

# A new way to break STV ties in a special case

Earl Kitchener  
ekk@talk21.com

## 1 Proposal

The simplest example of a particular type of tie has three votes, AB, BA, CA, for one place. The quota is 1.5, and so, under the normal rules, one candidate is selected at random for exclusion, giving the chance of election as  $2/3$  for A and  $1/3$  for B. If it is B, A will be justifiably aggrieved, and opponents of STV will argue that a random choice has given a perverse result.

A general rule to cover cases of this type would be to say that when all continuing candidates are tied (whether for exclusion or for election), they are all to be excluded, but only for the current preferences, all later preferences being unaltered. If voting is seen as a process of cutting off the top preference of each vote as soon as the fate, election or exclusion, of the candidate concerned has been decided, and reducing the value of the vote in the case of election, then this proposal introduces a new type of exclusion in which the top candidate is cut off in the normal way, but the candidate is not removed from any other votes.

The above votes, but with two places to be filled, give an example of a tie for election. Under the normal rules, whichever candidate is elected first, each of the other two has an equal chance of second place. So each of the three candidates has  $2/3$  of a chance of being elected. Under the proposals, A wins with 2 votes, B is elected with 1, and C gets none.

A possible objection is that the proposal violates the rule that later preferences must never be looked at until the fate of earlier ones has been decided, and there is a danger that it might discourage sincere voting, but this seems unlikely, and is out-weighted by its advantages if voting is sincere.

If Borda's method of counting votes is used for tie-breaking, this proposal would not be necessary; but it

has the advantage of being less of a departure from the present system.

This tie is very unlikely except in small elections, but it might well occur if partners are voting for a senior partner. If the proposal is considered too sweeping, it could be restricted to the case where the voters are the same as the candidates, and they each vote first for themselves. This would still give most of the benefits.

A powerful test of any proposed change to vote counting is, "Would it, compared with other rules, make any voters or candidates justifiably aggrieved, or lead to insincere voting?" This proposal gains on the first test, and only loses slightly on the second. Allowing parties to put up more candidates than they can hope to get in, and discouraging tactical voting, are also important, but not likely to be affected by changes in tie-breaking rules.

## 2 Editorial notes on tie breaking

The question of ties with STV has arisen several times in *Voting matters*. The previous material can be summarised as follows:

- Earl Kitchener in Issue 11 of *Voting matters* advocates the use of Borda scores [1].
- David Hill in Issue 12 argues against the use of Borda scores [2].
- Jeff O'Neill in Issue 18 notes that many rules use a first-difference rule, but he advocates a last-difference rule [3].
- Wichmann considers the use of computers in Issue 19. Here, the suggestion is that no specific rule is needed and that the computer can try all options and the result taken can be the most likely one [4].
- Earl Kitchener has returned to the subject with an alternative proposal to Borda scores in a special case which appears above.

## 2.1 Existing rules

The ERS rules [6] and the Church of England rules use the first-difference method in an attempt to break a tie.

The Meek algorithm [7] uses a deterministic algorithm based upon a random number generator to break a tie. No manual intervention is used. The New Zealand variant uses a similar method.

When the Church of England rules are applied using a computer, then the software must break the ties without manual intervention in a manner which is not defined (by the rules).

For Ireland, the manual rules are being computerized and have been used for three trial constituencies in 2002. Here, tie-breaking invokes a manual procedure, ie, the computer software does not break the tie.

A curiosity is that in the Irish rules if when allocating surplus remainders there is a tie of the fractional part, the surplus vote is given to the candidate with the largest total number of papers from that surplus; if that is also tied then first difference is used.

It seems that a Condorcet comparison has been used to resolve a strong tie between A and B (i.e. tie can't be broken by first/last difference) in very small manual counts i.e. examine the papers to see how many times A is ahead of B compared to vice versa.

## 2.2 Discussion

This section was produced as a result of an email debate; those contributing included: James Gilmour, David Hill, Michael Hodge, Joe Otten, Joe Wadsworth and Douglas Woodall.

A number of issues arise from tie-breaking:

**Are tie-breaking rules needed?** Surely better to have a rule than toss a coin?

If a rule like first-difference, fails to break the tie, then drawing lots or some computer equivalent is needed unless we allow later preferences to be looked at. But the disadvantages remain formidable as we are then unable to promise that later choices cannot upset earlier ones. These extra tie-breaking rules complicate the counting process, since ties can arise in more than one way. It seems that just drawing lots would be adequate.

If we are saying that for:

1	AB
1	BA
1	CA

fairness demands A is elected, the same would apply to

1000	AB
1000	BA
1000	CA

So what about

999	AB
1000	BA
1000	CA

Or even

1000	AB
1001	BA
1000	CA

It seems that if the logic of looking at later preferences is sound and compelling, then they should be considered in these later examples. They are all almost identical with almost the same support for A, yet B wins with probability 1/3, 1 and 1/2 respectively. If the 1/3 should be 0, on the grounds of later preferences, perhaps the 1 or 1/2 should be reduced too?

There seems nothing in the logic of the argument that limits it to ties. Why not judge all exclusions on the basis of 'probability of election' in some sense given an analysis of all later preferences, limited only by a 'probably-later-no-harm' principle defined statistically?

This would be a rival to STV, to be considered on its merits, without muddying the waters by introducing features of it to STV for extremely marginal benefits. The claim being made here is that we want the Condorcet winner (or a similar result in the multi-seat case) rather than the AV winner. The argument is quite separate from tie breaking as such, and Condorcet-type rules need paradox breakers as well as tie breakers. If anything of the sort is to be considered, then Sequential STV [8] could be the starting point.

### If rules are used, what criteria are appropriate?

There is significant opposition to using later preferences in breaking a tie, see [2], for instance. One can argue against this on the grounds that it is hard to observe the difference between *any* tie-breaking logic and a random choice.

There was significant support for using the last-difference rule as opposed to the first-difference rule. One correspondent wrote of the latter, "It would be a bit like requiring the Speaker, in the event of a tied vote in the House, to cast his vote

not in favour of the status quo, but in favour of the outcome that more closely resembled the very earliest legislation ever passed on that question.” But it can also be argued that any such rule is arbitrary and, if it is not necessary to change, it is necessary not to change.

The first-difference rule can have the effect of giving preference to first-preference votes as opposed to transfers — this seems against the spirit of STV. With a computer, one can experiment with different procedures for breaking a tie. A reasonable criterion would be the method that most reliably resulted in the election of the candidates with the highest probabilities of being elected from breaking the ties in all the possible ways. The special case that Kitchener uses would always give the optimal result, but it is unclear how often that special case arises.

The use of Borda scores is not liked by the supporters for STV, but it is unclear if similar perverse results could be obtained if Borda scores were introduced only to break ties.

The issue of voter satisfaction has been raised. It certainly seems unsatisfactory that all the existing rules will report a random choice for elections in which the choice does not change the candidates elected. This is quite common with candidates with very low numbers of first-preferences. However, the following could be proposed to measure voter satisfaction in a tie-breaking rule:

- the method which maximizes the voters contributing to those elected;  
Maximising voters seems to accord to the *inclusive* view of STV which allows voters to be added to those supporting an already elected candidate as occurs with the Meek rules.  
The conventional approach of the manual rules is *exclusive* in which voters are not added to the list of those supporting an already elected candidate.
- the method which minimizes the non-transferable votes.  
The conventional practice with the manual rules is to minimise the non-transferable votes by considering transferable votes first when transferring surplus. In contrast, the Meek rules do not do this. However there are those who would claim that any proposal artificially to reduce non-transferables is immoral, in that it distorts what the voters have asked for.

### 3 References

- [1] Earl Kitchener. Tie-Breaking in STV. *Voting matters*. Issue 11, pp 5–6. (see <http://www.mcdougall.org.uk/VM/ISSUE11/P3.HTM>)
- [2] I. D. Hill. Tie-breaking in STV. *Voting matters*. Issue 12, pp 5–6. (see <http://www.mcdougall.org.uk/VM/ISSUE12/P2.HTM>)
- [3] J. C. O’Neill. Tie-Breaking with the Single Transferable Vote. *Voting matters*. Issue 18, pp 14–17. (see <http://www.mcdougall.org.uk/VM/ISSUE18/I18P6.PDF>)
- [4] B. A. Wichmann: Tie Breaking in STV. *Voting matters*. Issue 19, pp 1–5. (see <http://www.mcdougall.org.uk/VM/ISSUE19/I19P1.PDF>)
- [5] GS1327: General Synod, Single Transferable Vote regulations 1990 and 1998. (Obtainable from Church House Bookshop, Great Smith Street, London SW1P 3BN.)
- [6] R. A. Newland and F. S. Britton. *How to conduct an election by the Single Transferable Vote*. ERS 3rd Edition. 1997. (see <http://www.electoral-reform.org.uk/votingsystems/stvrules.htm>)
- [7] I. D. Hill, B. A. Wichmann and D. R. Woodall. Algorithm 123 — Single Transferable Vote by Meek’s method. *Computer Journal*. Vol 30, pp277–281, 1987.
- [8] I.D. Hill and Simon Gazeley. Sequential STV — a further modification. *Voting matters*, Issue 20, pp6–8.