

A Plan for a Presidential Election

The U.S. presidential election is special in that it must follow rules set down in the Constitution, and the rules can only be changed by the difficult amendment process. Many in this country are dissatisfied with the Electoral College system and want to abolish it. I present here a way of conducting the election which keeps the Electoral College, but modifies it in a way that cures some of its problems. The main rules are kept, namely that there must be one vote for each voter and that the votes are for electors in each state, which electors then vote for the president. Each state has a number of electors equal to the number of representatives plus senators that it sends to Washington. (The elector can be a virtual entity--not a real person.) Keeping the electors for the two senators in each state maintains the protection against swamping of low-population states by populous states, which was desired by the founding fathers.

Traditionally, the process has had the electors from each state vote unanimously for one of the candidates, so it is winner-take-all in each state. A few states are now trying to get away from winner-take-all, with electors to be split among the candidates. The way they are doing this splitting is to have each congressional district get an elector who will vote for the winner in his district and the state as a whole get two extra electors (for the senators) who will vote for the state-wide winner. In this paper, I propose splitting of the *electors'* votes and having the electors remain as the body which elects the president--as envisioned by the framers of the Constitution. The improvement here is the use of an algorithm--new to the field of social choice--for processing the election in an entirely new way.

The algorithm was discovered by me, and I call it the contest-analysis algorithm because of its applicability to contests of many kinds. In elections, it has the ability to cope with the heretofore intractable situation in which voters are allowed to split their votes among two or more candidates--intractable because no method of aggregating votes is free of logical flaws. The algorithm processes the election by computing *strengths of participants* (voters and candidates) from the overall pattern of voting and uses these strengths to determine the election outcome. The vote-aggregation problem is not present because votes are used only indirectly and not aggregated.

I propose setting this up as a two-stage problem: *voters* in the congressional districts determining split votes which the state *electors* (one per district plus two more 'at-large' in each state) will use to elect the president. The original voters (the true voters casting ballots in the districts) vote for only one candidate each, and their votes determine the apportionment of the single vote of each elector. The voters do not have to rank the candidates, something that it is unrealistic to expect them to do. (Having the voter pick a favorite is already asking a lot of him. Since he typically does not think much about the rest of the slate, he is ill-equipped to rank candidates.) Ranking of candidates in each district comes automatically from the original balloting, and another similarly-done ranking of candidates for the state can be used by the 'at-large' electors.

The following sections will show how the district election will be processed, how its outcome will feed into the Electoral College, and how the Electoral College will elect the president. Of course, the Electoral College will operate automatically and need not consist of real people.

An example

I will use a simplified model of the U.S. in which there are just five states, having a total of twelve

congressional districts. An elector from each district, plus two extra electors from each state (the senatorial electors), brings the total of electors to 22. The election has four candidates (A, B, C, and D), and the popular vote in the districts of the states is distributed as shown on the table below. Two electors in each state are 'at large', their preferences fully on the candidate who gets the most popular votes in the state. For each state on the table, the first two electors are the at-large ones and the following electors are for the districts. (As mentioned above, the at-large electors could have their preferences divided among the candidates in proportion to the statewide tallies, if it is agreed that all states would do it this way.)

<u>Elector</u>	<u>Preference for candidates</u>			
	A	B	C	D
1	1	0	0	0
2	1	0	0	0
3	.65	.20	.10	.05
4	.35	.35	.20	.10
5	0	1	0	0
6	0	1	0	0
7	.20	.70	.10	0
8	.30	.40	.15	.15
9	.40	.50	.05	.05
10	1	0	0	0
11	1	0	0	0
12	.50	.40	.05	.05
13	.60	.30	.10	0
14	.40	.40	.10	.10
15	.30	.50	0	.20
16	0	1	0	0
17	0	1	0	0
18	.30	.40	.30	0
19	.20	.50	.10	.20
20	0	1	0	0
21	0	1	0	0
22	.10	.80	.05	.05
Totals	8.30	11.45	1.30	.95

The totals could show the winner; in fact candidate B would be a majority winner if the election were to be decided by these totals (and if we define majority to mean winning more than half of the available vote fractions). This method of processing election results is known as a Borda count. The Borda count has a drawback in that it does not consider that *the electors are not all equal after they have voted*. Each casts a single distributed vote, but how that vote is distributed makes the electors clearly different from one another. An elector who distributes his vote more in favor of strong candidates should be stronger than an elector who does the opposite. Similarly, a candidate who is more favored by strong electors should get an extra boost from that favoritism. These interactions among the participants form the basis for the contest analysis algorithm, which computes strengths of participants.

When contest analysis is applied to the data of Table 1 to compute what is called the applied strengths of the candidates, those numbers determine the ranks of the four candidates: 0.392, 0.530, 0.045, and 0.032, after normalizing to unity. These numbers are more spread out than the Borda counts of Table 1

(which, when normalized, are 0.377, 0.520, 0.059, and 0.043). Contest analysis causes candidate B to win by a larger fraction. The idea of majority does not really apply in the contest-analysis approach, since we are not dealing with quantities of votes. The Constitution requires a majority of the electoral vote for winning the election, which otherwise gets thrown into the House of Representatives. Methods for adjusting votes to turn the election into one with a majority outcome have been proposed, and this idea is explored below, but I claim that contest analysis cannot benefit from adjustment of votes. In fact, the analysis can only be harmed with such adjustments and should be left alone--with the strengths of candidates in the unadjusted election representing the true will of the electorate.

From the data, it can be seen that ten of the electors (the senatorial ones) can be combined into two groups, one group of four and one group of six.. Grouping would reduce the size of the problem without changing the results.

The contest-analysis method

The derivation of the basic equation of the contest algorithm is located elsewhere on this site ([Derivation](#)), so I will just write it down here:

$$X_i^2 = \sum_j [A_{ij} \cdot f_{ij} \cdot X_j] \text{ where } f_{ij} = A_{ij} / \sum_i (A_{ij}) \text{ and where the sums go over all } i \text{ or } j$$

The algorithm uses an iteration routine to solve for X_i , the magnitude of a vector "owned" by participant i . The index i represents the participant in the contest who is pointing at other participants, and the index j represents the participant being pointed at. The essence of a contest is participants pointing at each other, and every contestant must point at one or more other contestants. In addition to possessing a vector, each participant possesses a direction in a space of n directions, where n is the number of participants in the contest. Pointing at participant j then consists of pointing in direction j , and no participant can point in his own direction. The quantity A_{ij} in the equation is an element of the input data set called a *score*, where the scoring is done by participant i with respect to participant j . (Scoring implies pointing from one participant to another, hence the vector picture of the process. A larger score means that the pointing vector has greater magnitude.) The quantity f_{ij} is the fraction of all scores against participant j that are due to participant i .

With n participants in the contest, there are n equations of the type shown, and the program goes through them in sequence to solve for all the X values. After the X values are determined, the above equation for X_i^2 will then represent the square of the magnitude of the scoring vector of participant i , and its terms will be the squares of the various orthogonal components of that vector. Thus, all magnitudes and directions of the scoring vectors in the problem are known, and the vector solution can be displayed by a square array. (All participants must do some scoring to be part of the contest.) The entries in this array will be the squares of the components of scoring vectors in the directions of the participants scored against. The square array for the vector solution also serves as the array for displaying the input data; the double index i,j pertains to both.

Comparison with Instant Runoff Voting

Instant Runoff Voting (IRV) is in use in several places (Australia, for example); it is being vigorously promoted in this country by an organization called the Center for Voting and Democracy (<http://www.fairvote.org/>). It has clear advantages over the present plurality system in which the voter

can express his opinion for only one candidate. With IRV, the voter can give first-, second-, etc., choices on his ballot. The rules in a particular election will state how many choices he has, and he does not need to use all of his choices. The voters must be placed into groups, as above, to avoid having to keep track of individual voters. The votes for first-choice candidates are tallied to see if that produces a majority winner. If it does not, the candidate with the least votes is deleted and the voters who voted for that candidate (as first choice) are allowed to have their second-choice votes applied to the remaining candidates. If that tally does not result in a majority for any candidate, the one with the least votes in this round is deleted, and the process is repeated for voters who voted for the second deleted candidate. (They get their votes counted for their next-lower choice.) Voters who did not pick second, third, etc., choices may get dropped as the steps continue, but otherwise every voter gets a full vote.

As the name implies, instant runoff is the same as having a runoff election (or a sequence of them) with the same set of voters as the original election and with each voter keeping the same order of preference on candidates. It saves the delay and expense of having another election for the runoff. Of course, a true runoff brings out a different (usually smaller) set of voters, and preferences may change between the two elections. The chief advantage of IRV is the reduction of the effects of 'spoiler candidates', since a candidate with no chance of winning will be eliminated in a round of IRV, but the votes for him will be redirected toward one of the other candidates. If the original election produces a majority winner, however, there will be no runoff and the anti-spoiler advantage will be absent.

A philosophical difficulty with IRV has to do with the fact that minor groups of voters get to determine the winner with their second and third choices for candidates. The major groups of voters have second and third choices, too, but these choices are not figured into the process. With the contest analysis method, all voters have all their choices considered.

The idea behind IRV is very good, and support is growing for its adoption, but there are practical drawbacks. First, it is unrealistic to expect voters in a presidential election to be able to do more than pick a favorite. They tend to ignore all lesser candidates. Second, having to keep track of individual voters, in order to be able to later replace higher choices with lower ones, is problematical--and even grouping them according to their preference patterns could require a lot of groups.

It would be possible to have IRV work with the electors, if the electors are kept winner-take-all. (This is a take-off on the setup of the contest-analysis plan, as described at the beginning of this report.) The possibility of throwing the election into the House (if there is no majority) would be eliminated, but otherwise all the disadvantages of the present system would remain.

What about employing the Borda counts on split votes in some way to guarantee a majority? We can still delete the weakest candidate, but then we have to do something about the vote fractions which that candidate had. Options are to delete the fractions and then renormalize the remaining fractions or to just delete the fractions, leaving the voters with unequal total votes. There is some justification for inequality of votes, since a voter might deserve some penalty for betting on the wrong horse--after all, if votes were not split, the voter would lose his entire vote. (This point of view cannot be expressed with IRV, making it even more questionable. It somehow does not seem right that a voter on the losing end can have his vote resurrected, full strength, and applied over and over again as candidates are deleted.)

If we adopt the deletion-without-renormalization approach, it is obvious that the Borda count does not need an instant runoff. Deleting candidates and their fractions, without changing any of the undeleted fractions, will leave the totals unaffected; the winner will be as shown by the original Borda count.

With contest analysis, we have strengths computed for candidates and voters. These strengths will change with any adjustment made to any vote quantity--the whole structure of interlocking strength vectors is a representation of the election. Votes for weak candidates play a role, and moving them around will introduce a distortion in our picture of the thinking of the voters. The picture is complete only when all votes are left in place. That being the case, there is no need to avoid declaring the winner of the election to be the candidate with the greatest applied strength--analogous to the plurality winner in a Borda count. Putting this another way--one is not allowed to tamper with valid input data in a mathematical problem (by adjusting, deleting, or moving it) in order to produce a solution more to one's liking.

If the IRV method has the drawback of requiring too much from the voter--ordinal ranking of candidates--the contest-analysis method would seem to have even more of that same drawback, since it requires *cardinal* ranking of candidates. But, when a neat way of obtaining cardinal rankings is available--as described above with the Electoral College--the contest-analysis scheme becomes very attractive.

Borda and Condorcet considerations

The Borda count--figuring the winner from the column totals on the table above--is one of the two main traditional methods of processing votes. The other main method, Condorcet, consists of a count of winners in pairwise contests. This count of winners is the traditional Condorcet method, but I claim that another form of the Condorcet method is more suitable when the voters express cardinal preferences instead of just ordinal ones. With *ordinal* Condorcet (using ordinal preferences), there can be disagreement between Borda and Condorcet results--a famous fly in the ointment of vote processing. But, with the *cardinal* Condorcet method, one counts the *differences between preferences* in pairwise contests (positive and negative numbers, not just 0 and 1) and Condorcet and Borda are always in agreement on preference order.

So, if Borda and cardinal Condorcet methods agree with each other, why not just stick with Borda and not consider the new vector approach of contest analysis at all? The answer is that contest analysis can produce a result different from the other two: It considers the fact that a voter's strength will depend upon his pattern of voting--something which is ignored by Borda and Condorcet. Also, it is often desired to arrive at cardinally ranked election outcomes--which cardinal Condorcet cannot do at all and which Borda cannot do well.

Conclusion

Presented here has been an outline of a new way of conducting a presidential election, a way in which the present electoral system is preserved. By removing winner-take-all from the electoral voting, it encourages candidates to campaign everywhere, not just in "battleground states". Then, it repairs the present processing problem in elections where voters can rank the candidates. (This it does with the new contest-analysis algorithm.)

A major obstacle standing in the way of its adoption, however, is the fact that contest analysis is an entirely unprecedented procedure which must be provided for in a Constitutional amendment--a very big order. Before any effort toward amending the Constitution can begin, there must be consensus within the academic community on the superiority of the new approach, then consensus within the legal profession, and finally some level of acceptance among politicians. To indicate how difficult it will be

to get consensus, I would just state here that my attempts to obtain support from key contributors to the field of social choice in academia have failed. Mild interest has been expressed, but no endorsement has been offered, and everybody seems content to go on working in the field as they were before-- despite the fact that the field is in obvious need of repair. As a scientist trained in one of the "hard sciences", where any new finding is immediately pounced upon for either verification or refutation, I am puzzled by this situation.

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