Problems with Single Transferable Vote

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Thus far the debate around single transferable vote (STV) has focused on comparing it with the current system in British Columbia. There has been little discussion about the *prima facie* merits and deficiencies of STV. As much as the current 'first-past the post' system is deficient BC-STV is worse.

On May 17, 2005, the BC-STV referendum failed.[1] While a simple majority was in favour, less than the needed 60% of the electorate opted for it. In 77 of 79 electoral districts a majority was in favour, exceeding the second threshold of 48 districts. Since then the government of BC has committed itself to holding another referendum on STV. Premier Gordon Campbell made the following statements on April 27, 2006 in the Legislature regarding the date of the referendum on electoral reform:

> When British Columbians vote on STV on May 12, 2009, they will have before them the new electoral boundaries and representation plan that would apply. ... If [BC-]STV is chosen to replace our current electoral system in that referendum, it will now be implemented for the scheduled 2013 general election.[2]

Introduction

Single transferable vote is also known as the Hare System[3], or Hare-Clarke System, was first proposed as an alternative to first-past-the-post in the eighteenth century. While, John Stuart Mill said of it is "a scheme which has the almost unparalleled merit of carrying out a great principle of government in a manner approaching to ideal perfection". Others have said it is "the second worst voting system ever devised".[4] This might be too harsh an assessment but the shortcomings of the system are well documented. These include:

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[1] http://www.cbc.ca/bc/story/bcv_referendumresult170505.html

[2] *BC Legislature HANSARD, 2006 Legislative Session: Second Session, 38th Parliament*, Vol. 10, No. 2, p. 4128.

[3] Thomas Hare (1806–1891) was an English barrister who published two books on theory and reform of election methods.

[4] Michael Dummett, Logician, Oxford University, also described STV as "quasi-chaotic, ... exceptionally erratic in ... operation, producing results that are virtually random"

1. STV can be manipulated through redistricting. That is a candidate or party can win in a large district but lose in a plurality of districts equal to the large district. Alteratively, they win in the small districts but lose in the large. Hence, victories can be engineered at the bureaucratic level when boundaries are decided upon.

2. STV elects many MLA (*i.e.*, 2–7) from one district reducing local accountability. That is it leaves doubt in the mind of the constituent as to who is their MLA. Further, it allows MLAs to drop pleadings from constituents because they assume another MLA will take up the pleading.[5] This feature destroys the most basic advantage of the Westminster model.

3. STV allows for parties to direct supporters to short their ballots, *i.e.*, mark "1" and "2" in a two MLA district defeating the spirit of STV.

4. STV allows for no-show paradox in which act of numbering a candidate last could make them a winner.[6]

5. STV allows for thwarted-majority paradox in which a candidate who could win in a set of pair-wise elections cannot win under STV.[7]

6. STV is non-montonic, which means voters can penalize a candidate for ranking them 1 instead of 2, or 2 instead of 3.[8] *I.e.*, more votes can create a loser as apposed to a winner.[9]

The final deficiency is counter intuitive, even paradoxical, and is outlined below.

In STV candidates vie for quota. Quota is calculated by the following formula:

$$Q = \left\lfloor \frac{V}{S+1} + 1 \right\rfloor,$$

where Q is quota, V is voters not votes, and S is number of seats for the district. Quota is the minimum number of first-placed votes such that the maximum possible number of candidates can be elected in round 1 without electing more than the open number of seats.

If a candidate reaches quota their surplus if any is redistributed. If no candidate is elected in a round, then the candidate with the lowest number of votes is eliminated and their votes are distributed to the candidates their supporters ranked as lower.

[5] This is the major objection by pundit Bill Tieleman. He also adds "The short version of criticism of STV is that it is complicated, confusing, prone to errors and delay, and not truly proportional, and that it reduces local accountability, increases party control, and allows special interests to dominate party nominations." See, B. Tieleman, 2004, "Single Transferable Vote Equals Multiple Problems", *Georgia Straight*, published 10-Nov-2004.

[6] This means because you marked a candidate as 'last' say as 16 in a 4 MLA district this candidate gets elected even though they barely have your approval. Therefore, you would have been better off not showing up at the poll.

[7] Also called "inability to ensure victory of Condorcet winner". See, footnote 3 of, Farrell, D.M., and I. McAllister, 2003, *Australian Journal of Political Science* **38**, pp. 479–491.

[8] Also called the for the "perverse social choice" paradox.

[9] Doron, G., and R. Kronick, l977, "Single Transferable Vote: An Example of a Perverse Social Choice Function," *American Journal of Political Science* **21**, pp. 30l–311.

Example of STV in Action

Here is an election under STV for what two fruits to buy.[10] There are 26 voters. There are four fruits: Apple, Pear, Orange, and Lemon. The votes are:

Class	Number of Vote	Preferences (Best to Worst)			
A	9	Apple	Pear	Orange	Lemon
B	6	Orange	Lemon	Pear	Apple
C	2	Lemon	Orange	Pear	Apple
D	4	Lemon	Pear	Orange	Apple
E	5	Pear	Orange	Lemon	Apple

After round 1, Apple is elected because 9 votes[11] is quota for this election. No surplus is transferred.[12] The standings now are:

Class	Number of Vote	Preferences (Best to Worst)		
B	6	Orange	Lemon	Pear
C	2	Lemon	Orange	Pear
D	4	Lemon	Pear	Orange
E	5	Pear	Orange	Lemon

Next, it is clear nobody has quota so the candidate with the lowest number of votes is eliminated. In this case Pear, **NB** it is not Lemon because Lemon support is in classes C and D. This yields the following result.

Class	Number of Vote	Preferences (Best to Worst)		
B,E	6+5	Orange	Lemon	
C	2	Lemon	Orange	
D	4	Lemon		Orange

Orange is over quota and the two fruits have been chosen under STV. The example is not contrived, as the low number of votes can be multiplied by a thousand and accurately represent an election.

Example Counter Intuitive Result Under STV

Take the example of the election above. Again using STV decide which two fruits to buy with 26 voters. However, instead of class C have class C′ which now ranks Orange preferentially to Lemon. The votes are:

Class	Number of Vote	Preferences (Best to Worst)			
A	9	Apple	Pear	Orange	Lemon
B	6	Orange	Lemon	Pear	Apple
C′	2	Orange	Lemon	Pear	Apple
D	4	Lemon	Pear	Orange	Apple
E	5	Pear	Orange	Lemon	Apple

[10] This examples is a modification of an example from P. Hoffman, 1988, *Archimedes Revenge*, Ballantine Books.

[11] Because $S = 2$, and $V = 26$.

[12] The transferring of surplus does not effect this example, so it is constructed without it for simplicity. In general the transferring of surplus can lead to the "wrong" result if done incorrectly. However, under the proposed BC-STV the transferring will be done correctly. That is transferred surplus will have appropriate weighting or transfer value.

Again, Apple is elected after round 1. No surplus is transferred. Yielding:

Class	Number of Vote	Preferences (Best to Worst)		
B	6	Orange	Lemon	Pear
C′	2	Orange	Lemon	Pear
D	4	Lemon	Pear	Orange
E	5	Pear	Orange	Lemon

The candidate with the lowest number of votes is eliminated. In this case, as apposed to the last case, it is Lemon with 4 votes. The final results are:

Class	Number of Vote	Preferences (Best to Worst)	
B	6	Orange	Pear
C′	2	Orange	Pear
E,D	5+4	Pear	Orange

Pear is over quota and the two fruits have been chosen under STV. This example could not be more counter intuitive. The only difference between the two examples is two Lemon supporters (C) switched there first vote to Orange and that cost Orange the election. **More votes for Orange cost Orange the election.** Now imagine if these candidates were persons and not fruit. The act of giving more support to a person can cost them the election. That is not a feature of an open and democratic system.[13]

This is a pathological example but it is not contrived. It could happen. The chances of occurrence are lower than winning by vote splitting under first past the post but non-monoticity is a feature of STV. A variation of this situation could happen under BC-STV.

Conclusion

The question in the referendum was and likely will be:

> Should British Columbia change to the BC-STV electoral system as recommended by the Citizens' Assembly on Electoral Reform?
> ⎵Yes ⎵No

Given all the deficiencies of STV enumerated above and especially because of non-monotonicity, any informed voter, despite any misgivings of the current system, could feel comfortable voting no. Indeed, the may even urge others to do the same. STV does not represent significant progress and it comes with costs. Lack of transparency is never a cost that should be accepted lightly.

[13] This feature makes STV non transparent. Even worse detecting that this has occurred is an NP-Hard problem. So a voter is unlikely to know when they have been cheated. See, `http://www.isye.gatech.edu/people/faculty/John_Bartholdi/papers/stv.pdf`.