No. 22-807

IN THE

Supreme Court of the United States

THOMAS C. ALEXANDER, in His Official Capacity as President of the South Carolina Senate, et al.,

Appellants,

—v.—

THE SOUTH CAROLINA STATE CONFERENCE OF THE NAACP, et al.,

Appellees.

ON APPEAL FROM THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF SOUTH CAROLINA

BRIEF FOR *AMICI CURIAE* NICHOLAS O. STEPHANOPOULOS AND JOWEI CHEN IN SUPPORT OF APPELLEES

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INTEREST OF *AMICI CURIAE*[1]

Nicholas O. Stephanopoulos is Kirkland & Ellis Professor of Law at Harvard Law School. Jowei Chen is Associate Professor of Political Science at the University of Michigan. Professor Stephanopoulos and Professor Chen have significant academic and practical experience with the use of computational redistricting in the context of racial gerrymandering. They have coauthored two articles on the subject. *See* Jowei Chen & Nicholas O. Stephanopoulos, *The Race-Blind Future of Voting Rights*, 130 Yale L.J. 862 (2021) [Chen & Stephanopoulos, *Race-Blind Future*]; Jowei Chen & Nicholas O. Stephanopoulos, *Democracy's Denominator*, 109 Calif. L. Rev. 1019 (2021); *see also Allen v. Milligan*, 143 S. Ct. 1487, 1513 (2023) (citing Chen & Stephanopoulos, *Race-Blind Future*); *id.* at 1532 (Thomas, J., dissenting) (same). Professor Stephanopoulos has helped to litigate a racial-gerrymandering case relying in part on computational redistricting. *See Jacksonville Branch of NAACP v. City of Jacksonville*, 635 F. Supp. 3d 1229 (M.D. Fla. 2022). Professor Chen has deployed computational redistricting as an expert witness in two racial-gerrymandering cases. *See City of Greensboro v. Guilford Cnty. Bd. of Elections*, 251

[1] In accordance with Supreme Court Rule 37.6, *amici curiae* state that neither Appellants, nor Appellees, nor their counsel, had any role in authoring, nor made any monetary contribution to fund the preparation or submission of, this brief.

F. Supp. 3d 935 (M.D.N.C. 2017); *Raleigh Wake Citizens Ass'n v. Wake Cnty. Bd. of Elections*, 166 F. Supp. 3d 553 (E.D.N.C. 2016), *aff 'd in part, rev'd in part*, 827 F.3d 333 (4th Cir. 2016).

SUMMARY OF THE ARGUMENT

Computational redistricting refers to the use of computer algorithms to generate district maps. Some types of algorithms can produce large numbers of maps, which can then be harnessed to conduct certain analyses. To date, this Court has been presented with computational-redistricting evidence in the contexts of partisan gerrymandering, *see Rucho v. Common Cause*, 139 S. Ct. 2484, 2505-06 (2019), and racial vote dilution,[2] *see Allen*, 143 S. Ct. at 1512-14. This case is the first before the Court including computational-redistricting evidence in the context of racial gerrymandering. Two of the plaintiffs' experts used computer algorithms to create many congressional district maps for part or all of South Carolina. These sets of computer-generated maps, when compared to the enacted congressional plan, bolstered the district court's conclusion that race was the predominant factor in the design of South Carolina's First Congressional District. *See S.C. State Conf. of NAACP*

[2] In this brief, racial vote dilution refers only to effect-based claims like the one in *Allen*. The term is not used here to encompass intent-based claims of racial vote dilution, as to which computational-redistricting evidence can be probative.

v. Alexander, No. 3:21-cv-03302, 2023 WL 118775, at *8 (D.S.C. Jan. 6, 2023).

The purpose of this brief is to inform the Court about the uses—and usefulness—of computational redistricting in the racial-gerrymandering context. *First*, the brief describes the limited relevant litigation. In five cases (including this one), racial-gerrymandering plaintiffs have submitted analyses showing that one or more challenged districts had significantly different racial compositions from most or all corresponding districts generated by computer algorithms without considering racial data. These analyses suggested (even though, alone, they didn't prove) that race predominated in the construction of the challenged district(s). *See, e.g.*, *id.* (discussing "expert testimony that provided further support for a finding that race predominated over all other factors in the design of Congressional District No. 1").

Second, the brief explains why computational redistricting can be probative in the racial-gerrymandering context. The basic logic is that racial-gerrymandering claims focus on the intent of mapmakers, and computational redistricting can be a helpful way to produce evidence of mapmakers' intent. Consider a district attacked as a racial gerrymander and defended on the basis that one or more of nonracial criteria A, B, and C predominantly account for the district's creation. A computer algorithm can be instructed to incorporate criteria A, B, and C—but to ignore racial data—and to churn out large numbers of districts in the vicinity of the disputed district. If these computer-generated districts significantly differ demographically from the disputed district, that's supportive evidence for the inference that race predominantly drove that district's formation. Had race *not* been the primary factor, that district would likely have had a different demographic makeup, one in the range of the computer-generated districts.

Critically, the emphasis on intent in racial-gerrymandering claims distinguishes this context from other areas where this Court has been skeptical of computational redistricting. In *Rucho*, ensembles of computer-generated maps were offered as the benchmark for determining partisan *effect*—a "baseline from which to measure how extreme a partisan gerrymander is." 139 S. Ct. at 2505. Likewise, in *Allen*, Alabama argued that "millions of possible districting maps for a given State" should constitute the "race-neutral benchmark" relative to which the *effect* of racial vote dilution should be assessed. 143 S. Ct. at 1506. The Court properly rejected Alabama's claim on several grounds, one of which was that racial vote dilution "turns on the presence of discriminatory effects, not discriminatory intent." *Id.* at 1507. Unlike racial vote dilution, though, racial gerrymandering turns on the presence of racial intent, not racial effects. Computational redistricting can therefore be probative here for precisely the reason it was inapt in *Allen*—its ability to shed light on mapmakers' motives.

It's true, as the Court pointed out in *Allen*, that it's generally infeasible for computer algorithms to enumerate every lawful map for a jurisdiction. *See id.* at 1514 ("What would the next million maps show?"). But mathematical proofs show that modern algorithms *can* produce—and mounting empirical evidence demonstrates that they often *do* produce—representative map ensembles with the same statistical properties as the entire map universe. *See, e.g.*, Benjamin Fifield et al., *The Essential Role of Empirical Validation in Legislative Redistricting Simulation*, 7 Stat. & Pub. Pol'y 52 (2020) [Fifield et al., *Essential Role*]. The Court was also correct in *Allen* that the inclusion of different criteria in algorithms can "yield different benchmark results." 143 S. Ct. at 1513. But in racial-gerrymandering cases, experts rely on the criteria specified by jurisdictions, not whichever parameters they happen to prefer. Experts also should and do conduct robustness checks to investigate if their conclusions hold when they vary the instructions for their algorithms.

Lastly, the brief highlights some best practices for computational redistricting in the racial-gerrymandering context. One follows directly from the above discussion. To be most helpful, a computer algorithm should incorporate as many as possible of a jurisdiction's nonracial line-drawing criteria. These requirements can include elaborate rules about compactness and splits of political subdivisions, compliance with the Voting Rights Act (VRA) (ascertained using analyses of voter behavior, not racial targets), and the pursuit of partisan advantage (if a jurisdiction admits this aim and if state law permits it). Only if the fullest possible set of nonracial criteria is taken into account can the output of an algorithm be most useful as evidence of mapmakers' intent.

The other best practice we flag at the outset is generating districts for a portion of a jurisdiction instead of, or in addition to, creating jurisdiction-wide maps. For example, if a single district is challenged, that district and the districts it borders could be scrambled by an algorithm while all other districts are held constant. The rationales for this approach are twofold. One, racial-gerrymandering claims are district-specific, so it's most relevant how analogues to a particular enacted district, in a particular area, change demographically when they're redrawn without considering racial data. Two, as just noted, it's important to incorporate as many as possible of a jurisdiction's nonracial criteria in an algorithm. *All* of a jurisdiction's nonracial criteria are necessarily satisfied in the regions of computer-generated maps that an algorithm leaves unaltered.

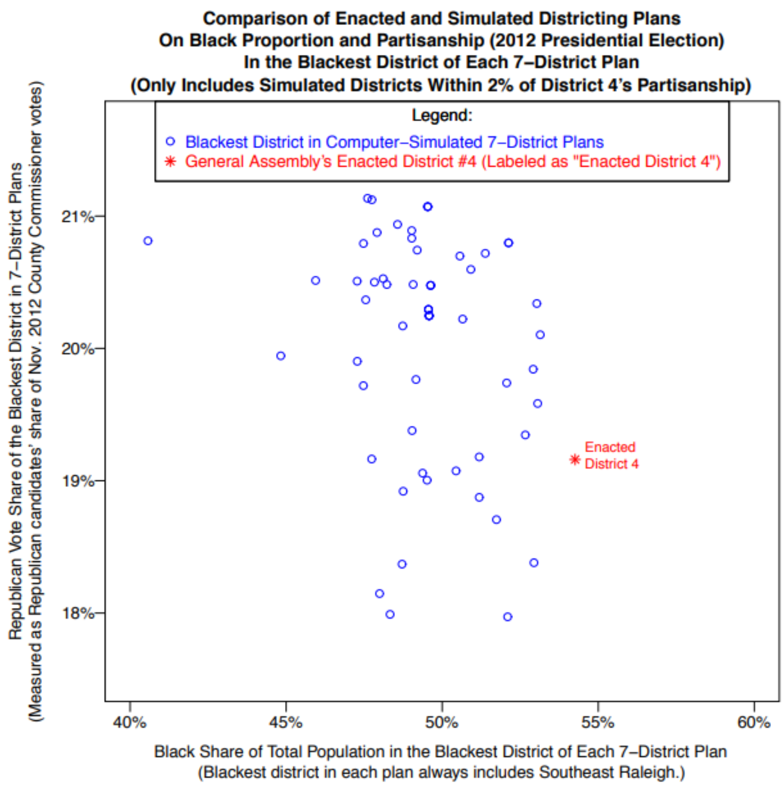
ARGUMENT

I. COMPUTATIONAL REDISTRICTING IS BEGINNING TO BE USED IN THE RACIAL-GERRYMANDERING CONTEXT.

Computational redistricting was widely used in partisan-gerrymandering cases in federal court prior to *Rucho*, *see, e.g.*, *Rucho*, 139 S. Ct. at 2517-18 (Kagan, J., dissenting), and it continues to be a mainstay of state-court partisan-gerrymandering litigation, *see, e.g.*, *Harkenrider v. Hochul*, 197 N.E.3d 437, 443 (N.Y. 2022). As this Court saw in *Allen*, computational redistricting has also played a role in recent racial-vote-dilution cases. *See* 143 S. Ct. at 1506-14; *see also, e.g.*, *Robinson v. Ardoin*, 605 F. Supp. 3d 759, 794-95, 824-25 (M.D. La. 2022). However, computational redistricting has made fewer inroads in the racial-gerrymandering context. In only five cases (including this one) have racial-gerrymandering plaintiffs presented computational-redistricting evidence. Because the volume of this litigation is so small, it's feasible to describe each relevant case, and we do so here.

Raleigh Wake Citizens Association was the first racial-gerrymandering case in which plaintiffs relied in part on computational-redistricting evidence. That suit alleged that one of the seven districts in the 2015 Wake County Commissioners Plan, District 4, was a racial gerrymander. *See* 166 F. Supp. 3d at 620-26. To bolster this claim, one of the plaintiffs' experts, Professor Chen, compared the Black population of District 4 to the Black population of the most heavily Black district (always in southeastern Raleigh) in each of 500 computer-generated maps. These comparator maps ignored racial data but complied with the nonracial criteria of equal population, contiguity, compactness, and preservation of precinct and municipal boundaries. Professor Chen found that "[t]he simulated blackest districts have a black population share ranging from 34.8% to 53.1%." Expert Report of Jowei Chen at 16, *Raleigh Wake Citizens Ass'n*, 166 F. Supp. 3d 553 (No. 5:13-CV-607-D) [*Raleigh* Chen Report]. In contrast, "[i]n the enacted District 4, blacks comprise 54.3% of the total population, a percentage completely outside of the range of the simulated distribution." *Id.* This result supported the inference that "District 4 was not drawn in a race-neutral manner." *Id.*

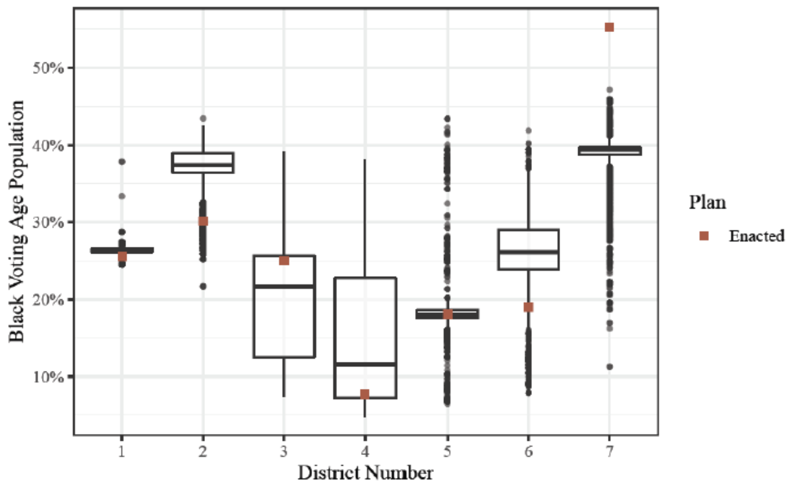
Professor Chen further addressed the possibility that partisanship, not race, might have predominantly explained District 4's demographic makeup. He zeroed in on the sixty computer-generated maps in which the most heavily Black district had a Republican vote share within two percentage points of District 4's Republican vote share (19.2%). As illustrated below, District 4 had a larger Black population than any of these corresponding districts with essentially identical partisan characteristics. Professor Chen thus "rule[d] out the possibility that a possible partisan goal might have caused the extreme racial composition of [District 4]." *Id.* at 18.



The next racial-gerrymandering case including computational-redistricting evidence closely resembled *Raleigh Wake Citizens Association* and so can be summarized quickly. In *City of Greensboro*, the plaintiffs claimed that one of the eight districts in the 2015 Greensboro City Council Plan, District 2, was a racial gerrymander. *See* 251 F. Supp. 3d at 951. Professor Chen was again one of the plaintiffs' experts, and he again compared the racial composition of District 2 to that of the district with the third-largest Black population (generally in northeastern Greensboro) in each of 100 computer-generated maps. These comparator maps disregarded racial data but satisfied the nonracial criteria of equal population, contiguity, compactness, and preservation of precinct boundaries. Professor Chen determined that "[t]he racial composition of District 2"—61.0% Black—"is entirely outside of and higher than this range" for the corresponding districts—50.2% to 60.0% Black. Expert Report of Jowei Chen at 18, *City of Greensboro*, 251 F. Supp. 3d 935 (No. 1:15-CV-559) [*Greensboro* Chen Report]. Professor Chen also concluded that race predominated over partisanship in District 2's formation because it was more heavily Black than the subset of corresponding districts with Republican vote shares within two percentage points of District 2's Republican makeup (22.3%). *See id.* at 20-21.

The third racial-gerrymandering case featuring computational-redistricting evidence was *Singleton v. Merrill*, 582 F. Supp. 3d 924 (N.D. Ala. 2022), *aff'd*, 143 S. Ct. 1487 (2023). (*Singleton* was consolidated with *Milligan v. Merrill*, which also alleged racial vote dilution in violation of Section 2 of the VRA. "[C]onsistent with the longstanding canon of constitutional avoidance," the district court declined to decide the racial-gerrymandering claims. *Id.* at 1035.) The plaintiffs asserted that Alabama's lone majority-Black congressional district, District 7, was a racial gerrymander because it intentionally "packed" Black voters. The plaintiffs also maintained that Districts 1, 2, and 3, all majority-white districts, were racial gerrymanders because they were intentionally "stripped" of Black voters who would have been placed in these districts had race not predominated in their design. *See* Complaint at 49-50, *Milligan v. Merrill*, 582 F. Supp. 3d 924 (N.D. Ala. 2022) (No. 2:21-cv-01530).

One of the plaintiffs' experts, Professor Kosuke Imai, supported these claims with computational-redistricting evidence. To produce a first set of 10,000 comparator maps without using racial data, he matched or beat the enacted plan in terms of equal population, contiguity, average district compactness, and county splits, and avoided pairing incumbents. *See* Expert Report of Kosuke Imai at 7, *Singleton*, 582 F. Supp. 3d 924 (Nos. 2:21-cv-1291, 2:21-1530) [*Singleton* Imai Report]. As shown below, District 7 had a larger Black population than any of the 10,000 districts that corresponded to it (in the sense of sharing the same incumbent). Similarly, Districts 2 and 6 had smaller Black populations than almost all of the 10,000 districts that corresponded to them. *See id.* at 10.



Professor Imai also created a second set of 10,000 race-conscious comparator maps that each included one majority-Black district but otherwise satisfied the same criteria as the first map set. The majority-Black district in each of these maps was never as heavily Black as District 7. *See id.* at 13-15. And the district with the second-largest Black population in each of these maps almost always had a larger Black population than the enacted district with the second-largest Black population (District 2). *See id.* at 15-16. Professor Imai generated one more set of 10,000 race-conscious comparator maps that, in addition to the criteria already noted, avoided splitting Baldwin County, Mobile County, and the counties comprising the community of interest of the Black Belt. *See* Rebuttal Expert Report of Kosuke Imai at 4, *Singleton*, 582 F. Supp. 3d 924 (Nos. 2:21-cv-1291, 2:21-cv-1530) [*Singleton* Imai Rebuttal Report]. Again, Professor Imai's results were unchanged. District 7 remained more heavily Black than any corresponding district, and District 2 continued to have a smaller Black population than almost any corresponding district. *See id.* at 5-6.[3]

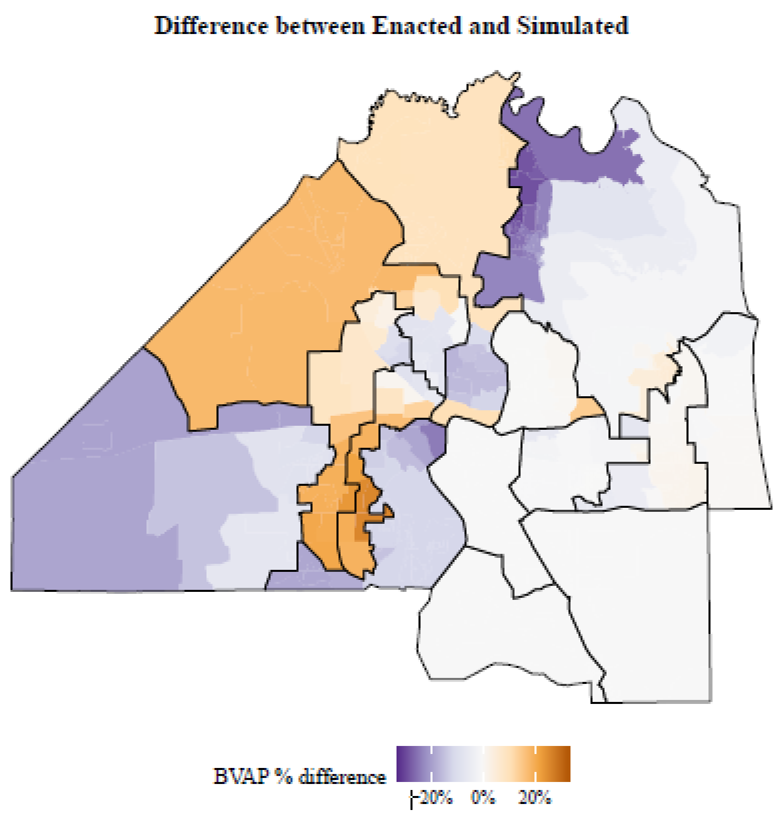
Professor Imai was also the relevant expert in the fourth racial-gerrymandering case to include computational-redistricting evidence, *Jacksonville Branch of NAACP*. The plaintiffs in this case challenged seven of Jacksonville's fourteen single-member City Council districts. Four districts (Districts 7, 8, 9, and 10) were alleged to have been intentionally packed with Black voters, and three districts (Districts 2, 12, and 14) to have been intentionally stripped of Black voters. To produce a comparator set of 10,000 maps, Professor Imai matched or beat the enacted plan in terms of equal population, contiguity, average district compactness, precinct splits, and neighborhood splits. He also avoided pairing incumbents and froze three districts that didn't border the challenged districts. He further incorporated Section 2 of the VRA by ensuring that each map, like the enacted plan, included at least four "VRA-performing districts," i.e., "district[s] where the candidate of choice for Black voters is predicted to win at least two thirds of the time and the votes cast by

[3] Professor Imai performed all these analyses only to support plaintiffs' racial-gerrymandering claims. Alabama then improperly attempted to portray the analyses as relevant to the entirely separate issue of racial vote dilution. This Court squarely rejected this effort in *Allen*. *See* 143 S. Ct. at 1512-14.

Black voters are likely to form a majority of the votes received by such candidate." Expert Report of Kosuke Imai at 10, *Jacksonville Branch of NAACP*, 635 F. Supp. 3d 1229 (No. 3:22-cv-493) [*Jacksonville* Imai Report].

Professor Imai's findings were starkest for three packed districts (Districts 7, 9, and 10) and two stripped districts (Districts 2 and 12). Districts 7, 9, and 10 were more heavily Black than all or almost all of the 10,000 districts that corresponded to each of them (in the sense that the districts had the same rank order with respect to Black population size). Likewise, Districts 2 and 12 were less heavily Black than all or almost all of the 10,000 districts that corresponded to each of them. *See id.* at 12-14. In ruling that the challenged districts were unlawful racial gerrymanders, the district court relied on these results (in addition to much other evidence). "[T]he statistical analysis in the Imai Report supports the conclusion that it is statistically improbable that the Challenged Districts would be drawn as they are absent race as a predominant factor." *Jacksonville Branch of NAACP*, 635 F. Supp. 3d at 1284; *see also id.* at 1280 ("The Imai Report also shows that the 2022 Enacted Plan maintains this statistically anomalous racial sorting . . . .").

Professor Imai also conducted what's known as a dislocation analysis in this case. That is, he compared the Black population share of the enacted district in which each precinct was placed to the average Black population share of the 10,000 districts to which the precinct was assigned in the computer-generated maps. As depicted below, shades of orange indicate that a precinct's enacted district was more heavily Black than—packed relative to—a precinct's average comparator district. Conversely, shades of purple mean that a precinct's enacted district was less heavily Black than—stripped relative to—a precinct's average comparator district. This analysis reveals that much of the enacted plan's racial packing occurred in south-central and western Jacksonville, where elongated districts with large Black populations engulfed many precincts that usually ended up in less heavily Black districts in the comparator maps. The analysis also shows that much of the enacted plan's racial stripping took place in southern and northeastern Jacksonville, where districts with artificially low Black populations took in many precincts that tended to land in more heavily Black districts in the comparator maps. *See Jacksonville* Imai Report at 15.



This leaves only the present case, in which the plaintiffs charge that South Carolina's First Congressional District is an illegal racial gerrymander and Professor Imai is once more the pertinent expert.[4] Professor Imai conducted two local analyses without using racial data and focusing on the boundary between District 1 and District 6 (South Carolina's lone Black-opportunity district). To run these analyses, he matched or beat the enacted plan, on average, in terms of equal population, contiguity, district compactness, split counties, and split municipalities, and avoided pairing incumbents. In the first analysis he allowed the entire border between District 1 and District 6 to vary; in the second, he permitted only the portion of the border in Charleston County to move. Professor Imai also created a third set of 10,000 race-conscious statewide maps. These maps took into account the same criteria as the first two map sets but they further ensured that each district corresponding to (because it shared an incumbent with) District 6 had a Black population share between 45% and 50%, large enough to elect a Black-preferred candidate. *See* Expert Report of Kosuke Imai at 8-10, *S.C. State Conf. of NAACP*, No. 3:21-cv-03302 (D.S.C. Jan. 6, 2023) [*South Carolina* Imai Report].

All three analyses yielded highly consistent results. Namely, District 1 had a smaller Black population than almost all corresponding districts in

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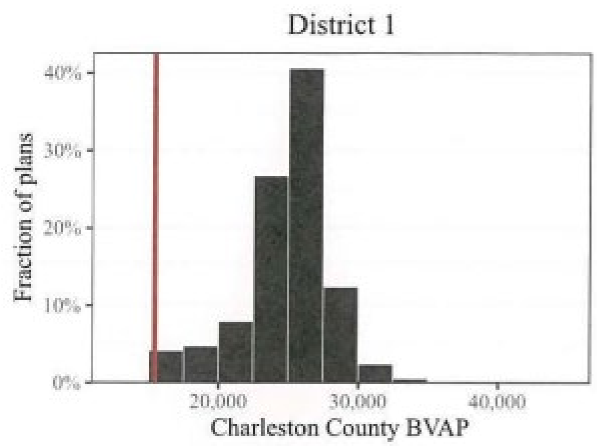
[4] Another expert also presented computational-redistricting evidence. *See* Expert Report of Moon Duchin at 22-27, *S.C. State Conf. of NAACP*, No. 3:21-cv-03302 (D.S.C. Jan. 6, 2023) [*South Carolina* Duchin Report].

the comparator sets. The below chart comes from Professor Imai's second local analysis, which allowed only the Charleston County section of the boundary between District 1 and District 6 to fluctuate. The average district corresponding to District 1 in this comparator set contained 24,900 Black voters from Charleston County—9,500 (or 2.9 standard deviations) more than District 1's actual 15,400 Black voters from Charleston County. *See id.* at 14. The district court cited both this finding and the output of Professor Imai's statewide analysis. *See S.C. State Conf. of NAACP*, 2023 WL 118775, at *8. The court agreed that this "expert testimony . . . provided further support for a finding that race predominated over all other factors in the design of Congressional District No. 1." *Id.*



Professor Imai also performed a pair of dislocation analyses in this litigation. Specifically, he examined how often precincts in and around District

1 were placed in the district corresponding to District 1 in his first comparator set (where only the boundary between District 1 and District 6 varied) and his third comparator set (where all seven congressional districts were reshuffled). In both cases, many heavily Black precincts in and near Charleston typically ended up in District 1, not (as in the enacted plan) District 6. This is the area where District 1's racial stripping is most blatant—where District 1 tried hardest to avoid concentrations of Black voters. *See South Carolina* Imai Report at 12, 16.

II. COMPUTATIONAL REDISTRICTING CAN BE PROBATIVE IN THE RACIAL-GERRYMANDERING CONTEXT.

Computational-redistricting evidence, then, *has* played a role in a few racial-gerrymandering cases to date. Should it *continue* to be used in these cases going forward? We believe so. Computer-generated maps can help illuminate the intent of line-drawers—the central issue in racial-gerrymandering cases—and supply the alternative map this Court has occasionally mentioned. The racial-gerrymandering context is also materially different from the racial-vote-dilution context, in which the Court properly rejected computational-redistricting evidence in *Allen*. And the Court's more general objections to computer-generated maps in *Allen*, while apt, can be overcome by modern methods.

A. Legal Uses

More than any other redistricting theory, racial-gerrymandering claims revolve around the intent of mapmakers. A plaintiff must prove that "race was the predominant factor motivating the legislature's decision to place a significant number of voters within or without a particular district." *Miller v. Johnson*, 515 U.S. 900, 916 (1995); *see also, e.g.*, *Cooper v. Harris*, 581 U.S. 285, 291 (2017) (discussing the different ways that a plaintiff can establish "legislative intent"); *Hunt v. Cromartie*, 526 U.S. 541, 547 (1999) (noting that "appellees . . . were required to prove that [the challenged district] was drawn with an impermissible racial motive"). Only if a predominant racial purpose has been demonstrated does a disputed district become subject to strict scrutiny. *See, e.g.*, *Cooper*, 581 U.S. at 292.

The basic reason why computational redistricting can be probative in the racial-gerrymandering context is that it's a technique well-suited to shedding light on the intent of line-drawers. In particular, computer algorithms can incorporate many of a jurisdiction's nonracial criteria and then churn out maps that satisfy these criteria at least to the same extent as the jurisdiction's enacted plan. If the districts in these maps that correspond to the challenged district significantly diverge from that district demographically, this constitutes evidence that race was the predominant factor motivating that district's formation. In this case, a predominant racial purpose is probable since, but for such a purpose, the challenged district would likely have had quite different demographic characteristics. *See, e.g.*, Chen & Stephanopoulos, *Race-Blind Future*, at 923 ("It may be a plausible inference that certain opportunity districts were primarily designed for racial reasons if their volume exceeds that which would generally result from a nonracial redistricting process. Why would so many opportunity districts exist . . . but for an overriding racial objective?").

To illustrate this logic by reference to this case, the South Carolina Legislature explicitly stated its criteria for congressional redistricting. These criteria were compliance with federal law (including the one-person, one-vote rule, the VRA, and the prohibition of racial gerrymandering), contiguity, and the "additional considerations" of compactness, constituent consistency, minimizing divisions of counties, cities, and towns, and preserving communities of interest. *See S.C. State Conf. of NAACP*, 2023 WL 118775, at *4.[5] Professor Imai therefore included only criteria from this list in his computer algorithm and then generated large numbers of local maps (limited to District 1 and

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[5] Notably absent from this list was any partisan objective. *Cf. Rucho*, 139 S. Ct. at 2510 (noting that North Carolina's 2016 congressional redistricting criteria *did* "includ[e] one labeled 'Partisan Advantage'"). Had a particular partisan composition for District 1 been one of South Carolina's stated criteria, this goal could have been included in a computer algorithm. *See, e.g.*, *Greensboro* Chen Report at 18-21; *Raleigh* Chen Report at 16-18.

District 6) and statewide maps. In essentially all these maps, the district corresponding to District 1 had a larger Black population than District 1 itself. *See South Carolina* Imai Report at 11-17. This result supported the inference that District 1 was drawn with the predominant racial purpose of suppressing its Black population. But for such a purpose, District 1 would probably have had a larger Black population, just like its corresponding districts in virtually all the comparator maps.

That computational redistricting can be probative in the racial-gerrymandering context is our main claim here. But we also make two subsidiary points. The first is that racial-gerrymandering plaintiffs *may*—but *need not*—present computational-redistricting evidence. A predominant racial purpose may be proven in many ways: "through direct evidence of legislative intent, circumstantial evidence of a district's shape and demographics, or a mix of both." *Cooper*, 581 U.S. at 291 (internal quotation marks omitted). Computer-generated maps that satisfy many of a jurisdiction's nonracial criteria but ignore racial data are simply one more kind of circumstantial evidence. In theory, a racial-gerrymandering plaintiff could rest her case entirely on such maps (though, prudently, no plaintiff to date has done so). Alternatively, a plaintiff could submit such maps along with other direct and/or circumstantial evidence (like the plaintiffs in the five cases summarized above). Or a plaintiff could offer no such maps at all (like most racial-gerrymandering plaintiffs historically). There's no requirement that computational redistricting be conducted, nor would such a rule make sense since "neither [the] presence nor [the] absence" of any type of evidence "can itself resolve a racial gerrymandering claim." *Id.* at 319.

Our other doctrinal point is that a computer algorithm can produce the alternative map the Court has occasionally flagged as useful (but not necessary) evidence of line-drawers' intent. *See, e.g.*, *Easley v. Cromartie*, 532 U.S. 234, 258 (2001). The alternative map the Court has meant is one that achieves a jurisdiction's nonracial objectives without the same degree of racial packing and/or stripping. *See, e.g.*, *id.* Such a map "can serve as key evidence . . . show[ing] that the legislature had the capacity to accomplish all its partisan goals without moving so many [or so few] members of a minority group into the district." *Cooper*, 581 U.S. at 317. Notably, a map generated by a properly programmed algorithm *is* an alternative map of just this kind. If an algorithm incorporates a jurisdiction's nonracial criteria, each map it yields attains those goals without any deliberate racial packing and/or stripping. And of course, an algorithm can spit out not just one or a handful of alternative maps but rather thousands or even millions. An algorithm is thus one—though certainly not the only—method through which a racial-gerrymandering plaintiff can craft a suitable alternative map.

B. Distinctions from Racial Vote Dilution

A reasonable question is how computational redistricting can be probative in racial-gerrymandering litigation when the Court recently held in *Allen* that it has no place in racial-vote-dilution cases.[6] The answer is that both rationales for this holding in *Allen* are inapplicable to the racial-gerrymandering context. The first rationale was that liability for racial vote dilution "turns on the presence of discriminatory effects, not discriminatory intent." 143 S. Ct. at 1507. As discussed above, computational redistricting can help identify the intent of mapmakers. Mapmakers' intent, however, simply isn't a relevant issue in a standard racial-vote-dilution suit.

But mapmakers' intent *is* an issue—in fact, often the *dispositive* issue—in racial-gerrymandering litigation. Again, a plaintiff's initial burden in a racial-gerrymandering case is to show that race was

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[6] More specifically, the Court held in *Allen* that *sampling* algorithms that try to generate representative ensembles of maps have no place in racial-vote-dilution cases. *Allen*, 143 S. Ct. at 1514-15. The Court didn't address *optimization* algorithms that try to identify maps that perform as well as possible on several dimensions. *See generally* Br. of Computational Redistricting Experts as *Amici Curiae* in Support of Appellees and Respondents at 3-14, *Allen v. Milligan*, 143 S. Ct. 1487 (2023) (Nos. 21-1086, 21-1087) [Computational Br.].

the predominant motive for the design of a given district. If a plaintiff carries this burden, victory is likely since strict scrutiny then applies to, and usually dooms, the challenged district. Computational redistricting can be probative in the racial-gerrymandering context, then, for the same reason it's unsuited to the racial-vote-dilution context. Namely, racial gerrymandering, unlike racial vote dilution, does fixate on racial intent, and computational redistricting can be a powerful tool for uncovering evidence of racial intent.

The *Allen* Court's other rationale for rejecting computational redistricting in racial-vote-dilution litigation was that the technique implies a benchmark for measuring discriminatory effect that's precluded by the Court's precedent. Under that precedent, the baseline relative to which racial vote dilution is evaluated is *race-conscious*. It's the demonstrative map submitted by the plaintiff "to show, as [the Court's] cases require, that an additional majority-minority district could be drawn." *Id.* at 1512. This map is necessarily "created with an express [racial] target in mind." *Id.* Indeed, "[t]hat is the whole point of the enterprise." *Id.* In contrast, the benchmark urged by Alabama was the typical map produced by a computer algorithm *without* using racial data. That map could be completely different from the baseline established by existing precedent. The Court thus rightly dismissed Alabama's proposal, remarking that "[t]he contention that mapmakers must be entirely 'blind' to race has no footing in [the Court's] case law." *Id.*

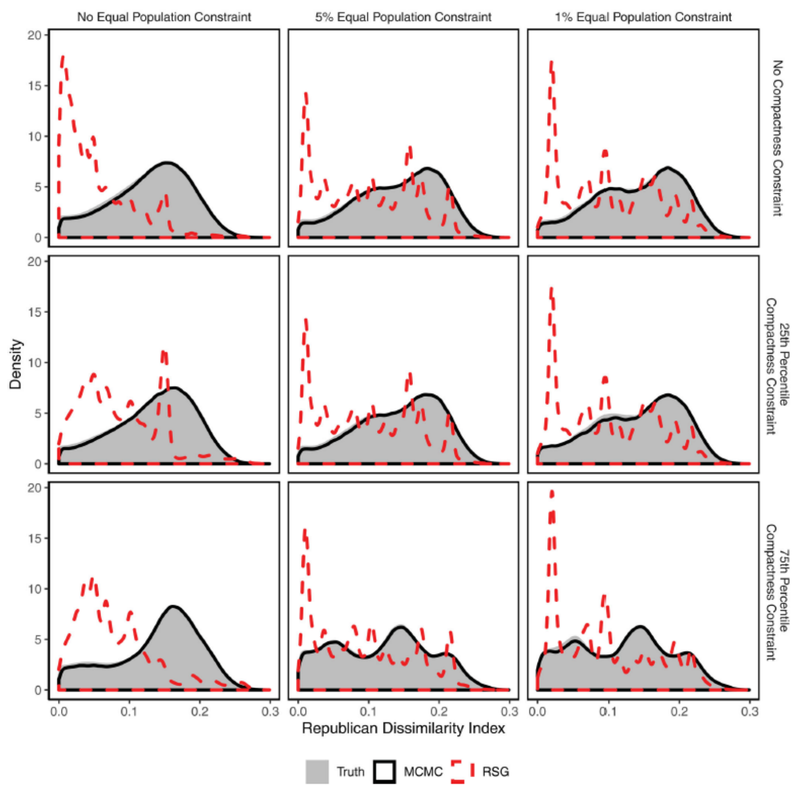
Again, this is an ironclad basis for spurning computational redistricting in the racial-vote-dilution context. And again, this rationale doesn't carry over to the racial-gerrymandering context. In racial-gerrymandering law, there's no race-conscious benchmark relative to which discriminatory effect is assessed. In fact, there's no baseline of any kind for determining discriminatory effect, because discriminatory effect isn't part of this cause of action. Accordingly, the use of comparator maps generated by a computer algorithm without considering racial data doesn't conflict with any racial-gerrymandering precedent.

C. Responses to Methodological Concerns

In *Allen*, the Court didn't just give legal reasons for not embracing computational redistricting that don't apply to racial-gerrymandering litigation. The Court also raised a pair of methodological concerns about the technique that plainly *do* extend to racial-gerrymandering cases. The first concern was that, no matter how many maps they create, computer algorithms can capture only a tiny slice of the entire, near-infinite map universe. *See id.* at 1514 ("Two million maps, in other words, is not many maps at all."). In that case, the Court worried, results based on the first batch of comparator maps might diverge from results drawn from the next batch, or the one after that. *See id.* ("What would the next million maps show?").

The Court is correct that, in most real-world redistricting scenarios, the number of lawful maps is astronomical, far beyond the capabilities of computer algorithms to enumerate fully. But this is no cause for alarm because modern Markov Chain Monte Carlo (MCMC) algorithms are able to produce *representative* map ensembles. *See, e.g.*, Benjamin Fifield et al., *Automated Redistricting Simulation Using Markov Chain Monte Carlo*, 29 J. Computational & Graphical Stat. 715, 717 (2020) [Fifield et al., *MCMC*] ("[The] basic MCMC algorithm is designed to obtain a . . . representative sample from any distribution over valid redistricting plans."). Just as representative samples of survey respondents have similar properties to the population being polled, representative map ensembles resemble the universe of maps satisfying the specified criteria. The Court's question in *Allen*—"What would the next million maps show?"—therefore isn't "[a]nswerless," as the Court supposed. 143 S. Ct. at 1514. Rather, as long as the initial set of comparator maps is representative, the next million (or billion, or trillion) maps would have much the same characteristics and lead to much the same conclusions.

How do we know that the map ensembles generated by MCMC algorithms are actually representative? There are mathematical proofs to this effect, which hold if certain conditions are satisfied. *See, e.g.*, Fifield et al., *MCMC*, at 716-23; Cory McCartan & Kosuke Imai, *Sequential Monte Carlo for Sampling Balanced and Compact Redistricting Plans*, 18 Annals Applied Stat. (forthcoming 2024) (manuscript at 4-10). Additionally, scholars have examined the performance of MCMC algorithms in situations where all lawful maps *can* be enumerated so the "ground truth" for the entire map universe *is* known. In the figure below, for instance, the gray region in each panel is the actual distribution of the Republican Dissimilarity Index (a measure of partisan dispersion) under various constraints across all two-district maps that can be formed from seventy Florida precincts. The dashed red line corresponds to an earlier "random-seed-and grow" (RSG) algorithm that's unable to produce a map ensemble representative of the true map universe in any panel. On the other hand, the solid black line denoting the MCMC algorithm perfectly tracks the boundaries of the gray region in every panel, indicating outstanding representativeness in all cases. *See* Fifield et al., *Essential Role*, at 62.



The *Allen* Court's other methodological concern stemmed from the fact that redistricting involves many requirements, which can be operationalized in many ways. *See* 143 S. Ct. at 1513 ("Districting involves myriad considerations [requiring] quantifying, measuring, prioritizing, and reconciling . . . ." (internal quotation marks omitted)). Because of this array of criteria and implementation choices, one computer algorithm's parameters might differ from another's. As a result, algorithms' outputs might diverge as well. *See id.* ("What happens when the maps [the algorithms] produce yield different benchmark results?"); *see also Rucho*, 139 S. C. at 2505 ("It is easy to imagine how different criteria could move the median map toward different partisan distributions.").

Again, the Court is right that, when computer algorithms are programmed differently, they sometimes yield divergent map ensembles. But several factors mitigate this concern. First, in the racial-gerrymandering context, practitioners of algorithms *don't* have unbounded discretion in selecting requirements and making implementation choices. Instead, for their work to be most helpful, they must follow a jurisdiction's lead, using its (nonracial) criteria operationalized as it happens to prefer. Here, for example, the South Carolina Legislature explicitly stated its congressional redistricting criteria. *See S.C. State Conf. of NAACP*, 2023 WL 118775, at *4. Professor Imai thus had little flexibility in programming his algorithm. He had to use the parameters specified by the Legislature. And to tie his hands still tighter, he not only *used* those parameters but also required his comparator maps to *perform* at least as well on those parameters as the enacted plan. *See South Carolina* Imai Report at 8-10.

Second, since some wiggle room remains even when experts follow a jurisdiction's lead, they commonly create multiple sets of comparator maps based on different groups of criteria. Experts then check whether their results remain about the same across the various sets of maps. If so, that suggests that the results aren't being driven by particular contestable choices, but rather are robust to the use of different parameters. Here, to illustrate, Professor Imai incorporated Section 2 of the VRA into one of his comparator sets but not the other two. He also varied whether his maps scrambled all of South Carolina's congressional districts or just two of them, and in the latter case whether the entire boundary between District 1 and District 6 could change or just its Charleston County portion. *See id.* That none of these permutations affected Professor Imai's conclusions is a sign of their solidity. Here, contra the *Allen* Court's worry, "the maps [that different criteria] produce[d]" *didn't* "yield different benchmark results." 143 S. Ct. at 1513.[7]

That worry, lastly, can hardly be limited to computational redistricting. Almost *every* method that experts use in litigation (and academics in scholarship) can lead to different outcomes depending on which variables are included and how the analysis is conducted. The proper response to this fact, in the words of the *Allen* Court, isn't to deem computational redistricting "categorically irrelevant." *Id.* at 1513

[7] Academic work using computer algorithms to study race and redistricting has also found that "results are robust to different methodologies." Chen & Stephanopoulos, *Race-Blind Future*, at 895 n.158; *see also* Computational Br. at 31 (noting that "two competing studies . . . using divergent methodologies" reached the same conclusion about the consequences of race-blind redistricting).

n.8. Instead, it's for courts to proceed with their eyes open—to "be attentive to [potential methodological] concerns" and to "exercise caution before treating results produced by algorithms as all but dispositive." *Id.* That's sound counsel with respect to algorithms and, indeed, all techniques that litigants deploy in court.

III. COMPUTATIONAL REDISTRICTING SHOULD BE CONDUCTED IN CERTAIN WAYS TO BE MOST USEFUL IN THE RACIAL-GERRYMANDERING CONTEXT.

Computational redistricting can be probative, then, in the racial-gerrymandering context. Our final aim in this brief is to explain how the method can be *most* probative, *most* useful in determining the intent of mapmakers. We identify five best practices, all of which were implemented by Professor Imai in this case. In assessing the weight of this type of expert evidence, courts should consider how closely these best practices are heeded in future racial-gerrymandering cases. The more closely they're heeded, the more light computational redistricting can shed on mapmakers' intent.

First, consistent with our above discussion, it's important for a computer algorithm to include as many as possible of a jurisdiction's nonracial criteria. As just noted, one benefit of such thoroughness is that it reduces the discretion of an expert to pick and choose parameters. In addition, the more accurately an algorithm emulates a jurisdiction's actual redistricting process (except for any reliance on race), the stronger are the inferences that can be drawn from the algorithm's results. In an ideal scenario, if an algorithm fully captures (nonracial) mapmaking in a jurisdiction, any material differences between the enacted plan and the set of comparator maps are persuasive indicia of racial intent.

Including as many nonracial criteria as possible means going beyond basic requirements like equal population, contiguity, and compactness. Where it's a criterion, for instance, the avoidance of county and municipality splits should be entered into an algorithm, even if such avoidance is regulated by complex rules. *See, e.g.*, Expert Report of Kosuke Imai at 32-37, *League of Women Voters of Ohio v. Ohio Redistricting Comm'n*, 192 N.E.3d 379 (Ohio 2022) (Nos. 2021-1193 et al.) (complying with Ohio's elaborate county-splitting restrictions). Similarly, the preservation of communities of interest should be achieved, where applicable, by identifying and then not dividing communities. *See, e.g.*, *Singleton* Imai Rebuttal Report at 4 (respecting the community of Alabama's Black Belt); *South Carolina* Duchin Report at 30-38 (respecting certain South Carolina communities identified by public testimony). Where there are significant minority populations and voting is racially polarized, Section 2 of the VRA should be taken into account as well, preferably by assessing voter behavior using ecological inference. *See, e.g.*, *Jacksonville* Imai Report at 8-10. And if a jurisdiction (unlike South Carolina) admits a partisan purpose, and this purpose is permitted by state law, that goal should be an algorithm parameter, too. *See, e.g.*, *Greensboro* Chen Report at 18-21; *Raleigh* Chen Report at 16-18.[8]

Second (and also previewed above), an expert performing computational redistricting should generate several sets of comparator maps. Each set should be based on a slightly different group of criteria, approximating a jurisdiction's actual redistricting process in a slightly different way. The main benefit of this strategy is robustness: demonstrating that the expert's results aren't sensitive to particular choices about criteria and metrics, but rather remain stable as these parameters are varied. *See, e.g.*, Daryl DeFord & Moon Duchin, *Random Walks and the Universe of Districting Plans*, *in* Political Geometry: Rethinking Redistricting in the U.S. with Math, Law, and Everything in Between 341, 367 (Moon Duchin & Olivia Walch eds., 2022) ("[A] suite of strong robustness checks . . . is needed to raise our confidence in the reliability and replicability of this kind of analysis."). This strategy also allows plaintiffs to anticipate and preemptively rebut defenses that a jurisdiction might assert. If

[8] For plaintiffs' experts to incorporate jurisdictions' nonracial criteria into their algorithms, these criteria first need to be identified. If the criteria aren't publicly available, then defendants should identify the criteria in a timely fashion during the discovery process and, if feasible, link asserted criteria to contemporaneous redistricting records.

plaintiffs think a jurisdiction might claim that nonracial criterion X, implemented through metric Y, predominantly explains a district's shape, plaintiffs' expert can incorporate this parameter into one of the comparator sets.

Here, to reiterate, Professor Imai produced three comparator sets: two without using racial data and limited to District 1 and District 6, one race-conscious (in that it ensured compliance with Section 2 of the VRA) and statewide. *See South Carolina* Imai Report at 8-10. Professor Imai also created three comparator sets in *Singleton*, all for Alabama as a whole. The first didn't use racial data, the second was race-conscious (ensuring compliance with Section 2), and the third further prevented certain counties and communities of interest from being split. *See Singleton* Imai Report at 7-8; *Singleton* Imai Rebuttal Report at 4. In *Jacksonville Branch of NAACP* as well, Professor Imai defined a minority-opportunity district in two different ways, and then checked that his conclusions were the same no matter which definition he used. *See Jacksonville* Imai Report at 28.

Third, an expert may wish to complement, or even replace, jurisdiction-wide comparator maps with maps that reshuffle districts only in the vicinity of the challenged district(s). The cases in which this Court has seen computational-redistricting evidence, until now, have involved partisan-gerrymandering or racial-vote-dilution claims. These claims are often jurisdiction-wide, and so have been the comparator maps brought to the Court's attention. "A racial gerrymandering claim, however, applies to the boundaries of individual districts. It applies district-by-district." *Ala. Legislative Black Caucus v. Alabama*, 575 U.S. 254, 263 (2015). For this kind of claim, it's sensible for a computer algorithm to focus on the area of the challenged district(s) and to keep other districts fixed. How an algorithm might reshape those other districts has little bearing on the predominant motive for the formation of the challenged district(s). A secondary advantage of freezing multiple districts is that doing so necessarily realizes all of a jurisdiction's objectives for those districts. Whether those objectives are political or nonpolitical, partial or public-spirited, they're secured by districts that preserve the enacted status quo.

For precisely these reasons, Professor Imai's "local simulation analysis" in this case "focuse[d] on the boundary between Districts 1 and 6." *South Carolina* Imai Report at 8. The analysis froze South Carolina's five other congressional districts and allowed only a single district boundary (or only the Charleston County section of that boundary) to change. The analysis thereby targeted the region where racial gerrymandering was suspected and attained all of the state's redistricting goals with respect to the five fixed districts. In *Jacksonville Branch of NAACP*, likewise, Professor Imai "fr[o]ze three irrelevant districts in the southeast . . . that are neither challenged nor border[] any of the challenged districts." *Jacksonville* Imai Report at 22. Again, this methodological choice bolstered the inferences that could be drawn about the disputed districts and respected the city's priorities regarding the fixed districts.

Fourth, it's necessary to *link* each challenged district to a corresponding district in each comparator map. No such linkage is required in partisan-gerrymandering or racial-vote-dilution cases, where the key issues tend to be jurisdiction-wide: respectively, how many districts are won by a particular party, or how many districts are minority-opportunity districts. Because racial-gerrymandering claims are district-specific, however, jurisdiction-wide statistics about the enacted plan and the comparator maps have limited value. What matters more is how the racial composition of each challenged district compares to the racial makeups of the districts that correspond to it in the comparator maps. To determine which districts in the comparator maps in fact correspond to each challenged district, some technique for establishing correspondence is essential.

Several such techniques exist, and an expert should use her judgment in choosing among them. One approach is to link each challenged district to the district in each comparator map that occupies the most similar geographic area. Professor Imai took this approach in his local analyses in this case, pairing the enacted District 1 with the district in each comparator map that mirrored that district except for its border with District 6. *See South Carolina* Imai Report at 11-14; *see also Raleigh* Chen Report at 16 (pairing the challenged district with the most heavily Black district in southeastern Raleigh in each comparator map). Another method, available if a computer algorithm avoids contests between incumbents, is to link each challenged district to the district in each comparator map that shares the same incumbent. Professor Imai did this in his statewide analysis in this case. *See South Carolina* Imai Report at 10; *see also Singleton* Imai Report at 9 (same). Still another technique is to order districts by their minority populations, in both the enacted plan and the comparator maps, and then to pair the enacted district with the nth-largest minority population with the computer-generated district with the nth-largest minority population. Professor Chen took this tack in *City of Greensboro*, as did Professor Imai in *Jacksonville Branch of NAACP*. *See Greensboro* Chen Report at 18; *Jacksonville* Imai Report at 12.

And *fifth*, an expert should consider supplementing the conventional presentation of the results of a computer algorithm with a dislocation analysis. To repeat, a dislocation analysis is carried out for building blocks of districts like precincts. The analysis shows how the racial composition of the enacted district in which each (say) precinct is placed compares to the average racial makeup of the districts to which the precinct is assigned in the comparator maps. The power of this method is that it identifies where exactly—at a subdistrict level—racial gerrymandering may or may not have taken place. Precincts that usually end up in districts in comparator maps with racial compositions sharply different from the racial makeups of precincts' enacted districts are likely sites of racial gerrymandering. And vice versa for precincts whose enacted districts demographically resemble the districts in comparator maps in which they tend to land.

Here, Professor Imai presented two dislocation analyses, one for his comparator maps that varied only the boundary between District 1 and District 6, the other for his comparator maps that redrew all of South Carolina's congressional districts. Both analyses demonstrated that heavily Black precincts in and near Charleston were almost always placed in District 1 by the computer algorithm—not, as in the enacted plan, District 6. This was thus the region where race played the largest role in redistricting, where the mapmakers strove most diligently to suppress District 1's Black population. *See South Carolina* Imai Report at 12, 16. In *Jacksonville Branch of NAACP*, similarly, Professor Imai used a dislocation analysis to pinpoint the precincts that were most often assigned to less (or more) heavily Black districts in the comparator maps, indicating that those precincts' enacted districts were packed with (or stripped of) Black voters. Precincts in south-central and western Jacksonville were the main sites of racial packing, while precincts in southern and northeastern Jacksonville were the hubs of racial stripping. *See Jacksonville* Imai Report at 15.

CONCLUSION

For the foregoing reasons, the Court should affirm the decision below. The Court should also acknowledge the probative value of computational redistricting in the racial-gerrymandering context, especially when implemented using best practices.

Respectfully submitted,

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