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Alternative Voting Systems

The Effect of Voting Systems on Single-Winner Multicandidate Electoral Outcomes

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Abstract

This paper examines the effect that voting systems can have on electoral outcomes in single-winner multicandidate elections. Using ballots collected from a county level Republican Party special election, we run six simulated elections using preference based voting systems and compare the results to the special election outcome. We find that voting system can have an effect on electoral outcomes, but that this effect depends heavily upon the closeness of the election.

In July 2007 Republican Representative Scott Wyatt resigned from the Utah House of Representatives to become President of Snow College. Under Utah law, if a member of the legislature resigns, the party must determine how to replace him or her, and must replace the representative in a 'timely' manner. The rules established by State code and the Republican Party indicate that Wyatt's replacement was to be chosen by the county party, and appointed nominated by the Governor.

The Cache County Republican Party's special election to replace Representative Wyatt is a story in alternative voting mechanisms. Once Representative Wyatt formally resigned, the party chairman called for a special election among precinct delegates. As this was an internal party election neither state nor local law, and in fact no party rule indicated how the election should occur or what mechanism should be used to select the winner.

In the absence of such requirements, the county party chairman, in consultation with other party leaders, chose to use a modified Instant Run-off Voting (IRV) mechanism. This mechanism, which requires voters rank their preferences in descending order, had been used at a previous state delegate convention and had significantly reduced the time necessary for calculating the winner. When asked, the chairman indicated that this time savings was his primary reason for choosing IRV as the voting system.

His decision was not without controversy. A number of delegates and at least one candidate argued that changing how voting would occur was likely to confuse voters, and would eliminate the ability of candidates to campaign between iterative rounds of voting as they had in the past. Despite these concerns, the chairman used IRV as the voting system at a special election with three candidates on September 7, 2007. Only minor problems occurred with voters who did not understand the instructions, and few concerns were heard among attendees.

The Cache Republican Party provided us the original ballots which allowed us to address the following: In the special election would an alternate voting system have selected a different winner and or different rankings given the expressed preferences of the delegates? We ran simulation of Plurality, Borda Count, Condorcet, Coombs, Contingent, and Bucklin voting systems to address this question.

Methodology

The ballots from the special election were collected immediately after the results of the election had been certified by party officials and we used the actual ballots to determine the outcome of alternative voting systems. A sample ballot is included, Table 1.1, and only the names have been changed in deference to the actual candidates. The candidates in our study will be referred to as A, B, and C. Delegates were instructed to rank their preferred candidates from one to three, one being most preferred, and we used those preferred orderings as the baseline for determining preferences in each of the alternative voting systems. On a number of ballots only 1st and 2nd preferences were marked. For these ballots we assigned the candidate receiving no votes as 3rd preference. For ballots where only a single preference was indicated, we recorded that as a 1st preference and did not record a 2nd or 3rd preferences for that vote.[1] In some cases this resulted in differing N's across rounds of voting.

[1] These ballots may have been strategic voting by delegates not wanting to give any votes to the other candidates.

Table 1.1: Sample Ballot

Cache Co. Republican Party
Legislative District 5
Special Election
September 7, 2007

Please list your preference for the candidates listed below, with your first choice listed as "1", second choice as "2" and third choice as "3". Spoiled ballots will not be accepted. Contact the Help Desk should you damage your ballot or with additional question.

☐ **Candidate A**

☐ **Candidate B**

☐ **Candidate C**

The voting instructions given to delegates orally and on the ballot reminded delegates that placing a number from one to three in each box was necessary—that other marks could confuse the counting and possibly invalidate the outcome. When marks other than numbers indicated a single candidate that mark was construed, by us and the party, to be a 1st preference for that ballot. If a ballot contained two marks which were non-numeric the ballot was considered spoiled, and excluded from the count.

Actual Electoral Outcome

In an IRV system, such as the one used in the special election, voters rank candidates according to preference. Any time a candidate receives an absolute majority of first preference votes, that candidate wins. If no candidate receives an absolute majority of first preference votes, the candidate with the fewest number of first preference votes is eliminated, and the votes cast for that candidate are redistributed to remaining candidates according to their second preferences. This process is repeated until one candidate has an absolute majority of first preference votes among the candidates remaining.[2]

In this election the count of 1st round votes; candidate A received 55/159 votes, or 34.6%, candidate B received 46/159 votes, or 28.9%, and candidate C received 58/159 votes, or 36.5%. As no candidate received greater than 50% candidate B was dropped from the race and his votes were distributed to the 2nd choice listed on his voters ballots. In the second round count candidate A received 69/159 votes or 43.4%, and candidate C received 90/159 votes, or 56.6%. Candidate C was declared the winner and was forwarded to the governor for appointment to the Utah House of Representatives. The results are shown in table 1.2.

Table 1.2: IRV

Candidates	A	B	C
Round 1	55	46	58
Round 2	69	X	90

[2] Richie, Robert, Steven Hill, and Caleb Kleppner. "Instant Runoff Voting and Full Representation: Keys to Fulfilling Democracy's Promise." Democracy's Moment. Lanham, MD: Rowman and Littlefield, 2002. 143-157.

Simulations of Alternative Voting Systems

We conducted six simulated elections of alternative voting systems to answer the question: will an alternate voting system have selected a different winner given the expressed preferences of the delegates? The voting systems examined here are Plurality, Borda Count, Condorcet, Coombs, Contingent, and Bucklin. Approval voting[3], Majority[4], and Single Transferable Vote (STV)[5] systems are not included in this research—sufficient data was not available to run simulations on these systems. Excluding Condorcet pair wise competitions, ballot preferences were given numerical values which outcomes were based on. Each simulation fits within the constraints of the data set collected and offers a valid outcome. All six simulations provide a clear winner.

Plurality[6]

The plurality winner was candidate C. In single winner plurality elections each voter is allowed to vote for a single candidate. The candidate with the largest share of votes is the winner. In the simulated election candidate A received 55/159 votes, or 34.6%, candidate B received 46/159 votes, or 28.9%, and candidate C received 58/159 votes, or 36.5%. These results are shown in Table 1.3.

Table 1.3: Plurality

Candidates	A	B	C
1st place votes	55	46	58

[3] Brams, Steven J., and M. Remzi Sanver. "Critical Strategies Under Approval Voting: Who Gets Ruled in and Ruled Out." Electoral Studies. 25 (2006): 287-305.
[4] Farrell, David M. Electoral Systems: A Comparative Introduction. New York, New York: Palgrave, 2001.
[5] Diamond, Larry and Marc F Plattner. Electoral Systems and Democracy. Baltimore: The Johns Hopkins University Press, 2006.
[6] Farrell, David M. Electoral Systems: A Comparative Introduction. New York, New York: Palgrave, 2001.

Borda Count[7]

The winner of the Borda Count was candidate C. Voters in a Borda Count rank candidates by allotting a certain amount of points which correspond with preference (i.e. three points for most preferred, 2 points for next most preferred, etc.). The point allotments of each ballot are tallied, and the candidate with the most total points is elected. In our simulation a 1st place ranking received 3 points, 2nd place 2 points, and 3rd place 1 point. The result was candidate A receiving a total of 292 points, candidate B 285, and Candidate C 337. The point totals are shown in Table 1.4.

Table 1.4: Borda Count

Candidates	**A**	**B**	**C**
Total Points	292	285	337

Condorcet[8]

The Condorcet winner was candidate C. Determining the Condorcet winner of any election requires matching every candidate in complete pair wise comparisons and for a true Condorcet winner to emerge from the election that winner must defeat every other candidate in cross wise comparisons. For these simulations we used ranked pairs to complete the count. In a three candidate election like this simulation one candidate must defeat both the others in pair wise comparisons.

This simulation was completed using each ballot and creating three comparisons A vs. B, B vs. C, and C vs. A. When the total of the comparisons were totaled a clear Condorcet winner and loser emerged. The Condorcet winner was candidate C defeating both A and B in the

[7] Emerson, Peter. Designing an All-Inclusive Democracy. Belfast, Northern Ireland: Springer, 2007.

[8] Black, Duncan. The Theory of Committees and Elections. Cambridge: Cambridge University Press, 1971

simulated cross wise comparisons, The Condorcet loser was candidate A losing to both C and B in the simulated comparisons. In this simulation in the cross wise comparison of A vs. B, A received 75 and B 76. In B vs. C, B received 64 and A 95. In C vs. A, C received 89 and A 69. The results are shown in Table 1.5.

Table 1.5: Condorcet Comparisons

Comparisons	A vs. B	B vs. C	C vs. A
Condorcet Results	75 vs. 76	64 vs. 95	89 vs. 69
Winner	B	C	C
Loser	A	B	A

Coombs Method[9]

The Coombs winner was candidate C. Voter using the Coombs method rank every candidate on the ballot. Like IRV, any candidate is ranked first by an absolute majority wins. If a winner is not determined in the first round, the candidate that is ranked last by the highest number of voters is eliminated. The process is repeated with the continuously reduced field of candidates until one candidate obtains an absolute majority of first place votes.

In the simulation the initial count of first place rankings no candidate received over 50% of the cast votes. As such a count of the 3rd place rankings of each candidate was completed. Candidate A received 60 3rd place votes, B 50, and C 31. Candidate A received the most 3rd place rankings and was eliminated. In the second count, candidate B received 46/104 votes, or 44.2%, and candidate C received 58/104, or 55.8%. Candidate C received an absolute majority of the votes remaining after candidate A was eliminated and is winner of the Coombs simulation. These results are shown in Table 1.6.

[9] Grofman, Bernard, and Scott L. Feld. "If You Like the Alternative Vote, Then You Ought to Know About Coombs Rule." Electoral Studies 23 (2004): 641-659.

Table 1.6: Coombs

Candidates	A	B	C
3rd Place Votes	60	50	31
1st Place Votes	X	46	58

Contingent Vote[10]

The Contingent Winner was candidate C. Using the contingent voting method, voters rank candidates in order of preference. If no candidate receives an absolute majority of first preference votes, all but the two leading candidates in terms of first preference votes received are eliminated. In the second and final round, the votes of those who supported eliminated candidates are distributed among the two remaining candidates according to their second preference votes. The candidate who receives an absolute majority wins. Under no circumstances do more than two rounds occur. As a derivative of IRV that simply limits vote counting to 2 rounds the outcome is identical to IRV, candidate C wins, and the results are found in Table 1.7.

Table 1.7: Contingent

Candidates	A	B	C
Round 1	55	46	58
Round 2	69	X	90

Bucklin[11]

The Bucklin Winner is candidate C. Voter using the Bucklin method rank all candidates on the ballot. First choice votes are counted first. If a candidate has an absolute majority, that candidate wins. If no majority is achieved, second choice votes are counted and added to the first

[10] Rallings, Colin, Michael Thrasher and David Cowling (2002), 'Mayoral Referendums and Elections', *Local Government Studies* 28 (4), pp67-90.

[11] Taagepera, Rein and Mathew Soberg Shugart. Seats and Votes: The Effects and Determinants of Electoral Systems. New Haven: Yale University Press, 1989.

choices. Again, if an absolute majority is achieved, that candidate is elected. This process continues until an absolute majority is reached and a winner is decided.

In our simulation 1st round counting yielded, candidate A received 55/159 votes, or 34.6%, candidate B received 46/159 votes, or 28.9%, and candidate C received 58/159 votes, or 36.5%. As no candidate received over 50% 2nd round choices were added. Candidate A received 33 additional votes bringing his vote total to 88, candidate B received 49 additional votes bringing his total to 95, and candidate C received 66 additional votes brining his total to 124. As he received 77.9% of the original vote total Candidate C is the simulated winner. The results are shown in Table 1.8. As each candidate received over 50% the Bucklin method represents a derivation of approval voting.

Table 1.8: Bucklin

n=159

Candidates	A	B	C
1st Place Votes	55	46	58
2nd Place Votes	33	49	66
1st + 2nd / # of ballots	55.3%	59.7%	77.9%

The Effect of Voting System on Electoral Outcomes

Although candidate C won in each simulation our findings show that the use of different voting systems can lead to quite different results in single-winner multicandidate elections. Depending on the voting system, Candidates A and B both took second and third place. Candidate A took second place under Contingent, Condorcet, Plurality, and IRV voting systems, but Candidate B came in second when Borda Count, Coombs, and Bucklin voting systems were used. Table 1.9 shows the outcome of each voting system simulation.

Table 1.9: Electoral Outcomes by Voting Procedure

Electoral Outcome	1st	2nd	3rd
Borda	C	B	A
IRV*	C	A	B
Coombs	C	B	A
Bucklin	C	B	A
Contingent	C	A	B
Condorcet	C	A	B
plurality	C	A	B

***Results of actual election

Our findings are consistent with Brams, Hansen, and Olsen's (2006) conclusion that different multicandidate preference voting systems provide different electoral outcomes. This variation in multicandidate election outcomes is largely a product of election closeness. The Brams, Hansen, and Olsen experiment used ballots from the 2006 Public Choice Society (PCS) Presidential election. The election was conducted using approval voting (AV) and was a dead heat. In addition to the approval voting, voter preference ranking data on each candidate was collected. Election results were calculated using Condorcet, Plurality, Borda count, and the Hare system (STV). The four preference voting systems selected two separate winners out five candidates. Neither of the preference winners was the AV winner.

Unlike the Brams, Hansen, and Olsen experiment, the margin of victory in our case was significant. Candidate C was not significantly affected by the selection of voting system. However, there was little difference in the number of votes between candidates A and B, which, like the PCS experiment, accounts for their exchange between second and third places.

In short, electoral outcomes in single-winner multicandidate elections can be different depending on voting system used. The significance of this effect remains largely dependant upon the closeness of the election.

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