Edited comments on Robert Newland's suggestions

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1 Introduction

A moderated email discussion was held based upon the questions raised by Robert Newland [1] about 23 years ago, but only published in 2006. Those participating in the discussion were (in alphabetical order): Bernard Black (BB), James Gilmour (JG), David Hill (IDH), Michael Hodge (MH), Chris Jerdonek (CJ), Henry Kitchener (HK), Jonathan Lundell (JL), Michael Meadowcroft (MM), Joe Otten (JO), Colin Rosenstiel (CR), Markus Schulze (MS), Nicolaus Tideman (NT), and Paul Wilder (PW).

Although the discussion was initially concerned with ten questions, it soon diverged into other, related, topics. It was agreed that the editor should attempt to edit the material rather than relying upon using only the original email text.

2 The questions and discussion

The questions and the discussion that arose from each are enumerated in the following sub-sections. Not surprisingly, some respondents said the questions were wrong and answered a slightly different point.

Questions raised in 1983 are not necessarily appropriate for today. A count in 1983 would probably have needed a main-frame while today any office computer could do a count in a few seconds.

Direct input to a computer (DRE - Direct Recording Electronic voting) would not typically have been envisaged in 1983, nor was the capability to read ballot papers using OCR as well developed — the questions need to be phrased in a manner suitable for today. On the other hand CR had a counting program working on a ZX81 in 1981.

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2.1 Does computerising STV counts save time/money?

BB: This is of no consequence; the right result is all important. IDH: Not to any noticeable extent, unless a recount is necessary to fill a casual vacancy or for some other purpose. Then it is very substantial. (A point repeated by MH.)

JL: Probably. Certainly, if ballots are cast in a computer-readable form (DRE or optical scan, say). Other considerations are probably more significant.

In particular, Newland's comment that, "Voting machines capable of accepting preferences seem an unlikely investment for infrequent public elections," is probably wrong today, at least in the United States, where Federal law mandates machinery that, as a happy side effect, is capable of implementing STV, given the requisite laws, programming and certification.

On the other hand, the widespread practice of voting by mail will continue to require voting machinery in which the primary ballot is paper. In my county (San Mateo, just south of San Francisco), more than half the ballots cast in the June primary election were cast by mail.

NT: This is an empirical question, so its final resolution will presumably be determined by experience. However, if voting is done on a computer screen, as seems increasingly likely, I cannot imagine how it could happen that a computerised count would not save time and money in elections with more than 100 or so voters. Even if voting is not by computer, as long as voters produce scanable ballots, I would expect computer counting to save time and money. If the votes are made public, as I am inclined to think they ought to be, then there will be programs in the public domain to count them, so it will be a good idea to use a computer to count them, to avoid consequential human errors in the counting process. The availability of such programs, along with the votes cast, will make it possible for anyone who wishes to do so to verify that the accepted program elects the candidates that officials say are

elected.

JG: As someone else has already suggested, this question should now be answered by reference to the data available from recent computerised counts in large scale elections. Modern high-speed scanning of paper ballots and intelligent OCR have almost certainly changed this out of all recognition since Robert wrote his note in 1983.

CR: I agree that when we introduced full computer counting into Liberal Democrat elections it made little difference in time and effort. However, from long experience it is now clear to me that we made a considerable gain in accuracy because copying ballot paper data are inherently simpler than interpreting preferences when making transfers.

2.2 How important is witnessing a manual count?

BB: The opportunity to view the count should be available to candidates or their agents. IDH: Not very. It can appear much more meaningful than it actually is, because witnesses can rarely see much that is really relevant. Having systems that actually get the right answer is much more important, but convincing the public that it has been properly done is vital.

MH: I regard it as vital that candidates (or their representatives) can witness counts, whether manual or computer.

JL: To digress slightly, California law requires a manual count of 1% of the ballots (county by county) as a check on the automated count. This raises obvious problems for STV in general and computation-intensive STV methods in particular.

I witnessed a manual recount recently (city council, at large plurality election for three seats). I had a lot more confidence in the result as a consequence of seeing the count, even though the margin was very small. That is good, albeit somewhat subjective.

I agree with David Hill that, "Having systems that actually get the right answer is much more important, but convincing the public that it has been properly done is vital." That is to say, a witnessed manual count is but a means to an end.

NT: Fairly important, I would say.

JG: I suspect this does not happen in most private elections. It appears to be important in public elections for two reasons; Firstly, it is the only means by which candidates and their agents can have any assurance that the ballot papers have been counted correctly; Secondly, it is the only means by which candidates and their agents can collect some information about voting patterns that they consider useful for future campaigning.

Auditing

Apart from a witnessed count, another method to gain confidence in the result are auditing procedures. There was a lengthy discussion on this which is summarised below.

JL: Have reformers settled the question of the extent to which STV algorithms should be replicable "by hand"? To me this question has primacy over questions of representation and "inclusiveness" because it is about trusting the validity of the tally itself. Some answers may limit which algorithms can be considered.

If proper procedures are followed, it seems to me that no replicability by hand is needed. In the United States there is a manual tally process for machine counted elections that involves manually checking the ballots in 1% of precincts selected at random. (Whether this is implemented correctly in practice is another matter.) It seems that no replicability by hand is needed if (1) the ballot rankings are publicly and digitally released, and arranged by some grouping (e.g. by precinct), (2) the digital data are manually checked against the physical ballots in some fraction of those groupings (e.g. 1% of them), and (3) the voting algorithm is fully specified to the public. This would be enough for any organization or member of the public to verify the tally.

JO: It seems that no replicability by hand is needed if (1) the ballot rankings are publicly and digitally released, and arranged by some grouping (e.g. by precinct), (2) the digital data are manually checked against the physical ballots in some fraction of those groupings (e.g. 1% of them), and (3) the voting algorithm is fully specified to the public.

I agree that simplicity of the rules is important. Meek rules I find the simplest, other rules tending only to appear simple when details about the order in which things are done and so forth are glossed over. However while their simplicity is an advantage, their impracticality for hand-counting is not.

JG: With regard to transparency, so far as the imminent (2007) elections in Scotland are concerned, you should remember that the conventional STV paper ballots will be scanned and the counting all done within a computer program. So the tally-men and tally-women will not be at all able to tally the papers or the votes. Indeed, the STV (local government) and AMS (Scottish Parliament) ballot papers will possibly be scanned together — the software separates the votes.

If DRS stick with the scanning procedure they demonstrated, and *if* the Scottish Executive allow the publication of one of the very useful reports that program produced, it will give the parties and others a great deal of information about the STV preferences, ballot box by ballot box. The report I have in mind shows the numbers of preferences at each level (1, 2, 3, 4 etc) for each candidate. It does not show the patterns of transfers, but it does provide very valuable information for the candidates and their agents, and it does it painlessly. I have written to the Scottish Executive and to lots of others saying this is *one* part of the open reporting we need to have in the Scottish procedure.

PW: Transparency in procedures and counting methods in all elections is important, but in public elections it is crucial to maintaining confidence in and the legitimacy of those elected.

[There was a discussion about the US style of auditing and its potential application to Scotland. This has not been included.]

2.3 Are the ERS76 rules the best for a manual count?

Respondents were given an opportunity to consider ERS97 in their response.

BB: Neither. All possible improvements were not made in the 97 version. IDH: Given that all manual counts are only approximations, for reasons of practicability, the ERS rules are probably almost as good as can be got, though I am still waiting for a proper description of the reduced quota feature of ERS97.

NT: The rules could probably be improved a little, here and there, but the improvements would not add much value to the existing rules. I would guess that 98% or 99% of what could be achieved by the best manual-count rules could be achieved by the existing rules. So the important thing is to get STV in use, and then consider refinements.

JG: To answer this question you must first define "best".

I would suggest there are six sets of rules that *could* be used for manual counts: Dáil Éireann, Northern Ireland, ERS73 (not quite identical to the NI rules), ERS76, ERS97, and my version of WIGM STV. (I exclude the Australian Federal Senate rules based on the Inclusive Gregory Method because the transfer value averaging procedure in those rules means that they do not comply with "one person, one vote" [3].)

Exclusive versus Inclusive rules

Farrell and McAllister [3] use the term "inclusive" to characterise a variant of STV which uses more votes in a transfer thus ensuring that more voters are involved in the election of subsequent candidates. Hence one could characterise a rule as "exclusive" if it minimises the voters involved.

JG: I think it is important that any and all discussions of computerisation of STV counts and of the counting procedures that computerisation might make practicable, should take fully into account the effects of the various procedures in relation to the "exclusiveness" or "inclusiveness" of representation. This essential context is missing from almost all these questions.

You may define "best" in terms of the "exclusiveness" or "inclusiveness" of the procedures in different sets of STV rules; there is a diversity of views on which is "best" in this respect. You may define "best" in terms of practicality; there is likely to be less diversity of view on that.

If maximum "exclusiveness" is your definition of "best", you will choose the Dáil Éireann rules. If any element of chance is completely unacceptable, you will exclude the Dáil Éireann rules from any further consideration.

If maximum "inclusiveness" is your definition of "best", you will choose my WIGM STV rules [4]. If you want the maximum "exclusiveness" without any element of chance, you will choose the NI rules or ERS73.

If you want to maximise the practicality you would probably choose ERS76 or ERS97.

Interestingly, in revising ERS76 to ERS97 some "exclusive" features were dropped, but this does not appear to have been done with any conscious intent of making the rules more "inclusive".

MM: Maybe some rules have defects, but the crucial difference with the rules for Dáil Éireann elections and for those in Northern Ireland, is that they are already entrenched in law and have been used successfully in many elections.

CR: What about the Cambridge, Mass, rules which could be described as more exclusive (I do not really buy the simple linear scale model of inclusiveness/exclusiveness anyway because there are other, more political factors to weight various counting rules by).

Cambridge has no derived surpluses at all. If a candidate reaches the quota during a transfer they are leapfrogged by further votes in that round. The only surpluses they have are first stage ones. They are randomly selected for transfer or not, see [8].

JG: The Dáil Éireann rules have a principled structure, which come at the "exclusive" end of the spectrum (called "exclusive" only because it is the opposite of the "inclusive" variants). The Cambridge, MA. rules certainly present a simplification compared with the Dáil rules, but I don't think their arbitrary handling of what would otherwise be consequential surpluses in any way enhances the "exclusiveness" of the representation they deliver.

2.4 Given a computer count, should improved counting procedures be used?

BB: Yes. IDH: Yes. It is absurd to be stuck with approximations where they are unnecessary. NT: Yes.

MH: No, due to the desire to allow a manual count using the same rules — the procedure adopted by the Church of England.

JG: As noted above, the wording of this question reveals the questioner's prejudice and it presents no context for the assessment of "improved".

2.5 Given a computer count, should more than two decimal places be used?

BB: Yes. IDH: Yes, but merely that without other changes does not help much. NT: Yes.

JG: Before considering the number of decimal places that should be used for calculations within STV procedures, I would strongly recommend that all STV counting rules for public elections should prescribe that when votes are transferred, candidates should be credited with only integer numbers of votes. That would greatly simplify the presentation of the results and would aid public understanding and acceptance. This, however, is not a matter of "rounding for presentation" - that way lies disaster. As in the Australian Federal Senate rules, the candidates are credited with only the integer part of the total vote to be transferred and appropriate procedures have to be specified to deal with the "vote fractions not transferred". I have not tried to apply this "integer only" approach to Meek STV, but it can be applied to all other versions of STV rules, from Northern Ireland rules to my WIGM rules for manual counting. Dáil Éireann STV is already integer only.

Once the practicality of result sheet presentation has been separated from internal calculation (by adopting integer transfers), determining the number of decimal places to be used in calculations becomes essentially an exercise in numerical analysis. We should certainly use more than 2 decimal places because of the significant vote loss than can occur with such truncation, as explained in my paper [5]. Where the possibility of a manual count has to be retained alongside computerised counting, I have recommended 7 decimal places for practical reasons associated with the use of pocket electronic calculators [4].

2.6 Given a computer count, restart after an exclusion?

BB: Yes. IDH: Yes, provided that other changes are made to make it work properly. Merely to do that without other changes is disastrous, see [9]. NT: Yes.

JG: I presume by this you mean "go back to the beginning and start the count again as though the excluded candidate had never stood". This presumably reduces the total valid vote by the number of votes for the excluded candidate that are not transferable (no next available preference) and so reduces the quota for the "new" count. That could have all sorts of interesting effects.

2.7 Given a computer count, transfer to already elected candidates?

BB: Yes. IDH: Yes.

JL: The benefits of Meek's method are compelling, if we use computers for the count. However, a manual count, or recount, or verification, becomes impossible, and while publication of the ballots would make independent computer counting possible, there are significant ballot secrecy concerns associated with such publication.

Moreover, manual verification requires another step prior to the (computerized) count, namely verifying that the ballots in the ballot file represent the will of the individual voters. In California, that's likely to mean examining a voter-verified paper copy of an electronic ballot, another area for ballot secrecy concerns, and one in which truncation of unused preferences will not help (they are already on the paper).

NT: Yes.

JG: This is an illogical question because the decision whether or not to transfer votes to already elected candidates does not depend on computerisation, but on the STV procedures you are using. It would, of course, be impractical for public elections without the use of a computer, but that is a separate issue.

As Robert Newland showed in this 1983 note [2], it would be wrong to transfer votes to already

elected candidates if you are using the Gregory Method of fractional transfers with last parcel only. Robert also showed that, to give coherent results, transfers to already elected candidates are required if you are transferring all ballot papers, as in WIGM and Meek.

Consideration of Meek

The use of the Meek algorithm arose several times within the debate on the main questions, but the issues raised are collected here.

NT: To my mind, the answer to improving and simplifying is the Meek rules. These rules have been around for nearly 40 years now. They eliminate some limitations of the Newland-Britton rules that are very distressing to voting theorists. They have a very straightforward explanation. It would generally take too long to count by these rules by hand, but confirming a count by hand-calculator is reasonably straightforward, if rather time-consuming. The rules have been written into "legislation" by the Royal Statistical Society (and in New Zealand law: Editor).

To make the Meek rules even more acceptable, I would propose that someone write a computer program with even more auditing than the present program. In particular, I would suggest that the program should produce an audit trail that shows the allocation of each vote at each stage of the count.

If you feel that the Meek rules are too complicated, then the rules now in use in Northern Ireland (a slight variation on Newland-Britton) might be considered. Voting theorists will be concerned of the ease with which strategy can be employed against them.

CR: Interestingly, Robert Newland's article, in a few short sentences, shows why Weighted Inclusive Gregory treatment of surpluses is such a nonsense.

This discussion also needs to consider more political aspects of different STV variants. My main objection to Meek (and implicitly to some of Robert's ideas) is that they reduce the effective value of votes of less well-informed voters, those who do not express full preference lists. These voters are likely to be politically skewed, with effects on party representation and on the acceptability of STV to our potential supporters.

JL: During a manual recount in California, witnesses must be permitted. They are generally representatives of the candidates. So, independent of whether a computer is making the primary count, ballots are visible to the (semi-) public during the recount. Is this an issue? Perhaps not; recounts are expensive and rare, and as you say, could be implemented without any one person seeing the entire ballot.

With Meek's method, though, a hand count is not practical. So a "manual recount" must be replaced by some other process, presumably a manual verification of the ballot file, and then making the ballot file available for an independent count, and it is not clear to me that truncation (say) could be part of either step.

I am not particularly concerned about the secrecy problem at this step in the process. Again, just looking at the California process, there are secrecy issues already in a manual recount; a vote-seller could "prove" his ballot by casting a distinctive write-in in an irrelevant race. Worse, our vote-by-mail system, used by a large percentage of the electorate, is wide open to both vote-selling and coercion. That is not a good thing, of course, but introducing STV is not going to make things appreciably worse.

On the other hand, jurisdictions with a stronger commitment to ballot secrecy are likely to have a problem implementing STV, maintaining secrecy, and making counting transparent.

HK: Many voters will only know enough about the candidates to put a few at the top of their list. There may be a "party" in whom they have confidence, and who they would like to use to complete their paper. I have found this with the Friends of the National Trust, and with the ERS Support Group. Adding Party Lists would eliminate, or at least reduce, short votes, which would meet the objection some people have to the way Meek treats short votes.

CR: My political concern, especially about Meek but it could also apply to WIG, is that the votes of people who express short preference lists can be devalued. As it is expecting a lot of voters in mass elections to have enough valid information to make informed preference choices for all candidates this could give some voters an advantage.

2.8 Given a computer count, should all candidates be elected with the same number of votes?

BB: Yes. IDH: Yes, in principle, but it is not necessary in practice to do extra work to reach that, once it known for certain which candidates are elected and which are not.

JL: I like the principle, but I am doubtful that it is practical, if we mean to (say) reduce the quota until all seats are filled at the original quota. If quota q

fills one too few seats (without reducing the quota), and quota $q' < q$ fills all the seats, is there a quota q'' between q and q' that also fills all the seats, but with different winners?

In Green Party (California and US) internal STV elections, we require that a candidate reach the quota to be deemed elected, and leave seats empty if necessary, another way (not always appropriate or practical) to answer this question in the affirmative.

MM: Clearly the search for improvements to the operation of STV is on-going, and the advent of the computer opens up new possibilities, but the nature of STV and the relatively complex (for the average elector) concept of the quota and redistribution according to preferences etc, lends itself to caricature by its opponents.

It is interesting to note that the various arithmetical formulae relating to the distribution of list seats does not attract the same attack.

NT: Yes, provided that there is a restart after exclusions. The quota should be lowered as votes become non-transferable.

JG: It is difficult to imagine why anyone would want to do this. It could be achieved only by a complex iterative procedure with an ever-diminishing quota and a series of transfers among the already known winners until all the winners were credited with an equal number of votes. The purpose of the election is to identify the unique set of winners to fill a stated number of seats. When you reach the stage at which you can do that (according to the rules you are using), there is little point in proceeding further.

If you are using a Droop quota and you have filled all the vacancies and there are some votes (less than one quota) then credited to the runner-up, I can see no useful purpose in transferring those votes, much less any useful purpose in going on to equalise the numbers of votes credited to each of the already elected candidates.

CJ: I can see doing this in cases where a "countback" may be used later on to fill a vacancy. In one version of countback, vacancies are filled with STV using all votes that went to elect the vacating candidate(s) in the last election or countback, together with the exhausted votes. If candidate totals are not first equalized, then some voters will not have a fair say in the countback result. For example, if one candidate has a large surplus at the conclusion of the election and some other candidate vacates, the countback would not be fair to the voters who have votes in that pile with surplus. If the tally had continued and surpluses cleared, a lot of those votes could have wound up in the exhausted pile (affecting the result of the countback).

2.9 Given a computer count, should all papers be considered for transfer of a consequential surplus?

BB: Yes. IDH: Yes, all *relevant* papers.

JL: Yes (Meek)

NT: Yes.

JG: Like several other questions, this question has nothing to do with computer counting but everything to do with the type of STV rules you are implementing. As Robert Newland has shown [2], for rules that are to be internally consistent, you must take only the last parcel for Dáil Éireann, Northern Ireland, ERS73, ERS76 and ERS97 rules. In contrast, for internal consistency in WIGM and Meek, you must transfer all papers. So the real question is, once again, do you want "exclusive" or "inclusive" representation, and by how much?

2.10 Is excluding the lowest candidate the best?

BB: Yes.

IDH: If we stick to the principle that later preferences must not under any circumstances upset earlier ones, it appears to be the only sensible rule available, though it is sometimes unsatisfactory. If we are prepared to abandon that absolute principle then I believe "Sequential STV" to be better, see [10].

JL: Here we presumably mean lowest number of first-place votes. I want to preserve later-no-help/harm, and so am reluctant to consider any but first-place votes, so: yes. I think so.

The attractions of Condorcet methods (for single-seat elections) and Sequential STV (otherwise) are undeniable, but the value of being able to unconditionally assure the voter that subsequent preferences will not harm earlier ones is very valuable, not to be give up lightly.

NT: If exclusions are to be done one by one, I prefer a rule of excluding the candidate who would not be elected if the number to be elected were one less than the total not excluded yet. This rule excludes at each stage the candidate with the least apparent claim to inclusion with the others. This rule is not ideal. Its weakness is apparent in the fact that if just one candidate is to be elected, the rule can exclude a Condorcet winner. But even though the rule is not ideal, it is an improvement on eliminating the candidate with the fewest votes.

If a better exclusion rule is desired, then my recommendation is to not exclude candidates one by one, but rather employ a rule that takes account of

the comparisons of all possible outcomes (sets of elected candidates) with one another, see [6].

MS: An alternative STV method is also available [8].

JG: Here again, it depends on what you mean by "best". Some of us like to give electors an absolute guarantee that a later preference can *never* harm an earlier preference. If you regard this as an important principle, to be upheld in all circumstances, you have no option but to exclude the lowest candidate (or pair, or three, etc). Those who come from a social choice background are concerned (or horrified) that a Condorcet winner could be excluded by this procedure and criticise STV for this effect. But if you once open the door to taking later preferences into account to decide the fate of earlier preferences in any circumstances, you will have opened the door to tactical voting in STV. In public elections, with large numbers of anonymous voters, tactical voting is impossible under the present "lowest candidate exclusion" rules and it would have very serious implications to make any change in that.

3 References

[1] R. Newland. Computerisation of STV counts. *Voting matters* Issue 22, pp11-13.

[2] R. Newland. Consequential Surplus: Transfer of the last parcel. *Representation* No. 99, Vol 25, summer 1985, pp 18-19.

[3] D. A. Farrell and I. McAllister. The 1983 Change in Surplus Vote Transfer Procedures for the Australian Senate and its Consequences for the Single Transferable Vote. *Australian Journal of Political Science*, vol 38, No 3, November pp479-491. Available via the McDougall web site.

[4] J. Gilmour. 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. *Voting matters*. Issue 22. pp21-25.

[5] J. Gilmour. Calculation of Transfer Values — Proposal for STV-PR Rules for Local Government Elections in Scotland. *Voting matters* Issue 17, pp20-24.

[6] N Tideman and D. Richardson. "Better Voting Methods through Technology: The Refinement-Manageability Trade-Off in the Single Transferable Vote", *Public Choice* 103 (2000) pp. 13-34.

[7] ELECTION OF CERTAIN CITY AND TOWN OFFICERS BY PROPORTIONAL REPRESENTATION OR PREFERENTIAL VOTING. Massachusetts General Laws, Chapter 54A. http://www.cambridgema.gov/Election/mgls.html

[8] M Schultze. Free Riding and Vote Management under Proportional Representation by the Single Transferable Vote. http://m-schulze.webhop.net/schulze2.pdf

[9] I. D. Hill. Comments on Newland's paper. *Voting matters*. Issue 23, pp1-2.

[10] I. D. Hill and Simon Gazeley: Sequential STV — a further modification. *Voting matters*. Issue 20, pp6-8.