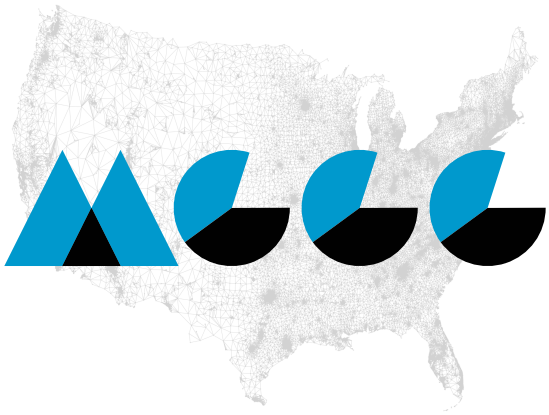
Study of the 2024 STV City Council Election in Portland, Oregon



Data and Democracy Lab
(MGGG Redistricting Lab)

Contents

Contributors

Jeanne Clelland, Moon Duchin, and David McCune are the principal contributors to this report. Christopher Donnay and Peter Rock in the Data and Democracy Lab of the Brooks School of Public Policy, Cornell University, provided VoteKit-based software support.

Version 3.0 | January 2025

1 Executive summary

- There is good evidence that **people of color were able to elect candidates of choice in every district** (§4.2). More generally, the use of STV ensured that no single bloc of like-minded voters could sweep the results anywhere (§4.3).
- Contrary to certain press narratives, **the roll-off rate was not especially high**. ("Roll-off" refers to voters who indicate a preference in the up-ballot contests, like President, but skip the city council election.) Rather, the city council participation in 2024 was intermediate between the levels observed in the last two presidential years (§5.1).
- Another claim is that people of color had their voices undermined by high rates of ballot error. On the contrary, across all groups, **error rates are moderate and did not impact the ability to elect candidates**. We find that the rate of "spoiled" ballots (unable to be counted) was well under 2% in each district, while a large majority of ballots stayed active all the way through the last round of meaningful tabulation (§5.2). We consider the rates of "STV exhaustion," where ranking too few candidates deprives a voter of their voice, and of "futility," where ballots are complete but nonetheless do not contribute to the outcomes, and find that both are quite low—futility rates in particular are at or under roughly two percent in each district.
- Analyzing how the STV mechanism mattered for outcomes, **we find extremely strong performance on measures of proportionality**, like first-place coverage, top-three coverage, and mentions (the number of voters who ranked a winner at all). In these measures, STV performs better than other popular systems such as Plurality block voting (widely used for city councils) as well as Borda count and Condorcet voting (both popular with scholars), when faced with Portland voters' actual preferences (§6-7).

Overall, we find that STV delivered strikingly well on its promise of better proportionality for the voters of Portland.

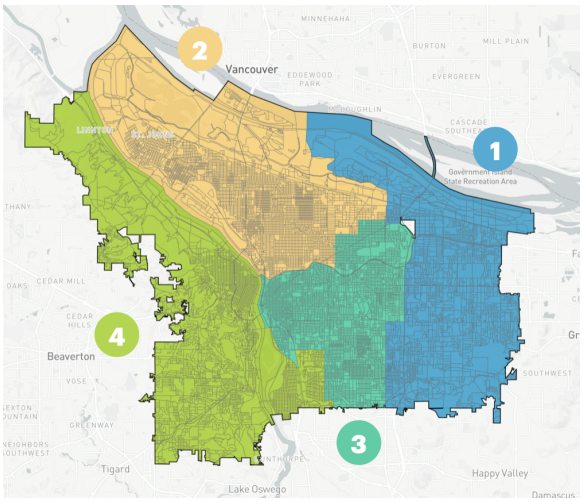


Figure 1. The four multi-member districts used for the 2024 City Council elections.

2 Background

In November 2022, voters in Portland, Oregon approved an overhaul to their system of election. Previously, Portland had a *commission model*, with four councillors elected at-large, plus the mayor as a member of the council. In that system, candidates ran for numbered seats—for instance "City Commissioner Position 4"—for which the whole city voted. The new system holds the mayor separate and expands to 12 seats, with four geographical districts electing three councillors each through ranked-choice voting. The districts are shown in Figure 1.

The precise system of election now in place is called STV or "single transferable vote"; support from roughly a quarter of the district's voters is the threshold required for election. Voters can rank up to six candidates, and rounds of tabulation are conducted with support transferring down the ballot until three candidates cross the threshold.[1]

STV has been employed around the United States at various points in history, and is used in six other countries internationally. Advocates say that it tends to secure proportional representation for many kinds of groups—in fact, it is sometimes referred as a "proportional representation system." Whether and how it lived up to that billing is the main question studied here.

In particular, supporters argue that STV is likely to allow communities of color to elect candidates of their choosing in proportion to their share of population. In Portland, people identifying with a non-White race and/or as Hispanic—henceforth referred to as people of color or "POC"—made up 33.6% of total population and 30.6% of voting age population in the 2020 Decennial Census.[2] If we measure by so-called descriptive representation, where we consider whether POC officials are present in proportion to POC voters, the council would need to have three to four non-White members out of 12. If we measure by the opportunity to elect candidates of choice (as in the Voting Rights Act of 1965), then **proportionality would call for three to four members who were preferred by people of color**.

The actual outcome in November 2024 seated five candidates of color, and six POC-preferred candidates overall. The winning candidates of color are Candace Avalos (Black and Latina), Loretta Smith (Black), Sameer Kanal (South Asian), Angelita Morillo (Latina), and Tiffany Koyama Lane (Asian). In this report, we will present evidence that those winners were candidates of choice for POC voters, and that one of the White candidates elected (Mitch Green from District 4) was likely a POC candidate of choice as well.

We will analyze the **mechanics of the STV election** to explain that the voting system played a direct role in securing such strong representation for communities of color, while several other popular systems of election would have delivered different results when faced with identical voter preferences.

[1] The Wikipedia page contains a complete round-by-round accounting of the vote tabulation, and the official results are hosted on Multnomah County's website for District 1, District 2, District 3, and District 4.

[2] A commercial voter file with a modeled race attribute suggests that the share of POC among registered voters is 25.2%. Below, we will use census race/ethnicity names like "Hispanic" rather than terms more often used in self-description like "Latina/Latino" when appropriate to the data source.

3 Basic observations

The November election had a staggering 98 named candidates listed on city council ballots across the four districts. In addition to first-place votes, we will record their *mentions*: the ballots on which they are ranked in any position (see Figure 2). We say that a candidate is *viable* if they were *mentioned on more ballots than the threshold for election* in their district. Under STV, a candidate cannot cross the election threshold if their number of mentions is below it.[3] Of the 98 named candidates across the four districts, only 29 meet this standard of viability.

Summary of candidates and winners, by self-identified race.

- District 1: 7 viable candidates out of 16 named candidates in all. **Winners** are Candace Avalos (Black and Latina), Loretta Smith (Black), and Jamie Dunphy (White)—they cross the election threshold in that order. Terrence Hayes (Black) is also labeled as viable.
- District 2: 9/22 viable. **Winners** are Sameer Kanal (South Asian), Elana Pirtle-Guiney (White), Dan Ryan (White). Michelle DePass and Tiffani Penson were the other viable candidates of color (both Black), and were two of the last three candidates to be eliminated in the STV tabulation.
- District 3: 5/30 viable. **Winners** are Steve Novick (White), Angelita Morillo (Hispanic), Tiffany Koyama Lane (Asian). The other two viable candidates were White.
- District 4: 8/30 viable. **Winners** are Olivia Clark (White), Mitch Green (White), Eric Zimmerman (White). All eight viable candidates were White.

Summary of top-line conclusions characterizing candidate support.

- In District 1, **Candace Avalos** was the most popular candidate not only for people of color but also for White voters overall. Avalos had particularly strong support from Hispanic voters, but her support also shows a geographical pattern that goes beyond demographics, centered on the Lents neighborhood. Meanwhile, **Loretta Smith** was the primary candidate of choice for Black voters.
- In District 2, when POC voters are combined, **Sameer Kanal** appears as their clear candidate of choice. White voters' preferences are distinct, with **Dan Ryan** and **Elana Pirtle-Guiney** as favorites. **Tiffani Penson** was the most popular candidate with Black voters.
- In District 3, **Angelita Morillo** and **Tiffany Koyama Lane** were the top picks of voters of color, but it is not the case that each is estimated to be preferred by her own racial group—for instance, both run quite strongly with Hispanic voters. **Steve Novick** was preferred by White voters. Beyond the patterns of racial/ethnic support, Morillo also shows geographical strength in the Kerns neighborhood to the northwest of the district.
- In District 4, all the viable candidates were White. Among those, **Mitch Green** emerges as the POC candidate of choice, while **Olivia Clark** was far and away the choice of White voters.

[3]This is because round-by-round transfers cause lower-ranked votes to be converted to first-place votes. It is technically possible, but would be highly unlikely, to win election as the "last candidate standing" while falling below this viability line.

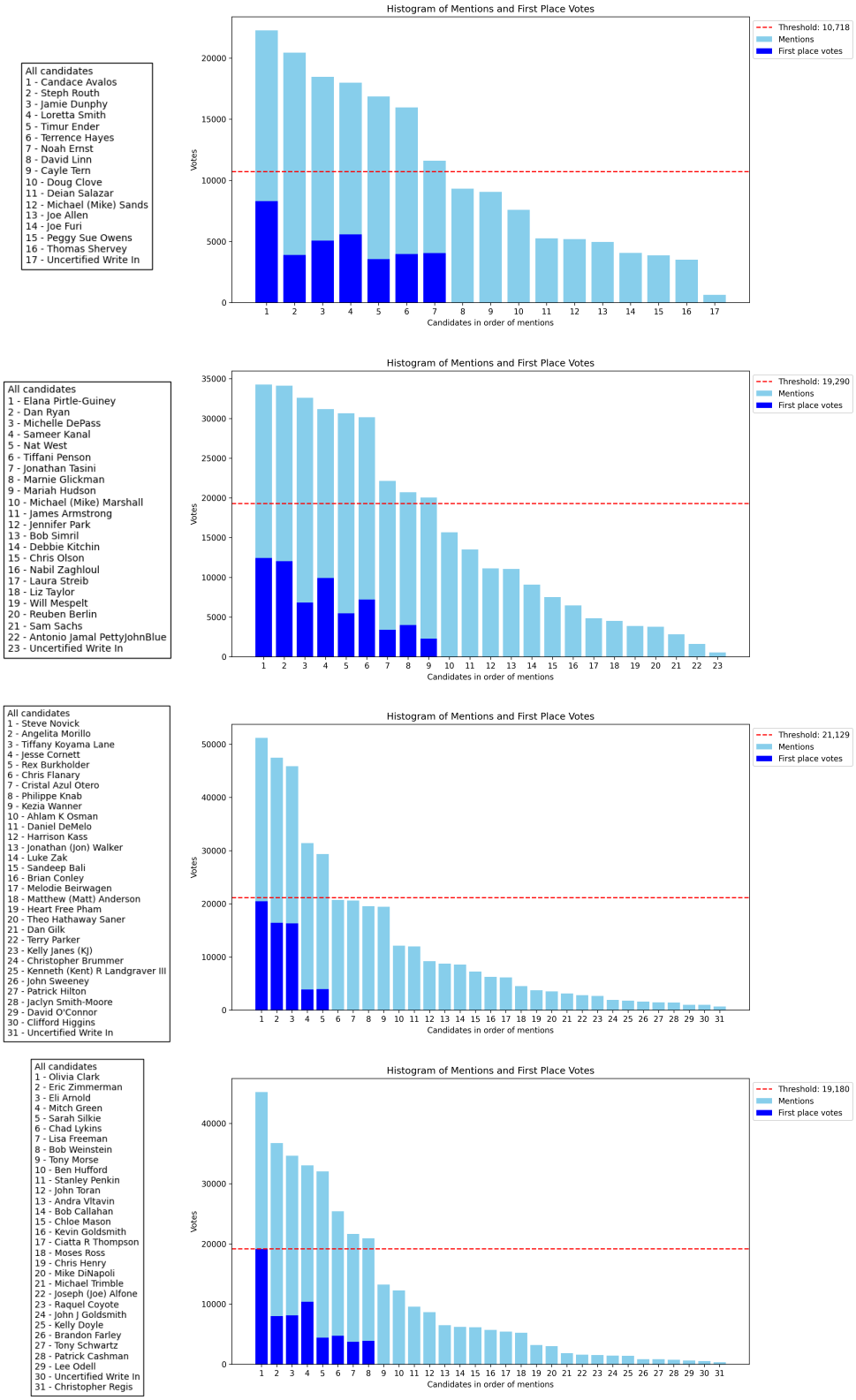


Figure 2. In each district, the histogram shows the number of mentions (rankings in any position) per candidate. First-place votes are shown in dark blue for viable candidates.

4 Candidates

4.1 Candidate strength

There are several reasonable measurements of the strength of candidates: we can count their number of first-place votes, or their number of mentions, which gives credit for every ranking, no matter the position. Another measure of strength is positional scoring, where higher rankings are worth more points but lower rankings are still taken into account. This is sometimes called a *Borda score* (or Borda points) for candidates, and the standard scoring when voters can rank six would be 6 for a first-place vote, 5 for a second-place vote, and so on down to 1 point for a 6th-place vote.[4]

Another notion of candidate strength that is popular with some scholars is to consider candidates two at a time—whoever wins head-to-head in a pairwise comparison is considered to be stronger. If one candidate is preferred head-to-head to all others, they are called a "Condorcet candidate." For example, in District 1, Avalos beats all others head-to-head (she is Condorcet); Routh beats all but Avalos head-to-head, Dunphy beats all but the first two head-to-head; and so on. When the head-to-head strengths are clean in this way, we can call this the Condorcet order.

In Portland, all four districts have Condorcet candidates—and in fact all four districts have a Condorcet order on their viable candidates.[5]

District 1	Avalos > Routh > Dunphy > Smith > Ender > Hayes > Ernst
District 2	Pirtle-Guiney > Ryan > Kanal > DePass > Penson > West > Tasini > Glickman > Hudson
District 3	Novick > Morillo > Koyama Lane > Burkholder > Cornett
District 4	Clark > Zimmerman > Arnold > Green > Silkie > Lykins > Freeman > Weinstein

We will see below that putting a high weight on this notion of candidate strength would have led to less representative outcomes.

4.2 Candidates of choice

Racially polarized voting (RPV) analysis uses statistical techniques to infer how support for individual candidates varies by race, based on correlating racial demographics with election results by precinct. The two most widely accepted methods for RPV analysis are ecological regression (ER) and ecological inference (EI).

As a caveat, we note that both ER and EI work best when there are many precincts and the racial composition varies sharply. In the Portland City Council elections, districts have only 17 to 29 precincts, which is relatively few for a good RPV analysis. Additionally, the largest individual racial groups (Hispanic, Asian, and Black) each make up less than 10% of Portland's CVAP, and they are not highly geographically concentrated. For all of these reasons, EI and ER do not give high-confidence standalone results. However, we can pull out some comparisons with a strong statistical signal to complement other forms of analysis. In the district-by-district review below, we explain the evidence that supports the top-line conclusions regarding candidate support.

[4] We also considered a 5-2-1-0-0-0 score vector, which gives strong value to first-place votes and some credit for second- and third-place votes. This may be better matched to STV dynamics, which rely heavily on first-place support.

[5] Interestingly, District 3 also contains what is known as a *Condorcet cycle*: after the viable candidates, and after one more candidate named Flanary, the next three (Knab, Wanner, Azul Otero) receive conflicting head-to-head support from voters. Wanner is preferred to Knab 18,021 to 17,658; Knab is preferred to Azul Otero 16,415 to 12,225; but Azul Otero is narrowly preferred to Wanner, 18,602 to 18,289.

4.2.1 District 1

District 1 has the highest POC population share of the four districts, at 36% POC and 64% White by CVAP (citizen voting age population). It is instructive to compare the support patterns of Candace Avalos and Loretta Smith in Figures 3-5. Avalos was the overall favorite candidate by far; by ER, she is estimated to have received first-place votes from 27% of POC voters and 15% of White voters, and she was similarly dominant when using Borda points or mentions as the metric. Among individual non-White racial groups, Avalos had extremely strong support from Hispanic voters and moderate support from Asian voters across all metrics. Her estimated first-place support from Black voters is still significant, at roughly 15% (in line with her support from White voters).

Meanwhile, Black candidate Loretta Smith—who was known to the voters as a former county commissioner, and had run two unsuccessful city council campaigns—received similar estimated support from White voters, at about 13%. Smith's support pattern suggests that she was the first choice of Black voters; however, she received extremely limited support from Hispanic and Asian voters, so that her overall POC support is limited.

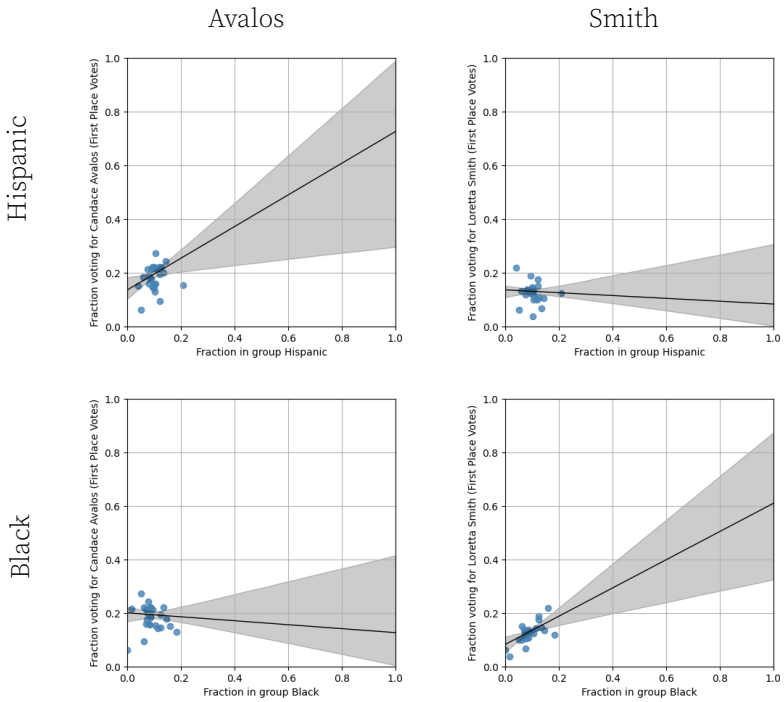


Figure 3. These scatterplots show fit lines computed by a Bayesian ER (ecological regression) method that conditions on the intercepts between 0 and 100% share for the demographic groups. An upward sloped line indicates that the candidate is inferred to be *more* popular with the minority group than with the complementary group, while a downward-pointed line shows the reverse inference. In this case, Avalos is estimated to be highly popular for the top ranking from Hispanic voters, while Smith is highly popular with Black voters.

Figure 3 shows the correlation between Avalos and Smith first-place vote support and the Hispanic and Black demographic shares. The same information is visualized differently in Figure 4. Finally, Figure 5 shows the differences in the support patterns on a map of the district.

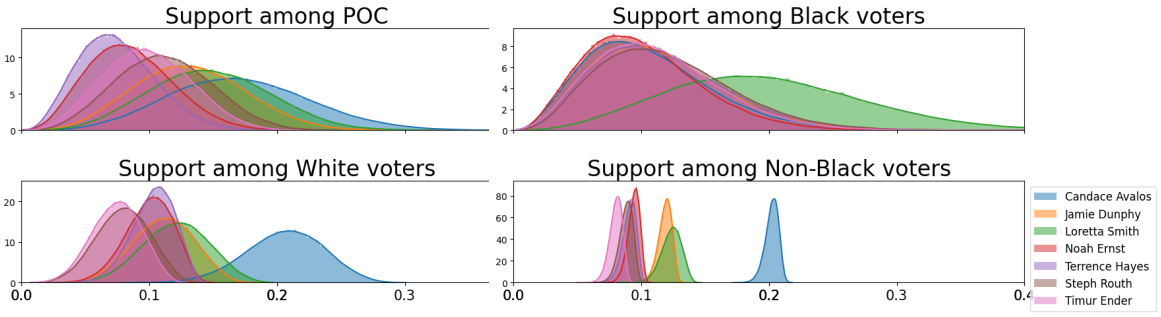


Figure 4. Another statistical view of voters' preferences by different racial and ethnic splits: EI estimates of first-place support by each group for each candidate. Avalos is strong with most groups, but Smith is preferred by Black voters.

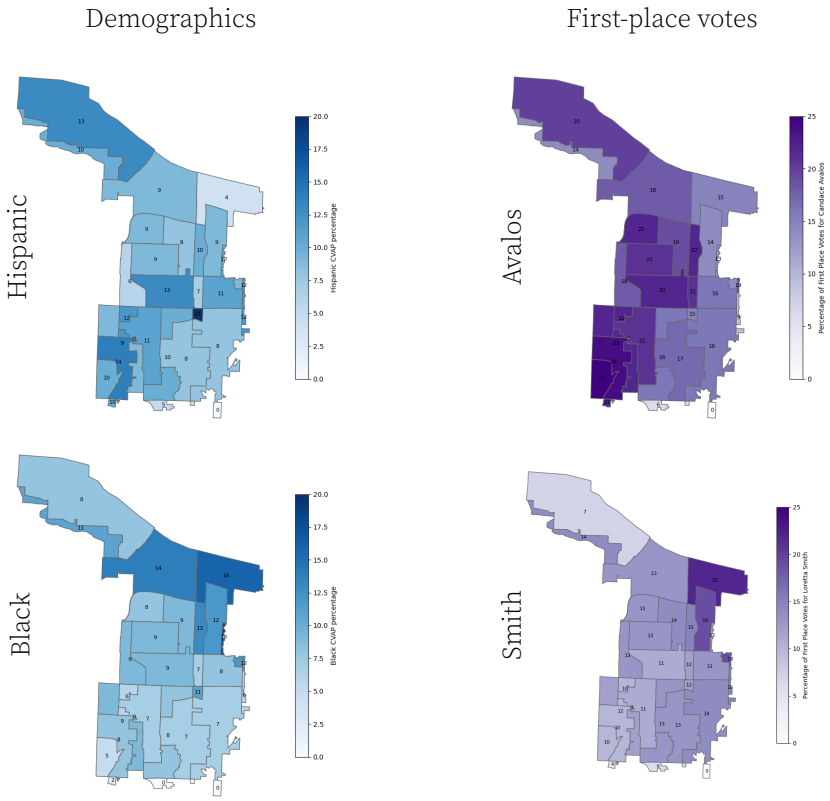


Figure 5. We compare the geographical distributions of Hispanic and Black CVAP (citizen voting age population) share to the geographic distributions of support for Avalos and Smith. Smith appears to be the candidate of choice for Black voters, while Avalos shows a pattern of neighborhood support (centered on Lents, in the southwest corner of the district) that is stronger than the demographic patterns.

4.2.2 District 2

District 2 is 27% POC by CVAP. Ryan and Pirtle-Guiney had significantly more support than any of the other candidates by the usual measures of first-place votes and overall Borda support. They also had similar profiles regarding the racial demographics of their support, with approximately 20% of first-place votes from White voters and very little support from POC voters. Kanal's support appears to be quite strong across all non-White racial groups, with especially strong support from Asian voters, but he is also in the top three for White voters. Figure 6 lets us visualize these findings.

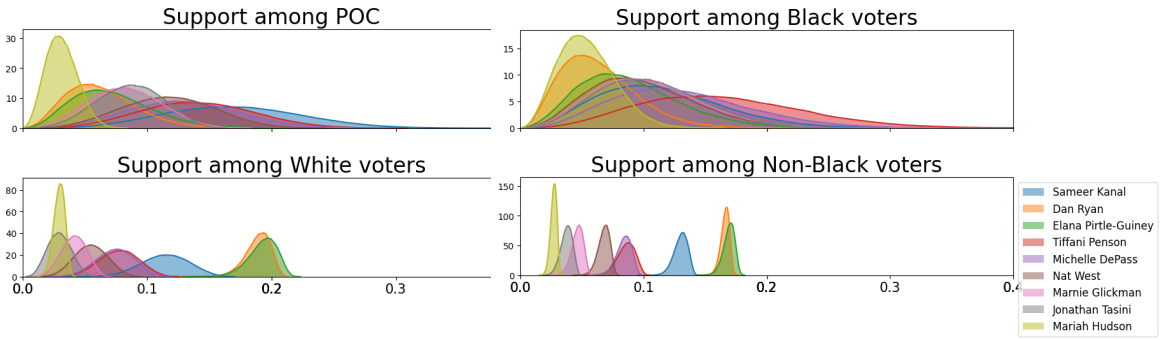


Figure 6. EI plots of first-place support show that Ryan and Pirtle-Guiney are well ahead with White voters in first-place support. Kanal shows strength with White voters and is also strong with POC.

4.2.3 District 3

District 3 is 21% POC and 79% White by CVAP. Novick had the most support of any candidate; ER analysis (Figure 7) estimates that he received approximately 30% of first-place votes from White voters and very little support from POC voters.

Morillo and Koyama Lane, on the other hand, both had very strong POC support; the methods agree that these two are the top candidates for people of color, though the confidence intervals are wide.

Collectively, these RPV estimates suggest a significant advantage for this trio of candidates over the field in terms of first-place support—and a look back at Figure 2 corroborates this. These three are so far ahead that the round-by-round process leaves essentially no chance for any fourth candidate to catch up.

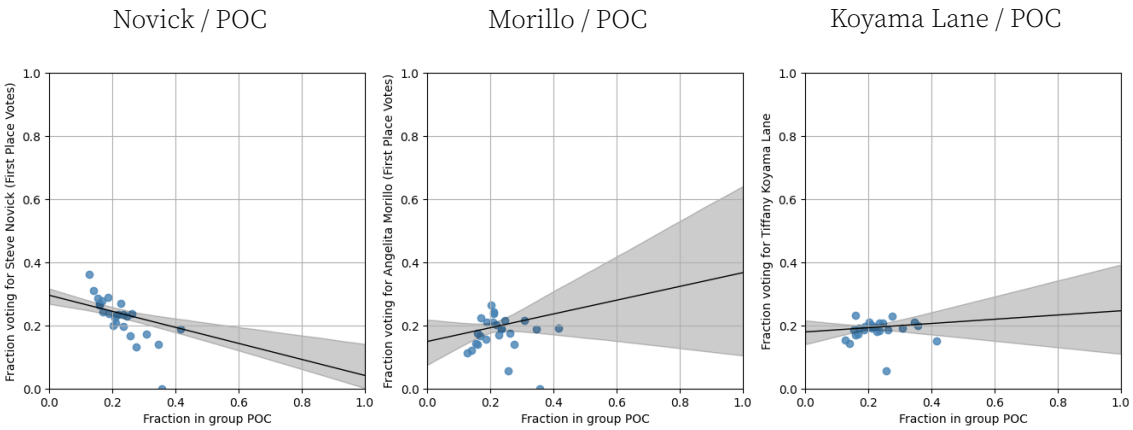


Figure 7. Novick is White-preferred, while Morillo shows signs of strength with overall POC voters. Koyama Lane is estimated to have similar support from White and non-White voters, as seen from the flat slope of the fit line.

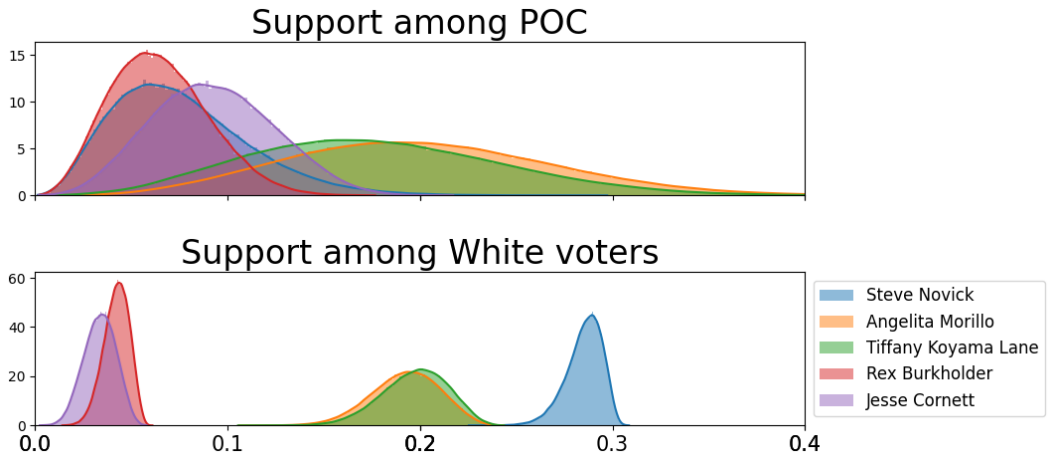


Figure 8. EI plots for District 3. Though somewhat different, this gives a broadly consistent story that Novick is popular with White voters but not POC, while Morillo and Koyama Lane are estimated to have over 15% of the first-place votes from both White and POC voters (with more uncertainty in the POC estimates). EI also finds that Koyama Lane's support is likely roughly equal from White and POC voters, as seen from the similarly centered curves here.

4.2.4 District 4

District 4 is the Whitest of the four, at 20% POC CVAP. Olivia Clark starts out far ahead; in fact, she was less than 50 votes shy of threshold at the outset, before any rounds of elimination. Figures 9-10 show that this was achieved with little support from voters of color; by contrast, Mitch Green performs strongly with POC voters, and Zimmerman's support is fairly flat across groups. Though it is not shown in the plots, we can confirm that Zimmerman has stronger positional support (Borda points) than either Green or Arnold, indicating that he was the second or third choice of many voters. This helps explain his victory over Arnold, despite starting with fewer first-place votes.

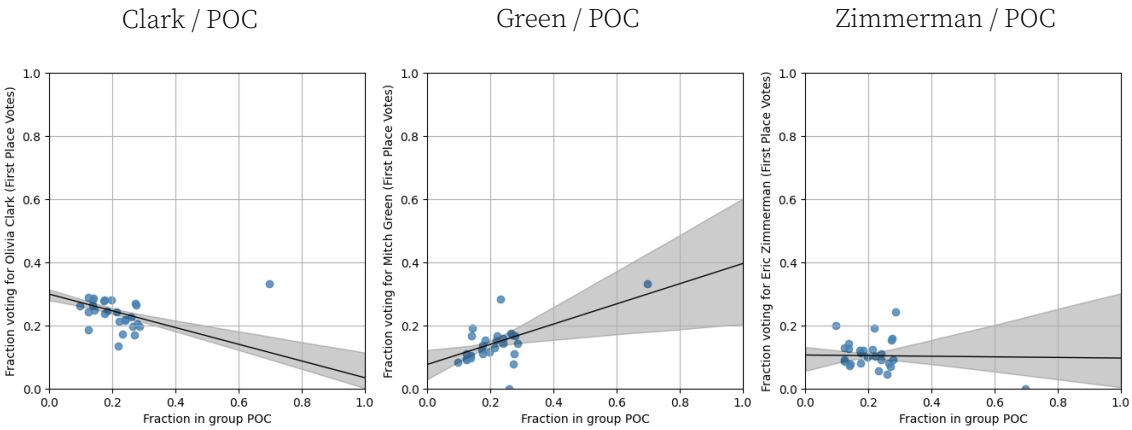


Figure 9. Clark is White-preferred while Green looks to be the choice of voters of color.

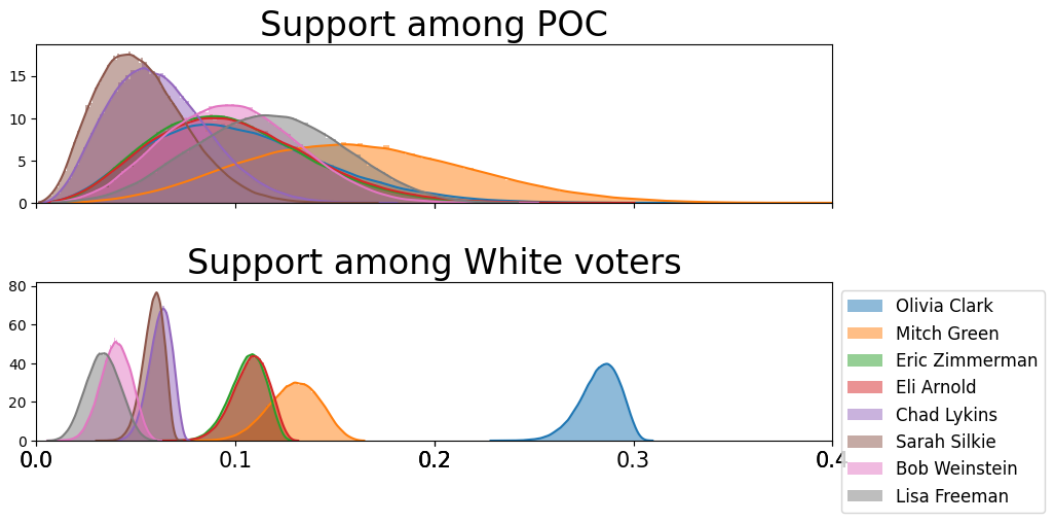


Figure 10. EI plots for first-place support in District 4.

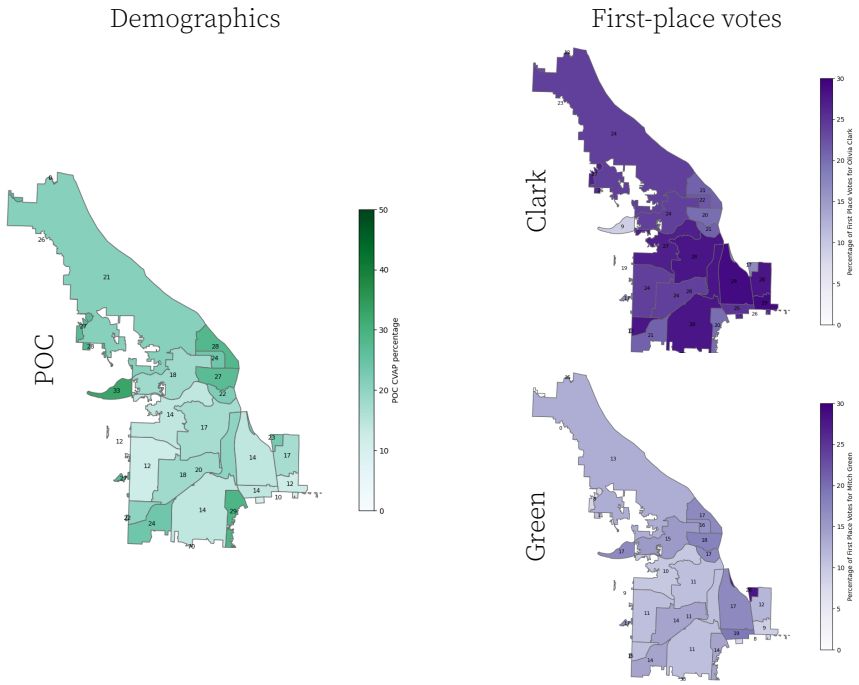


Figure 11. We compare the geographical distribution of POC CVAP share to the geographic distributions of support for Clark and Green. In first-place votes, Green has a visual correspondence with the residential patterns of POC voters, while Clark's votes follow nearly a reversed pattern.

4.3 Candidate similarity

The following heatmaps show us patterns of shared support among candidates. Darker green cells show that some candidates "boost" others: for instance, if a District 1 voter ranked Steph Routh, they were more than 18 percentage points more likely to rank Candace Avalos than a typical District 1 voter overall. On the other hand, purple shades show a negative effect: District 1 voters that ranked Doug Clove were nearly 27 percentage points less likely to rank Avalos.

This visualization can help reveal when there are groups of candidates whose supporters all show mutual support. In District 1, there is an unmistakable affinity for Avalos, Routh, Dunphy, and Ender—and to a lesser extent, Linn and Tern. The fact that Loretta Smith's column appears very pale means that a mention of Smith was not predictive of any other voter behavior—except that it substantially boosts the likelihood of ranking Hayes.

District 2 shows the least strong patterning of the four, but a few points are notable. One is that lower-performing candidates Hudson, Marshall, and Armstrong all share support, mutually boosting one another—and also boosting front-runners Pirtle-Guiney and Ryan. And we see that the two Black women who were viable candidates, Tiffani Penson and Michelle DePass, do not share support—ranking one of them makes you slightly *less* likely to mention the other.

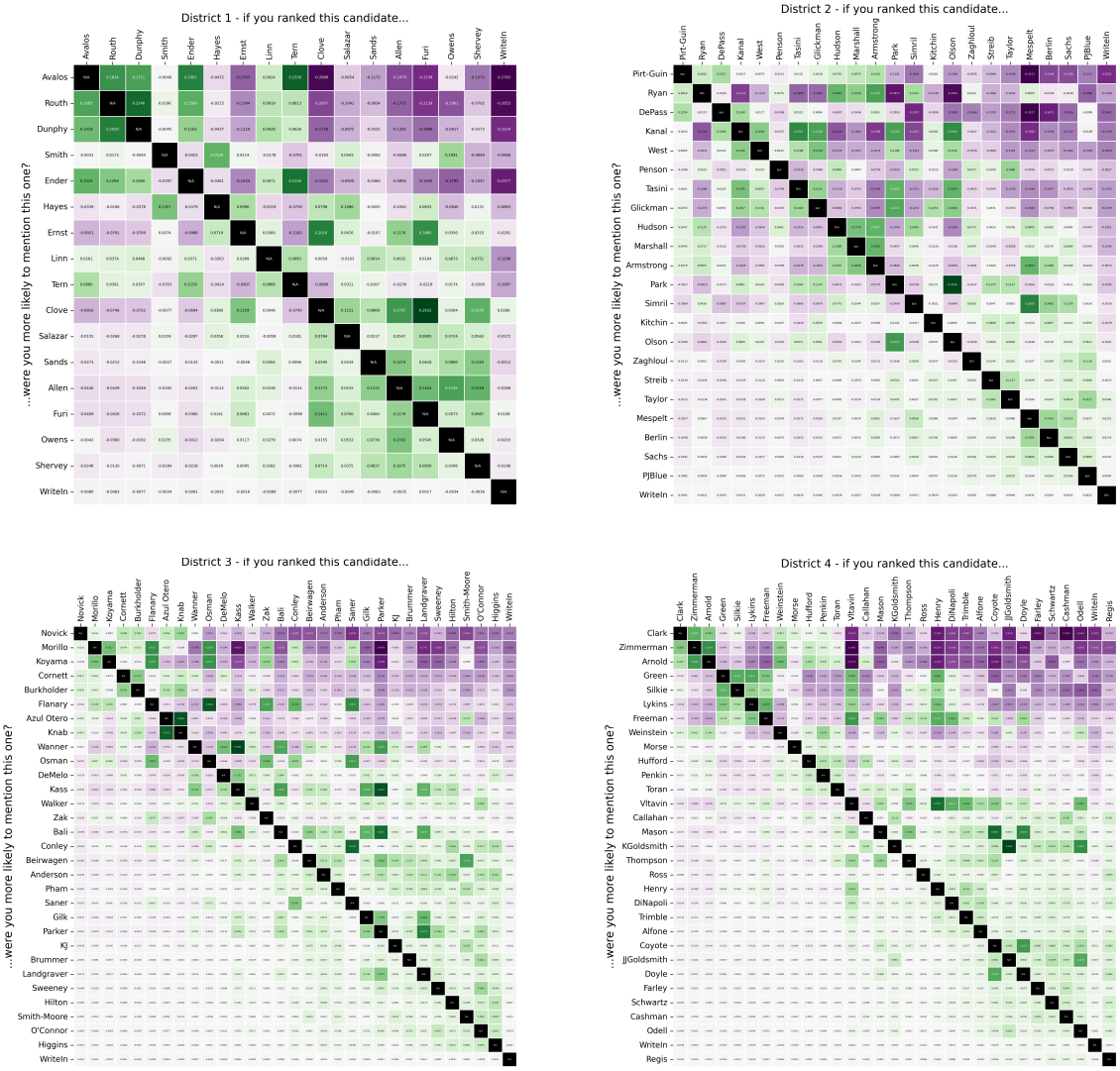


Figure 12. Patterns of shared support. A positive "boost" effect appears in **green**, while a negative effect appears in **purple**. Full-size plots are available in the Appendix.

In District 3, sweeping an eye across the rows of Morillo and Koyama Lane shows strong parallels all the way through; their support is boosted and weakened by other votes in extremely similar ways. For all of the negative correlations—notably, Wanner, Kass, and Parker—the drag on Morillo's popularity is stronger than on Koyama Lane's. Certain other candidate pairs like Azul Otero and Knab are tightly coupled. Finally, District 4 shows a very interesting pattern: the eight viable candidates break very clearly into two groups with shared support. Clark, Zimmerman, Arnold and Weinstein all boost one another, as do Green, Silkie, Lykins, and Freeman – and without exception, those who mention a candidate from one of those groups are likely to avoid the other group. Vitavin and Henry, though they have far less support, clearly have an affinity with the Green group.

5 Voter behavior

5.1 Roll-off

In some of the press (and social media) coverage that came out just after the STV election, there was concern that voter confusion had caused a marked pattern of "roll-off"—that is, that many Portlanders who showed up to cast a ballot in the presidential contest simply never made it down-ballot to vote for their city councillors. However, a comparison with historical patterns from the previous two presidential years shows that the roll-off rate in 2024 was intermediate between the level in 2016 and the level in 2020, though both of those years had conventional plurality at-large elections. The number of cast votes for President was intermediate between the previous contests as well, suggesting that it was the ambient electoral dynamics, not the system of city council election, that created a stronger impact on voter participation.[6]

November 2016	Total Cast Votes	Share of Pres.
President	333,533	1.000
Attorney General	303,751	.911
Secretary of State	308,492	.925
State Treasurer	301,246	.903
City Commissioner Position 4	260,448	.781
November 2020	Total Cast Votes	Share of Pres.
President	385,308	1.000
Attorney General	366,319	.951
Secretary of State	368,960	.958
State Treasurer	365,213	.948
City Commissioner Position 4	335,861	.872
November 2024	Total Cast Votes	Share of Pres.
President	344,147	1.000
Attorney General	326,829	.950
Secretary of State	328,750	.955
State Treasurer	326,643	.949
City Council STV	280,322	.815

Table 1. Vote counts from 2016, 2020, and 2024, showing "roll-off" from the presidential race to the down-ballot city council.

5.2 Voter ranking behavior: Error rates

Because most ranked-choice elections require voters to bubble in their choices on a Scantron-style paper sheet, there are different opportunities for voters to deviate from the jurisdiction's intended voting behavior than there are on typical choose-one ballots. Both single-vote and ranked ballots allow for so-called *overvotes*, where a voter makes too many choices. In the setting of rankings, this might mean ranking two different candidates as the second-place choice, for instance. On ranked

[6]The overall population of Portland, using ACS 1-year estimates from the year before each of these elections, was 630,395 in 2023, 653,467 in 2019, and 632,187 in 2015). So the highest overall turnout in 2020 also corresponds to a higher overall city population.

ballots, voters can also skip a position or can rank a candidate with duplication, putting them in more than one rank—skips and duplicates do not spoil the ballot, but may indicate confusion with the format. It is important to remember that while these are errors from a technical perspective, they are frequently easy to interpret in terms of voter preference. For example, if I mark both candidates A and B as my first-choice vote, then skip a position and put C in third place, this is very likely to communicate that I mean to rank them with a tie, or equal preference. Similarly, if I vote candidate A in every position, this is likely to be meant as an expression of enthusiasm.

In Portland, pre-processing used by the city had several effects: eliminating certain write-in candidates;[7] treating overvotes as skipped rankings; deduplicating ballots with repeats; and finally condensing the ballot so that the valid votes are listed in order.[8] Only after ballots were cleaned and condensed in this way was the official preference profile created. For instance, District 1 had 43,669 ballots in its raw data, and the cleaning process left 42,871 ballots at the start of official tabulation.[9] 712 (about 1.6% of cast ballots) were eliminated because every position was either skipped or overvoted: these can be considered "spoiled ballots" in the sense that they were discarded due to overvote error. An additional 77 were eliminated because the only ranked candidates were numbered write-ins; this should not be considered voter error.

Table 2 shows spoilage by district, then the rate at which voters cast a ballot with an overvote as first choice or an overvote anywhere on the ballot, and finally the rate of ballots that had to be adjusted in the cleaning process under Portland's rules before tabulation could begin. The adjusted ballots do not include ballots which were spoiled.

District	Spoiled	Overvote in first place	Overvote in any rank	Adjusted and tabulated
1	1.6%	2.1%	3.4%	4.2%
2	0.6%	0.8%	1.3%	2.0%
3	0.6%	0.8%	1.1%	1.6%
4	0.7%	0.9%	1.3%	1.6%
overall	0.8%	1.0%	1.6%	2.1%

Table 2. Spoilage, overvote, and adjustment rates in Portland by district.

As a point of comparison, we can calculate the corresponding overvote and confusion rates for the 2021 ranked-choice primary elections in New York City, which marked the first time city voters cast ranked ballots.[10] Since the Portland district elections have many candidates, we consider only elections from NYC with a large number of official candidates (see Table 4 in the supplementary materials).[11] Across the comparable NYC contests, the median ballot "spoilage" rate was 0.5%, with

[7] Technically, the Portland rules distinguished between certain write-ins treated as certified, with identifiers such as "Write-in-120," from others classified as "Uncertified Write In." The UWI type was allowed to be recorded in the official voting profile, where UWI was treated as a single candidate in the elimination rounds, while the numbered write-ins were eliminated in the cleaning process.

[8] For instance, if a voter ranked A and B in first place, followed by C in second place, nobody in third place, and D in fourth, this would be simplified first to (overvote,C,skipped,D) and then to (C,D).

[9] The threshold of election in this district—the 10,718 votes required to be elected—was calculated by applying the threshold formula $\lceil (N+1)/(m+1) \rceil$ to the number of *cleaned* ballots N and the number of seats to be filled m.

[10] For NYC data, see vote.nyc/page/election-results-summary-2021.

[11] We are comparing to individual districts instead of comparing citywide rates because we have chosen to break out only those NYC contests that had nine or more named candidates, in order to create a stronger comparison. 11 such contests appear in Table 4.

a maximum of 0.7%; the median rate at which voters cast an overvote for their first choice was 0.5%, with a maximum of 0.7%; the median rate at which voters cast an overvote somewhere on their ballot was 0.9%, with a maximum of 1.3%; and the median rate at which ballots would need adjustment was 3.8%, with a maximum of 4.6%. These numbers are largely in line with what we see in Portland (though Portland's District 1 is consistently the highest).

For another point of comparison, we can consider Glasgow, Scotland, a city of similar size to Portland that first adopted STV for local elections in 2007.[12] The Glasgow City office of elections does not share data with the same granularity, but they do report the number of ballots with an overvote in the first rank. In 2007, Glasgow City held 20 STV elections across the city's 20 districts. The median overvote rate in rank one was 1.2% across the districts, with a maximum rate of 2.6%—a higher incidence of that behavior than even Portland's District 1. Furthermore, there is a clear trend in Scotland toward reductions in overvotes as further STV elections were conducted in 2012, 2017, and 2022. We expect the same trend to be observable in Portland as voters become more familiar with ranked-choice voting.

5.3 Voter ranking behavior: Ballot length

Continuing the comparison with Scottish STV, we can look at the patterns of ballot length, or the number of candidates ranked. When Scottish voters are ranking candidates to fill m seats, the most common ballot length is m, and typically the next most common behavior is to rank all available candidates. It is natural to interpret a ballot ranking exactly m candidates with an expression of the voter's preferred winner set.

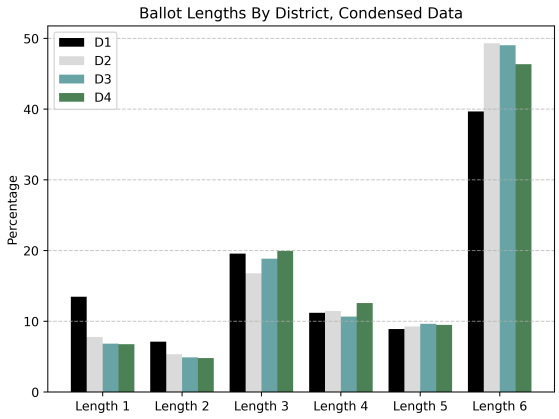


Figure 13. The length of a ballot by district. Though District 1 had the highest rate of bullet votes and the lowest rate of complete ballots, the differences are relatively minor and the strong trend in favor of complete ballots is visible across Portland.

Portland voters received voter education material from grassroots groups urging them to rank all candidates, and they listened—in all four districts, a complete ballot was the most common length by a large margin, cast by nearly 40% of voters in District 1 and over 45% in the other three districts (see Figure 13). By contrast, "bullet votes," which list only one choice and leave the other

[12] For Glasgow data, see onlineservices.glasgow.gov.uk/forms/election/ResultsForLocal.aspx.

positions blank, are under 15% of cast votes in District 1 and under 10% in the other districts, even after ballots have been condensed in the pre-processing described above.

Some observers worried that minority communities might be more likely to vote short ballots. One way to get a vantage point on that is to consider whether ballots with a first-choice vote for a candidate of color look different in terms of their overall length. However, the identity of the top choice seems to make no meaningful difference in the ballot length patterns (Figure 14). However, we do note that voters who rank a White candidate first are more likely to bullet vote in each case, leaving the rest of their ballot blank.

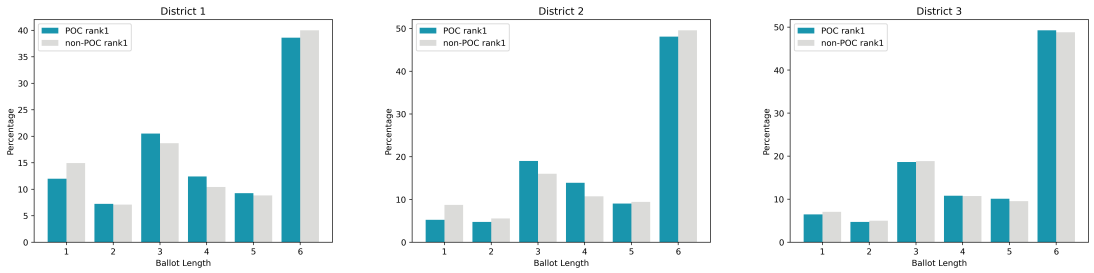


Figure 14. The distribution of ballot lengths in Districts 1, 2, and 3, split out by whether voters ranked a POC candidate first. District 4 had no candidates of color close to viability, and so is excluded. None of these districts shows a significant difference in the number of names ranked.

5.4 Ballot exhaustion

In a ranked-choice election which unfolds round by round, a ballot is often called *exhausted* if the ballot is not used in the final round of meaningful tabulation. For example, in District 1, Candace Avalos crosses threshold in Round 13, and those ranking Avalos first have some surplus weight transferred to their next choice. Round 15 is the last round of tabulation before the winners are confirmed, when Dunphy, Hayes, and Smith are still in contention for the two remaining seats. Thus, in District 1, for a ballot to not be considered exhausted, it must include at least one of these three candidates. In single-winner ranked-choice elections, exhausted ballots are often viewed as problematic because they do not contribute to the determination of the winner. In the multi-winner (STV) context, this makes less sense. For example, consider a District 1 voter who bullet-votes for Avalos versus a voter who bullet-votes for Smith. The former ballot is considered exhausted (because Avalos is elected early) while the latter is not. But the Avalos bullet voter may be completely satisfied with the outcome. For this reason, we find it useful to nuance the idea of ballot exhaustion by offering other, more interpretable measures.

Active rate: How many ballots were still active when the last decision was made?

D1: 77.0%, D2: 77.9%, D3: 81.7%, D4: 60.0%

STV exhaustion rate: How many ballots ranked fewer than six candidates, and did not include any winner or the last candidate eliminated?

D1: 12.6%, D2: 8.3%, D3: 5.9%, D4: 7.9%

Futility rate: How many ballots ranked six candidates, but did not include any winner or the

last candidate eliminated?

D1: 1.4%, D2: 1.6%, D3: 1.8%, D4: 2.1%

The active rate is far higher than the rates of exhaustion and futility in each district—and this does not even include voters who may be satisfied because they supported the first candidate to cross threshold. Even the glut of long-shot candidates did not lead to high rates of futility. Thus, while future voter education can potentially influence voters to rank more names to avoid "exhaustion," this first run of STV already saw quite effective voter expression. This will be discussed further below, where we report other measures of voter satisfaction; for instance, the share of voters who ranked some winner on their ballot was between (roughly) 80 and 87 percent in each district.

6 STV compared to other systems

6.1 Other voting rules

Which candidates could have won if a different voting rule had been used instead of STV? This can be difficult to answer authoritatively because candidates and voters may have behaved differently under a different system. However, we can still gain insight about how other voting rules would have performed if we hold constant the voter preferences reported in Portland.

For each district, we calculated winner sets using alternative voting rules. We first use two alternative rules that are based on rankings:

- **Head-to-head** (Condorcet): The winners are the three candidates who beat all other candidates in a head-to-head matchup. It is not always guaranteed that some three candidates beat all others head-to-head, but this occurred in every district in Portland.
- **Positional** (Borda count): A candidate receives 6 points for each ballot on which they are ranked first, 5 points for each ballot on which they are ranked second, and so on. A candidate receives no points from a ballot on which they are not ranked. The three candidates with the most total points are the winners.

These are popular with theorists, but are only extremely rarely found in real-world political elections. We also consider two frequently used systems of election.

- **Plurality** (Single Non-transferable Vote, or SNTV): Each voter chooses one favorite candidate. We assume that a voter would choose the candidate they ranked first.
- **Block** (Plurality block voting): To fill three seats, voters choose three candidates, unranked. We assume that a voter would select the three candidates they ranked highest.

Table 3 shows the winners under the various voting methods in each district. The table also considers how much "proportional" support each set of winners receives. For example, in District 1 44.2% of the voters ranked one of Avalos, Smith, and Dunphy (the STV winners) as their first choice, 70.9% of voters ranked one of the three candidates in their top three, and 79.6% of voters ranked one of the three candidates anywhere on the ballot.

Voting Method	District 1 Winners	First-place support	Top-three support	Mentions
STV	**Avalos**, **Smith**, Dunphy	44.2%	70.9%	79.6%
Head-to-head (Condorcet)	**Avalos**, Routh, Dunphy	40.2%	63.6%	72.9%
Positional (Borda)	**Avalos**, Routh, **Smith**	41.5%	71.0%	79.5%
Plurality (Vote for 1)	**Avalos**, **Smith**, Dunphy	44.2%	70.9%	79.6%
Block (Vote for 3)	**Avalos**, Routh, **Smith**	41.5%	71.0%	79.5%
Best top-three coverage	**Avalos**, **Smith**, Ernst	41.8%	74.8%	82.8%
Best mentions coverage	**Avalos**, **Smith**, Ernst	41.8%	74.8%	82.8%
Voting Method	**District 2 Winners**	First-place support	Top-three support	Mentions
STV	**Kanal**, Pirtle-Guiney, Ryan	44.6%	74.6%	84.0%
Head-to-head (Condorcet)	Pirtle-Guiney, Ryan, **Kanal**	44.6%	74.6%	84.0%
Positional (Borda)	Ryan, Pirtle-Guiney, **Kanal**	44.6%	74.6%	84.0%
Plurality (Vote for 1)	Pirtle-Guiney, Ryan, **Kanal**	44.6%	74.6%	84.0%
Block (Vote for 3)	Ryan, Pirtle-Guiney, **DePass**	40.6%	67.3%	79.6%
Best top-three coverage	**Kanal**, Ryan, **Penson**	37.8%	75.9%	85.9%
Best mentions coverage	**Kanal**, Ryan, **Penson**	37.8%	75.9%	85.9%
Voting Method	**District 3 Winners**	First-place support	Top-three support	Mentions
STV	Novick, **Morillo**, **Koyama Lane**	62.9%	81.8%	87.3%
Head-to-head (Condorcet)	Novick, **Morillo**, **Koyama Lane**	62.9%	81.8%	87.3%
Positional (Borda)	Novick, **Koyama Lane**, **Morillo**	62.9%	81.8%	87.3%
Plurality (Vote for 1)	Novick, **Morillo**, **Koyama Lane**	62.9%	81.8%	87.3%
Block (Vote for 3)	Novick, **Koyama Lane**, **Morillo**	62.9%	81.8%	87.3%
Best top-three coverage	Novick, **Morillo**, **Koyama Lane**	62.9%	81.8%	87.3%
Best mentions coverage	**Koyama Lane**, Novick, Wanner	49.8%	81.8%	88.3%
Voting Method	**District 4 Winners**	First-place support	Top-three support	Mentions
STV	Clark, **Green**, Zimmerman	48.9%	77.4%	85.7%
Head-to-head (Condorcet)	Clark, Zimmerman, Arnold	46.0%	65.9%	74.5%
Positional (Borda)	Clark, Zimmerman, Arnold	46.0%	65.9%	74.5%
Plurality (Vote for 1)	Clark, **Green**, Arnold	49.1%	80.0%	87.0%
Block (Vote for 3)	Clark, Zimmerman, Arnold	46.0%	65.9%	74.5%
Best top-three coverage	Clark, **Green**, Arnold	49.1%	80.0%	87.0%
Best mentions coverage	Clark, **Green**, Arnold	49.1%	80.0%	87.0%

Table 3. This table shows the three winners under different voting rules in each district. The winners are presented in order, as ranked by the voting rule, with Hispanic-identified, Black-identified, and Asian-identified candidates highlighted in **green**, **amber**, and **red**, respectively. Avalos identifies as **Black and Latina**. In addition, Mitch Green is a **White** candidate who was preferred by POC voters. The last three columns show the breadth of representation for each winner set. For instance, 44.2% of District 1 voters supported one of the STV winners as their first choice; 70.9% put one of those winners in their top three; and 79.6% mentioned one of the winners among their six rankings. The bottom two rows for each district show the optimal set of three winners for coverage by top-three or mentions support. (First-place support for winners is maximized by the Plurality voting rule.)

One reason to build a table like Table 3 is that we can see how the STV mechanism works to realize the promise of proportional representation. In District 1, Loretta Smith is the candidate of choice of Black voters (see Section 4.2) and because her bloc of support is large enough, STV awards her a seat. A head-to-head method would not give Smith a seat, instead seating Routh. But this outcome is not consonant with proportional representation because Routh is highly similar to Dunphy (Section 4.3), creating redundancy among the winners at the expense of a candidate of choice for Black voters.

In District 4 STV allows for Green, the candidate of choice for POC (Section 4.2), to win a seat instead of Arnold. As shown in Section 4.3 Arnold and Zimmerman are very similar candidates; from a PR perspective there is no value in electing both of them while excluding the POC-preferred candidate Green. This district also demonstrates how STV can protect against outcomes of "vote-splitting": the most similar candidates to Green are Silkie and Lykins, neither of whom win seats. Under a positional method Green doesn't win a seat because he splits the vote with Silkie and Lykins, but under STV the Green-Lykins-Silkie bloc receives enough support for one of them to win a seat, and voters who support one of these three candidates are not punished for vote-splitting.

Table 3 also raises questions about why some candidates who do well under a proportionality measure like top-three support fail to win seats under STV. In District 1, for example, even though Ernst does well when we maximize coverage across ballots, he is not one of the three winners. The reason is that Ernst supporters tend to bullet vote more than supporters of other candidates, which means that only slates containing Ernst register as satisfying those voters in the proportionality measures. (If Ernst supporters were to rank one or two more candidates on their ballots, he would be less likely to show up when we maximize these coverage measures.) In District 2, the table suggests that either DePass or Penson could earn a seat instead of Dan Ryan or Pirtle-Guiney. Such an outcome would be preferable if we want to maximize POC representation on the Portland city council, so why would STV fail to elect DePass or Penson? We explore this further in Section 7; the short answer is that Penson and DePass do not have a large enough base of shared support for one of them to win a seat. If Penson supporters were to overwhelmingly rank DePass second and vice versa, STV would likely give one of them a seat. Furthermore, STV places a lot of weight on first-place support, and neither Penson nor DePass secure enough first-place support to win a seat, despite securing enough support down the ballots to win a seat under block voting (DePass) or under a method which maximizes mentions coverage (Penson).

7 Narratives and discussion

We close with some brisk questions and answers with an eye to electoral narratives.

Question: In District 1, Steph Routh seems like a strong candidate because she is mentioned on many ballots and she would be a winner under several alternative systems of election. Why does she lose under STV rules?

Answer: She shares common supporters with Dunphy, but he has significantly more first-place votes.

Since each voter's ballot stays with their first-choice candidate until that candidate is elected or eliminated, first-place votes have more impact in STV than in some of the other voting systems considered in Section 6. In particular, since Routh was eliminated before Dunphy was elected, any voter who ranked Dunphy above Routh never had their vote for Routh impact the tabulation.

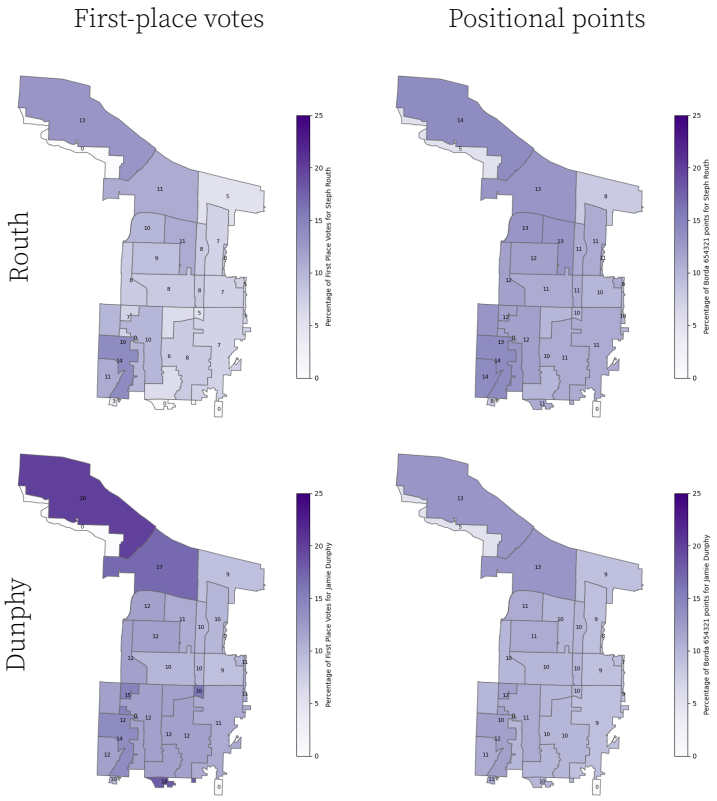


Figure 15. Jamie Dunphy has stronger first-place support than Routh. She makes up for that with strength in lower rankings, but the transfers often don't make it that far down the ballot.

Other systems like Block voting would let shared support count fully for both candidates. But STV favors proportionality by having shared support only count in tabulation for one candidate at a time.

Question: In District 2, Penson and DePass are Black women who were viable candidates and two of the last three to be eliminated. In the STV process, why did they both fall short?

Answer: Unlike with some POC candidate pairs in other districts, they did not share support. Neither elimination order would have helped the other, because votes would not transfer strongly between them in either direction.

Penson and DePass each received less support than the three winning candidates, but their combined support might have been enough to win a seat. It is natural to wonder if they had a common base of support, but suffered from vote splitting. However, the analysis here reveals that this is not the case. Intriguingly, Penson and DePass enjoy similar racial composition of their voters—both have strong Black support and moderate Hispanic support—but if either one were eliminated first, her support would not mainly transfer to the other.

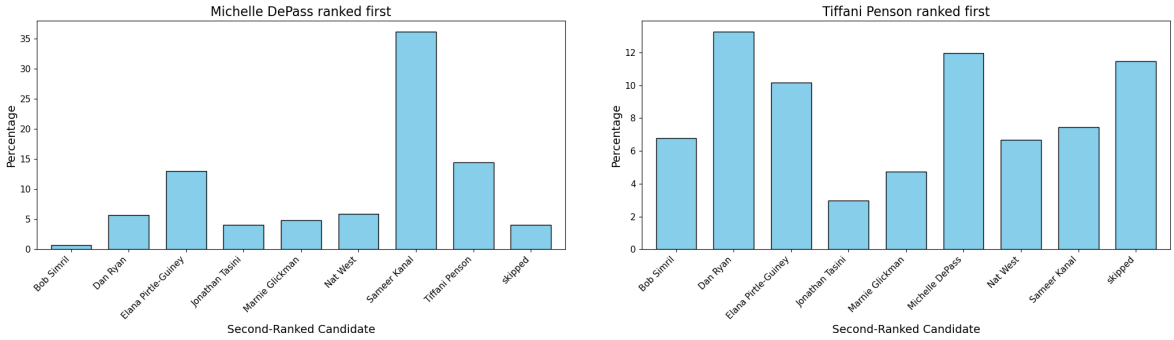


Figure 16. For voters who rank DePass or Penson in first, these histograms show the distribution of who is ranked second.

Figure 16 shows that a DePass elimination would send the strongest support to Kanal, while a Penson elimination would scatter support across eight candidates.[13] We also note that the figure shows that over 10% of voters ranking Penson first are bullet voters (with "skipped" in second place).

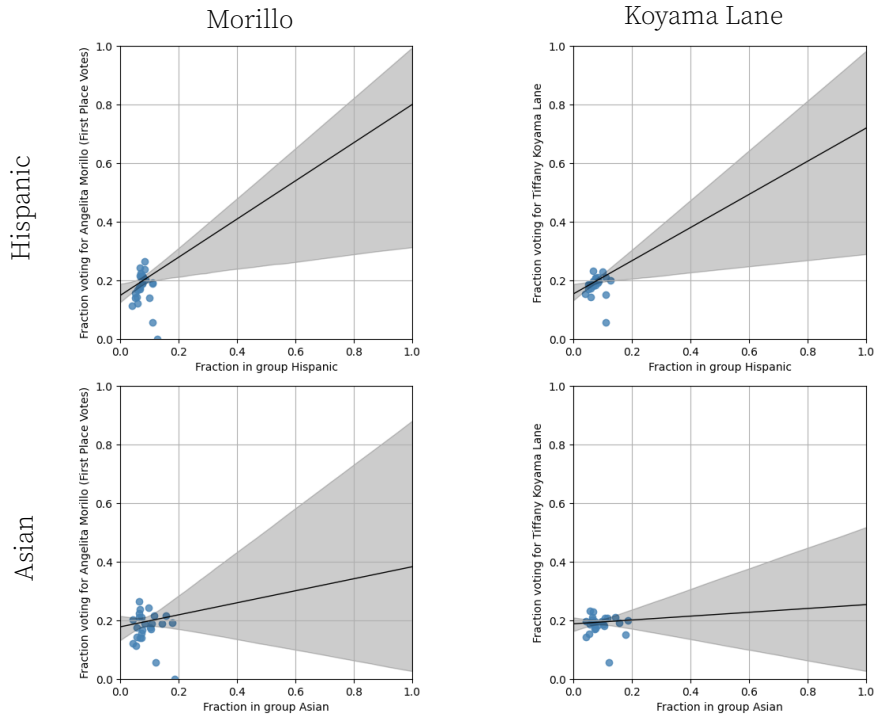


Figure 17. Both Morillo and Koyama Lane are notably strong with Hispanic voters.

[13] In the actual tabulation, DePass was first to be eliminated in Round 18, only 1,447 of her 8,293 votes were transferred to Penson, compared to 3280 that went to Kanal. If most of DePass's vote strength had transferred to Penson, she likely would have reached the threshold for election.

Question: In District 3, is there evidence of a split along racial lines within communities of color, where Hispanic voters prefer Morillo while Asian voters prefer Koyama Lane?

Answer: No. Both seem quite popular with Latino voters, for instance.

Perhaps surprisingly, Koyama Lane even seems to enjoy a higher level of support from Latino voters than from Asian voters. (See Figure 17.)

Question: In District 4, why was Green and not Arnold elected under STV, while most other voting rules would seat Arnold and not Green with the same voter preferences?

Answer: Broadly, there were two slates of candidates that received support from mostly distinct sets of voters. Green is favored in STV because he represents a different bloc of voters than Clark, Zimmerman, and Arnold.

The clearest view of this came in Section 4.3, Figure 12, where Clark, Zimmerman, and Arnold were part of a grouping of candidates who were all mutually "boosting"—voters who ranked any one of them were more likely to mention the others. Green–Silkie–Lykins–Freeman form the other grouping, and as Silkie, Lykins, and Freeman are successively eliminated, the lion's share of their support goes to Green, pushing him over threshold.

This is an excellent illustration of the proportionality tendencies of STV. In other systems, a significant voter bloc supporting the Clark–Zimmerman–Arnold triumvirate could easily get them all elected (see Table 3). But in STV, a voter bloc must have overwhelming size before it can sweep an election; otherwise, the complementary support will coalesce as the rounds go on, just as we see here—and the effect is a more broadly representative set of winners.

References

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[2] Data and Democracy Lab, *VoteKit Python Package*. https://github.com/mggg/VoteKit

[3] Thomas Weighill and Moon Duchin, Explainer: Ranked Choice Voting. In *Political Geometry*. M. Duchin and O. Walch (Eds.). Birkhaüser, 2021. https://mggg.org/publications/political-geometry/20-WeighillDuchin.pdf

A Supplementary table

NYC 2021	Spoiled	Overvote in first place	Overvote in any rank	Adjustment
DEM Comptroller	0.4%	0.3%	0.8%	3.8%
DEM Council D1	0.2%	0.2%	0.4%	1.5%
DEM Council D7	0.5%	0.5%	0.9%	3.0%
DEM Council D9	0.6%	0.5%	1.0%	3.6%
DEM Council D26	0.7%	0.7%	1.0%	2.9%
DEM Council D27	0.6%	0.6%	1.3%	4.6%
DEM Council D29	0.4%	0.3%	0.7%	2.3%
DEM Council D40	0.6%	0.5%	1.0%	3.9%
DEM Council D49	0.5%	0.4%	0.9%	4.3%
DEM Kings Pres	0.3%	0.3%	0.7%	3.3%
DEM Mayor	0.6%	0.6%	1.1%	3.9%

Table 4. Spoilage, overvote, and adjustment statistics for New York City IRV elections in 2021, restricted to contests with nine or more named candidates. Voters could rank up to five.

B Boost plots

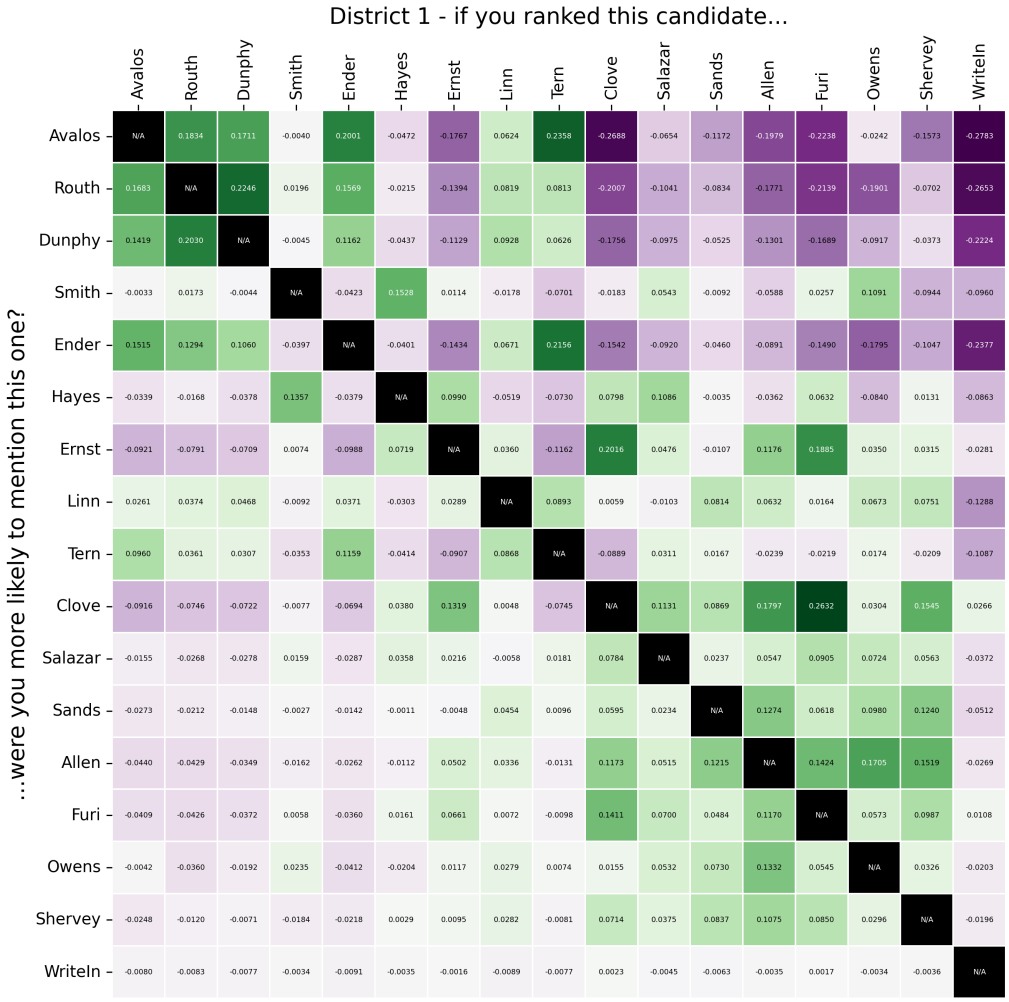

Figure 18. Boost matrix for District 1.

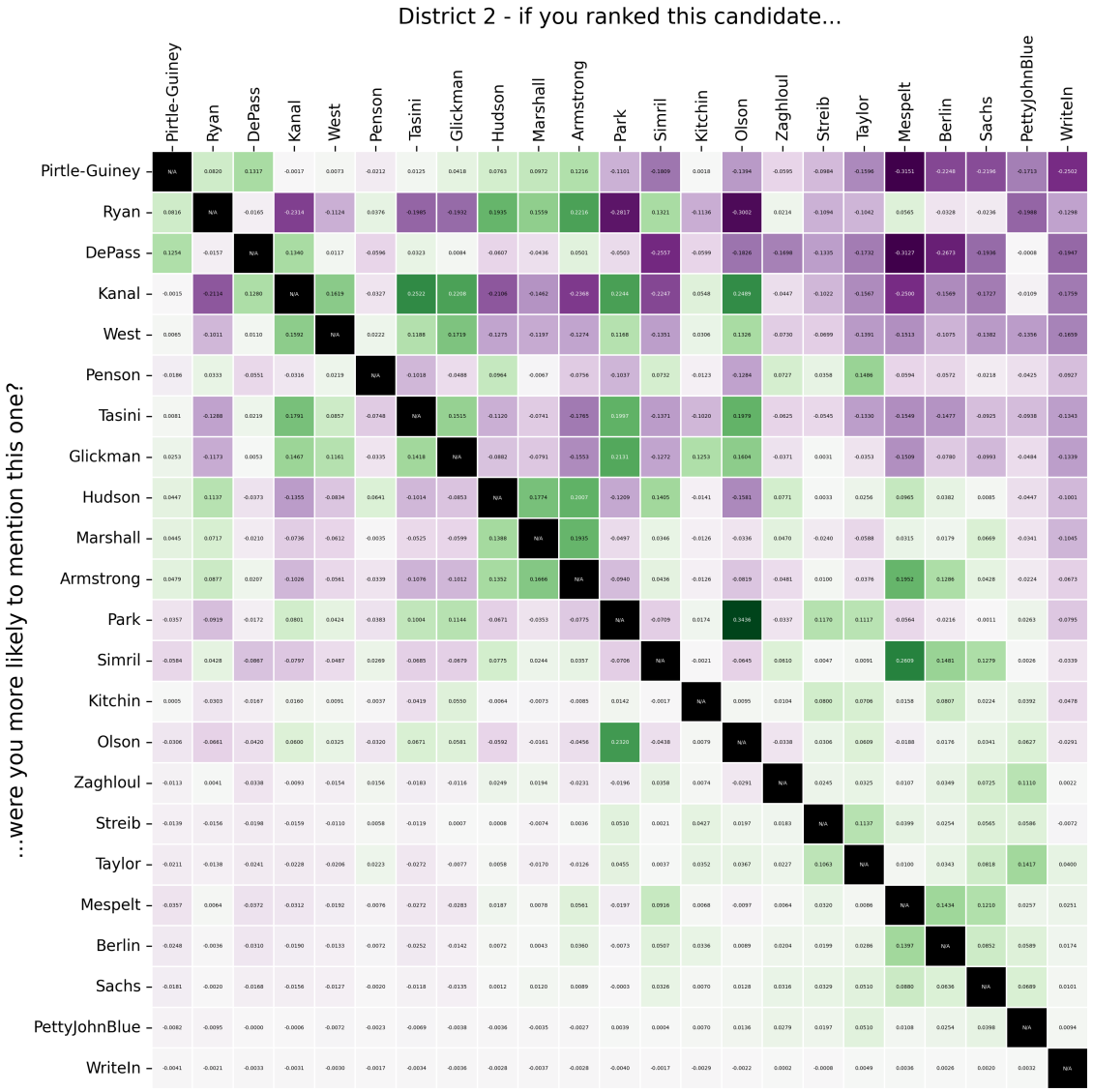

Figure 19. Boost matrix for District 2.

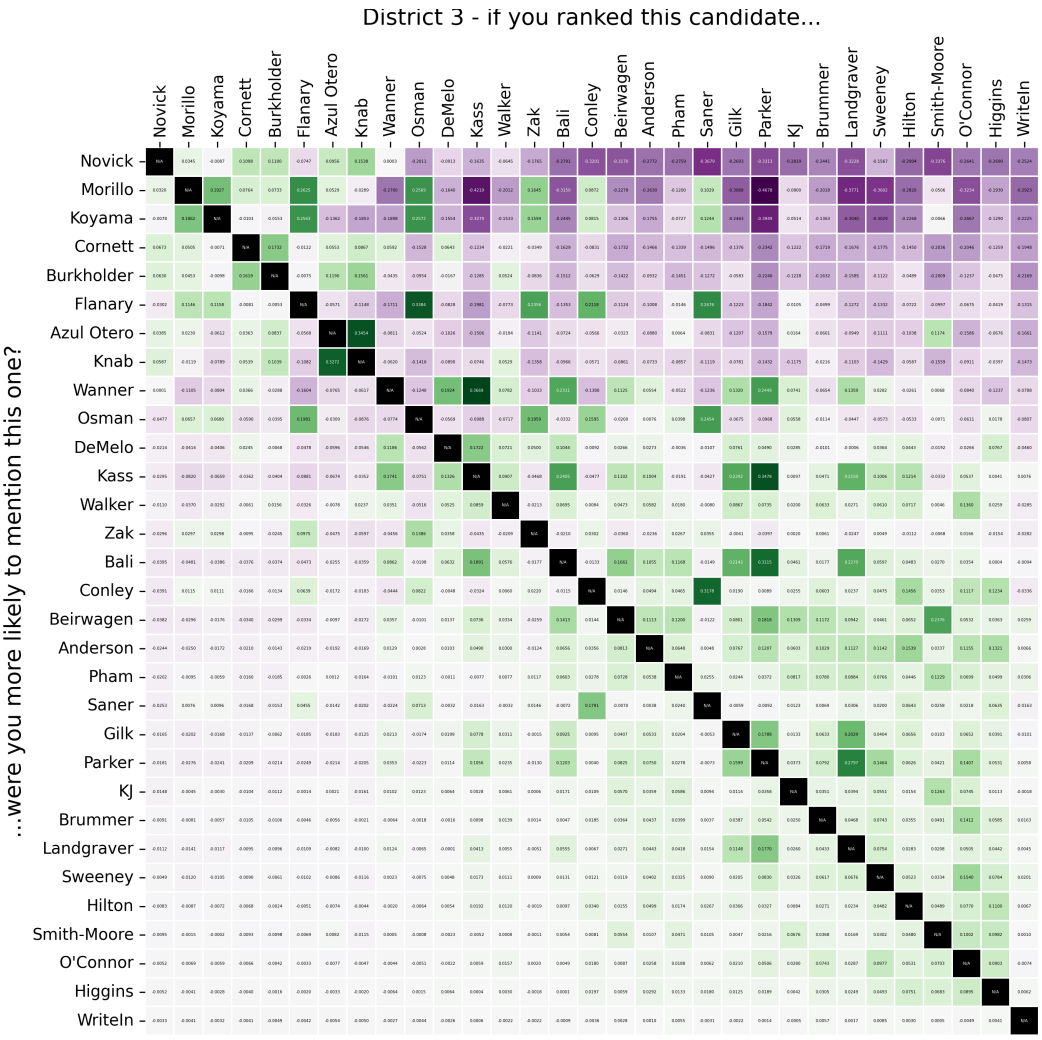

Figure 20. Boost matrix for District 3.

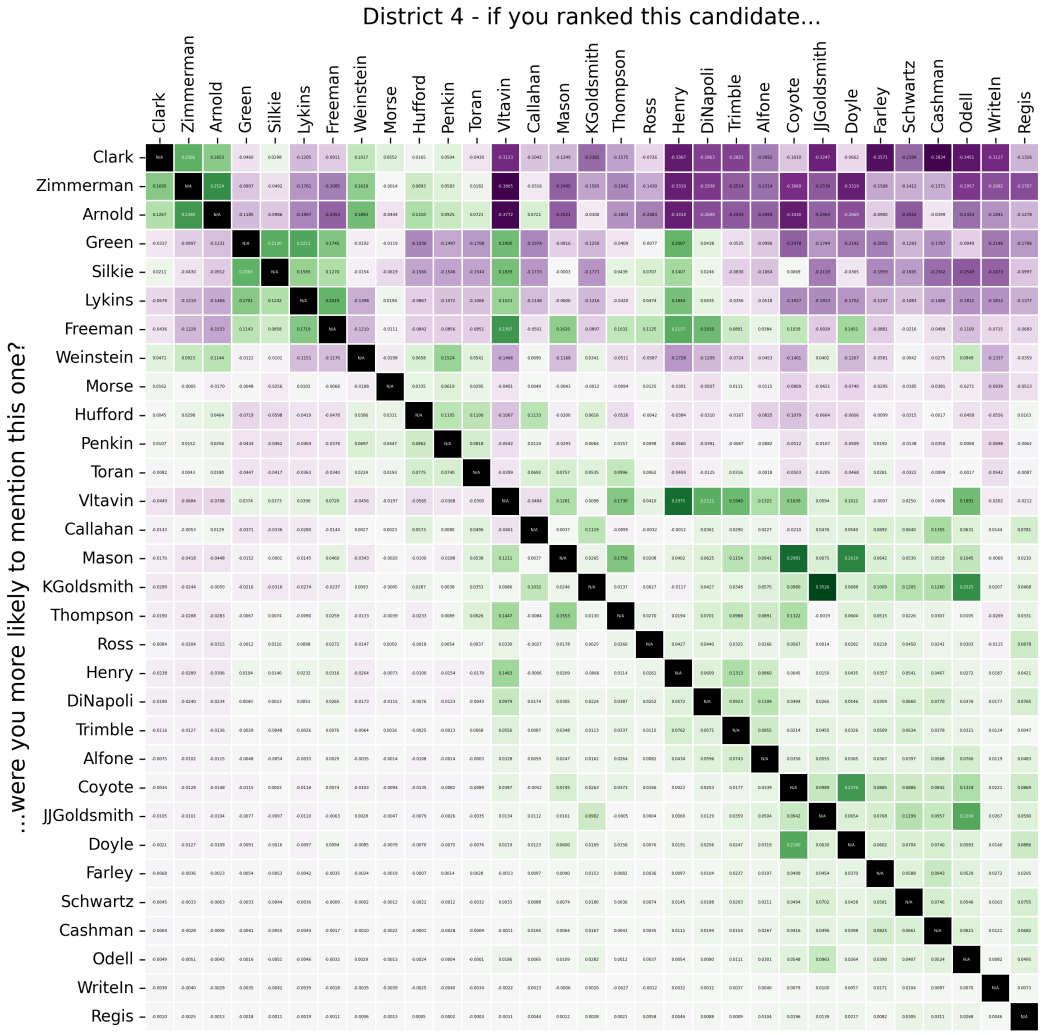

Figure 21. Boost matrix for District 4.