The New York Academy of Sciences

ABSTRACTS FOR CONFERENCE ON DEMOCRATIC REPRESENTATION AND APPORTIONMENT: QUANTITATIVE METHODS, MEASURES, AND CRITERIA

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"A Normative Theory of Representative Democracy"

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In this paper we discuss problems of representation and apportionment in a theory of representative democracy which we have developed. On problems of representation we present mechanisms for direct and representative democracy that take into account the relative intensities of a voter's preferences over issues and that effectively resolve the so-called "intensity problem" (e.g., a lethargic majority winning over an intense minority) in democratic decision making. On problems of apportionment we define the theoretical conditions for voting rights and the establishment of policies that must be met to make our proposed voting system completely optimal. Finally, we apply the model to the much discussed problem of the interdependence of governmental activities and propose an operational voting system to internalize accurately spillovers among governments.

"Cumulative Voting: An Effective Electoral Device for Fair and Minority Representation"

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The concept of cumulative voting was first advanced by James Garth Marshall in 1854. This electoral device has three significant characteristics: 1) it retains the district system of representation with districts returning

three representatives; 2) it gives each voter three votes to cast for the candidate(s) of his choice; and 3) its aim is minority rather than proportional representation. Illinois is the only American state utilizing this device for the election of members of its House of representatives. As of March, 1971, Illinois had the largest number of Black members in its house of any state and it had the highest percentage of Black membership among the five largest states. Today there is a rebirth of interest in cumulative voting as a means to realize greater representation of minorities. Under this device, it is possible for a disciplined minority equal to 25% plus one of the participating voters to win one of the three seats in a three-member district. Thus, cumulative voting holds promise as a means to enable organized minorities to win a fairer share of the representative seats to which their actual numbers entitle them in legislative bodies at both the state and local levels.

"A Consumer Sovereignty Model of Representation"

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A citizen sovereignty model of political representation is developed based upon the consumer sovereignty model of economic analysis. Both positive and normative results from consumer theory are applied to political institutions in order to choose a set of political institutions which will make a citizen's political behavior more like his consumer behavior. Choice of a percentage budget is shown to be one political output where consumer theory may be usefully applied. Assuming citizen preferences are accepted as a foundation, an ideal percentage budget is derived which best represents these preferences. In attempting to choose an optimal set of political institutions which will yield the ideal budget, analogies between consumer behavior and citizen behavior are developed. Consumer theory provides a framework for incorporating transactions costs, information costs, choice of weights, and frequency of elections into the area of political representation. It is also shown that many narrow representation issues are a subset of a larger set of important matters which should be of concern to analysts who accept the basic paradigm.

"A Theory of Voter Influence Over Foreign Policy"

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Most voters are unable to know which foreign policy alternatives they would prefer because voters cannot predict the utility consequences of these hypothetical alternatives. Hence the key to voter influence over

foreign policy lies in the ability of voters to evaluate the ex post utility consequences of the President's policy choices against their personal performance standards without having to compare these choices with the discarded alternatives. Thus, voter support of the incumbent varies directly with the ex post effects of policy decisions upon the subjective utility of ordinary voters who have no real opinions about untested policy alternatives. From this we can derive a model of Presidential choice subject to voter influence by positing that Presidents are selected from among a group of professional politicians who 1) share a common utility function in which the dominant "good" is voter support, and 2) differ primarily in their skill in predicting how alternative policies will affect voter utility. This model is applied to some foreign policy decisions of recent Presidents.

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"Pivotal States in the Electoral College:
An Empirical Investigation"

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Formal analyses of the relative voting strengths of the American states in the electoral college have shown that larger states have a disproportionately greater probability of being included in a winning coalition in the selection of the President. These formal analyses are based exclusively on the *a priori* voting strength of each state and do not consider the probability that the outcome in a given state can be altered by changes in campaign strategy. To examine the thesis of a large-state bias in the electoral college, "pivotal" states are defined to be those which are the closest electorally and which could alter the outcome of the Presidential election. Ten relatively close Presidential elections from 1876 to 1968 were chosen, the "pivotal" states selected, and an analysis of the *actual* bias in the electoral college was undertaken. In total, 36 pivotal states were found. The mean proportion of electoral votes for the "pivotal" states was significantly larger than the mean for all states ($P < .005$), suggesting that the electoral college is in fact biased towards greater large state power.

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"A Necessary Evolution of Mathematical Models
In Political Science"

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The use of mathematics in political science is generally limited to the study of power in terms of participation in the running of institutions. This power is then considered as a goal in itself. But first, power can be taken and used by different means as propaganda, myths and fear. Then it can be

a means of achieving different goals as ideology. Is it possible to measure such phenomena and to integrate them into a mathematical model? A first attempt is presented here with a model analyzing the use of propaganda in the strategy of a Government pursuing different goals as pure power and ideological achievements. The model (based upon the optimal control theory) analyzes the behavior of the Government, what can be the optimal equilibrium between production of concrete goods and the use of propaganda according to the political goals of the ruling conditions.

"Committees, Representation, and Policy of Outcomes"

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In order for a representative to act for his constituents, it is essential that he seek to effect policy outcomes through the process of collective decision-making. In most contexts, collective decision-making groups consist of a general voting body (the set of all group members) and committees (subsets of the set of all group members). Because committee decisions require the approval of the voting body, committee members are confronted with the task of allocating resources to proposals which are satisfying to themselves as well as acceptable to the voting body. A model is developed which explains the decisional outcomes of committees in terms of key variable components of collective decision-making (decision-making rules, the number and cohesion of factions in committees and the voting body, and the size of voting body). The results of the analysis indicate that committees will tend to reach near unanimous agreement in order to increase the likelihood that their decisions will be accepted by the voting body.

"The 3/2's Rule in Presidential Campaigning: A Game-Theoretic Model of Campaign Allocations to States Under the Electoral College"

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The purpose of this paper is to assess the effect of the winner-take-all feature of the Electoral College on the allocation of resources by candidates to the states in a presidential campaign. Conceptualizing the

campaign as a two-person zero-sum infinite game, it is found that the main effect of this feature is to induce candidates to allocate campaign resources roughly in proportion to the 3/2's power of the electoral votes of each state, which creates a peculiar bias that makes voters living in the largest states as much as three times as attractive campaign targets as voters living in the smallest states. Empirically, it is shown that the 3/2's rule explains quite well the time allocations of presidential and vice-presidential candidates in the 1960, 1964, and 1968 campaigns; for the 1972 presidential campaign, optimal allocations are indicated for all fifty states and twenty-five "toss-up" states. A comparison with optimal allocations under a system of direct popular-vote election of the president reveals that such a system would be less susceptible to manipulative strategies than the Electoral College as well as being compatible with the egalitarian principle of "one man, one vote."

"The Impact of Redistricting on the Passage of State Legislation"

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This study involved conducting a multiple regression analysis designed to determine the relations between measures of reapportionment and the passage of controversial legislative acts while controlling for the political and economic characteristics of the 50 states during the 1960's. The study indicated that reapportionment did correlate with the passage of legislation in the fields of civil rights, labor legislation, gun control, women's liberation, auto safety regulation, aid to parochial schools, and welfare legislation. These findings seem explainable by the fact that under-represented groups favoring such legislation received increased representation in the legislatures as a result of reapportionment.

"Legislative Pluralism, Committee Assignments, and Internal Norms:
The Delayed Impact of Reapportionment in California"

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Equal-population reapportionment produced significant policy change in the California Legislature, but not immediately. The delayed and indirect impact of changes in representation on policy outputs can be explained by the internal legislative characteristics which impede or speed up change—including policy pluralism, leadership, committee assignments, norms, and

new member socialization. These findings are based on a field study of the California Legislature in the first five sessions after the 1965 reapportionment.

"Positive and Normative Theories of Apportionment"
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Malapportionment studies with descriptive objectives largely posit associations between apportionment patterns and legislative outcomes which rest on casual implicit theory that ignores those forms of legislative behavior most directly related to the apportionment process. Assuming that the objective of constitutional reapportionment requirements is to prevent the use of the legislative districting process for partisan advantage—it is argued that judicial enforcement of reapportionment requirements may well enhance rather than inhibit the possibilities for such manipulation. Criteria that have been advanced to guide judicial decisions are largely unrelated to the behavior that they desire to preclude. This paper presents a theoretical measure for estimating the degree of manipulation of the reapportionment process that takes place within existing constraints of the nebulous "one man—one vote" criteria. A theoretical specification of an "ideal" apportionment system which would eliminate the possibility of manipulation of the reapportionment process for partisan advantage is also described.

"Public and Private Good Markets"
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Proponents of vote-exchange models have had difficulty establishing the claim that the logrolling process has the optimal properties which the economic market analogy suggests. This optimum is characterized, and its attainment is shown to depend jointly on the decision rule and the disposition of votes through exchange, given a decision rule. It is argued that the most nearly optimal individualistic process is probably one with majority rule and quadratically increasing resource expenditures required for added influence gained. Coalition formation is an unsatisfactory approach, but a similar "consensual" phenomenon may lead to optimal results. A third approach is an individualistic process with discriminatory pricing, and a framework for the analysis of such processes is offered.

"Analysis of Individual Preorderings to Discover a Typology of the Individuals and the Process of Collective Decision Making"

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There exist two main types of process for collective choices; the process of the first type are built only on individual preferences represented by preorderings. These process represent the formal process (political and legal process for example) used in a society. The process of the second type take in account the intensity of individual preferences represented by cardinal scales of utility. Arrow's theorem and others related results apply to the process of the first type for which it seems difficult to define a completely satisfying procedure. In order to minimize these difficulties a two-steps process of decision making starting from individual preorderings is analyzed. First one defines a metric on the space of agents from which an ultrametric is deduced. These operations are equivalent to define a certain type of typology, called a hierarchy of the agents. In each class of this hierarchy the individual preferences are, by definition, close in a certain sense. Thus it is easy to represent each class by a collective preordering. The second step of the procedure is concerned by the aggregation of these representative preorderings.

"A Continuous Transformation Useful for Districting"

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Imagine that one could stretch a geographical map so that areas with many people would appear large, and areas with few people would appear small. If such a map could be made one would expect all voting districts to be the same size for they should contain equal numbers of people. Drawing on such maps should simplify the process of creating district boundaries. The construction of maps of the requisite type is shown to require the simultaneous solution of a pair of non-linear partial differential equations, for which an iterative computer solution procedure has been devised. Three experimental attempts to district using this method are described.

"The Iowa Redistricting System"

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A system for legislative districting by computer is described. The system comprises programs useful in data preparation, district generation, and

report preparation. The system was used extensively in 1972 in the preparation of legislative districts by the Iowa Supreme Court for the State of Iowa and in 1971 legislative and congressional districting of the state. Earlier versions of the system were used in 1967 and 1969 state redistricting problems. Recent developments in the system have been oriented toward solving relatively large districting problems. For example, the basic data set for Iowa contains more than 3,000 population regions, primarily census enumeration districts. The algorithmic logic associated with the main districting program is discussed.

"Quantitative and Descriptive Guidelines to Minimize Legislative Gerrymandering"

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The most significant contemporary problem of legislative representation is how to maintain the standard of one man, one vote while simultaneously minimizing partisan and factional gerrymanders. Paradoxically, increasing judicial insistence upon closer population equality encourages partisan gerrymandering, since even minimal constraints of county and other sub-unit boundaries are sacrificed. A survey of the dimensions of the problem and of various proposed quantitative guidelines suggests the need for numerical standards that would permit some flexibility, avoid gerry-manders, and recognize political communities while maintaining an overall quantitative standard of one man, one vote. Also developed are suggested state constitutional and Congressional statutory language which could describe the conditions to be met by constituency-makers (quantitative standards, compactness, contiguity, local government boundaries, trans-portation networks, etc.). Evolution of such guidelines would serve a much-needed reference point for courts as they continue to apply the equal protection clause of the 14th Amendment to the problem of legislative apportionment.

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