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Book Review

Putting the theory of committee voting on the agenda

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Of the three main categories into which textbooks generally fall: those for the beginner, those for the undergraduate and those for the *cognoscenti*, Nicholas Miller's monograph[1], by the nature of the series in which it appears, clearly falls into the second category. The series is a valuable one which has, as far as one can tell, come to a premature end. Harwood's original plan was, apparently, to assemble a thirtyeight volume Encyclopedia of Economics from individual monographs (of which there were to be about four hundred). These were to be published separately in the "Fundamentals of Pure and Applied Economics" series, as and when they became ready. Although originally scheduled for completion by the early 1990's, the fact that only about sixty essays have been published, makes the project look, regrettably, unlikely to come to fruition. Four hundred essays of the same standard of expertise and scholarship as this one, would have been an achievement the publishers could have been proud to have instigated.

Where the alloted space is limited, the difficult balance has to be struck between the extent of the technical detail examined, the amount of general explanation provided and the width of the horizon taken in; and confinement to the limits of a monograph hardly helps. But Miller makes a masterly shot at the overall impossible task of packing a gallon's worth of voting theory into a pint pot. The problem is, as always, where to compress the technicalities involved in important theoretical results, and where to expand the

[1] Nicholas R. Miller: *Committees, Agendas and Voting*: a volume in the Political Science and Economics section of Fundamentals of Pure and Applied Economics edited by J. Ferejohn. Harwood Academic Publishers, Yverdon, 1995. 152 pp. ISBN 3-7186-5569-1.

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discussion of their significance. In the present instance, the more expository sections and the more formally compressed part, divide the book into two fairly distinct parts, although these are not separately labelled as such. But more than space-allocation is at stake here. The choice between different degrees of magnification of the fine detail, has to take into account factors of more than a purely pedagogical nature. There is, in fact, a fairly subtle interplay between the three epistemological vectors (to coin a term for lack of a better) of the understanding, the expounding and the establishing, of theoretical results. Roughly: to formalise or not to formalise, that is the problem.

Views on this question are sharply divided. The two extremes are: the view that proving or disproving impossibility theorems, for example, is no more than pushing fancy symbols around for the fun of it, and the view that the theorising is built on clay if it is restricted to natural, or semi-natural, language without formal foundations. The most common view seems to be somewhere in between. Underlying the disagreement is a more fundamental one which rarely comes to the surface. This is the lack of uniformity in the use of the term 'theory', which is so easily adjectivised. In common usage the term often refers to what would more accurately be described as 'a compact and intelligible presentation of a set of related ideas'.[2] This is the lowest common denominator, as it were, among the various usages. Consider the following sequence of questions: Did Sherlock Holmes have any theories? Did Adam Smith have a theory? Did Mendel have a theory? Did Darwin have a theory? Did Euclid have a theory? Did Einstein have a theory? Does Stephen Hawking have a theory? Well, leaving aside Sherlock Holmes, for whom a 'theory' is an intelligent non-technical hunch on the basis of observed facts, what the others had was certainly more than 'a compact and intelligible presentation of a set of related ideas'. In each case the additional component was increasing function of something not easily pinned down. The word 'technicality' springs to mind, but is not precise enough for the job. What they all have in common is that their conclusions can, or could ideally, be shown to depend, in a strictly deductive sense, on one and the same set of initial hypotheses. The 'strictly deductive' dependence is, of course, a matter of mathematical inference of one kind or another – very often purely set-theoretic. In short, the factor which increases through the sequence of these examples is the explicitness of their recognition of this deductive dependence.

Collective-choice theory in general, and tournament theory in particular, is in fact two-tier theorising. It is 'two-tier', in that its conclusions are presented, discussed or objected to, either in a mixture of natural and technical language, or almost entirely in mathematical language. Presentations and discussions of, for example, McKelvey's Global Cycling Theorem[3] or its

[2] "Whoever puts together your views in a compact and intelligible form which he calls a theory, is assured of some degree of allegiance." Quinton (1979).

[3] McKelvey (1976), summarised on pp. 64–65.

subsequent corollaries, such as the proof by Banks that the sophisticated voting outcome of an amendment agenda is restricted to a subset of the uncovered set[4] are commonly, and most conveniently, semi-formal. The technical terms: 'amendment agenda', 'sophisticated outcome' and 'Banks set' are deployed as informal mnemonics whose strictly precise expansions are left out of the picture, only to be invoked should occasion arise. In the formal option, the underlying machinery is continuously available for inspection. Clearly, the context largely determines which option is the more appropriate. The formal approach would be as out of place in an elementary text as the informal would be in a research paper. The situation is not, however, as simple as that, and can seem so only at the cost of ignoring the subtle interplay, already mentioned, between the understanding, the expounding and the establishing, of theoretical results.

Without splitting too many philosophical hairs, it has to be admitted that succeeding in expounding a theoretical conclusion presupposes understanding it. In which case, the criteria for deciding whether the exposition has succeeded will include whatever has to be the case for someone legitimately to claim to have understood the statement. A reasonable candidate for this, is the requirement that he or she be able, if not to prove the theorem themselves, at least to be able to recognise a proof (or refutation) of it to *be* one, when presented with it.[5] The relevance of this ability to the claim that the statement in question has been understood, lies in the simple fact that the steps in the proof consist, to a large extent, in the unpacking of the often fairly complex defining conditions of the technical terms involved.

The bearing of all this on the book under review can best be brought out by reference to a particular instance of the problem to which it gives rise – the exposition of one of the theorems governing sophisticated voting outcomes. The problem, it should be stressed, is a perfectly general one attaching to any serious exposition of the subject at undergraduate level. Since it is also one to which there can be no unanimously agreed answer, the difficulties to which it gives rise will generate no agreed solution; and although of some interest in its own right it can, therefore, hardly be a basis for adverse criticism of this book.

The theorems in question are those about voting outcomes for different types of agendas, restricted by different parameters such as voting order, sincere versus sophisticated voting behaviour, and the power of the agenda-setter. But, whatever the parameters, the mere formulation of the theorems presupposes a clear typology of agenda-structures. There being, regrettably,

[4] The ramifications are discussed in Miller Grofman and Feld (1990), as 'Proposition 16', p. 87.

[5] This is the gist of the comprehensive logical theory relating inference and meaning, known as Manifestationism, which was first put forward by Michael Dummett (1978), and subsequently amended and developed by Neil Tennant in various publications, but definitively in Tennant (1997).

no standard classification, Miller goes to some trouble to rationalise the original usages of Farquharson and those of Ordeshook and Schwartz (1987). He modifies the latter in not restricting each non-initial node to a unique alternative (which would make all binary agendas pairwise), and illustrates the main types, giving examples matched with agenda-trees. There is, however, one small grouse to air at this point. That is his use of the terms 'successive' and 'sequential' according to whether the *status quo* is first or last in the sequence of single-branched outcome nodes,[6] yet subsequently distinguishing "all sequential binary agendas" from "successive (or sequential) agendas."[7] The simplest course here would perhaps have been to include the overall category of "(any) binary agenda-tree", as he did in his original ground-breaking work on the subject in Miller (1977).[8] In that case, the wording of at least one of the generalisations about the possible sophisticated voting outcomes of "sequential binary procedures" can be taken as referring to any binary procedure.

The kind of expository problem alluded to above can be illustrated by reference, in particular, to the proof of Proposition 11[9], understood as stating that the possible sophisticated outcomes of any binary agenda, A, always fall within the topcycle:

"Consider any alternative x in TC(A), some outcome node v such that $\Gamma(v) = \{x\}$, and the reverse path leading from v to the initial node. Alternative x is the sophisticated equivalent at v. At any preceding node traversed by the path, x can be displaced as the sophisticated equivalent only by some other alternative y that beats x. Alternative y in turn can be displaced only by some other alternative that beats y. And so forth. Thus either x or some alternative in $\mathscr{P}(x)$ is the sophisticated equivalent at the initial node, and therefore the sophisticated voting outcome must belong to TC(X)."

This is unfaultable as a succinctly worded proof of the theorem at the informal level. The present purpose is to look at the difficult choice which a book of this nature has to make between alternative possible presentations of proofs of this kind. The point is not that some particular other formulation would have been unquestionably better for the purpose, but that there *is* a choice, that it is a difficult one, and that the reasons for the difficulty are of some pedagogic significance which is commonly overlooked.

Between this tightly compressed summary and the very lengthy and virtually 'unreadable', totally unabridged and completely formal proof there is, of course, a whole spectrum of slightly less compressed, while slightly more

[6] *Op. cit.* pp. 17–18.

[7] *Op. cit.* p. 69.

[8] Proposition 8′. Under any binary procedure the sophisticated voting decision belongs to the Condorcet set." *Loc. cit.* p. 789.

[9] *Op. cit.* p. 85.

formal, abridgements. The trouble is that the clarity and precision resulting from increasing the formality of the proof, can be bought only at the cost of intelligibility to the intended (non-expert) reader. Conversely, and this is the nub of the present contention, the greater *apparent* intelligibility of the decreasingly formal versions, is bought at the cost of real understanding. This can be illustrated by comparing the above proof with that of Proposition 16, stating that the set of possible sophisticated outcomes for amendment agendas is the Banks set:

"To demonstrate this, we need only observe that, given any voting order, the resulting sophisticated equivalent agenda under amendment procedure (more precisely, the truncated version in which repetitions are deleted) is a Banks chain. Thus its top element, which is the sophisticated voting outcome, is a Banks' alternative. Referring to Example 7, we saw that the sophisticated equivalent agenda is $(x_2, x_2, x_4, x_4, x_6, x_6)$, so its truncated version is (x_2, x_4, x_6) – a Banks chain with bottom element x_6 and top element x_2. Considering all possible voting orders, we construct all possible Banks chains, so [Q.E.D.]."[10]

An essential, but not immediately apparent, difference between the two proofs, is that only in the latter case, has an algorithm been given, to which appeal can be made should the convertibility of the abridged proof into a complete proof be challenged. No such 'bridge' has been made available in the case of Proposition 11.

It does not seem to be an over-idealistic condition on abridged proofs in a given context, that they should be convertible into the real thing by reference to the definitions referred to in that context. It is precisely at this point that dependence of understanding a conclusion, on the ability to follow each step in the proof of it, comes into play. Both of these proofs proceed, reasonably enough, on a 'draw or visualise a reverse path through the tree' basis. But for someone who is uncertain whether he or she has drawn or visualised the path in their tree correctly, the only real check is to be shown how any such path in any such tree can be understood as a vector of nodes, satisfying a precise formal definition. The situation is, in fact, not unlike that in which someone is not convinced that the angles of all triangles sum to 180° just because those of a particular triangle he has drawn do. He or she can be said to fully understand the theorem (i.e. what triangularity has to do with the sum of the angles) only if they are able to follow each step in the purely formal proof.

The author has in fact, included (in the second paragraph of the section) a description of the reverse-path to such an outcome, so that an explicit formulation of it might well seem unnecessary. But from the present, perhaps hypercritical point of view, the inclusion of definitions to back up some of the proofs, while leaving those for other proofs tacitly understood, may give the

[10] *Op. cit.* p. 87.

misleading impression that their availability in the either case is merely a matter of convenience. As the author himself points out: "Especially in the case of sophisticated voting under amendment procedure, these algorithms are substantially more convenient than the general procedures identified above and lead to theoretical insights."[11] The theoretical insights are, of course, the provable results which include the unabridged proofs of both of the above Propositions.

Since the sophisticated outcomes of the two main types of agenda is dependent on the voting order, and the algorithms for them have therefore to take the voting order into account, there can of course be no one algorithm for the sophisticated outcomes of all binary agendas. But a non-constructive definition of the sophisticated outcome at a given node can be given which, although it does no more than trace recursively the reverse-path to the sophisticated outcome, serves as the required bridge between the compressed and the fully expanded proof. The definition uses: BA_α for: binary agendas on feasible set α; $OutNd_{A,\alpha}$ for: outcome nodes of agenda-tree A for feasible set α; $DecNd_{A,\alpha}$ for: decision nodes of agenda-tree A for feasible set α; and $SucNd_{A,\alpha}(x,y,z)$ for: x,y are successor nodes of node z of agenda-tree A for feasible set α:

$seqv_{A,\alpha}(\beta)$ (the sophisticated equivalent at node β of binary agenda-tree A) = df.

$$\iota x(A \in BA_\alpha \;\&\; \beta \in Nd_{A,\alpha} \;\&\; \begin{cases} x = \iota z \in \beta & \text{if } \beta \in OutNd_{A,\alpha} \\ x = \iota z((z = seqv_{A,\alpha}(\eta) \;\&\; zT seqv_{A,\alpha}(\eta')) \vee \\ \quad (seqv_{A,\alpha}(\eta) = z = seqv_{A,\alpha}(\eta') \vee (z = seqv_{A,\alpha}(\eta') \;\&\; zT seqv_{A,\alpha}(\eta))) \\ \quad \text{if } \beta \in DecNd_{A,\alpha} \;\&\; SucNd_{A,\alpha}(\eta, \eta'\beta)) \end{cases}$$

i.e.: the member of an outcome node is the sophisticated equivalent at that node; and the sophisticated equivalent at a decision node is that sophisticated equivalent at one of its successor nodes which either beats, or is identical with, the sophisticated equivalent at the other.

In these terms, the definition of the sophisticated outcome is of course (using A° for the easily defined initial node): $soph_{A,\alpha} =$ df. $seqv_{A,\alpha}(A°)$

These are, clearly, fine points which is no way detract from this book's masterly treatment of its subject matter. It is, in fact, only the clarity and elegance of these and the very large number of other summary proofs in the remaining sections of the book, which enable such points to be raised. The profusion of provable facts about committee voting with which the author regales his reader in the second half of the book, contrast starkly with the inevitable lack of discussion of their evident significance for committee for-

[11] *Loc. cit.*

mation and organisation. A companion monograph would not be out of place, devoted precisely to this other side of the penny, and with space enough to allow for theoretical digressions.

The author's discovery that the set of possible sophisticated outcomes for amendment agendas is a subset of the uncovered set, was just one of those pivotal results which sparked off further developments. The minutiae of some of these, have been assembled in Laslier (1997) in an elegantly formalised treatment of the properties of algebraic solutions in tournament theory. At a less rigorous level, the weak inclusion of the Banks set in the uncovered sets, prompts the thought that the reduction might be carried still further. A smaller actual solution set, seems an unlikely prospect, but there is at least one, albeit not unconditionally existent, *proper* subset of the Banks set which might be considered even more theoretically attractive than the Banks set itself. To generate this set, a 'vacuous Banks trajectory' could be defined as the limiting case of a Banks trajectory, namely one which consists of a single ordered pair. The first element in the pair is then the top-point of a vacuous Banks trajectory. The underlying distinction is that between the sense of the expression 'cycle-avoiding' in reference to any of the three Banks-points in a tournament consisting of a cyclic triad, and its sense in reference to the single Banks-point in a tournament consisting of a transitive triad. From a purely formal point of view, the difference turns on a rather intuitively unstraightforward property of the logical operation used for 'if'. This property carries with it the consequence that any statement of the form $\forall x$: if ϕx then ψx, counts as true in the event of the conditions ϕ not being satisfied by any elements of the domain of discourse. Thus, in the limiting case of the transitivity condition for binary relations, where the relation is asymmetrical and consists of a single ordered pair $\langle x, y\rangle$, the statement that if xTy and yTz then xTz, is vacuously true.

For this reason, the Banks set fails to distinguish between points which are strongly cycle-avoiding in virtue of heading non-vacuously transitive chains and 'vacuous Banks sets' which are cycle-avoiding in heading merely vacuously acyclic chains. In other words, non-vacuous Banks sets are top-points of maximally transitive Banks trajectories, not merely of cycle-avoiding ones. In addition, 'non-vacuous Banks sets' always have a better overall Copeland score than their unreduced counterparts, in the sense that the point which is excluded never has a better Copeland score than any of those in the non-vacuous set.

An example of a non-vacuous Banks set, is provided by a sub-tournament of the 7-element tournament discussed by Miller, Grofman and Feld (1990) in their original presentation of the Banks set. The sub-tournament is:

$$\{\langle x_1, x_2\rangle, \langle x_2, x_3\rangle, \langle x_3, x_4\rangle, \langle x_4, x_1\rangle, \langle x_2, x_4\rangle, \langle x_3, x_1\rangle\}$$

Here, the Banks set is $\{x_1, x_2, x_3\}$, of which x_1 is the top-point of a vacuous trajectory. The non-vacuous Banks set is therefore: $\{x_2, x_3\}$, where the Copeland scores are: $x_1 = -1$, $x_2 = +1$, $x_3 = +1$.

Or again, Miller (1980) uses the following instance of a minimally intransitive strong tournament:

$$v1 \rightarrow v2, \ldots, v7$$
$$v2 \rightarrow v3, \ldots, v8$$
$$\vdots$$
$$v6 \rightarrow v7, v8$$
$$v7 \rightarrow v8$$
$$v8 \rightarrow v1$$

Here, $UC(T) = \{v1, v2, v8\}$, $B(T) = \{v_1, v_2, v_8\}$ and the non-vacuous Banks set is $\{v_1, v_2\}$ with the Copeland score $+5$ for v1, and -5 for v8.

The theorem is easily seen to be provable in virtue of the fact, pointed out to me by J-F. Laslier, that if a tournament has a 'vacuous Banks trajectory' $\langle x, y \rangle$ (in the sense defined above), then for any other point z, it is provable that y beats z and z beats x. On this basis the proof of the theorem is, in outline, as follows:

If a tournament of order n has a vacuous Banks point x then, since x is beaten by every point which is beaten by the point it beats, the Copeland score for x is $1 - (n - 2)$. At the same time, no point is beaten by every other point. So no point can have the lowest possible Copeland score for any tournament, namely, $1 - n$. Therefore, excluding a vacuous Banks point from the Banks set only result in a better 'overall Copeland record' (i.e.: having fewer members, they having at least as good scores).

In short: if a tournament has both a vacuous and a non-vacuous Banks set, the latter has a better Copeland record than the original Banks set.[12]

Deprived of the luxury of room to digress, Miller goes on to deploy, in the space remaining to him, an impressive array of known results in the related areas of: order-of-voting effects, co-operative voting outcomes, agenda control of various types, and manipulation by agenda expansion. These are followed by a series of sections giving a carefully argued presentation of each of the main results that have been proved on monopoly agenda-setters, gate-keeping agenda formation, competitive agenda formation and, finally, open agenda formation. The reason for this emphasis on the question of agenda formation is that, as the author points out, while the theory of committee voting "within the framework established by Black and Farquharson... is now largely complete and most of its results have been covered here, [t]he major gap lies in the area of agenda formation processes". The whole area is one which he sees as calling for "a consideration of procedural and institutional details beyond the scope of the original Black-Farquharson formation."[13]

[12] Once again, only the fully detailed formal proof reveals the implicit conceptual intricacy of the claim.

[13] *Op. cit.* p. 141.

The discussion, in this last section, of the specific results that are provable about agenda formation, such as Miller's Proposition 42 on spatial competitive agenda setting games[14] might be seen as containing the germ of a kind of 'meta-voting theory'. Decisions as to what agenda-structure is to be adopted and what voting-order, and the limits, if any, to be put on ideological persuasion (such as subliminal advertising), are themselves matters of collective decision-making. An example of the kind of situation at which theorising at this meta-level would be directed, is the decision-making of a newly inaugurated constitutional assembly, as in France in 1789–1792 (prompting Sieyes' pamphlets and Condorcet's mathematical investigations in the first place), and in France and Britain in 1997, vis-à-vis prospective government action on electoral reform (prompting such contributions to the debate as Dummett 1997). Add in, for good measure, the factor of 'perfect information', in the sense that all the members are familiar with voting theory, and the voting game is at one level above the competitive agenda setting games to which Proposition 42 refers; it is competitive 'voting-process' game.[15]

The paradoxical element which looms up here, is the apparent theoretical infinite regress. Like most paradoxes, the possible resolutions are more interesting than the paradoxes themselves. In the present case, some recent work, Chapman (forthcoming), on a form of legal collective decision making, contains the germ of a solution to this imaginary infinite regress. Chapman is concerned with multi-issue decision-making (albeit, in a technical jurisprudential context). In summary form, his basic idea is that the viability of the issue-partitioning involved, be made (a) the result of a 'reason-based distinction-drawing process', (b) that the voters be, in some way, responsible for the rationality of the basis on which the weak separability of their preference-orderings rests, and (c) that these requirements constitute a more realistic way of avoiding instability under majority voting, than Arrow's abstract target of blindly avoiding thoughtless path-dependence.

Extrapolating to the general, not specifically legal, context, the underlying pre-suppositions, here, seem to be the following four:

(1) The existence of criteria by which the distinctions on which the partitioning of the issues is based, can be judged as duly reason-based.

[14] *Op. cit.* p. 131.

[15] In 1800, for example, when Borda's voting procedure was, according to Jean Mascart, "discussed at length" by the Première Classe (of which Napolean was then president), the committee finally "*se rallia à l'opinion exprimée par son président*" (italics in the original) – an outcome well-deserving of Jean Mascart's dry comment: "Pendant les six mois qu'il conserva ses fonctions de président de la Première Classe, c'est à cette innovation que se borna le rôle de Bonaparte: c'est peu... et l'on peut imaginer que ce soit déjà trop." Mascart (1919).

(2) Some form of institutionalisation of the requirement that the voters rankings of the alternatives are, by these criteria, 'rationally' weakly separable, relative to the basis for the partitioning.
(3) The voters being either sufficiently sensitive to the difference between 'good' and 'bad' reason-based distinction-drawing, to feel restricted in their ranking of the alternatives, or else there being some kind of sanction inducing such self-restriction. This would presumably amount to a form of induced sophisticated voting.
(4) Finally, the existence of some objective logical standard for judging the extent to which distiction-drawing is reason-based – this involving a combination of semantic and formally deductive considerations such as, those involved in one of Chapman's own examples. Here, (in an Alice-in-Wonderland judicial disagreement between three judges, in which the issue is 'verdict-first' or 'sentence-first'), conclusions which can be shown to follow from the 'sentence-first' premiss, are compared with conclusions which can be shown to follow from the 'verdict-first' premiss, are compared with conclusions which can be shown to follow from the 'verdict-first' premiss; both inferences being made under the same (in this case legal-) semantic premisses and, presumably, the same social 'value-principles'.

A fully worked-out theoretical account of these four conditions is, clearly, a tall order, and more of a research project than a finished theory, as Chapman himself would be the first to agree. Nevertheless, under these four conditions a case might be made out for comparing the outcome of the deliberations of a hypothetical committee of voting theorists, burdened with the task of deciding which voting procedure was least open to theoretical objections, with the outcome of the deliberations of the judges sitting in a court of appeal. Although, inevitably, falling short of a provably objective theoretical result, the outcome could be seen as a similar combination of enlightened judgement and personal conviction. Although this is, as it stands, a nowhere nearly detailed enough response to exercise the spectre of the infinite regress, it does at least suggest the possibility of a more satisfactory solution to the above paradox than the pessimistic alternative, namely: that all collective decision-making is no more than a verbal facade for what is, at bottom, a way human beings have of convincing themselves that they are not merely resolving social conflict without resort to violence, but that they are doing so rationally. Seen in this light there may, *pace* Miller, be more work yet to be done in voting theory, on what might be called its philosophical foundations, before voting theory is complete.

Such récherché matters are, clearly, beyond Miller's brief which in this book (in contrast to his own well-known original work in the area), is mainly the well-trodden ground at the centre of voting theory. He ends by pointing to other directions in which voting theory can usefully be developed. Having in mind, perhaps, those who criticise the Back-Farquharson formulation for insufficient concern with its underlying dependence on information about other committee members' preferences, he puts it on record that a start had

already (1995) been made in taking this into account, in the form of two other monographs in the same series, namely Calvert (1986) and Banks (1991).

This book will be welcomed by lectures and students alike for its depth of coverage, in so short a space, of the main results of the theory of committee-voting and agendas. It fills a longstanding gap in the basic texts on the subject.

Corrections

p. 38, last line but one of the footnote: "may get xIy and yIz but yPz", should be: "may get xIy and yIz but either xPz or, possibly, zPx".

p. 55, 11 lines from the bottom: "Strategies s^2 and s^4 both require a voter at the final decision node v_1 to vote $+1$ (i.e., for y), rather than -1 (i.e., for z); such a choice is insincere for voter 2 who prefers y to z" should be: "Strategies s^2 and s^4 both require a voter at the final decision node v_1 to vote $+1$ (i.e., for z), rather than -1 (i.e., for y); such a choice is insincere for voter 2 who prefers y to z".

p. 59, line 17: "so as to bring about z as the outcome" should be: "so as to bring about x as the outcome" (i.e.: by both adopting strategy s^2).

p. 68, 6 lines from the bottom of the test: the reference to "the set of top elements of all chains", should be "the set of top elements of all Banks chains".

Trivial typing errors

p. 17, line 9: there seems to be some missing words at "An alternative is complete specification of bill defeated and passed".
p. 27, line 9: for "in which at every" read: "in which every".
p. 50, line 11: for "beat" read: "best".
p. 74, for "self-eivident" read: "self-evident".
p. 80, line 16, for "these agendas" read: "in these agendas"
p. 87, line 12: for "SOPH|SA(A)'" read: "SOPH|A(A)'"
p. 99, Proposition 24: for "agent" read: "agenda".

References

Banks, JS (1985) Sophisticated Voting Outcomes and Agenda Control. Soc. Choice Welfare 1(4): 295:306
Banks, JS (1991) Signalling Games in Political Science. Harwood Academic Publishers, Yverdon
Black, D (1958) The Theory of Committees and Elections. Cambridge University Press, Cambridge, p. 73

Calvert, RL (1986) Models of Imperfect Information in Politics. Harwood Academic Publishers, Yverdon
Chapman, B (forthcoming) More Easily Done Than Said: Rules, Reasons and Rational Social Choice Oxford. J. Legal Studies (Summer 1998)
Dummett, M (1978) Truth and Other Enigmas. Duckworth, London, pp. 215–247
Dummett, M (1997) Principles of Electoral Reform. Clarendon Press, Oxford
Laslier, J-F (1997) Tournament Solutions and Majority Voting. Springer, Berlin, Heidelberg, New York
Mascart, J (1919) La Vie et les Travaux du Chevalier Jean-Charles de Borda..., Lyons, 1919, pp. 133–4
McKelvey, RD (1976) Intansitivities in Multidimensional Voting Models and Some Implications for Agenda Control. J. Econ. Theory 12: 472–482
Miller, NR (1977) Graph-Theoretical Approaches to Voting. Amer. J. Polit. Sci. 21: 769–803
Miller, NR (1980) A New Solution Set for Tournaments and Majority Voting. Amer. J. Polit. Sci. 24(No. 1): 79, Fig. 2(a)
Miller, NR, Grofman, B, Feld, SL (1990) The Structure of the Banks Set. Public Choice 66: 243–251
Ordeshook, PC, Schwartz T (1987) Agendas and Control of Political Outcomes. Amer. Polit. Sci. Rev. 81: 179–199
Quinton, Lord Anthony (1979) T.S. Eliot Lecture
Tennant, N (1997) The Taming of the True. Clarendon Press, Oxford