**Policy 360 - Episode 60- Gerrymandering Part 2: An Unlikely Detective**

Kelly Brownell: Hello, and welcome to Policy 360. I'm Kelly Brownell, dean of the Sanford School of Public Policy at Duke University. This is the second in a pair of conversations about partisan gerrymandering in North Carolina, with implications for beyond.

 Recently, North Carolina's congressional maps were thrown out by a panel of federal judges. In the 191-page opinion, Judge James A. Wynn, Jr., wrote that state Republicans had been, quote, motivated by invidious partisan intent, close quote, in dividing up the state to benefit themselves.

 And Republicans been publicly clear with their intent. For example, State Representative David Lewis, who chairs the House Select Committee on Redistricting, said at one committee meeting where participants were discussing potential scenarios, and I quote, I acknowledge freely that this would be a political gerrymander, which is not against the law. I propose that we draw the maps to give a partisan advantage to 10 Republicans and three Democrats because I do not believe it's possible to draw a map with 11 Republicans and two Democrats.

 The federal ruling by the panel of judges would require North Carolina to redraw the maps by the end of the month. However, the Supreme Court has stepped in and put the requirement to redraw the maps on hold, likely because they are considering a gerrymandering case in Wisconsin.

 So, I have invited Jonathan Mattingly to join me today. Jonathan is the chairman of the math department at Duke, and a highly esteemed scholar. His mathematical analysis of North Carolina's 13 districts was key to that first ruling, the one that called the map unconstitutional in North Carolina.

 Jonathan, welcome to Policy 360.

Jonathan M.: Thank you.

Kelly Brownell: Well, how did you get interested in gerrymandering in general, and North Carolina in particular?

Jonathan M.: Initially it started when I was hearing a lecture, a rally might be a better way of putting it, when there was a speaker talking about gerrymandering, and he brought up the fact that in 2012 the majority of North Carolinians voted for a Democratic representative in the U.S. congressional races, but yet the election outcome was nine Republicans and four Democrats.

 That was astounding to me at one level, but then we went on to say, clearly, there should have been seven Democrats, because that would have been just over the majority. And I guess I started asking myself, when people make statements like that, it's always ... It's because that wasn't what we expected to happen, or that wasn't what should have happened.

 And you need to ask yourself first, well, what should have happened, and what would one expect to have happen, before you can make any qualitative statements about someone having crossed a line, or being an extreme outlier, some kind of statistical anomaly if you were to think about what one might have done. And that question somehow motivated everything.

Kelly Brownell: So, I'm imagining that having mathematical expertise brought to bear on this issue has been enormously important, because otherwise you're just going on anecdote, and instincts, and peoples' feelings. Is that right?

Jonathan M.: Yeah, I mean, that was really our motivation. Initially it was an undergraduate project with a student of mine, and she and I asked, how would we probe that question? How would we put some kind of rigorous intellectual or, you know, scientific inquiry around the question, what would one expect?

 I mean, another thing that people often say is they look at one of the districts and they go, "My, that district has 75% Democrats in it, that's ... Obviously somebody did something nefarious." Well, you know, maybe it just happens that North Carolina is such that when you draw 13 districts and you have to fit one in the far western corner where it gets really narrow, and you have to take account of the cities, maybe that's just what happens.

 Turns out that's not what happens, but ... Spoiler alert. But, you know, that question, to put some kind of understanding, or some kind of rigorous understanding behind that value judgment about whether it's expected or unexpected, what one should accept as a legislative result or not.

Kelly Brownell: So, how did you go about analyzing this information that you had access to?

Jonathan M.: Well, so, there are a few principles that are nonpartisan that tend to guide gerrymandering. In particular, we were guided by a North Carolina bill, House Bill 92 from a number of years ago, that passed one chamber of the North Carolina General Assembly but never passed the other chamber, so it never became law.

 But we were guided by that, and it lays out a number of nonpartisan criteria. So, you want your districts to satisfy the one person one vote. So, in North Carolina, if we have 13 districts, each district should have about one thirteenth of the state's population.

 And you don't want them to be squiggly and all over the place, and that's because we have some idea of geographic representation. We're supposed to have ... This Republic of ours is supposed to somehow be based on locality and representation.

 And then there's other issues about not splitting counties, because those might be historical groups of interest. And then, of course, some compliance with the Voting Rights Act.

 So we said, "Okay, there's some criteria. Let's take every district that we could come up with, and let's score it as to how well it satisfies those different design criteria, equal population, kind of relatively compact, looking more like a circle than some squiggly snake, splitting counties, how many counties should it split? How bad were they? And then something about the Voting Rights Act."

 And we take that score, and then we draw random districts based on how low their score is. There's a way of doing that mathematically called Markov Chain Monte Carlo, it's a well-established idea in Bayesian statistics, and all this hubbub around machine learning, around molecular designs of drugs, and then we use that to draw these random districts.

Kelly Brownell: So, I understand there are two approaches to gerrymandering that people refer to, packing and cracking. How does that work?

Jonathan M.: Well, the idea is that, you know, if you have a certain number of Democrats in the state in a certain election you could stick them all in as few districts as possible, you know, make them 100% Democrats, and then that would allow them to have less impact. Because, of course, if you spread them out more equally they might carry more districts. And alternatively, by spreading out in an area very, just below 50%, you can keep a party from carrying.

 And I said Democrats just because we were talking about North Carolina, but, you know, it happened both ways. In history, it probably ... In North Carolina, it probably was done by the Democratic Party, and currently, in Maryland, there's strong evidence that the Maryland maps are gerrymandered to favor the Democrats.

Kelly Brownell: So, what did your analysis show at the end of the day? You mentioned that it showed that a number of the existing districts violated the rules that you had, but you were able to come up with a preferable map that satisfied the rules.

Jonathan M.: Well, yeah, I should be careful. So, one thing we're pretty stringent about is we are not making new maps to be used. That's a political enterprise, there are lots of externalities that are never going to go into some mathematical analysis that we have, and that has to probably be a political procedure.

 What we want to do is give some idea about that background of what one should expect so that one can flag a map as saying, this map is unusual. This map is an outlier. You better have a good reason for having done this, and you better come to court and defend yourself.

 Now, in this particular case we had the good luck of interacting with Tom Ross and his Beyond Gerrymandering project, and there they had this panel of judges. I understand you talked about that earlier. There were some judges, and they drew a map.

 So, we had this human drawn map that was drawn by some bipartisan procedure, and we wanted to see, did that one look like what we typically saw, and did the North Carolina maps look completely different? And the answer was yes.

 What we saw in these maps drawn by the state legislature were three most Democratic districts with way more Democrats than would expect, more than any of our maps had. And then we had next ... The next three districts, going from most Democratic to least Democratic, had many less Democrats. So, the first had been packed, and the second had been cracked, so that their influence was spread out, and they had many less Democrats than they would have expected. And the result of that was that it flipped an election that might have had six or seven Democrats elected to one that only had four.

Kelly Brownell: So, you testified before a panel of federal judges, can you tell us about that?

Jonathan M.: Yeah, that was an interesting experience. It's not one that most mathematicians have. It's become good cocktail conversation on the math cocktail circuit. Don't laugh.

 So, you know, I showed up, and I had talked to ... I have to say, the Common Cause team was really fantastic. They were really great about getting me prepared for that, and I went in, and the surprise was that on the very first day, as you walked into the courtroom, the judges decided that all the statements of fact were agreed upon by both sides, and they would just enter the depositions into the court record.

 Well, they asked the parties to agree to this, and we would skip straight ... All the factual witnesses. We'd just skip them all. They were all there. They had all shown up. They had all come to Greensboro for this trial, some of them flown in. And they're like, "We're just going to skip all that."

 And, so, I thought I was going to be witness four, and then they turned to me and they said, "All right, Mattingly, you're next." And I was the lead witness. I came right ... That was it. So, it was a little trial by fire.

Kelly Brownell: So, how hard is it to explain to non-mathematical people what you did?

Jonathan M.: Well, I mean, I think we tried to very well ... Very much in this case. I mean, what happened was I was there for two to three hours, and I gave a lecture. I mean, I talked to the judges with PowerPoint slides, and I showed them pictures.

 And, really, the idea is the following, You say, we're going to draw a whole bunch of random maps. So, what do I mean by that? We have this big bag, and the degree of goodness, how well is satisfies our design criteria. The lower the score is, the more often it's in this big bag of maps. You know, think of some big bingo hopper, and you rotate it around, stir it up, you reach in, you pull out a map.

 You pull out that map, and you lay it down, and you say, okay, let's take the 2012 election. Let's take all the votes. We know all the votes and all the precincts. So, now we have this new map in front of us, let's take precinct one here, and let's add up all the votes in the precincts for one party, let's say the Republicans.

 You add up all the votes, and you say, "Ah, the Republicans won that one." You do that with each of the districts, and you also look by how much they want them, typically, and that gives you some idea of the structure of the election.

 And then you do that over and over again, we did that 24,000 times. In fact, in one part we did it over almost 120,000. And, so then you ask, what's the outcome of this election? And you tabulate it, and you get some outcome, and then you can say, well, where ... What would the North Carolina General Assembly's two maps do, and what would this map done by the judges?

 You can show that theirs were outliers, but even more so, you can do this analysis where you dig in under the details, and that's probably the most important, because sometimes can get it right for not the right reasons, and you can look and say, wow, look, they packed a lot more Democrats in these most Democratic districts.

 We should have never seen that many Democrats. We never saw, in all the random maps you drew, we never saw them. But in these maps that the General Assembly made, you know, they were unusual.

 And I'll throw in one interesting thing. A lot of times when people talk about gerrymandering, you know, it's the t-shirt with the scraggly district and the ugly, non-compact district. But, you know, if you look at the 2012 ... If you play a little game. You put up the North Carolina 2012 maps, you put up the North Carolina 2016 maps, and you put up the maps drawn by the judges, and you say, which of these is the odd man out? Which of these is not like that other?

 You'll look at them and you'll right away say, ah, the 2012. It's got all these crazy, scraggly districts. You know, they look like snakes. They look like the gerrymander snakes, the gerrymander salamander of the original ... Governor Gary's gerrymandered map, and the 2016 looks nice. But when you look at its structure it acts almost just like the 2012. And, so, without that mathematical lens, we would have been just left looking for unusual districts and hoping that that unusual district was the signature of some nefarious act.

Kelly Brownell: So, have these sorts of mathematical models been applied in other locations?

Jonathan M.: Well, this idea of Monte Carlo sampling to sample from some probability distribution of interest, I mean, that grew out of the Manhattan Project, so back in the early '50s. It's the basis for chemical design of drugs, and most of the Bayesian statistics machine learning revolution of big data that we hear about has that floating in the background.

Kelly Brownell: So, it seems to me that the more that mathematicians get interested in this process the better off we'll be, because then we'll be just going away from instinct and intuition.

Jonathan M.: Yeah, I mean, I think that's true. I don't think we will replace instinct and intuition. I think what we're here to do is help give some rigor to the thought process around it, and give some clarity to when something is unusual and maybe gone too far.

 I mean, people like to say, well, this is a political object, political experience, it should just be political, but our democracy is a highly checked and balanced democracy. You know, we worry about, did everyone vote? We worry about, was there voter fraud? We worry about, was there illegal money in this election?

 We worry about all those things, but then if, once you get to the votes, and you just say, here we have the votes ... The will of the people expressed by this vote, and if by just drawing a map I'm able to take it from three Democrats elected to nine Democrats elected, maybe we need a check and balance on how we draw those maps, because clearly the will ... The same votes end up leading to three Democrats or nine Democrats, and then we take a political mandate from that result? It seems like which mandate we had had a lot more to do with who drew the map than who voted.

Kelly Brownell: So, I could imagine that this kind of work could be seen as value free, that the population, the politicians, decide what the criteria should be, and then you and your colleagues could figure out whether certain districts meet those criteria or don't. But does mathematics help define what some of the important criteria should be?

Jonathan M.: There are people who are thinking about that. That's really the other way around, the inverse problem. I'm talking about, here are some criteria, what kind of maps does it typically draw and does your map look like it, that's my question.

 You know, other people are asking, well, if we want to have these outcomes, if we want to design the game, the system of politic, so that we arrive at certain desirable outcomes, certain balances, how could we design the system to do that? I mean, that's also a very legitimate question. People have looked at that, that's not been my emphasis to date.

Kelly Brownell: Well, I can't tell you how impressed I am by the collaboration that you and Tom Ross struck up with this. It seems like the very best of both worlds. Here you have Tom with, you know, a rich legal background and the history in politics, and then you being an absolutely top rate scientist, coming together to work on this, produce something very impressive.

 And the fact that it's, you know, been heard by the federal courts, could end up in the Supreme Court at some point, just shows how much is at stake here, and how important this is. So, thank you very much for describing this work.

Jonathan M.: It's my pleasure to be here. For me, this has been a huge, kind of, wonderful stimulating moment in my career to interface with the people here at Sanford, and really bring some clarity so that we could make a difference.

Kelly Brownell: So, my guest has been Jonathan Mattingly, chair of Duke's Math Department. We'll have a link to this project, quantifying gerrymandering, on our website, Policy360.org. Until next time, I'm Kelly Brownell.