

1 A. Yes, I am.

2 Q. To your knowledge when is the district considered in
3 racial gerrymandering?

4 A. My understanding is that racial gerrymandering --
5 district is considered a racial gerrymander if racial
6 considerations predominate in the drawing of the district
7 lines.

8 MS. HUNKER: Your Honor, I'm going to object. The
9 witness is not an expert and there's been found -- he's
10 not an attorney. And there's been no foundation about his
11 knowledge on this particular legal scheme.

12 MR. CHEUNG: Your Honor, I'm just asking for his
13 personal understanding.

14 THE COURT: I don't take it as him instructing me on
15 it, and so I think that's something you can cross-examine
16 about --

17 MR. CHEUNG: Yes, Your Honor.

18 THE COURT: -- and cover it that way. Without that
19 context, I'll overrule it.

20 Q. (BY MR. CHEUNG) Dr. Stern, how do your ensemble maps
21 comply with the prohibition against racial gerrymandering?

22 A. So the ensemble maps are drawn entirely race blind.
23 In drawing the maps, the algorithm does not have access to any
24 racial or demographic data. It only uses geography and total
25 population in order to ensure approximate population equality,

1 but does not have any information even -- does not even have
 2 access to any information about race or demographic. So these
 3 maps in the ensemble are completely race blocked.

4 Q. And in your opinion, does avoiding racial
 5 gerrymandering explain why 2025 districts are not compact when
 6 compared to your ensemble?

7 A. No, it does not.

8 Q. Dr. Stern, did you also look at how the 2025 map
 9 distributes the Black voting age population compared to your
 10 ensemble?

11 A. Yes, I did. Although, as I mentioned, the maps
 12 themselves were drawn race blind. I looked at the allocation
 13 of Black voting age population after-the-fact to assess what
 14 the typical split would be for maps that were drawn in this
 15 fashion.

16 Q. How does the 2025 maps distribution of Black
 17 population compare to your ensemble?

18 MS. HUNKER: Your Honor, I'm going to object. In the
 19 stipulations, we had agreed that the 2025 plan was not
 20 necessary in order to comply with the Voting Rights Act.

21 And so that seems to take the issue off -- from dispute
 22 between the parties.

23 MR. CHEUNG: Your Honor, I'm fine withdrawing this
 24 question if the parties do not dispute that CDs four and
 25 five are not justified under the Voting Rights Act.

1 MR. GORE: We stipulate to that.

2 MS. HUNKER: We stipulate to that, Your Honor.

3 THE COURT: Okay. We can move on.

4 MR. CHEUNG: Okay. Thank you, Your Honor.

5 Q. (BY MR. CHEUNG) Dr. Stern, did you also look at
6 whether any legislative objective of avoiding placing the
7 current incumbents of CDs four and five into a same district
8 could explain the design of CDs four and five?

9 A. Yes, I did.

10 Q. What did you find out -- how did you go about
11 answering that question?

12 A. Well, in addition to my full ensemble of 100,000
13 maps, which did not place any encompassing restrictions. I
14 also looked at only those maps that did place the incumbents in
15 two separate districts. So there were about 33,000 of these.
16 So about a third of the ensemble maps kept the incumbents
17 separate. I then performed an additional ensemble analysis
18 where I compared the Missouri First Map only to those 33,000 or
19 so maps that separated the incumbents and redid all the
20 analyses with that as the baseline.

21 Q. And what was the result of the comparison against the
22 baseline of ensemble maps that do not place incumbents in the
23 same district?

24 A. Again, I observed it didn't change any of my
25 conclusions. I observed severe splitting of Jackson County and

1 counties overall. Severe splitting of Kansas City and
2 municipalities overall. Greater splitting of VTDs. And across
3 a wide range of compactness measures I observed that the
4 Missouri First Map was substantially and consistently less
5 compact than the ensemble maps, even looking only at those
6 ensemble maps that separated the incumbents.

7 Q. And so does any objective of placing incumbents in
8 separate districts explain why CDs four and five are not
9 compact compared to your ensemble?

10 A. No, it did not.

11 Q. Turning to the question of population equality. How
12 do your ensembles account for the legal requirement of drawing
13 --

14 A. So the ensembles draw maps that are approximately
15 population balance within a specified tolerance. So my
16 original ensemble in the main body of my report ensures that
17 the populations of CD4 and CD5 deviate from the ideal
18 population that would be perfect splitting by no more than plus
19 or minus one percent to look at whether reducing that tolerance
20 to have a narrower population -- allow narrower population
21 deviation would affect the results. I also created a separate
22 ensemble that only allow .1-percent deviation from the ideal
23 population.

24 Q. And did you find that changing the population
25 tolerance affected the results?

1 A. No, the results were nearly identical.

2 Q. Is it typical for researchers to use a population
3 tolerance of one-percent or .1-percent when drawing ensembles?

4 A. It's common to have a population tolerance that's of
5 that magnitude. Yes. I've seen even more than one percent
6 before but something on the order of one percent or less is
7 very common.

8 Q. Would it have been feasible for you to program the
9 algorithm to be hundred thousand maps of perfectly equal
10 population?

11 A. No. That would've been computationally unfeasible
12 with the algorithm that I used and what sort of the best
13 techniques available at the moment computationally.

14 Q. Do you know how easy or difficult it is take one of
15 the maps in your ensemble that has the one-percent or
16 .1-percent deviation and manually adjust the lines to perfectly
17 balance a population?

18 A. My understanding is that it's quite straight forward.
19 So from speaking with other computational redistricting experts
20 in my experience in this area over the years my understanding
21 is that maps are often drawn on coarser units, like, counties,
22 and then going down to VTDs and then within a small tolerance.
23 And then one generally splits VTDs into blocks and makes some
24 small adjustments to get perfect population balance. And it's
25 generally accepted that given a map that is nearly population

1 balanced it's fairly easy to get perfectly population balanced
 2 just by reassigning a fairly small number of blocks without
 3 substantially changing the properties of the map. My
 4 understanding is that one of the other plaintiff's experts in
 5 this case actually did that with some of the maps in my
 6 ensemble.

7 Q. And do you expect those adjustments to perfectly
 8 balance population to significantly change the compactness
 9 scores of the ensemble maps?

10 A. No, I don't.

11 Q. And we'll talk about this in greater detail later.
 12 But do any of the maps in your ensemble naturally have
 13 perfectly balanced population?

14 A. They do. So just by chance, 30 maps in my ensemble
 15 that had a .1 percent population tolerance happen to be drawn
 16 with perfect population balance. So .1 percent is the maximum.
 17 So really any possibility between .1 percent under .1 percent
 18 over is possible. And 30 of these just happened to have
 19 perfect population balance randomly.

20 Q. So in your view does a requirement of drawing equally
 21 populated districts explain why CDs four and five are not
 22 compact?

23 A. No, it does not. There were several of these -- for
 24 two reasons. One is, as mentioned, several of my ensemble maps
 25 did have perfect population balance and out performed the

1 Missouri First Map on compactness and on these other
2 traditional redistricting criteria. And furthermore, any of
3 the ensemble maps could have been slightly adjusted without
4 changing their overall properties substantially to have perfect
5 population balance.

6 Q. Dr. Stern, did you also consider whether the 2025 map
7 is not compact because legislators tried to follow state senate
8 boundaries?

9 A. Yes, I considered that explanation.

10 Q. To your knowledge, is adherence to state senate
11 boundaries a recognized redistricting principle?

12 A. It's not something I had encountered before.
13 Typically, when one talks about trying to maintain geographies
14 one talks about things, like, counties and municipalities. In
15 previous districts, I hadn't previously encountered a stated
16 desire to preserve other types of state legislative districts.

17 Q. Notwithstanding that, did you try to test the theory
18 --

19 A. Yes, I did.

20 Q. -- trying to follow --

21 A. Yes, I did.

22 Q. What did you find when you tried to test that theory?

23 A. Well, I applied the same methodology that I did with
24 other types of splitting, including counties, municipalities,
25 and VTDs, and previous congressional districts. So what I did

1 was I took each state senate district or portion thereof in CD4
 2 and CD5 looked at the largest intact portion of population and
 3 added those up across all senate districts. In addition, I
 4 also did just a simple count of the number of districts that
 5 were split along the CD4, CD5 boundary. And what I found was
 6 that either looking at population intactness or the number of
 7 splits the Missouri First Map split senate districts more times
 8 and more severely than about 90-percent of the ensemble maps.

9 Q. Have you considered Dr. Trende's argument that State
 10 Senate Districts are more difficult to follow in some parts of
 11 the state but not others?

12 A. Yes, I remember that argument.

13 Q. What do you recall of that argument?

14 A. I recall that Dr. Trende said that there is a
 15 trade-off and that preserving counties outside of Jackson is at
 16 odds with preserving State Senate Districts. And he used that
 17 as explanation for why senate district lines were followed in
 18 certain cases within Jackson County but why this standard does
 19 not apply consistently along the entire boundary.

20 Q. And did you find Dr. Trende's argument to be
 21 persuasive?

22 A. No, I didn't.

23 Q. And why is that?

24 A. Well, if these two things were at odds than one would
 25 expect that better state senate district preservation lead to

1 worse county preservation and vice versa. However, my ensemble
2 only contains the same number of split counties as the Missouri
3 First Map. At most one. And in many cases splits these
4 counties less severely as I've shown. And also split senate
5 districts fewer times and less severely. So if these were
6 really at odds you would expect to see a trade-off where one of
7 these was better and one of these was worse, and we just don't
8 see that in the ensemble.

9 Q. Earlier you had mentioned several maps in your
10 ensemble that just randomly happen to have perfectly balanced
11 population. Did you compare some of those maps to the 2025
12 map?

13 A. Yes, I did.

14 Q. What did you find in comparing the properties of
15 those maps?

16 A. So first of all, I'll mention that these maps adhere
17 to all the same -- make all the same choices outside of CD4 and
18 CD5 because the other six districts are identical to those in
19 the Missouri First Map. Only CD4 and CD5 are changed. The
20 maps that I presented are more compact and less extreme than
21 the 2025 map across these 11 measures of both boundary length
22 and district shape and size. All five of the maps keep
23 counties and municipalities more intact and they all split
24 fewer VTDs, with four of the five splitting zero VTDs. In
25 contrast with the 18 split VTDs in the Missouri First Map.

1 All five of these are better in terms of preservation
 2 of historical congressional district boundaries measured by
 3 intact population. All five better preserve state senate
 4 boundaries. Would you like me to skip the next item because
 5 that's been taking off the table?

6 Q. Yes, that's fine.

7 A. Okay. As I mentioned, they all have perfectly equal
 8 population between CD4 and CD5. And as previously mentioned of
 9 all ensemble maps the districts are continuous.

10 Q. So just to summarize all the different factors that
 11 you accounted for in your analysis was your analysis able to
 12 account for all policy considerations where there should be
 13 principles that the legislature may have had in mind when
 14 enacting district lines outside of CD4 and CD5?

15 A. Outside of CD4 and CD5 it took all of the same -- it
 16 made all of the same choices because none of the other
 17 boundaries were changed at all. So to the extent that any
 18 policy preferences or trade-offs were applied elsewhere in the
 19 map those same decisions were made in my ensemble map outside
 20 of CD4 and CD5.

21 Q. How did your analysis assess the closely united
 22 territory aspect of compactness?

23 A. So it looked at closely united territory by examining
 24 the intactness of counties, municipalities. By considering, as
 25 I mentioned, the historical unity of Jackson County and Kansas

1 City with the same district historically containing the largest
 2 intact portion of both of these. As well as intactness of
 3 counties and municipalities overall and that -- those factors.
 4 In addition to, the usual ones having to do with physical shape
 5 and size.

6 Q. How did your analysis account for compactness from
 7 the perspective of physical shape and size in the traditional
 8 metric?

9 A. So I examined the performance of the ensemble maps on
 10 a wide range of metrics looking at both the properties sort of
 11 the length of the boundary as well as the shapes of the
 12 individual districts. And the ensemble map outperformed the
 13 Missouri First Map sometimes by a really substantial degree
 14 consistently across these 11 metrics. So Missouri First Map is
 15 non-compact compared to the ensemble maps and this is robust to
 16 the selection of compactness metrics.

17 Q. How did you account for contiguity?

18 A. I accounted for contiguity by ensuring that all of
 19 the ensemble maps consist of contiguous districts.

20 Q. How did you account for population equality?

21 A. I accounted for that by ensuring that there was only
 22 a small population difference between CD4 and CD5 in the
 23 ensemble. Less than one-percent in one of the ensembles and
 24 less than .1-percent in the other ensemble.

25 Q. How did you account for natural boundaries?

1 A. I accounted for that in a couple ways. One was
2 because all of these districts are drawn on official census
3 geographies. They all conform with boundaries both natural and
4 the boundaries of the state, and counties and so on to the
5 exact -- precisely as the census geographic units do. I also
6 incorporated natural boundaries into the compactness discussion
7 by looking at the cut edges metric, which as I previously
8 mentioned, does not penalize boundary length that is necessary
9 to fall in natural boundaries.

10 Q. How did you account for population density?

11 A. So I accounted for it in a few ways in my
12 measurements of compactness. One, as I mentioned, the cut
13 edges metric controls for population density because of the
14 fact that there are more blocks in densely populated areas.
15 Additionally, two of the compactness metrics I employed
16 Population Polygon and Population Circle look at population
17 rather than merely the area or the shape or size of the
18 district in computing the scores.

19 Q. How did you account for respect for political
20 subdivision boundaries?

21 A. Well, I accounted for the attempt to not split
22 counties by ensuring that my ensemble maps were drawn in such a
23 way that avoided county splits and did not split counties
24 anymore times than observed in the Missouri First Map. I also
25 observed that the ensemble maps split the same or fewer

1 counties, municipalities, and VTDs and splits the population of
2 those units less severely than the Missouri First Map.

3 Q. How did you account for historical congressional
4 boundaries?

5 A. I accounted for historical congressional boundaries
6 by, as previously mentioned, measuring the number of historical
7 congressional district split along the CD4, CD5 boundary, as
8 well as the population of those districts left intact by the
9 splitting. And determined that this was -- that these
10 districts were split fewer times and less severely in terms of
11 population compared to the 2025 map.

12 Q. How did you make sure that your ensemble maps did not
13 predominately consider race?

14 A. I ensured that by having the ensemble be drawn
15 entirely race blind without incorporating any racial or
16 demographic data.

17 Q. How did you account for incumbent protection?

18 A. I accounted for it by doing a separate ensemble
19 analysis using only the ensemble maps that separated the
20 incumbents and observing that it did not affect the conclusions
21 from my analysis of the full ensemble.

22 Q. And how did you account for adherence to state senate
23 boundaries?

24 A. I accounted for that by applying the same methodology
25 I used for intactness of counties and municipalities,

1 congressional districts. And determined that the ensemble maps
2 split fewer of the senate districts and split the population
3 less severely compared with the Missouri First Map.

4 Q. Based on everything you have considered would you
5 describe the difference in compactness between the 2025
6 districts and your ensemble maps as a practical minimal
7 deviation resulting from the advancing --

8 A. No, I would not.

9 Q. And why wouldn't you consider that non-compactness to
10 be a minimal practical deviation?

11 A. First because the deviations are quite large. As I
12 mentioned, the boundary in the Missouri First Map is over twice
13 as long as the typical ensemble map. And across this wider
14 range of metrics we see significantly less compactness of the
15 Missouri First Map compared to the ensemble.

16 MR. CHEUNG: Thank you, Dr. Stern. No further
17 questions.

18 **CROSS-EXAMINATION**

19 BY MS. HUNKER:

20 Q. It's good seeing you again, Dr. Stern.

21 A. Likewise. Good to see you.

22 Q. I'm going to ask a few questions now that plaintiff's
23 have concluded their direct examination. You're a
24 Mathematician; correct?

25 A. Yes, I am.

1 Q. Your undergraduate degree was in mathematics?

2 A. Yes, it was.

3 Q. Your Master's degree was in Finance, as well as
4 Mathematics?

5 A. It was in mathematics with finance.

6 Q. Your Doctorate was in Applied and Computational
7 Mathematics?

8 A. Correct.

9 Q. And you are a Professor of Mathematics?

10 A. Yes, I am.

11 Q. In short, your formal academic training is in
12 mathematics?

13 A. Yes.

14 Q. Your formal academic training is not in political
15 science?

16 A. In terms of my training and my degrees, no.

17 Q. You attached a curriculum vitae or CV to your
18 December 30 amended report; correct?

19 A. Correct.

20 Q. I'm going to have Keith put on the screen if we can
21 just blow it up a little bit bigger. In your CV, you list a
22 number of publications and preprints; is that right?

23 A. Yes, I do.

24 Q. There are 36 publications and preprints altogether?

25 A. On this copy of my CV, yes.

1 Q. Of the 36 publications and preprints that you list in
2 your CV only one addresses redistricting?

3 A. Correct.

4 Q. That publication addressed communities of interest?

5 A. Yes.

6 Q. It did not address compactness directly?

7 A. No.

8 Q. You testified as an expert in New York Communities
9 for Change v. Nassau County?

10 A. Yes, I did.

11 Q. And that was a redistricting case?

12 A. Yes, it was.

13 Q. It involved a challenge to Nassau counties
14 legislative districting matters; is that right?

15 A. Yes.

16 Q. That is the only other time, outside of the present
17 litigation that you have testified as an expert?

18 A. Yes.

19 Q. And do you not believe that compactness is being
20 challenged in the Nassau County case?

21 A. No, I don't believe so.

22 Q. As such you have not acted as expert involving a
23 redistricting challenge on a compactness claim until this case?

24 A. That's correct.

25 Q. Nor have you acted as expert in any redistricting

1 challenge to a district located in Missouri before this case?

2 A. That's correct.

3 Q. And so it's fair to say that the present action is
4 the first time you're acting as an expert witness in a
5 redistricting case involving a challenge under Missouri's
6 compactness requirement?

7 A. Yes, that's correct.

8 Q. You drafted the reports you submitted in this case?

9 A. Yes, I did.

10 Q. That said, you did consult with counsel about some of
11 the language?

12 A. Yes.

13 Q. You especially consulted with counsel regarding legal
14 cases and standards you cite in your reports?

15 A. That's right.

16 Q. And counsel explained to you the legal standard for
17 compactness in *Pearson v. Koster*?

18 A. Yes.

19 Q. Counsel helped you understand what as compact may be
20 -- means in light of *Pearson v. Koster*?

21 A. Yes.

22 Q. And you relied on that definition of compactness when
23 drawing the conclusions in your reports?

24 A. Yes, I did.

25 Q. You do not recall counsel directing your attention to

1 any other Missouri Supreme Court case?

2 A. I don't recall any other case being brought to my
3 attention, no.

4 Q. You also had counsel help edit and revise your
5 reports?

6 A. That's correct.

7 Q. For example, you got feedback from counsel about how
8 things might be best explained by a nonmathematical audience?

9 A. Best explain to a nonmathematical audience, but yes.

10 Q. And I appreciate that. The scope of work was also
11 determined in conversation with counsel?

12 A. Can you repeat that question?

13 Q. The scope of work was also determined in conversation
14 with counsel?

15 A. Yes.

16 Q. Counsel advised you on what subjects to address in
17 your reports?

18 A. Yes.

19 Q. For example, counsel advised you to focus your
20 assessments on Jackson County?

21 A. Counsel advised me to consider Jackson County, but I
22 also considered other things as well. But yes.

23 Q. Counsel advised you to focus your assessments on
24 Kansas City?

25 A. Yes. Same answer.

1 Q. Counsel didn't specify for you to focus your
2 assessments on any other part of the state?

3 A. That's incorrect. They asked me to assess CD4 and
4 CD5 and their properties in total of all the territory they
5 cover.

6 Q. With a focus on Kansas City and Jackson County?

7 A. With the focus including Kansas City and Jackson
8 County but not exclusive to them.

9 Q. Counsel also advised you on which redistricting
10 considerations you should look at in your report?

11 A. Can you repeat that question, please?

12 Q. Counsel also advised you on which redistricting
13 considerations you should look at in your report?

14 A. They advised me on redistricting considerations.

15 Other considerations are ones that I would incorporate in any
16 ensemble analysis I conducted, even without that guidance.

17 Q. Let's talk a bit about the scope of your report and
18 analysis. You were asked to determine whether CD4 and/or CD5
19 could have been drawn in a more compact manner while keeping
20 the remaining six congressional districts identical to those in
21 the Missouri First Map?

22 A. Yes.

23 Q. And if you could draw CD4 and/or CD5 in a more
24 compact manner you were asked whether compliance with
25 recognizing redistricting considerations explains why CD4 and

1 CD5 under the Missouri First Map are not as compact may be?

2 A. That's right.

3 Q. Counsel only asked you to look at CD4 and CD5?

4 A. That's right.

5 Q. And to conduct this analysis you used a computer
6 software to generate an ensemble of alternative maps?

7 A. Yes.

8 Q. The computer software that generated the ensemble
9 maps it only varied the boundaries between CD4 and CD5 in the
10 Missouri First Map?

11 A. Correct.

12 Q. It did not vary any other boundary in the Missouri
13 First Map?

14 A. No, it did not.

15 Q. All the ensemble maps have the same outer boundary as
16 the combined CD4 and CD5 area in the Missouri First Map?

17 A. Correct.

18 Q. Or another way of putting it, is that each of the
19 ensemble maps cover the same territory as the combined CD4 and
20 CD5 on the Missouri First Map?

21 A. Yes.

22 Q. You did not create an ensemble for any other boundary
23 lines in the Missouri First Map?

24 A. No, I did not.

25 Q. You did not create an ensemble for any other

1 combination of districts in the Missouri First Map outside of
2 CD4 and CD5?

3 A. No, I did not.

4 Q. You therefore do not offer any opinion on whether
5 other districts besides CD4 and CD5 could have been drawn in a
6 more compact manner?

7 A. That's correct.

8 Q. Because your ensemble is limited to the CD4 and CD5
9 boundary line you did not analyze whether any of CD4 or CD5s
10 boundary lines in the Missouri First Map can be explained by
11 compliance with recognized redistricting considerations?

12 A. Could you repeat that question?

13 Q. Sure. Because your ensemble is limited to CD4 and
14 CD5 boundary line you did not analyze whether any other CD4 or
15 CD5 boundary lines in the map can be explained by compliance
16 with redistricting considerations? And I am referring to the
17 outer boundaries.

18 A. Yes, that's correct. I didn't hear the word other
19 and I wanted to make sure it was in there.

20 Q. Likewise, because your ensemble is limited to the CD4
21 and CD5 boundary line you did not analyze whether any other
22 congressional district boundary line in the Missouri First Map
23 can be explained by compliance with redistricting criteria?

24 A. Correct.

25 Q. You did not examine the preservation of the prior

1 congressional districts or any boundary line in the Missouri

2 First Map other than the boundary line dividing CD4 and CD5?

3 A. That's correct.

4 Q. You did not examine the preservation of senate

5 districts or any boundary line in the Missouri First Map other

6 than the boundary line dividing CD4 and CD5?

7 A. Correct.

8 Q. And outside of your analysis concerning Jackson

9 County and Kansas City splits you did not examine the

10 preservation of political subdivisions such as counties and

11 cities for any boundary line in the Missouri First Map outside

12 of the boundary separating CD4 and CD5?

13 A. That's correct. In Jackson County, Kansas City. I

14 also responded to some things having to do with the three-way

15 split including CD6, but no others. And all of my ensemble

16 analysis was on the CD4 and CD5.

17 Q. And that analysis you discussed regarding Kansas City

18 and Jackson County that's in your rebuttal report; correct?

19 A. That is correct.

20 Q. Finally, you did not offer any opinion in your

21 reports about the compactness metrics of any congressional

22 district in the Missouri First plan outside of CD4 and CD5?

23 A. That is correct.

24 Q. Changing gears somewhat. You spoke during direct

25 examination about the methodology behind the creation of your

1 ensemble maps. I don't want to retread the same ground. But
 2 as a broad summary you gave the computer program ReCom a set
 3 territory in this case CD4 and CD5 in the Missouri First Map.
 4 You then told the program to randomly split the combined region
 5 into two districts following certain criteria constraints. Is
 6 that a fair summary?

7 A. Yes.

8 Q. And this produced an ensemble of 100,000 alternative
 9 maps?

10 A. There were 100,000 in my original ensemble. And I
 11 produced an additional 100,000 for my second ensemble that had
 12 population tolerance.

13 Q. So then let me specify. This produced 100,000
 14 alternative maps in your first ensemble?

15 A. That's correct.

16 Q. Although you did say earlier there was some
 17 duplicated maps in the ensemble that by chance were --

18 A. That's correct.

19 Q. And you did not specify in your report how many
 20 duplicates there were?

21 A. No, I did not. I didn't examine that question.

22 Q. To build your ensemble you relied on a number of data
 23 sources, including from the U.S. Census Bureau?

24 A. Yes.

25 Q. All well block seismic files from the Missouri

1 Spatial Information Service?

2 A. Spatial. Yes.

3 Q. You gained access to that information from the
4 Missouri Office of Administration?

5 A. That's correct. There was a link from the Office of
6 Administration to the official source of data for Missouri
7 Spatial Data Information Service.

8 Q. And you consider these sources to be credible?

9 A. Yes, I do.

10 Q. And you would not use any data source that you
11 believe to be neither?

12 A. No, I would not.

13 Q. My next set of questions are going to address the
14 criteria and constraints that govern your ensemble. First,
15 your ensemble as we said earlier was confined to CD4 and CD5 in
16 the Missouri First Map?

17 A. Yes.

18 Q. That means your program cannot draw any configuration
19 that included territory of other congressional districts?

20 A. That's correct. It couldn't have possibly crossed
21 any of the outer boundaries.

22 Q. Any possible map that would have crossed into a
23 boundary line besides the boundary line separating CD4 and CD5
24 would not have been drawn?

25 A. Correct.

1 Q. As an example in the 2022 map CD5 grabs a piece of
 2 Clay County, which in the Missouri First Map is in CD6. That
 3 would not be a possible configuration that your program could
 4 draw under the constraints you were giving it?

5 A. That's right.

6 Q. In the 2012 map, CD5 grabbed the entirety of Ray
 7 County, which is also in CD6 in the Missouri First Map. That is
 8 not a possible configuration that your program can draw under
 9 the constraints you gave?

10 A. That's right. My ensemble could not have drawn any
 11 districts that crossed into CD6 or any other district other
 12 than four and five.

13 Q. But you'd agree that the Missouri legislature did not
 14 have that constraint on the redistricting?

15 A. Yes, I agree.

16 Q. They have the option of drawing all eight districts?

17 A. Yes, and they did.

18 Q. And they have the option, for example retaining the
 19 2022 map?

20 A. I presume that they did. Yes.

21 Q. You also included a preference for maps that did not
 22 split counties?

23 A. That's correct.

24 Q. As a consequence none of the maps generated in your
 25 ensemble split more than one county?

1 A. That's right. It did not split more than one county
2 along the CD4, CD5 boundary. There were, of course, some
3 additional counties that were already split along the outer
4 boundaries and none of that was changed.

5 Q. But not more than one in the CD4, CD5 boundary?

6 A. That's correct.

7 Q. There were a small number of maps in your ensemble
8 that split zero counties, though?

9 A. A very small number, yes.

10 Q. And that was due to the population tolerance?

11 A. That's correct.

12 Q. And to be clear you were trying to only split one
13 county along the CD4 and CD5 boundary?

14 A. I'd say that is correct.

15 Q. Configurations that had more than one split along the
16 CD4 and CD5 border were sufficiently improbable under your
17 constraints that they did not appear in your ensemble?

18 A. That's right.

19 Q. There are municipalities in Missouri that span
20 multiple counties?

21 A. Yes.

22 Q. Kansas City, for example, expands beyond Jackson
23 County?

24 A. Yes, it does.

25 Q. Your program was specifically configured to avoid

1 splitting counties?

2 A. That's right.

3 Q. But it was not specifically configured to avoid
4 splitting municipalities?

5 A. Correct.

6 Q. Another constraint was the population tolerance?

7 A. Yes.

8 Q. Specifically, each district deviates from the ideal
9 district size by no more than plus or minus one-percent?

10 A. In the original ensemble, yes.

11 Q. Yes. And I'm talking right now about the original
12 ensemble?

13 A. Of course.

14 Q. The ideal district size in Missouri is 769,364. And
15 this is on page -- sorry paragraph 25 --

16 A. I appreciate that.

17 Q. -- of your report.

18 A. Yes, that's correct.

19 Q. One percent of that is 7,694 when rounded?

20 A. Could you repeat the question?

21 Q. Sure. One percent of the ideal district size is
22 7,694 when rounded?

23 A. That's correct.

24 Q. In laymen's terms, to the map in your ensemble could
25 have as many as 7,694 people above the ideal district size?

1 A. That's right.

2 Q. And the maps in your ensemble could have as many as
3 7,694 people below the ideal district size?

4 A. That's correct.

5 Q. So along with each other the maps in your ensemble
6 could have a variance of over 15,000 people?

7 A. That's right.

8 Q. To round off list of straints. The maps in your
9 ensemble had to be geographical contiguous?

10 A. Yes.

11 Q. And the districts had to consist of whole geographic
12 units?

13 A. That's right.

14 Q. And those geographic units are contiguous portions of
15 VTD in the CD4 and CD5 region?

16 A. That's right.

17 Q. You stated earlier and you stated in your rebuttal
18 report that you did not set out a specific compactness target
19 when having your program generate the ensemble maps?

20 A. That's right.

21 Q. But you agree that the ReCom algorithm used in the
22 GerryChain has natural preference for compact maps?

23 A. Yes, I agree.

24 Q. For clarity ReCom is the particular algorithm that
25 you used to draw the maps?

1 A. That's right.

2 Q. And GerryChain is the software that includes -- of
3 your drawing?

4 A. Yes.

5 Q. And so you and Dr. Trende are in agreement that the
6 ReCom algorithm used in GerryChain has a natural preference for
7 compact maps?

8 A. Yes.

9 Q. You and Dr. Trende also agree that the ReCom
10 algorithm does not enforce compactness but it does tend to
11 avoid extreme or pathological district shapes?

12 A. That's right.

13 Q. And you provided an example of pathological map in
14 your rebuttal report?

15 A. Yes, I did.

16 Q. I'm going to have Keith bring that up on the screen.

17 This is figure three from Plaintiff's Exhibit 22, which is

18 Dr. Stern's rebuttal report. Do you recognize the images on

19 the screen as figure three in your rebuttal report?

20 A. Yes, I do.

21 Q. Map B is the pathological one?

22 A. That's right.

23 Q. And it was drawn by a different algorithm called

24 Flip?

25 A. Correct.

1 Q. Flip in contrast to ReCom the algorithm you used does
2 not favor compactness?

3 A. That's right.

4 Q. Because ReCom favors compactness it is astronomically
5 unlikely to draw a pathological map as depicted in figure three
6 labeled map B?

7 A. Yes.

8 Q. And so there's a set of possible maps that the
9 algorithm you used to create your ensemble is unlikely to draw
10 because it favors compactness?

11 A. I would say it's a matter of degree. The more
12 pathological the less likely it is to be drawn, but there's no
13 firm line beyond which ReCom will not draw it.

14 Q. And I'm not right now talking about a firm line. I'm
15 just saying that there is a set of possible maps that your
16 algorithm is unlikely to draw because it favors compactness?

17 A. Yeah, I would say that's correct.

18 Q. You just said don't try to metric or score where you
19 can say that it becomes astronomically improbable for ReCom to
20 draw a certain configuration?

21 A. That's right.

22 Q. You're not providing a specific compactness metric
23 let's say, like, Polsby-Popper or Reock where it would become
24 astronomically improbable for ReCom to draw a pathological map
25 you cite in your rebuttal report?

1 A. That is right.

2 Q. The methodology you used to create your ensemble maps
3 now you're not aware of it being used in another redistricting
4 case challenging a district on a claim of compactness?

5 A. I've not aware of any specific case where that was
6 done. No.

7 Q. We can take that down. Let's turn our attention to
8 conclusions you drew when comparing your ensemble with the

9 Missouri First congressional. You testified -- you wrote in
10 your report -- I'm going to ask a different question. You

11 wrote in your report that splitting a county's population
12 nearly evenly between CD4 and CD5 is more problematic than
13 splitting only a small portion of the county's population and
14 having the rest remain intact?

15 A. Yes, I did.

16 Q. And one of the reasons you gave is that by splitting
17 the population nearly evenly the configuration makes the pieces
18 too small to form an effective block?

19 A. That's right, I said that.

20 Q. You do not offer an opinion on how big a population
21 must be before it can form an effective block?

22 A. No. I'd consider effectiveness a matter of degree
23 again as opposed to having a threshold of effectiveness.

24 Q. But you haven't conducted a specific analysis in your
25 report, nor did you testify to one about how big a population

1 must be before it can form an effective block?

2 A. No.

3 Q. You do not suggest any threshold or break line
4 standard regarding what percentage of the district must consist
5 of the county's residents for the residents to form an
6 effective block?

7 A. That's bright line. I think that was a
8 mistranscription in my deposition. But aside from that
9 correction that's correct.

10 Q. It did seem like a weird word, but I wasn't going to
11 question it. You have not conducted analysis in western or
12 central Missouri and what coalitions would occur or likely to
13 occur?

14 A. No, I have not.

15 Q. You used the term cracking in your report?

16 A. That's correct.

17 Q. And you've heard of it's antonym packing?

18 A. Yes, I am.

19 Q. And familiar with the term packing?

20 A. Yes, I am.

21 Q. Broadly speaking packing involves deluding in groups
22 of political power by overpopulating them into districts so
23 they have influence over peer receipts?

24 A. That's correct.

25 Q. The ensemble median had the largest Jackson County

1 piece at 701,167? This is page 13, table one of Plaintiff's
2 Exhibit 21.

3 A. That's correct.

4 Q. And as we discussed the ideal district population
5 size is 769,364?

6 A. That's correct.

7 Q. At the deposition you and I sat for you did not know
8 the total population of Jackson County?

9 A. That's right.

10 Q. However, we can both agree that Jackson County is the
11 largest county by population in the combined CD4 and CD5 area?

12 A. That's right.

13 Q. You also did not know at the time the second largest
14 county by population in the combined CD4 and CD5 area?

15 A. That's right.

16 Q. Do you know it now?

17 A. I don't.

18 Q. And you don't have an understanding of how much
19 larger the population of the CD4 and CD5 of Jackson County is
20 in the next largest county by population?

21 A. It's something I can look at in my data, but I don't
22 have it before me. And I didn't mention it in my reports.

23 Q. When you compared your ensemble to the 2025 map you
24 inquired whether splitting Kansas City could be explained as a
25 trade-off to achieve less severe splitting of municipalities

1 overall?

2 A. That's right.

3 Q. To do this you looked at the total size of the
4 largest intact portion of all municipalities and then totaled
5 them up?

6 A. That's right.

7 Q. That means you took Kansas City's largest piece as
8 well as the largest piece of all the municipalities in CD4 and
9 CD5 and added them together?

10 A. That's right.

11 Q. Kansas City is the most populous municipality in the
12 CD4 and CD5 area by far?

13 A. I'm not sure what the second largest is, but I'll
14 agree to the largest. I don't know about by far.

15 Q. And you said yourself in your report that splitting
16 Kansas City drives the overall municipality numbers?

17 A. Yes, it does.

18 Q. And you never isolated the other cities to determine
19 how the 2025 map performed with respect to keeping residents in
20 those cities together specifically?

21 A. That's correct. I looked at Kansas City and I looked
22 at all municipalities overall.

23 Q. Now you and I have been discussing the substance of
24 municipal splits that occurred in the 2025 map. Specifically,
25 in the contested region. But you do not count the number of

1 municipalities that were split in the 2025 map overall compared
2 to the 2022 map?

3 A. No, I did not.

4 Q. And you offer no opinion about the assertion that the
5 number of municipal splits has declined from the 2022 map to
6 the 2025 map?

7 A. I didn't analyze that question so I don't offer an
8 opinion one way or the other.

9 Q. Likewise, you do not include in your report any
10 analysis about the number of county splits in the 2025 map
11 overall compared to the 2022 map?

12 A. That's right.

13 Q. And so you offer no conclusions in your report about
14 the assertion the number of county splits has declined the 2022
15 map to the 2025 map?

16 A. That's right.

17 Q. As part of your comparison of the ensemble with the
18 Missouri First Map you looked to see if the CD4 and CD5
19 boundary lines respective to state senate district lines?

20 A. That's correct.

21 Q. That analysis did not focus on the Jackson County
22 Kansas City area?

23 A. No, it did not.

24 Q. Instead, it looked for the preservation of said
25 districts overall in the CD4, CD5 under the 2025 map?

1

A. Yes.

2

Q. You observed the boundary lines does follow certain

3

senate district lines while also splitting other senate

4

district lines?

5

A. Yes.

6

Q. The senate district lines that the CD4 and CD5

7

boundary line follows those are in Jackson County area?

8

A. Give me one second while I turn to that page in my

9

report so I can respond.

10

Q. And if you need to refresh your recollection, I'm

11

happy to bring up your deposition as well.

12

A. Yes. It follows certain boundary lines in Kansas

13

City while splitting others. And it also has -- there are also

14

places outside that it follows and splits senate district

15

lines.

16

Q. But in Jackson County the senate district lines do go

17

along the CD4 and CD5 boundary line?

18

A. Not entirely because senate district seven is split

19

three ways.

20

Q. Maybe I'll rephrase. The CD4 and CD5 boundary line

21

in Jackson County that follows along senate district lines?

22

A. Not entirely because senate district seven has

23

portions in both CD4 and CD5.

24

Q. You'd agree with me that there's not one single

25

metric that determines whether a district is compact?

1 A. I'd agree with that, yes.

2 Q. To that end in your amended report you look at a
3 number of compactness metrics?

4 A. That's right.

5 Q. Where you compare CD4 and CD5 in the Missouri First
6 Map with your ensemble, first ensemble?

7 A. That's right.

8 Q. That analysis was confined to CD4 and CD5, it did not
9 look at the compactness scores of other districts in the 2025
10 map?

11 A. No, it did not.

12 Q. You're aware that Dr. Trende and Dr. Hood both
13 reported individual districts scores?

14 A. Yes.

15 Q. You did not double check their calculations?

16 A. I don't believe that I did, no.

17 Q. And you don't offer an opinion about their
18 calculations one way or another?

19 A. About their compactness calculations?

20 Q. Yes.

21 A. No.

22 Q. You haven't compared the compactness scores of your
23 ensembles to any of the prior congressional maps?

24 A. That's correct. And as I explained, I don't think
25 that would be an appropriate comparison.

1 Q. And so because you don't believe it's an appropriate
2 comparison you haven't assessed how your ensemble maps
3 compactness scores compare to the 2022 map?

4 A. That's correct.

5 Q. And so the only appropriate comparison you believe is
6 the ensemble to your 2025 map?

7 A. That's correct.

8 Q. Turning again to the compactness metrics. The maps
9 you generate in the ensemble the scores would have varied
10 between the maps?

11 A. That's correct. There's a range of different scores
12 observed in the ensemble for all of these scores.

13 Q. So, for example, the ensemble would have maps that
14 have different Polsby-Popper scores?

15 A. Yes.

16 Q. And it's possible your program to produce a map that
17 would have had a higher Polsby-Popper score than the maps in
18 your ensemble?

19 A. Can you repeat that, please?

20 Q. Sure. It's possible through your program to produce
21 a map that would have had a higher Polsby-Popper score than the
22 maps in your ensemble?

23 A. If I had generated a larger ensemble it's possible
24 that I would've observed some additional maps that had an even
25 larger Polsby-Popper scores.

1 Q. I'm going to -- Keith -- bring up your amended report
 2 Plaintiff's Exhibit 21. Specifically, paragraph 48 on page 23.
 3 Do you see those on the projection?

4 A. Yes, I do.

5 Q. In this paragraph, you list the nine metrics of
 6 compactness you considered in your report besides boundary
 7 length and cut edges?

8 A. That's right.

9 Q. You chose the nine metrics because they were reported
 10 in the September 10, 2025 memo on the Missouri First Map?

11 A. That's right.

12 Q. And you cited to that memo in footnote 10?

13 A. Yes, I did.

14 Q. That memo was offered by Adam Kincaid?

15 A. I don't have any independent knowledge of the
 16 production of this memo, but it purports to be attributed to
 17 Adam Kincaid and that's what it looks like to me.

18 Q. That's who you cited to in your report; correct?

19 A. That's right.

20 Q. It's titled memo to representative Dirk Deaton SV one
 21 sponsor regarding the Missouri First Map?

22 A. HB one sponsor, but yes.

23 Q. It's fair to say that if your report contains a
 24 citation you relied on that source in forming the conclusion in
 25 your report?

1 A. I don't believe any of my conclusions rely on
2 anything in the Kincaid memo.

3 Q. Do you recall sitting for the deposition in the
4 beginning when I had asked you about the exact question, if
5 your expert report contains a citation you relied on that
6 source in forming the conclusions of your report?

7 A. I believe so.

8 Q. And do you recall what your answer was?

9 A. I don't recall.

10 Q. Let's pull it up. This is your deposition. Page 16,
11 lines one through four. Now do you see line one?

12 A. Yes, I do.

13 Q. And I'm not sure if you're able to read line one
14 through three, if you could read it for the record.

15 A. You want me to read starting from your question on
16 this?

17 Q. Yes.

18 A. And it's fair to say that if your expert report
19 contains a citation you relied on that source in forming the
20 conclusions in your report?

21 Q. And what was your answer?

22 A. My answer was yes.

23 Q. And so I ask again, is it fair to say that if your
24 report contains a citation that you relied on that source in
25 forming the conclusions of your report?