Why MRCV Is the Best Possible Ordinal (Ranked-Choice) Voting System

By Roy A. Minet

Introduction

It has been known for more than two centuries that the widely-used plurality voting system is awful. Its two largest flaws are: 1) it is utterly incapable of rendering an intelligent decision whenever no option receives a majority of the votes; 2) limiting voters to a single choice very frequently causes an almost irresistible pressure to vote insincerely (known as "voting for the lesser-of-two-evils").

IRV (Instant Runoff Voting) is one of many alternative voting system proposals which has gained some traction. Allowing voters more than one choice and promoting lower choices when higher ones are eliminated does relieve the vote-for-the-lesser-of-two-evils pressure. However, there still are extremely important situations in which IRV is utterly incapable of rendering an intelligent decision, just like plurality. If no option has received a majority of the first choice votes, IRV eliminates the "weakest" one, promotes lower choices to fill any "holes" caused by the elimination, and again checks to see if one of the options now has a majority. IRV makes the mistake of ignoring the valuable information it has collected in the form of additional choices and looks only at first choice votes to determine the "weakest" option. This is *not* reliable and can often blunder as badly as eliminating the option that actually should be the winner!

In 2007, MRCV (Minet Ranked Choice Voting) was proposed[1]. MRCV is nearly the same as IRV except for one crucially important improvement. When determining the weakest option, MRCV utilizes *all* available information by giving the most appropriate weight to choices after the first. In this way, MRCV reliably eliminates the weakest option and always renders good decisions under all circumstances. Thus, MRCV fixes not one, but both of the big flaws of plurality. It is argued that MRCV is the best possible RCV (ordinal or ranked-choice) voting system.

How MRCV Works

Each elector may rank his or her first, second and third choices. Any choice may be a write-in. A choice may not be repeated. Electors are not forced to rank three choices, but are limited to a maximum of three. The outcome will be determined by the following (sometimes) iterative procedure:

1. **Determine Winner** – Total the first choices. If any option has a majority of the first choices, it is the winner. If only one option remains, it is the winner. If there is no winner, proceed to step 2.

[1] See: "Voting Designed for Better Decisions", Roy A. Minet, ©2007.

2. **Eliminate Weakest Option** – Assign weighting points to the choices on each ballot. A first choice receives 4 points, a second choice receives 2 points and a third choice receives 1 point. Total the points for each option across all ballots. Eliminate the option having the lowest point total. If there is a tie, eliminate the tied option having the smallest total of first choice votes. If still a tie, eliminate the tied option that has the smallest total of second choice votes. If a tie persists, eliminate one of the tied options at random.
3. **Promote Choices** – If a ballot's first choice has been eliminated, promote the second choice (if any) to first. For any ballot where the second choice has been promoted or eliminated, promote the third choice (if any) to second. Any eliminated or promoted choice that has no lower choices will cease to exist. Go back to step 1.

Why MRCV Is Best

There are two aspects of any voting system: 1) information must be collected from voters regarding their intents and desires; 2) the data that was gathered must be processed in some manner to yield the decision which results in the greatest satisfaction totaled over all voters. These are somewhat independent, but voters' knowledge of 2) can affect the sincerity of the information they provide for 1). Both aspects are examined below. When limited to ordinal systems, it is argued: that the data gathered by MRCV is the best possible; and that MRCV always processes the data in a way which yields decisions which result in the greatest satisfaction of voters. If these things are both true, we can be certain that no better ordinal voting system is possible.

Gathering Data from Voters

It should be immediately obvious that plurality cannot possibly do a good job because it does not gather enough information. A single choice is insufficient. Voters must be empowered to provide more complete information regarding their desires and intents. Obviously, it is unhelpful to collect additional data if it is either meaningless or insincere.

- Voters must understand what information they are to provide and, to a reasonable extent, how it will be used to determine the result
- Voters must be able and willing to provide valid information
- Voters must be motivated to provide sincere (and not insincere or "strategic") information

A cardinal voting system could potentially do a better job than an ordinal one, but obtaining sincere cardinal data from voters is much more problematic than collecting valid ordinal information. (In 2016, a good cardinal system was proposed, named True Weight Voting[2] or TWV.) Ordinal data is not as information-rich, but a credible job can still be done when restricted to ordinal data.

Some ordinal systems (e.g., Condorcet and Borda) require that voters provide a complete ranking of all options. Such systems could work only if there are at most three or four fixed options. If multiple

[2] See: "Voting for Better Decisions", Roy A. Minet, ©2016.

ad hoc write-in options are to be handled, these systems are not even theoretically workable. When there are more than two or three options, few voters are likely to be familiar with all of them and will be unable to provide valid rankings. If forced to provide them, the data will just be unhelpful noise. Any system which requires a full ranking of all options is of academic interest only and cannot be seriously proposed for real-world elections. (Interestingly, almost all the mathematics of "fairness," upon which untold effort has been expended, depends upon having valid, complete rankings.)

Allowing voters only a single choice is clearly insufficient. Collecting more than three choices is extremely unlikely to contribute any additional valid, meaningful data. Also, as will become clear in the following section, the importance to the decision-making process declines exponentially, so choices after the first two or three cannot possibly have much significance in determining the result, even if the data were valid. Thus, we are quickly led to the conclusion that either two or three choices is the optimum data set to solicit. MRCV allows, but does not require, a maximum of three choices. In the real world, many voters will provide less than three, but the option is available to voters who are sufficiently informed and motivated to provide this level of detail—in this case, it is valid and useful data even though it's bearing on the decision cannot be large.

Processing the Data

A key and fundamental design decision that must be made for any ranked-choice voting method is how much importance or weight will be given to choices after the first. If we could gather valid cardinal data for each choice, this would be the information we seek; namely, how strongly each voter favors each choice. Lacking this, what valid inferences can be made from just the ordinal data?

Suppose that the strength of a given voter's support for the option ranked first is "F" (we don't know a specific value for this, so we assign a variable name instead). Since we have no better information about any other voter, we are forced to assume that the strength of support for the first choice of every voter is the same, namely, F (although certainly it is not the same).

Similarly, we don't know the strength of the voters support for the option ranked second, so we assign a different variable name, "S". Furthermore, we can calculate the value of S for any given voter from the value of F (for the same voter) by multiplying F by some factor we will call a relative weighting factor. That is, $S = wF$, where "w" is the weighting factor. What do we know about the value of w?

At one extreme, the voter may have liked the top two choices equally and may have flipped a coin to decide which option to rank first. In this case, S = F and, therefore, $w = 1$. We can be sure that w can't have a value greater than 1 (if it did, the voter would have ranked the second option first).

At the opposite extreme, the voter may not have liked the second choice option much at all and may have seriously considered leaving that option out of the ranking altogether. Since, in fact, the decision was to include the option, it must enjoy some positive amount of support (however small) from that voter. Therefore, w must have a value greater than zero, so $w > 0$.

Thus, $0 < w <= 1$. Again, since we have no better information, we are forced to assume that *w* is the same for all voters, although we know that it surely is not. However, the situation may not be as bleak as that sounds. We can still make quite excellent decisions when large numbers of voters are involved if we know the average value of *w* for all voters. It might be possible to design some tests to measure the average *w* for lots of voters in various elections and races (indeed, that might be an exercise worth the effort). Statistically, it is highly unlikely that the average *w* would either be close to 1 or close to 0. In fact, the best assumption that can be made is that the average value of w is 0.5. That is, averaged over lots of voters for many races in many elections, voters' support for the options they rank second is half as strong as their support for the option they rank first.

By repeating exactly the logic we have just been through, we can conclude that the weight of a third choice should be assumed to be half of the weight of a second choice (and, therefore, a quarter of the weight of a first choice). In fact, this can be extended to as many choices as one would like (i.e., a fourth choice is half the weight of a third choice or an eighth of a first choice, etc.) Even if valid data could be obtained for such "lesser choices," their influence on the decision declines exponentially so we need not be concerned by the absence of this data.

By using proper weightings for the choices, a "scoring system" can be constructed that will rank all options in the order of their support totaled over all voters. Most people find it easier to deal with integers rather than decimal fractions, so 4 "points" are awarded for a first choice 2 "points" for each second choice and 1 "point" for each third choice, which accomplishes the proper weightings. The option receiving the highest point total will be the choice that results in the greatest voter satisfaction. There can be no better way to utilize ordinal data.

The scoring system could very well be used to directly identify the winning option. In fact, there are solid arguments as to why this would be best. However, MRCV does not do this. Instead, the scoring system is used to very reliably identify the weakest option, which then is eliminated in an iterative, last-man-standing system (like IRV). This will lead to exactly the same final result a large percentage of the time, but is not guaranteed to do so. There are several reasons for the eliminations approach:

- It is very important for all voters to clearly understand that, if their first choice is eliminated, their second choice is "promoted," and will then count in every way as though it had been their first choice. It is this which exorcises that irresistible pressure to vote for the "lesser-of-two-evils."
- If the scoring system "errs" for any reason, it could pick the wrong winner. However, a small error in eliminating the worst option is not usually a problem as long as the error is not so egregious as to eliminate the option that should win (a big problem with IRV). Thus, a successive elimination procedure can be seen as "safer."
- It would be a hard sell to convince people to give up "majority rule," so the iterative system eliminates options until one has a majority of the first choices (or is the only one remaining). In fact, the scoring system is not even used if an option initially has an outright majority of first choices. It is easy for voters to see that MCRV usually works just like familiar old plurality.

Other Interesting Observations

The value chosen for *w* has a profound effect on the behavior of an ordinal voting method. It is crucial to use the optimum value of 0.5.

As *w* is decreased from 0.5, choices after the first have less and less influence over the outcome. When decreased all the way to $w = 0$, they have no influence and only first choices count. At $w = 0$, behavior is the same as plurality and the IRV elimination method.

On the other hand, if *w* is increased, choices after the first exert a larger and larger influence upon the outcome. If increased all the way to $w = 1$, all choices count equally. Voters then lose the ability to specify which is their first choice; or in order to do so, they no longer have the option of additional choices. This is Approval voting.

Thus, MRCV might be thought of as the “happy medium” between Approval voting on one side and plurality/IRV on the other.

Implementation

Although MRCV certainly can be done using rustic means such as hand-marked paper ballots, the use of modern technology is strongly recommended if carefully done. In fact, a comprehensive software implementation of MRCV is available called Election Manager. EM is capable of running entire elections and may be used royalty-free for non-commercial purposes.

Voter-verifiable paper ballots are printed and deposited in a traditional ballot box to serve as a durable audit trail for auditing and/or recount purposes. EM produces a list of each polling place’s (randomized) ballots. The lists are both human and machine-readable (XML with checksum). Each list can be validated against the corresponding paper ballots (EM can produce aids to accelerate audits). The lists are centrally tallied by EM to produce the final results. Since all Lists are made publicly available, anyone can independently verify the final tally using any method they wish.

An Illustrative Example

Imagine the following hypothetical, but entirely possible and not terribly far-fetched election. Alice, Bob and Chuck are running for some office. A total of 99 votes are cast. Let’s say the votes were 34 for Alice, 33 for Bob and 32 for Chuck.

Using plurality, Alice is declared the winner on the basis of one vote more than a third of the votes. Nearly two thirds of the voters did not want Alice to win! Oh well. There is no way to tell whether Alice or Bob would garner the majority of the votes if Chuck were eliminated. There is no way to tell whether Alice or Chuck would garner the majority of the votes if Bob were eliminated. With only about a third of voters supporting Alice, it is even possible that she should be eliminated. Plurality fails utterly when no option receives more than 50% of the votes. It does not even have the information necessary to make an intelligent choice in that situation.

How would this same election have turned out using IRV?

Suppose that the 34 voters that voted for Alice provide their ranking as A, C, B. The 33 who voted for Bob rank the options as B, C, A. The 32 who voted for Chuck rank their choices as C, B, A. IRV first looks at just the first choices and concludes, as did plurality, that no option has a majority. IRV then eliminates the option that received the fewest first choice votes; that would be C with 32 first choices. C is then removed from the rankings and choices below C in the rankings (if any) are promoted to fill the “hole” created by C’s removal. The rankings will now appear:

34 A, B
33 B, A
32 B, A

IRV again examines the first choice votes which now are 34 for Alice and 33 + 32 = 65 for Bob. Bob now has a solid majority of the first choices and is declared the winner.

At first glance, this seems fairly reasonable. But is it the best decision? Let’s look at the original ranking of the voters more carefully.

34 A, C, B
33 B, C, A
32 C, B, A

Note that 34 people liked Alice best, but no one ranked her second and 65 ranked her third. Similarly, 33 liked Bob best, 32 ranked him second and 34 ranked him last. With Chuck, 32 ranked him best, 67 ranked him second and no one ranked him third.

	1st	2nd	3rd
A	34	0	65
B	33	32	34
C	32	67	0

Most reasonable people would say that Alice, with 34 first choices and zero second choices, is the weakest option and should be the first to be eliminated. If Alice were eliminated, the rankings would then appear:

34 C, B
33 B, C
32 C, B

Now, Chuck would be the winner with a solid majority of 66 first choices. It could be convincingly argued that the 99 voters would be happier overall with Chuck as the winner instead of Bob (and certainly happier than with Alice winning). Yet IRV eliminates Chuck, who pretty clearly is the strongest candidate and should be the winner!

Plurality is necessarily inferior because it does not collect enough information from voters to make good decisions under all circumstances. However, IRV is worse in the sense that it actually does collect useful additional data, but then completely ignores it when making the crucial decision as to which option should be eliminated.

Revisiting the above hypothetical election using MRCV, the rankings were:

34 A, C, B
33 B, C, A
32 C, B, A

Weighting "points" for A are 34 x 4 + 33 x 1 + 32 x 1 = 201.

Weighting "points" for B are 34 x 1 + 33 x 4 + 32 x 2 = 230.

Weighting "points" for C are 34 x 2 + 33 x 2 + 32 x 4 = 262.

By assigning reasonable weightings to voters' second and third choices (instead of ignoring this valuable data), Alice is clearly revealed to be the weakest option and is eliminated first. Chuck is then the winner with 66 of the first choices.

Weighting points only come into play when no option has a majority of the first choices. They are used to iteratively eliminate the weakest option until a remaining option either has a majority of first choices or is the only remaining option. Note that Chuck did have the largest weighting point total (which is comforting), but that weighting points are not used to pick the winner. This is important as it means that the weighting system does not need to be perfect as would be the case if it were picking the winner directly; it only needs to be good enough ***not to eliminate the best option*** as can easily happen with IRV.

Just one example has been explored. Since it required only one elimination, it does not illustrate that the weighting points are reassigned immediately prior to performing each elimination, so that promoted choices always receive the full benefit of their new rank. The reader is encouraged to try MRCV in any kind of election, real or contrived. It always renders reasonable choices and does not produce an awful result under any circumstances. A small amount of complexity is necessarily added, but the (Douglas) Jones Rule (understandable by a bright high school student) is still satisfied.

A Final Observation

The 2016 U.S. presidential election was a dramatic demonstration of the awesome power of the lesser-of-two-evils phenomenon to mercilessly suppress votes for new or emerging choices. This evidence strongly indicates that it would be extremely hard for newer alternatives to ever "get out of the cellar" and garner more than about 4% of the vote. With IRV, it should finally be possible to get out of the cellar, but only to then be eliminated by IRV's process that looks only at first choice votes.

The MRCV method makes it overall easier for new choices to compete with the old; possibly, even win. But it is very important to note that this was not in any way a design objective. The method was designed solely to consistently render the decision which results in the greatest satisfaction among all voters as a whole. Giving second and third choices appropriate weightings accomplishes that and, as a byproduct, should result in more competitive elections. Competition always drives improvement, so it is to be fervently hoped that, over time, the quality of government would improve.