Research Article

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Reflecting People's Will: Evaluating elections with computer aided simulations

https://doi.org/10.1515/openps-2021-0021
received May 26, 2021; accepted June 25, 2021.

Abstract: The aim of this study is evaluate various single winner voting systems with the help of computer aided simulations. The impact of phenomena such as strategic voting, spoiler effect and centre squeeze are studied on various election systems such as First Past the Post, Ranked voting, Approval voting and Score voting. The democratic process gives great moral legitimacy to the winner as they are deemed to be chosen by the people, ergo the election system too needs to accurately reflect the will of all the people. Single winner systems or "winner takes all" systems have the advantage of decisive governments as compared to proportional systems but by its construct exclude parliamentary representation to a large percentage of voters who ended up on the losing side. It is therefore even more important that the single winner system mirror the voters mandate as accurately as possible. I conclude after evaluation that alternate systems such as Instant Runoff or Approval voting could be considered in lieu of the FPTP systems as they have fewer flaws and are more likely to give a truer representation of electorate's choice.

Keywords: Strategic voting; Elections; Democracy; First Past The Post (FPTP); Plurality; Approval Voting; Score Voting.

1 Introduction

In the history of Indian elections, the number of seats won by a party has never matched the percentage of total votes received by that party. This anomaly is not just limited to India, but it is found in nearly every plurality based democratic system. One of the most prominent illustrations of this phenomenon in recent history is the 2016 US Election, in which Hillary Clinton won the popular vote but lost the election. This begs the question as to whether there are other alternative single winner voting systems which reflect the choice of the voters more accurately.

2 First Past the Post

The First-Past the Post (FPTP), or 'winner takes all', voting system works such that whoever receives the most votes wins the election even if they don't reach the 50% mark. This system is followed by the UK (House of Commons), the United States (House of Representatives), India (Lok Sabha) among others. This system is usually implemented at a constituency level, in which the winner of the constituency receives a seat in Parliament. The elegance of the FPTP system lies in its simplicity. The voter is given the simple task of just one choice. This is a great advantage in developing nations with semi-literate populations, or in managing large, complicated paper-based elections such as in the US. These robust democracies prove that FPTP does work, albeit with some major flaws. This paper seeks to discuss these flaws and alternatives to this system.

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2.1 Flaws

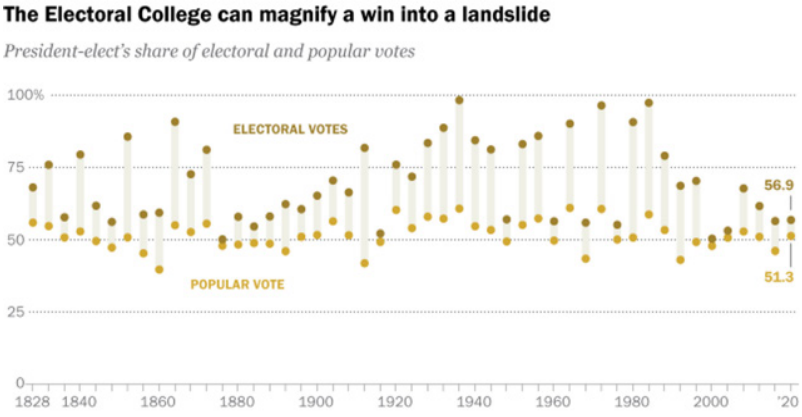
2.1.1 Inequity

The system fosters inequity in that all votes do not count the same. For example, voters in swing states have a far greater effect on the outcome of the election than voters in a state with clear majority. As an illustration, in the 2020 US elections, where California was a significant majority blue state, incremental voters had no impact in the overall outcome for California. However for closely fought swing states, every undecided voter was worth their weight in gold for both sides, which is further amplified by the winner take all electoral college system. This system exponentially increases the value of the fence sitting voter in these swing states and creates the moral hazard of politicians soliciting voters of such swing constituencies, often with inducements.

2.1.2 Disproportionate Representation

This anomaly is best illustrated by an example. In the 2019 general elections in India the Bhartiya Janata Party (BJP) won by a landslide. The ratio of votes received between BJP and the Congress Party was around 2:1 (229,076,879 : 119,495,214, still considered a landslide in the Indian multiparty system) but the ratio of seats won was almost 6:1 (303:52). Congress similarly benefitted the same way when they were the dominant party in the past decades.

The US faces a similar predicament as the graph below (courtesy of Pew Research Center) shows the striking divergence of electoral and popular votes.



The real problem with this divergence of popular vote and electoral vote is that as a democracy depends on representation in parliament, and the disparity in seats won can change a country's policy significantly, thereby subduing the voice of the 'losing' voters. This to my mind undermines the core principle of democracy, that of accurately reflecting the wishes of the people.

2.1.3 Majority reversal

In some cases, a phenomenon of majority reversal is observed. The 2016 elections in the US are a great example of this. The overall majority had voted for the Democratic Party with Hillary Clinton amassing 48% of the votes to Donald Trump's 46%, however the Democratic party won only 227 seats to the 304 seats by the Republicans. Some other examples of these phenomena include Canada in 2019, Ghana in 2012, New Zealand in 1978 and in 1981 and the UK in 1951.

This occurrence indicates that narrowly winning seats and losing large in other constituencies is a more efficient strategy to optimise vote distribution than winning large in any constituency, leading to other political banes such as gerrymandering. The probability of majority reversal is higher in close elections (**Geruso, M et al, 2019).**

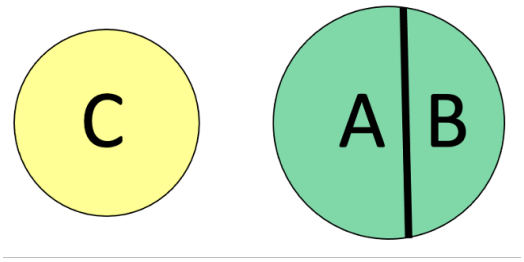
2.1.4 Duverger's Law

Duverger's Law states that in single ballot plurality elections, with constituencies represented by a single member (such as that of FPTP) will tend to favour a two-party system. This model works well with a small number of parties and for India this law should be applied to individual constituencies where it is often a race between two to three parties. The main idea behind this law is that people consider voting for a third party as a wasted vote which disincentivises third party candidates from spending resources, further leading to less people taking them seriously. Most simple plurality systems end up facing this vicious cycle and trend to a two party dominant system.

A simple summary of the infeasibility of a >2 Party Systems in a plurality democracy

The explanation of Duverger's law is often cited using the phenomenon of strategic voting **[Grofman, B et.al, 2009]**. Imagine that there are 3 parties A, B and C in a constituency of 100 people. A poll shows that 49 people are going to vote for A, 48 for B and 3 for C. The three voters for C strongly dislike A and are indifferent to B. To them it is clear that C has no chance of winning, so they change their vote and decide to vote for B instead. This way B will win the election but they are not actually content with the result and are just happy that A lost. Voters will end up voting based on who they think others will vote for, not based on who they want to elect, leading to less satisfaction with the government and making it extremely difficult for a third party to become a serious alternative.

Strategic voting is magnified by the Spoiler Effect. The spoiler effect occurs in all systems to some extent; usually when multiple candidates share similar ideologies. Since people can only vote for a single candidate, they are forced to choose between them if they support those ideologies, leading to a splitting of the vote. Imagine that 60% of the country preferred dogs and 40% preferred cats. Candidate A and B both support dogs and receive 25% and 35% of the votes each. Candidate C who is in favour of cats will still have 40% of the votes and since plurality systems by definition do not require a majority (over 50%), Candidate C will win although most people supported the principle (or ideology) of A/B. This is a sub optimal result and leads to no voice for a large percentage of the population which ended on the losing side.



SPOILER EFFECT : Candidates who support dogs are in green, cats in yellow. The total area of the circles indicates number of votes received. Area of (C) < Area of (A+B) but A(C)>A(A)>A(B).

Another more subtle impact of the spoiler effect is that spoilers with extreme ideological positions make the main stream centrist parties appear more middle ground than they would have been without the spoilers, thereby subliminally enhancing their centrist appeal(**Wang et al, 2018).**

For all these reasons I believe the flaws with the simple plurality (FPTP) system are significant. There is of course tremendous inertia to make changes to the current system which seem to work on the surface, however change must be considered if the alternatives come closer to meeting the will of the electorate.

I will now discuss alternatives with the help of a Java simulation using swing to see whether other single winner systems measure up better to this objective.

The code for the simulation is provided below.

(https://github.com/dv145/VotingSystems)

3 Ranked voting (Instant Runoff Voting)

Instant runoff voting is widely considered to be the most feasible alternative to plurality voting. Australia and New Zealand are some examples of countries that hold their main elections in this fashion while several other countries use it for smaller polls such as India (Election of the President), Canada (primaries) and even the United States has recently implemented the system in some local elections and regional primaries.

It essentially works by ranking candidates based on voter preference. In this system, two scenarios may occur:

1. A candidate receives >=50% of the first-place votes and they are elected.
2. No candidate receives 50% of the first-place votes. Then the candidate with the least votes is eliminated and the votes they received are distributed amongst other candidates based on their second choice.

This process continues till a candidate finally receives a majority of the votes.

3.1 Advantages Over Plurality Voting

- Reduces strategic voting and spoiler effect.
- Provides a more accurate representation of votes and therefore higher voter satisfaction.
- Promotes majority support as at least 50% of the voters need to have approved a candidate
- Discourages negative campaigning

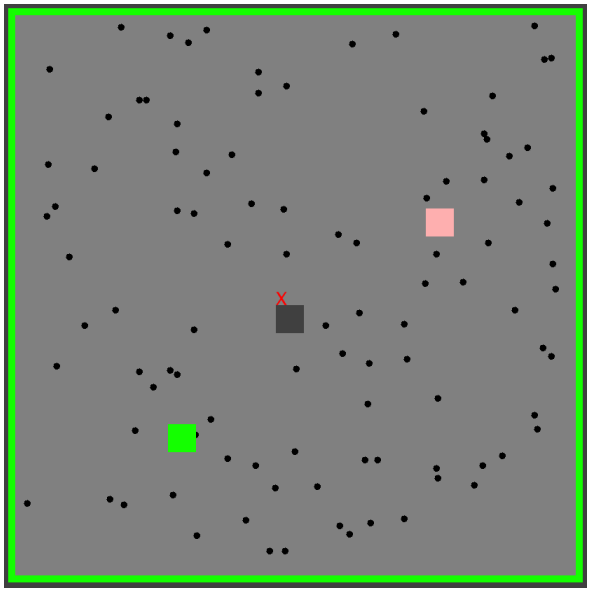
3.2 Flaws

Instant Runoff Voting does correct for the Spoiler Effect and strategic voting but when the candidates roughly form a line on the political compass (something that voters tend to perceive when classifying candidates as left or right), a phenomenon known as centre squeeze occurs.

Imagine that there are only two candidates A and B and 100 voters. A is to the extreme end of a political spectrum, while B is in the centre. A gets 38 votes and B receives 62.

Now consider a new candidate C enters the election. C is at the opposite end of the spectrum as A. The new vote share is as follows : A – 38, B – 29, C – 33. (Note that all the votes for C are taken from B, voters who are against A).

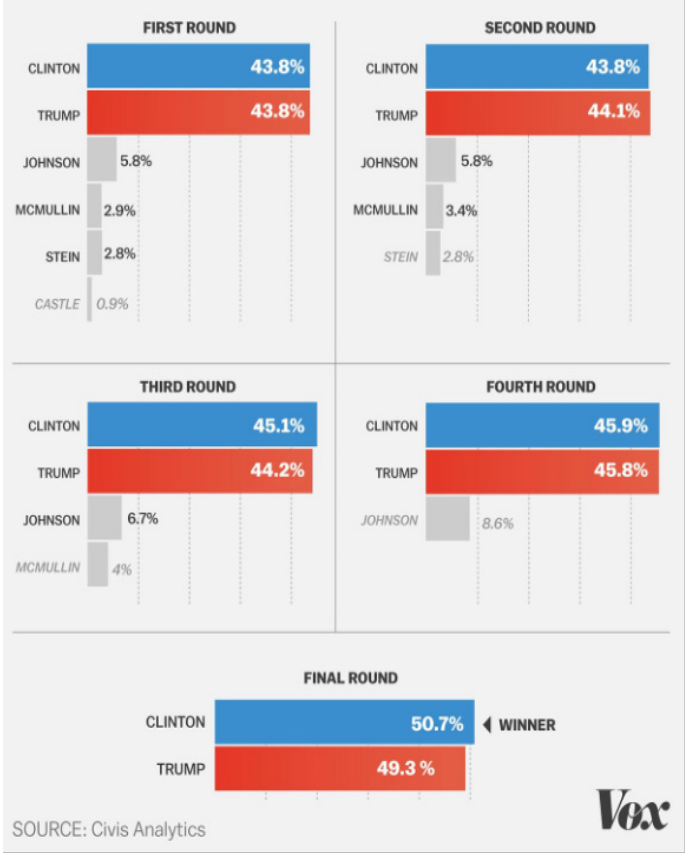
Now B is eliminated as they have the lowest share of the first preference votes and get weeded out in the ranking system. While B will be the second preference for all of voters who voted for C, that counts for naught. After B is eliminated as it sits in the middle of pollical spectrum it is observed in this simulation that 13 of B's 29 votes go to A and 16 go to C. Tallying these new transferred votes, the new vote share becomes A – 51 and C – 49. So a candidate who lost comprehensively in a two way runoff with B is now the winner and B, the comprehensive winner is eliminated by a thin margin.



Simulation 1 : Shows instant runoff the centre squeeze phenomenon in instant runoff voting. The black dots represent voters and the coloured squares are candidates. The distance from the candidates are reflective of ideology i.e. the closer a dot is to a candidate, the higher they rank said candidate.

Instant runoff corrects for the spoiler effect to some extent and reduces strategic voting, however, centre squeeze is a real issue in a three legged race. With two dominant parties, it works well in that it establishes a clearer winner than plurality elections. It has however been observed that the long term end results are likely to be similar, with the same major parties and elimination of smaller parties, similar to plurality voting (but to a lesser extent) as has been witnessed in the Australian elections. A great disadvantage is that instant runoff voting will require voter education and more effort in electoral management given the iterations involved in tabulations. Instant runoff voting should not be seen as the infallible saviour to democracy but it is certainly, in theory at least, superior to plurality voting **(Langan P, 2005)**.

A great illustration of how this system better represents the popular vote is shown in the following simulation of the 2016 US elections.



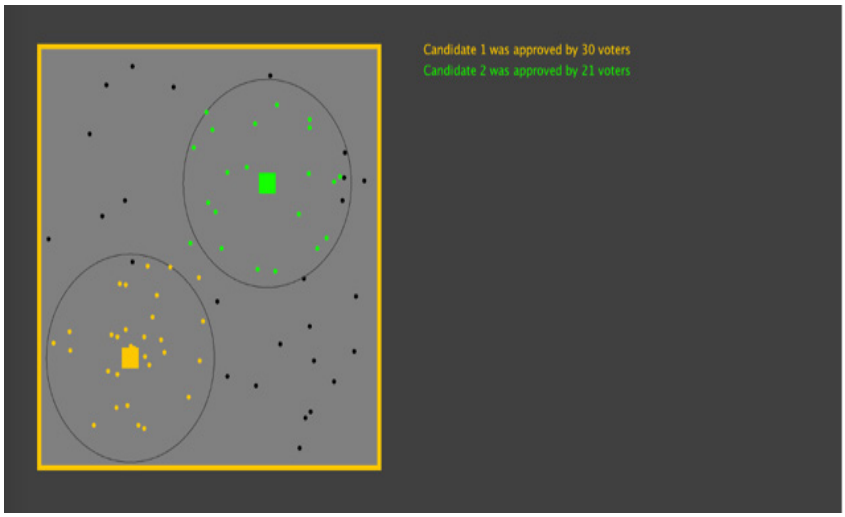
The 2016 US Elections if They Were Instant Runoff (via Vox) – Hillary wins both popular and election as she crosses 50%

Some other lesser-known forms of ranked choice voting are Borda Count (adding up the rank numbers and the lowest total wins like in golf) used in Slovenia and Concordet voting which pits the candidates against each other in a sort of tournament and the majority wins (this always picks the theoretically 'best' candidate but sometimes fails to find a winner which means it requires a backup system to fall back on, therefore it is not used anywhere in the world.)

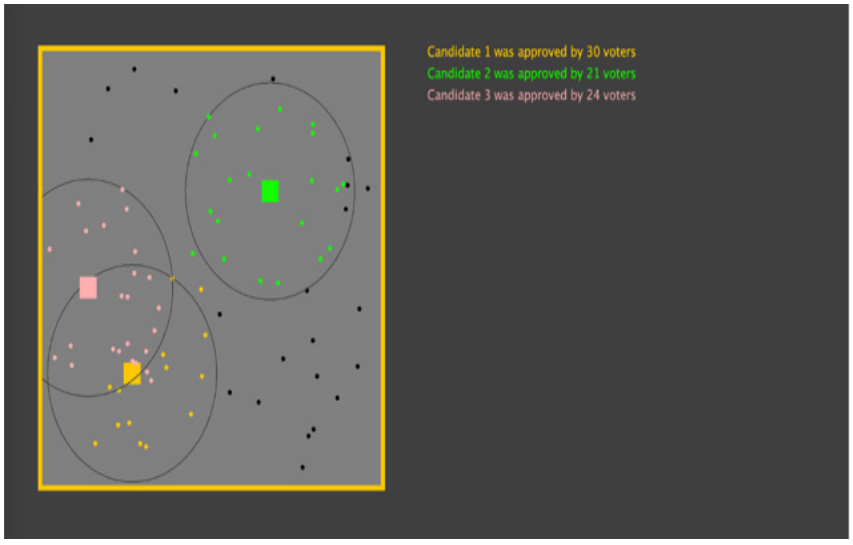
4 Approval Voting

In approval voting the candidates simply select every candidate that they approve and the winner is the candidate approved by the most voters.

Consider a political spectrum (as shown in grey) where two candidates 1 and 2 (represented by squares) lie. All voters (dots) that lie within the circles surrounding the candidates approve said candidate. The border is the same colour as the square of the winner.



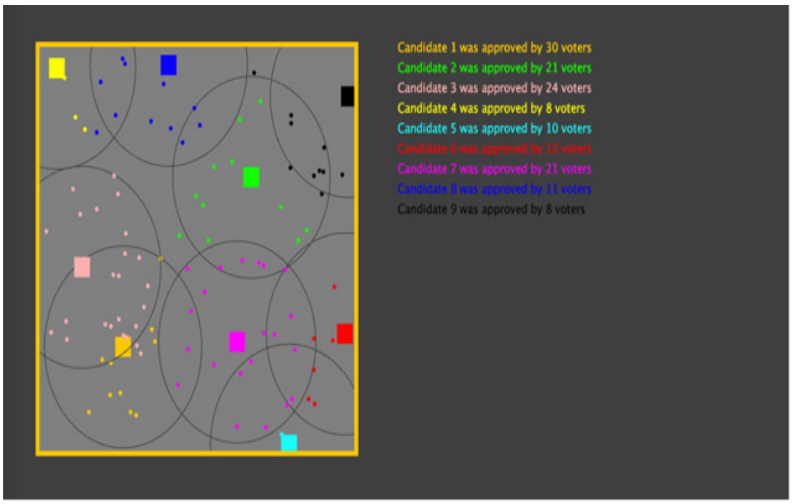
Java Simulation 2a : In this image Candidate 1 wins the election as they are approved by the most voters.



Java Simulation 2b : Now a new Candidate 3 enters the election. Note that they have a similar policy to candidate 1.

Candidate 1 still receives the same number of votes and wins the elections despite some of voters voting for Candidate 3 as well. More voters approve of 3 than 2, therefore Candidate 3 will receive more seats in parliament than 2 and the total representation will be accurate and immune to the spoiler effect and centre squeeze. The black dots represent the people that did not vote or voted for other parties.

This means that multiple parties and policies can thrive in an approval voting chosen democracy, without experiencing centre squeeze.

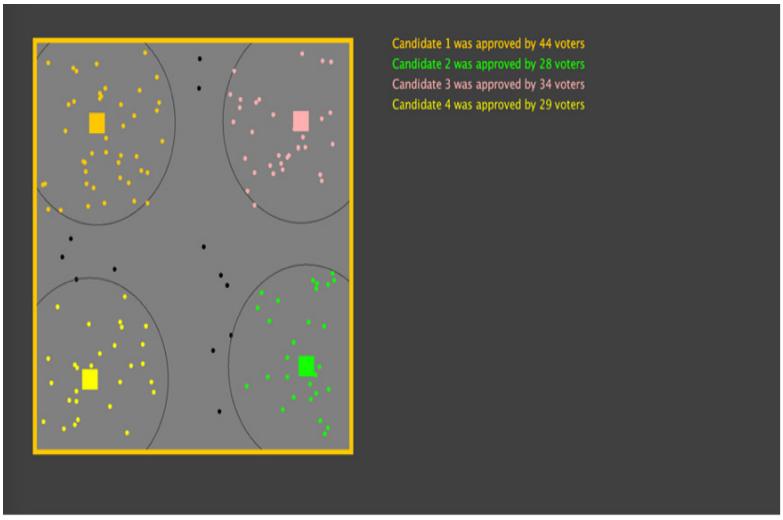


Java Simulation 2c: A multi-party depiction of the approval voting system.

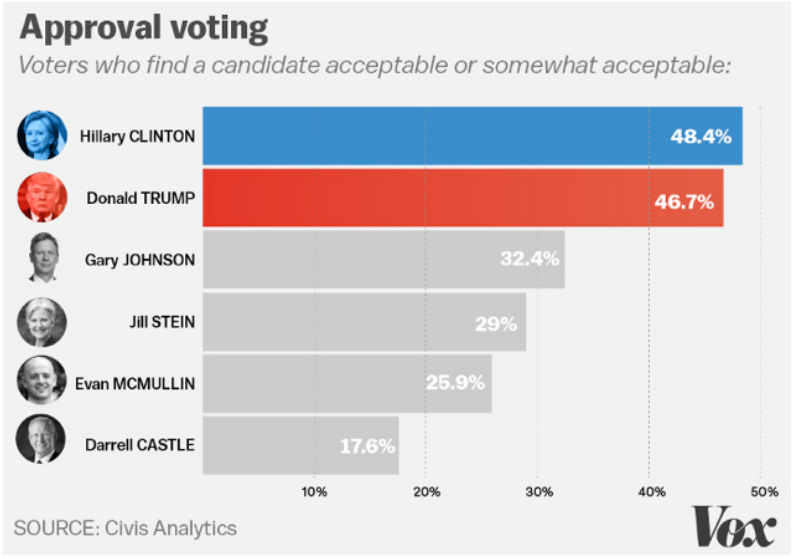
4.1 Flaws

One key flaw with this system is that, similar to simple plurality voting, a majority (>50% of the vote) is not needed to win the election. Given increasing polarization between left (or centre) and right is in most countries, this may essentially reduce to plurality voting with some added formalities.

Another flaw of this system is that the votes of voters who approve of multiple major candidates are essentially worthless as they do not distinguish sufficiently between choices and bring everyone up, therefore they should strategically disapprove of their least favourite candidate.



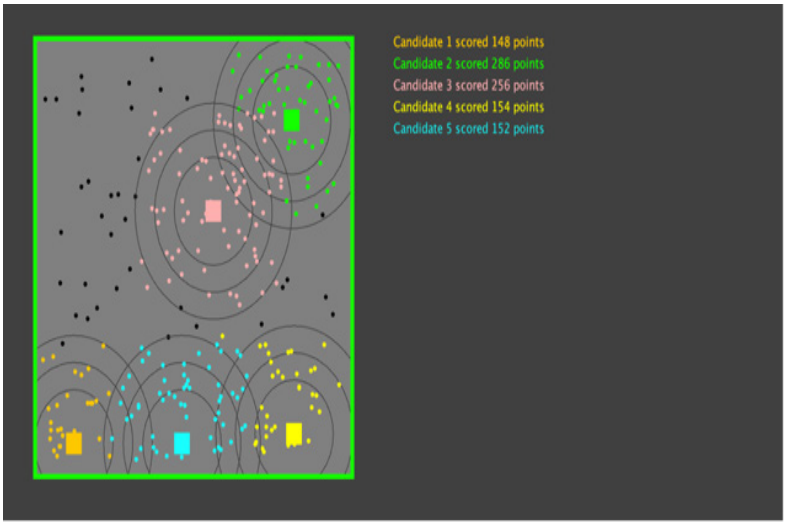
Java Simulation 2d Approval Voting is Essentially Plurality Voting When There is No Overlap (Polarising Policies)



The Speculated Outcome of The 2016 US Elections if it was Approval Voting (via Vox) Note the massive increase in vote shares of third party candidates, however the results are no different from plurality

5 Score Voting

In this method, voters score each candidate based on their approval of them. It may be thought of as a refined form of approval voting with some elements of ranked choice voting. The scoring system may be on any scale but for the sake of simplicity the following simulation scores voters on a scale of 1 to 3.



Java Simulation 3 : In this simulation three circles are drawn around each candidate (squares). All the voters (dots) within the outermost circle are worth 1 point, the middle circle 2 points and innermost circle 3 point. These points are added up and the candidate with the highest total tally wins.

5.1 Flaws

Score voting shows the same flaws as approval voting except it reduces strategic voting as voters may select all candidates and score them based on their preference, allowing them to vote for multiple candidates they approve but still express the degree of their approval. It is important to understand that strategic voting is still not eliminated as voters can strategically assign scores to candidates.

Another important flaw of all the aforementioned systems except for plurality voting is that they require public education. Voter education and complexity are still barriers that we need to overcome in order to even consider the implementation of these systems as feasible, especially in developing countries.

6 Conclusion

This paper discusses only single winner systems, comparing the plurality based system with more elaborate alternatives. Single winner systems have worked well for the most thriving democracies such as Australia, India, USA and France. They provide decisive governments and clear mandates, usually without the need for extensive coalitions. However within the construct of single winner systems, variations exist to determine the single winner. I have demonstrated through this paper that the real risk of deviation between popular vote and electoral votes can be partially mitigated by modifications such as IRV, approval voting or score voting. These systems, though more complicated reflect a more nuanced view of the underlying votes. It would be pertinent to mention here that despite the advantages of single winner systems, several countries have successful multi winner proportional systems or even hybrid systems. One to call out is the German system, which seeks to blend the best of both worlds with a plural individual vote at the constituency level and a proportional system with a second vote for the party. The Bundestag first has seats allocated to constituencies and the remainder being divided to maintain proportionality of the second party vote. A system of this nature, though slightly complicated for voters, does meet the gold standard of a democracy - that of giving voice to all its people, not just the majority. Of course, to make any changes either in the single winner method or a proportional type system will require wide support across elected representatives currently in power, thereby making any change difficult unless there is a groundswell of opinion in the favour of such change.

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