EPR's Count: Detailed Description

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Introduction

The basic justification for Evaluative Proportional Representation (EPR) is to help improve the workings of representative democracies. EPR helps to make it as likely as possible that the electorate will justifiably see the whole legislative body, such as a city council, and each citizen's representative as responsible, accountable, and wise.

Unlike any of the existing voting methods, EPR guarantees that each citizen's vote will continue to count proportionately in the deliberations of the legislative body, such as a city council. Each EPR voter is invited to assess the ideal qualities needed by the office and then to grade as many of the candidates as they might wish as either Excellent (*ideal*), Very Good, Good, Acceptable, Poor, or "Reject" (*completely unsuitable*). Each voter can give the same grade to more than one candidate. Each candidate not graded is automatically counted as a "Reject" by that voter. These grades can be counted by anyone who can add and subtract whole numbers, or in seconds by the EPR algorithm EPRv2.r.

Each citizen's EPR vote is used to select a winner based on the highest grade of at least Acceptable they have given to any candidates. As a result, each citizen is assured that their vote will proportionately continue to count during the deliberations of their legislative body. Except in two cases, the voter's winner will be the candidate who receives the voter's *highest grade* of at least Acceptable as discovered by Stage 1 of EPR's count: Exception 1) this candidate received too many votes (is super popular); Exception 2) this candidate received too few votes to be elected.

The first exception arises in order to remove the anti-democratic possibility of any winner retaining enough votes to dictate to the legislative body by receiving at least 50% plus one of all the votes. For example, our simulated EPR election limits the percent of the votes any super-popular *winner* can retain to 20% (see Simulated Election Output and other external references[4]). This would mean that at least three winners would have to agree before any majority decision could be made.

Consequently, Stage 2 begins the process of transferring all the extra votes held by any super-popular candidates to other candidates. Each non-super-popular candidate is eligible to receive at least one of these extra votes. A ballot containing a super-popular candidate's extra vote is automatically transferred by the algorithm to a remaining eligible candidate on this ballot who is awarded the highest remaining grade of at least Acceptable. If such a candidate is absent, this ballot becomes a proxy vote that must be publicly transferred during Stage 4 to an eligible winner judged most fit for office by this super-popular candidate.

Stage 3 elects the winners by identifying the target number of candidates who currently hold one of the largest numbers of votes. Next, Stage 3 automatically transfers each of these ballots currently held by an unelected candidate to the running total of an eligible winner. This process is similar to that for super-popular candidates. Extra votes are transferred to a remaining eligible candidate on a ballot who has been awarded the highest remaining grade of at least Acceptable. If such a candidate is absent from the ballot, this vote automatically becomes a proxy vote that must be publicly transferred during Stage 4 to an eligible winner judged most fit for office by this ballot's unelected candidate. Stage 4 occurs after the algorithm count has been completed.

The final number of votes received by each winner is the *weighted vote* each will use during the deliberations of the legislature. No vote is needlessly wasted. Each citizen is given every appropriate reason to be pleased.

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Note: If in the unlikely event that fewer than the target number of winners have received all the votes cast by the electorate by the end of Stage 2, then this smaller number alone are automatically elected. This is because together they have already received each and every citizen's highest grade, or next highest remaining grade. Each citizen's vote has been fully counted without any avoidable quantitative or qualitative waste. Each citizen is proportionately represented directly by the winner who had received their vote. In this event, Stages 3 and 4 of EPR's count become unnecessary.

However, if a city or state chooses always to require a set number of representatives to be elected, the existing algorithm can be modified to guarantee this. This modification is detailed in Endnote 3. At the same time, note that any such modification may needlessly cause some citizens' votes to be partly wasted qualitatively.

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To summarize, each voter's winner will be the candidate who receives the voter's *highest grade* except in two cases: 1) the candidate given this highest grade has received too many votes and this ballot was selected to be transferred, or 2) the candidate received too few votes to be elected. Either of these exceptions require this voter's ballot to be transferred to an eligible remaining candidate on their ballot who has received the next highest remaining grade. However, if the ballot does not grade another eligible candidate in this way, this citizen's vote becomes a proxy vote that must be transferred to the winner judged most fit for office either by the relevant super-popular winner or unelected candidate.

All but Stage 4 of EPR's count can be completed within seconds by the computer algorithm provided in EPR algorithm EPRv2.r. That algorithm follows the same more detailed steps described in greater detail below.

Full Details of EPR's Count

Stage 1: Discovering the Total Number of Highest Grades Exclusively but Provisionally Counted for Each of all the Candidates

Stage 1 of the count discovers for which candidate each voter's highest grade will be provisionally counted. As explained above, these totals can only be provisional because some votes may need to be transferred to other candidates by Stages 2, 3 or 4.

Any of the above votes *(grades)* are called *affirmed evaluations* when they are provisionally counted within the running total for a particular candidate at any point in the count. Only after all the relevant citizens' votes have been finally distributed among the winners by Stages 3 and 4 do these different numbers of affirmed evaluation also become the weighted votes that each winner will have in the council.

Stage 1 starts with a matrix in which each row lists all the grades given to all of the candidates by each of the voters. The name (or code) of each candidate is placed at the top of each column. The code number of each citizen voter is listed on the left of each row. The grade given to each candidate by each voter is listed in his or her row in the column under that candidate.

In this matrix, the six *grades* are given number-names: 6 = Excellent, 5 = Very Good, 4 = Good, 3 = Acceptable, 2 = Poor, and 1 = Reject. Again, these numbers are not numeric but nominal.

In Stage 1, the count starts (and continues in Stages 2, 3 and 4) with a Bucklin-like[2] process that determines the total number of highest grades awarded by all voting citizens which are counted exclusively but provisionally for each of all the candidates by the end of Stage 1. These votes are composed of the highest grade of at least Acceptable awarded by each voter to one of the candidates. The elected candidates are those that have received the largest totals of affirmed evaluations by the end of Stage 2 (see below).

Again, only one of the grades awarded by a citizen to each of the candidates can be exclusively and provisionally added to the running total of affirmed evaluations for one of the candidates. This is required by the principle of one-citizen one-vote. As soon as this grade (vote) is provisionally added to the running total of one of the candidates at one point in the count, all the grades which that voter may also have awarded to other candidates on their ballot are provisionally marked as used. They will have no further effect on any grades to be counted for other candidates during Stage 1. The one grade that is being used from such a voter is given provisionally to the one candidate whose running total of affirmed evaluations is larger than any of the other candidates who may also have been awarded the same grade by the same voter at that point in the count. This choice is justified by the assumption that the candidate who currently has the largest number of equally high evaluations is probably the one most qualified for office.[2]

Next, Stage 1 begins the round by round task of finding the total number of Excellents (if any) that must be added to the running totals of affirmed evaluations for each candidate.

Round 1 of Stage 1 discovers which of all the candidates has received the largest number of Excellents (6s). Again, this candidate retains these votes exclusively but provisionally even though some of the ballots counted for this candidate may also have awarded the same grade to other candidates. If more than one of the candidates would have the same largest number of affirmed evaluations at a given point in the count (if they were to receive the relevant shared grade at the same time), the one to receive it exclusively must be determined by lot.

Round 2 of Stage 1 determines which candidate has exclusively received the next highest number of affirmed evaluations. Successive rounds of Stage 1 discover which of all the remaining Excellents are exclusively but provisionally added in turn to the running total of affirmed evaluations for each of the other candidates. When no further Excellents remain among the uncounted ballots, further rounds similarly discover to which candidates' running totals of affirmed evaluations each of the remaining Very Goods, Goods, and Acceptables are added. No grade of Poor or Reject is added to any of these totals.

Given that each candidate might receive any one of the four possible highest grades that could have been added to their running totals from any voters, it could take up to a total number of rounds equal to four times the number of candidates to complete the count in Stage 1.

By the end of Stage 1, only one of the highest grades in each row of the matrix is the grade that has been exclusively but provisionally added to the running total of *affirmed evaluations* for one of the candidates. The only exception is if a ballot gives no candidate a grade of Acceptable or better. In effect, this citizen has not voted for any candidate.

Stage 2: Avoiding Dictatorship by transferring all *Extra* Citizens' Votes from any Super-popular Candidates to other Candidates

If EPR's count were to end with Stage 1, it is unlikely but theoretically possible that in some elections, one of the candidates could receive at least 50% plus one of all the citizens' votes. This would enable such a winner to dictate to the council. As explained above in the Introduction, to avoid this anti-democratic possibility, Stage 2 limits the percentage of all the votes in the council that any super-popular winner may retain. Any such extra votes are transferred to other eligible candidates. As many as possible of these extra votes are transferred automatically as explained in the Introduction. Any that remain become proxy votes to be transferred during Stage 4. The resulting running totals from Stage 2 enable Stage 3 to elect the target number of winners by identifying those candidates with the largest running totals of affirmed evaluations.

The first step in Stage 2 determines if any candidates have more than the permitted limit of affirmed evaluations. If there is more than one such candidate, the extra votes for the one with the largest number are transferred first.[2] If more than one currently has this same largest number, the one required to transfer his or her extra votes first is determined by lot.

In order to give the fullest possible scope for citizens' ballots to determine which other candidates must receive these extra votes, all the ballots currently counted for such a super-popular candidate must be examined for any that also award a highest remaining grade to an eligible remaining candidate (any ties resolved by lot).

If there are fewer or the exact number of such transferrable ballots, these are automatically transferred respectively to each of the other candidates so graded (any ties resolved by lot). If there are more such ballots than needed, the particular ballots to help transfer the required number of extra votes must be selected by lot. In addition, each remaining extra vote that cannot be automatically transferred by the algorithm becomes a non-returnable proxy vote that must be publicly transferred during Stage 4 to the eligible winner judged most qualified for office by the relevant super-popular winner provisionally holding the ballot containing the proxy vote.

Stages 3 and 4 go on to determine the exact number of *weighted votes* each winner will have in the council.

Stage 3: How all the Citizens' Votes initially given to Unelected Candidates must be transferred to the Winners

First, Stage 3 discovers the target number of winners by identifying the number of candidates who have received the largest number of affirmed evaluations by the end of Stage 2. For any tie between candidates to become one of the winners, the algorithm tries to break the tie by calculating any relevant differences between the sets of grades that compose the tied total number of affirmed evaluations held by the tied candidates. If the nominal numbers that represent each of the grades that compose each tied candidate's total are separately added as if they were numeric instead, one might be found to have the highest score. When so, that candidate becomes the winner. Otherwise, the winner is decided by lot.

Assuming that the target number of winners has been determined, Stages 3 goes on to discover how all the affirmed evaluations currently held by all the unelected candidates must be transferred to the current running totals of the winners. This is because EPR promises that each citizen's vote will continue to count proportionately in the deliberations of the council.

EPR gives every citizen's ballot every opportunity to determine to which winner's weighted vote their own vote will be added. Only eligible winners can receive transferred votes, who are those with fewer votes than the permitted limit of affirmed evaluations. When possible, each vote

must be transferred to an eligible winner who received a remaining highest grade on the relevant ballot that is provisionally held by the unelected candidate (any tie resolved by lot). These ballots include any that gave the unelected candidate their highest grade as well as any that gave them their remaining highest grade.

The transfer of these ballots starts with those currently held by the unelected candidate with the largest number of affirmed evaluations (any tie resolved by lot).[2] Each such ballot is automatically transferred by the computer algorithm to the relevant winner.

When no grade of at least Acceptable for one of the eligible winners is marked on a ballot currently held by an unelected candidate, this ballot automatically becomes this citizen's proxy vote. Each such proxy vote must be transferred during Stage 4 to the eligible winner judged by the relevant unelected candidate to be the winner most fit for office.

Stage 4: Transferring any Proxy Votes to Finalize the Number of Weighted Votes each Winner will have in the Council (Legislature).

Stage 4 transfers all the proxy votes from the ballots currently held either by a super-popular winner or an unelected candidate, which are those that could not be automatically transferred earlier because they did not award any of the eligible winners a grade of at least acceptable. Each proxy vote must now be personally and publicly transferred to the winner judged most fit for office either by the relevant super-popular winner or unelected candidate.

These transfers of proxy votes begin with the winner or unelected candidate currently with the largest number of affirmed evaluations (any tie resolved by lot).[2] Proxy vote transfers are non-returnable.

As a final result, one vote from each citizen will have been added to the total of affirmed evaluations held by one of the winners. These totals also define the different *weighted vote* that each winner will have in the legislative body, such as a council.

This is how EPR gives every citizen every appropriate reason to vote, vote honestly, and to be pleased with the election. At the same time, the voting power of each winner in the council is proportionately increased by each elector's single vote. No vote is needlessly wasted quantitatively or qualitatively.

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Endnotes

1. Stephen Bosworth (stevebosworth@hotmail.com) is a retired Professor of Political Philosophy and Comparative Politics. He taught at universities in the UK, California, and the Turkish Republic of Northern Cyprus. Dr. Anders Corr (corr@canalyt.com) is

publisher of the *Journal of Political Risk*. Stevan Leonard (ngc1432@yahoo.com) is the computer programmer who modified and finalized our EPR algorithm. Contact Dr. Bosworth for more details on EPR, and Stevan Leonard or Dr. Corr for details on the algorithm and computer simulation.

2. Originally, Bucklin voting was a single-winner voting method. It is named after its promoter, James W. Bucklin. First choice votes are counted first. If one candidate has an absolute majority, that candidate wins. Otherwise, the second choices are added to the first choices, and so on until one candidate has received a majority (see https://www.electology.org/bucklin-voting). EPR uses Bucklin's apparent assumption that, other things being equal, the candidate most qualified for office is probably the one who receives the largest number of highest grades. We also assume that such a candidate will probably be seen by their voters as the candidate most qualified, and if necessary, also most qualified to judge which winner should receive their proxy vote.

3. This note explains how EPR's algorithm could be modified to guarantee that any target number of representatives will be elected. Some cities or states may require this even though any such modification may needlessly cause some citizens' votes to be partly wasted qualitatively.

   Again, the following modification to the existing algorithm would apply only in the unlikely event that fewer than the target number of winners had received all the votes by the end of Stage 2:

   First, identify all of the ballots currently held by each of the already elected candidates that also award a remaining highest grade to a remaining candidate who still has not received any affirmed evaluations by the end of Stage 2. Start with the current winner who provisionally held the largest number of affirmed evaluations at the end of Stage 2 (any tie resolved by lot).[2] Automatically transfer one of these ballots, chosen by lot, to the candidate currently with no votes so identified. Do the same with a ballot currently held by the winner with the second highest number of affirmed evaluations. Continue such transfers from the third, and fourth, etc. current winners until each of the target number of winners has received at least one vote. If necessary, repeat this chain of one-at-a-time transfers until all the desired number of winners are elected with at least one vote.

   If this procedure fails to elect the target number of winners, the remaining number must be elected by transferring one non-returnable proxy vote at a time to one of the candidates who still has not received any affirmed evaluations. Again, this last-resort-process must start with the winner who currently holds the largest number of affirmed evaluations at the end of Stage 2 (any tie resolved by lot).[2] This process ends when all the target number of winners has been elected with at least one vote.

4. External references:
   EPR Count: Detailed Description