Developing STV Rules for manual counting to give effect to the Weighted Inclusive Gregory Method of transferring surpluses, with candidates' votes recorded as integer values

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The Local Governance (Scotland) Act 2004 [1] makes provision for councillors in Scotland to be elected by the single transferable vote (STV) from wards returning either three or four councillors. The first elections under these new provisions will be held in May 2007. The Act does not specify any STV counting rules, but requires Scottish Ministers to make such rules by order.

1 Proposal to use WIGM

When the Local Governance (Scotland) Bill [2] was introduced in the Scottish Parliament it included most (but not all) of the STV counting rules used for District Council elections in Northern Ireland [3]. Among those included were the provisions for the transfer of surplus votes by the Gregory Method, applied only to the 'last parcel' of ballot papers for a consequential surplus [4]. During the Stage 1 consideration of the Bill by the Local Government and Transport Committee of the Scottish Parliament, several MSPs questioned the use of the Gregory Method and suggested that the 'last parcel' provision treated some voters unfairly (eg see [5] at col 380). The Committee also discussed the possibilities of using electronic counting which was attractive because the elections for the Scottish Parliament (by a regional version of the Additional Member System) would be held on the same day.

In their Report [6] on the Stage 1 consideration of the Bill, the Committee said, in relation to technical issues surrounding the counting of votes:

> "The Committee: Concludes that the method set out in the Bill is the most appropriate one for local government elections in Scotland at this time, given the currently available counting technology;
> Believes that its preferred alternative, the 'weighted inclusive Gregory method', is, theoretically, the most effective counting method as it ensures that the preferences expressed by all voters are counted; but notes manual counts using this system would be unrealistically time consuming; and
> Recommends that the 'weighted inclusive Gregory method' be introduced to replace the system set out in the Bill when electronic counting becomes available."

Several technical amendments to the STV counting rules were discussed during the Stage 2 debate on the Bill, but the Gregory Method and the 'last parcel' provision were retained for the transfer of surpluses. However, at the Stage 3 debate on the Bill, on the floor of the Parliament Chamber, the Scottish Executive Minister tabled amendments that had the effect of removing all the detailed STV counting rules, and these amendments were passed [7,8].

The second Newsletter of the 2007 Elections Steering Group [9] announced: "Scottish Executive Ministers have agreed that work should go forward on the possibility of introducing e-counting for the 2007 local government elections." The invitation to tender for the provision of e-counting facilities was issued in August 2005 [10]. (The award of this contract to DRS Data Services Ltd was announced in February 2006 [11].)

The tender document issued to interested contractors [12] specified that the STV counting rules were to be based on the "Weighted Inclusive Gregory Method" (WIGM) of transferring surpluses. The tender document included a description of STV

rules incorporating WIGM, based on the incomplete and defective description given in the Technical Report of the British Columbia Citizens' Assembly on Electoral Reform [13].

2 Definition of WIGM

The term "Weighted Inclusive Gregory Method" appears to have been coined by Farrell and McAllister [14], where they give the following description of the procedure for determining the transfer value for a candidate's surplus votes:

"For those votes that the candidate has received at full value, TV = s/v, where v is the candidate's total vote. For those votes that the candidate has received from another candidate's surplus, TV = $(s/v)\beta$, where β is the TV that was applied in the transfer of the surplus votes to the previous candidate."

(The definitions of "TV" and "s" were given earlier in the paper: "TV" = transfer value; "s" = candidate's surplus.)

The Weighted Inclusive Gregory Method has not yet been implemented anywhere in the world and so there is no working legislative language available. However, a legislative description of WIGM was included in the Electoral Legislation Amendment Bill 2003 presented to the Legislative Assembly of the Parliament of Western Australia [15]:

"Unless all the vacancies have been filled, the surplus votes (if any) of any candidate elected under clause 4, or elected subsequently under this clause, shall be transferred to the continuing candidates as follows —
(a) the number of surplus votes of the elected candidate shall be divided by the number of votes received by him and the resulting fraction shall be the surplus fraction;
(b) in relation to any particular ballot papers for surplus votes of the elected candidate, the surplus fraction shall be multiplied by the transfer value at which those ballot papers were transferred to the elected candidate, or by one if they expressed first preference votes for the elected candidate, and the product shall be the continued transfer value of those particular ballot papers;
(c) the total number of ballot papers for surplus votes of the elected candidate that each

(i) express the next available preference for a particular continuing candidate; and
(ii) have a particular continued transfer value,

shall be multiplied by that transfer value, the number so obtained (disregarding any fraction) shall be added to the number of votes of the continuing candidate and all those ballot papers shall be transferred to the continuing candidate,

and if on the completion of the transfer of the surplus votes of the elected candidate to a particular continuing candidate that candidate has received a number of votes equal to or greater than the quota, that candidate shall be elected."

(The Bill received a first and second reading, but was withdrawn in November 2003 for reasons not related to the proposed change to the STV counting rules.)

This legislative description introduces the term "surplus fraction" for Farrell and McAllister's calculated "s/v", which is then applied to each parcel of ballot papers with a different current value, Farrell and McAllister's "β", ie the "transfer value" at which those ballot papers were received by the candidate with the current surplus. The Western Australian Bill used the term "continued transfer value" for the value at which the ballot papers would be transferred from the candidate with the current surplus. In UK STV rules we prefer the term "current value" for whatever value a ballot paper may have when a calculation is made and "transfer value" for the value at which the ballot paper will be transferred to the next available preference.

3 Putting WIGM into UK legislation

The terminology of the Western Australia Bill is helpful in that it distinguishes (and names) the two steps in the process of calculating correctly weighted transfer values when a candidate has a surplus and all of that candidate's ballot papers are transferred. This legislative language does not, however, provide 'ballot-paper-by-ballot-paper' handling instructions of the kind usually found in UK rules for the conduct of STV counts (eg [3]). It was with this in mind that I prepared the detailed rules in the document that has been deposited on the McDougall website [16]. That document has been through several drafts and I am grateful to Brian

Wichmann, David Hill, John Curtice and the anonymous Referee of this paper for corrections and helpful comments. It has been made widely available to those who are involved in the preparation of the secondary legislation that will be required for the 2007 elections.

Although the intent was that e-counting would be used for the 2007 elections, and the Local Government and Transport Committee of the Scottish Parliament recommended the use of WIGM only if e-counting were to be introduced, there was nothing to indicate that manual counting by WIGM rules should not be undertaken if this were demanded or necessary. A manual count by WIGM rules would take longer than a manual count by (classical) Gregory Method rules because more ballot papers have to be sorted and counted more times, but it would not be impracticable for a public election as an exceptional requirement. It seemed appropriate, therefore, to devise first the WIGM rules for a manual count. Once these had been determined as coherent and unambiguous, it would be a smaller task to adapt the manual rules for e-counting. As explained in the preamble [16], the rules were written to fit into a more comprehensive legislative document and follow the conventions of UK secondary legislation (eg [3]).

4   Consequential issues

The essential description of WIGM is quite simple, but its adoption raises several issues that affect other aspects of the STV counting rules.

Because surpluses are to be spread across all the ballot papers then held by the candidate from whom the surplus is being transferred, each ballot paper will, in most cases, carry forward a smaller vote value. In the Northern Ireland rules [3], transfer values are calculated to two decimal places and any remainder ignored. The votes transferred to successive preferences are similarly calculated to two decimal places and the totals of votes credited to candidates are shown to two decimal places on the result sheet. If the WIGM calculations were similarly truncated at two decimal places, substantial numbers of ballot papers would quickly have no recordable value. The precision of calculation must, therefore, be greater when WIGM rules are applied. To ensure reproducibility no matter how the count is undertaken, it is necessary also to specify the precision of each step of each calculation. As explained in the preamble to the rules, the precision was set at seven decimal places on pragmatic and practical grounds.

(The information about the precision of the transfer value calculations in the STV elections to the Australian Federal Senate taken from the AEC website and given in an earlier paper [17] was incorrect [18]. For those STV elections the precision is not limited at all [19], but this has no consequences because of the 'value averaging' method that is used in those rules to calculate transfer values *de novo* for each surplus.)

As noted in the document deposited on the McDougall website, these rules do not make any provision to overcome the anomaly that arises with WIGM when votes are not transferred to already elected candidates. This will be the subject of a separate paper.

5   Integer vote values

It is a feature of the Australian STV rules that use an 'inclusive' method of transferring surplus votes that only whole numbers of votes are credited to candidates when transfers are made [20]. The Commonwealth Electoral Act 1918 prescribes the flawed "Inclusive Gregory Method" and not the Weighted Inclusive Gregory Method, but the Western Australian WIGM Bill [15] included the same provision (see sub-paragraph (c) in the text quoted above). This approach has much to commend it, as it will simplify the result sheet and so aid public comprehension. (It would probably be of benefit if it were adopted more widely for STV counting rules.) Apart from its presentational advantages, this approach avoids acceptability problems that could arise in WIGM elections from candidates being separated by minute fractions of votes. With integer vote totals, candidates will either be separated by at least one vote or have the same number of votes.

Of course, the fractional parts of the vote totals that are not transferred to the candidates cannot be ignored; they must be accounted for properly. These fractional parts are shown separately on the Australian integer result sheets as 'Lost by fraction'. I prefer the term 'Vote fraction not transferred' because it is more correctly descriptive and does not convey the idea that any votes can be "lost".

This truncation to an integer value is applied only to the total value of all the parcels and sub-parcels being transferred to any one candidate; it is not applied to the values of the individual parcels and sub-parcels before the candidate's transferable total is calculated. There is only one truncation for each candidate to whom votes are transferred in any one

stage. That way the 'Vote fraction not transferred' is minimised.

Note that when a multiple exclusion occurs, the 'Vote fraction not transferred' can be negative. This happens when the sum of the values of the ballot papers, **including all the fractional parts**, held by the excluded candidates exceeds the sum of the integer votes credited to the excluded candidates. Thus previously 'non transferred' votes can be brought back into play. This is another reason for preferring a term other than "lost".

6 Non-transferable votes

When an 'inclusive' transfer of a surplus is effected, the transfer values are calculated taking into account **all** the votes then credited to the elected candidate and **all** the ballot papers are transferred. Ballot papers with no 'next available preference' are set aside as 'non transferable' and take with them as 'non-transferable' the proportionate share of the surplus. This approach is wholly consistent with the 'inclusive' concept that is given effect by the requirement to examine and transfer all parcels of ballot papers held by the candidate with the surplus.

7 Deferred surpluses

It could be argued that the 'inclusive approach' that underlies WIGM would require the transfer of **all** surpluses, ie that there should be no provision to defer the transfer of any surplus, no matter how small. However, if there is to be any possibility of manual counting, it would be best to retain the 'deferred surplus' provision so that the handling of large numbers of ballot papers of extremely small values could be avoided except when the votes on those ballot papers would affect what has to happen next.

8 Sub-stages during exclusions

STV counting rules that use the Gregory Method of transferring surpluses usually provide for sub-stages during exclusions, in which the transfer of a parcel of ballot papers of the same value constitutes a sub-stage. The transfer of first preference ballot papers before the transfer of other ballot papers of value 1 vote also constitutes a separate sub-stage in the Northern Ireland rules [3]. If any candidate attains the quota at the end of a sub-stage, that candidate is 'deemed elected' and no further transfers are made to that candidate. This is consistent with the 'exclusive approach' to STV that seeks to keep the voters

in discrete, 'exclusive' groups so far as possible. Although it is clearly not directly related to WIGM, the sub-stage approach to handling exclusions seems incompatible with the 'inclusive' approach that underlies WIGM. I have, therefore, made no provision for sub-stages during exclusions.

9 Publication of results

I have taken the opportunity to specify fully what must be published once an STV count has been completed. This rectifies a deficiency in the Northern Ireland rules [3].

10 Casual vacancies

The suggested rules do not include any provisions relating to the filling of casual vacancies because policy decisions on casual vacancies are required before the relevant election rules can be devised. Should it be decided that a by-election must be held when a single vacancy occurs, I would commend the use of the special purpose STV rules published by the Electoral Reform Society [21]. I codified these rules in their present form in 1978, working under the guidance of Frank Britton and Robert Newland.

11 'Inclusive' and 'exclusive' representation

A discussion of the 'inclusive' and 'exclusive' approaches to proportional representation and STV counting rules will be the subject of a separate paper.

12 References

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