Expert Report of Amicus Dr. Matthew Petering in Support of Proposed Wisconsin Legislative Map *173#008*

Clarke v. Wisconsin Elections Commission

January 12, 2024

Qualifications

I am an Associate Professor of Industrial & Manufacturing Engineering at the University of Wisconsin-Milwaukee and owner of District Solutions LLC, a Milwaukee-based redistricting consulting firm (DistrictSolutions.net). I was born and raised in Milwaukee County and have a PhD and master's degree, both in Industrial & Operations Engineering, from the University of Michigan. I also have a BA in Mathematics from Washington University in Saint Louis.

Over the past 20 years, I have developed uniquely specialized knowledge and expertise in the highly technical discipline of mathematical optimization, which can be applied to create rigorously fair Wisconsin voting district maps. I have more than 20 years of experience designing and writing computer algorithms that do complex optimization tasks which are often too difficult for people to do by themselves. During the 2021 redistricting cycle, I was engaged in drafting proposals for modifying the aldermanic districts in the City of Milwaukee.

The details of my academic background and qualifications are included in my curriculum vitae which is attached at the end of this report.

Executive Summary

This report describes the performance of a map, named *173#008*, that was created by Dr. Matthew Petering's *FastMap* redistricting algorithm. Two .csv files, containing the assembly and senate district assignments for the 202,510 (non-water) Wisconsin census blocks, have been mailed to the Court-appointed consultants and parties. All metrics below, except the chance of winning a given number of seats, are computed by DavesRedistricting.org (DRA). Additional information regarding the analyses which follow is provided in the appendix.

1. Population Equality

Wisconsin's population was 5,893,718 according to the 2020 Census. Because Wisconsin has 99 assembly and 33 senate districts, the ideal population for each assembly (senate) district is 59,533 (178,598). Table 1 presents the deviation scores for the districts in map *173#008*. Wisconsin has a tradition of adopting maps with an overall range in deviation of 2% or less. *173#008* has a 1.98% (1.35%) range in population deviation in the assembly (senate).

Table 1. Analysis of population deviation in map *173#008*

	Deviation from Ideal Population	Persons	Percent
Assembly	Mean Deviation	274	0.460
	Largest Positive Deviation	594	0.998
	Largest Negative Deviation	–584	–0.981
	Overall Range in Deviation	± 1178	± 1.979 (i.e., 1.98%)
Senate	**Deviation from Ideal Population**	**Persons**	**Percent**
	Mean Deviation	437	0.245
	Largest Positive Deviation	1393	0.780
	Largest Negative Deviation	–1023	–0.573
	Overall Range in Deviation	± 2416	± 1.353 (i.e., 1.35%)

2. Political Subdivision Splits

Split Counties

The assembly map splits 52 counties 134 times. The senate map splits 38 counties 61 times.

Split Municipalities

The assembly map splits 56 of Wisconsin's 1850 municipalities. The senate map splits 39 municipalities.

3. Contiguity

All assembly and senate districts are strictly contiguous except those which include actual islands in Lake Superior, Lake Michigan, Green Bay, and Lake Winnebago. For the few districts that include such offshore islands, the main portion of the district is strictly contiguous.

4. Compactness

DRA gives the assembly districts an overall compactness rating of 74 of 100 and the senate districts an overall compactness rating of 56 of 100. According to DRA, the average (Reock, Polsby-Popper) compactness score of the assembly districts is (0.4443, 0.3747). The average (Reock, Polsby-Popper) compactness score of the senate districts is (0.3867, 0.3233).

5. Federal Law Compliance

The map adheres to the Equal Protection Clause and the Voting Rights Act (VRA) of 1965.

Voting Rights Act Compliance

Assembly districts 7-9, 10-12, and 16-18 (and senate districts 3, 4, 6) in *173#008* are identical to their counterparts in the map used for the Nov. 2022 election (SB621). Thus, *173#008* and SB621 have equivalent VRA compliance. When SB621 was considered in *Johnson v. WEC*, Sections II and IV of Dr. John Alford's expert report dated December 15, 2021 demonstrated that assembly districts 7-9, 10-12, and 16-18 (and senate districts 3, 4, 6) comply with the VRA.

Compliance with the Equal Protection Clause

All assembly and senate districts besides those mentioned in the previous paragraph were created by a computer algorithm, with only a few manual modifications at the end to ensure strict contiguity. Humans played almost no role in drawing the boundaries of these "non-VRA" assembly and senate districts. No lines were intentionally manipulated in violation of the Equal Protection Clause.

6. Community Considerations

Among several communities of interest, one group stands out for its merits and well-defined boundaries: Native American communities. The boundaries of Wisconsin's Native American reservations and tribal lands are clearly depicted at WisconsinFirstNations.org. Of the nine largest Native American reservations and tribal lands in Wisconsin, eight are entirely within assembly districts in map *173#008*. Furthermore, these eight areas are found within a total of three assembly districts—36, 74, and 83. The only Native American reservation not wholly contained in one assembly district is one that spans two counties. In this case, county splitting considerations superseded community considerations, and the reservation was split into two districts, one for each county.

7. Political Neutrality

Political neutrality is evaluated using five metrics: *proportionality*, *efficiency gap*, *chances of winning a proportional seat share*, *number of competitive districts*, and *majority rule*. The first four are computed using DRA's 2016-2022 *composite* election data. The last is computed using the results of recent individual elections.

Proportionality

DRA gives *173#008* a proportionality rating of 99 of 100 for the assembly and 100 of 100 for the senate. According to DRA's 2016-2022 composite election data, Democrats have 51.16% of the statewide, two-party vote in Wisconsin. In a perfectly proportional election this translates to (.5116)*(99) = 50.65 assembly and (.5116)*(33) = 16.88 senate seats for Democrats. Using a *fractional seats* approach, DRA predicts Democrats will win 50.73 (16.98) seats in the assembly (senate) if map *173#008* is used. That is, *173#008* will result in Democrats winning 0.08 (0.1) more seats in the assembly (senate) than in a perfectly proportional map. This deviation from perfect proportionality is miniscule. *For all intents and purposes, the map is strictly proportional in both the assembly and senate*.

Efficiency Gap

According to DRA, the efficiency gap of the assembly and senate maps are +1.07% and +0.85% respectively. These positive values favor Republicans, but only slightly.

Chances of Winning a Proportional Seat Share

Another way to evaluate political neutrality is to estimate each party's chances of winning a proportional share of seats. Rounded to the nearest integer, a proportional share of assembly (senate) seats for Democrats is 51 (17) and for Republicans is 48 (16). Using Monte Carlo simulation, the estimation is that Democrats have a 52.3% chance of winning at least 51 assembly seats and a 64.4% chance of winning at least 17 senate seats. Meanwhile, Republicans have a 63.5% chance of winning at least 48 assembly seats and a 65.4% chance of winning at least 16 senate seats. Thus, both parties have at least a 50% chance of winning a seat share in proportion to their overall share of the statewide vote in the assembly and senate. *Overall, the map gives both parties an equal opportunity for proportional representation in both chambers.*

Number of Competitive Districts

In the assembly, 29 districts are in the 45%-55% competitive range. In the senate, 10 are in this range. The large number of competitive districts gives both parties a substantial opportunity to win additional seats if they field good candidates.

Majority Rule

We overlaid nine different sets of election data onto the map: the most recent two elections for president, two elections for governor, three elections for U.S. Senate, and two elections for attorney general. Democrats won six of these elections, Republicans three. In eight of the nine elections, the candidate who won the popular vote also carried a majority of assembly and senate districts in the map. In one election, the candidate who won the popular vote carried a majority of assembly districts but not senate districts. *Overall, the map strongly embodies the principle of majority rule*.

Overall Assessment

Map *173#008* is a politically neutral map. It does not bestow partisan privilege on either political party. It complies with strict legal requirements and has excellent performance for traditional criteria including compactness, county splitting, and municipality splitting.

Map Images

Figures 1-2 show the assembly and senate districts in map *173#008*.

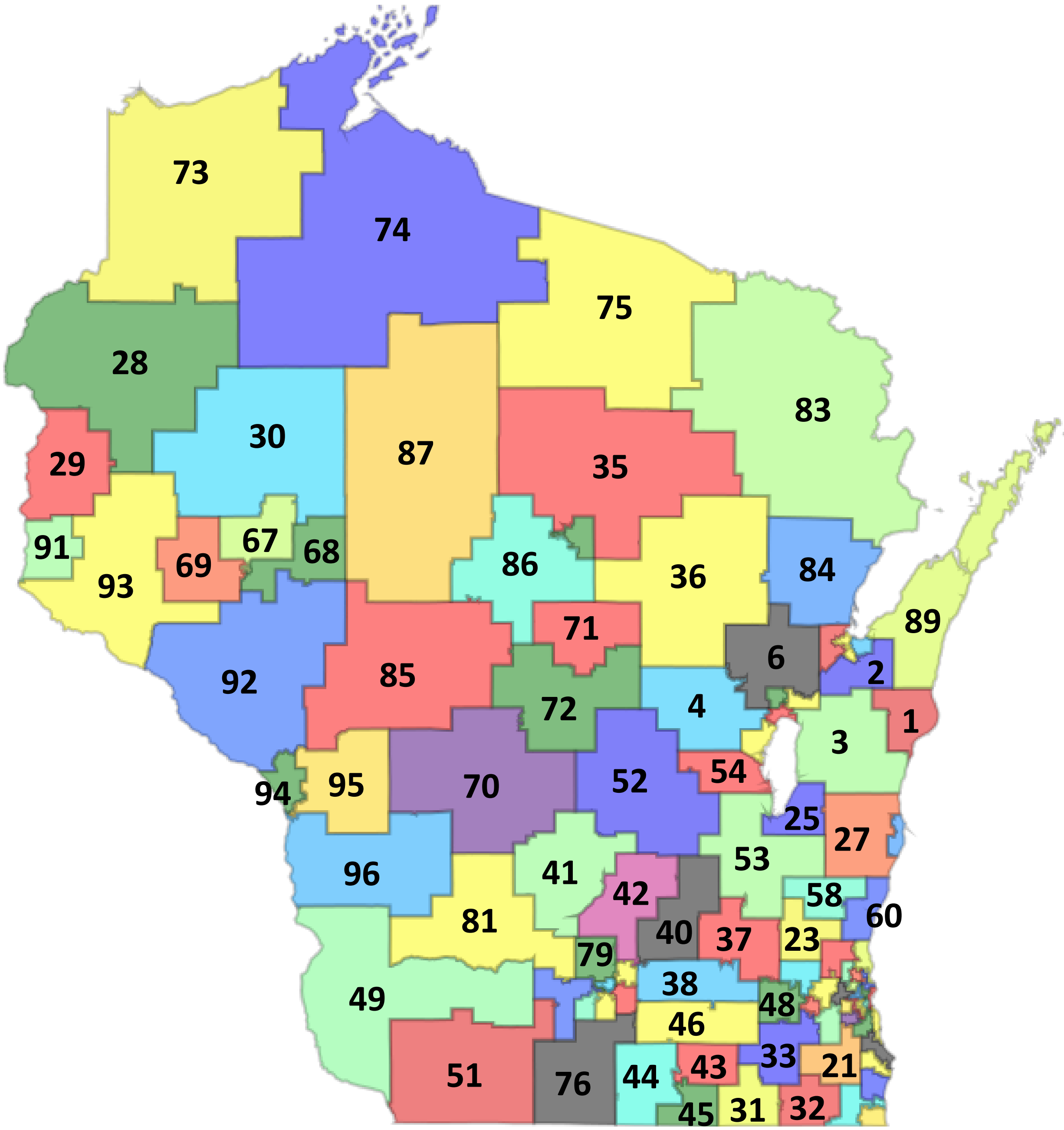

Figure 1. Assembly districts in map *173#008*

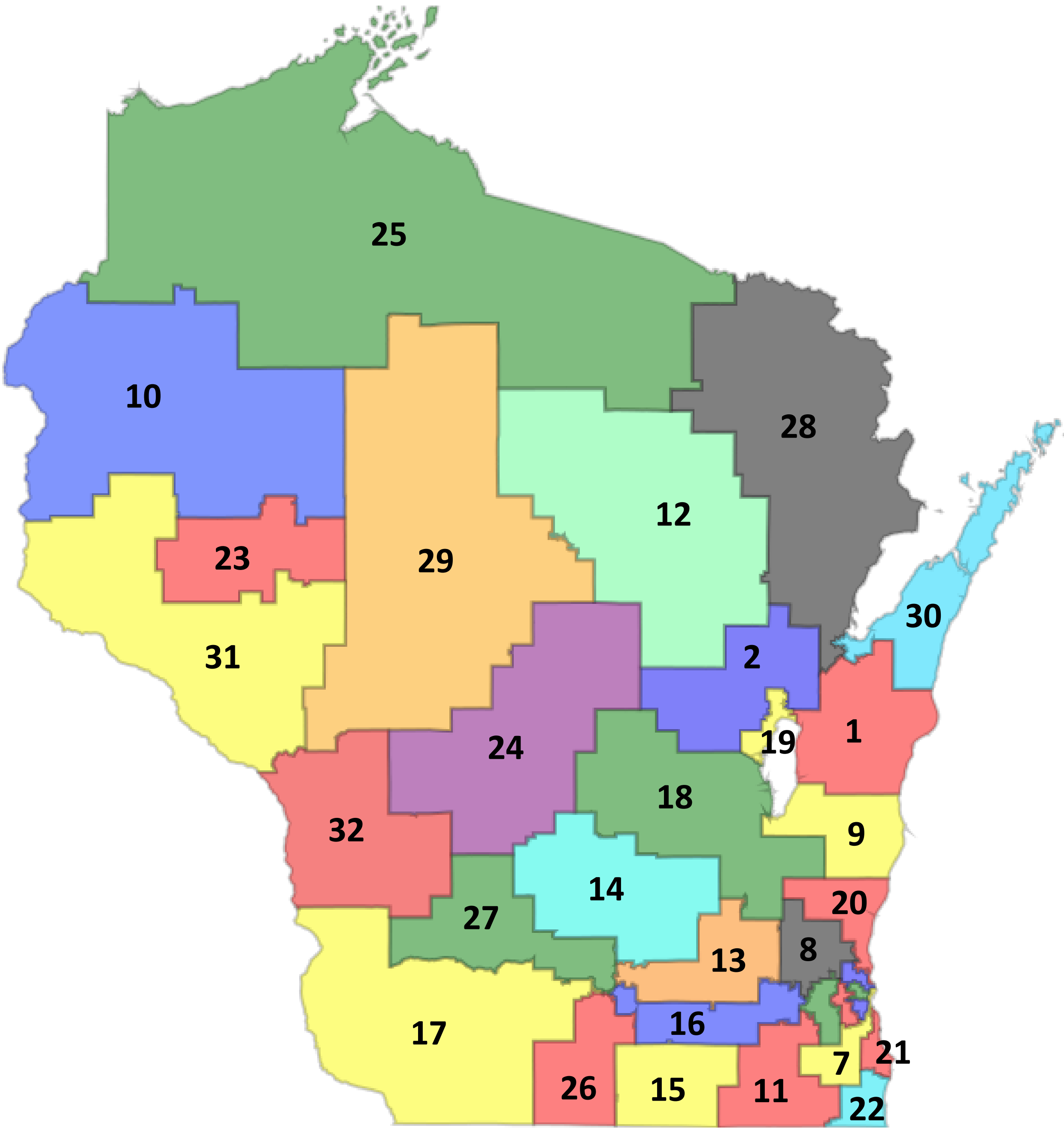

Figure 2. Senate districts in map *173#008*

Appendix

1. Population Equality

Table A1 below shows the population of each assembly district and the deviation in each district's population from the ideal assembly district population of 59,533. The assembly districts with the highest and lowest populations are highlighted.

Table A1. Population of each assembly district and deviation from ideal district population

District	Population	Deviation	District	Population	Deviation	District	Population	Deviation
1	59487	-46	34	60003	470	67	59523	-10
2	59294	-239	35	59259	-274	68	60024	491
3	59200	-333	36	60008	475	69	59122	-411
4	59139	-394	37	59828	295	70	59900	367
5	59840	307	38	59557	24	71	59563	30
6	59395	-138	39	60053	520	72	59789	256
7	59603	70	40	60038	505	73	58953	-580
8	59362	-171	41	59877	344	74	59002	-531
9	59571	38	42	60076	543	75	59663	130
10	59503	-30	43	59320	-213	76	59467	-66
11	59565	32	44	59441	-92	77	59646	113
12	59351	-182	45	60042	509	78	59800	267
13	59538	5	46	59580	47	79	59735	202
14	59049	-484	47	60111	578	80	59598	65
15	59543	10	48	59528	-5	81	59210	-323
16	59714	181	49	58954	-579	82	59214	-319
17	59435	-98	50	59900	367	83	59998	465
18	59346	-187	51	59672	139	84	59728	195
19	59604	71	52	59280	-253	85	59515	-18
20	58980	-553	53	59927	394	86	59739	206
21	59150	-383	54	59662	129	87	59847	314
22	59045	-488	55	59192	-341	88	59771	238
23	59848	315	56	59365	-168	89	58977	-556
24	59993	460	57	59984	451	90	59604	71
25	59743	210	58	59072	-461	91	59355	-178
26	59217	-316	59	59773	240	92	59355	-178
27	59306	-227	60	59659	126	93	59354	-179
28	60073	540	61	58949	-584	94	60127	594
29	60076	543	62	59179	-354	95	59035	-498
30	59409	-124	63	59544	11	96	59487	-46
31	59181	-352	64	59011	-522	97	59001	-532
32	59445	-88	65	59377	-156	98	60037	504
33	59591	58	66	59187	-346	99	59575	42

Table A2 below shows the population of each senate district and the deviation in each district's population from the ideal senate district population of 178,598. The senate districts with the highest and lowest populations are highlighted.

Table A2. Population of each senate district and deviation from ideal district population

District	Population	Deviation	District	Population	Deviation	District	Population	Deviation
1	177981	-617	12	179270	672	23	178669	71
2	178374	-224	13	179438	840	24	179252	654
3	178536	-62	14	179991	1393	25	177618	-980
4	178419	-179	15	178803	205	26	178913	315
5	178130	-468	16	179219	621	27	178543	-55
6	178495	-103	17	178526	-72	28	178940	342
7	177734	-864	18	178869	271	29	179101	503
8	178886	288	19	178541	-57	30	178352	-246
9	178266	-332	20	178504	-94	31	178064	-534
10	179558	960	21	177672	-926	32	178649	51
11	178217	-381	22	177575	-1023	33	178613	15

2. Political Subdivision Splits

Split Counties

The *assembly map* splits 52 counties 134 times. Table A3 below shows which counties are split in the assembly map, the number of pieces each county is split into (i.e., the number of assembly districts that overlap with the county), and the number of times the county is split (which is one less than the preceding value).

Table A3. List of split counties in the assembly map and number of times each is split

County	No. Split Pieces	No. Times Split	County	No. Split Pieces	No. Times Split
Adams County	3	2	Milwaukee County	18	17
Barron County	2	1	Monroe County	3	2
Bayfield County	2	1	Oconto County	2	1
Brown County	7	6	Outagamie County	5	4
Burnett County	2	1	Ozaukee County	4	3
Calumet County	2	1	Pierce County	2	1
Chippewa County	3	2	Polk County	2	1
Clark County	2	1	Portage County	2	1
Columbia County	3	2	Price County	2	1
Crawford County	2	1	Racine County	5	4
Dane County	15	14	Richland County	2	1
Dodge County	4	3	Rock County	4	3
Dunn County	3	2	Rusk County	2	1
Eau Claire County	4	3	Sauk County	2	1
Fond du Lac County	4	3	Shawano County	3	2
Forest County	2	1	Sheboygan County	2	1
Grant County	2	1	St. Croix County	3	2
Iowa County	2	1	Vilas County	2	1
Jackson County	2	1	Walworth County	4	3
Jefferson County	3	2	Washburn County	2	1
Juneau County	2	1	Washington County	4	3
Kenosha County	4	3	Waukesha County	10	9
La Crosse County	3	2	Waupaca County	2	1
Manitowoc County	2	1	Waushara County	4	3
Marathon County	6	5	Winnebago County	4	3
Marquette County	2	1	Wood County	3	2
Sum		62			72

The *senate map* splits 38 counties 61 times. Table A4 below shows which counties are split in the senate map, the number of pieces each county is split into (i.e., the number of senate districts that overlap with the county), and the number of times the county is split (which is one less than the preceding value).

Table A4. List of split counties in the senate map and number of times each is split

County	No. Split Pieces	No. Times Split	County	No. Split Pieces	No. Times Split
Adams County	2	1	Monroe County	2	1
Brown County	3	2	Outagamie County	2	1
Burnett County	2	1	Ozaukee County	2	1
Calumet County	2	1	Price County	2	1
Chippewa County	2	1	Racine County	4	3
Crawford County	2	1	Richland County	2	1
Dane County	7	6	Rock County	2	1
Dodge County	4	3	Rusk County	2	1
Dunn County	3	2	Sauk County	2	1
Eau Claire County	2	1	Shawano County	3	2
Fond du Lac County	2	1	St. Croix County	2	1
Forest County	2	1	Walworth County	2	1
Jackson County	2	1	Washburn County	2	1
Jefferson County	2	1	Washington County	2	1
Juneau County	2	1	Waukesha County	6	5
Kenosha County	2	1	Waupaca County	2	1
Marathon County	2	1	Waushara County	3	2
Marquette County	2	1	Winnebago County	3	2
Milwaukee County	7	6	Wood County	2	1
Sum		33			28

Split Municipalities

The *assembly map* splits 56 municipalities 98 times. Table A5 below shows which municipalities are split in the assembly map, the number of pieces into which each municipality is split (i.e., the number of assembly districts that overlap with the municipality), and the number of times the municipality is split (which is one less than the preceding value).

Table A5. List of split municipalities in the assembly map and number of times each is split.

Municipality	No. Split Pieces	No. Times Split	Municipality	No. Split Pieces	No. Times Split
Appleton city	4	3	Mequon city	2	1
Bellevue village	3	2	Middleton city	2	1
Brookfield city	2	1	Middleton town	2	1
Brown Deer village	2	1	Milwaukee city	14	13
Caledonia village	2	1	Mount Pleasant village	2	1
Dunn town (Dane Co.)	2	1	Neenah city	2	1
Eau Claire city	3	2	New Berlin city	4	3
Fond du Lac town	2	1	North Prairie village	2	1
Fox Crossing village	2	1	Oak Creek city	3	2
Franklin city	3	2	Oconomowoc city	2	1
Grand Chute town	3	2	Oshkosh city	2	1
Green Bay city	4	3	Pewaukee city	3	2
Greenfield city	3	2	Racine city	3	2
Harrison village	2	1	Salem Lakes village	2	1
Hortonia town	2	1	Sheboygan town	2	1
Janesville city	3	2	Somers town	2	1
Jefferson city	2	1	Stettin town	2	1
Kaukauna city	2	1	Stockton town	2	1
Kenosha city	3	2	Sun Prairie city	4	3
La Crosse city	3	2	Vandenbroek town	2	1
La Prairie town	2	1	Watertown city	2	1
Lake Geneva city	2	1	Waukesha city	5	4
Lawrence town (Brown Co.)	2	1	Waukesha town	3	2
Lyons town	2	1	Wauwatosa city	3	2
Madison city	7	6	West Allis city	2	1
Madison town	3	2	Weston village	2	1
Medary town	2	1	Whitewater city	2	1
Menomonee Falls village	2	1	Wrightstown village	2	1
Sum		46			52

The *senate map* splits 39 municipalities 50 times. Table A6 below shows which municipalities are split in the senate map, the number of pieces into which each municipality is split (i.e., the number of senate districts that overlap with the municipality), and the number of times the municipality is split (which is one less than the preceding value).

Table A6. List of split municipalities in the senate map and number of times each is split.

Municipality	No. Split Pieces	No. Times Split	Municipality	No. Split Pieces	No. Times Split
Appleton city	2	1	Milwaukee city	6	5
Bellevue village	2	1	Mount Pleasant village	2	1
Brookfield city	2	1	New Berlin city	2	1
Brown Deer village	2	1	North Prairie village	2	1
Dunn town (Dane Co.)	2	1	Oak Creek city	2	1
Fond du Lac town	2	1	Oconomowoc city	2	1
Fox Crossing village	2	1	Oshkosh city	2	1
Franklin city	2	1	Pewaukee city	3	2
Grand Chute town	2	1	Racine city	2	1
Green Bay city	2	1	Salem Lakes village	2	1
Greenfield city	2	1	Stettin town	2	1
Harrison village	2	1	Sun Prairie city	2	1
Jefferson city	2	1	Waukesha city	4	3
Lawrence town (Brown Co.)	2	1	Waukesha town	2	1
Madison city	5	4	Wauwatosa city	3	2
Madison town	2	1	West Allis city	2	1
Menomonee Falls village	2	1	Weston village	2	1
Mequon city	2	1	Whitewater city	2	1
Middleton city	2	1	Wrightstown village	2	1
Middleton town	2	1			
Sum		23			27

3. Contiguity

All assembly districts except those listed below are strictly contiguous.

- Assembly district 55 is not strictly contiguous because it includes an island in Lake Winnebago that is offshore from the main portion of the district. The main portion of assembly district 55 is strictly contiguous.
- Assembly district 61 is not strictly contiguous because it includes an island in Lake Michigan that is offshore from the main portion of the district. The main portion of assembly district 61 is strictly contiguous.
- Assembly district 73 is not strictly contiguous because it includes an island in Lake Superior that is offshore from the main portion of the district. The main portion of assembly district 73 is strictly contiguous.
- Assembly district 74 is not strictly contiguous because it includes the Apostle Islands in Lake Superior that are offshore from the main portion of the district. The main portion of assembly district 74 is strictly contiguous.
- Assembly district 83 is not strictly contiguous because it includes an island in Green Bay that is offshore from the main portion of the district. The main portion of assembly district 83 is strictly contiguous.
- Assembly district 84 is not strictly contiguous because it includes islands in Green Bay that are offshore from the main portion of the district. The main portion of assembly district 84 is strictly contiguous.
- Assembly district 88 is not strictly contiguous because it includes an island in Green Bay that is offshore from the main portion of the district. The main portion of assembly district 88 is strictly contiguous.
- Assembly district 89 is not strictly contiguous because it includes islands in Green Bay and Lake Michigan that are offshore from the main portion of the district. The main portion of assembly district 89 is strictly contiguous.

All senate districts except those listed below are strictly contiguous.

- Senate district 19 is not strictly contiguous because it includes an island in Lake Winnebago that is offshore from the main portion of the district. The main portion of senate district 19 is strictly contiguous.
- Senate district 21 is not strictly contiguous because it includes an island in Lake Michigan that is offshore from the main portion of the district. The main portion of senate district 21 is strictly contiguous.
- Senate district 25 is not strictly contiguous because it includes islands in Lake Superior that are offshore from the main portion of the district. The main portion of senate district 25 is strictly contiguous.
- Senate district 28 is not strictly contiguous because it includes islands in Green Bay that are offshore from the main portion of the district. The main portion of senate district 28 is strictly contiguous.
- Senate district 30 is not strictly contiguous because it includes islands in Green Bay and Lake Michigan that are offshore from the main portion of the district. The main portion of senate district 30 is strictly contiguous.

4. Compactness

According to DRA, the average (Reock, Polsby-Popper) compactness score of the assembly districts is (0.4443, 0.3747). Table A7 below shows the Reock and Polsby-Popper compactness scores of the individual assembly districts.

Table A7. Reock and Polsby-Popper compactness scores of the assembly districts

District	Reock	Polsby-Popper	District	Reock	Polsby-Popper	District	Reock	Polsby-Popper
1	0.5488	0.486	34	0.3937	0.2153	67	0.4497	0.4124
2	0.355	0.4325	35	0.3775	0.4097	68	0.3019	0.3119
3	0.5275	0.5125	36	0.5237	0.5087	69	0.5577	0.4899
4	0.3889	0.3505	37	0.5022	0.3625	70	0.4673	0.4646
5	0.3192	0.2845	38	0.2707	0.3297	71	0.4269	0.5115
6	0.5608	0.3411	39	0.6044	0.3013	72	0.4099	0.3544
7	0.1822	0.1364	40	0.4017	0.4336	73	0.4564	0.3588
8	0.5885	0.3623	41	0.4918	0.4315	74	0.4458	0.1351
9	0.4328	0.235	42	0.4191	0.3526	75	0.4395	0.4082
10	0.3775	0.1621	43	0.4775	0.4768	76	0.4472	0.5163
11	0.3803	0.2403	44	0.5938	0.4734	77	0.6551	0.4188
12	0.4844	0.3411	45	0.4249	0.4358	78	0.5067	0.4609
13	0.432	0.3909	46	0.297	0.392	79	0.5623	0.2963
14	0.4109	0.2629	47	0.6282	0.3502	80	0.3771	0.3801
15	0.5161	0.4939	48	0.5304	0.352	81	0.33	0.3369
16	0.4728	0.3586	49	0.3307	0.3153	82	0.3938	0.3005
17	0.3518	0.3222	50	0.3839	0.2496	83	0.4367	0.3267
18	0.2679	0.2115	51	0.425	0.4834	84	0.5554	0.4716
19	0.2346	0.1467	52	0.5449	0.5015	85	0.4013	0.4216
20	0.423	0.345	53	0.494	0.3492	86	0.4919	0.3051
21	0.5163	0.5057	54	0.289	0.3699	87	0.6016	0.6375
22	0.5035	0.3478	55	0.484	0.326	88	0.4765	0.424
23	0.4928	0.4874	56	0.5746	0.5629	89	0.1537	0.1082
24	0.4964	0.4124	57	0.2979	0.2364	90	0.3097	0.2089
25	0.4088	0.4543	58	0.3348	0.4185	91	0.5399	0.5571
26	0.4524	0.3825	59	0.3435	0.2393	92	0.4921	0.4582
27	0.571	0.5319	60	0.3858	0.4568	93	0.3838	0.3105
28	0.4219	0.4251	61	0.2254	0.2515	94	0.5327	0.3256
29	0.6085	0.5359	62	0.3341	0.2609	95	0.5127	0.386
30	0.4916	0.5024	63	0.3414	0.2825	96	0.4092	0.4313
31	0.5735	0.5121	64	0.2651	0.1866	97	0.5187	0.2771
32	0.5268	0.5335	65	0.4821	0.3795	98	0.525	0.2732
33	0.4317	0.3407	66	0.5944	0.4655	99	0.5961	0.4704

According to DRA, the average (Reock, Polsby-Popper) compactness score of the senate districts is (0.3867, 0.3233). Table A8 below shows the Reock and Polsby-Popper compactness scores of the individual senate districts.

Table A8. Reock and Polsby-Popper compactness scores of the senate districts

District	Reock	Polsby-Popper		District	Reock	Polsby-Popper		District	Reock	Polsby-Popper
1	0.5901	0.4861		12	0.4417	0.4379		23	0.3444	0.3711
2	0.3866	0.3482		13	0.3121	0.2521		24	0.3864	0.4209
3	0.3888	0.2888		14	0.4236	0.4032		25	0.2568	0.1492
4	0.3373	0.231		15	0.469	0.5754		26	0.5034	0.4462
5	0.3938	0.1865		16	0.1752	0.1673		27	0.2565	0.2531
6	0.3978	0.2314		17	0.3855	0.3857		28	0.5009	0.2632
7	0.2866	0.244		18	0.3471	0.3126		29	0.4978	0.4005
8	0.5121	0.33		19	0.354	0.1849		30	0.1334	0.087
9	0.3823	0.4368		20	0.307	0.2786		31	0.3689	0.3069
10	0.4098	0.3759		21	0.3612	0.3322		32	0.4776	0.4809
11	0.4866	0.3524		22	0.3993	0.4063		33	0.4886	0.2432

5. Federal Law Compliance

Table A9 below shows the demographic information for assembly districts 7-9, 10-12, and 16-18 and senate districts 3, 4, and 6 in map *173#008*. This information is identical to the map that was used for the November 2022 election (SB621). Thus, *173#008* and SB621 have equivalent VRA compliance.

Table A9. Racial and ethnic data for assembly districts 7-9, 10-12, and 16-18 and senate districts 3, 4, and 6 for maps *173#008* and SB621 (same for both maps).

DISTRICT	PERSONS	PERSONS 18	WHITE 18	BLACK 18	HISPANIC 18	ASIAN 18	AMINDIAN 18	PISLAND 18	OTHER 18	OTHERMLT 18	%Black VAP	%Hisp VAP
Asm 7	59603	46329	30268	3130	9201	2213	841	35	460	181	6.8%	19.9%
Asm 8	59362	40439	8022	3432	26651	1417	485	22	214	196	8.5%	65.9%
Asm 9	59571	42238	13084	3330	22371	2439	514	22	292	186	7.9%	53.0%
Asm 10	59503	45220	19708	20700	2284	1497	280	13	376	362	45.8%	5.1%
Asm 11	59565	41166	5961	29420	1838	3089	194	14	242	408	71.5%	4.5%
Asm 12	59351	42610	12652	23644	2233	3167	274	14	289	337	55.5%	5.2%
Asm 16	59714	45615	14609	23985	3231	2737	292	22	363	376	52.6%	7.1%
Asm 17	59435	43760	12734	26333	1948	1771	265	30	305	374	60.2%	4.5%
Asm 18	59346	43972	15861	22337	2781	1831	371	29	373	389	50.8%	6.3%
Sen 3	178536	129006	51374	9892	58223	6069	1840	79	966	563	7.7%	45.1%
Sen 4	178419	128996	38321	73764	6355	7753	748	41	907	1107	57.2%	4.9%
Sen 6	178495	133347	43204	72655	7960	6339	928	81	1041	1139	54.5%	6.0%

When SB621 was considered by the Court in *Johnson v. Wisconsin Elections Commission*, Sections II and IV of Dr. John Alford's expert report dated December 15, 2021 demonstrated that assembly districts 7-9, 10-12, and 16-18 (and senate districts 3, 4, 6) complied with the VRA at the time.

The results of the August 9, 2022 primary elections also support this conclusion. Among all contests in the Democratic primary, four involved at least one minority candidate and at least one White candidate. These four contests—for U.S. Senate, Milwaukee County Sheriff, Milwaukee County Clerk, and Assembly District 10 Representative—all featured at least one Black candidate and at least one White candidate. In the contest for U.S. Senate, the Black candidate Mandela Barnes overwhelmingly won every one of the assembly districts 10-12 and 16-18 and senate districts 4 and 6. In the contest for Milwaukee County Sheriff, the Black candidate Denita Ball won every one of the assembly districts 10-12 and 16-18 and senate districts 4 and 6. In the contest for Milwaukee County Clerk, the Black candidate Anna Maria Hodges won every one of the assembly districts 10-12 and 16-18 and senate districts 4 and 6. In the final contest, the Black candidate Darrin Madison carried the only assembly district involved in the contest: district 10. To our knowledge, no contest in the August 9, 2022 primary involved at least one Hispanic candidate and at least one non-Hispanic candidate.

Overall, the evidence points to the conclusion that assembly districts 7-9, 10-12, and 16-18 and senate districts 3, 4, and 6 in map *173#008* will perform for Black and Hispanic voters.

6. Community Considerations

The boundaries of Native American reservations and tribal lands in Wisconsin are clearly depicted at WisconsinFirstNations.org/current-tribal-lands-map-native-nations-facts. Figure A1 shows the map of these communities of that can be downloaded from this website.

Figure A1. Map of Native American reservations and tribal lands in Wisconsin

Of the communities depicted above, nine are particularly large. Table A10 lists these nine communities and shows the assembly and senate districts with which they overlap. Of these nine communities, eight are entirely within individual assembly districts. Furthermore, these eight communities are found within a total of three assembly districts—36, 74, and 83—that have Native American voting age population (VAP) percentages of 12.01%, 14.88%, and 3.35% respectively.

The only Native American reservation not wholly contained within an assembly district is the Oneida reservation which spans two counties. In this case, the western and eastern portions of the reservation were assigned to different districts, one for each county, to reduce the amount of county splitting in the map.

Table A10. Consideration of Native American communities in map *173#008*

Community of Interest	Overlapping Assembly District(s)	% Native American VAP in Assembly District(s)	Overlapping Senate District(s)
Menominee Reservation Stockbridge-Munsee Reservation	36	12.01%	12
Red Cliff Ojibwe Reservation Bad River Ojibwe Reservation Lac Courte Oreilles Ojibwe Reservation Lac du Flambeau Ojibwe Reservation	74	14.88%	25
Mole Lake Ojibwe Reservation Forest County Potawatomi Trust Lands	83	3.35%	28
Oneida Reservation	6, 82	4.83%, 5.38%	2, 28

8. Political Neutrality

For a swing state like Wisconsin, most measures of political neutrality are generally consistent. John F. Nagle & Alec Ramsay, *On Measuring Two-Party Partisan Bias in Unbalanced States*, 20 Election Law Journal 116 (2021). Thus, the following evaluation of political neutrality focuses on the metrics that are most direct and easiest to understand. Exceptional performance for these metrics indicates exceptional performance for other metrics of political neutrality.

Table A11 shows the number of votes received by Democrats and Republicans in each proposed assembly district, averaged over the six recent statewide elections that comprise the 2016-2022 composite election data used by DRA: 2022 governor, 2022 U.S. Senate, 2022 attorney general, 2020 president, 2018 U.S. Senate, and 2016 president. Table A12 shows the number of votes received by Democrats and Republicans in each proposed senate district, averaged over the same six elections. Similar tables for individual elections can easily be compiled using the "export district data" feature in DRA.

Table A11. DRA 2016-2022 composite election data for the assembly districts in map *173#008*

Dist.	Dem Votes	Rep Votes	Dem Vote%	Rep Vote%	Dist.	Dem Votes	Rep Votes	Dem Vote%	Rep Vote%	Dist.	Dem Votes	Rep Votes	Dem Vote%	Rep Vote%
1	11234	14681	43.3%	56.7%	34	12470	12410	50.1%	49.9%	67	14446	13148	52.4%	47.6%
2	12839	16532	43.7%	56.3%	35	10957	18728	36.9%	63.1%	68	15547	12923	54.6%	45.4%
3	10081	19886	33.6%	66.4%	36	9755	16887	36.6%	63.4%	69	13348	11701	53.3%	46.7%
4	10607	18818	36.0%	64.0%	37	9505	20196	32.0%	68.0%	70	9455	15213	38.3%	61.7%
5	13311	14263	48.3%	51.7%	38	16147	14077	53.4%	46.6%	71	16309	12927	55.8%	44.2%
6	9901	19016	34.2%	65.8%	39	24634	5333	82.2%	17.8%	72	11954	16945	41.4%	58.6%
7	13990	8926	61.0%	39.0%	40	14539	12816	53.1%	46.9%	73	15032	13390	52.9%	47.1%
8	8310	1820	82.0%	18.0%	41	13599	12870	51.4%	48.6%	74	14897	14169	51.3%	48.7%
9	10800	3957	73.2%	26.8%	42	17298	13115	56.9%	43.1%	75	13589	19962	40.5%	59.5%
10	23275	3835	85.9%	14.1%	43	15182	11241	57.5%	42.5%	76	18580	12493	59.8%	40.2%
11	17621	2056	89.6%	10.4%	44	15219	11228	57.5%	42.5%	77	24763	4369	85.0%	15.0%
12	16534	4260	79.5%	20.5%	45	12534	9769	56.2%	43.8%	78	26285	6875	79.3%	20.7%
13	14851	14296	51.0%	49.0%	46	16362	13613	54.6%	45.4%	79	26264	8641	75.2%	24.8%
14	19413	14480	57.3%	42.7%	47	30316	6127	83.2%	16.8%	80	24600	3798	86.6%	13.4%
15	13679	12005	53.3%	46.7%	48	12744	23298	35.4%	64.6%	81	14903	13044	53.3%	46.7%
16	17078	1638	91.2%	8.8%	49	12780	13079	49.4%	50.6%	82	13064	16521	44.2%	55.8%
17	21252	3779	84.9%	15.1%	50	27240	7695	78.0%	22.0%	83	9767	19120	33.8%	66.2%
18	19377	3566	84.5%	15.5%	51	14435	12418	53.8%	46.2%	84	9524	20254	32.0%	68.0%
19	24592	5526	81.7%	18.3%	52	10014	17684	36.2%	63.8%	85	11002	15036	42.3%	57.7%
20	15436	12264	55.7%	44.3%	53	8156	20178	28.8%	71.2%	86	11180	19094	36.9%	63.1%
21	10821	20833	34.2%	65.8%	54	13449	14839	47.5%	52.5%	87	7605	16471	31.6%	68.4%
22	11482	22362	33.9%	66.1%	55	13449	12008	52.8%	47.2%	88	11123	9013	55.2%	44.8%
23	9265	24371	27.5%	72.5%	56	14656	12459	54.1%	45.9%	89	14575	17734	45.1%	54.9%
24	13950	19943	41.2%	58.8%	57	13595	11991	53.1%	46.9%	90	13162	10625	55.3%	44.7%
25	10700	15362	41.1%	58.9%	58	9602	21761	30.6%	69.4%	91	14199	14831	48.9%	51.1%
26	12481	11348	52.4%	47.6%	59	21716	13402	61.8%	38.2%	92	11001	15143	42.1%	57.9%
27	10891	20906	34.3%	65.7%	60	13998	20004	41.2%	58.8%	93	10073	17102	37.1%	62.9%
28	10501	17687	37.3%	62.7%	61	16574	11586	58.9%	41.1%	94	15529	12375	55.7%	44.3%
29	10705	17207	38.4%	61.6%	62	13525	12962	51.1%	48.9%	95	14268	12390	53.5%	46.5%
30	9806	17522	35.9%	64.1%	63	13587	9551	58.7%	41.3%	96	15020	12417	54.7%	45.3%
31	10850	15208	41.6%	58.4%	64	11447	9573	54.5%	45.5%	97	12211	13763	47.0%	53.0%
32	9942	16995	36.9%	63.1%	65	13789	12738	52.0%	48.0%	98	14159	19997	41.5%	58.5%
33	10749	23664	31.2%	68.8%	66	13822	11137	55.4%	44.6%	99	12889	22357	36.6%	63.4%

Table A12. DRA 2016-2022 composite election data for the senate districts in map *173#008*

Dist.	Dem Votes	Rep Votes	Dem Vote%	Rep Vote%	Dist.	Dem Votes	Rep Votes	Dem Vote%	Rep Vote%	Dist.	Dem Votes	Rep Votes	Dem Vote%	Rep Vote%
1	34154	51099	40.1%	59.9%	12	33182	48025	40.9%	59.1%	23	43341	37772	53.4%	46.6%
2	33819	52097	39.4%	60.6%	13	50286	39606	55.9%	44.1%	24	37718	45085	45.6%	54.4%
3	33100	14703	69.2%	30.8%	14	45436	38801	53.9%	46.1%	25	43518	47521	47.8%	52.2%
4	57430	10151	85.0%	15.0%	15	42935	32238	57.1%	42.9%	26	69628	23737	74.6%	25.4%
5	47943	40781	54.0%	46.0%	16	59422	43038	58.0%	42.0%	27	65767	25483	72.1%	27.9%
6	57707	8983	86.5%	13.5%	17	54455	33192	62.1%	37.9%	28	32355	55895	36.7%	63.3%
7	50849	38623	56.8%	43.2%	18	31619	52701	37.5%	62.5%	29	29787	50601	37.1%	62.9%
8	34697	66676	34.2%	65.8%	19	41700	36458	53.4%	46.6%	30	38860	37372	51.0%	49.0%
9	34072	47616	41.7%	58.3%	20	45316	55167	45.1%	54.9%	31	35273	47076	42.8%	57.2%
10	31012	52416	37.2%	62.8%	21	43686	34099	56.2%	43.8%	32	44817	37182	54.7%	45.3%
11	31541	55867	36.1%	63.9%	22	39058	33448	53.9%	46.1%	33	39259	56117	41.2%	58.8%

Importantly, every metric for political neutrality can be analyzed using either a "fractional seats" or "past-the-post" approach, and the two approaches can lead to different predictions and assessments of political neutrality. In *past-the-post* accounting, the predicted number of seats won by Party A equals the number of districts where Party A voters outnumber Party B voters. In *fractional seats* accounting, Party A's share of the (two-party) vote in each district is converted to a *fractional value between 0 and 1* which is both the predicted number of seats Party A wins in the district and the chance that Party A wins the district. These "fractional seat" values are then summed over all districts to give the predicted number of seats won by Party A.

Figures A2 and A3 show the difference between the *past-the-post* and *fractional seats* approaches to analyzing political neutrality. Each figure considers Party A's share of the two-party vote in a single district. As shown in Figure A2, *past-the-post* accounting allocates one seat to the party with more voters in a district no matter if the district is lopsided or closely contested. If the district is perfectly tied, each party is assumed to win 0.5 seats in it.

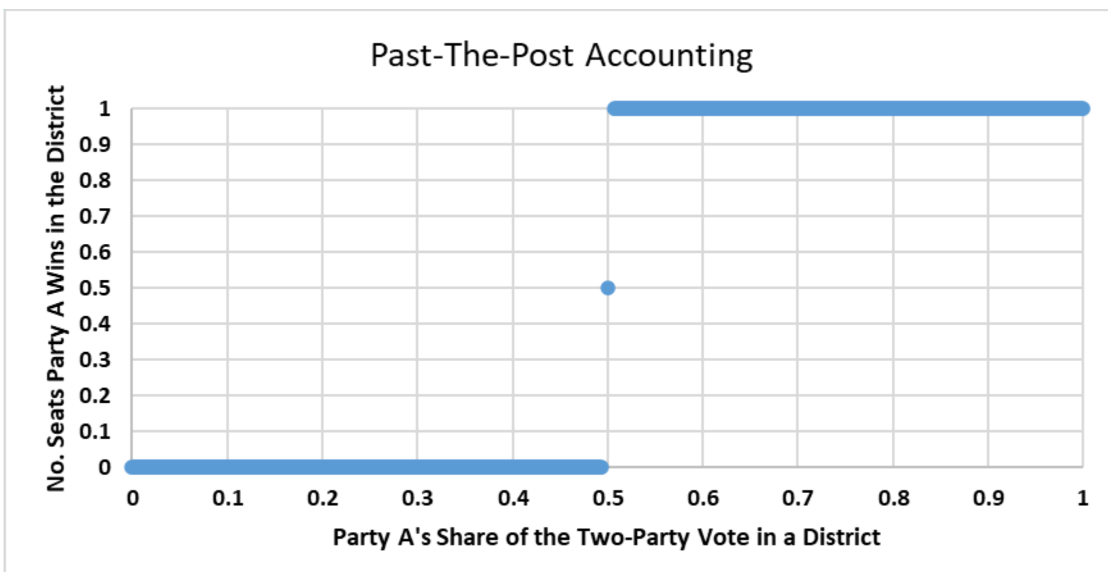

Figure A2. In past-the-post accounting, a district is categorized as a complete loss (win) if a party has less (more) than 50% of the two-party vote in the district.

On the other hand, *fractional seats* accounting assumes a district is a total win or loss only if it is lopsided. If the district is competitive, each party is assumed to have a non-zero probability of winning it, i.e., a fractional predicted number of victories in it between 0 and 1. For example, DavesRedistricting.org assumes that a party with a two-party vote share of (50, 52, 54, 56, 58, 60) percent in a district has a (50.0, 69.1, 84.1, 93.3, 97.7, 99.4) percent chance of winning it and is therefore predicted to win (0.5, 0.691, 0.841, 0.933, 0.977, 0.994) seats in the district. Figure A3 shows this relationship. (In precise mathematical terms, Figure A3 shows the cumulative distribution function of a normally distributed random variable with mean 0.5 and standard deviation 0.04.)

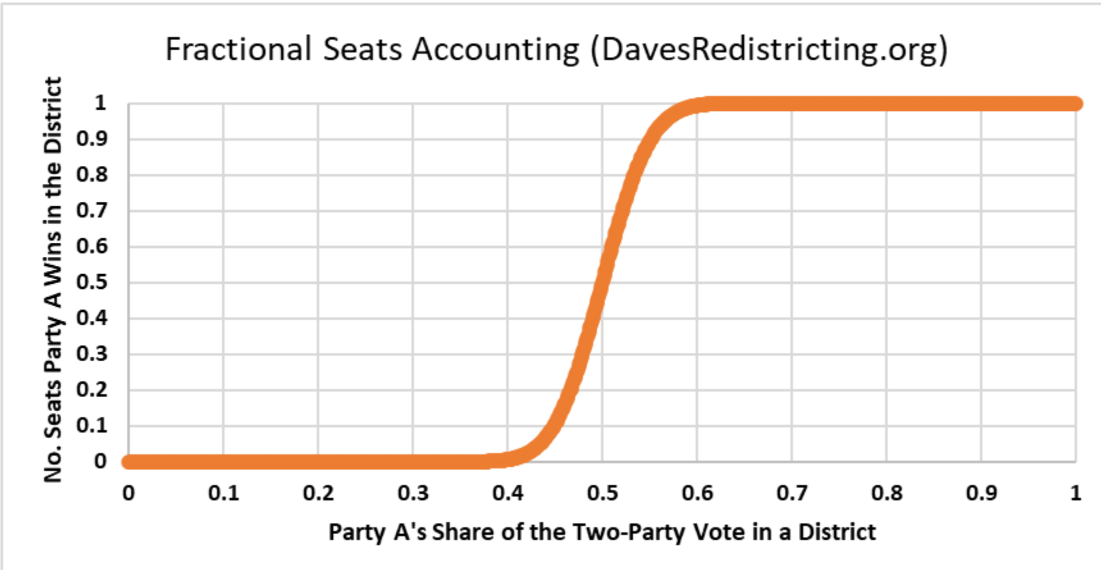

Figure A3. In fractional seats accounting, a district is assumed to be a complete win or loss only if it is lopsided. If a district is competitive, each party is assumed to have a fractional, non-zero probability of winning it (i.e., a fractional, non-zero predicted number of seats it wins in the district).

Clearly, the *fractional seats* and *past-the-post* approaches can lead to different predictions and assessments of political neutrality. For example, in a state with eight districts in which Party A has 52% of the vote share in *every* district, the fractional seats approach predicts that Party A wins 0.691*8 = 5.53 districts whereas the past-the-post approach predicts that it wins 8.00 districts. Another example showing how these approaches lead to different predictions is provided in Section I.C.3 of my *amicus curiae* brief dated November 8, 2023.

Overall, *fractional seats* accounting is more reasonable than *past-the-post* accounting because it is neither extremely sensitive nor insensitive to changes in voter preferences; the smoothness of the curve in Figure A3 shows that fractional seats predictions change modestly—with no sudden thresholds—when a party's vote share in a district changes within the range from 40% and 60%. On the other hand, Figure A2 shows that past-the-post predictions are entirely unresponsive when a party's vote share in a district changes from 40% to 49.9%; hyper responsive when a party's vote share in a district changes from 49.9% to 50.1%; and entirely unresponsive when a party's vote share in a district changes from 50.1% to 60%. Fractional seats accounting is conceptually more sound than past-the-post accounting because it considers the uncertainty inherent in campaigns and elections and it is not extremely sensitive to minor changes in a few voters' preferences.

But is *fractional seats* accounting better than *past-the-post* accounting at predicting actual election results? Yes, according to a study of state legislative elections included in my *amicus curiae* brief dated November 8, 2023. Therefore, the following analysis of political neutrality will be done mostly through the lens of fractional seats accounting. This type of accounting is built into the political neutrality metrics used by DavesRedistricting.org.

Next, the political neutrality of map *173#008* is evaluated using five metrics: *proportionality*, *efficiency gap*, *chances of winning a proportional seat share*, *number of competitive districts*, and *majority rule*. The first three metrics are computed via the fractional seats methodology; the final two are computed via simpler, past-the-post accounting. The first four metrics are computed using the composite data in Tables A11 and A12, and the last metric is computed using the results of recent individual elections.

Proportionality

The sum of the values in the "Dem Votes" and "Rep Votes" columns in Table A11 are 1,413,742 and 1,349,626 respectively. Overall, Democrats have received 1,413,742/(1,413,742 + 1,349,626) = 51.16% of the two-party vote in Wisconsin in recent elections. In a perfectly proportional election this translates to (.5116)*(99) = 50.65 assembly and (.5116)*(33) = 16.88 senate seats for Democrats. Meanwhile, Republicans have received 48.84% of the two-party vote. In a perfectly proportional election this translates to (.4884)*(99) = 48.35 assembly and (.4884)*(33) = 16.12 senate seats for Republicans.

After using Figure A3 to convert each value in the "Dem Vote%" column in Table A11 to a predicted number of *fractional seats* won by Democrats in each district and then summing the totals for all districts, the prediction is that map *173#008* will result in Democrats winning 50.73 seats in the assembly. Using the same procedure applied to Table A12, we predict that Democrats will win 16.98 seats in the senate if map *173#008* is used. (DRA computes these fractional seat totals automatically.) The values of 50.73 and 16.98 are 0.08 and 0.10 seats higher than the values in the previous paragraph for a perfectly proportional map: 50.65 and 16.88 respectively. Thus, Democrats are predicted to win 0.08 (0.10) more seats in the assembly (senate) than in a perfectly proportional map. This deviation from perfect proportionality slightly favors Democrats. However, the deviation is insignificant. *For all intents and purposes, the map is strictly proportional in both the assembly and senate*. For this reason, DRA gives *173#008* proportionality ratings of 99 of 100 for the assembly and 100 of 100 for the senate.

Efficiency Gap

According to DRA, the efficiency gap of the assembly and senate maps are +1.07% and +0.85% respectively. These positive values favor Republicans, but only slightly.

Chances of Winning a Proportional Seat Share

Another way to evaluate political neutrality is to estimate each party's chances of winning at least a proportional share of seats. Rounded to the nearest integer, a proportional share of assembly (senate) seats for Democrats is 51 (17) and for Republicans is 48 (16).

After using the relationship in Figure A3 to convert the "Dem Vote%" and "Rep Vote%" values in Tables A11 and A12 into probabilities that each party wins each district, we simulated 1,000,000 assembly elections and 1,000,000 senate elections using Monte Carlo simulation and noted the number of districts each party won in each election. The number of simulated elections in which each party won at least its proportional share of seats was then computed. This was then divided by 1,000,000 to compute the percentage of elections in which each party won at least its proportional share of seats. This percentage can also be interpreted as the likelihood that each party will win at least its proportional share of seats in a future election. According to this procedure, the estimation is that Democrats have a 52.3% chance of winning at least 51 assembly seats and a 64.4% chance of winning at least 17 senate seats if map *173#008* is used. Meanwhile, Republicans have a 63.5% chance of winning at least 48 assembly seats and a 65.4% chance of winning at least 16 senate seats. *Overall, both parties have at least a 50% chance of winning a seat share in proportion to their overall share of the statewide vote in both the assembly and senate.*

Number of Competitive Districts

Looking at Table A11, 29 of the 99 assembly districts are in the 45%-55% competitive range. According to Table A12, 10 of the 33 senate districts are in the 45%-55% competitive range. Overall, there are a substantial number of competitive districts in both the assembly and senate. This gives both parties a significant opportunity to win additional seats if they field good candidates.

Majority Rule

Nine different sets of election data, like that shown in Tables A11 and A12, were overlaid onto map *173#008* to see its performance for nine recent statewide elections: the most recent two elections for president, two elections for governor, three elections for U.S. Senate, and two elections for attorney general. Democrats won six of these elections, Republicans three. After doing so, the number of assembly and senate districts in map *173#008* that were carried by the winning candidate in each election was computed. In eight of the nine elections, the candidate who won the popular vote also carried a majority of assembly and senate districts in the map. In one election—the 2022 election for U.S. Senate—the candidate who won the popular vote carried a majority of assembly districts but not senate districts. In this election, Senator Ron Johnson defeated challenger Mandela Barnes by about 1% of the vote. However, Ron Johnson only carried 16 of the 33 senate districts in map *173#008*. *Overall, the map strongly embodies the principle of majority rule*.

Comparison with Other Maps

Map *173#008* significantly outperforms SB621 regarding contiguity, political neutrality, compactness, competitiveness, and county splitting, but not municipality splitting. Map *173#008* also outperforms the map (*155#176*) that accompanied the *amicus curiae* brief I submitted to the Court on Nov. 8, 2023. According to the scoring methodology I proposed in that brief, maps *173#008*, *155#176*, and SB621 have total penalty scores of 2173, 2227.4, and 3453.9 respectively. Maps with lower penalty scores are better, so *173#008* is the best and most appropriate of the three maps. A detailed breakdown of the scoring is shown below. Full descriptions of subcriteria 5A-9A and 5S-9S and the metrics used to score them are provided in the brief.

Table A13. Detailed scoring of maps *173#008*, *155#176*, and SB621

		***173#008* (strictly contiguous)**		***155#176* (strictly contiguous)**		**SB 621 (not contiguous)**	
Subcriterion	**Weight**	**Penalty Score**	**Weighted Penalty Score**	**Penalty Score**	**Weighted Penalty Score**	**Penalty Score**	**Weighted Penalty Score**
5A	50	0.08	4	0.02	1	9.80	490
6A	1000	0.5557	555.7	0.5447	544.7	0.6418	641.8
7A	5	70	350	70	350	83	415
8A	1	134	134	142	142	156	156
9A	1	56	56	98	98	51	51
5S	150	0.10	15	0.07	10.5	4.05	607.5
6S	1000	0.6133	613.3	0.5792	579.2	0.6316	631.6
7S	15	23	345	25	375	24	360
8S	1	61	61	65	65	71	71
9S	1	39	39	62	62	30	30
		Total Penalty = 2173		**Total Penalty = 2227.4**		**Total Penalty = 3453.9**	

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EDUCATION

Univ. Michigan-Ann Arbor	Industrial & Operations Engineering	Ph.D.	2007
Univ. Michigan-Ann Arbor	Industrial & Operations Engineering	M.Sc.	2003
Washington Univ. (St. Louis)	Mathematics	B.A.	1999

POSITIONS HELD

06/14 – present	**Associate Professor with Tenure, Industrial & Manufacturing Engineering Department, University of Wisconsin—Milwaukee (UWM)**
10/10 – 07/11	Associate Professor, Department of Logistics, The KLU, Hamburg, Germany
08/07 – 06/14	**Assistant Professor, Industrial & Manufacturing Engineering Department, UWM**
09/06 – 04/07	Teaching Assistant, Industrial & Operations Engineering Dept., University of Michigan
11/05 – 07/06	Research Engineer, The Logistics Institute—Asia Pacific, National Univ. of Singapore
06/05 – 09/05	Intern, Operations Planning Dept., PSA Corporation, Port of Singapore, Singapore
01/04 – 03/05	Research Fellow, Industrial & Systems Engineering Dept., National Univ. of Singapore
09/03 – 12/03	Teaching Assistant, College of Engineering, University of Michigan
09/02 – 04/03	Teaching Assistant, Industrial & Operations Engineering Dept., University of Michigan
05/02 – 08/02	Research Assistant, Industrial & Operations Engineering Dept., University of Michigan
02/01 – 06/01	Full-time substitute teacher for grades K-12 in Madison, Wisconsin
02/00 – 06/00	Full-time substitute teacher for grades K-12 in Milwaukee, Wisconsin
06/99 – 08/99	Cryptologic Mathematician, U.S. Dept. of Defense, National Security Agency, Maryland
05/97 – 08/97	Intern, Actuarial Dept., Northwestern Mutual Life Insurance Co, Milwaukee, Wisconsin

NEWS COVERAGE

1. "Lawmakers are redrawing Wisconsin's legislative map. How does this computer-generated version compare to one drawn by committee?" *Milwaukee Journal Sentinel* front-page story, January 10, 2024. https://www.jsonline.com/story/news/politics/2024/01/09/computer-algorithim-or-peoples-committee-comparing-proposed-wisconsin-redistricting-maps/72108910007.
2. "The state supreme court minority's view of gerrymandering," *Urban Milwaukee*, December 27, 2023. https://urbanmilwaukee.com/2023/12/27/data-wonk-the-state-supreme-court-minoritys-view-of-gerrymandering.
3. "UW-Milwaukee professor creates computer algorithm to take humans out of redistricting process," *TMJ4 Milwaukee 6 o'clock News*, WTMJ-TV Milwaukee, December 12, 2023. https://www.tmj4.com/news/local-news/uw-milwaukee-professor-creates-computer-algorithm-to-take-humans-out-of-redistricting-process.

4. "Can we get fair political districts in Wisconsin?" *Shepherd Express*, December 7, 2023. https://shepherdexpress.com/news/features/can-we-get-fair-political-districts-in-wisconsin.
5. "How the gerrymander wastes votes," *Urban Milwaukee*, November 29, 2023. https://urbanmilwaukee.com/2023/11/29/data-wonk-how-the-gerrymander-wastes-votes.
6. "Why that 'Iowa' redistricting plan was unfair," *Urban Milwaukee*, October 4, 2023. https://urbanmilwaukee.com/2023/10/04/data-wonk-why-that-iowa-redistricting-plan-was-unfair.
7. "Redistricting maps by humans gerrymandered Wisconsin. Powerful algorithms could do better." *Milwaukee Journal Sentinel*, Sunday print edition Opinion Section main story, October 1, 2023. https://www.jsonline.com/story/opinion/2023/09/25/wisconsin-supreme-court-redraw-electoral-maps-computer-algorithms-redistricting/70919652007.
8. "New Milwaukee board Game, *Distrix*, teaches people how gerrymandering works," WUWM 89.7 Milwaukee *Lake Effect* radio program, February 2, 2021. https://www.wuwm.com/podcast/lake-effect-segments/2021-02-02/new-milwaukee-board-game-distrix-teaches-people-how-gerrymandering-works
9. "Board game tackles real-world problem of gerrymandering," *UWM Report*, January 14, 2021. https://uwm.edu/news/board-game-tackles-real-world-problem-of-gerrymandering

COURT DOCUMENTS FILED

Amicus brief showing how computer algorithms can make fair legislative maps in Wisconsin, *Clarke v. Wisconsin Elections Commission*, Wisconsin Supreme Court case number 2023AP1399, November 8, 2023.

PATENT APPLICATIONS

"Districting strategy game," M.E.H. Petering, USPTO document number US-20200276493-A1, September 3, 2020.

BOARD GAMES

Distrix, M.E.H. Petering, Distrix Games (2020). Best Abstract Game at the 2021 UK Games Expo (Judges' Award Winner). Silver medal winner at the 2020 Serious Play Tabletop Game Competition.

BOOKS

The Distrix Puzzle Book, M.E.H. Petering, Distrix Games (2020). Winner, Spring 2021 Academics' Choice Smart Book Award.

JOURNAL PUBLICATIONS

1. "Responsive production planning and replenishment consolidation scheduling for a two-echelon supply chain," S. Alavi, M.E.H. Petering, and A. Ross, forthcoming in *International Journal of Logistics Systems and Management*.

2. “Learning with supervised data for anomaly detection in smart manufacturing,” M. He, M.E.H. Petering, P. LaCasse, W. Otieno, and F. Maturana, *International Journal of Computer Integrated Manufacturing*, 36 (2023) 1331-1344.
3. “A mathematical modeling approach to university course planning,” M. Khamechian and M.E.H. Petering, *Computers and Industrial Engineering*, 168 (2022), article number 107855. [corresponding author]
4. “The multi-spreader crane scheduling problem: Partitions and supersequences,” C.T. Cheng, M.E.H. Petering, and Y. Wu, *Discrete Applied Mathematics*, 289 (2021) 207-218.
5. “Real-time location-positioning technologies for managing cart operations at a distribution facility,” C.-H. Cheng, Y.-H. Kuo, H. Lam, and M.E.H. Petering, *Applied Sciences*, 11 (2021), article number 4049.
6. “Inventory control with flexible demand: Cyclic case with multiple batch supply and demand processes,” M.E.H. Petering, X. Chen, and W. Hsieh, *International Journal of Production Economics*, 212 (2019) 60-77. [corresponding author]
7. “The two-echelon open location routing problem: Mathematical model and hybrid heuristic,” K. Pichka, A.H. Bajgiran, M.E.H. Petering, J. Jang, and X. Yue, *Computers and Industrial Engineering*, 121 (2018) 97-112. [corresponding author]
8. “A survey of dial-a-ride problems: Literature review and recent developments,” S.C. Ho, W.Y. Szeto, Y.-H. Kuo, J.M.Y. Leung, M.E.H. Petering, and T.W.H. Tou, *Transportation Research Part B*, 111 (2018) 395-421.
9. “Discrete event simulation analysis of a reservation-based, one-way car sharing system,” L. Li and M.E.H. Petering, *Journal of Simulation*, 12 (2018) 1-22. [corresponding author]
10. “Sequencing dual-spreader crane operations: Mathematical formulation and heuristic algorithm,” S. Lashkari, Y. Wu, and M.E.H. Petering, *European Journal of Operational Research*, 262 (2017) 521-534. [corresponding author]
11. “Real-time container storage location assignment at a seaport container transshipment terminal: Dispersion levels, yard templates, and sensitivity analyses,” M.E.H. Petering, Y. Wu, W. Li, M. Goh, R. de Souza, and K.G. Murty, *Flexible Services and Manufacturing Journal*, 29 (2017) 369-402. [corresponding author]
12. “Mixed integer programming for railway capacity analysis and cyclic, combined train timetabling and platforming,” M.E.H. Petering, M. Heydar, and D. Bergmann, *Transportation Science*, 50 (2016) 892-909. [corresponding author]
13. “Strategic evacuation planning with pedestrian guidance and bus routing: A mixed integer programming model and heuristic solution,” M. Heydar, J. Yu, Y. Liu, and M.E.H. Petering, *Journal of Advanced Transportation*, 50 (2016) 1314-1335.
14. “Scheduling multiple yard cranes with crane interference and safety distance requirement,” Y. Wu, W. Li, M.E.H. Petering, M. Goh, and R. de Souza, *Transportation Science*, 49 (2015) 990-1005.
15. “Real-time container storage location assignment at an RTG-based seaport container transshipment terminal: Problem description, control system, simulation model, and penalty scheme experimentation,” M.E.H. Petering, *Flexible Services and Manufacturing Journal*, 27 (2015) 351-381. [corresponding author]

16. "Simulation analysis of hospital intensive care unit reimbursement policies from the triple bottom line perspective," M.E.H. Petering, O.T. Aydas, K. Kuzu, and A. Ross, *Journal of Simulation*, 9 (2015) 86-98. [corresponding author]
17. "A new mixed integer program and extended look-ahead heuristic algorithm for the block relocation problem," M.E.H. Petering and M. Hussein, *European Journal of Operational Research*, 231 (2013) 120-130. [corresponding author]
18. "Mixed integer programming for minimizing the period of a cyclic railway timetable for a single track with two train types," M. Heydar, M.E.H. Petering, and D. Bergmann, *Computers and Industrial Engineering*, 66 (2013) 171-185. [corresponding author]
19. "A continuous time model for multiple yard crane scheduling with last minute job arrivals," W. Li, M. Goh, Y. Wu, M.E.H. Petering, R. de Souza, and Y.C. Wu, *International Journal of Production Economics*, 136 (2012) 332-343.
20. "Decision support for yard capacity, fleet composition, truck substitutability, and scalability issues at seaport container terminals," M.E.H. Petering, *Transportation Research Part E*, 47 (2011) 85-103. [corresponding author]
21. "Development and simulation analysis of real-time, dual-load yard truck control systems for seaport container transshipment terminals," M.E.H. Petering, *OR Spectrum*, 32 (2010) 633-661. [corresponding author]
22. "Effect of block width and storage yard layout on marine container terminal performance," M.E.H. Petering, *Transportation Research Part E*, 45 (2009) 591-610. [corresponding author]
23. "Effect of block length and yard crane deployment systems on overall performance at a seaport container transshipment terminal," M.E.H. Petering and K.G. Murty, *Computers and Operations Research*, 36 (2009) 1711-1725. [corresponding author]
24. "Development and simulation analysis of real-time yard crane control systems for seaport container transshipment terminals," M.E.H. Petering, Y. Wu, W. Li, M. Goh, and R. de Souza, *OR Spectrum*, 31 (2009) 801-835. [corresponding author]
25. "Discrete time model and algorithms for container yard crane scheduling," W. Li, Y. Wu, M.E.H. Petering, M. Goh, and R. de Souza, *European Journal of Operational Research*, 198 (2009) 165-172.
26. "Performance analysis of a multiple vehicle tandem system with inter-vehicle buffers and blocking," M.E.H. Petering, J. Seo, and C. Lee, *Computers in Industry*, 58 (2007) 3-11. [author who did correspondence]

CONFERENCE PUBLICATIONS

1. "Linear penalty relation and genetic algorithms for the block relocation problem with weights," M. Hussein and M.E.H. Petering, 2013 IIE Annual Conference, San Juan, Puerto Rico, May 2013.
2. "Genetic algorithm-based simulation optimization of stacking algorithms for yard cranes to reduce fuel consumption at seaport container transshipment terminals," M. Hussein and M.E.H. Petering, 2012 IEEE Congress on Evolutionary Computation, Brisbane, Australia, June 2012 ("A" rated computer science conference).
3. "Global retrieval heuristic and genetic algorithm in the block relocation problem," M. Hussein and M.E.H. Petering, 2012 IIE Annual Conference, Orlando, Florida, May 2012.

4. “Evacuating highly populated urban zones during an emergency: a transit-based solution and optimal operational strategies,” M. Heydar, Y. Liu, and M.E.H. Petering, Transport Chicago, Chicago, Illinois, June 2011.
5. “Parallel versus perpendicular yard layouts for seaport container transshipment terminals: an extensive simulation analysis,” M.E.H. Petering, International Trade and Freight Transportation Conference, Ayia Napa, Cyprus, September 2008.
6. “Simulation analysis of yard crane routing systems at a marine container transshipment terminal,” M.E.H. Petering, Y. Wu, W. Li, M. Goh, K.G. Murty, and R. de Souza, International Congress on Logistics and Supply Chain Management Systems, Kaohsiung, Taiwan, May 2006.
7. “Simulation analysis of algorithms for container storage and yard crane scheduling at a container terminal,” M.E.H. Petering and K.G. Murty, Second International Intelligent Logistics Systems Conference, Brisbane, Australia, February 2006.
8. “Performance analysis of a multiple vehicle tandem system with inter-vehicle buffers and blocking,” M.E.H. Petering, J. Seo, and C. Lee, Fifth International Conference on “Analysis of Manufacturing Systems – Production Management,” Zakynthos Island, Greece, May 2005.

CONFERENCE PRESENTATIONS

1. “*Distrix* and *FastMap*: Addressing America’s gerrymandering problem with a puzzle book, strategy game, and computer algorithm,” M.E.H. Petering, INFORMS Annual Conference, Phoenix, Arizona, October 2023.
2. “University course scheduling during a pandemic,” M.E.H. Petering and M. Khamechian, CORS/INFORMS International Conference, Vancouver, Canada, June 2022.
3. “Reevaluating order fulfillment plans in real time in an online retail environment,” A. Kalantari and M.E.H. Petering, INFORMS Annual Conference, Seattle, Washington, October 2019.
4. “Inventory control with flexible demand: Cyclic case with multiple batch supply and demand processes,” M.E.H. Petering, X. Chen, and W. Hsieh, INFORMS Annual Conference, Phoenix, Arizona, November 2018.
5. “Evaluating exact vs. rule-based algorithms for the unending real-time traveling repairperson problem under true simulated operating conditions,” M.E.H. Petering, Odysseus 2018 Seventh International Workshop on Freight Transportation and Logistics, Cagliari, Sardinia, Italy, June 2018 (peer-reviewed abstract—60% acceptance rate).
6. “Using simulation and optimization to evaluate algorithms for revising online order fulfillment plans in real time,” A. Kalantari and M.E.H. Petering, POMS Annual Conference, Houston, Texas, May 2018.
7. “Simulation and optimization for reevaluating order fulfillment decisions in an online retail environment,” A. Kalantari and M.E.H. Petering, INFORMS Annual Conference, Houston, Texas, October 2017.
8. “Simulation and optimization for reevaluating order fulfillment plans in an online retail environment,” A. Kalantari and M.E.H. Petering, POMS Annual Conference, Seattle, Washington, May 2017.
9. “Railway capacity analysis and cyclic, combined train timetabling and platforming for a single track, bidirectional railway line,” M. Heydar and M.E.H. Petering, INFORMS Annual Conference, Nashville, Tennessee, November 2016.

10. "Comparison of algorithms for the unending real-time traveling repairperson problem by fully embedding them within a discrete event simulation model," M.E.H. Petering, Odysseus 2015 Sixth International Workshop on Freight Transportation and Logistics, Ajaccio, Corsica, France, June 2015 (peer-reviewed abstract—60% acceptance rate).
11. "Discrete event simulation analysis of a reservation-based, one-way car sharing system," M.E.H. Petering, The Sixth POMS-HK International Conference, Guangzhou, China, January 2015.
12. "Triple bottom line analysis of alternative reimbursement policies and configurations for a hospital intensive care unit with early patient discharges and readmissions," M.E.H. Petering, O.T. Aydas, K. Kuzu, and A. Ross, Sustainability Summit, Milwaukee, Wisconsin, March 2014.
13. "Integer programming for cyclic railway timetabling and routing on a single track unidirectional line," M.E.H. Petering, M. Heydar, and D. Bergmann, INFORMS Annual Conference, Minneapolis, Minnesota, October 2013.
14. "Discrete event simulation analysis of a reservation-based car sharing system offering one-way journeys," L. Li and M.E.H. Petering, INFORMS Annual Conference, Minneapolis, Minnesota, October 2013.
15. "Real-time container storage location assignment at a seaport container transshipment terminal: dispersion levels and math programming strategies," M.E.H. Petering, K.G. Murty, Y. Wu, W. Li, M. Goh, and R. de Souza, 2nd INFORMS TSL Society Workshop, Pacific Grove, CA, June 2013 (peer-reviewed abstract).
16. "Mixed integer programming for capacity analysis of a single track railway part III," M.E.H. Petering and M. Heydar, IIE Annual Conference, San Juan, Puerto Rico, May 2013.
17. "Mixed integer programming for minimizing the period of a cyclic railway timetable for a single track line with two train types," M.E.H. Petering, M. Heydar, and D. Bergmann, INFORMS Annual Conference, Phoenix, Arizona, October 2012.
18. "Real-time container storage location assignment at a seaport container transshipment terminal part III," M.E.H. Petering, LOGMS 2012 Conference, Bremen, Germany, August 2012.
19. "Genetic algorithm-based simulation optimization of stacking algorithms for yard cranes to reduce fuel consumption at seaport container transshipment terminals," M. Hussein and M.E.H. Petering, 2012 IEEE Congress on Evolutionary Computation, Brisbane, Australia, June 2012 ("A" rated computer science conference).
20. "Real-time container storage location assignment at a seaport container transshipment terminal part II," M.E.H. Petering, Odysseus 2012 Fifth International Workshop on Freight Transportation and Logistics, Mykonos Island, Greece, May 2012 (peer-reviewed abstract—61% acceptance rate).
21. "Real-time container storage location assignment at a seaport container transshipment terminal part II," M.E.H. Petering, INFORMS Annual Conference, Charlotte, North Carolina, Nov. 2011.
22. "A new mixed integer program and comparison of algorithms for the block relocation problem," M.E.H. Petering and M. Hussein, INFORMS Annual Conference, Austin, Texas, Nov. 2010.
23. "Real-time container storage location assignment at a seaport container transshipment terminal," M.E.H. Petering and K.G. Murty, LOGMS 2010 Conference, Busan, South Korea, September 2010.
24. "Real-time container storage location assignment at a seaport container transshipment terminal," M.E.H. Petering and K.G. Murty, IIE Annual Conference, Cancun, Mexico, June 2010.

25. "Design and real-time control of a seaport container transshipment terminal," M.E.H. Petering, INFORMS Annual Conference, San Diego, California, Oct. 2009.
26. "Parallel versus perpendicular yard layouts for seaport container transshipment terminals: an extensive simulation analysis," M.E.H. Petering, CORS-INFORMS Meeting, Toronto, June 2009.
27. "Real-time container storage location assignment at a seaport container transshipment terminal," M.E.H. Petering and K.G. Murty, Odysseus 2009 Fourth International Workshop on Freight Transportation and Logistics, Cesme, Turkey, May 2009 (peer-reviewed abstract).
28. "Development and simulation analysis of real-time yard crane control systems for seaport container transshipment terminals," M.E.H. Petering, Y. Wu, W. Li, M. Goh, and R. de Souza, INFORMS Annual Conference, Washington DC, Oct. 2008.
29. "Parallel versus perpendicular yard layouts for seaport container transshipment terminals: an extensive simulation analysis," M.E.H. Petering, International Trade and Freight Transportation Conference, Ayia Napa, Cyprus, September 2008.
30. "Development and simulation analysis of real-time, dual-load yard truck dispatching systems for seaport container transshipment terminals," M.E.H. Petering, 3rd German-Korean Workshop on IT-Based Planning and Control of Seaport Container Terminals, Bremen, Germany, Aug. 2008.
31. "Design of seaport container transshipment terminals: yard layout, fleet composition, and scalability issues," M.E.H. Petering, IIE Annual Conference, Vancouver, Canada, May 2008.
32. "Real-time container storage location assignment at a seaport container transshipment terminal," M.E.H. Petering and K.G. Murty, INFORMS Annual Conference, Seattle, Washington, Nov. 2007.
33. "Simulation analysis of yard crane routing systems at a marine container transshipment terminal," M.E.H. Petering, Y. Wu, W. Li, M. Goh, K.G. Murty, and R. de Souza, International Congress on Logistics and Supply Chain Management Systems, Kaohsiung, Taiwan, May 2006.
34. "Simulation analysis of algorithms for container storage and yard crane scheduling at a container terminal," M.E.H. Petering and K.G. Murty, Second International Intelligent Logistics Systems Conference, Brisbane, Australia, February 2006.
35. "Performance analysis of a multiple vehicle tandem system with inter-vehicle buffers and blocking," M.E.H. Petering, J. Seo, and C. Lee, Fifth International Conference on "Analysis of Manufacturing Systems – Production Management," Zakynthos Island, Greece, May 2005.

INVITED PRESENTATIONS AND SEMINAR TALKS

36. "An algorithmic approach to redistricting in Michigan," presentation to the Michigan Independent Citizens Redistricting Commission (MICRC), https://www.youtube.com/watch?v=NJnn7Xj3Gb8&t=4371s.
37. "Unraveling gerrymandering: Wisconsin's journey to fair redistricting," Milwaukee Public Library online program, May 24, 2021, https://www.youtube.com/watch?v=vuisaqZ9K08.
38. "Fair maps or gerrymandered maps?" Virtual town hall meeting with Wisconsin State Senator Chris Larson, April 26, 2021, https://www.youtube.com/watch?v=yQ80hscLzlw.
39. "Transforming connected systems into smart connected systems: research insights and future opportunities," Sheldon Lubar School of Business, UW-Milwaukee, April 2018.

40. "Illustration of three operations research modeling techniques," Department of Systems Engineering and Engineering Management, Chinese University of Hong Kong, Hong Kong, February 2016.
41. "Math and computer modeling of logistics and transportation systems," UW-Milwaukee Applied and Computational Mathematics research group seminar, April 2, 2015.
42. "Real-time container storage location assignment at a seaport container transshipment terminal," Department of Systems Engineering and Engineering Management, Chinese University of Hong Kong, Hong Kong, January 2015.
43. "Computer-driven decision support for the design and operations management of logistics and transportation systems," UW-Milwaukee Computer Science Dept., October 25, 2013.
44. "Operations research in action in today's world," meeting of the UW-Milwaukee INFORMS student chapter, UW-Milwaukee Institute of Industrial Innovation, December 9, 2011.
45. "Design, analysis, and real-time control of seaport container transshipment terminals," The Kühne Logistics University, Hamburg, Germany, April 6, 2011.
46. "Real-time container storage location assignment at a seaport container transshipment terminal," Institute for Maritime Logistics and Fraunhofer Center for Maritime Logistics, Technical University of Hamburg—Harburg, Hamburg, January 17, 2011.
47. "A new mixed integer program and comparison of algorithms for the block relocation problem," Institute of Information Systems, University of Hamburg, December 9, 2010.
48. "Design, analysis, and real-time control of seaport container transshipment terminals," Faculty of Applied Sciences, Simon Fraser University, Vancouver, July 26, 2010.
49. "Introduction to container shipping," Center for International Education, UW—Milwaukee, March 24, 2009.
50. "Real-time container storage location assignment at a seaport container transshipment terminal," Division of Systems & Engineering Management, Nanyang Technological University, Singapore, Jan 10, 2008.
51. "Simulation analysis of real-time yard control systems for marine container transshipment terminals," Dept. of Ocean and Resources Engineering, University of Hawaii, Oct 18, 2006.
52. "Simulation analysis of real-time yard control systems at a marine container transshipment terminal," Department of Industrial and Operations Engineering, University of Michigan, September 27, 2006.
53. "Operations management at a marine container terminal," The Logistics Institute—Asia Pacific, National University of Singapore, February 16, 2006.

RESEARCH FUNDING

EXTERNAL FUNDING

1. Title: "Southeast Wisconsin Wind Energy Educational Collaborative."
   Source: U.S. Department of Energy
   Dates: September 1, 2009 – August 31, 2011
   Amount: $330,184
   Role: Co-PI (PI is Professor David Yu)

2. Title: "CFIRE Partner Grant Years 1-2: Freight Transshipment, Cost, & O-D Table Disaggregation."
   Source: National Center for Freight & Infrastructure Research & Education at UW-Madison
   Dates: October 1, 2007 – September 30, 2009
   Amount: $200,000
   Role: Co-PI (PI is Professor Alan Horowitz)

INTERNAL FUNDING

3. Title: "Reducing the cost of operating the UW-Milwaukee shuttle bus services."
   Source: UWM Dept. of Facilities Planning & Management (Dept. of Parking & Transit)
   Dates: January 21, 2014 – June 20, 2014
   Amount: $47,000
   Role: Sole PI

COORDINATION OF PROGRAMS, DEPARTMENTS, OR CENTERS

1. Faculty leader of two, three-week-long UWM College of Engineering and Applied Science (CEAS) study abroad programs at Chung Yuan Christian University and Feng Chai University in Taiwan (July 2012, 2013, 2014, 2015, 2016, 2017).

INVOLVEMENT IN STUDENT ACTIVITIES

1. Faculty Advisor, UWM student chapter of the Institute of Industrial and Systems Engineers (IISE) (2012-2022).

AWARDS AND HONORS FOR SERVICE

1. Received the "Advisor of the Year" award (one recipient per year across the entire university) for work done as the faculty advisor of the UW-Milwaukee student chapter of the Institute of Industrial and Systems Engineers (IISE) during the 2012-2013 academic year.

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

1. Institute for Operations Research and the Management Sciences (INFORMS)—member since 2002.
2. Institute of Industrial and Systems Engineers (IISE)—member since 2006.

UNIVERSITY-RELATED COMMITTEE AND TASK FORCE WORK

UW-Milwaukee University-Wide Committee Work

1. Member of university-wide Global Studies Advisory Committee (2008-09, 2011-14, 2016-17).
2. Member of university-wide Undergraduate Overseas Research Awards Review Committee (2008-10, 2011-14, 2016-17).
3. Member of university-wide Physical Environment Committee (2016-18).
4. Member of university-wide Task Force on Internationalization (2009 calendar year).

UW-Milwaukee College of Engineering and Applied Science (CEAS) Committee Work

5. Member of CEAS Transportation Engineering Search and Screen Committees (2022-2023).
6. Chair of CEAS Academic Planning Committee (2021)
7. Member of CEAS Scholastic Appeals Committee (2020)
8. Member of CEAS Academic Planning Committee (2017-2018, 2020)
9. Member of CEAS Curriculum Committee (2016-2017)
10. Member of CEAS Best Place to Work Committee (2013-2014).
11. Member of CEAS/Lubar Supply Chain Management Search and Screen Committee (2011-2012).
12. Member of CEAS Green Manufacturing Search and Screen Committee (2008-2009).
13. Member of CEAS Graduate Program Subcommittee (2007-2009).

UW-Milwaukee Dept. of Industrial and Manufacturing Engineering (IME) Committee Work

14. Department ABET Accreditation Coordinator (2016-2024)
15. Chair of IME Dept. Curriculum Committee (2009-2010, 2011-2014).
16. Member of team that prepared IME Dept. Five-Year Strategic Plan, 2013.
17. Chair of IME Dept. Operations Research Track Qualifying Examination Committee (2011-2013).
18. Member of IME Dept. Search and Screen Committee (21 faculty candidates hosted and interviewed, 2007-2010).

The Kühne Logistics University

19. Academic advisor for M.Sc. Program in Global Logistics during 2010-2011 academic year.
20. Chair of the admissions committee for M.Sc. programs during 2010-2011 academic year.
21. Deputy chair of the examinations committee during 2010-2011 academic year.

NOTEWORTHY INDUSTRIAL EXPERIENCE

Seaport container terminals (worldwide)
Visited, and spoke with managers at, 30 seaport container terminals around the world

Manufacturing facilities in greater Milwaukee
Organized six field trips to local manufacturing companies during each of the Fall 2011, 2012, 2013, 2014, 2015, 2016, 2017, and 2018 semesters as part of the course "IND ENG 350: Manufacturing Processes" which have enhanced student comprehension of modern manufacturing practice.

SPECIAL ASSIGNMENTS FOR PROFESSIONAL ORGANIZATIONS

1. Reviewer for the journal "INFORMS Journal on Applied Analytics"
2. Reviewer for the journal "Computers and Operations Research"
3. Reviewer for the journal "Computers and Industrial Engineering"
4. Reviewer for the journal "Decision Support Systems"
5. Reviewer for the journal "Transportation Science"
6. Reviewer for the journal "Transportation Research B"
7. Reviewer for the journal "Transportation Research E"
8. Reviewer for the journal "Naval Research Logistics"
9. Reviewer for the journal "Journal of Simulation"
10. Reviewer for the journal "European Journal of Operational Research"
11. Reviewer for the journal "Production and Operations Management"
12. Reviewer for the journal "Annals of Operations Research"
13. Reviewer for the journal "OR Spectrum"
14. Reviewer for the journal "Flexible Services and Manufacturing"
15. Reviewer for the journal "IEEE Transactions on Automation Science and Engineering"
16. Reviewer for the journal "IISE Transactions"
17. Reviewer for the journal "INFOR"

EXTERNAL CONSULTING

Consultant, Voces De La Frontera — drafted multiple proposals to incorporate a third Hispanic influence district into the City of Milwaukee aldermanic districts, 2021.

Consultant, Tax Airfreight, Inc. — developed model-based solutions for improving the productivity of an overnight LTL transportation and logistics company, 2017.