CONDORCET - SINGLE TRANSFERABLE VOTE,
The Least Manipulable Rule for Electing the Candidate Whose Support is Broadest

Robert B. Loring

Abstract

Recent computer simulations and empirical evidence have confirmed that Thomas Hare's candidate-elimination process is less-often manipulable than any other multi-candidate voting system. But the simulations have shown Hare's rule often fails to elect a candidate who meets Condorcet's criterion – the candidate who can beat every one of the other candidates in one-on-one elections. I suggest improving Hare's single transferable vote by using Condorcet's criterion (rather than the majority of first-preferences criterion). If no candidate meets Condorcet's criterion on the initial ballots, then use Hare's process of eliminating the candidate(s) with the fewest first-place votes until one of the remaining candidates beats each of the others. This system induces the sincere ballots needed to find a Condorcet winner; it elects this candidate whenever one exists, and when there isn't one, it decisively resolves the tied voting cycle.

Preface

Each of us is concerned with maximizing the quality of group decisions while minimizing the costs. We want to maximize information and incentives for constructive compromise while minimizing the time and information burdens on ourselves as decision makers. Tools that assist such co-operation can increase tolerance, freedom, political equality, and stability. These are my basic goals when attempting to develop tools such as the one introduced by this essay. Two themes concerning legitimacy alternate throughout this essay: picking the candidate whose support is broadest and doing that despite attempts at manipulation. The article compares the new voting system first with its direct predicessor, Hare's single transferable vote, then with other voting systems. It then explores the probable impacts and best uses of voting systems with a strong central tendancy.

I hope this essay will be a significant contribution to the tools for practising democracy. It claims no contribution to the basic techniques,

and little to the understanding of political science. It relies largely on previously corroborated research. In contrast, authors of earlier voting systems relied on mainly polemical arguments, concocted examples, prejudiced cases, and, rarely, mathematical proofs to support their claims. Objective statistical research was usually absent. But recent computer simulations and empirical data give this essay a solid advantage in proving its worth. Indeed, the voting system reported here resulted directly from reading the authors listed in the bibliography – and to them goes much of the credit for it.

Introduction to Voting Theory for C-STV

Quoted from Chamberlin and Cohen (1978), Chamberlin, Cohen, and Coombs (1984),
Phillip Straffin (1980), Samuel Merrill (1988), and Dennis Mueller (1989).
Comments in brackets are by R. B. Loring. Page numbers in brackets refer readers to
illustrations in this essay.

"Social choice theory is concerned with the aggregation of individual preferences into social choices" (Chamberlin, Cohen, and Coombs)

"Political designers have made systems of voting one of their major concerns at least since the lawgivers of classical Greece. The choice of a voting system [to aggregate preferences] may have many different kinds of consequences. Its operations may satisfy some notions of fairness and violate others. It may bias social choices toward or away from the status quo or the interests of particular groups. It may create or suppress information that affects the subsequent evolution of preferences within the polity. It may be more or less resistant to various classes of manipulations. Since the Enlightenment the use of logical and mathematical tools to investigate some of the important consequences of voting systems has grown steadily. Since World War II it has grown explosively. As a result we now have a substantial body of rigorously derived results that may be of some relevance to political designers.

"Standing back from the detail, we can summarize the contemporary literature by saying that for every possible voting system there is at least one undesirable thing that can happen. Generally there are many." (Chamberlin and Cohen)

"The accumulation of impossibility theorems in the field testifies to the elusiveness of the goal of finding one best way of carrying out this process. The theorems and counterexamples that populate the literature of social choice theory cannot, however, remove the necessity of making social choices. On a practical level, we must continue to make social choices in all areas of our public life, and some compromises among principles are necessary when methods of social choice are selected." (Chamberlin, Cohen, and Coombs)

"The ultimate consumer of such theoretical results is presumably the political designer. But what use can one make of them? If all plausible systems are flawed, then one must begin to ask which flaws are acceptable in a given context. That question has in its turn two components: (1) In the context for which one is designing, how important is a given flaw of a system? (*e.g.* [How important is it] that voters may gain by misrepresenting their true preferences when they cast a ballot). (2) How likely is that flaw actually to be exhibited in the context? (Perhaps the voters in question will typically have very little of the information, about how others will vote, that is required to profitably misrepresent true preferences)." (Chamberlin and Cohen)

[Phillip Straffin shows some of the undesirable things which can happen when committees use the common sequencial pairwise voting system.]

"2.1 The Weaknesses of Sequential Pairwise Voting

"In discussing voting power in Chapter One [of Topics in the Theory of Voting], we were looking only at the case where decisions were being made between two alternatives: a motion on the floor was to be voted on by a 'yes' or a 'no.' In most decision situations, the ultimate decision to be made is among more than two alternatives. Probably the most common way of making such a decision among multiple alternatives is to use a 'parliamentary procedure to reduce the decision to a sequence of pairwise [one-against-one] decisions.

"Unfortunately, reducing a decision among multiple alternatives to a sequence of pairwise decisions can have bizarre effects. Consider a case in which three voters must choose among four alternatives $A, B, C,$ and D, and suppose the voters have preferences among the alternatives as follows:

Example i. (3 Voters)

1 Voter	1 Voter	1 Voter
A	C	B
B	A	D
D	B	C
C	D	A

"Thus, the first voter has A as his first choice, B as his second choice, down to C as his last choice. Consider the result of sequential voting by majority rule, and suppose that the voters vote according to the above preferences. Suppose alternative A is first paired against B: the first and second voters will choose A and the third will choose $B,$ and A will win by a 2-to-1 vote. Then if A is paired against C, C will win, by a 2-to-1 vote. Finally, when alternative C is paired against D, D will win, again by a 2-to-1 vote. The sequence can be shown as:

"Hence, alternative D is chosen, in   spite of the fact that if we look back at the preference lists, we can see that D seems to have little in its favor, and in fact the voters are unanimous in preferring B to D. Sequential pairwise voting can choose clearly undesirable alternatives.

"Sequential voting is also highly sensitive to the 'agenda' – the order in which alternatives are introduced. Consider the same voters with the same preferences, but with three alternative agendas:

"Hence, in this example <u>any</u> <u>one</u> of the four alternatives can be chosen, depending on the order in which the alternatives are brought up for a vote. Chance, or sophisticated manipulation of the agenda, can have as much to do with the outcome as the preferences of the voters. With regard to manipulating the agenda, Duncan Black has given one rule of thumb: the later you bring up your favored alternative, the better chance it has of winning. The idea is that if there are other alternatives which might beat yours, those others might themselves be beaten earlier in the voting. When many voters reason this way, conflict over the agenda can replace substantive conflict over the alternatives.

"A third effect of sequential pairwise voting has been carefully analyzed in a classic monograph by Robin Farquharson. Consider Agenda ii, which chose alternative A. Alternative A is the last choice of our third voter, and he might well ask if there is any way he could do better. There is, indeed. On the first vote in Agenda ii, our third voter helped alternative B to overcome alternative C. Suppose he had voted <u>insincerely</u> for C in the first vote instead of his true preference for B. The result would have been

"Our third voter has thus achieved   his second choice instead of his last choice by this judicious bit of insincerity, and in the process has produced a rather undesirable social outcome. Sequential pairwise voting invites voters to think strategically and vote insincerely.

"Given that sequential pairwise voting is unattractive in these kinds of ways, much attention has been given to analyzing and designing other voting rules for choosing among three of more alternatives. In this chapter we will look at a number of these rules and evaluate some of their strengths and weaknesses. The approach for evaluation will be to write down precisely a number of criteria which reasonable voting rules might be expected to satisfy, and investigate which voting rules satisfy which criteria. For instance we have already seen one such criterion in our discussion of sequential pairwise voting. It is classically associated with the Italian economist Vilfredo Pareto (1848-1923):

"<u>Pareto</u> <u>Criterion</u>: If <u>every</u> voter prefers an alternative X to an alternative Y, a voting rule should not produce Y as a winner.

"Sequential pairwise voting violates this criterion.

"This 'axiomatic' approach to the study of voting rules was pioneered by Kenneth Arrow, and the results of his and later analyses were both enlightening and discouraging: it is quite easy to write down a short list of reasonable sounding criteria, and prove that no voting rule

can satisfy all of them. . . . Hence, we cannot expect to find a perfect way of making decisions among three or more alternatives. Still, even in an imperfect world some methods may be better than others. We will try to find some of the better ones."
(Phillip Straffin, <u>Topics in the Theory of Voting</u>. Boston: UMAP, 1980. pages 19-21)

"Were it possible to design a multicandidate voting system satisfying all desirable objectives, the choice of such a system would be simple and there would be no reason for this book [Making Multicandidate Elections More Democratic]. Remarkably, even a seemingly modest list of criteria may be self-contradictory, that is the satisfaction of one criterion may be incompatible with the satisfaction of others.

"Arrow showed that no multicandidate system based on transitive[i] rankings by voters can simultaneously satisfy the following four conditions: monotonicity, independence of irrelevant alternatives, nonimposition, and nondictatorship. As Arrow's axioms have been extensively analyzed elsewhere, . . . I will only describe each intuitively here.

"Roughly speaking, a voting system violates *monotonicity* if a candidate can achieve a win because of loss of support (or fail to win because of a gain in support). [Page 15 was a case that includes this.] A system is *independent of irrelevant alternatives* if the relative standings of the candidates cannot be altered by the entry of additional candidates into the race. [Page 8 has an example of this.] *Nonimposition* means that the outcome cannot be imposed independently of the voters' prefer-ences, that is no candidate loses to another for every possible voting outcome. *Nondictatorship* means that the result need not always coincide with the preferences of one particular voter.

"Arrow's impossibility theorem shows that any multicandidate voting system based on transitive rankings will violate one or more of these basic expectations at least some of the time. Accordingly, we must evaluate the degree to which these and other desired criteria are met.

"Much work in social-choice theory – in assessing electoral procedures – has focused on which procedures logically satisfy political desiderata [desirable qualities or criteria] such as monotonicity or the Condorcet criterion [defined on page 2]. Under this approach, the question is: does the procedure satisfy the criterion in all conceivable circumstances? The construction of a single counterexample is sufficient to prove a violation of such a criterion. This kind of study, although theoretically elegant, is limited in the sense that it offers us no information about the likelihood of such a violation taking place in practise.

"By contrast, I assume that the legitimacy of an electoral outcome does not require the logical certainty of a given political desideratum, but

---

[i]   A voter's preference order is said to be *transitive*, if, whenever the voter prefers *A* over *B* and *B* over *C*, he also prefers *A* over *C*. One of the major findings of social-choice theory, the *paradox of voting*, first observed by Condorcet, is that a transitive ordering for all voters does not ensure that the social ordering will be transitive. [See C-STV page 2, Example 1 A Voting Cycle.]

only its likelihood. This likelihood will be assessed for a number of electoral procedures. Inferences will be drawn from (1) theoretical models, (2) computer simulations, and (3) empirical data involving elections and polls."
(Samuel Merrill.   <u>Making</u> <u>Multicandidate</u> <u>Elections</u> <u>More</u> <u>Democratic.</u> Princeton NJ: Princeton University Press, 1988. pages 9-10)

"The important differences that arise when alternative voting rules and democratic procedures are used illustrates the single most important lesson public choice teaches — institutions do matter. The outcomes of a process vary with the types of issues decided, the methods of representation, and the voting rules employed. The interrelationships among these various elements are sometimes subtle and intricate. Public choice seeks to explicate these intricacies."
(Dennis Mueller. <u>Public Choice 2</u>. Cambridge University Press, 1989. page 6)