

DETERMINING THE RESULT:

Transferring Surplus Votes in the Western Australian Legislative Council



WESTERN AUSTRALIAN Electoral Commission

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FOREWORD

The single transferable vote (STV) system, which is a form of proportional representation (PR), requires voters to indicate an order of preference amongst a list of candidates by using the numbers 1, 2, 3 and so on. Each candidate must receive a certain proportion, known as a quota, of the formal vote to be elected. It is designed so that the mix of successful candidates in a multi-member election reflects as closely as possible the proportional allocation of all the votes cast in that election.

While the PR-STV system is widely regarded as one of the most complicated in terms of converting votes into seats, it attempts to maximise the effectiveness of the vote of the individual. This is achieved by transferring votes from one candidate to another in the event that an elector's first choice acquires a surplus of votes, or alternatively fails to attain enough votes to gain election. The notion of the transferability of the vote has given rise to a complex body of rules for counting votes, distributing surpluses and eliminating candidates.

PR-STV is used in the Federal Senate and most Australian states to fill vacancies in multi-member electorates. While there are a number of broad similarities in the way in which PR-STV has been implemented in these jurisdictions, the systems differ in a number of important respects, including the way in which surplus votes are distributed during the count.

Since 1987, elections for the Western Australian Legislative Council have been conducted using PR-STV. Although the decision to adopt PR-STV enjoyed the broad support of the two largest parties in 1987, and has been used in four subsequent Western Australian State elections, it is only recently that criticism of aspects of the system has been voiced in Parliament.

The catalyst for the criticism was the outcome of the election in the Mining and Pastoral region. Within weeks of the 2001 State Election, concerns were raised about the method used to transfer surplus votes of elected candidates. Two political parties claimed in Parliament that the Western Australian Electoral Commission had failed to correctly apply the processes set out in Schedule 1 of the *Electoral Act 1907*. The Commission refutes this criticism and believes Schedule 1 was applied correctly.

It was also contended that the formula used by the Commission to transfer the surplus votes of elected candidates resulted in a number of ballot papers increasing in value. The Commission agrees that the current formula does allow some ballot papers to increase in value under certain conditions, which is a known disadvantage of the method as explained further in the paper. The small increase that occurred in the Mining and Pastoral Region in the 2001 Election had no impact on the outcome.

Given these concerns, and the lack of any comprehensive academic work on this subject, such a research paper as this one is long overdue. It profiles the five most recognised methods for transferring the surplus votes of elected candidates: the Random Selection method, the Gregory system, the Inclusive Gregory system, the Inclusive Weighted Gregory system and the Meek Method. While its intention is not to provide a definitive version of the best system for transferring

surplus votes, it does attempt to canvass some of the available options and their respective strengths and weaknesses.

Although this is a complex topic, I believe that Dr Narelle Miragliotta has done an excellent job in explaining the material in a clear and informative way. I hope this paper will provide a useful starting point for an objective and considered discussion on the available methods for transferring surplus votes. The Western Australian Electoral Commission is pleased to publish this significant contribution to electoral research.

Dr K W Evans
ELECTORAL COMMISSIONER

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CHAPTER ONE

THE NATURE OF PROPORTIONAL REPRESENTATION (SINGLE TRANSFERABLE VOTE) AND ITS USE IN AUSTRALIA

The system of proportional representation using the single transferable vote (PR-STV) was devised initially by Thomas Wright Hill in the 19th century. Hill's ideas were later refined by Carl Andrae in Denmark and Thomas Hare in England, working independently of each other, in the 1850s (Bogdanor 1984; Homeshaw 2001; Newman 1992). The system has mostly been adopted in those countries which have at some time been under British rule¹. This unique pattern of use prompted one scholar to describe PR-STV as the 'Anglo-Saxon method for securing proportional representation' (Bogdanor 1984). PR-STV is presently used in Australia, Malta, the Republic of Ireland and local and European Parliament elections in Northern Ireland.

Of the jurisdictions that favour PR-STV, Australia ranks as its most enthusiastic supporter. PR-STV has proven to be an unusually popular choice for electing representatives to state, territory and national parliaments in Australia. The first recorded use of PR-STV in Australia dates back to 1897 when it was incorporated on a limited basis for state elections in Tasmania. Since this time, PR-STV has been adopted for use in the Commonwealth Senate and for state and territory elections in the Australian Capital Territory, New South Wales, South Australia, Tasmania and Western Australia. The willingness of Australian decision-makers to embrace PR-STV, widely regarded as the most theoretically optimal form of proportional representation, allows Australia to claim the distinction of providing 'a substantial share of the world's experience with STV elections' (Hughes 2000: 155). This chapter examines the nature and operation of PR-STV with particular focus on its use in Australia.

What is PR-STV?

PR-STV is essentially a combination of two distinct sets of electoral principles. The first element of PR-STV is the concept of proportional representation. Proportional representation is premised on the idea that the composition of members in parliament should reflect the approximate wishes of the voting public. It attempts to achieve this by lowering the threshold required to win a seat so as to ensure that political groups and candidates who represent minority views and opinions have increased opportunities to gain election to the legislature.

The second aspect of PR-STV is the notion of the single transferable vote (STV). STV is a voting system intended to afford the voter the widest selection and choice when electing candidates, while simultaneously attempting to minimise the likelihood that their vote will be wasted. This principle is achieved by allowing the voter to pick more than one candidate listed on their ballot paper. If the individual's first choice of candidate accumulates more votes than is required for election or

¹ There are two exceptions to this rule. PR-STV was at one time used in Denmark. More recently, Estonia adopted the system briefly for its first post-communist election in 1990, but then replaced it with a variant of the List system (Gallagher 2000: 294).

alternatively has little chance of winning due to a low vote, the voter's ballot paper is transferred to the continuing candidate listed as the next preference (Amy 2000; Farrell 2001; Lakeman 1974). In this way, PR-STV significantly improves the odds that the vote of an elector will contribute to the election of at least one of the winning candidates.

A Snapshot of the Values and Assumptions which Underpin PR-STV Systems

PR-STV is underpinned by a number of assumptions about the nature of representation and choice that should be afforded to the voter (Bogdanor 1984; Farrell 2001; Lakeman 1974). The three major elements that PR-STV stresses, include:

An Intelligent Electorate

PR-STV is an electoral system that is underpinned by faith in the intellectual capacities of the voter. It assumes that the electorate is capable of coping with the complexities of the electoral system, even if individuals do not grasp all of the subtleties and more technical aspects of a highly sophisticated vote counting regime.

Representation of Diverse Interests in the Legislature

PR-STV is not designed to constitute governing majorities in the legislature but rather to ensure that different sets of political opinion are represented in parliament in proportion to their strength in the electorate. In practical terms, this means that PR-STV gives priority to the representation of a diverse cross-section of opinions within society rather than privileging specific geographical interests, as occurs under single-member electorates.

A Candidate-Centred Electoral System Where the Voter is in Control

PR-STV is an electoral system predicated on a commitment to securing greater freedom and choice for the elector at the ballot box. This system of voting, in its pure form, rejects the idea that the elector should be forced to vote for lists of candidates ranked according to the wishes of the party machine. Rather, PR-STV is designed to permit the voter to choose the order in which candidates are elected so as to minimise the influence of political parties in favour of individual candidates.

The Mechanics of PR-STV

The amalgamation of the principles of proportional representation with the notion of the single transferable vote is an electoral system that combines the use of multi-member electoral districts with an ordinal ballot paper format which permits the voter to rank all candidates in order of preference. Jurisdictions which use PR-STV most commonly divide a geographical area into a number of electoral districts which return more than one, although ideally five, candidates each². On polling day, each voter is handed a ballot paper which makes possible the expression of multiple choices when filling out their voting slip.

There are a number of broad similarities in the vote counting processes adopted by those jurisdictions which use PR-STV. The initial stage of the count consists of sifting through and organising the various ballot papers. Any informal votes (those ballot papers which have been filled out incorrectly) are removed from the count while the valid votes are sorted according to their first preferences and tallied. Once the total number of formal votes has been ascertained, a quota is calculated. The quota is the minimum number of votes required by a candidate to attain election. Quotas are normally computed using the Droop method. The formula for determining a quota is calculated by dividing the number of valid votes by the number of candidates to be elected plus one, and one is added to the final result.

$$\frac{\text{Total number of valid first preference votes}}{\text{(Number of candidates to be elected + 1)}} + 1$$

Candidates who manage to attain an exact quota of votes are declared elected and their ballot papers are set aside. Similarly, those candidates who acquire a vote greater than the quota are declared elected. The surplus votes of each elected candidate are then transferred to the candidate whom the voter has marked as their next preference. If after all surpluses have been transferred and vacancies still remain unfilled, the contestant with the smallest number of votes is eliminated and his or her votes are distributed according to the next available choice shown on the ballot paper. The process of distributing surpluses of elected candidates and eliminating low-scoring contestants continues until all vacancies are awarded (Amy 2000; Farrell 2001; Newman 1992; Wright 1980).

It is important to note that the system of PR-STV is unlikely to deliver perfectly proportionate outcomes or prevent some votes from being wasted. PR-STV does not guarantee that the voter's ballot paper will necessarily be used to elect their first choice of candidate or that it will even contribute towards the election of any of the contestants. PR-STV only increases the likelihood that all or part of a person's vote will assist the election of at least one of the winning contestants. Similarly, PR-STV does not always ensure that groups or individual candidates will secure representation in parliament commensurate with their share of the vote. PR-STV only slightly improves the chances of small party and independent candidates securing election due to the more moderate thresholds that are usually required for election (see Appendix 1).

² It is well established in the literature that the optimal size for PR-STV constituencies is at least five candidates (Farrell 2001: 142).

How PR-STV Differs from other Electoral Systems

PR-STV is only one of a number of electoral systems that can be used to convert votes into seats. It can be distinguished from at least two other electoral formulas, the plurality system and majoritarian system. Plurality formulas are regarded as the least elaborate of the three major categories of electoral systems. They typically only require the winning candidate to attain more votes than any other contestant. In contrast, majoritarian formulas award a seat to the candidate with a majority of the vote, or more votes than their opposition combined. Both the plurality and majoritarian systems, while they can be adapted for use in multi-member districts, are mostly used in conjunction with single-member electoral districts (Amy 2000; Newman 1992). The higher thresholds required for election, when combined with the use of single-member electoral districts, has the effect of rendering outcomes under these systems significantly less proportionate than PR-STV systems and also considerably more likely to discriminate against political groups whose voter support is geographically diffuse.

It is also possible to differentiate PR-STV from other forms of proportional representation systems, such as the List system. List systems are similar to PR-STV systems in that they attempt to achieve greater proportionality of outcomes through the use of multi-member electoral constituencies. Unlike PR-STV, however, List systems give the party machine maximum control over the order of the election of candidates. This is made possible because the List system of proportional representation enables each political party to put up a slate of candidates equal to the number of seats to be filled in an electoral district. While some party lists are ‘closed’, in that the voter is compelled to accept the list in the order presented by the party, other List systems allow the voter some discretion in selecting candidates (Amy 2000; Bogdanor 1984; Farrell 2001; Humphreys 1911). The features of the different electoral systems are summarised in Table 1 below.

Table 1
Comparison of the Three Major Types of Electoral Systems

Electoral system	How seats are awarded	Types
Plurality	Seat is awarded to the candidate or candidates with the most votes	First Past the Post Block Vote
Majoritarian	Seat is awarded to the candidate who attains more than 50 percent of the vote	Two round run off Alternative Vote Supplementary Vote
Proportional	Seats are awarded in proportion to votes cast	Party List Mixed Member Single Transferable Vote

(Source: Newman 1989; Reilly 2001)

PR-STV in Australia

There are at least four characteristics that are common to those jurisdictions which use PR-STV in Australia:

1. The organisation of the electorate into multi-member rather than single-member electoral districts.
2. The use of the Droop formula to calculate the quota for election.
3. The option for voters to select more than one candidate when casting their vote.
4. Compulsory voting for all persons over the age of 18 years.

There are, however, substantial differences in the models of PR-STV adopted by various Australian parliaments. The application of PR-STV in Australia provides a good example of the diversity that can be found within the family of PR-STV systems. While some variations are superficial, such as the name used in various jurisdictions to describe their particular form of PR-STV, other differences between the systems are more significant³. The major areas of divergence in Australia exist in relation to where PR-STV is used, district magnitude, ballot structure, ballot design, the methods of filling casual vacancies and the formula used to transfer surplus votes. A summary of the differences can be found in Appendix 2.

Where PR-STV is used

Where PR-STV has been adopted in Australia, there are variations as to which chambers use it for electing representatives. PR-STV is most commonly used for the election of upper houses. One of the major reasons for this is the belief that the stress on the principles of proportionality and the representation of smaller parties makes PR-STV less appropriate for use in lower houses where government is formed, because it militates against the formation of stable governing majorities. PR-STV is presently used in the Commonwealth Senate, the Western Australian Legislative Council, the South Australian Legislative Council and the New South Wales Legislative Council. However, two Australian jurisdictions have rejected the view that PR-STV is suitable only for electing members to upper house chambers. Both the Australian Capital Territory and Tasmania employ PR-STV for elections of the lower house. Their experience with PR-STV shows that, contrary to popular belief, the use of this electoral formula does not necessarily preclude government majorities in parliament.

³ In Australia, PR-STV assumes a variety of different names. The Commonwealth refers to this electoral formula as the 'Senate System', whereas in Western Australia it is known as 'Proportional Representation'. In Tasmania it is referred to as the 'Hare-Clark System', while the South Australians have labelled it 'Modified Hare-Clark'. In contrast, in New South Wales it is known as 'Optional Preferential Proportional Representation' (Electoral Council of Australia 2001).

District Magnitude

There are variations in district magnitudes, or the number of seats assigned to any given electoral region, where PR-STV is used in Australia. District magnitude is one of the most important determinates of proportionality at elections. As shown in Table 2, as the number of candidates to be returned in a district rises, the thresholds required for election decrease, and in doing so there is greater proportionality of outcomes (Rae 1971).

Table 2

Thresholds of Representation for the Single Transferable Vote

Number of Members to be Elected	Minimum Percentage of Votes Required to Gain a Seat
2	33.33%
3	25.00%
4	20.00%
5	16.67%
6	14.29%
7	12.50%
8	11.11%
9	10.00%

(Source: Commission on Government, Report No.1, 1995)

Two of the states that use PR-STV, South Australia and New South Wales, elect members on a state-wide basis⁴. This means that the entire state forms a single constituency for the purpose of electing members to the upper house. Western Australia, the Commonwealth Senate, Tasmania and the Australian Capital Territory, however, do not favour this arrangement. These jurisdictions divide the electorate into various regions which elect a number of members each, usually more than three representatives⁵. The decision to opt for smaller district magnitudes is more often than not a compromise between those groups keen to ensure the diverse representation of political views within parliament and those who believe that it is important that elected representatives retain some connection to a specific geographic area (COG, Report No. 1, 1995). The differences in district magnitude and its effect on the threshold needed to win a seat in those jurisdictions which use PR-STV in Australia is highlighted in Table 3.

⁴ It should be noted that in both New South Wales and South Australia, only half the members in the Legislative Council face election at any given time.

⁵ The exceptions to this are the Australian Capital Territory and Northern Territory, where only two representatives are elected for Senate elections.

Table 3
Percentage of the Vote Required to Gain Election in those Jurisdictions which Use PR-STV systems in Australia

Commonwealth <i>Normal Half Senate Election</i>	6 members are returned from each of the 6 States with candidates requiring approximately 14.28% of the vote to gain election 1 member is returned from each of the 2 territories with candidates requiring approximately 33.33% of the vote to gain election
New South Wales	21 members are returned on a state-wide basis, with candidates requiring approximately 4.5% of the vote to gain election
Western Australia	4 regions return 5 members with candidates requiring approximately 16.67% of the vote to gain election 2 regions return 7 members with candidates requiring approximately 12.5% of the vote to gain election
South Australia	11 members are returned on a state-wide basis with candidates requiring approximately 8.33% of the vote to gain election
Tasmania	5 regions each returning 5 members with candidates requiring approximately 16.67% of the vote to gain election
Australian Capital Territory	2 electorates returning 5 members with candidates requiring approximately 16.67% of the vote to gain election 1 electorate which returns 7 members with candidates requiring approximately 12.5% of the vote to gain election

(Source: Western Australian Electoral Commission; South Australian State Electoral Office; New South Wales State Electoral Office; Australian Capital Territory Electoral Commission; Tasmanian Electoral Office; Australian Electoral Commission)

Ballot Structure

There are significant differences in the requirements for voting in Australia. For elections of the Senate, the Western Australian Legislative Council and the South Australian Legislative Council, voters must allocate a rank order of preferences for every candidate listed on the ballot paper. The failure to place a consecutive number alongside the name of every candidate that appears on the ballot paper puts the voter at risk of casting an informal vote.

The rules for casting a vote in Tasmania, the Australian Capital Territory and New South Wales are different. Voters are not compelled to allocate a preference for every candidate but are only obliged to vote for as many candidates as there are vacancies to be filled. This means that if there are five seats to be filled then the voter must assign a sequential preference for at least five candidates in order to cast a valid vote.

Ballot Design

There are significant variations in the format and design of the ballot paper across those jurisdictions that use PR-STV. In Western Australia, South Australia, New South Wales and the Senate, the option exists for the voter to surrender the rank ordering of the candidates listed on the ballot paper to the party to whom they intend to allocate their first preference vote. The voter can choose to indicate a rank order for every candidate or alternatively place a number 1 in the box alongside the political party or group they wish to vote for. The preferences of electors who choose to vote ‘above the line’, as it is known colloquially, are then distributed according to the preference schedule of the party or group.

The Tasmanian and Australian Capital Territory parliaments have rejected the ‘above the line’ voting option at elections on the basis that it reduces the discretion and independence of the elector to cast a vote according to his or her conscience. The commitment of both jurisdictions to attenuate the influence of political parties over the election of candidates is highlighted by the use of a device known as the ‘Robson rotation’. The ‘Robson rotation’ ensures that the listing of candidates belonging to a party grouping varies on ballot papers. This also equalises the effect of donkey voting—when the voter simply allocates preferences from the top to the bottom of the list—such that no single candidate is advantaged by appearing in the number one position on the ballot paper.

Methods for Filling Casual Vacancies

There are a variety of methods used to fill casual vacancies where PR-STV is used in Australia. The Australian Capital Territory, Western Australia and Tasmania fill a casual vacancy by conducting a recount of the votes cast at the previous general election. There are slight variations, however, if there is no contestant from the same party as the vacating member who is prepared to contest the vacancy. The Western Australian and Tasmanian solution to this problem is to hold a by-election, whereas the Australian Capital Territory responds to this eventuality by requiring the parliament to appoint a person from the same party as the vacating member.

In the Senate, South Australia and New South Wales there is no recount of the vote in the event of a vacancy occurring, such as by the death or resignation of a sitting member between general elections. A replacement candidate is normally selected by the relevant state or territory parliament. It is usually the case that parliament will be constrained in its choice of which candidate is permitted to fill the vacancy owing to the convention that the candidate should be a member of the same political party as the vacating member.

Transferring Surplus Votes

The formulas used to transfer the surplus votes of candidates elected as a result of a transfer of votes from other elected and excluded candidates vary across Australia. The Senate, Western Australia

and South Australia use a method known as the Inclusive Gregory method⁶. This method requires that all ballot papers received by an elected candidate are transferred to continuing candidates. In the Australian Capital Territory and Tasmania, only those ballot papers that gave immediate rise to an elected candidate's surplus are considered eligible for transfer. This method is referred to as the Gregory method. In New South Wales, only the last parcel of ballot papers that were credited to a candidate at the point that he or she was elected are transferred to continuing candidates⁷. However, the ballot papers that are selected for reassignment are chosen at random, a practice which does not occur in either the Inclusive Gregory or Gregory methods. This procedure is known as Random Selection (Electoral Council of Australia: 2001).

The variations that exist in the methods to transfer the surplus votes of an elected candidate are possibly the most technical and complex aspects of PR-STV systems. It is also true that formulas to distribute surplus votes have the ability to impact on electoral outcomes. Despite this, there is surprisingly little discussion in the academic literature on the nature and effects that the various methods can have on the selection of winners and losers at an election. The next section of this paper attempts to redress this by tracing the evolution of methods to transfer surplus votes, with particular reference to the Australian experience.

⁶ The terms the 'Inclusive Gregory' method and the 'Weighted Inclusive' method were coined originally by Farrell and McAllister (Farrell & McAllister 2002)

⁷ It is likely that there will be slight variations in the application of the Random Selection method in those jurisdictions which use this system for transferring surplus ballot papers of elected candidates. An example of this is the conduct of the count for Legislative Council elections in New South Wales. There are at least two formulas used to distribute the surplus ballot papers of candidates who have been elected as a consequence of a transfer of ballot papers from other candidates. On those occasions where a candidate has been elected following a transfer of ballot papers from a candidate or candidates who have been elected on first preference votes, the transfer value is calculated by dividing the elected candidate's surplus by those votes transferred to that candidate. Both the elected candidate's first preference votes as well as any exhausted ballot papers are not considered when determining the number of surplus ballot papers for transfer. However, if a candidate is elected with a surplus of votes as a result of a transfer of ballot papers from other elected and excluded candidates, the formula which is used to determine how many ballot papers are transferred is different. In these cases, the surplus of the elected candidate is divided by the last parcel of ballot papers received by that candidate at the point at which he or she was elected, minus any exhausted ballot papers (*New South Wales Constitution Act 1902*).

CHAPTER TWO

PROPORTIONAL REPRESENTATION (SINGLE TRANSFERABLE VOTE) AND THE PROBLEMS OF TRANSFERRING VOTES

Proportional representation using the single transferable vote (PR-STV) has at various times enjoyed the endorsement of advocates such as the political philosopher John Stuart Mill (1806-1873), as well as a number of academics writing about electoral systems at the beginning of the 21st century (Farrell 2001). Despite the support PR-STV receives in quarters of the academic community, its use is largely confined to only three national systems—Australia, Malta and Northern Ireland. This contrasts with the popularity of the List system, which is favoured by 80 percent of countries that presently elect their legislatures using proportional representation (Farrell 2001).

One reason that explains the reluctance of decision-makers to use PR-STV is due to concerns about the elaborate nature of its vote counting rules⁸. The vote counting procedures of PR-STV are often criticised for being unnecessarily complex and difficult for the average voter to understand. Proponents of PR-STV have attempted to address this by attempting to improve the accuracy and fairness of vote counting rules. Much of this effort has been concentrated on refining the mechanisms for transferring votes to continuing candidates as contestants are either elected or eliminated from the count. This section traces the evolution of methods used to transfer votes using PR-STV.

The Problems of Transferring Votes

The concept of the ‘transferability’ of the elector’s vote, which is at the heart of the PR-STV system, gives rise to a situation where there are at least five different ways in which a candidate can be elected:

1. elected with an exact number of first preference votes
2. elected with a surplus of first preference votes
3. elected with a combination of first preference votes and vote transfers from a previously elected candidate
4. elected with a combination of first preference votes and votes from excluded candidates
5. elected with a combination of first preference votes and vote transfers from previously elected candidates and excluded candidates.

It is extremely unlikely that any of the elected candidates at an election will attain an exact quota of votes needed to win a seat. The distribution of votes between candidates is inevitably uneven with some contestants attracting more votes than are required to gain election and other contestants

⁸ It is also true that political parties are typically averse to this type of electoral system because it places control of the election process in the hands of the voter. List-PR systems developed, therefore, as a compromise between those wanting greater proportionality in electoral outcomes and those favouring greater control by party machines (Farrell 2001).

obtaining too few. This tendency is amplified when there are a large number of candidates contesting an election, as typically occurs under PR-STV systems owing to lower electoral thresholds. The more contestants that have nominated for the election, the greater the likely effects of vote dispersion and the more vote transfers that will need to be performed to finalise the results (Krebs 1998, 927). This has necessitated the development of rules to count votes to ensure that all vacancies are eventually filled.

Many of the rules that have been devised to count votes are standard features in the jurisdictions which use PR-STV. For example, it is accepted practice that the surplus votes of an elected candidate should always be distributed ahead of those of low-scoring candidates. There is also agreement that when distributing the first preference votes of an excluded candidate, the count should behave as if that contestant had never existed. This typically means that the first preference votes of a candidate eliminated from the count are transferred at full value, or 1.00.

There are, however, differences of opinion about the procedures that should govern the transfer of other types of votes. This problem is particularly manifest in relation to the transfer of surplus ballot papers of a candidate elected as a result of a transfer of votes from other elected candidates or excluded contestants. Variations and disagreements exist as to which parcels of votes should be transferred and what value should be assigned to them.

The first recognised method for dealing with the issue of surplus votes was devised by Thomas Hare, one of the men credited with the invention of PR-STV. Hare originally proposed that all of the ballot papers which immediately gave rise to an elected candidate's surplus should be passed on to the next available preference. That is, at the point at which a candidate attains a quota, any further counting of first preferences for this contestant should cease and the remaining surplus votes checked for their second and subsequent preferences and reassigned to the relevant continuing candidate or candidates (Hoag & Hallet 1926; Humphreys 1911: 140-141).

Hare's method was soon discredited on the basis that it injected an unacceptably high element of chance and uncertainty to election outcomes. Depending on the order in which votes were counted, this would determine which ballot papers made up the elected candidate's quota and which would be transferred to continuing candidates. It became clear that this method could quite easily produce a different set of election results when applied to different ballot papers. Moreover, the propensity for differential election results was likely to be significantly increased in small elections where the contest was close and a recount was required (Hoag & Hallet 1926; Humphreys 1911: 140-141).

Although some proponents regarded the element of chance in Hare's original method to be negligible, particularly in the case of large elections⁹, a new system was devised in order to reduce the propensity for error when transferring surplus votes. The resulting system, known as the proportionate method of Random Selection, sought to do this by guaranteeing that each unelected candidate marked as the voter's next preference received an exact proportionate share of the

⁹ See Humphreys (1911) pages 336-342.

surplus. The relevant number of votes was then drawn at random from the elected candidate's ballot papers and transferred to the appropriate continuing candidates (Humphreys 1911: 142-143).

The Random Selection method was regarded as more accurate than Hare's original scheme and it was thought that in 'an election of any considerable size those rules get a very close approximation of the right values' (Hoag & Hallett 1926: 392). However, not everyone was convinced that the Random Selection method necessarily solved all of the problems identified in Hare's original proposal. Concerns were expressed that while the Random Selection method eliminated the element of chance the first time that surplus ballot papers were distributed, it was not, however, wholly removed if some of these ballot papers were used in subsequent transfers to other candidates (Hoag & Hallett 1926). Some scholars ventured that in a close election it was possible that ballot papers that had been chosen at random for transfer were only likely to be representative in relation to the candidate for whom the ballot papers had been initially selected. There was no guarantee that if the elected candidate was to attain a surplus that these same ballot papers would provide an accurate indication of the strength of support for those candidates remaining in the count. This could prove problematic in a recount as the process of repeatedly taking fresh samples of votes could potentially lead to a different outcome each time (Lakeman 1974).

In 1880, an Australian mathematician by the name of J B Gregory devised a solution to the problem of the random selection of ballot papers. Gregory suggested that whenever it was necessary to transfer surplus votes, all of the elected candidate's papers should be transferred but at a reduced value. Gregory proposed that this could be achieved by dividing the elected candidate's surplus by the total number of votes received by that candidate. The resulting figure, known as the transfer value, is then multiplied by the second choices listed on the elected candidate's ballot papers. In this way, all of the successful candidate's votes are transferred, rather than a random selection of his or her ballot papers, at a reduced value rather than at full value. This system was subsequently labelled the 'Gregory' method¹⁰ (Hoag & Hallett 1926; Homeshaw 2001; Humphreys 1911).

Although the Gregory method represented a refinement of the Hare and Random Selection models, some aspects of these earlier systems were retained. One particular practice that was continued was where a candidate was elected as a result of a transfer of ballot papers from other elected or excluded contestants, only the last parcel of votes which was received by the winning candidate was considered eligible for reassignment¹¹.

The decision to transfer only those ballot papers thought responsible for the successful candidate's surplus was largely a response to practical considerations. The constraints of traditional hand counting methods made it expedient to only include the last parcel of papers where there were many ballot papers that needed to be re-examined for subsequent preferences. Not only did this make it quicker to perform the count, because it significantly reduced the number of ballot papers that

¹⁰ The Gregory method was first used in Australia following its incorporation in elections for the Tasmanian Legislative Assembly in 1907 (Newman 1992; Homeshaw 2001).

¹¹ In the case of the Random Selection method, when there is a secondary surplus the only papers selected for transfer are those last filed in the sorting process and the same proportion of the ballot available for each continuing candidate is taken for transfer (Hoag & Hallett 1926; Humphreys 1911).

needed to be checked for later preferences, but it was also advantageous if a recount was required (Todd & Hill 1999).

There was also a philosophical basis for only including the last parcel of ballot papers when transferring the surplus ballots of an elected candidate. Leslie Sykes suggests that one of the reasons for not considering all the votes of a candidate elected with a surplus was the belief that these original votes had exhausted their value and should not be used in any subsequent transfer of votes (Sykes 1990). This view has been rejected in some academic circles on the basis that it presupposes that the voter seeks only to contribute to the election of one candidate¹². Some scholars argue that such logic has the effect of imbuing those votes last credited to a winning candidate with a special significance only because they had the good fortune of being added to the votes an elected candidate had previously received at the point he or she was elected (Sykes 1990).

In Australia, this emerged as an issue at the 1974 Commonwealth Senate election¹³. At this time, Senate elections were conducted using the Random Selection method. It was claimed by the Australian Labor Party (ALP) that the failure of the electoral rules to specify that a winning candidate's first preference votes should be included in a transfer of surplus votes resulted in the party losing a seat to the Liberal Party. Labor's position was later given credibility when Australian academic, Alastair Fischer, published several research papers supporting the ALP's claim that the practice of only transferring the last parcel of ballot papers credited to an elected candidate had cost the party a seat in the Senate on this occasion (Fischer 1981). Fischer's research concluded that the decision not to consider all the ballot papers of an elected candidate when transferring surpluses was 'a negation' of proportional representation and did not 'keep faith with those voters who presently vote for a second party in a party list in the mistaken belief that their preferences have some weight' (Fischer 1981: 60).

¹² In 1991, the Plant Committee, set up by the Labour Party in Britain to examine voting systems, argued that it was arbitrary to only consider the last parcel of votes and that the 'most thorough and no doubt most fair method is to look at the second preferences of all votes' (quoted in the *Jenkins Report* 1998: 74).

¹³ The particulars of this case are as follows. The number three on the Coalition's joint ticket in Queensland, Neville Bonner, was elected to the Senate. Bonner had attained an extraordinarily high number of first preference votes from people who did not necessarily follow his party's ticket. These votes were not transferred in keeping with the rule that the first preference votes of a candidate elected as a result of a transfer of preferences are not included when distributing surplus ballot papers. The result was that Malcolm Colston of the ALP failed to win the last seat. It was later claimed by Colston that had all votes of the elected candidate been transferred then he would have won the final Senate seat 'by over 10,000 votes instead of losing by 4,911' (Colston 1975: 109).

When the ALP won national office in 1983 it was no surprise that the method for transferring surplus votes, along with the Random Selection system, was investigated officially by the Joint Standing Committee on Electoral Reform (JSCER), which was reviewing the Commonwealth electoral system. The first report handed down by the JSCER took the view that the failure to not account for all of an elected candidate's votes when transferring his or her surplus was a 'defect' in the system (JSCER 1983: 58). In light of the concerns raised in the JSCER report¹⁴, it was recommended that 'when transferring excess votes, all of the votes for a candidate be counted, including his number one votes, not only those ballots transferred to him' from other elected and excluded contestants (JSCER 1983: 65).

The new system subsequently adopted on the recommendation of the JSCER was a modified variant of the Gregory method. The new method, while retaining most of the fundamental principles of the Gregory system, included the refinement that all of an elected candidate's preferences must be considered when calculating transfer values. The system, dubbed the 'Inclusive Gregory' system, came into effect for Senate elections in 1984. Within a year of the implementation of the Inclusive Gregory system for Commonwealth upper house elections, the same formula was adopted by the South Australian Parliament for the Legislative Council (South Australian Electoral Office 2002). Two years later, Western Australia adopted the same method for use at Legislative Council elections.

Despite the willingness of three Australian parliaments to adopt the Inclusive Gregory system, there were significant criticisms expressed of the new procedure. It was the Proportional Representation Society of Australia that first raised concerns about the system in a submission made to the JSCER, which had been appointed to review the operation of the 1983/84 amendments to the Commonwealth's electoral legislation. The Proportional Representation Society's submission, among other things, expressed concern that the equal weighting in the distribution of surpluses was 'defective' and could cause a situation where some transfer values might rise, rather than decrease, in value. The Proportional Representation Society argued that this would give unfair advantage to some voters (JSCER 1986: 133).

The Proportional Representation Society proposed that a solution to this problem was to weight the transfer values of those ballot papers received under an existing transfer value in a previous count. However, the Australian Electoral Commission (AEC) responded to the Proportional Representation Society's scheme, known as the Weighted Inclusive system, by saying that this model was more complicated than any of the other methods presently in use. In particular, the AEC argued that the modification would impose an additional arithmetical burden as well as increase the number of counts required to undertake subsequent exclusions. The Australian Electoral Commissioner concluded by saying that the Proportional Representation Society's proposal would increase the time required to conclude the scrutiny and thus to obtain the final result. The JSCER

¹⁴ Within the Commonwealth Parliament, the concern was raised that rules that permit only the last parcel of ballot papers to be included in the transfer of an elected candidate's surplus were unfair and would encourage political parties to behave dishonestly. It was suggested that this anomaly created an incentive for the major parties to not rank those candidates likely to enjoy broad public support in the number one position on the party's ticket in a bid to frustrate the wishes of those voters who might not ordinarily vote for the party this candidate represents (*CPD*, Senate 29 May 1984, 2344).

concurred with the position of the AEC with the result that the Proportional Representation Society's proposed modification to the formula of the Inclusive Gregory method was not adopted (JSCER 1986).

Many of the concerns that were voiced in the mid to late 1980s about the Weighted Inclusive method no longer strictly apply. The widespread use of computers has meant that it is now possible to perform multiple and complex calculations easily. However, computers are being put to uses other than merely streamlining traditional hand counting processes. Computer technology is proving amenable to the development of new methods to count votes and transfer the surplus ballot papers of elected candidates. The objective is to increase the accuracy of election outcomes by reducing the number of arbitrary decisions that are made to expedite the counting of votes when using conventional hand counting systems. The most advanced of these new methods which is in use at the present time is the Meek system¹⁵.

The Meek method was initially developed by British mathematician, Brian Meek, in 1969 and later refined by Douglas Woodall, Brian Wichmann and David Hill in 1987 (Hill & Todd undated; Lampp 2002). The Meek method seeks to address the fact that traditional hand counting methods do not transfer votes to candidates who have already reached a quota of votes necessary for election (Woodall 1994:11). Some scholars argue that the failure to distribute the preferences of the voter in exact order, particularly when the next available choice is an elected candidate 'entails questionable equality to have one's vote transferred' (Tideman & Richardson 2000a). It is suggested that this practice can encourage some voters to engage in a particular form of tactical or insincere voting which allows them to increase the influence of their vote over the outcome. The strategy involves assigning a first preference vote for a candidate that is likely to be excluded early in the count. Because all initial surpluses will have been transferred when this candidate is eliminated, it means that the voter does not use their vote to elect candidates who do not need their help. This allows the voter to exert a greater influence over the election of the remaining candidates (Tideman & Richardson 2000a; Todd & Hill undated; Woodall 1994).

The Meek solution to this problem is to make it possible for an elected candidate to continue to receive votes from excluded and other elected candidates until all vacancies have been filled. This is achieved through the calculation of a retention fraction for every candidate such that when a candidate is elected he or she retains a fraction of every vote or part of every vote that is transferred to them.

¹⁵ In addition to the Meek system, there is the Warren method. The Warren method is regarded as being very similar in its objectives to the Meek method in that it seeks to make it possible to transfer the votes of excluded candidates to already elected candidates and then re-do the transfers of the elected candidate's surpluses. Whereas the Meek method uses 'retention values' to achieve this outcome, the Warren method employs the concept of 'candidate prices'. At this stage, the Warren method is regarded as highly experimental with some scholars, such as David Hill, concerned that there are still problems which need to be ironed out before the Warren method could be considered viable (Hill 1994). For more information on the Warren method see (Warren 1994; Tideman & Richardson 2000b).

Table 4
Evolution of Methods for Transferring Surplus Votes

Random Selection Method	A proportion of the relevant ballot papers are transferred at full value
Fractional Methods <ul style="list-style-type: none"> • Gregory system • Inclusive Gregory system • Weighted Inclusive system 	All relevant ballot papers are transferred at a fraction of their value
Computerised Methods <ul style="list-style-type: none"> • Meek method 	The capacity to transfer ballot papers to candidates already elected

The Meek method represents the continuation of the tradition among users and supporters of PR-STV systems to refine the vote counting process in order to give better expression to the wishes of the voters. The desire on the part of advocates of PR-STV systems to improve the accuracy and efficiency of pre-existing methods has inevitably resulted in the invention of systems designed to meet perceived shortfalls in earlier models. Despite the evolution in methods over the years to transfer surplus and unused ballot papers (see Table 4), the creation of newer techniques has not necessarily resulted in older methods disappearing from use. Many of the jurisdictions which favour PR-STV continue to use the Random Selection method and the original Gregory system, even though both schemes were developed more than 100 years ago.

The next chapter examines in detail the mechanics of five of the most commonly used and discussed methods to transfer surplus votes.

CHAPTER THREE

THE DEVIL IN THE DETAIL: RANDOM SAMPLING, THE FRACTIONAL METHOD AND COMPUTERISED METHODS

The previous chapter traced the development of methods to transfer surplus votes in PR-STV systems. It showed that new techniques have emerged in response to attempts to refine and improve existing models and advancements in technology. This section surveys the Random Selection method, the Gregory method, the Inclusive Gregory method, the Weighted Inclusive Gregory method and the Meek method in detail and outlines the various strengths and weaknesses of these systems¹⁶. This is followed by a case study which provides a practical demonstration of the differences between each of the methods.

Similarities and Differences Between the Methods

There are a number of broad similarities in the way that each of the five methods approach the transfer of surplus votes of a candidate elected on first preference votes. The number of ballot papers to be transferred is calculated by subtracting the total number of votes received by the candidate elected on first preference votes from the quota. The resulting figure determines the number of ballot papers available for transfer to candidates who remain active in the count. Similarly, each of these methods handle the transfer of votes from candidates who have been excluded from the count in much the same fashion. The ballot papers of a candidate who has been eliminated are always transferred at the same value at which that candidate received them.

There are, however, significant differences in the manner in which the various methods deal with the surplus votes of a candidate elected as a result of transfer of votes from other candidates. Each of the methods vary not only in respect of which parcel of ballot papers is selected when transferring surplus votes, but also what values are attributed to these votes at the point at which they are passed on to continuing candidates.

The Random Selection Method

The Random Selection method is one of the original schemes devised to transfer the ballot papers of elected candidates with an excess of votes. It was the method selected by the Commonwealth Parliament of Australia when proportional representation was adopted for Senate elections in 1949. The Chifley Labor Government believed at the time that any of the attendant problems associated with the random selection of ballot papers for transfer to be so mathematically insignificant as to be 'negligible'. The Government played down the risks further by suggesting that 'in 98 percent or 99 percent of instances the electors will vote the party ticket' (CPD 16 April 1948). The

¹⁶ This chapter was compiled with the assistance of Kirsten Robinson from the Western Australian Electoral Commission, Bogey Musidlak from the Proportional Representation Society of Australia and Stephen Todd from the Electoral Reform Coalition of New Zealand. For a brief summary of the advantages and disadvantages of each of these methods see Appendix 4.

Government also justified its choice of this method on the basis that it would permit the electoral authorities to verify election results quickly and would be easier to apply than any of the other systems on offer at that time¹⁷. In 1983, the Hawke Labor Government replaced the Random Selection method with the Inclusive Gregory method, on the recommendation of the Joint Standing Committee on Electoral Reform. The Random Selection method continues to be used in Malta and Ireland and for elections of the New South Wales Legislative Council.

How the Random Selection Method Works

A candidate is elected with a surplus following a transfer of preferences from other elected and excluded contestants. In order to determine how many ballot papers each of the remaining candidates should receive, the elected candidate's total number of surplus votes is divided by the number of ballot papers in the last parcel received by the candidate at the point at which he or she was elected. The resulting figure is multiplied by the number of ballot papers in the last bundle of votes credited to the elected candidate for each continuing contestant listed as the next preference. A quantity of ballot papers equal to this number is then drawn at random from the last parcel of votes and assigned to the relevant continuing candidate at full value (Electoral Council of Australia: 2001). The formula for determining how many ballot papers are transferred is calculated as follows:

$$\frac{\text{Elected candidate's surplus}}{\text{Number of ballot papers in the last parcel}}$$

The Advantages of the Random Selection Method

- It results in the transfer of the correct number of ballot papers to each of the continuing candidates. The method ensures that the surplus votes of an elected candidate are transferred in due proportion to the remaining candidates for whom a subsequent preference has been expressed.
- The method produces both an accurate and consistent electoral outcome if the ballot papers selected for transfer are not later used in subsequent transfers¹⁸.
- The method can be performed without sophisticated computer programs. This means that results are easy to verify manually.

¹⁷ The Government rejected the Gregory system because it was believed that the method was only suitable when the number of votes are small and concentrated to one centre. 'Not only would that delay completion, involve risks of loss in transit, and increase costs heavily, but also in the larger states the Commonwealth Electoral Office would be forced to secure staff, equipment, extra people and pay for their accommodation costs' (CPD 16 April 1948).

¹⁸ However, it is worth mentioning that in New South Wales it is possible that outcomes in a relatively close election would be consistent in a countback of votes owing to the high number of electors who choose to vote above the line. For example, at the 1999 election of the Legislative Council approximately 96 percent of voters opted to vote in accordance with the instructions of the political party or group that they had assigned their first preference vote (New South Wales State Electoral Office 2002).

The Disadvantages of the Random Selection Method

- It can introduce an element of chance to the election outcome if the transfer of papers that have been selected at random enables another candidate to attain a surplus. Because these ballot papers have been chosen at random there is the possibility that the further preferences shown on them may not be the same as those on any other set of papers chosen in the same way. This can create a significant problem if the vote between two candidates is close and a recount is required. This leads to the possibility that a different set of results could be obtained in a countback¹⁹.
- There is the slight possibility that under certain conditions some ballot papers could increase in value. This could occur if the same ballot paper was transferred more than once during the course of the count.
- The method considers only the last parcel of ballot papers received by the elected candidate, at the point at which he or she was elected, eligible for transfer. Earlier parcels of ballot papers credited to an elected candidate are regarded as having exhausted their value, while the last packet of ballot papers that was transferred to the contestant is deemed to be surplus. In doing so, this practice discriminates against those voters whose ballot papers are transferred to the elected candidate ahead of his or her attaining a quota. This delivers an unfair electoral bonus to those ballot papers that give immediate rise to the elected candidate's surplus.

The Fractional Methods

The fractional methods represent the second generation of techniques devised to transfer the surplus votes of elected candidates. There are three basic types of fractional systems: the Gregory method, the Inclusive Gregory method and the Weighted Inclusive Gregory system. The three fractional methods are similar to the extent that surplus ballot papers are transferred at a fraction of their original value, known as a 'transfer value'. There is, however, significant variation in which parcel of ballot papers is used to calculate the transfer value and to which votes the transfer value is subsequently applied.

The Gregory Method

The Gregory system is the original fractional method and was first used in Australia for elections of the Tasmanian Legislative Assembly on a state-wide basis in 1901. The Australian Capital Territory Legislative Assembly adopted the Gregory method following a referendum to replace the D'Hondt system of proportional representation with PR-STV in 1992. The Gregory method is often

¹⁹ It is generally acknowledged that it is improbable that a grossly unrepresentative selection of ballots would be selected. In 1981, Fischer calculated that the probability that the winning margin would be small enough to have to worry about the sampling problem is estimated to be 2.1 percent. He claims that if the practice continued to be used, the probability that the wrong candidate would be elected in the future is estimated to occur in one state in Australia on about .22 percent of occasions that a Senate election is held Australia wide (Fischer 1981). The high number of voters who vote in accordance with the instruction of the party that they indicated a first preference for adds credence to this view.

colloquially referred to as the ‘last parcel method’ owing to the practice of including only the last batch of ballot papers that gave rise to the elected candidate’s surplus. It is the method currently endorsed by the Proportional Representation Society of Australia and the Electoral Reform Society of Great Britain and Ireland (<http://www.cs.mu.oz.au/~lee/prsa/index.html>; <http://www.electoral-reform.org.uk>).

How the Gregory Method Works

When a candidate is elected with a surplus derived from the transfer of votes from other elected and/or excluded candidates, the excess of votes is passed on to continuing candidates. A ‘transfer value’ is calculated by dividing the surplus of the elected candidate by the total number of ballot papers contained in the last parcel of ballot papers that were credited to the contestant. The last parcel of ballot papers is then checked and sorted into parcels according to each of the remaining candidates for whom the next preference has been indicated. The transfer value is then multiplied by the number of ballot papers for each of the relevant continuing candidates (Electoral Council of Australia: 2001). The transfer value is calculated as follows:

$$\frac{\text{Elected candidate's surplus}}{\text{Number of ballot papers in the last parcel}}$$

The Advantages of the Gregory Method

- Like the Random Selection method, the Gregory system ensures that the correct number of votes in the last parcel of ballot papers credited to the elected candidate is transferred to each of the continuing candidates for whom a subsequent preference has been expressed.
- The Gregory method eliminates the element of chance associated with the Random Selection method because it transfers all the relevant ballot papers at a fraction of their incoming value. This ensures that a consistent electoral outcome will be produced if a recount of the result is required.
- There is no likelihood that any of the votes will increase in value as a result of the transfer of surplus votes.
- The simplicity of the method means that the count can be conducted without the use of computers.

The Disadvantages of the Gregory Method

- Like the Random Selection method, the Gregory method does not treat all the ballot papers of a candidate elected with a surplus equally. This method decides which ballot papers are eligible for transfer based on the order and timing of the exclusion of other candidates. The result is that the value of the last parcel of ballot papers received by an elected candidate will have greater worth than ballot papers received by the candidate in intervening counts. The votes that constitute the last parcel not only contribute to the election of the candidate to whom their vote

was transferred, but in the event the elected candidate acquires a secondary surplus, these ballot papers are then passed on to remaining candidates (Farrell & McAllister 2002; Sykes 1990). This practice undermines the democratic principle that the ballot papers of all voters should be considered equally.

The Inclusive Gregory Method

The Inclusive Gregory system was first used for Commonwealth Senate election in 1984. It was later adopted by both the South Australian and Western Australian parliaments for electing representatives to their respective legislative councils. The Inclusive Gregory system is specifically designed to ensure that all of the votes of a candidate elected with an excess of the quota are considered when transferring surplus ballot papers, and not just the last parcel of votes credited to the elected candidate.

How the Inclusive Gregory Method Works

Unlike the Gregory system, the Inclusive Gregory method does not regard surplus ballots not contained in the last parcel as having exhausted their total value. For this reason, all the ballot papers of a candidate elected due to a transfer are included when calculating the transfer value. The transfer value is derived by dividing the elected candidate's surplus by the total number of ballot papers received by that candidate. This is multiplied by the number of votes for each continuing candidate for whom a second preference is indicated to determine the number of votes to be transferred. The transfer value is calculated as follows:

$$\frac{\text{Elected candidate's surplus}}{\text{Total number of ballot papers received by the elected candidate}}$$

The Advantages of the Inclusive Gregory Method

- This method is designed to guarantee that all surplus ballot papers, and not just the last parcel received, are considered when calculating the transfer value. Not only does it mean that all of the ballot papers that make up the surplus are given equal weight in the calculation of transfer values, but that all voters are afforded the opportunity to contribute to the election of more than one candidate.
- The relative simplicity of the Inclusive Gregory system means that the count can be performed without the use of computers.

The Disadvantages of the Inclusive Gregory Method

- There is the possibility that under certain circumstances the vote values of some ballot papers transferred previously in the count will be passed on at a higher value than that at which they were received. This seems most likely to occur where the elected candidate's vote is composed of a number of parcels of ballot papers transferred under different transfer values. If the transfer values of some of these ballot papers are relatively small and the ratio of the elected candidate's surplus to his or her total number of ballot papers is 10 percent or greater, there is a strong

possibility that some of these smaller parcels of ballot papers will rise in value. The increase in the value of some ballot papers, under these conditions, runs counter to the concept of the *single* transferable vote.

- There is a risk that any large parcel of ballot papers transferred at a pre-existing transfer value can dominate the elected candidate's surplus at the expense of smaller parcels of ballot papers credited at full value. This can occur because transfer values are calculated not on the basis of the elected candidate's total number of votes but on the total number of ballot papers received.

The Weighted Inclusive Gregory Method

The Weighted Inclusive Gregory method was devised by the Proportional Representation Society of Australia in the early to mid 1980s. The method has not been adopted by any jurisdiction either in Australia or overseas which uses PR-STV. The Weighted Inclusive system is the model preferred by the Proportional Representation Society of Australia unofficially²⁰ (Musidlak 2002).

This method transfers all ballot papers of an elected candidate while simultaneously ensuring that the value of ballot papers does not exceed 1.00. The Weighted Inclusive Gregory system does this by applying different fractional values to each of the parcels of votes that make up the elected candidate's total vote.

How the Weighted Inclusive Gregory Method Works

The Weighted Inclusive Gregory system does not treat all of the ballot papers of a candidate elected with a surplus in the same way. In the case of an elected candidate's first preference votes and the ballot papers received from excluded candidates, a transfer value is obtained by dividing the elected candidate's surplus by his or her total vote. The resulting transfer value is then applied to both the elected contestant's first preference votes and the ballot papers received from excluded candidates. However, votes that are transferred to the elected candidate at less than full value, are dealt with differently. The transfer value is calculated by dividing the surplus of the elected candidate by the elected candidate's total vote and then multiplied by the fractional value at which the transferred vote was received. The resulting fraction is then applied to those votes for which a separate transfer value has been calculated. The transfer value is calculated as follows:

Elected candidate's first preference votes and/or votes received from excluded candidates:

$$\frac{\text{Elected candidate's surplus}}{\text{Total number of votes received by the elected candidate}}$$

Ballot papers transferred to the elected candidate which were received under a pre-existing transfer value:

²⁰ The Proportional Representation Society of Australia does not openly advocate support for the Weighted Inclusive Gregory system because it is presently concerned with lobbying Australian governments on other electoral matters (Musidlak 2002).

$$\frac{\text{Elected candidate's surplus}}{\text{Total number of votes received by the elected candidate}} \times \text{current transfer value}$$

The Advantages of the Weighted Inclusive Gregory Method

- This method ensures that all votes, and not just the last parcel of ballot papers credited to the contestant at the point at which he or she was elected, are included in the surplus ballot papers.
- The method avoids the situation whereby incoming values of transferred surplus votes might increase in value. All transfer values are included, although there is no possibility that previously transferred ballots will increase in value.

The Disadvantages of the Weighted Inclusive Gregory Method

- The counting process is considerably more involved than the other two variants of the fractional method. It would require many additional calculations in order to finalise the results. It would be extremely difficult to calculate transfer values under this method in a timely fashion without the assistance of computers.
- The method is slightly more complex than either the Gregory method or the Inclusive Gregory method. This undermines the principle that the mechanics of an electoral system should be transparent and easy to convey to the voter and other relevant stakeholders.

The Meek Method

The Meek method represents the third generation of techniques for transferring surplus votes²¹. It has been approved in New Zealand for use in District Health Board elections in 2004, and Territorial and Regional councils also have the option to conduct local government elections using Meek rules.

According to Stephen Todd and I D Hill, the Meek system ‘retains all the essential features and aims of STV’ with a number of innovations (Hill & Todd undated paper). In particular, there are two aspects of the Meek system which distinguish it from traditional hand counting rules. First, the Meek method has the capacity to ensure that an elected candidate continues to receive votes from excluded and other elected candidates until all vacancies have been filled. Second, Meek can recalculate the quota needed for election during the count to take into account those ballot papers which are non-transferable.

How the Meek Method Works

The terminology of the Meek method is not ‘transfer values’, as employed in the fractional methods, but ‘retention fractions’. This retention fraction is known as a ‘keep value’ and it refers to that proportion of every vote, or part of every vote, received by an elected candidate (Hill & Todd

²¹ For more detail on the Meek method see Appendix 3.

undated). The ‘keep value’ for all candidates is initially set at 1.0. It does not change until a candidate is either elected or excluded. If a candidate is successful in attaining sufficient votes to gain election, his or her ‘keep value’ is reduced to reflect that proportion of the vote that the candidate must retain in order to maintain a quota. In the event that the candidate is eliminated from the count, his or her ‘keep value’ is permanently reset to 0.0 with the count behaving as if that contestant never existed. The ‘keep value’ is calculated by dividing the quota by the candidate’s current votes. The resulting figure is the fraction of the vote retained by the candidate while the remainder of the figure is that portion of the vote which is transferred to continuing candidates. Successive counts and changes to ‘keep values’ are made in this way until all positions have been filled (Hill & Todd undated; Lampp 2002). The ‘keep value’ is calculated as follows:

The current quota

The total number of the candidate’s current votes

The Advantages of the Meek Method

- This method, like the Inclusive Gregory method and Weighted Inclusive Gregory method, guarantees that all votes are considered equally in a transfer of surplus votes of an elected candidate.
- It is capable of ensuring that vote values at no time exceed 1.00. This means that ballot papers, particularly those previously transferred, will not inflate in value if passed on subsequently, as can sometimes occur when using the Inclusive Gregory method.
- The method transfers votes in the exact order indicated by the voter on the voting paper, even if candidates have already been elected. The only exception to this rule is if the candidate nominated as the next available preference has already been excluded.
- Reduces incentives for voters to cast their vote in any way other than according to their actual preferences. That is, the Meek method can minimise the incidence or the occurrence of strategic voting.
- The Meek method claims to minimise the number of wasted votes. This is achieved owing to the ability of the Meek system to recalculate the quota to reflect the smaller total of votes remaining in the count as votes are credited to the non-transferable total (Hill & Todd undated).

The Disadvantages of the Meek Method

- The Meek method is too complex to perform by hand and computers would be required to tabulate the results. This would make it extremely difficult to verify the results manually should this be required.
- There is the concern that due to the complexity of the rules, the Meek method adds further to the elaborate nature of PR-STV vote counting rules. The fact that the method is complicated could undermine the transparency of the vote counting process. In particular, the highly complex

iterative nature of the Meek rules would make it extremely difficult for officials from political parties to scrutinise the count.

- The method is experimental in that it has not been trialled in any large sized election.

A Case Study of the Methods

It is clear from the previous description of the five methods that there are significant variations in the manner in which each approach the transfer of surplus votes of a candidate who was elected following a transfer of votes from other elected and excluded candidates. The next section of this chapter will demonstrate the practical differences between each of these methods with the aid of a case study. It is important to point out that the case study is capable of providing the reader with only a glimpse of the potential of each of the methods to affect the outcome of an election under particular circumstances.

An Election Scenario

Ira has been elected having received a total of 925 votes. The quota is 650 votes which means that Ira has 275 surplus votes. Ira’s vote is made up of the following subparcels of ballot papers assigned to him during the course of the count, in the following order:

- (i) 475 first preference votes;
- (ii) 160 votes received following Rhonda’s election which represent 1,600 ballot papers; and
- (iii) 290 votes received at full value, as a result of Carla’s exclusion from the count.

Ira’s first preference votes	Rhonda	Carla
475	160 (1,600)	290

There is still one vacancy to be filled following Ira’s election and two candidates remaining—George with 520 votes and Sandie with 500 votes. Ira’s surplus votes will decide who wins the final seat. Each of Ira’s ballot papers, including those received from Rhonda and Carla, are examined for their next preferences. It becomes clear that 80 percent of Ira’s ballot papers have indicated a higher preference for Sandie over George, 60 percent of Rhonda’s supporters prefer Sandie to George while 80 percent of Carla’s ballot papers show George as the next preference.

Preference Rankings

	George	Sandie
Ira - 475	95	380
Rhonda - 160(0)	64(0)	96(0)
Carla - 290	232	58

The next section demonstrates how each of the different vote transferring formulas might affect the selection of the winner.

The Random Selection Method

Formula:

$$\frac{\text{Ira's surplus (275)}}{\text{Carla's ballot papers (290)}} \times \text{Carla's ballot papers for each of Sandie and George}$$

Ira's Vote	Sandie	George
A proportion of Carla's ballot papers to each candidate	54	219
TOTAL	+ (500) 554	+ (520) 739

Winner: <i>George</i>	1st preference votes	Rhonda's ballot papers	Carla's ballot papers
Incoming value	1.00	160 votes selected at random from 1,600 ballot papers 1.00	1.00
Outgoing value	0	0	273 ballot papers at full value 1.00
Contribution to surplus (%)	0	0	100

The Gregory Method

Formula:

$\frac{\text{Ira's surplus (275)}}{\text{Carla's ballot papers (290)}} \times \text{Carla's ballot papers to each of Sandie and George}$

Ira's Vote	Sandie	George
Carla's ballot papers x 0.94827586	55	220
TOTAL	+ (500) 555	+ (520) 740

Winner: <i>George</i>	1st preference votes	Rhonda's ballot papers	Carla's ballot papers
Incoming value	1.00	1.00	1.00
Outgoing value	0	0	0.94827586
Contribution to surplus (%)	0	0	100

The Inclusive Gregory System

Formula:

$$\frac{\text{Ira's surplus (275)}}{\text{Total number of Ira's ballot papers (2,365)}} \times \begin{matrix} \text{Ira's ballot papers} \\ \text{Rhonda's ballot papers} \\ \text{Carla's ballot papers} \end{matrix}$$

Ira's Vote	Sandie	George
Ira's ballot papers x 0.11627907	44	11
Rhonda's ballot papers x 0.11627907	111	74
Carla's ballot papers x 0.11627907	6	26
TOTAL*	(+ 500) 661	(+520) 631

* As votes are calculated in whole values, any left-overs are not included. On this occasion, this represents three votes that could not be allocated.

Winner: <i>Sandie</i>	1st preference votes	Rhonda's ballot papers	Carla's ballot papers
Incoming value	1	0.1	1
Outgoing value	0.11627907	0.11627907	0.11627907
Contribution to surplus (%)	20	67	13

The Weighted Inclusive Gregory Method

Formula:

$$\frac{\text{Ira's surplus (275)}}{\text{Ira's total vote (925)}} \times \text{Ira's ballot papers} = \text{Carla's ballot papers}$$

$$\frac{\text{Ira's surplus (275)}}{\text{Ira's total vote (925)}} \times \text{existing transfer value of Rhonda's ballot papers to be applied to Rhonda's ballot papers only}$$

Ira's Vote	Sandie	George
Ira's ballot papers x 0.29729729	113	28
Rhonda's ballot papers x 0.02972972	29	19
Carla's ballot papers x 0.29729729	17	69
TOTAL	(+ 500) 659	(+520) 636

Winner: <i>Sandie</i>	1st preference votes	Rhonda's ballot papers	Carla's ballot papers
Incoming value	1	0.1	1
Outgoing value	0.29729729	0.02972972	0.29729729
Contribution to surplus (%)	51	17	31

The Meek Method

Formula:

Quota of the vote needed for election (650)

Ira's total vote (925)

- = fraction of each of Ira's, Rhonda's and Carla's ballot papers retained by elected candidate (0.7027027)
- = fraction of each of Ira's, Rhonda's and Carla's ballot papers transferred to each of Sandie and George (0.2972973)

Ira's Vote	Sandie	George
Ira's ballot papers x 0.2972973	113	28
Rhonda's ballot papers x 0.2972973	29	19
Carla's ballot papers x 0.2972973	17	69
TOTAL	(+ 500) 659	(+520) 596

Winner: <i>Sandie</i>	1st preference votes	Rhonda's ballot papers	Carla's ballot papers
Incoming value	1.00	1/10th of 1,600 ballot papers transferred 0.10	1.00
Outgoing value	0.297	0.029	0.297
Contribution to (%)	51	17	31

A Summary of the Findings

The case study shows that there are significant differences, not only in the assumptions that underpin each of the methods, but also which ballot papers are selected for transfer and what values are attributed to them. In the case of the Random Selection method it is clear that the model operates on the basis that all ballot papers received by Ira prior to his attaining a quota have exhausted their value. The only ballot papers that are deemed to have not expended all of their 'potential' are those votes belonging to Carla. The logic of this method results in the disposition of Ira's surplus being dominated totally by Carla's ballot papers at the expense of those voters who voted for either Ira or Rhonda.

The Gregory system, much like the Random Selection method, is premised on the belief that all but the last parcel of ballot papers received by the elected candidate have exhausted their full potential. However, unlike the Random Selection method, the Gregory system does not transfer surplus ballot

papers at full value but allocates all votes at a fraction of their incoming value. The difference is clear when comparing the outgoing value of Carla's ballot papers under the two methods. While the Random Selection system transfers 273 of Carla's ballot papers at full value, the Gregory system transfers all 290 of her ballot papers at a transfer value of 0.9482. The advantage of the Gregory system over the Random Selection method only becomes clear in the event of a countback of the vote. Unlike the Random Selection method, the Gregory system is capable of delivering the same outcome following a recount.

The Inclusive Gregory system starts from the assumption that all ballot papers have an equal right to affect the make-up of the surplus. Not only does this mean that all of the subparcels of ballot papers that comprise Ira's total vote are used to calculate the transfer value, but that the resulting transfer value is applied to all ballot papers credited to him notwithstanding the value at which they were initially transferred. The effect of this is apparent when comparing the incoming and outgoing value of Rhonda's ballot papers. The case study shows that Rhonda's ballot papers increased in value by 0.016 rather than decreased as would be expected to occur on a subsequent transfer. Moreover, Rhonda's ballot papers dominate Ira's surplus despite the fact her ballot papers have expended some of their value in helping to elect another candidate previously.

The central tenet of the Weighted Inclusive Gregory method is that all ballot papers that make up Ira's total vote should be afforded the opportunity to contribute to the election of the next candidate in proportion to their remaining value. In order to ensure that this is achieved, a separate transfer value is calculated and applied to Rhonda's ballot papers because these have been received under an existing transfer value. This ensures that Rhonda's ballot papers do not rise in value or that they are over-represented in Ira's surplus. The contribution that each of the subparcels of votes make to the surplus is considerably more equitable than occurs under the Random Selection method, the Gregory system and the Inclusive Gregory method.

The Meek method is similar to the Weighted Inclusive Gregory method to the extent that it ensures that all parcels of ballot papers are included in the calculation of transfer values in due proportion. It also ensures that each of the subparcels received by Ira contribute to his surplus proportionate to their value. However, it is important to note that the demonstration of the Meek method does not show the full application of this system, which is the capacity to recalculate the quota and transfer ballot papers to candidates already elected. The ability of the Meek method to undertake both functions means that it is possible that it might occasionally produce slightly different election results to the Weighted Inclusive Gregory system.

CHAPTER FOUR

THE DILEMMA OF CHOICE: IS THERE A RIGHT METHOD FOR TRANSFERRING SURPLUS VOTES?

An ongoing challenge for proponents and users of proportional representation using the single transferable vote (PR-STV) has been to devise an appropriate mechanism to transfer ballot papers. There have been various attempts to improve and refine existing methods for transferring surplus votes. New formulas and methods have been devised over the years in response to perceived flaws in existing models, and advances in technology make techniques possible that were untenable when vote counting had to be performed manually.

This paper has examined five of the most recognised methods for transferring surplus votes. In particular, it has focused on the mechanisms for transferring the surplus ballot papers of candidates elected as a consequence of a transfer of ballot papers from other elected and/or excluded candidates. The research shows that there are significant variations between the systems. Not only does each method attribute very different values to outgoing or transferred surplus votes, but there are also differences in which ballot papers of an elected candidate are selected for transfer.

There is also evidence that each of the five methods has the potential to exert a slightly different impact on the outcome of an election. The case study included in chapter three provides an indication of the influence that the choice of formula can have on outcomes under particular conditions. The case study demonstrated that two of the methods, the Random Selection method and the Gregory method, resulted in a different winner than the three other formulas. The fact that only some of these methods picked the same candidate to win is consistent with the findings of a study undertaken by Tideman and Richardson (2000a) who compared various electoral formulas for transferring surplus votes. Their research revealed that different vote counting mechanisms could yield slightly different outcomes, particularly in relation to the election of the last candidate. Tideman and Richardson argue that variations in outcomes between the various systems are likely to be more pronounced the closer the result of an election and the greater the number of candidates that are contesting seats.

The paper also shows that there are definite trade-offs associated with each of the systems surveyed. Some of the methods, such as the Random Selection and the Gregory methods, are relatively easy to implement and simple to use. At the same time, both methods can be criticised for privileging certain voters because their ballot papers were credited to the candidate at the point at which he or she was elected. In contrast, the Inclusive Gregory method gives priority to ensuring that all ballot papers are considered when transferring the surplus votes of an elected candidate even if this means that some ballot papers increase in value. The Weighted Inclusive Gregory and the Meek methods avoid the anomalies of the other systems. These methods include all ballot papers received by an elected candidate in a transfer of his or her surplus votes but can also guarantee that the value of a vote will not exceed 1.00 on a subsequent transfer. However, both methods are considerably more

complex and elaborate than the Random Selection, Gregory and the Inclusive Gregory methods. The highly iterative nature of the Meek system, in particular, can significantly reduce the transparency and manageability of vote counting procedures and complicate the ability of party officials to scrutinise the counting of votes.

There does not appear to be any consensus about which of the methods provides the best system for transferring surplus votes. The lack of agreement about which system is superior is confirmed by the fact that the various jurisdictions which use PR-STV each employ different methods. Northern Ireland, Malta and New South Wales continue to use the Random Selection method even though this is strongly objected to by some scholars because it can introduce discrepancies into the results, particularly if the outcome of an election is close and it is necessary to perform a recount. The Tasmanian and Australia Capital Territory legislatures use the Gregory method because it is regarded as both philosophically sound and functional. This is despite the fact that the Gregory system has been criticised because it considers only the last parcel of ballot papers when transferring surplus votes. In contrast the Commonwealth Senate, South Australia and Western Australia adopted a system that can increase the value of some votes under certain conditions. The Commonwealth, particularly, continues to use this system despite knowledge of this anomaly on the basis that the instances where transfer values might rise are potentially rare.

Even if there was such a thing as a 'best' method, there is no guarantee that it would remedy the problem of arbitrary and random effects impacting on electoral outcomes. This is partly a by-product of the fact that there is no such thing as the perfect electoral system.

It is generally acknowledged that all electoral systems 'can be proven to fail relatively undemanding tests of fairness and rationality' (Reilly 2001: 163; Dummett 1997; Farrell 2001; Katz 1997; Rae 1971). This is no less true of PR-STV as the preference orderings of some voters will count more than others, no matter how sophisticated a method purports to be. For example, the second preferences of voters who choose a relatively unpopular candidate will always have their ballot papers counted before the second preferences of those electors who voted for a relatively popular candidate. This situation arises by virtue of the arbitrary, albeit necessary, rule that once all surplus ballot papers have been distributed the lowest scoring candidate must be eliminated (Reilly 2001: 163). The existence of anomalies does not necessarily lessen the legitimacy of an electoral system. The 'odd' random effect is tolerated not only because it is understood that no electoral system is perfect, but because PR-STV is the most appropriate electoral formula if the objective is to ensure greater proportionality in electoral outcomes and to increase the freedom of choice available to the voter.

Moreover, there are many other factors which impact on electoral outcomes, not just the formula for transferring surplus votes. Decisions made in relation to district magnitude, for example, are likely to have a much greater influence on the selection of the winners and losers than most other types of electoral rules. The division of a voting area into multi-member regions rather than on a state-wide basis has the effect of significantly increasing the number of votes that a candidate requires to win a seat. The larger the district magnitude, the less votes that an individual candidate will need to attain in order to win a seat (Farrell 2001; Katz 1997; Rae 1971).

It would appear, therefore, that the choice of formula to transfer surplus votes is not a straightforward proposition. All of the systems reviewed in this paper possess both strengths and weaknesses and all accomplish the task that they were designed to perform. This is not to suggest, however, that reform should not be attempted if the use of a particular formula for transferring surplus votes generates an anomaly which is at odds with those values deemed by the political community to be important. The issue is which democratic principles an electoral system holds as sacrosanct and what trade-offs should be made to preserve these values or ideals.

APPENDIX 1

PROPORTIONALITY OF OUTCOMES AT ELECTIONS OF THE WESTERN AUSTRALIAN LEGISLATIVE COUNCIL SINCE 1989												
Election	1989		Seats won	1993		Seats won	1996		Seats won	2001		Seats won
Party	First preference vote		First preference vote	First preference vote		First preference vote	First preference vote		First preference vote	First preference vote		First preference vote
	(n)	(%)	(%)									
Australian Democrats	28,111	3.32	0	27,640	3.01	0	64,461	6.58	5.88	38,968	3.72	0.00
Australian Labor Party	350,046	41.33	47.06	337,554	36.82	41.18	323,886	33.08	35.29	397,846	37.94	38.24
Christian Democrats	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	16,105	1.54	0.00
Greens WA	16,156	1.91	0	47,305	5.16	2.94	54,336	5.55	8.82	83,883	8.00	14.71
Grey Power	34,055	4.02	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Independents	14,856	1.75	0	38,304	4.18	2.94	37,236	3.80	0	25,613	2.44	0
Liberal Party	347,665	41.05	44.12	418,039	45.60	44.12	449,799*	45.94	41.18	356,126	33.96	35.29
National Party	42,338	5.00	8.82	36,614	3.99	8.82	5,087	0.52	8.82	25,204	2.40	2.94
One Nation Party	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	103,571	9.88	8.82
Others	13,712	1.62	0	11,327	1.24	0	44,357	4.53	0	1,436	0.14	0
TOTAL FORMAL VOTE	846,939	100.00	100.00	916,783	100.00	100.00	979,162	100.00	99.99	1,048,752	100.00	100.00

Source: Western Australian Electoral Commission 2001: 168

* At this election the Liberal and National parties ran a joint ticket in the Agricultural and South West regions.

APPENDIX 2
THE APPLICATION OF PROPORTIONAL REPRESENTATION (SINGLE TRANSFERABLE VOTE) IN AUSTRALIA

Jurisdiction	Chamber	Name of system	Date of introduction of current system	Number of members	Above the line voting	Vote allocation	Compulsory voting	Robson rotation	Method of distributing surpluses
Commonwealth	Senate	Senate system	1949	76 elected from 8 electoral districts	yes	full preferential voting	yes	no	Inclusive Gregory method
Australian Capital Territory	Legislative Assembly	Hare-Clark	1993	17 elected from 3 electorates	no	minimum preferential voting	yes	yes	Gregory method
New South Wales	Legislative Council	Optional Preferential Proportional Representation	1978	42 members with the state serving as a single constituency	yes	minimum preferential voting	yes	no	Random Sampling method
South Australia	Legislative Council	Modified Hare-Clark	1982	22 members with the state serving as a single constituency	yes	full preferential voting	yes	no	Inclusive Gregory method
Tasmania	Legislative Assembly	Hare-Clark	1907	24 members elected from 5 electoral districts	no	minimum preferential voting	yes	yes	Gregory method
Western Australia	Legislative Council	Proportional Representation	1989	34 members elected from 6 electoral regions	yes	full preferential voting	yes	no	Inclusive Gregory method
<i>Source: Electoral Council of Australia 2001 & Reilly 2001</i>									

APPENDIX 3

NEW ZEALAND STV (BY MEEK'S METHOD)

Prepared by Stephen Todd from the Electoral Reform Commission of New Zealand

Detailed description of the count

1. At each stage in the count, each candidate has an associated 'keep value', which indicates the proportion of every vote, or part of a vote, received by that candidate which is kept, the remainder being transferred. Every candidate's keep value is initially set to 100%, or 1.000, and it does not change until that candidate is either elected (when it is reduced below 100%) or excluded (when it is permanently reset to 0%, or 0.000).
2. Each time the votes are counted, it is done in the following way. Suppose that candidate A's keep value is 80%, or 0.800, candidate B's is 50%, or 0.500, candidate C's is 100%, or 1.000, and candidate D's is 0%, or 0.000. Then a voting paper listing DCAB (in that order) would be counted as—
 - nothing to D,
 - 100% of a vote to C,
 - nothing to A or B (because C has taken the lot).

A voting paper listing ABC (in that order) would be counted as—

- 80% of a vote to A,
- 10% of a vote to B (ie 50% of the remaining 20%),
- 10% of a vote to C (ie 100% of the remainder).

A voting paper listing BDA (in that order) would be counted as—

- 50% of a vote to B,
- nothing to D,
- 40% of a vote to A (ie 80% of the remaining 50%),
- 10% of a vote regarded as non-transferable (because this remaining 10% has run off the end of the list).

After each count of the votes, the current quota is calculated as—
(number of votes currently assigned to candidates)
divided by (number of vacancies + 1)

where the number of votes currently assigned to candidates is the total number of valid votes cast, minus the current number regarded as non-transferable.

1. Any candidate whose votes equal or exceed the current quota is elected (if not already elected earlier) and given a new keep value, calculated as—
(candidate's current keep value) times (current quota)
divided by (candidate's current votes).

Thus, for example, a candidate who has $\frac{4}{3}$ times the number of votes necessary for election needs to keep only $\frac{3}{4}$, or 75%, of what that candidate previously kept.

2. After every such change, to one or more candidates, the votes are recounted using the new keep values. This has the effect of transferring the surplus votes of all the elected candidates in accordance with the voters' later preferences. However, it does not necessarily remove all surpluses in a single step, since some of A's votes may go to B, but some of B's votes may go to A simultaneously. This will leave each of them with a surplus, though the total surplus will be smaller than before. It is necessary to repeat steps 3, 4 and 5 until, for all practical purposes, no surplus remains. In the present implementation, this is taken to be when the total remaining surplus is less than $\frac{1}{10,000}$ of a vote.
3. If, at the end of any count of the votes, no surplus remains, but the number of candidates elected so far falls short of the number of vacancies to be filled, then the candidate who currently has fewest votes is excluded, and that candidate's keep value is reset to 0%. The votes are then recounted. (If an exclusion is necessary and two or more candidates have equal fewest votes, then the one who had fewest votes at the earliest point at which they had unequal votes is excluded, but if they have always been equal, then one of the tied candidates is chosen by a random (or pseudo-random) process for exclusion.)

It is usually clear before all surpluses are transferred that an exclusion will be required, and which candidate it must be. In such cases the exclusion may be made at once, giving a short cut which cannot change the final result of the election.

How was my vote used?

If an election has been conducted by NZ STV, and the final keep values have been published (as they should be), any voters who remember their preference orders can work out how their votes were used, as follows.

Suppose you voted for Bodkins as first preference, for Edkins as second preference, etc. and their final keep values were published as 0.310, 0.772, etc. as shown in the table below. The first thing to do is to make such a table with the order of preference that you actually used for the real candidates and fill in their published final keep values in column **3**.

Always start with 1.000 as the first item, one line above your first candidate, in column **6**, and then in each row in turn, fill in columns **4**, **5** and **6**, using the rules shown.

Preference	Candidate	Final keep value	Previous vote remaining	Vote kept	Vote remaining
1	2	3	4 Previous (6)	5 (3) x (4)	6 (4) - (5)
					1.000
1	Bodkins	0.310	1.000	0.310	0.690
2	Edkins	0.772	0.690	0.533	0.157
3	Atkins	0.000	0.157	0.000	0.157
4	Dawkins	0.702	0.157	0.110	0.047
5	Firkins	1.000	0.047	0.047	0.000
6	Gaskins	0.570			
7	Catkins	0.978			

When an excluded candidate appears, such as Atkins above, the keep value is 0.000, so no part of the vote is kept. When a candidate is either the runner-up or the last to be elected, such as Firkins, the keep value is 1.000, so that candidate keeps everything received and later preferences get nothing.

Column **5** shows how the vote was used. It can be seen that 0.310 of it went to help elect Bodkins, 0.533 of it went to help elect Edkins, 0.110 of it went to help elect Dawkins and the remaining 0.047 went to Firkins and, if Firkins was the runner-up, was unused.

Stephen Todd
 Electoral Reform Coalition
 Wellington

APPENDIX 4

A COMPARISON OF THE RANDOM SELECTION, FRACTIONAL AND MEEK METHODS

Random Selection (Ireland, Malta & New South Wales)

Advantages	Disadvantages
Transfers the correct number of ballot papers	Possibility that some votes will exceed 1.00 under certain conditions
Count can be verified manually	Random selection introduces an element of chance if the transfer generates a consequential surplus
Rules are relatively easy to explain to voters	Risk that if the election is close and a recount is required that it could give rise to a different outcome
	Considers surplus ballots not contained in the last parcel as fully dealt with
	Assumes each elector is only seeking to elect one person in a multi-member election

Gregory Method (Australian Capital Territory & Tasmania)

Advantages	Disadvantages
Maintains value of vote at 1.00	Assumes each elector is only seeking to elect one person in a multi-member election
Last parcel of votes contains ballot papers of the same value	Gives ballot papers from later transfers greater weight (a ballot paper distributed from a candidate who was not elected has a greater prospect of contributing to the election of more than one candidate)
Count can be verified manually	An arbitrary distinction is drawn between those votes considered to have exhausted their potential and those which are deemed to be responsible for generating the surplus
	Considers surplus ballots, not contained in the last parcel, as fully dealt with

Inclusive Gregory Method (Commonwealth Senate, Western Australia and South Australia)

Advantages	Disadvantages
Avoids the anomaly in the Gregory system whereby surplus ballot papers, which are not contained in the last parcel, are considered as fully dealt with	Possibility of ballot papers being worth more than one vote in certain circumstances (this may occur if the surplus of an elected candidate contains votes from a previously elected candidate with a smaller surplus)
Does not privilege votes received late in the count	There is a risk that any large parcel of ballot papers received under an existing transfer value will be over-represented in the surplus
Count can be verified manually	
Allows each elector to contribute to the election of the number of candidates to be elected	

Weighted Inclusive Gregory Method

Advantages	Disadvantages
Avoids anomaly in Gregory system whereby surplus ballot papers, which are not contained in the last parcel, are considered fully dealt with	The counting process would be more involved than the Inclusive Gregory method and computerised software for calculating election results would be necessary
Avoids possibility in Inclusive Gregory system where some ballot papers are worth more than one vote in certain circumstances	Rules are less transparent and understandable to the voter
All ballot papers are included, although transfer values are weighted to take account of existing transfer values	

Meek Method (New Zealand District Health Board Elections beginning 2004)

Advantages	Disadvantages
Ensures that transfer values don't exceed 1.00	Counting process is too tedious to be performed by hand. Specialised computerised software for calculating election results would be necessary
Votes are transferred to the next preference in the exact order indicated by the voter, unless candidate is excluded	The high level of complexity associated with this method results in the vote counting rules being less transparent and understandable to the voter
Reduces incentives for strategic voting	
Minimises vote wastage (quotas are recalculated throughout the count to reflect the removal of non-transferable votes)	

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