Hammersmith, Suann (MICRC)

Subject: FW: Follow-up letter to the MICRC (Matt Petering; 2021-07-29)
Attachments: PeteringLetterToMICRC_2021-07-29.pdf

From: Matthew E H Petering <mattpete@uwm.edu>
Sent: Thursday, July 29, 2021 12:56 PM
To: Hammersmith, Suann (MICRC) <HammersmithS@michigan.gov>
Subject: Follow-up letter to the MICRC (Matt Petering; 2021-07-29)

Dear Sue,

Thanks for your message and the link to the YouTube video. I enjoyed making the presentation and hope it was thought-provoking and valuable to the MICRC! Thanks for reminding me about the paperwork. I will fill it out and send that back to you in a few days. In the meantime, can you forward the attached follow-up letter to the commissioners? My presentation session ended rather abruptly with few questions at the end (I was expecting many), and I did not have the opportunity to properly address several important issues that surfaced during my presentation.

Thanks for your help. I hope you are having a good afternoon!

Sincerely,
Matt

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July 29, 2021
From: Matt Petering, PhD
To: Michigan Independent Citizens Redistricting Commission

Dear Commissioners:

Thank you very much for the opportunity to meet with you on July 22 and provide you with a detailed introduction to computational based redistricting using my FastMap computer algorithm. FastMap is a powerful tool that makes it feasible to do redistricting in a new, rigorous, and fair way. Humans will always make the final redistricting decisions, and this algorithm allows them to choose among hundreds of outstanding options instead of a few mediocre ones that are manually created. Using an algorithm also reduces the possibility of lawsuits based on the "intent to rig a map" because no human is involved in making detailed line-drawing decisions.

I hope my presentation was successful in convincing you of two things. First, there is enormous complexity in making fair maps. In Michigan, there is an expectation that such maps will satisfactorily address seven different criteria found in the Constitution. The sheer quantity and diversity of data that are needed to develop such maps and the dizzying number of decisions that must be made about their use places the problem of redistricting in the "big data" realm. Big data problems like this are ideally suited for analysis by computer algorithms that access, manage, and apply all relevant data to reach fair outcomes in the mapmaking process.

Second, I hope you could see how much better the maps created by my algorithm were than the maps currently in use. In each case—for state house, state senate, and congressional districts—the map created by FastMap vastly outperformed the current map regarding the criteria most noticeable to the general public: political fairness, competitiveness, and compactness.

There were two issues raised by your attorney that need further clarification on my part. First, she raised questions about the capability of the algorithm to address two of the criteria dealing with communities of interest (COI) and the Voting Rights Act (VRA). About the inclusion of COI, as I described in my presentation, as soon as the COI and their boundaries are defined, FastMap will be able to input them into the mapmaking process just as it currently does with counties and municipalities, and it will minimize COI splits.

I agree with your attorney's criticism of using only demographic information to meet the requirements of the VRA. An advantage of the FastMap algorithm is that additional analytical information about racial bloc voting etc. can be entered readily into the program to refine the establishment of VRA districts to consider both coalition and majority-minority districts. Appropriate statistical tests—including homogeneous precinct analysis and bivariate regression analysis—can be performed to guide FastMap in its formation of VRA districts.

The most substantive issue that surfaced during my presentation was our different interpretation of the following language from the Constitution: *"The commission shall abide by the following criteria in proposing and adopting each plan, **in order of priority**."*

I understand your attorney stated that the prioritization among the criteria was absolute and that criteria (a)–(g) need to be addressed independently in that order. In contrast, I described how prioritization is achieved in the algorithm. In FastMap, criteria are given quantitative weights that guide the algorithm's computations with decreasing weights as one moves down the criteria. Within that framework, the computer program works to achieve an optimum outcome for the collection of criteria simultaneously rather than dealing with them one at a time.

Based on my experience working on dozens of multi-criteria decision making problems during the last 20 years, I have two observations. First, a strict prioritization approach usually leads to vastly inferior results compared to a weighted approach for these types of problems. Second, a strict prioritization approach is not even feasible for Michigan right now. Let me explain.

The deep problem with addressing each criterion one-at-a-time, independently, in rank order is that reaching a final decision about each criterion sequentially forecloses possibilities for good maps with respect to each successive criterion. Without looking at performance for lower-ranking criteria, a final decision about which maps "meet" a higher-ranking criterion is made. For example, let's say that the outcome for each criterion (c)-(g) can be scaled from 0-100 with 100 being the best, and let's say that the outcome for criteria (a) and (b) is either "Pass" or "Fail." Consider two potential maps for MI State House shown in Table 1:

Table 1. Scoring of two potential maps for MI State House.

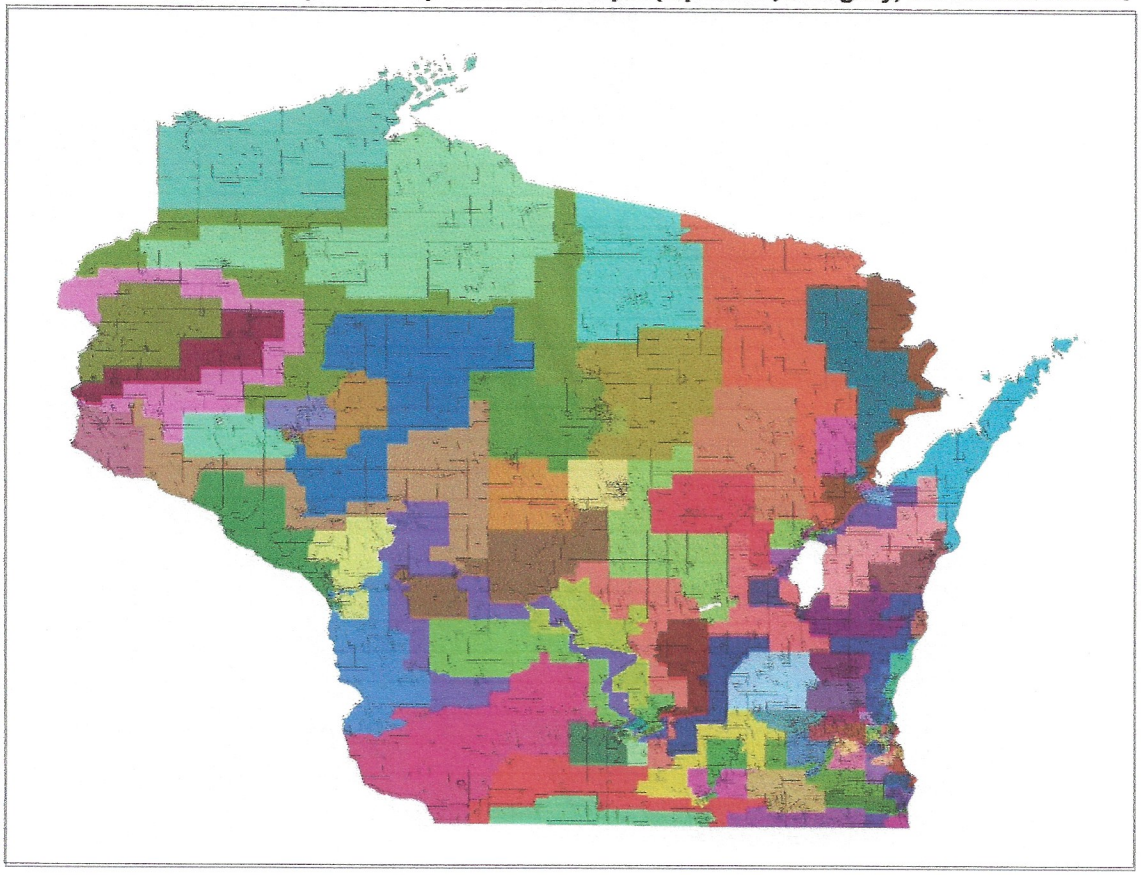
Criterion	Score for Map #1	Score for Map #2
(a)	Pass	Pass
(b)	Pass	Pass
(c)	81	80
(d)	0	100
(e)	0	100
(f)	0	100
(g)	0	100

A strict prioritization approach would judge Map #1 to be superior to Map #2 because it is better regarding criterion (c). But Map #1 is a terrible map overall with very poor performance regarding criteria (d)-(g). A weighted approach, on the other hand, attaches weights to criteria (c)-(g) and chooses the map whose "total weighted score" is higher. In my presentation, I indicated that the weights for components (c)-(g) might be 100, 80, 60, 40, and 20 respectively. If these weights are used, then Map #1's total weighted score is 8100, and Map #2's total weighted score is 28,000. According to the weighted approach, Map #2 is far superior to Map #1; this agrees with most people's intuition.

The other issue is that a strict prioritization approach is not even feasible for Michigan right now. According to a strict prioritization approach, mapmakers are not allowed to look at the "scores" for lower-ranking criteria when they are making decisions about higher ranking criteria. But compactness is Michigan's lowest-ranking criterion. If a strict prioritization approach is used, then a map like that shown in Figure 1 (which is a "random," fair Wisconsin map) will be allowed to "make it through" the "checks" of criteria (a), (b), (c), (d), and so on. But will this happen? Will mapmakers allow a highly noncompact map like this—even if it has excellent performance for criteria (a)-(f)—to be among the final maps considered by the MICRC? No way. This

indicates that even the MICRC's lowest-ranking criterion will have to be considered alongside the higher-ranking criteria, and be traded-off with them, when the higher-ranking criteria are considered. In other words, a strict prioritization approach is not feasible. Another approach that simultaneously keeps its eye on all criteria will have to be used. This is what FastMap does with its weighted approach.

Figure 1. A highly noncompact WI map that satisfies equal population, contiguity, and fairness criteria.



In conclusion, I suggest that whether an algorithm or a computer-assisted human makes your maps, each will recognize that all seven criteria need to be under consideration simultaneously; weighting the importance of each criterion will either be done explicitly by the algorithm or implicitly by the human. Due to the immense complexity of Michigan's redistricting landscape, I believe that the FastMap algorithm can do a much better job of keeping an eye on seven criteria simultaneously than a human. Thus, an algorithm like FastMap is an important component of a team redistricting effort that is ultimately controlled by human team members.

Best wishes for the success of your work. I hope I will be part of it.

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