preserved every district from the 2022 Map that contained sizable and electorally effective minority populations, there could be no credible claim of minority vote dilution under the Voting Rights Act.

The Results. As Professors Grofman and Cervas confirmed, the Wright Map complied with the federal laws governing race and redistricting.²⁰⁰ And in the 2024 primary and general elections, Milwaukee County’s minority districts (which the Governor’s Map also preserved) once again nominated and elected minority-preferred candidates, as likely would have been the case under any of the proposed remedial maps.

7. Compactness

The Law. Article IV of the Wisconsin Constitution requires assembly districts to “be in as compact form as practicable”²⁰¹ and senate districts to be “of convenient . . . territory.”²⁰² As the *Clarke* court noted, the compactness requirement “is set out in broad terms, the interpretation of which may lead to difficult questions and require a complex balancing of interests.”²⁰³ In contrast to the Constitution’s clear mandate of “contiguous territory,” compactness is “required only when it is practicable” and thus cannot be read as a crisp “constitutional imperative for all districts.”²⁰⁴ The Constitution’s compactness criterion is “secondary” and “subservient” to both population equality and respect for county, town, and ward lines, so districts need be only “reasonably, though not perfectly, compact.”²⁰⁵

The Wisconsin Supreme Court has generally defined compactness as “closely united in territory” but “has never adopted a particular measure of compactness.”²⁰⁶ Perhaps no single metric can capture the Wisconsin framers’ varied goals in requiring “practicable” compactness, including “prevent[ing] gerrymandering” and making districts “more geographically cohesive” and thus respectful of community interests.²⁰⁷

The Algorithm. The Wright team constrained their search algorithm to consider only maps whose least-compact district,

regarding “the relationship between the constitutional guarantee of equal protection and the [Voting Rights Act]”).

200. See Grofman/Cervas Rpt., *supra* note 144, at 9, 22.

201. WIS. CONST. art. IV, § 4.

202. *Id.* art. IV, § 5.

203. *Clarke v. Wis. Elections Comm’n*, 2023 WI 79, ¶ 14, 998 N.W.2d 370, 381.

204. *Id.* ¶ 20, 998 N.W.2d at 383.

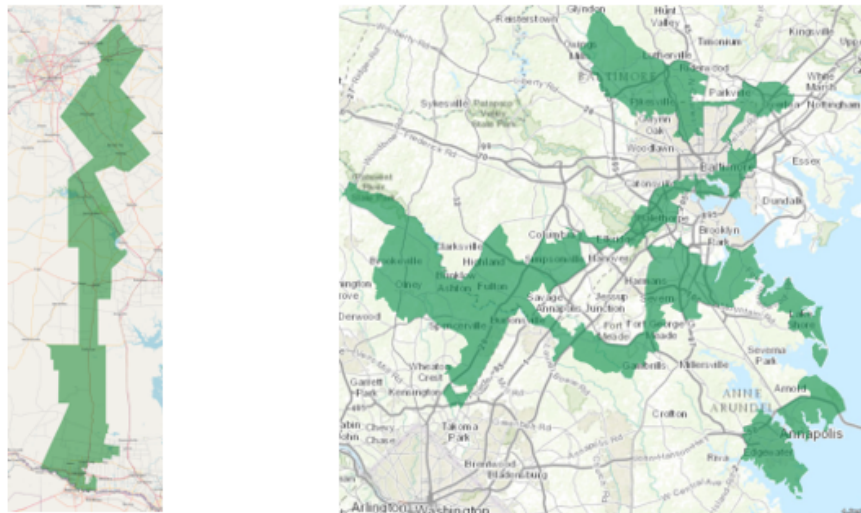
205. *Wis. State AFL-CIO v. Elections Bd.*, 543 F. Supp. 630, 634 (E.D. Wis. 1982) (three-judge court).

206. *Clarke*, 2023 WI 79, ¶ 66, 998 N.W.2d at 398 (quoting *Wis. State AFL-CIO*, 543 F. Supp. at 634).

207. *Id.* ¶ 35, 998 N.W.2d at 389 (quoting *Hickel v. Se. Conf.*, 846 P.2d 38, 45 (Alaska 1992)).

according to two specific measures, was more compact than the least-compact district in the recently invalidated 2022 Map. This at least ensured that the Wright Map would dominate the invalidated map on compactness (by those measures). For these purposes, the Wright team chose to use Polsby-Popper and Reock scores, both of which are grounded in plane geometry. The Polsby-Popper score focuses on a district's jaggedness by comparing its area to the length of its perimeter. And the Reock score focuses on a district's elongation by comparing its area to the area of the smallest circle that could circumscribe the district. For both metrics, a hypothetical circular district, being neither jagged nor elongated, would receive a perfect score. See Figure G for examples of actual districts that score poorly on these metrics.

FIGURE G²⁰⁸



The Wright team's search algorithm also required the *mean* Polsby-Popper and *mean* Reock scores across *all* districts to equal or exceed the recently invalidated 2022 Map's means. Here, too, the Wright team set its algorithmic constraints to demand more than the Wisconsin Constitution requires.

Using the 2022 Map as a benchmark to prevent the compactness of the districts in the Wright Map from backsliding was an important constraint. But the Wright team wanted its new map to do even better on compactness. So, as described below, maximizing compactness

208. Texas's former Fifteenth Congressional District (left panel) would score poorly on the Reock metric, which penalizes elongated districts. Maryland's former Third Congressional District (right panel) would score poorly on the Polsby-Popper metric, which penalizes winding, scraggly boundaries.

became one of the four objectives that the Wright team’s search algorithm sought to optimize when seeking Pareto-superior maps.²⁰⁹

The Results. The results of the algorithm’s approach to compactness are described below.²¹⁰

B. The Mapmaking Algorithm’s Objectives: Pushing Toward the Pareto Frontier

As the Wright team’s search algorithm sought maps that satisfied all constraints and crept ever closer to the Pareto frontier, its objectives focused on four goals: maximizing compactness, minimizing county splits, minimizing municipal splits, and minimizing partisan impact. To better explore the “haystack” of potential maps, the Wright team experimented with different combinations of these factors across multiple runs of the search algorithm. Again, the descriptions of the Wright team’s approach are not meant to suggest that this is the best or only way to set algorithmic objectives—they merely serve as illustrations to guide future mapmakers.

1. Maximizing Compactness

The Law. As described above, the Wisconsin Constitution requires assembly districts to be as compact “as practicable,” which suggests this criterion must be balanced against others.²¹¹

The Algorithm. As noted above, constraints in the Wright team’s search algorithm set floors for compactness to ensure that both the minimum and the mean Polsby-Popper and Reock scores were at least as good as the 2022 Map’s.²¹² The algorithm’s objectives went further, however, to seek out maps that maximized a map’s mean compactness scores. So compactness was also an objective. This too comported with the *Clarke* court’s interpretation of the Wisconsin Constitution’s “as compact form as practicable” mandate.²¹³ Had the search algorithm evaluated compactness only as a constraint and not also as an objective, the resulting map’s compactness likely would have been driven down to the level of the 2022 Map as the algorithm sought to optimize other objectives.

The Results. As Professors Grofman and Cervas confirmed, the Wright Map’s districts were compact and convenient.²¹⁴ In both chambers, under three standard measures of district compactness—Polsby-Popper, Reock, and Convex Hull scores²¹⁵—the mean scores

209. *See infra* Section III.B.1.

210. *See infra* Section III.B.1.

211. *See supra* Section III.A.7.

212. *See supra* Section III.A.7.

213. WIS. CONST. art. IV, § 4.

214. *See* Grofman/Cervas Rpt., *supra* note 144, at 9.

215. The Polsby-Popper and Reock scores are explained above. *See supra* Section III.A.7. The Convex Hull score is also grounded in plane geometry but

for the Wright Map's districts consistently outperformed those for the 2022 Map's districts.²¹⁶

But this trait was not unique to the Wright Map. All six of the proposed remedies featured more compactness than the 2022 Map, though the Legislature's Map only barely improved on its predecessor.²¹⁷ Among the other five proposals, the Governor's Map and the Johnson Assembly Map scored somewhat better on multiple compactness metrics.²¹⁸

2. *Minimizing County Splits*

The Law. As noted above, the Wisconsin Constitution requires assembly districts to be bounded by county, town, or ward lines.²¹⁹ For most of the state's history, county lines were almost sacrosanct, as no assembly district combined parts of two or more counties.²²⁰ In *Clarke*, the Wisconsin Supreme Court acknowledged that modern population-equality standards would necessitate some county splits but stated that, when evaluating proposed maps, the court would consider "the extent to which assembly districts split counties."²²¹

The Algorithm. The Wright team's search algorithm sought to minimize the number of counties split between two or more districts.²²² Several recent developments to ReCom-style algorithms help preserve political subdivisions like counties.²²³ When two adjacent districts are merged into a super-district, the algorithm is

focuses on a district's indentation by comparing its area to the area that would be encompassed by stretching an imaginary rubber band around the district's perimeter. So a crescent-shaped district would perform poorly on this metric. A hypothetical circular district again would receive a perfect score.

216. See Jan. 12 Br., *supra* note 1, at 23–25 & fig.1.

217. See Jan. 22 App'x, *supra* note 152, at 10–11.

218. See *id.*

219. See *supra* Section III.A.3.

220. See H. Rupert Theobald, *Equal Representation: A Study of Legislative and Congressional Apportionment in Wisconsin*, in 1970 WIS. BLUE BOOK 71, 199–212; see also State ex rel. Att'y Gen. v. Cunningham, 51 N.W. 724, 740 (Wis. 1892) (Pinney, J., concurring) (citing "the constitutional rule preserving the territorial integrity of counties in the apportionment of the state into assembly districts").

221. *Clarke v. Wis. Elections Comm'n*, 2023 WI 79, ¶ 66, 998 N.W.2d 370, 398. Because, according to the 2020 Census, six of Wisconsin's seventy-two counties have too many residents for one senate district, and another nineteen counties have too many residents for one assembly district, some county splits are unavoidable today.

222. See Amariah Becker & Dara Gold, *The Gameability of Redistricting Criteria*, 5 J. COMPUTATIONAL SOC. SCI. 1735, 1740–50 (2022) (systematically comparing ways to measure how much a districting map splits political subdivisions such as counties).

223. See, e.g., Eric A. Autry et al., *Metropolized Multiscale Forest Recombination for Redistricting*, 19 MULTISCALE MODELING & SIMULATION 1885, 1885–87 (2021).

made “aware” of county lines and prioritizes using them when re-partitioning the super-district to create two new districts. The Wright team built on these developments to help the algorithm find maps with fewer county splits than if the district-drawing had been blind to county geography.

The Results. The Wright Map respected counties by reducing county splits, thereby preserving counties’ territorial integrity, as Professors Grofman and Cervas confirmed.²²⁴ In both the Assembly and the Senate the Wright Map split fewer counties than the map enacted by the Legislature in 2011, the map adopted by the *Johnson* court in 2022, and the maps proposed in 2024 by the Legislature and the Democratic Senators.²²⁵ But the Johnson, Governor’s, and Clarke Maps split even fewer counties than did the Wright Map.²²⁶

3. *Minimizing Municipal Splits*

The Law. Citing both state and federal precedent, the *Clarke* court identified “reducing [the number of municipal splits]” as one of the traditional but nonmandatory districting criteria worth considering “when evaluating submitted maps.”²²⁷

The Algorithm. As with counties, the Wright team’s search algorithm used recently developed techniques to pursue maps that minimized the number of municipalities (cities, villages, and towns) split between two or more districts.

The Results. By reducing the number of municipal splits, the Wright Map respected Wisconsin’s cities, villages, and towns, as Professors Grofman and Cervas confirmed.²²⁸ In both chambers combined, the Wright Map split fewer municipalities than did the map enacted by the Legislature in 2011 and the maps proposed in 2024 by the Legislature, the Democratic Senators, and the Governor.²²⁹ But the Clarke Map and the Johnson Map split even fewer municipalities, in each chamber, than the Wright Map did.²³⁰

4. *Minimizing Partisan Impact*

The Law. In addition to the districting mandates that indisputably would apply to a legislative map enacted by the State’s

224. See Grofman/Cervas Rpt., *supra* note 144, at 7–8 & n.15.

225. See Jan. 22 App’x, *supra* note 152, at 9, 14–15.

226. See *id.*

227. *Clarke v. Wis. Elections Comm’n*, 2023 WI 79, ¶ 68 & n.29, 998 N.W.2d 370, 399 & n.29 (citing *Johnson v. Wis. Elections Comm’n (Johnson III)*, 2022 WI 19, ¶ 69, 972 N.W.2d 559, 586; *Wis. State AFL-CIO v. Elections Bd.*, 543 F. Supp. 630, 636 (E.D. Wis. 1982) (three-judge court)); see also *id.* ¶ 66, 998 N.W.2d at 398 (citing WIS. CONST. art. IV, § 4) (discussing the extent to which assembly districts split towns).

228. See Grofman/Cervas Rpt., *supra* note 144, at 8 tbl.3.

229. See Jan. 22 App’x, *supra* note 152, at 12–13.

230. See *id.*

political branches, the Wisconsin Supreme Court held that a map ordered into effect by the judiciary must also minimize partisan impact.²³¹ In its December 2023 ruling in *Clarke*—unlike in *Johnson* two years earlier—the court recognized that, as “a politically neutral and independent institution,” the court must “consider partisan impact when evaluating remedial maps” to avoid selecting a map that advantages or privileges “one political party over another.”²³² The *Clarke* court explained that “it is not possible to remain neutral and independent by failing to consider partisan impact entirely.”²³³ Quoting the U.S. Supreme Court’s seminal precedent in *Gaffney v. Cummings*,²³⁴ the *Clarke* court explained that ignoring partisan impact is a “politically mindless approach [that] may produce, whether intended or not, the most grossly gerrymandered results.”²³⁵

A map designed to minimize partisan impact and equitably reflect all voters’ political viewpoints and partisan affiliations will promote three related goals: (1) majority rule (or majoritarianism), allowing the political party whose legislative candidates receive the majority of votes statewide to win the majority of legislative seats; (2) partisan symmetry, the equal treatment of both major parties’ voters; and (3) electoral responsiveness, with competitive districts making the Legislature responsive to the will of the electorate and sensitive to shifts in public opinion and voter preferences.²³⁶

These points are not new. In the nineteenth century, the Wisconsin Supreme Court recognized that legislative districting should strive to achieve “equality of representation” for all

231. See *Clarke*, 2023 WI 79, ¶¶ 69–71, 998 N.W.2d at 399–400.

232. *Id.*

233. *Id.* ¶ 71, 998 N.W.2d at 400.

234. 412 U.S. 735, 753 (1973).

235. *Clarke*, 2023 WI 79, ¶ 71, 998 N.W.2d at 400 (quoting *Gaffney*, 412 U.S. at 753); see also *Johnson v. Wis. Elections Comm’n (Johnson I)*, 2021 WI 87, ¶ 112, 967 N.W.2d 469, 503 (Dallet, J., dissenting) (“[A]lthough it sounds contradictory, the only way for the court to avoid unintentionally selecting maps designed to benefit one political party over others is by considering the maps’ likely partisan effects.”).

236. Electoral responsiveness is quite distinct from the other two goals. See ANTHONY J. MCGANN ET AL., *GERRYMANDERING IN AMERICA: THE HOUSE OF REPRESENTATIVES, THE SUPREME COURT, AND THE FUTURE OF POPULAR SOVEREIGNTY* 65–66 (2016); Edward R. Tufte, *The Relationship Between Seats and Votes in Two-Party Systems*, 67 AM. POL. SCI. REV. 540, 542, 544, 554 (1973). By contrast, majority rule, which usually focuses on vote shares or seat shares that are close to 50/50, is essentially a less exacting variant of partisan symmetry, which can be defined as a condition in which “*v* percent of the popular vote results in *s* percent of the seats, and this holds for all parties and all vote percentages.” Richard G. Niemi & John Deegan, Jr., *A Theory of Political Districting*, 72 AM. POL. SCI. REV. 1304, 1304 (1978).

Wisconsinites,²³⁷ that “the voice of the majority shall govern,”²³⁸ and that “the will of the majority of the voters . . . shall prevail.”²³⁹ And at the dawn of the reapportionment revolution in the 1960s, the U.S. Supreme Court elaborated on these same “democratic ideals of equality and majority rule,” stating:

Logically, in a society ostensibly grounded on representative government, it would seem reasonable that a majority of the people of a State could elect a majority of that State’s legislators. . . . Since legislatures are responsible for enacting laws by which all citizens are to be governed, they should be bodies which are collectively responsive to the popular will.²⁴⁰

At a minimum, these democratic ideals of equality and majority rule require that a remedial map not systematically award most of the legislative seats to one political party if the other political party’s candidates earn more votes statewide.²⁴¹

The Algorithm. Designing a search algorithm to minimize partisan impact and promote majority rule, partisan symmetry, and electoral responsiveness, all while addressing other districting criteria, proved to be the most complex aspect of this computational-redistricting exercise. The Wright team’s algorithm had to assess whether votes that citizens could be expected to cast in future legislative elections would be equitably translated into legislative seats under a newly proposed map—so that control of the legislative chambers was more likely to be secured by the political party whose legislative candidates won the most votes statewide. That in turn required a model for forecasting how many votes each party’s candidates would receive in potential future assembly and senate elections and how many seats each party’s candidates would win.

As described below, the Wright team developed a Wisconsin-specific model for forecasting each major political party’s future vote totals in both the Assembly and the Senate in each ward in the State, assuming that both parties fielded a candidate in each district.²⁴² The

237. *State ex rel. Lamb v. Cunningham*, 53 N.W. 35, 57 (Wis. 1892).

238. *Soens v. City of Racine*, 10 Wis. 271, 276 (1860).

239. *Gillespie v. Palmer*, 20 Wis. 544, 561 (1866) (Dixon, C.J., concurring).

240. *Reynolds v. Sims*, 377 U.S. 533, 565–66 (1964).

241. Many courts have thus sought to minimize partisan impact when selecting a remedial map. *See, e.g.*, *Jackson v. Nassau Cnty. Bd. of Supervisors*, 157 F.R.D. 612, 615 (E.D.N.Y. 1994); *Good v. Austin*, 800 F. Supp. 557, 567 (E.D. Mich. 1992) (three-judge court); *Prosser v. Elections Bd.*, 793 F. Supp. 859, 867 (W.D. Wis. 1992) (three-judge court) (per curiam); *Hastert v. State Bd. of Elections*, 777 F. Supp. 634, 659 (N.D. Ill. 1991) (three-judge court); *Carter v. Chapman*, 270 A.3d 444, 470 (Pa. 2022); *Maestas v. Hall*, 274 P.3d 66, 76 (N.M. 2012); *Burling v. Chandler*, 804 A.2d 471, 483 (N.H. 2002); *Wilson v. Eu*, 823 P.2d 545, 576 (Cal. 1992); *Legislature v. Reinecke*, 516 P.2d 6, 38 (Cal. 1973).

242. The Wright team used a two-party election model because independent, third-party, and write-in candidates often get less than 1%, and almost always

Wright team assessed the model's outcomes under a hypothetical statewide vote that was perfectly evenly divided between the two parties. Given the hyper-competitive nature of Wisconsin's statewide electorate, transforming the model's original results to reflect a fifty-fifty perfect tie required little adjustment. With a tied statewide vote, the ideal level of symmetry and majoritarianism would dictate each party carrying forty-nine or fifty (of the ninety-nine) assembly districts and sixteen or seventeen (of the thirty-three) senate districts, with forecasted elections in the median assembly district and the median senate district being as close to tied as possible. This, after all, would epitomize partisan symmetry and maximize the prospects for majority rule in both legislative chambers.²⁴³ Thus, party control of the Legislature would not be preordained by the mapmakers, but rather driven in each election cycle by the people of Wisconsin. So the Legislature's composition would follow shifts in popular sentiment.

Constructing an accurate model to predict legislative-election results is not easy. Perhaps the simplest model for forecasting votes cast in a future assembly (or senate) election in a given ward would be to use the Democratic and Republican vote totals in that ward from the most recent assembly (or senate) election. But if only one party fielded a candidate in that legislative election in the district containing the ward, the vote totals would be deceptively low and, more importantly, misleading, with one party capturing 100% of the vote and the other getting 0%. And a similar (if muted) problem might arise if the most recent legislative election pitted a powerful longtime incumbent against an underfunded, largely unknown political newcomer.

A common workaround is to use ward-level vote totals for each major political party from the most recent presidential election, when two well-known, amply funded candidates squared off in every ward in the state. This method seemingly promotes evenhanded comparisons appropriate for statewide analyses. Unless a

less than 5%, of the total votes cast in Wisconsin. See John Johnson, Craig Gilbert & Charles Franklin, *Wisconsin Elections, 2000–2025: Statewide Overview*, MULAW POLL (June 6, 2025), <https://perma.cc/6YUQ-SXHN>.

243. The operative principles here are majority rule and partisan symmetry—not proportional representation. If, for example, one party's assembly candidates garnered 55% of the vote statewide, it might well be reasonable for that party to win, say, 60 of the 99 assembly seats (i.e., about 61% of the seats), so long as the *other* major party would be similarly rewarded if *its* assembly candidates likewise garnered 55% of the vote statewide. Partisan symmetry thus “does not require proportionality but only that the disproportionality be the same for both parties.” MCGANN ET AL., *supra* note 236, at 65–66; see also Jonathan Cervas, Bernard Grofman & Scott Matsuda, *The Role of State Courts in Constraining Partisan Gerrymandering in Congressional Elections*, 21 U.N.H. L. REV. 421, 430 & n.51 (2023) (citing sources) (“Social science is unequivocal in NOT expecting proportionality in single-member, winner-take-all districting schemes.”).

presidential or vice-presidential candidate hailed from Wisconsin, neither ticket would have profited from any obvious “home field” advantage in one part of the state. And because partisan affiliation and electoral behavior, at least in recent years, often reflects voters’ views of current or recent occupants of the White House,²⁴⁴ the last presidential vote alone may be a decent, albeit rough, proxy for the next assembly (or senate) vote.²⁴⁵ But simply assuming that future legislative elections will mirror past presidential elections ignores several variables that might significantly improve an election model’s accuracy.

The Wright team developed a sophisticated Wisconsin-specific election model that was trained on recent, ward-level Wisconsin assembly and senate election returns and took into consideration a broad set of nuanced factors, including: a partisan baseline calculated using the results of both presidential and nonpresidential statewide elections in each ward; recent trends in each ward’s partisan performance;²⁴⁶ the presence of a legislative incumbent on the ward’s ballot;²⁴⁷ and the “personal vote” that legislative incumbents benefit from solely in wards that they already represent.²⁴⁸

244. See GARY C. JACOBSON, *PRESIDENTS AND PARTIES IN THE PUBLIC MIND* 1, 143, 190 (2019).

245. See STEVEN ROGERS, *ACCOUNTABILITY IN STATE LEGISLATURES* 206–09 (2023).

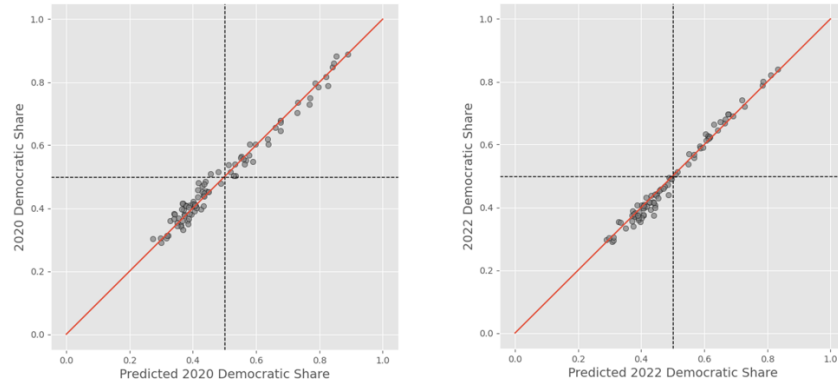
246. For an astute summary of recent partisan patterns and trends in different geographic regions of Wisconsin, see John Johnson, *Wisconsin Elections, 2000–2025: Wisconsin’s Frozen Electorate*, *MULAW POLL* (June 6, 2025), <https://perma.cc/K3VD-RSRK>.

247. See ROGERS, *supra* note 245, at 135–78 (analyzing voters’ responses to state-legislative incumbents seeking reelection); see also Stephen Ansolabehere & James M. Snyder, Jr., *The Incumbency Advantage in U.S. Elections: An Analysis of State and Federal Offices, 1942–2000*, 1 *ELECTION L.J.* 315, 320 fig.2 (2002) (showing that state legislators outperform challengers and open-seat candidates, but their advantages are typically not as large as federal legislators’).

248. See Stephen Ansolabehere, James M. Snyder, Jr. & Charles Stewart, III, *Old Voters, New Voters, and the Personal Vote: Using Redistricting to Measure the Incumbency Advantage*, 44 *AM. J. POL. SCI.* 17, 17 (2000) (showing that the personal vote accounts for much of the incumbency advantage).

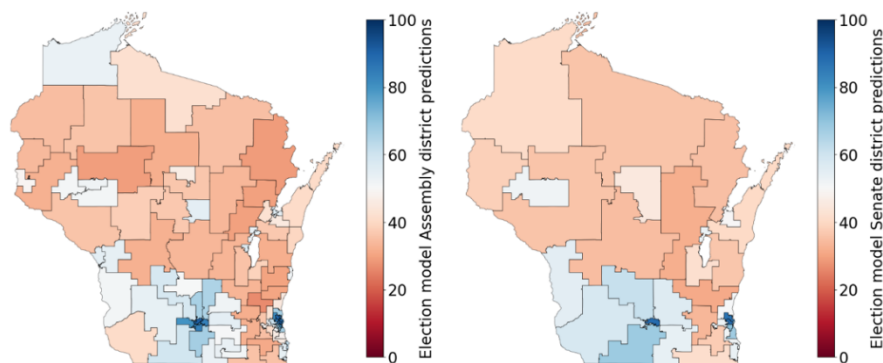
Figure H shows the results of that model when used to predict November 2020's ninety contested legislative elections and November 2022's eighty-five contested legislative elections (using only data that would have been available beforehand). The two graphs show that the Wright team's model performed exceptionally well. It correctly predicted the winning party in eighty-eight of the ninety elections in 2020 and eighty-four of the eighty-five elections in 2022. The plots also show that the predicted Democratic vote share by district closely aligned with actual outcomes.

FIGURE H²⁴⁹



249. Each dot in the left panel represents one of the ninety contested Wisconsin legislative elections in November 2020. The x-value is the Democratic vote share in the actual district election. The y-value is the Wright election model's prediction, based only on data from before 2020. The right panel shows the equivalent data for November 2022's eighty-five contested Wisconsin legislative elections. The proximity of the grey dots to the red diagonal line ($y=x$) demonstrates the accuracy of the model's district-specific election forecasts.

Figure I shows the Wright Map, with each district colored according to the model’s January 2024 prediction for the November 2024 general election, with blue signifying a Democratic and red a Republican district. For these purposes, the model treated all senate districts, including those with odd district numbers, as if they were up for election at the same time. The Wright team could forecast each chamber’s partisan makeup, fold this forecast into their mapmaking search algorithm, and thus pursue maps that would prioritize the principle of majority rule.

FIGURE I²⁵⁰

Although the Wright team’s search algorithm sought to minimize partisan impact primarily by operationalizing that criterion as an *objective*, it also used a *constraint* to address one related issue: treating Democratic and Republican incumbent officeholders equitably. Regardless of what mapmaking technology is deployed, when a new map replaces a fair map, an imbalance in the partisan composition of the “paired” incumbents (those who can seek reelection only by competing against a fellow sitting legislator) sometimes suggests a lack of neutrality in the new map. But the 2022 Map, far from being fair, was severely skewed, with Republican incumbents outnumbering Democratic incumbents by about two to one.²⁵¹ To promote neutrality and partisan symmetry, more Republican

250. Each district in the Wright Assembly Map (left panel) and Wright Senate Map (right panel) is colored by the election model’s prediction for the November 2024 legislative elections. Being able to estimate each district’s partisanship allowed the Wright team to optimize partisan-fairness measures during algorithm runs.

251. See Dan Shafer, *New Board, New Game*, RECOMBOBULATION AREA (Sept. 16, 2024), <https://perma.cc/BQ8V-UF8V> (“[T]here are simply more Republican incumbents because of the outsized level of seats that they’d gained under The Gerrymander.”).

incumbents would have to be paired, to bring the number of *unpaired* Republican incumbents closer to parity with the number of *unpaired* Democratic incumbents. The algorithm accomplished this goal by constraining the pairing of incumbent legislators.

The Results. The Wright Map excelled on partisan neutrality. Prior to the *Clarke* litigation, a pervasive myth had held that it was impossible to draw a politically neutral map for the Wisconsin Legislature because Democratic voters are clustered in dense urban centers, especially in Milwaukee and Madison, while Republicans are spread more efficiently across most of the state.²⁵² The petitioners' proposed remedies, particularly the Wright Map, laid that myth to rest.

The Wright Map demonstrated that the votes that Wisconsin citizens will cast in future legislative elections can be equitably translated into legislative seats—and likely into control of both legislative chambers by whichever political party's candidates earn the most votes statewide. To be sure, no map can entirely eliminate the risk of an antimajoritarian outcome, with one political party gaining (or retaining) control of the Legislature while another party's legislative candidates win more votes statewide. But among the half-dozen remedial maps the parties proposed to the court, the Wright Map most effectively minimized this risk.

The court's expert consultants, Professors Grofman and Cervas, confirmed that the Wright Map satisfied principles of political neutrality, partisan symmetry, and majority rule, as “most of the time, the party that wins the most votes will win the most seats” in both the Assembly and the Senate.²⁵³ The consultants drew a sharp distinction between, on the one hand, the Legislature's and the Johnson Maps—each of which they deemed a “partisan gerrymander” that would insulate the Legislature from “the forces of electoral change”—and, on the other hand, the petitioners' four proposed remedies, including the Wright Map.²⁵⁴ The Johnson Map, they estimated, would eliminate less than one third of the 2022 Map's pro-Republican skew, and the Legislature's Map would not reduce the skew at all.²⁵⁵ The court's consultants identified the petitioners' four proposed remedies as “markedly more politically neutral,” estimating that any of them would eliminate more than two-thirds of the 2022 Map's pro-Republican skew in each chamber.²⁵⁶ Importantly, the

252. See *Johnson v. Wis. Elections Comm'n (Johnson I)*, 2021 WI 87, ¶ 48, 967 N.W.2d 469, 484; see also Grofman/Cervas Rpt., *supra* note 144, at 23–24 (debunking this myth).

253. Grofman/Cervas Rpt., *supra* note 144, at 23.

254. *Id.* at 14 n.26, 22–25.

255. See *id.* at 22; see also Feb. 8 Br., *supra* note 188, at 15–19.

256. Grofman/Cervas Rpt., *supra* note 144, at 20–21; see *id.* at 16, 22–24.

court's consultants found that none of these four proposals "overshot" its target and created partisan bias favoring Democrats.²⁵⁷

Likewise, the Wright petitioners' testifying expert, Washington State University data-analytics professor Daryl DeFord, pressure-tested the Wright Map using his own Wisconsin-specific model analyzing not only statewide-election results but also ward-level returns in state-legislative elections, incumbency factors, and recent trends. Professor DeFord concluded that the various petitioners' maps all vastly improved on the 2022 Map, and that the Wright Map was extraordinarily symmetric and majoritarian.²⁵⁸ Professor DeFord found that, among the four proposals that largely eliminated the prior maps' partisan skew, assessments varied depending on which partisan-fairness metric was deployed. Although the differences were not huge, he found that the Democratic Senators' Senate Map and the Wright Assembly Map came closest to perfect neutrality.²⁵⁹

Larger differences among these four proposed remedies became apparent when analyzing incumbent "pairings" and, as discussed in more detail below,²⁶⁰ the sequencing of staggered senate elections. As for "pairing" incumbents so they can seek reelection only by competing against a fellow sitting legislator, the Wright Map treated Democratic and Republican incumbent officeholders more equitably. Because the 2022 Map was severely skewed, Republican incumbents outnumbered Democratic incumbents by about two to one.²⁶¹ So, in a truly neutral, symmetric remedial map in a highly competitive state like Wisconsin, it was likely that more Republican legislative incumbents would have to be paired against another sitting legislator. Each of the six proposed remedies left more Republican incumbents than Democratic incumbents *unpaired*, potentially handing those incumbents a smoother path to reelection. But the Wright Map did the best job of reducing this discrepancy, thus

257. See *id.* at 23–24 (stating that these four maps retained "modest levels of partisan bias" and thus "remain[ed] tilted toward the Republicans"); *id.* at 16 (referring to the maps' "modest Republican-leaning partisan bias").

258. See DeFord Rpt., *supra* note 149, at 22, 28, 30, 33, 41; Jan. 22 Br., *supra* note 151, at 28–31; Jan. 12 Br., *supra* note 1, at 40–48.

259. See Jan. 22 Br., *supra* note 151, at 28–31; see also Sam Wang, *Grading Wisconsin's Potential New Legislative Maps: Wright Petitioners, Governor Evers, and Clarke Petitioners Rise to the Top of the Class*, SUBSTACK: FIXED BUGS IN DEMOCRACY (Jan. 19, 2024), <https://perma.cc/R5T7-ZS4L> (giving the Wright Map a letter grade of A for both the Assembly and the Senate, stating that the "Wright petitioners score very well on partisan symmetry," and highlighting that, among the parties' six proposals, the Wright Map had the "mean-median difference that is closest to [a perfect] zero" and was most likely to generate majoritarian outcomes in both chambers).

260. See *infra* Section III.C.

261. See Jan. 22 Br., *supra* note 151, at 32.

minimizing partisan impact, consistent with the court's request.²⁶² On this measure, there was a clear rank-ordering, with the Wright Map performing best.²⁶³

Part of the reason why the Wright Map scored so well on partisan symmetry was that it contained enough competitive districts to reflect even relatively small, but meaningful, shifts in voter preferences. This made the Wright Map responsive to the shifting will of the electorate, as Professors Grofman and Cervas confirmed.²⁶⁴

Professor DeFord identified as “competitive” the districts where neither party's nominee would be likely to win the general election by six or more percentage points, meaning both candidates were expected to garner between 47% and 53% of the vote.²⁶⁵ Other than the Legislature's Map, all the proposed remedies contained more of these districts, in each chamber, than did the 2022 Map.²⁶⁶ The 2022 Map and the Legislature's Map each had only eight competitive legislative districts.²⁶⁷ By contrast, the Wright Map had twenty, and the other proposed maps had between eleven and eighteen.²⁶⁸ And the Wright Map's electoral responsiveness was robust across multiple methodologies.²⁶⁹

Of course, the parties, the Wisconsin Supreme Court, and their respective experts were evaluating and comparing the proposed maps long before the August 2024 primaries and the November 2024 general election were held. Today, by contrast, we know precisely how the Governor's Map performed in those elections. And we can

262. See *Clarke v. Wis. Elections Comm'n*, 2023 WI 79, ¶¶ 69–71, 998 N.W.2d 370, 399–400.

263. See Jan. 22 Br., *supra* note 151, at 31–32.

264. See Grofman/Cervas Rpt., *supra* note 144, at 23–24 (petitioners' maps would “create a competitive environment,” “reflect the political competitiveness of the state,” and subject the Wisconsin Legislature to “the forces of electoral change”); *id.* at 12 n.2 (“[Maps] demonstrating this property of responsiveness—where an increase in . . . vote share leads to an increase in the number of seats won—align with the principle of representing the changing dynamics of voter sentiment.”); Jan. 22 Br., *supra* note 151, at 32–36; Jan. 12 Br., *supra* note 1, at 48–49.

265. DeFord Rpt., *supra* note 149, at 44; *accord* Jan. 22 Br., *supra* note 151, at 32; Jan. 12 Br., *supra* note 1, at 48.

266. See Jan. 22 App'x, *supra* note 152, at 109.

267. See *id.*

268. See *id.*

269. See Jan. 22 Br., *supra* note 151, at 33–36; Feb. 8 Br., *supra* note 188, at 21. Commentators and amici also recognized the Wright Map's electoral responsiveness. See, e.g., Craig Gilbert, *In a 50/50 Wisconsin Electorate, What Does a “Neutral” Election Map Look Like?*, MILWAUKEE J. SENTINEL (Jan. 29, 2024), <https://perma.cc/T63Z-2VCE> (noting that the Wright Map had “the highest number of competitive Assembly seats”); Brief of Amicus Matthew Petering, Ph.D., Regarding Consultants' Report at 24, *Clarke v. Wis. Elections Comm'n*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Feb. 8, 2024) (similar, for both the Wright and the Johnson Maps).

estimate how an alternative, such as the Wright Map, would have performed had it been adopted. Accurate estimation is aided by the fact that, in addition to ward-level results for state-legislative elections, we also have ward-level results from the two statewide elections at the top of the same ballot in November 2024. Remarkably, they form a mirror image: in the presidential election, the Republican, President Donald Trump, won by about 29,000 votes (0.87 percentage points) over Vice President Kamala Harris,²⁷⁰ while in the U.S. Senate election, the Democrat, Senator Tammy Baldwin, won by about 29,000 votes (0.87 percentage points) over entrepreneur Eric Hovde.²⁷¹ Averaging those two elections provides insight into how votes might have been distributed across districts in a 2024 general election if the two parties had been almost perfectly tied statewide.²⁷²

Because the Governor's Senate Map was used in 2024 elections covering only half the state, it is more straightforward to analyze the seats-votes relationship in the Governor's Assembly Map, which applied statewide in 2024. Under that map, the Republican advantage in the Assembly shrunk by more than two-thirds, dropping from twenty-nine seats (sixty-four Republicans, thirty-five Democrats) under the 2022 Map to only nine seats (fifty-four Republicans, forty-five Democrats).²⁷³

The Republican advantage might have declined even further absent a stark imbalance in candidates advantaged by incumbency, as there were fifty Republican but only twenty-two Democratic incumbents on the general-election ballot in November 2024.²⁷⁴

270. See Lawrence Andrea, *Donald Trump Wins Wisconsin, Propelling His Return to the White House*, MILWAUKEE J. SENTINEL (Nov. 6, 2024), <https://perma.cc/4MFX-8YES>.

271. See Lawrence Andrea, *Eric Hovde Again Cites Debunked Claims in Questioning His 2024 Election Loss to Tammy Baldwin*, MILWAUKEE J. SENTINEL (Feb. 12, 2025), <https://perma.cc/DS4P-6YBY>.

272. Furthermore, because Baldwin and Hovde both hail from Madison, there is no need to compensate for any regional "home field" advantage.

273. As for the Assembly's sixty-four Republican and thirty-five Democratic incumbents: ten Republican and thirteen Democratic members did not seek reelection, four Republican and zero Democratic members lost their primaries (all to fellow legislators), four Republican and zero Democratic members lost in the general election (with three falling to Democratic challengers and one to a Democratic incumbent), and forty-six Republican and twenty-two Democratic members were successfully reelected. Of the nine Republican assembly incumbents who moved their residences to new assembly districts in 2024, seven won. As of January 2025, there were twenty-three new Democrats, eight new Republicans, and a record thirty-four women in the Assembly. See LAURA FELONE DAY, WIS. LEGIS. REFERENCE BUREAU, PROFILE OF THE 2025 WISCONSIN LEGISLATURE 1–3 (2025).

274. In addition to the fifty Republican assembly incumbents who ran for reelection in November 2024, three Republican *former* assembly incumbents, who collectively had served fifty-four years in the Legislature, successfully ran and returned to the Assembly.

Republican assembly candidates carried a majority of the map's twelve most competitive districts (based on the Trump/Hovde average) because most of those districts had Republican incumbents, and all but one of those Republican incumbents were reelected.²⁷⁵

But incumbency was not the whole story. Throughout the State, Republican Assembly candidates—not only incumbents, but also challengers and open-seat candidates—outperformed the Republicans at the top of the ticket. In seventy of the eighty-two districts where both major parties had nominees on the ballot, the Republican assembly candidate outperformed both Hovde and Trump; and in seventy-four of those eighty-two districts the Republican assembly candidate outperformed the Trump/Hovde average which, again, represents a nearly dead-even statewide vote.²⁷⁶ In a year when Republican assembly candidates were running that well, any map that minimized partisan impact would likely have resulted in Republicans maintaining control of the Assembly.

Had the Wright Map, instead of the Governor's Map, been adopted, Democrats would have ended up in a stronger position in the 2025 Senate, for reasons developed further below.²⁷⁷ But the net difference between the two maps in the Assembly was modest.²⁷⁸ All in all, as the court's consultants had found, both assembly maps “avoid[ed] political gerrymandering,” were “markedly more politically neutral” than the prior map, and, if adopted, would reflect “the political competitiveness of the state” and “the will of the electorate.”²⁷⁹

These benefits flowed in part from the maps' electoral responsiveness. Based on the Trump/Hovde (or Harris/Baldwin) average, both maps improved over the 2022 Map, with the Governor's Map and the Wright Map having 12 districts and 20 districts,

275. See Shawn Johnson, *Republicans Retain Majority in Wisconsin Assembly*, WIS. PUB. RADIO (Nov. 6, 2024), <https://perma.cc/J5UC-5D6F>.

276. Cf. John Johnson, *Donald Trump Won 50 Wisconsin Assembly Seats. So Did Tammy Baldwin.*, MARQ. UNIV. L. SCH.: FAC. BLOG (Nov. 15, 2024), <https://perma.cc/2Q46-DPTB> (comparing assembly election returns with returns from elections for President and U.S. Senate).

277. See *infra* Section III.C.

278. On the one hand, in Wisconsin's Fox Valley, for example, Democrats likely would have carried two assembly districts in Outagamie County instead of one, picking up an open seat in Appleton and Grand Chute; and a southern Milwaukee County assembly district that Republican incumbent Bob Donovan moved into and carried only narrowly would have been even harder for him to win. On the other hand, in the La Crosse metropolitan area in southwestern Wisconsin, Vernon County's Republican Representative Loren Oldenburg, one of only four assembly incumbents defeated in November 2024 under the Governor's Map, might have prevailed under the Wright Map, which kept rural, increasingly Republican Crawford County in his district.

279. Grofman/Cervas Rpt., *supra* note 144, at 16, 21, 23–24.

respectively, in the range that Professor DeFord had identified as competitive (47% to 53%).²⁸⁰

C. *The District-Numbering Algorithm*

The Wright team made one final, crucial innovation in designing its map: it used an algorithm to optimize the way senate districts were numbered, to accelerate unwinding the existing Republican gerrymanders. The Wisconsin Senate presents a distinctive and especially interesting story because, unlike the Assembly, its members serve staggered four-year terms, with half the members “holding over” and half subject to election in any two-year cycle.

The Law. The Wisconsin Constitution provides that “senate districts shall be numbered in the regular series, and the senators shall be chosen alternately from the odd and even-numbered districts for the term of 4 years.”²⁸¹ And Wisconsin law requires nesting Assembly Districts 1, 2, and 3 in Senate District 1; Assembly Districts 4, 5, and 6 in Senate District 2; and so on.²⁸²

Because Wisconsin Senators serve staggered four-year terms, with even-numbered districts voting in presidential-election years and odd-numbered districts voting in midterm-election years, for the two calendar years following the initial post-redistricting election roughly half the Senators are “holdovers” elected from districts in the old map. The benefits of the new senate map thus do not fully accrue until after the second biennial election under the new map.

Without careful consideration of which districts get even numbers and which get odd, even a map with district boundaries drawn to minimize partisan impact runs the risk of unnecessarily perpetuating or even increasing partisan bias in the Senate for two extra years. That problem would seem curable through careful district-numbering. But district numbering is typically constrained because “holdover” Senators who retain their district numbers ordinarily should not be required to represent wholly foreign parts of the State.²⁸³ When possible, there should be overlap between a holdover Senator’s former and new districts. To bolster continuity, it therefore may be preferable for senate districts to consist of “some or all of the same counties as the parallel predecessor districts” under the prior senate map.²⁸⁴

280. See *Election Results Archive*, WIS. ELECTIONS COMM’N (2025), <https://perma.cc/9HLZ-FPFA>; see also DeFord Rpt., *supra* note 149, at 44.

281. WIS. CONST. art. IV, § 5.

282. See WIS. STAT. § 4.009 (2023); see also WIS. CONST. art. IV, § 5 (“[N]o assembly district shall be divided in the formation of a senate district.”).

283. See, e.g., 71 OP. ATT’Y GEN. WIS. 157, 161 (1982).

284. *Johnson v. Wis. Elections Comm’n (Johnson I)*, 2021 WI 87, ¶ 85 n.13, 967 N.W.2d 469, 495 n.13 (Hagedorn, J., concurring) (citations omitted) (arguing for a least-change approach).

Even with continuity bolstered this way, some voters will be shifted into new districts such that they will get to vote in senate elections in two consecutive cycles and others will need to wait six years for a new senate election. That inequity is “an inevitable concomitant of redistricting” in a state that holds staggered senate elections even after redistricting.²⁸⁵ Following each redistricting, courts in Wisconsin have viewed some two-year waits and some six-year waits “as inevitable, and thus as presumptively constitutional, so long as no particular group is uniquely burdened.”²⁸⁶ This issue is not unique to Wisconsin.²⁸⁷

The Algorithm. Once the Wright team finalized its map’s district boundaries, all that remained was numbering the districts. This final stage presented an optimization problem best solved by computer. To identify an optimal solution to the district-numbering problem, the Wright team framed the renumbering task as a linear-assignment problem—a problem that can be solved optimally with an efficient algorithm.

The team’s primary objective was to minimize partisan impact from the senate map immediately following the 2024 election. The secondary objectives were to minimize the number of Wisconsin residents facing a six-year wait before voting again for a Senator and to maximize the number who retained their senate-district number. Given a relative weighting of these objectives, the senate district-numbering problem (unlike the mapmaking “problem”) is not computationally intractable and thus could be solved to optimality.

After the district-numbering algorithm established the number for each new senate district, its three nested assembly districts received the corresponding assembly-district numbers. So, for example, Senate District 1 would contain Assembly Districts 1, 2, and 3. For each assembly-district triplet, there are only six options for assigning these assembly-district numbers. The algorithm chose from among those six options by maximizing the number of assembly incumbents who would retain their district numbers and then broke ties by maximizing the number of assembly constituents who would retain their assembly-district numbers.

The Results. The Wright team’s district-numbering algorithm yielded impressive results promoting partisan balance. The Wright Map was the only proposed remedy that offered the possibility of

285. *Prosser v. Elections Bd.*, 793 F. Supp. 859, 866 (W.D. Wis. 1992) (three-judge court) (per curiam); *see also* *Wis. State AFL-CIO v. Elections Bd.*, 543 F. Supp. 630, 659 (E.D. Wis. 1982) (three-judge court).

286. *Baldus v. Members of Wis. Gov’t Accountability Bd.*, 849 F. Supp. 2d 840, 852 (E.D. Wis. 2012) (three-judge court).

287. *See* Margaret B. Weston, Comment, *One Person, No Vote: Staggered Elections, Redistricting, and Disenfranchisement*, 121 *YALE L.J.* 2013, 2028–30 (2012) (listing Wisconsin as one of sixteen states with staggered senate terms that continue after redistricting).

majoritarian outcomes in both houses of the Legislature—Assembly and Senate—beginning in November 2024. The other proposed remedies effectively preordained continued Republican control of the Senate for an additional two years, no matter how Wisconsinites voted.

Because of the prior gerrymanders, the class of holdover Senators elected in 2022 from odd-numbered districts was imbalanced, with twelve Republicans and only five Democrats.²⁸⁸ The Wright Map, however, was designed to contain enough competitive senate districts—including even-numbered ones—to put control of the next Wisconsin Senate in the hands of Wisconsin's voters without delay.²⁸⁹ If the November 2024 state-senate general election tilted Republican, the Wright Map was designed to likely return a Republican Senate.²⁹⁰ But if the election tilted Democratic, the Wright Map—and only the Wright Map—likely would allow Democrats to control the chamber.²⁹¹

Under the Wright Map, if the 2024 general election was generally a strong one for Democrats, the Senate in 2025 and 2026 was projected to likely have seventeen Democrats and sixteen Republicans.²⁹² Under any of the other proposed maps, the maximum was projected to be fifteen or fewer Democrats, and in fact the new Senate seated in January 2025, following the November 2024 election under the Governor's Map, consisted of fifteen Democrats and eighteen Republicans.²⁹³

Put differently, based on Professor DeFord's model, if Democrats won at least 50.4% of the statewide vote in November 2024, they would likely have taken control of the Senate in January 2025 under the Wright Map.²⁹⁴ The equivalent figures required for Democratic control of the Senate under the Governor's Map and the Clarke Map were 59.0% and 59.2%, respectively; and for the Democratic Senators' Map, 64.7%.²⁹⁵ In Wisconsin, where no statewide candidate had garnered even 56% of the vote in any contested partisan election in the previous decade,²⁹⁶ Democratic support at levels like 59% or 64% was unimaginable. So the Wright Map was unique in not dictating two more years of Republican control of the Senate. That distinction

288. See Feb. 8 Br., *supra* note 188, at 21.

289. See Jan. 12 Br., *supra* note 1, at 39.

290. See Feb. 8 Br., *supra* note 188, at 22.

291. See Jan. 22 Br., *supra* note 151, at 38; Feb. 8 Br., *supra* note 188, at 22–23.

292. See Jan. 22 Br., *supra* note 151, at 38.

293. See *id.*

294. See *id.* at 39.

295. See *id.*

296. See *Election Results Archive*, WIS. ELECTIONS COMM'N (2025), <https://perma.cc/9HLZ-FPFA>.

was likely a key consideration in the Republicans' decision to enact the Democratic Governor's proposal.²⁹⁷

IV. THE STRENGTHS AND LIMITS OF COMPUTATIONAL REDISTRICTING

The prior Part shows in detail how mapmakers can use a computational-redistricting approach to draw an excellent map in the context of a real dispute. But the Wisconsin experience also yields broader lessons about the strengths and limits of computational redistricting.

The most important strength is that, compared with the manual approach, computational redistricting permits mapdrawers to consider many more high-performing maps. The ability to find superior maps can keep decisionmakers focused on the maps' effects and can meaningfully alter the incentives of political actors in the real world. In the Wisconsin case, for instance, the existence of a map drawn with computational tools appears to have helped resolve a legislative impasse and led Wisconsin Republicans to enact a map proffered by the Democratic Governor.²⁹⁸

Nonetheless, as described in the second half of this Part, computational redistricting has important limits. Human judgment remains crucial. And like any tool, a computational approach cannot itself resolve fundamental normative questions, including issues relating to what constitutes fair and effective representation that inevitably must guide mapmakers' choices. "[W]e must distinguish between . . . comput[at]ional redistricting] as a tool, as it can be, and as a saviour, which it can never be."²⁹⁹

A. *The Strengths of Computational Redistricting*

Based on the Wisconsin case study, it appears that the strengths of a computational-redistricting approach like the one used by the Wright team take three primary forms: creating better maps, refocusing districting disputes on maps and their effects, and altering real-world incentives. These strengths will only increase as technology improves in the run-up to the post-2030 round of redistricting.

1. *Creating Better Maps*

The experience of the Wright team in Wisconsin shows that computational redistricting can create better maps than can be drawn by even the nation's most skilled traditional mapmakers. Most obviously, by permitting the Wright team to assess many more high-performing maps than would be possible for a manual mapmaker to

297. See *supra* Section II.B.5.

298. See *supra* Section II.B.5.

299. Robert G. Dixon, Jr., 'One Man, One Vote'—What Happens Next?, 60 NAT'L CIVIC REV. 259, 264 (1971).

consider, computational redistricting helped generate a better map with respect to several criteria than could be achieved by hand with only traditional mapmaking software.

Redistricting is all about tradeoffs among competing criteria.³⁰⁰ In practice rather than theory, however, finding the set of maps on the actual Pareto frontier is almost certainly an intractable problem. Though computational redistricting cannot generate a set of truly Pareto-optimal maps, it can generate a set of maps that are closer to the Pareto frontier than mapmakers are likely to find by hand.³⁰¹ The maps' strengths are largely a function of the algorithm's quality and the length of time it is allowed to search for improvements. Usually, the longer a well-designed algorithm runs, the closer to the true frontier it can get, as it finds maps that dominate the "best" ones that it found previously. The set of maps generated in this way will likely be superior to maps that could be created manually—but once that set of maps is in hand, human input remains necessary to choose among them.

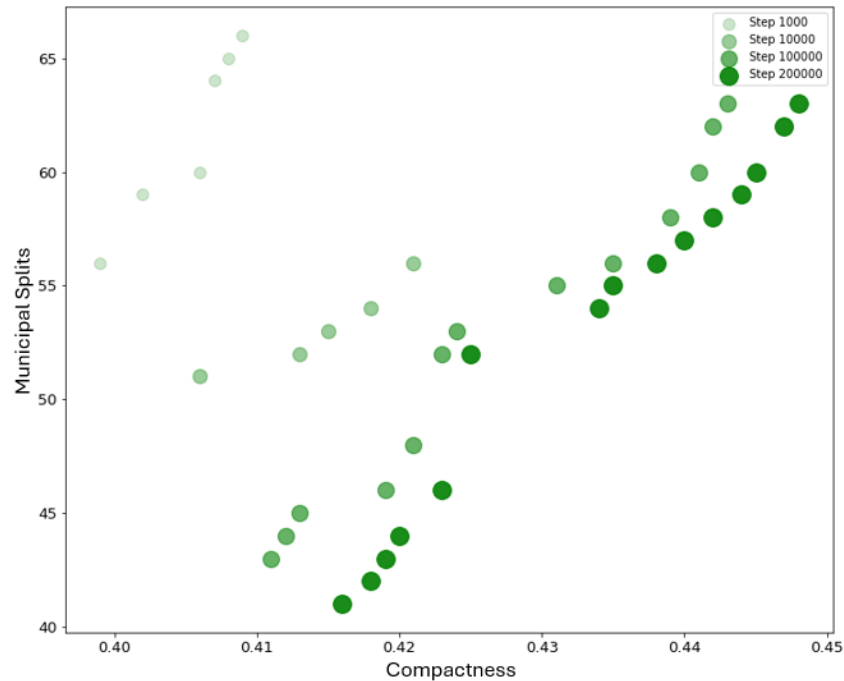
For example, Figure J shows a tradeoff between two criteria: district compactness (on the x-axis, where a higher compactness score is better) and respect for municipalities (on the y-axis, where a lower number of municipalities split by district boundaries is better). So maps in the graph's upper-left region are least desirable, and maps in the lower-right area are most desirable. Each green dot represents a single statewide map. The set of lightest green dots shows tradeoffs between compactness and municipal integrity that the search algorithm found relatively quickly. New tradeoffs between these two criteria emerged as the algorithm ran for a longer time. The maps that the algorithm initially generated were soon dominated by maps that the algorithm took longer to find. Thus, the darkest green dots, which represent maps that took longer for the algorithm to find, generally exhibit both higher levels of compactness (so the dark green dots lie to the right of the earlier, lighter dots) and fewer municipal splits (so the dark green dots lie below the earlier, lighter dots). Had the algorithm run longer, it likely would have pushed farther to the right and farther down, as the algorithm's "observed" Pareto (pseudo) frontier pushed ever closer to the actual Pareto frontier, where

300. See Heather K. Gerken, *Getting from Here to There in Redistricting Reform*, 5 DUKE J. CONST. L. & PUB. POL'Y 1, 11 (2010) ("There are always tradeoffs between districting criteria, but it is possible to find lots of plans that do well along a variety of sensible dimensions."); see DAVID BUTLER & BRUCE CAIN, CONGRESSIONAL REDISTRICTING: COMPARATIVE AND THEORETICAL PERSPECTIVES 90 (1992).

301. See Nicholas O. Stephanopoulos, *Redistricting Without Tradeoffs*, 125 COLUM. L. REV. (forthcoming 2026) (manuscript at 53) (finding that most enacted plans are "nowhere near Pareto frontiers—so, with respect to the status quo, much simultaneous improvement is usually feasible").

improving on one criterion would inevitably have resulted in a setback for the other criterion.

FIGURE J³⁰²



Computational redistricting can help improve this process relative to what a manual mapmaker can achieve. Assuming in this hypothetical that the mapmaker prioritized only two objectives (compactness and municipal splits), presumably she would never choose any of the maps represented by a light green dot over a map represented by a dark green dot that is farther to the right or farther down the graph (or both), as the latter dominates the former on one or both of the criteria that the mapmaker hoped to optimize. Thus, it should come as no surprise that, whenever a redraw has multiple competing objectives, a computer searching through billions of alternatives will find better combinations of geography than will a

302. This figure shows the collection of the best maps at different steps, from one of the Wright team's algorithm runs. The mean district compactness score (x-axis) and the number of split municipalities (y-axis) were computed for each map in the run. Because higher compactness is better and fewer municipality splits are better, finding maps closer to the lower-right corner of the figure was a goal of this run. The set of dots at each interval (1,000 steps, 10,000 steps, etc.) represents the "frontier" observed up until that point. Maps got better and better as the run progressed.

single individual using a mouse to manually draw one district at a time.

Indeed, setting aside its decisive advantage in district-numbering, which is discussed further above,³⁰³ the Wright Map equaled or beat all five of its competitors on multiple districting criteria: nesting, contiguity, keeping wards intact, keeping Indian reservations intact, complying with federal law on race and districting, and minimizing partisan impact in both chambers, including enhancing electoral responsiveness and minimizing inequitable treatment of each party's incumbent legislators. The Wisconsin experience therefore shows the promise of computational redistricting by offering a real-world example of how this new approach stacks up against the manual alternative.

And as described above, a computational-redistricting approach can work seamlessly with a sophisticated model for assessing partisan impact.³⁰⁴ Every time the Wright team's search algorithm drew a new set of districts, it would estimate each district's projected Democratic and Republican vote shares, along with a measure of how certain the model was in those predictions. With every district's predicted vote shares (and the uncertainty around those predictions), the algorithm could calculate the expected number of Democratic and Republican seats in each legislative chamber. A computational approach therefore permitted the Wright team to quickly assess how a map performed on the partisan-impact criterion, based on its separately developed, sophisticated model for assessing that issue.

Moreover, by making use of a subsidiary algorithm, namely with respect to the numbering of districts, a computational-redistricting approach can further improve the quality of a remedial map in ways that may not be achievable by a manual mapmaker. To be sure, the algorithm for optimizing senate numbering could be applied even to a map drawn by hand. But the Wisconsin example suggests that the potential to make use of algorithms in creative ways—and in ways that stack improved results on top of one another—could be promising in future cases.

2. *Refocusing on the Maps and Their Effects*

A second major benefit of this type of computational redistricting is that it focuses redistricting disputes on the measurable properties of the maps rather than the (often subjective and hard to divine) intent of the mapmakers. This is both because computational redistricting can result in better maps, tuned to more precisely defined and measured criteria and (counterintuitively) because of the complexity of the techniques used to generate them.

303. *See supra* Section III.C.

304. *See supra* Section III.B.4.

Most doctrines in redistricting law already focus on a map's results or effects, not the mapmaker's purpose or intent. The plaintiff in a "one person, one vote" suit need not show that maintaining population disparities across districts was intended to discriminate against voters in overpopulated districts.³⁰⁵ And Congress famously amended section 2 of the Voting Rights Act in 1982 to delete any requirement that plaintiffs prove discriminatory intent.³⁰⁶

Until federal courts exited their three-decade quest to police partisan gerrymandering,³⁰⁷ intent was an element in those claims, though one that was easily satisfied as it was widely accepted that "as long as redistricting is done by a legislature, it should not be very difficult to prove that the likely political consequences of the reapportionment were intended."³⁰⁸ And since the Court handed down *Shaw v. Reno*,³⁰⁹ intent remains relevant in racial-gerrymandering claims as judges wrestle with whether race was the "predominant" factor motivating specific districting decisions.³¹⁰ In many such cases, however, intent is inferred from the map's effects, by looking at whether the map, when overlaid with demographic data, appears to divide voters on the basis of race.³¹¹

305. See *Tucker v. U.S. Dep't of Com.*, 958 F.2d 1411, 1414 (7th Cir. 1992). But see *Cox v. Larios*, 542 U.S. 947, 947–51 (2004) (Stevens, J., concurring) (finding an equal-protection violation where a Georgia legislative map intentionally underpopulated Democrats' districts and overpopulated those of Republicans).

306. See *Thornburg v. Gingles*, 478 U.S. 30, 44 (1986) (explaining that Congress "repudiated" the discriminatory-intent test as "it is 'unnecessarily divisive because it involves charges of racism on the part of individual officials or entire communities,' it places an 'inordinately difficult' burden of proof on plaintiffs, and it 'asks the wrong question'" (citation omitted)).

307. Compare *Davis v. Bandemer*, 478 U.S. 109, 113 (1986) (holding partisan-gerrymandering claims justiciable in federal courts), with *Rucho v. Common Cause*, 139 S. Ct. 2484, 2506–07 (2019) (holding partisan-gerrymandering claims nonjusticiable in federal courts).

308. *Bandemer*, 478 U.S. at 129 (plurality opinion); accord *Vieth v. Jubelirer*, 541 U.S. 267, 281 (2004) (plurality opinion). Before *Rucho* was decided, some commentators proposed putting teeth in the partisan-gerrymandering doctrine's intent test and deleting the effects test altogether. See Justin Levitt, *Intent Is Enough: Invidious Partisanship in Redistricting*, 59 WM. & MARY L. REV. 1993, 1993 (2018) (proposing that partisan-gerrymandering claims focus on the nature of the mapmakers' intent, not the magnitude of the maps' impact); Michael S. Kang, *Gerrymandering and the Constitutional Norm Against Government Partisanship*, 116 MICH. L. REV. 351, 351 (2017) (challenging the premise that partisanship can ever be a constitutional government purpose).

309. 509 U.S. 630 (1993).

310. Compare, e.g., *Alexander v. S.C. State Conf. of the NAACP*, 144 S. Ct. 1221, 1240–51 (2024), with *id.* at 1268–87 (Kagan, J., dissenting).

311. See, e.g., *Cooper v. Harris*, 581 U.S. 285, 315 (2017) (finding racial predominance based in part on an expert report showing that a district was drawn to include Black Democrats rather than white Democrats).

Under the Wisconsin Constitution, the *Clarke* court did not attempt to discern whether any discriminatory purpose or intent gave rise to the noncontiguity in dozens of districts in the 2022 Map; the districts were invalid regardless.³¹² And just as the court did not inquire into intent in determining liability, so too it shut down any inquiry into intent in fashioning the remedy. When the Legislature and the Johnson intervenors proposed extensive discovery, likely including depositions and document requests about the genesis of each of the parties' proposed maps, the court denied their request.³¹³

This approach made sense given that, when instructing the parties on the parameters for their remedial proposals, the court called for maps that minimized “partisan impact,” not “partisan intent.”³¹⁴ The Johnson intervenors nonetheless argued that minimizing partisan impact required complete ignorance of political considerations and therefore offered a purportedly “random” map that allegedly ignored partisan impact while excelling on compactness and respect for political subdivisions.³¹⁵

In contrast, the Wright petitioners interpreted the court's instructions as requiring maps that evenhandedly translate votes, whether Republican or Democratic, into legislative seats. After all, randomness does not lead to fairness. Maps drawn “randomly” without attention to electoral data can turn out to be severely biased “accidental” gerrymanders, with a distorted, asymmetric translation of votes into seats. And an unbiased map can look like an outlier when compared with a large set of such purportedly “random” maps.³¹⁶

Banning mapmakers from considering electoral data and evaluating political impacts, as the Johnson Intervenors advocated, is the wrong approach. As political theorist Chuck Beitz correctly noted when arguing for the centrality of maps' effects, “it is a mistake to treat ‘accidental’ gerrymanders differently than deliberate ones” because both distort the representation of political parties in legislatures.³¹⁷ “When a ‘natural’ baseline plan contains partisan bias

312. See *Clarke v. Wis. Elections Comm'n*, 2023 WI 79, ¶¶ 1–3, 10–35, 988 N.W.2d 370, 377–79, 381–89.

313. See Initial Brief for Intervenor-Respondents Wisconsin Legislature at 61–62, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Oct. 16, 2023); Initial Brief for Johnson Intervenors at 37, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Oct. 16, 2023); Order re Post-Decision Matters at 3, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Dec. 22, 2023).

314. *Clarke*, 2023 WI 79, ¶¶ 69–71, 988 N.W.2d at 399–400.

315. See Brief for Intervenors-Respondents Johnson et al. in Support of Proposed Map at 10, 27–30, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 12, 2024) [hereinafter Johnson Br.].

316. See Becker et al., *supra* note 14, at 412–13 (discussing *Rucho v. Common Cause*, 139 S. Ct. 2484, 2517–18 (2019) (Kagan, J., dissenting)).

317. Charles R. Beitz, *How Is Partisan Gerrymandering Unfair?*, 46 PHIL. & PUB. AFFS. 323, 346 (2018); see also *Gaffney v. Cummings*, 412 U.S. 735, 753 (1973) (noting that, “in any event, it is most unlikely that the political impact of

and there is a feasible and otherwise unobjectionable alternative that reduces it, why not choose that alternative?”³¹⁸

In finding feasible, unobjectionable alternative maps that minimize partisan impact, computational redistricting focuses redistricting disputes where they belong: on the properties of the maps and their consequences for voters and for our system of democratic representation.³¹⁹ Perhaps counterintuitively, it is the very complexity of computational-redistricting techniques that pushes the discussion toward maps’ properties and consequences. Because these techniques are designed to—and, if well designed, in fact do—result in better maps, courts and others who turn to them need not have the capacity to read source code or assess the quality, or even the substance, of an algorithm. What matters, ultimately, are the properties of the resulting maps and their degree of adherence to the court’s articulated districting criteria—adherence that can be mathematically quantified. Indeed, more than forty years ago, Justice Stevens explained that measurable districting criteria “defined and applied with rigor and precision” can prevent courts faced with gerrymandering claims from falling back on the “I know it when I see it” standard.³²⁰

Although the Wright team’s computational-redistricting approach is complicated,³²¹ its complexity did not cause problems because the quality of the methodology was revealed by the Wright Map’s characteristics, which the Wisconsin Supreme Court and its expert consultants could verify independently, without looking “under the hood” of the methodology. Just as we measure a car’s acceleration by timing how long it takes to go from 0 to 60 miles per hour and not by analyzing the engine’s design, the court’s expert consultants properly evaluated the Wright Map by measuring it against specific districting criteria and comparing these measurements with those of the competing maps, not by picking apart the Wright team’s algorithms or deposing the other teams’ cartographers.³²²

[an ‘accidental’ gerrymander] would remain undiscovered by the time it was proposed or adopted, in which event the results would be both known and, if not changed, intended”).

318. Beitz, *supra* note 317, at 346.

319. See generally CHARLES R. BEITZ, FOR THE PEOPLE? DEMOCRATIC REPRESENTATION IN AMERICA (Henry E. Brady ed., 2024).

320. *Karcher v. Daggett*, 462 U.S. 725, 755–58 (1983) (Stevens, J., concurring) (quoting *Jacobellis v. Ohio*, 378 U.S. 184, 197 (1964) (Stewart, J., concurring)).

321. When designing software, it is far more difficult “to make it so simple that there are *obviously* no deficiencies . . . [than] to make it so complicated that there are no *obvious* deficiencies.” Charles Antony Richard Hoare, *The Emperor’s Old Clothes*, 24 COMM’NS ASS’N COMPUTING MACH. 75, 81 (1981).

322. See Micah Altman, *The Computational Complexity of Automated Redistricting: Is Automation the Answer?*, 23 RUTGERS COMPUT. & TECH. L.J. 81, 134 (1997) (“[D]ebate over particular district plans may illuminate political

The Wright team took this “focus on the maps’ properties” approach a step further by affirmatively assisting the Wisconsin Justices and their expert consultants in more readily evaluating the various remedial proposals before them. In addition to supplying the Wright Map for Wisconsin, the Wright team’s expert, Professor DeFord, provided a replication notebook—software that the court-appointed consultants could use to rerun Professor DeFord’s analyses of the Wright Map and then to compare the various remedial proposals on multiple criteria, at a level significantly more detailed than presented in this Article.³²³ Professor DeFord included a script that would report results for any other map submitted to the court, facilitating apples-to-apples comparisons.³²⁴ The resulting transparency and ease of use that such a replication notebook provides could, in future cases, make courts more comfortable comparing the merits and demerits of proposed maps—again, while focusing on maps’ properties and impacts on voters, not on the inner workings of the mapmaker’s brain or the algorithm’s design.³²⁵

3. *Altering Real-World Incentives*

The better maps that computational redistricting provides could meaningfully alter the incentives of real-world political actors in important ways. Indeed, the Wisconsin example arguably demonstrates that a computational-redistricting approach can generate maps that are so effective in correcting partisan imbalances that they drive beneficiaries of the preexisting gerrymandered system to accept maps that otherwise would be unthinkable for them to embrace.

As described above, once the Wisconsin Supreme Court was given the opportunity to replace one of the nation’s most notorious Republican gerrymanders with a fair map proposed by computational redistricters, the Republican Legislature ducked that outcome by enacting—on a nearly party-line vote, with Democrat legislators almost unanimously in opposition—an alternative map that removed most but not all of the prior gerrymanders’ pro-Republican skew.³²⁶ Wisconsin Republicans rationalized their decision to support Democratic Governor Evers’s map by pointing to the devastating

motives much more clearly than debate over [a computer program’s] technical characterizations of redistricting goals.”).

323. See DeFord Rpt., *supra* note 149, at 50.

324. See *id.*

325. See, e.g., *Carter v. Chapman*, 270 A.3d 444, 462–63 (Pa. 2022) (“[W]e rely upon the analyses performed by Dr. Daryl DeFord, which evaluate all of the submitted plans using the same methods and data sets. We appreciate Dr. DeFord’s efforts in this regard as it allows the Court to engage in an apples-to-apples comparison of the plans on each metric.” (footnote and citation omitted)); *id.* at 493 n.4 (Todd, J., dissenting).

326. See *supra* Section II.B.5.

consequences of the alternatives. Thus, Republicans justified their sudden support for Governor Evers's map as "picking the [best] of several bad options."³²⁷ In the Assembly, Republican Speaker Robin Vos issued a statement explaining that he supported the governor's assembly and senate maps "not because they are fair," but because they were "the most Republican-leaning" of the maps that the petitioners had presented to the Wisconsin Supreme Court.³²⁸ In the Senate, during the floor debate, Republican Duey Stroebel put it simply: "We kind of have a gun to our head, frankly."³²⁹ As noted, his colleague, Senate Republican Caucus Chair Van Wanggaard, after evaluating the options available to the *Clarke* court, was more colorful: "It was a matter of choosing to be stabbed, shot, poisoned or led to the guillotine. We chose to be stabbed, so we can live to fight another day."³³⁰

The Wisconsin case study shows the power of a well-crafted map drawn with the assistance of cutting-edge computational-redistricting techniques. It remains to be seen exactly how a new baseline of better-constructed maps will affect behavior in the post-2030 redistricting cycle. But it would not be surprising if (as here) some legislative impasses were resolved as self-interested actors understand the consequences of leaving a remedial map to the judicial process. Conversely, it may be the case that, as both sides make use of this approach, the result will be sophisticated maps that appear to excel on the various criteria at issue but in fact preserve or create partisan imbalance.³³¹ As discussed below, because computational redistricting is merely a tool in service of ends set by the mapmaker, this latter possibility will likely persist.³³²

B. *The Limits of Computational Redistricting*

1. *Better Maps—Not Perfect Maps*

Nonetheless, it is important to recognize the limits of what computational redistricting can achieve.³³³ Though computational

327. Johnson, *supra* note 131.

328. Beck et al., *supra* note 139 (quoting State Rep. Vos); *accord* Bauer, *supra* note 5 (same).

329. Beck et al., *supra* note 139 (quoting State Sen. Stroebel). Senator Stroebel went on to lose in the November 2024 general election. *See Election Results Archive*, WIS. ELECTIONS COMM'N (2025), <https://perma.cc/B4WY-HYGT>.

330. Bauer, *supra* note 5 (quoting State Sen. Wanggaard).

331. *Cf.* Wendy K. Tam Cho & Bruce E. Cain, *Deploying Trustworthy AI in the Courtroom: Lessons from Examining Algorithm Bias in Redistricting AI*, 2023 U. CHI. L.F. 87, 112 (2023) ("Advances in computers and line-drawing software increased the speed and accuracy of building new maps but also enabled more finely tuned gerrymandering.").

332. *See infra* Section IV.B.

333. *See* D. James Greiner, *The Quantitative Empirics of Redistricting Litigation: Knowledge, Threats to Knowledge, and the Need for Less Districting*,

redistricting can provide better maps than manual alternatives, it cannot produce perfect maps. Although the Wright team deployed algorithmic and computational techniques designed to pursue optimization of multiple districting criteria simultaneously, the resulting map did not outperform every map on every criterion by every measure. There are three reasons for this.

First, as a general principle, the better the map, the harder it is to improve on any one metric without triggering a setback on another metric. After all, the best imaginable maps lie on a multi-dimensional Pareto frontier, where improvement on one criterion inevitably triggers sacrifices on other criteria. So it is not surprising that when multiple remedial proposals are presented to a court by competing litigants, each may exhibit its own distinct advantages (and tradeoffs). Even if computational redistricting almost always can beat a single competitor, it may be difficult or impossible to beat multiple competitors simultaneously, across the board, on every criterion. We may all agree that Michael Jordan and LeBron James are the two greatest all-around basketball players ever, but that doesn't mean that either of them could out-shoot Steph Curry from the three-point line or out-rebound Shaquille O'Neal.

Second, and perhaps related, it often was the Wright Map's very strengths that drove its weaknesses. For example, there is no doubt that the Wright Map could have split fewer counties and fewer municipalities had it ignored (and thus fragmented) Indian reservations.³³⁴ Likewise, the Wright Map's compactness could have been enhanced if the Wright team's search algorithm tolerated the (legally permissible) splitting of noncontiguous wards. Thus, the choice to pursue certain goals will often come at the cost of better performance on other criteria.

Third, when the Wright team programmed its algorithms and drew its proposed remedy, it had access to the 2011 Map and the various maps that had been proposed to the *Johnson* court in 2021 and 2022, including the 2022 Map that the *Johnson* court ultimately adopted, but the team did not yet have access to the five proposals with which the Wright Map eventually would compete in 2024. The sponsors of each of those proposals had unique priorities that led them to make different districting choices. For example, the Clarke

29 YALE L. & POL'Y REV. 527, 536 (2011) ("Perhaps the most important thing that the past five decades have taught us, or should have taught us, is that quantitative techniques and technological advances have limits.").

334. See, e.g., Response of Petitioners to Consultants' Report at 13–17, *Clarke v. Wis. Elections Comm'n*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Feb. 8, 2024) (describing tradeoffs involving Barron County and the St. Croix Chippewa Reservation, and the Village of Howard and the Oneida Nation Reservation); Response of Governor Evers to Consultants' Report at 14 n.5, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Feb. 8, 2024) (describing similar tradeoffs).

team prioritized minimizing population deviations,³³⁵ while the Johnson team focused on maximizing compactness and minimizing county and municipal splits.³³⁶ Mapmakers can almost always design computational-redistricting approaches to find remedies that are “better” than preexisting hand-drawn maps, but algorithms are most successful at this task if their programmers know at the outset which maps they are trying to beat and on what metrics. Indeed, the Wright team could have taken any of the competing maps as its “seed” map and, almost certainly, developed a new map that improved on it. This suggests that a court or commission in the new era of computational redistricting might establish a rapid “simultaneous, multiple-round” competition, where proponents submit ever-better maps in each successive round after refining their maps to outperform competing proposals from the prior round.³³⁷

In short, the mere fact that the Wright Map did not dominate its five competitors on every districting criterion, as measured by every reasonable metric, does not negate the merits of computational redistricting. Rather, it highlights that computers and algorithms are merely tools for exploring alternatives more speedily and methodically in light of aims set by the mapmaker.

2. *The Inevitability of Human Judgment*

The discussion above points to an important reminder when implementing a computational-redistricting approach: as a technology for drawing maps, it remains reliant on human input. The “Magical Redistricting Machine” that draws districts “without the messy mixed motives of human involvement” is a mirage, as Professor Justin Levitt has explained.³³⁸ Though it may be tempting to view computational redistricting as a means to eliminate human discretion from the redistricting process, computational redistricting does no such thing.³³⁹ To the contrary, systematically searching through a vast array of a state’s valid maps to find better maps requires human

335. See Jan. 22 Br., *supra* note 151, at 16 tbl. 2.

336. See Johnson Br., *supra* note 315, at 10–18.

337. Cf. FCC v. NextWave Pers. Commc’ns Inc., 537 U.S. 293, 296 (2003) (describing how FCC awarded broadband licenses through “simultaneous, multiple-round auctions”).

338. Justin Levitt, Essay, *Weighing the Potential of Citizen Redistricting*, 44 LOY. L.A. L. REV. 513, 523 (2011).

339. One of the first articles on this topic recognized that the computer program should be “designed to implement the value judgments of those responsible for [redistricting]” and that the program should be judged by “its ability to produce districting patterns in a matter of seconds which accurately reflect whatever political value judgments are fed to the computer and simultaneously to meet the legally imposed requirements.” Stuart S. Nagel, *Simplified Bipartisan Computer Redistricting*, 17 STAN. L. REV. 863, 863–64 (1965).

input at nearly every stage. For example, computational redistricting still requires human judgment with respect to the following matters.

Defining and Measuring Criteria. One of the first issues a computational mapdrawer must consider is how to define and measure each districting criterion (and, relatedly, to decide what data to use to compute each metric). Although a manual mapmaker must, at least implicitly, address these same issues, algorithmic instructions require addressing them expressly and precisely. Even a criterion as seemingly simple as population equality requires human choices and value judgments. After the Supreme Court first held in *Baker v. Carr*³⁴⁰ that population-equality claims were justiciable under the U.S. Constitution,³⁴¹ it took the courts two decades to settle on “maximum population deviation”—the population difference between the map’s largest and smallest districts, typically expressed as a percentage of the ideal (or average) district population—as the best metric.³⁴²

Other districting criteria are harder to define and measure. To take just one example, the scientific literature contains dozens of competing metrics for assessing districts’ compactness.³⁴³ And once a particular compactness metric is chosen, should a search algorithm focus on the average compactness score for all districts in a map, or the compactness score for the map’s least compact district, or something else? Precisely defining and measuring each districting criterion is no small task for any mapmaker. Computational redistricting cannot eliminate this exercise of human judgment; rather, in designing an optimization technique for redistricting, the same kinds of choices must be made.

Relatedly, the task of translating often vague legal or judicial commands into algorithmic instructions is, again, mostly a matter of discretionary human judgment. What does the Wisconsin Constitution actually mean when it mandates that assembly districts “be in as compact form as practicable”?³⁴⁴ If the State’s highest court defines compactness “as ‘closely united in territory’” and then pronounces that it “has never adopted a particular measure of

340. 369 U.S. 186 (1962).

341. *See id.* at 208–37; *see also* ROBERT G. DIXON, JR., DEMOCRATIC REPRESENTATION: REAPPORTIONMENT IN LAW AND POLITICS 452–55 (1968) (cataloging competing mathematical measures of population inequality that courts considered in the 1960s).

342. *See* *Brown v. Thomson*, 462 U.S. 835, 842–43 (1983) (applying maximum population deviation as the key metric); *see also* *Evenwel v. Abbott*, 578 U.S. 54, 60 n.2 (2016) (defining “maximum population deviation”).

343. *See, e.g.*, Aaron R. Kaufman, Gary King & Mayya Komisarchik, *How to Measure Legislative District Compactness If You Only Know It When You See It*, 65 AM. J. POL. SCI. 533, 533–34 (2021); Richard Barnes & Justin Solomon, *Gerrymandering and Compactness: Implementation Flexibility and Abuse*, 29 POL. ANALYSIS 448, 448 (2020).

344. WIS. CONST. art. IV, § 4.

compactness,”³⁴⁵ where does that leave the computational redistricter? Perhaps some guidance could be gleaned from a fifty-state survey of redistricting case law or from the extensive academic literature on the mathematical properties of various district-compactness scores. But at some point, the algorithm designer must step up and craft rules that can be executed by a computer.³⁴⁶ The designer’s choices will be contestable; and if litigation is involved, they might well be contested.

Constraints vs. Objectives. Computational redistricting also requires human judgment to determine whether to operationalize a particular districting criterion as a constraint or as an objective. Sometimes a single districting criterion can be framed as both a constraint and an objective in the same algorithm. For example, a search algorithm could insist that every district’s population fall within 1% of the ideal district population (a constraint) and then also favor plans with lower deviations (an objective). Indeed, as described above, the Wright team took this approach to compactness, setting an absolute floor to bar bizarrely misshapen districts while also seeking maps with ever-more-compact districts.³⁴⁷ Other criteria might be treated as constraints or objectives, but not both. That is the approach that the Wright team took toward most districting criteria. Determining which criteria are “non-negotiable” (constraints) and which should be targeted for improvement (objectives) is a difficult—and inescapably human—decision.

In the Wisconsin litigation, the ultimate goal of the Wright team’s approach was to choose from a set of maps that showed the tradeoffs among the objectives while satisfying all constraints. At least as applied by the Wright team, computational redistricting sheds little light on how those tradeoffs should be resolved. That was a judgment call on the Wright team’s part. What the Wright team’s approach did accomplish, however, was to clarify the elasticity of each criterion and thus the magnitude of each tradeoff: For example, how much would an assembly map’s mean Reock compactness score improve if three additional county splits were tolerated? Or what would be the partisan impact of halving the senate map’s number of municipal splits? Answering these types of questions proved enormously helpful in making sound tradeoffs to home in on a single map—but ultimately, after divining the magnitude of a tradeoff, the decision

345. *Clarke v. Wis. Elections Comm’n*, 2023 WI 79, ¶ 66, 998 N.W.2d 370, 398 (quoting *Wis. State AFL-CIO v. Elections Bd.*, 543 F. Supp. 630, 634 (E.D. Wis. 1982) (three-judge court)).

346. *See Altman & McDonald*, *supra* note 11, at 91 (describing the “large gap between identifying representational values and creating criteria reflecting those values that can be optimized in a computer”).

347. *See supra* Sections III.A.7, III.B.1.

whether to then execute that trade remains a matter of human judgment, values, and priorities.³⁴⁸

Hand Touch-Ups. The algorithmic approach may not directly produce the final map that a mapmaker adopts. Indeed, this approach did not directly produce the Wright petitioners' final map. An additional exercise of judgment in the form of "hand touchups" was deployed as Step 8 of the Wright approach.³⁴⁹ There are many parts of the redistricting process for which computers outperform humans: churning through and assessing millions of maps, computing complex analyses and metrics, simultaneously tracking multiple criteria, and so on. But there are some tasks that may be easier for humans to perform by hand. For example, there might be an obvious pair of wards for which swapping their district assignments would improve district compactness or eliminate a county split or better track a river or major highway. While a human might immediately identify that improvement visually, an algorithm might run for a very long time before stumbling upon it.

Structuring the Search Algorithm. Computational redistricters also must make design choices related less (or less directly) to districting criteria than to the search algorithm itself. As discussed above, these choices included setting the value of N in Step 4 of the Wright team's eight-step search procedure, which will control how far the algorithm strays from a seed map before discarding the dominated maps and starting a new sequence of maps.³⁵⁰ Another choice was how to select in Step 6 a new seed to kick off the next sequence, which requires choosing between maps that do best on a single criterion and maps that balance performance across several criteria. These human choices will set the course of the search algorithm's progression—and may significantly affect the final map—but they are entirely the result of human judgment.

One way to grasp this additional layer of human judgment is to compare the very different results of the Wright Map and the amicus Petering Map, which the court declined to consider but which also made use of a variant of computational redistricting.³⁵¹ Like the Wright team, industrial-engineering professor Matt Petering began from the premise that the "most effective . . . way to make maps is to

348. Professor Levitt eloquently explained why it is impossible "to resolve the potential for abused discretion in the redistricting process by removing the discretion. . . . [S]queezing the discretionary latitude from those who execute a redistricting plan simply redirects the exercise of discretion to an earlier point in the process: important decisions must be made in order to fashion the inputs to a computer program" Levitt, *supra* note 338, at 529.

349. *See supra* Section I.B (describing the Wright team's eight-step search procedure).

350. *See supra* Section I.B.

351. *See Amicus Brief of Matthew Petering, PhD at 9, Clarke v. Wis. Elections Comm'n*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Nov. 8, 2023).

use a computer algorithm.”³⁵² But Professor Petering approached the task of drawing maps by deploying a “scoring methodology” that locked in specific weights for each of the various districting criteria, rather than exploring each criterion’s elasticity and the magnitudes of tradeoffs among various criteria.³⁵³ The Wright team did not design their search algorithm so rigidly, instead encouraging wide exploration of a broad collection of possible maps; therefore, unsurprisingly, the Petering and Wright Maps differed significantly, despite some surface similarity in the techniques employed.³⁵⁴

3. *The Illusion of Neutrality*

Finally, as suggested by the prior point, courts and policymakers should resist trumpeting computational redistricting as a “neutral” tool for drawing maps. Courts in particular may be tempted to turn to computer-drawn maps on the theory that they are impartial in a way that human mapmakers may not be. But though computational redistricting is a major advance, no districting map is truly neutral, regardless of who draws it or what methods they use.

Taking politics entirely out of redistricting is a “doomed enterprise”³⁵⁵ because, as Justice Alito recently stated, drawing districts is “inescapably political.”³⁵⁶ Professor Bob Dixon explained almost half a century ago that

[t]he key concept to grasp is that there are no neutral lines for legislative districts. Whether the lines are drawn by a ninth-grade civics class, a board of Ph.D’s, or a computer, every line drawn aligns partisan and interest blocs in a particular way different from the alignment that would result from putting the line in some other place.³⁵⁷

352. *Id.*

353. Expert Report of Amicus Dr. Matthew Petering in Support of Proposed Wisconsin Legis. Map 173#008 at 25, *Clarke*, 2023 WI 79, 998 N.W.2d 370 (No. 2023AP1399) (Jan. 12, 2024).

354. *See, e.g., id.*; *see also* Amicus Brief of Matthew Petering, PhD, *supra* note 351, at 7–24. For an approach that can score maps without imposing any prior weights on the criteria, *see* Ram Gopalan et al., *Selecting Good Redistricting Plans from a Large Pool of Available Plans Using the Efficient Frontier*, OMEGA, April 2024, at 1, 2.

355. Samuel Issacharoff, *Judging Politics: The Elusive Quest for Judicial Review of Political Fairness*, 71 TEX. L. REV. 1643, 1647 (1993).

356. *Alexander v. S.C. State Conf. of the NAACP*, 144 S. Ct. 1221, 1233 (2024); *see also* *Miller v. Johnson*, 515 U.S. 900, 915 (1995) (“Electoral districting is a most difficult subject” because it requires “exercis[ing] the political judgment necessary to balance competing interests.”); *White v. Weiser*, 412 U.S. 783, 795–96 (1973) (“Districting inevitably has sharp political impact and inevitably political decisions must be made . . .”).

357. Dixon, *supra* note 3, at 7–8; *see also* Nathaniel Persily, *In Defense of Foxes Guarding Henhouses: The Case for Judicial Acquiescence to Incumbent-*

As Professor Dixon understood, regardless of the sophistication of any particular tool—and computational redistricting is far more sophisticated than prior approaches—it cannot achieve neutrality. Rather, the question of how to “value various redistricting goals and decide the tradeoff between them” implicates “substantive judgments [that] do not emanate from technology, but rather from human deliberation.”³⁵⁸

This is particularly so with respect to a new map’s political implications. The U.S. Supreme Court stated in *Gaffney* that “districting inevitably has and is intended to have substantial political consequences.”³⁵⁹ Even a map drawn without access to political data would have a “political impact”; and “it is most unlikely that the political impact of such a plan would remain undiscovered by the time it was proposed or adopted, in which event the results would be both known and, if not changed, intended.”³⁶⁰ Computational redistricting is a tool rendering mapmaking more efficient, but it cannot fully transform this inherently political process into a “neutral,” apolitical one. Nor can it produce a “neutral” map, at least not in the sense where “neutral” means nonpolitical. It can, however, differentiate maps based on how evenhandedly they translate votes into seats.

What is needed, then, are ways to systematically analyze and evaluate competing maps, tied back to what courts and other legal authorities have said about districting criteria. Although there inevitably will be “gray areas” where reasonable minds can differ about which maps comply with legal mandates and enunciated public-policy goals (or “traditional” districting principles), in the Wisconsin case a clear consensus developed across litigants with radically different end-goals: the Republicans leading the Wisconsin Legislature appear to have concluded that the Wright Map outperformed the Governor’s Map on those criteria (and thus might well be selected by the Wisconsin Supreme Court) and would “guillotine” rather than merely “stab” the Republicans who had long relied on gerrymandering to survive politically.³⁶¹ Hence, they voted

Protecting Gerrymanders, 116 HARV. L. REV. 649, 677 (2002) (contending that traditional “neutral” districting principles “have predictable political and usually partisan effects”); Levitt, *supra* note 338, at 524 (“[M]ost potential rules for drawing district lines have predictable political consequences that may favor a particular party or set of parties, or a particular candidate or set of candidates, as compared to some alternative rule.”).

358. Cho & Cain, *supra* note 331, at 113–14; *see also* Greiner, *supra* note 333, at 536 n.41 (“[B]y now we should understand that we will never be able to computerize our way out of redistricting difficulties . . .”).

359. *Gaffney v. Cummings*, 412 U.S. 735, 753 (1973).

360. *Id.*

361. Bauer, *supra* note 5 (quoting State Sen. Wanggaard).

almost unanimously to enact the Governor's Map.³⁶² And apparently the Democrats in the Legislature reached the same conclusion. Hence, they voted almost unanimously against enacting the Governor's Map, even though it had been proposed by the leader of their own party.³⁶³ This shows the power of a map drawn with the aid of computational redistricting. But it does not show that computational redistricting somehow can extirpate "politics" from an inherently and inevitably political project.

CONCLUSION

The recent Wisconsin litigation provides an illuminating case study of both the promise and the practicalities of using computational redistricting rather than traditional mapmaking. Just as the redistricting software of the 1980s rendered the crayons and color markers of prior decades obsolete, so too, computational redistricting is likely to render individually drawn districts a relic of the past.

Computational redistricting can expose new possibilities as compared to traditional mapmaking. For example, defenders of Wisconsin's gerrymanders long contended that the skewed composition of the Wisconsin Legislature flowed inexorably from political geography, pointing to the self-packing of Democratic voters in Milwaukee and Madison. But the maps proposed by petitioners in *Clarke*—including the Wright Map, drawn with the assistance of computational redistricting—debunked that myth. It turns out that the Wisconsin Legislature could, in fact, more fairly represent the Wisconsin electorate, so that in turn the State's legislative outputs could more fairly reflect the people's policy preferences.

Indeed, despite the technical nature of much of the discussion here, it is important to remember what is fundamentally at stake. Improving redistricting matters because gerrymandering has consequences.

Here's a glaring example: for the last decade, more than 95,000 Wisconsinites have lacked healthcare coverage because they live in one of only three states outside the South that have refused to accept federal funding for Medicaid expansion under the Affordable Care Act.³⁶⁴ Public-opinion polling shows massive support for Medicaid

362. *See id.*

363. *See id.*

364. *See* Patient Protection and Affordable Care Act, Pub. L. No. 111-148, 124 Stat. 119 (2010); *see also* 42 U.S.C. §§ 1396a, 1396c, 1396d (2025); STATE OF WIS., BUDGET IN BRIEF 2025–27, at 30, 108–09 (2025); Alex Tausanovitch & Emily Gee, *How Partisan Gerrymandering Limits Access to Health Care*, CTR. FOR AM. PROGRESS (Feb. 24, 2020), <https://www.americanprogress.org/article/partisan-gerrymandering-limits-access-health-care/>. Since Congress enacted Medicaid in 1965, Wisconsin has voted for the Democratic nominee in nine of the fifteen

expansion in Wisconsin.³⁶⁵ And Wisconsin's current governor has twice won statewide election running on a platform promising Medicaid expansion, and then has consistently followed through on that promise when proposing state budgets.³⁶⁶ But the gerrymandered Legislature repeatedly blocked Medicaid expansion on party lines.³⁶⁷ This is just one example of an issue on which Wisconsin's divided government has failed to enact popular reforms—in sharp contrast to the neighboring state of Minnesota, which witnessed a torrent of legislative action after adopting relatively less biased, more responsive maps.³⁶⁸

At bottom, redistricting is how we effectuate our conception of representative democracy. However, as the Wisconsin example illustrates, not everyone shares the same conception of what that representative democracy should look like. Computational redistricting provides important tools for legislators, independent commissioners, litigants, and courts alike to construct maps and then measure how well they achieve a particular conception of representative democracy. Understanding the strengths and limits of computational redistricting therefore may be critical for the future of representative democracy in the United States.

presidential elections while the other two non-Southern States lacking Medicaid expansion (Kansas and Wyoming) have never done so.

365. See, e.g., MARQUETTE UNIV. L. SCH., MARQUETTE LAW SCHOOL POLL: APRIL 3–7, 2019 TOPLINE RESULTS FOR REGISTERED VOTERS (2019), <https://perma.cc/7DE3-2AS6> (finding that 70% of Wisconsin registered voters agreed that Wisconsin should “accept federal funds to expand Medicaid . . . to cover those with incomes up to 138% of the poverty line” while only 23% said Wisconsin should “reject federal funds and not expand Medicaid coverage”).

366. See, e.g., Laurel White, *Evers: ‘I’m Going to Fight Like Hell’ for Medicaid Expansion*, WIS. PUB. RADIO (May 22, 2019), <https://perma.cc/U93B-ZA7J>; *Evers’ First TV Ad Criticizes Walker [on] Medicaid Expansion*, ASSOCIATED PRESS (Aug. 27, 2018), <https://perma.cc/4X2H-L6AB>.

367. See, e.g., White, *supra* note 366; Guy Boulton & Patrick Marley, *A Health-Care Change Could Bring the State \$1.6 Billion in Federal Dollars. Republican Legislators Are Uninterested*, MILWAUKEE J. SENTINEL (Apr. 30, 2021), <https://perma.cc/Y28R-E67T>.

368. See Briana Bierschbach & Jessie Van Berkel, *Minnesota Legislature Wrapping Work on One of the Most Consequential Sessions in State History*, MINN. STAR TRIB. (May 21, 2023), <https://perma.cc/S3SD-F9M2> (describing enactment of reforms regarding paid leave, marijuana legalization, environmental issues, infrastructure construction, tax modifications, abortion rights, and universal gun background checks); see also *Wattson v. Simon*, 970 N.W.2d 42, 51 (Minn. Spec. Redistricting Panel 2022) (“The panel did not draw the legislative districts with the purpose of protecting, promoting, or defeating any incumbent, candidate, or political party.”).