

1 Australian Senate voting strategies

Have you ever wondered:

- how the Australian Senate voting system works,
- what this reveals about voting strategies, or
- how to oppose undesirable candidates?

In the 2022 Australian federal election, I wanted to vote against several parties, especially one. So, in my vote, I ranked all 26 parties, with my disliked parties at the bottom. Subsequently, I investigated the Senate voting system to see whether this strategy was sensible, and this article describes my findings. The article does not advocate for any party or political policy. It suggests you consider using our voting system more fully by ranking the parties you like, and those you dislike.

2 Readers' comments

One reader said, "This is a noble and valuable document, and I admire you for tackling this important but tedious subject. We all have a civic duty to be across it."

A statistician said, "I salute anyone who can make important, complex things very clear".

3 What the essay covers

For half-senate elections, which pick six Senators for each Australian state, this essay presents:

- How the preferential voting system picks Senators, using an example from the Australian Electoral Commission website.
- An analysis of the 2022 Victorian Senate election, showing how the Senate voting system (the count) spread the support of a vote that followed the Coalition how-to-vote card.
- The same for the ALP, Greens, and United Australia Party (UAP).
- How the count spreads the support of each vote between (1) the six winning candidates, (2) the 7th-placed candidate, and (3) exhausted. For example, the count spread a vote following the Coalition card:
 - 44.6% to place 1: the Coalition's top candidate,
 - 44.7% to place 3: the Coalition's second candidate,
 - 10.7% to place 6: the UAP top candidate, and
 - 0% to other candidates and exhausted.
- How the count does not spread a vote beyond that vote's preference for a candidate or party that gains places 6 or 7.
- The role of the losing 7th-placed candidate: it's surprising as election commentary rarely mentions this candidate.
- Strategies to maximise the impact of your vote by:
 - using your vote entirely, i.e., not exhausting part of your vote,

- defensive voting: voting for candidates you like, and voting against candidates that you dislike, and
- ranking each party that's likely to win a senate seat, i.e., the Coalition, the ALP, the Greens, and other parties like the UAP.
- A brief examination of eight senate elections to test whether defensive voting is worth the effort. For supporters of large parties, the defensive part of their vote exerts a little pressure in the occasional election.

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5 Strategy: Defensive voting

One voting strategy is to rank only candidates that you like. A disadvantage of this strategy is that you can waste a part of your vote.

You can avoid this waste by voting against the worst candidates, "defensive voting" that ranks:

- the parties or candidates you like first, then
- those you dislike, and then
- the worst.

For example, some Coalition voters seem to have used defensive voting in the 2022 Victorian senate election:

- The Coalition won 2 seats.
- The third Coalition candidate, Mirabella, gained 275,509 votes, just over half the votes needed to win a seat.
- Despite his many votes, he lost, gaining place 8.
- The count distributed his votes between the parties competing for the 6th and last seat: the ALP and UAP.
- The count distributed 10.7% of a Coalition above-the-line vote.
- This percentage of a Coalition vote was available for voting defensively, either against the ALP or the UAP.
- Of Mirabella's distributed votes:
 - 38% went to the UAP, and the UAP won. The Coalition how-to-vote card gave its second spot to the UAP and was an effective defensive vote against the ALP.
 - 27% of these Coalition votes went to the ALP. These votes seem like defensive votes against parties like the UAP or Greens.
 - 35% became exhausted and had no say in deciding the 6th seat. Many voters lost their chance to influence this seat.

An ALP vote example: In this same election, if the Coalition candidate Mirabella had won more votes, the ALP could have ended up in 8th place, and the count would have distributed these ALP votes. ALP voters would have had about 8% of their vote available for defensive voting against either the Coalition or UAP.

One defensive vote can exert slight pressure in the occasional election, but the cumulative impact of many similar defensive votes can change election results.

Each person will find their own balance between:

- the effort of ranking parties or candidates, and
- the value of fully presenting their preferences and using all their vote.

6 Strategies for ranking the many candidates.

One difficulty of voting in senate elections is that there are always so many candidates, e.g., 79 candidates in the 2022 Victorian election.

Each Australian state and territory is a single electorate in Australian Senate elections. These elections use “proportional representation with a single transferable vote”. It’s also called “optional preferential voting”, as voters have the option of ranking every candidate or party.

The state of Victoria forms one electorate with 12 Senators. In this 2022 half-Senate election, six of these senators were facing election. We had seventy-nine candidates from 26 parties competing for these 6 Victorian senate seats. The count picked the six Victorian senators from these 79 candidates based on the preferences of 3,821,539 voters.

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This picture is part of the 2013 Victorian Senate ballot paper showing:

- some columns: columns I to O,
- the party name for each column where applicable,
- a square for above-the-line voters to write their ranking number for that party,
- the thick black line separating above and below the line voting,
- each party’s candidates, ranked by the party, with their favourite on top, and
- a square for below-the-line voters to write their ranking number for that candidate.

Note by ranking the parties, voters can quickly rank candidates.

Each voter will have their own strategy. Some follow a party how-to-vote card. One woman I know voted under-the-line for parties that she liked, changing the order of each party's candidates by moving female candidates to the top of each party list.

I could have ranked all 79 candidates, putting the UAP candidates last. That strategy would have involved voting below-the-line by writing "1" next to the candidate I most favoured, "2" next to my second preference, and eventually "79" next to the last UAP candidate. I decided this was too much work and easy to get wrong.

My strategy was to rank all 26 parties above-the-line. I prepared a numbered list of each party and took this into the election booth. Appendix 1 shows how I prepared this guide with:

- the parties I liked first, then
- parties I knew little about, then
- parties I did not like, and then
- the UAP.

7 Our Preferential voting system is good.

The fate of democracies worldwide rests significantly on the quality of their electoral systems. Our preferential voting, with the Australian Electoral Commission setting electoral boundaries, has helped us avoid the extreme dysfunction of a two-party system, like in the USA. First-past-the-post systems entrench existing parties, while our system has promoted competition by allowing the emergence of challengers to the ALP and Coalition, e.g., the Democrats, the Greens, and the Teal independents.

8 Few understand this voting system.

Before investigating, I didn't know how the count picked Senators, let alone how the count spread the support of an individual vote. Now, I'm finding that many numerate and politically minded people also have little idea about our excellent voting system. It's a shame. More people should be on top of this detail and able to advocate for our voting system.

9 How the count picks Senators

9.1 The AEC example.

I show how our preferential voting picks Senators using an example election from the Australian Electoral Commission (AEC) website. The example has eight candidates competing for six seats.

<https://www.aec.gov.au/voting/counting/files/senate-count-process.pdf>

9.2 Quotas & Surplus votes

A candidate wins a seat when they gain one quota of votes or more.

The number of votes in a quota

$$= 1 + ((\text{number of formal ballot papers}) / (1 + \text{number of vacant Senate seats}))$$

In the AEC example:

- The number of formal ballot papers = 69,993
- The number of vacancies = 6
- One quota of votes = $1 + (69,993 / (1 + 6)) = 10,000$
- One quota is close to a 7th of the formal votes, about 14.3%

A winning candidate's surplus votes = (their total votes) minus (one quota).

9.3 The cycle of election & exclusion

Our preferential vote counting cycle:

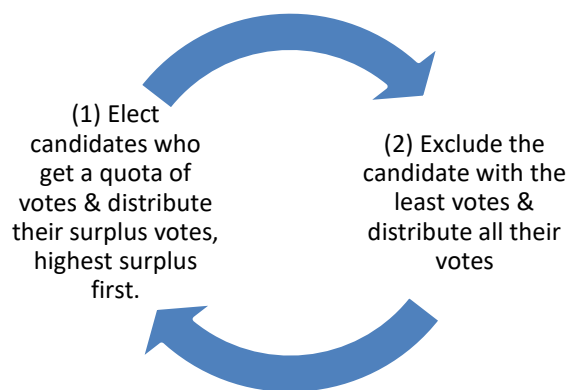


Figure 1: The election & exclusion cycle

The counting cycle:

1. elects all candidates who gain one quota of votes & distributes their surplus votes, distributing the highest surplus first,
2. excludes the candidate with the least votes & distributes all their votes, and
3. returns to step 1.

The cycle stops when:

- six candidates have won a quota, or
- the 6th seat is undecided, and neither of the two remaining candidates has won a quota; the candidate with more votes becomes the sixth Senator.

9.4 Events during the count

The eight candidates in the AEC example are A, B, C, D, E, F, G, and H. Here's the sequence of steps in the example count:

| Count | Action |
|---------------------------|---|
| 1: First preference count | Elect B: place 1 Elect A: place 2 Elect F: place 3 |
| 2 | Distribute B's surplus votes. |
| 3 | Distribute A's surplus. |
| 4 | Distribute F's surplus. Exclude C: place 8 (first exclusion = last placed) |
| 5-8 | Distribute all C's votes. Elect E: place 4 |
| 9-13 | Distribute E's surplus. Elect D: place 5 |
| 14-19 | Distribute D's surplus. Elect G: place 6 Reject H: place 7 |

Table 1: Full sequence of elections & exclusions for the AEC example

9.5 The count gives one reproducible result.

The count distributes votes in a way that gives one reproducible result.

The count first distributes B's 6,000 vote surplus because B has the largest surplus. The simplest way would be to pick 6,000 ballot papers from B's 16,000 ballots and distribute these 6,000 votes according to their next preference. However, you would get different results with different choices of the 6,000 ballot papers.

To get one reproducible result, the count distributes some support to the next preference of every one of these 16,000 ballots. The count weights the support of each vote so that, in effect, the count distributes 6,000 votes.

9.6 First winning candidate: Surplus distribution

Count one counts each client's "first preference votes". Then, count two takes the surplus votes from the first winning candidate, B, and distributes them to the other candidates.

| Candidate | A | B | C | D | E | F | G | H |
|-------------------------------------|--------|--------------------------|-------|-------|-------|--------|-------|-------|
| Count 1: First Preference Votes | 15,001 | 16,000 | 500 | 2,000 | 8,493 | 13,500 | 4,799 | 8,700 |
| Surplus votes | 5,001 | 6,000 | | | | 3,500 | | |
| Elected | Yes | Yes | | | | Yes | | |
| Count 2: Distributes B's surplus | | | | | | | | |
| B to A | 0 | 0 | | | | | | |
| B to C | | -2,000 $\times 0.375$ | 750 | | | | | |
| B to D | | -3,500 $\times 0.375$ | | 1,312 | | | | |
| B to E | | -1,000 $\times 0.375$ | | | 375 | | | |
| B to F | | 0 | | | | 0 | | |
| B to G | | -7,000 $\times 0.375$ | | | | | 2,625 | |
| B to H | | -2,500 $\times 0.375$ | | | | | | 937 |
| Votes after Count 2 | 15,001 | 10,000 | 1,250 | 3,312 | 9,868 | 13,500 | 7,424 | 9,637 |

Table 2: Candidate B surplus distributions: AEC example

- The "surplus votes" row in this Table shows the surplus gained by each candidate, e.g., Candidate B won 16,000 first preference votes, so B's surplus above the quota of 10,000 votes was 6,000.
- The "elected" row shows the candidates that gained a surplus and won with first preference votes alone: Candidates A, B, and F.

The count distributes Candidate B’s 6,000 surplus votes by transferring a fraction of each of B’s 16,000 votes to each vote’s next preference. This fraction is the “vote transfer value” (VTV). Candidate B’s VTV is:

- = the percentage of B’s votes that the count distributes
- = (B’s distributed votes) / (B’s votes gained)
- = $6,000 / 16,000 = 0.375 = 37.5\%$

For more on vote transfer value, see Section 11.4.

Table 2, row “B to C”, shows that 2,000 of the 16,000 votes for B had C as the next preference. The count takes $2,000 \times 0.375 = 750$ votes from B and passes these 750 votes to C. So, now 750 of C’s votes have come from 2,000 voters.

After the count distributes surplus votes, one vote stands for multiple voters.

The totals row in the following table highlights how the distribution of the next preference of each of 16,000 votes effectively distributes the surplus of 6,000 votes. It also raises “loss by fraction”.

| Candidate getting votes | Number of ballot papers supporting B and preferencing this candidate (N) | Transfer Weight (T) | Votes transferred to this candidate = $N \times T$ |
|-------------------------|--|---------------------|--|
| A (Elected) | 0 | 0.375 | 0 |
| C | 2,000 | 0.375 | 750.0 |
| D | 3,500 | 0.375 | $1,312.5 = 1,312$ |
| E | 1,000 | 0.375 | 375.0 |
| F (Elected) | 0 | 0.375 | 0 |
| G | 7,000 | 0.375 | 2,625.0 |
| H | 2,500 | 0.375 | $937.5 = 937$ |
| Loss by fraction | | | $0.5 + 0.5 = 1$ |
| Total | 16,000 | 0.375 | 6,000 |

Table 3: How the weighting factor works

9.7 The next preference

The count does not distribute votes to any candidate who has already won or lost, so a vote’s “next preference” becomes the “next undecided preference”.

In this example, the count only distributes B’s votes to the “undecided candidates” C, D, E, G and H, not to the already elected candidates A and F. When one of B’s votes had A or F as a “next preference”, the count distributes to that vote’s “next undecided preference”.

9.8 Distribution of an excluded candidate's votes

When the count excludes a candidate, it distributes all their votes. Each vote for the excluded candidate becomes one vote for that vote's next preference.

9.9 Electing a Senator "uses" part of a vote.

The first five winners only use part of each of their votes. For example, Candidate B wins 16,000 votes, a 6,000 surplus over the required quota of 10,000. The count uses a vote for B in two ways:

- part of each vote, $10,000 / 16,000 = 52.5\%$, supports B's election, and
- part, $6,000 / 16,000 = 37.5\%$, supports the vote's next preference.

A part of your vote slips past each winning candidate that you rank. This is how part of your vote can end up supporting candidates to whom you give a low preference, even when some of your top preferences become senators.

9.10 The 7th candidate keeps their votes.

The count distributes:

- the surplus votes of each winning candidate, leaving these senators with one quota of votes,
- all the votes supporting losing candidates, with one exception, the votes of the losing 7th placed candidate. The count stops after picking the sixth and last Senator.

9.11 Whole votes & "Loss by fraction"

When the count distributes surplus votes, it only distributes whole numbers of votes. In the AEC example, the distribution of B's surplus gave Candidate D $3,500 \times 0.375 = 1,312.5$ votes, which the count truncates to 1,312 votes. After many truncations, the count would lose votes, so a "loss by fraction" balances the numbers. (The count can generate a negative "loss by fraction". I'll skip that detail.)

10 Victorian 2022 Senate results

10.1 Victorian election results

Let's see how the count processed votes in the Victorian 2022 Senate election.

| Place | Candidate | Party | Votes Gained | Quotas Gained | Final Votes | Count | Transfer value |
|-------|------------------|-------|--------------|---------------|-------------|-------|----------------|
| 1 | Sarah Henderson | LNC1 | 1,224,398 | 2.243 | 545,935 | 2 | 55.4% |
| 2 | Linda White | ALP1 | 1,191,139 | 2.182 | 545,935 | 3 | 54.2% |
| 3 | Bridget McKenzie | LNC2 | 676,509 | 1.239 | 545,935 | 4 | 19.3% |
| 4 | Jana Stewart | ALP2 | 644,398 | 1.180 | 545,935 | 5 | 15.3% |
| 5 | Lidia Thorpe | Green | 547,656 | 1.003 | 545,935 | 294 | 0.3% |
| 6 | Ralph Babet | UAP1 | 455,528 | 0.834 | 455,528 | 360 | 0% |
| 7 | Casey Nunn | ALP3 | 374,234 | 0.685 | 374,234 | 360 | 0% |
| 8 | Greg Mirabella | LNC3 | 275,509 | | 0 | 359 | 100% |
| | Exhausted | | | | 261,868 | | |
| | Loss by Fraction | | | | 234 | | |
| | Total | | | | 3,821,539 | | |

Table 4: Victorian 2022 election results

- One quota was 545,935 votes.
- "Votes gained" is the candidate's "maximum votes gained" during the count.
- The "count" is the last count showing the "maximum votes gained":
 - the count before distribution of an excluded candidate's votes,
 - the count before distribution of a winning candidate's surplus votes,
 - or
 - the very last count for the 6th and 7th placed candidates.
- LNC1 = the first Liberal & National Party Coalition candidate
- UAP1 = the top United Australia Party candidate
- ALP2 = the second ALP candidate

The 2022 Victorian election data is from the Australian Electoral Commission (AEC).
<https://results.aec.gov.au/27966/Website/External/SenateStateDop-27966-VIC.pdf>

10.2 Count spreads each vote over only 7 candidates.

Every vote ends up spread over the first seven candidates and “exhausted”.

Look at the difference between the “first preference votes” and the “final votes”.

| Place | Candidate | Party | First preference votes | Final Votes |
|--------|----------------------|-------|------------------------|-------------|
| 1 | Sarah Henderson | LNC | 1,224,398 | 545,935 |
| 2 | Linda White | ALP | 1,191,139 | 545,935 |
| 3 | Bridget McKenzie | LNC | 4,094 | 545,935 |
| 4 | Jana Stewart | ALP | 3,115 | 545,935 |
| 5 | Lidia Thorpe | Green | 524,735 | 545,935 |
| 6 | Ralph Babet | UAP | 151,755 | 455,528 |
| 7 | Casey Nunn | ALP | 1,871 | 374,234 |
| 8 | Greg Mirabella | LNC | 2,127 | 0 |
| 9 - 79 | All other candidates | | 718,305 | 0 |
| | Exhausted | | | 261,868 |
| | Loss by Fraction | | | 234 |
| | Total | | 3,821,539 | 3,821,539 |

Table 5: Victorian 2022 election results

- Initially, the 3,821,539 “first preference votes” supported 79 candidates.
- Then, the count distributed the votes using each vote’s preferences.
- The count spread 3,821,539 “final votes” over only:
 - the six elected Senators,
 - the 7th place candidate,
 - exhausted votes, and
 - “Loss by Fraction”
- The vote distributions removed:
 - all surplus votes from candidates placed 1st to 5th,
 - no votes from candidates placed 6th and 7th, and
 - all votes from other candidates

10.3 Multiple counts to distribute one candidate's votes.

This election needed 360 separate "counts" to select the six Senators. I've used the count numbers loosely to make the explanation more compact. The counting system can take several counts to distribute one candidate's votes because the system uses one count to distribute each source of the distributed votes.

For example, the count distributed LNC3 Mirabella's votes in counts 355 to 360. It used six counts because these votes had six sources, for example:

- Mirabella's first preference votes, and
- LNC2 McKenzie's surplus votes that the count distributed to Mirabella.

10.4 Exhausted votes

In optional preferential voting, people do not have to give a preference to every candidate or party, so often, when the count tries to distribute a vote, the vote will not have a next preference. This vote will have "used all" or "exhausted" its preferences, so part of the vote will have no further influence on the election. The vote could've ranked and supported more candidates.

11 Vic Election: Coalition how-to-vote card: Voter C

11.1 How the count spreads an individual vote

Having discussed how the count picks Senators, I now focus on how the count spreads the support of an individual vote. I consider votes cast in the 2022 Victorian election by:

- person C, who followed the Coalition how-to-vote card,
- person A, who followed the ALP how-to-vote card,
- person G, who voted for the Greens, and
- person U, who followed the UAP how-to-vote card.

You can only know the spread of a vote's support after the election via calculations based on the detailed election results.

11.2 The Coalition card: C's vote

First, consider a vote by person C, who followed the Coalition how-to-vote card:

1. Liberal/National Coalition (LNC)
2. United Australia Party (UAP)
3. Derryn Hinch's Justice Party
4. Liberal Democrats
5. Shooters & Fishers and Farmers Party
6. Australian Democrats

Above-the-line voting is a quick way of achieving a below-the-line vote, as the voter does less numbering. Above-the-line voting accepts each party's ranking of that party's own candidates. When a voter follows the above Coalition card, they generate the following below-the-line vote:

- All the LNC candidates:
 - LNC1 Henderson
 - LNC2 McKenzie
 - LNC3 Mirabella
 - LNC4 ... then
- All the UAP candidates:
 - UAP1 Babet
 - UAP2 Moran
- All Derryn Hinch's Justice Party candidates
 - ...

11.3 Diagram: The spread of C's vote

..

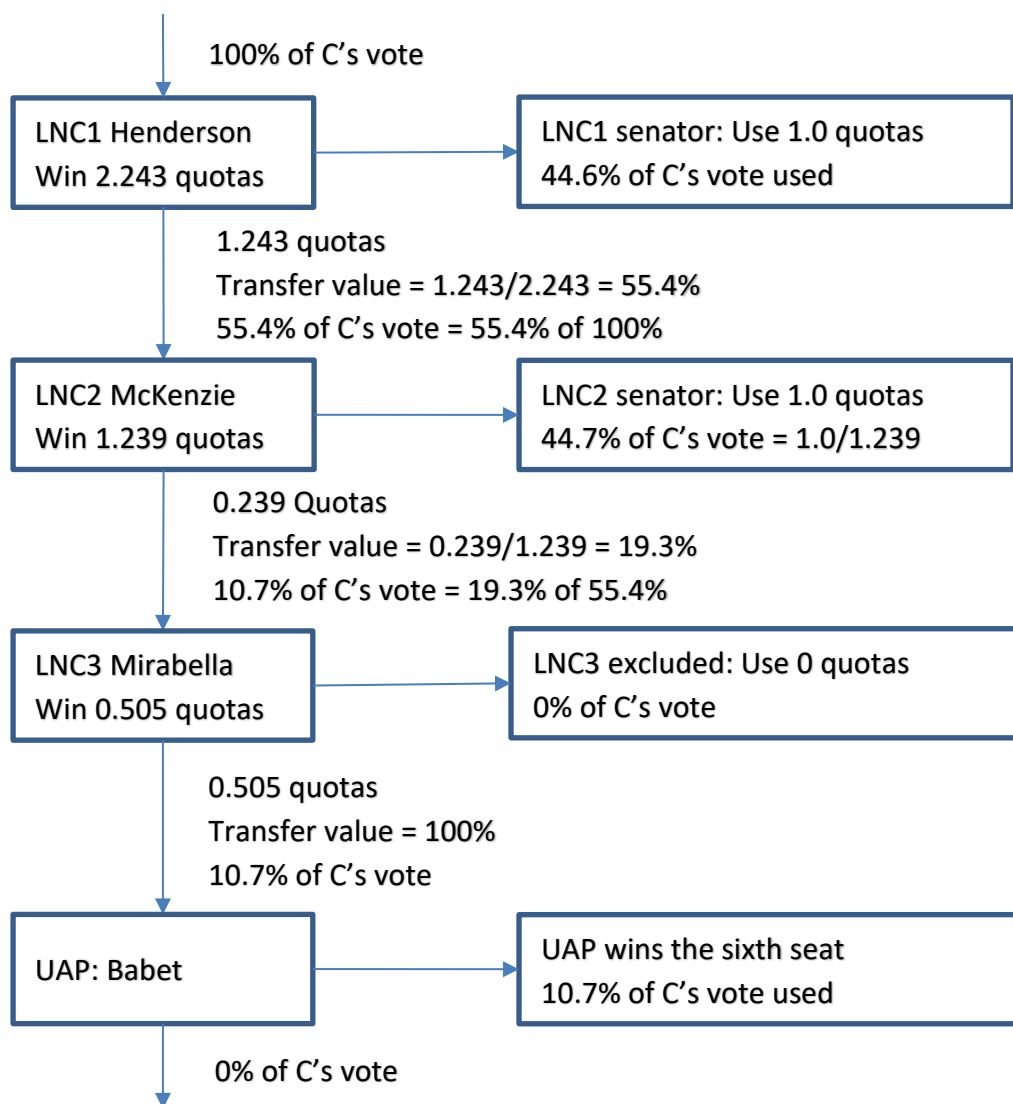


Figure 2: How voter C's vote spread between candidates

11.4 Vote transfer value

The "vote transfer value" (VTV) is an important measure of a candidate's distributed votes:

VTV = the candidate's percentage of "distributed votes" to "votes gained"

- For excluded candidates, the count distributes all their votes, so their VTV is 100%, e.g., the Coalition's Mirabella.
- For 6th and 7th placed candidates, the count distributes none of their votes, so their VTV is 0%, e.g., the UAP's Babet.

- For winning candidates, the count distributes their surplus votes, e.g., the Coalition’s Henderson. He gained 2.243 quotas of votes. The count elected him using 1 quota and distributed the remaining 1.243 quotas. His VTV:
 - = percentage of “distributed votes” to “votes gained”
 - = percentage of “distributed quotas” to “quotas gained”
 - = $1.243 / 2.243 = 55.4\%$

This VTV is the weighting factor the count applies to each of Henderson’s 1,224,398 votes, including C’s vote, when the count distributes Henderson’s surplus votes.

11.5 The part of a vote bypassing each ranked candidate

The candidates’ “vote transfer values” enable us to calculate how the count spreads an individual vote. Consider the distribution of C’s vote between candidates, as shown in Figure 2. The count:

- Gave the first preference on C’s vote, Henderson:
 - All (100%) of C’s vote.
- Passed support from Henderson to McKenzie:
 - = (Henderson’s VTV) x (the part of C’s vote gained by Henderson)
 - = 55.4% of [100% of C’s vote]
 - = 55.4% of C’s vote
- Passed support from McKenzie to Mirabella:
 - = (McKenzie’s VTV) x [the part of C’s vote gained by McKenzie]
 - = 19.3% of [55.4% of C’s vote]
 - = 10.7% of C’s vote

The VTV gives a quick way of calculating how much of any vote bypasses any candidate on that vote. You multiply together the VTVs of:

- that candidate, and
- each higher-ranked candidate on the vote.

For Mirabella, the amount of C’s vote that bypasses him:
 = (Mirabella’s VTV) x (McKenzie’s VTV) x (Henderson’s VTV)
 = 100% x 19.3% x 55.4% x
 = 10.7%

11.6 The part of a vote available for defensive voting

The part of your vote that bypasses your last “liked candidate” is the part the count leaves available for your defensive voting.

If voter C’s only liked candidates were the Coalition candidates, then the count made 10.7% of his vote available for his defensive voting. This defensive part of C’s vote was substantial because the VTV of each of Mirabella, McKenzie and Henderson was substantial. For example, if McKenzie had only won one quota of votes, his surplus and VTV would have been zero, leaving no part for defensive voting.

11.7 Follow C's vote through the count.

Supported by Figure 2, follow the progress of C's vote through the count.

- Count 1:
 - gave 100% of C's vote to C's first preference, LNC1 Henderson,
 - gave Henderson 2.243 quotas of votes,
 - elected LNC1 using:
 - one quota of votes
 - $(1 \text{ quota}) / (2.243 \text{ quotas}) = 1/2.243 = 44.6\%$ of C's vote,
- Count 2:
 - Distributed LNC1's surplus to C's next preference, McKenzie: NLC2
 - Used LNC1's VTV = 55.4% of C's vote
- Count 3:
 - gave LNC2 McKenzie 1.239 quotas of votes, from votes giving McKenzie first preference votes & distribution from Henderson,
 - elected McKenzie using:
 - one quota of votes,
 - $1.0 / 1.239 = 80.7\%$ of McKenzie's support, or
 - $80.7\% \text{ of } 55.4\% = 44.7\%$ of C's vote,
- Count 4:
 - Distributed LNC2 McKenzie's surplus to C's next preference, Mirabella
 - LNC3:
 - Distributed a part of C's vote to support Mirabella:
 - = (Henderson's VTV) x (McKenzie's VTV) of C's vote
 - = $55.4\% \times 19.3\% = 10.7\%$ of C's vote
- Count 359:
 - excluded LNC3 Mirabella. Mirabella had held the 10.7% of C's vote from counts 4 to 359, a long part of the count, and
 - put Mirabella in 8th place.
- Count 360:
 - Distributed Mirabella's 10.7 of C's vote.
 - jumped C's next preferences for other Coalition candidates: LNC4, LNC5 and LNC6, as the count had already excluded them,
 - passed support to C's next live preference, the UAP,
 - gave UAP Babet the full 10.7% of C's vote.
 - elected UAP Babet, as the 6th senator,
 - excluded ALP3 Nunn, putting Nunn in 7th place,

11.8 Table: The spread of C's vote

The count spread the support of C's vote between three of the seven top candidates; see “% of C's vote used” in the following table.

| Candidate | Quota | % of C's vote available | % of C's vote used | % of C's vote distributed | Count | Place |
|----------------|-------|-------------------------|--------------------|---------------------------|-------|-------|
| LNC1 Henderson | 2.243 | 100% | 44.6% | 55.4% | 2 | 1 |
| LNC2 McKenzie | 1.239 | 55.4% | 44.7% | 10.7% | 4 | 3 |
| LNC3 Mirabella | 0.505 | 10.7% | 0% | 10.7% | 359 | 8 |
| UAP Babet | 0.834 | 10.7% | 10.7% | 0% | 360 | 6 |
| Exhausted | | | 0% | | | |

Table 6: The spread of a Coalition vote

12 Vic election: Battle for the 6th seat

12.1 Three candidates competing for 6th place.

The UAP ended up with 455,528 votes to gain the 6th seat, ahead of the ALP with 474,234 votes (Table 5). So, the UAP won by 81,294 votes. The Coalition supporter's preferences could have pushed the seat to the ALP but backed the UAP.

After count 354, three candidates were competing for the 6th seat.

| Candidate | Votes after count 354 | Final position |
|-----------------------|-----------------------|-----------------|
| Babet UAP | 349,809 | 6 th |
| Nunn ALP3 | 300,798 | 7 th |
| Mirabella LNC3 | 275,509 | 8 th |
| | | |
| ALP beat Coalition by | 25,289 | |

Table 7: Votes before Mirabella's exclusion

12.2 The distribution of Coalition votes

Greg Mirabella, the Coalition's third candidate, had the least votes, so the count excluded him and distributed his 275,509 votes as follows.

| The candidate getting the votes from Mirabella. | Votes from Mirabella | Percentage |
|---|----------------------|------------|
| Babet UAP | 105,719 | 38% |
| Exhausted | 96,406 | 35% |
| Nunn ALP3 | 73,436 | 27% |
| Loss by fraction | Minus 52 | |
| Total | 275,509 | 100% |
| | | |
| UAP gained more than ALP3 | 32,283 | 12% |

Table 8: Distribution of all Mirabella's votes

- The ALP got 27% of Mirabella's distributed votes. It seems that these Coalition supporters ranked a party they liked (the Coalition) and then a party they didn't like (the ALP) ahead of worse parties (the UAP and possibly parties like the Greens). It seems that these voters used the preferential voting system fully and voted defensively against candidates they really did not like.
- Perhaps some of these voters who preferenced the Coalition and then the ALP were the electors who: (1) voted for independent Teal candidates and ousted the Coalition in some House of Representatives seats, and (2) still voted for the Coalition in the Senate but rejected the Coalition how-to-vote card.
- Exhausted votes, votes which preferenced neither the ALP nor UAP, were 35% or 96,406 of Mirabella's votes. Now, the UAP won by 81,294 votes, so the ALP could have won this seat if they had gained over 81,294 (84%) of these 96,406 exhausted votes,
- The UAP gained 38% or 105,719 of Mirabella's votes. The Coalition how-to-vote card suggested voting like this and would have generated many of these votes. The UAP won by 81,294 votes, so the distribution of the 275,509 Mirabella votes and the Coalition how-to-vote card played a major part in electing the UAP.

12.3 Five voters per Mirabella vote

On average, each of Mirabella's 275,509 votes combined the intent of about five voters.

While each of his 2,127 first preference votes came from just one person, many of his other votes combined the intent of multiple people, e.g., the votes he got when the count distributed the surplus of the top Coalition candidate, Henderson. Henderson won 1,224,398 first-preference votes, each coming from one person. Assuming all these people voted above-the-line for the Coalition, Mirabella would have got 10.7% of 1,224,398 = 131,010 votes from this source. That is, 9.3 people were involved in each of these Mirabella votes. Some calculations, not shown here, suggest that an average of about five voters were involved in each of Mirabella's final votes.

So, when considering how the election result could have changed, say, by one extra Mirabella vote going to the ALP, that's suggesting that about five people changed their vote.

13 Vic election: ALP how-to-vote card: Voter A

13.1 The spread of A's vote

Voter A followed the ALP how-to-vote card:

1. ALP
2. Greens
3. Derryn Hinch's Justice Party
4. Liberal Democrats
5. Animal Justice Party
6. Reason Australia

Here is how the count spread the support of this ALP vote:

| Candidate | Outcome | Place | Support Used |
|--------------|---------|-------|--------------|
| ALP1 White | Win | 2 | 45.8% |
| ALP2 Stewart | Win | 4 | 45.9% |
| ALP3 Nunn | Lose | 7 | 8.3% |
| Green Thorpe | Win | 5 | 0% |
| UAP Babet | Win | 6 | 0% |
| Exhausted | | | 0% |

Table 9: The spread of A's vote

13.2 The 7th placed candidate.

The third ALP candidate, Nunn:

- gained 7th place,
- lost because she gained fewer votes than 6th placed UAP Babet,
- held her votes till the very end of counting, and
- did not distribute any of her votes.

Any below-the-line vote with a number next to Nunn did not transfer any support to candidates ranked below Nunn.

In the same way, any above-the-line vote with a number next to the ALP did not transfer any support to parties ranked below the ALP.

In any election for 6 Senators, when a vote gives a preference to either the 7th place candidate, or the party of the 7th candidate, this preference stops the count from spreading any of that vote's support to that vote's lower preferences.

Election commentators discuss the winning candidates, but they rarely mention the 7th placed candidate and ignore the role of the 7th placed candidate in stopping the count from spreading a vote's support to lower preferenced candidates. These discussions would help voters to understand our voting system and the effectiveness of their vote.

13.3 Defensive voting could have played a role.

In this election, the ALP came 7th, so defensive voting by ALP supporters played no role. No ALP vote's support spread to any preference below the ALP. However, this could have been different.

Defensive voting by ALP supporters could have played a role if Mirabella had gained more votes than Nunn. Then, the count would have distributed Nunn's votes, and ALP supporters' preferences would have played a role in deciding between the UAP and the Coalition. ALP supporters could have preferenced:

- the Coalition to defend against the UAP,
- the UAP to defend against the Coalition, or
- neither the UAP nor the Coalition.

14 Vic Election: A Greens vote: Voter G

14.1 Spread of G's support

Say voter G ranked the parties:

1. Greens,
2. ALP,
3. Coalition and then
4. UAP.

Follow the progress of G’s vote for the Greens through the counting process.

- Count 1:
 - gave 100% of G’s support to Greens.
- Count 294:
 - elected the Green’s Thorpe with 1.003 quotas,
 - used one quota to support her win: $1 / 1.003 = 99.7\%$ of G’s vote
 - distributed the small surplus of 0.003 quotas: $0.003 / 1.003 = 0.3\%$ of G’s vote
 - jumped G’s next preferences ALP1 and ALP2 as they had both already won a seat, and
 - distributed the surplus to ALP3 Nunn,
- Count 360:
 - excluded Nunn, who had the support of 0.3% of G’s vote, and
 - elected UAP Babet, who won despite 0.3% of G’s vote.

The count spread the support of this vote to:

| Candidate | Outcome | Place | Support Used |
|----------------|---------|-------|--------------|
| Greens: Thorpe | Win | 5 | 99.7% |
| ALP1 White | Win | 2 | 0.0 |
| ALP2 Stewart | Win | 4 | 0.0 |
| ALP3 Nunn | Lose | 7 | 0.3% |
| UAP | Win | 6 | 0% |
| Exhausted | | | 0% |

Table 10: The spread of G’s vote

14.2 The 5th placed candidate.

This Greens vote is an example of 5th placed candidates who often have a tiny surplus. In this election:

- passing only 0.3% of their vote to the next preference,
- having a small “vote transfer value” of 0.3%, and
- nearly blocking the count from spreading that vote’s support any further.

14.3 Defensive voting

Only a tiny part of each Greens’ vote became available for defensive voting in this election. This 0.3% is small but still significant.

Count 295 distributed each of Thorpe’s 547,656 votes weighted by 0.3%. Thorpe’s surplus of 1,721 votes went to many parties, e.g., the ALP got 747 of these votes and the Victorian Socialists 404.

15 Vic Election: UAP how-to-vote card: Voter U

15.1 Follow the count.

Now consider a vote by person U who follows the how-to-vote card of Palmer's United Australia Party (UAP):

1. UAP
2. Liberal Democrats {LDP}
3. Informed Medical Options Party
4. Pauline Hanson's One Nation
5. Australian Federation party
6. Australian Values Party

Follow the progress of U's vote through the counting process.

- Count 1:
 - gave UAP Babet 100% support of U's vote, and
 - Babet held this support till the end of the counting.
- Count 360:
 - elected Babet, and
 - excluded ALP3 Nunn

15.2 The 6th placed candidate.

Babet won 6th place. This UAP vote exemplifies how the 6th-placed candidate:

- holds their votes till the end of the count,
- distributes no votes,
- has a vote transfer value of zero,
- wins a seat, and
- stops the count from spreading, as does the 7th-placed candidate.

For a below-the-line vote in this election, any vote with a number next to Babet passed no support to the vote's preferred candidate after Babet.

For an above-the-line vote in this election, any vote with a number next to the UAP passed no support to the vote's next preferred party after the UAP, i.e., the LDP.

In any Senate election, the 6th place candidate and their party stop the count from spreading.

15.3 The UAP & Defensive voting

For any vote with the UAP as the first preference:

- All the vote's support went entirely to supporting the UAP candidate,
- No support flowed past the UAP to lower preferenced candidates, and
- any defensive voting in the vote's lower rankings had no impact.

15.4 Strategy: Not ranking the major parties

The UAP card did not rank the major parties: the Coalition, ALP, and Greens, so if the UAP had lost, as they did in all other states, votes following the UAP card would have become 100% exhausted and had no further say in the election. These voters could consider defensive voting to increase their chances of having an influential vote. The same applies to other voters considering only ranking minor parties as a strategy.

16 Strategy: Rank all the likely winners.

16.1 Parties that block the spread of a vote

If you rank all the likely winners, you'll have a high probability of using your vote entirely. You'll probably waste your whole vote if you rank none of them.

To stop part of your above-the-line vote exhausting, include preferences for parties that use all or most of your vote, i.e., parties that gain:

- place 7, entirely blocking a vote's slippage of support,
- place 6, which also entirely blocks slippage, and
- place 5, which allows a little slippage. In eight elections, the slippage ranged from 0.3% to 7%.

Here are the parties that won these blocking places in eight recent senate elections.

| Senate Election | Place 5 | Place 6 | Place 7 |
|-----------------|------------|-----------|----------------|
| Victoria 2022 | Greens | UAP | ALP |
| NSW 2022 | Greens | Coalition | Cannabis Party |
| QLD 2022 | One Nation | ALP | Coalition |
| WA 2022 | Greens | ALP | Coalition |
| SA 2022 | Greens | Coalition | ALP |
| TAS 2022 | Coalition | Coalition | One Nation |
| | | | |
| Victoria 2019 | Greens | Coalition | Hinch Party |
| Queensland 2019 | Coalition | Greens | ALP |

Table 11: Parties winning places 5, 6, & 7 in eight elections

These parties were the likely winners in these elections. If you rank all the likely winners, you'll most probably use your vote fully.

16.2 Total blocking

Examination of the eight elections in Table 11 suggests that, for example, in 1 out of 8 elections (13% of elections), the Greens will gain place 6 or 7 and **entirely** block the slip of support to preferences below the Greens. Here's this statistic for each party.

| Party | Number of elections where the Party got place 6 or 7 | % of elections |
|-----------|--|----------------|
| ALP | 5 | 63% |
| Greens | 1 | 13% |
| Coalition | 6 | 75% |

Table 12: Elections in which a party got place 6 or 7.

16.3 Substantial blocking

Similarly, in 6 out of 8 elections (75% of elections), the Greens will gain place 5, 6 or 7 and **substantially** block the slip of support to preferences below the Greens. Here's this statistic for each party.

| Party | Number of elections where the Party got place 5, 6 or 7 | % of elections |
|-----------|---|----------------|
| ALP | 5 | 63% |
| Greens | 6 | 75% |
| Coalition | 7 | 88% |

Table 13: Elections where a party got place 5, 6, or 7.

16.4 Support distributed beyond a vote's top preferences.

The following table shows how a vote for major parties, or groups of parties, blocks a vote's spread. We can understand the Victorian 2022 election line (VIC 2022) by drawing on the above discussion of this election:

- For an ALP vote, 0% of the vote slipped past the ALP because the ALP gained 7th place.
- For a Green vote, 0.3% of the vote slipped past the Greens because the Greens won 5th place, and the count distributed their surplus votes.
- For a Coalition vote, 10.7% of the vote slipped because the Coalition's third candidate lost in 8th place, and the count distributed all his votes.
- For a vote preferencing the Greens and then the ALP, 0% of the vote slipped past the ALP, again because the ALP won 7th place.
- For a vote preferencing the ALP and then the Greens, 0% of the vote slipped past the ALP, again because the ALP won 7th place.
- For a vote preferencing the ALP, Greens and then the Coalition, 0% of the vote slipped past the ALP, again because the ALP won 7th place.

You can explain each of the following percentages in a similar way.

| Parties | ALP | Greens | Coalition | Green / ALP | ALP / Green | ALP / Green / Coalition |
|----------|------|--------|-----------|-------------|-------------|-------------------------|
| Election | | | | | | |
| VIC 2019 | 6.9% | 3% | 0% | 3% | 0.2% | 0% |
| VIC 2022 | 0% | 0.3% | 10.7% | 0% | 0% | 0% |
| QLD 2019 | 0% | 0 | 1% | 0% | 0% | 0% |
| QLD 2022 | 0% | 2.3% | 0% | 0% | 0% | 0% |
| TAS 2022 | 0.3% | 4% | 3% | 0.03% | 0.3% | - |
| Maximum | 6.9% | 4% | 10.7% | 3% | 0.3% | 0% |

Table 14: % Support spread beyond parties in five elections.

The table suggests that:

- The count often distributes no support beyond a major party; when it does, it's a small percentage of a vote's support.
- The count distributes less support beyond a combination of parties.
- For supporters of these parties, defensive voting gives a vote slightly more say in the occasional election.

16.5 The impact of defensive voting

Defensive voting may only give a vote slightly more say in the occasional election, but it can occasionally be influential. Again, consider parts of the 2022 Victorian election:

- When the Green candidate won, the count distributed her surplus votes. This was a small percentage (0.3%) of each vote, but it was 1,721 votes. These votes could influence a close election, see Section 14.3.
- When the Coalition's third candidate lost, the count distributed 10.7% of a Coalition vote, in all 275,509 votes. That's influential. (See Section 12.2)
- The third ALP candidate lost, gaining 7th place. However, if the Coalition had beaten her, and she had gained the 8th place, the count would have distributed all her votes, say 270,000 votes. These votes would have gone to the Coalition, UAP, or Exhausted and could have influenced the outcome.

16.6 Based on elections in this political era

This note draws its suggestions based on:

- only two recent elections, 2022 and 2019,
- elections in this political era where typically the Coalition won 2 seats, the ALP 2, and the Greens 1 with the sixth seat uncertain, and
- a few elections, most in 2022 when the ALP won government.

The reported statistics and suggestions would change with consideration of more elections or changes to the political landscape.

16.7 Based on elections for six senators

This note considers the half-senate elections for six Senators. These elections occur in Queensland, NSW, Victoria, Tasmania, SA, and WA. The number of Senators elected changes the probabilities of some events, so some conclusions reached here would not apply to:

- double dissolution elections, which elect twelve senators, and
- Territory elections, which elect two senators.

17 Structuring a vote

17.1 Preferencing parties likely to win.

Another voting strategy is to rank:

- the parties that you like, and
- all the parties that are likely to win.

This strategy makes it very likely that your preferences will include a blocking party that entirely or substantially eliminates the slippage of your vote's support passed the blocking party. Then, you can avoid allocating any lower preferences.

How might an ALP supporter have used this knowledge in the 2022 Victorian election, given this voter:

- picked the likely winners as the ALP, Coalition, Greens, UAP and Legalise Cannabis,
- strongly opposed the Coalition, and
- opposed the UAP even more.

This person could have voted:

- ALP,
- Other parties they liked,
- The Greens,
- Legalize cannabis,
- Other parties that seemed more appealing than the Coalition,
- The Coalition,
- No further ranking, e.g., no ranking of the UAP and Party X

This vote would have:

- ranked all the likely parties except one, the UAP,
- ranked the Coalition ahead of the UAP by not mentioning the UAP,
- blocked any of its support going to the unranked parties, including the UAP and Party X, because one of the ranked parties would gain place 6 or place 7,
- a disadvantage: it would not support Party X if Party X did well and competed with the UAP for a seat.

This approach makes defensive voting easier as you do not have to rank every party.

17.2 Impact of not numbering parties

When a voter does not put a number next to several parties, they:

- rank the “unnumbered parties” below every numbered party,
- deny support to all the “unnumbered parties”, and
- make it possible for part of their vote to become exhausted.

17.3 Unknown parties

Inevitably, voters will know little or nothing about some parties. A wise person would probably leave them unranked, instead of ranking them above their worst parties.

17.4 Putting a small party first

Voter A preferred the ALP and then the Greens, while voter G preferred the Greens and then the ALP. Comparing the resulting spread of these two votes' support shows what can happen when you rank a small party ahead of a big party.

A vote with the first preference going to a small party (here, the Greens) can support the first preference for an extended period. The result can be that the vote does not support the big party's top candidates, here the ALP candidates.

| Candidate | Support from ALP vote A | Support from Green vote G | Support from Vote G: if Greens had lost |
|----------------|-------------------------|---------------------------|---|
| Greens: Thorpe | | 99.7% | 0% |
| ALP1 White | 45.8% | - 0% | 0% |
| ALP2 Stewart | 45.9% | - 0% | 0% |
| ALP3 Nunn | 8.3% | 0.3% | 100% |
| LNC | 0% | 0% | 0% |
| UAP | 0% | 0% | 0% |

Table 15: The change from inserting a different first preference.

A's vote only supported each of the top three ALP candidates.

By comparison, G's vote supported Thorpe until she won at count 294. Then, the count distributed Thorpe's surplus. As ALP1 and ALP2 had won their seats by count 4, Thorpe's surplus vote went to ALP3.

Another possibility is that the count could have excluded Thorpe at count 294, then 100% of G's vote would have gone to ALP3.

If you prefer the ALP more than the Greens, give the ALP your first preference. You put an ALP win at risk by giving a party like the Greens first preference as the ALP might perform poorly: the count could elect ALP1 but exclude ALP2 while your vote supports the Greens.

17.5 Get your support to a liked candidate early!

If you rank one or more candidates before a candidate you want to win, the count can exclude your desired candidate before support from you and others reaches them.

The parties face this difficulty. For example, if every Coalition supporter followed the Coalition how-to-vote card, LNP1 could get all the first preferences, say 1.8 quotas. Then, LNC1's surplus of 0.8 quotas would go to LNC2, but LNC3 and LNC4 would initially have no votes, so the count would quickly eliminate them before they could gain votes from distributions.

This Table shows the first preference votes won by the Coalition candidates in this Victorian election.

| Candidate | First preference votes |
|-----------------|------------------------|
| LNC1 Henderson | 1,224,398 |
| LNC2 McKenzie | 4,094 |
| LNC3 Mirabella | 2,127 |
| LNC4 Kmetj | 550 |
| LNC5 Harrington | 893 |
| LNC6 Burgess | 1,868 |

Table 16: ALP & Coalition first preference votes

All these candidates won first preference votes, not just the top candidate, and in this regard, the ALP votes were similar. Parties must organise for people to vote below-the-line to support their second, third, fourth and fifth candidates to avoid losing them early in the count.

17.6 How-to-vote cards

Following a party how-to-vote card is a poor way to vote - unless the card fully expresses your preferences. This is because:

- Party how-to-vote cards suggest that you only vote for six parties above-the-line. They do this as (1) the AEC requires voters to rank at least six parties, and (2) the parties focus on getting your first preference and try to make voting more straightforward, and
- Parties make deals with one another about how-to-vote cards, which can lead to strange choices on how-to-vote cards.

18 Voting for individual candidates

I voted above-the-line for parties because it is simpler to find out how each party presents itself, but parties often put forward candidates you do not expect.

Sadly, it seems we need to consider learning about individual candidates and voting below-the-line.

I find this a daunting challenge, as there are so many candidates, and many have a low profile, especially when they have not already served in parliament.

19 Lower house voting is different.

Please note that voting for the Senate is very different to voting for the “House of Representatives”. While both use preferential voting, in the Representatives voting:

- There is only one representative elected to parliament from each electorate, not 2, 4, 6 or 12 as in the Senate. This means there is no need to distribute surplus votes from the single winning candidate, and the count does not spread your vote between several candidates.
- There are far fewer candidates in each electorate, around eight compared to around 79 in the Senate.
- You must give a preference to every candidate in your electorate. It is full, not optional, preferential voting like in the Senate.

20 Do not enter preferences both above and below the line.

If you wanted, for example, to change the order of your favourite party’s candidates, you could present your preferences by putting numbers in the preference boxes both above-the-line & below-the-line. This would be efficient and unambiguous.

However, when I wrote asking the AEC whether this would be a formal vote, they only replied that if I wanted changes to the law, I should write to the Parliament's Joint Standing Committee on Electoral Matters.

I suspect that a scrutineer could challenge a vote like this, and it could become a wasted vote.

21 Your reactions

Please let me know your reactions to this article, especially if you know of other articles on this subject.

22 References / Links to websites

AEC: Detailed data on each step in the count for the Victorian 2022 election

<https://results.aec.gov.au/27966/Website/External/SenateStateDop-27966-VIC.pdf>

AEC: The AEC example of the Senate count process

<https://www.aec.gov.au/voting/counting/files/senate-count-process.pdf>

AEC: 2022 Senate Results

<https://results.aec.gov.au/27966/Website/SenateStateResultsMenu-27966.htm>

ABC: 2022 Senate election results

<https://www.abc.net.au/news/elections/federal/2022/results/senate>

ABC: Party How-to-vote cards: The ABC website still showed an election guide, including most of the party's how-to-vote cards after the election.

<https://www.abc.net.au/news/elections/federal/2022/guide/senate-vic-htv#pagenav>

The Conversation: How does preferential voting work in the Senate:

<https://theconversation.com/explainer-how-does-preferential-voting-work-in-the-senate-116347>

23 Appendix 1: Preparing your own Senate voting guide.

You might like to prepare your preferences and a voting guide before voting day and take it into the polling booth. Making decisions while filling in the wide Senate voting form in the narrow voting booth is challenging, and an error can invalidate your vote.

Before election day, you can:

- Find the websites of the parties and their how-to-vote cards.
- Find voting guides via places like the Victorian Climate Action Network (VCAN)

Preparing your guide:

- The Australian Electoral Office (AEC) has a complete list of the Senate candidates for each state ordered as on the ballot paper with the column heading & party name. Alternatively, the ABC website also has this information.
- Copy and paste this information into a text file in Microsoft Notepad to remove any formatting.
- Copy and paste this into a word processor, e.g., Microsoft Word.
- Re-order the lines so it reflects your voting preferences. (There are some keyboard shortcuts to help with this.)
- Automatically number this list to generate your preference number for each party by clicking on “numbered dot points”.
- Alternatively, you could use the Microsoft Word “outline” feature to change the line order and generate your preference number.
- Print your voting guide, including the following information:

| Your preference for above-the-line voting | The column on the ballot paper | Party name |
|---|--------------------------------|------------|
| 1 | D | Coalition |
| 2 | K | ALP |
| ... | | |
| 26 | L | UAP |

Table 17: Example guide for voting.

24 The Author

I worked for a petrol company and then a petrochemical company as an operations researcher for 20 years after gaining a science degree. Then, I worked as a counsellor for 17 years, gaining a Master of Social Work by research into my counselling practice as a problem gambling counsellor. I’m now retired and urging climate action on my website.

Andrew Gunner

Updated: 4 October 2023