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INSTITUTIONAL EFFECTS ON COMMITTEE BEHAVIOR: OR, YOU CAN'T STOP TO SMELL THE ROSES WHEN PLAYING A 5-PERSON GAME

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Institutional Effects on Committee Behavior: Or, You Can't Stop to Smell the Roses When Playing a 5-Person Game

Introduction

Combining philosophy with empirical analysis is generally a dangerous thing to undertake. Something will always be lost in the translation. Nonetheless, in most instances such an endeavor is warranted. This paper provides a brief overview of a central concern in the debate between proponents of classical democratic theory and empirical democratic thought.[1] This concern reduces to whether the contextual elements of a polity (more specifically the institutional structure) have a significant effect on democratic practice. The empirical work in this paper attempts to show that changes in the structure of a "democratic" decision-making arrangement can affect the outcomes for that arrangement. Further, it is possible to model such an institution and subsequently to predict certain classes of outcomes.

At the general level, this paper is concerned with the apparent conflict between normative conceptions of democracy and the empirical world of democratic practice. As Bachrach (1967), Pateman (1970), Holden (1974), and Joseph (1981) have pointed out, the conflict arises from a reformulation of "classical" democratic theory in hopes of making it more clearly conform with the empirical world. Classical democratic theory suggests an ideal with which all of the people "make, and are entitled to make, the basic determining decisions on important matters of public policy" (Holden, 1974, p. 8). Of course,

some normative concern is voiced over who qualifies as "the people," what constitutes "basic determining decisions," and even what are "important matters" of public policy.

On the other hand, scholars such as Schumpeter (1950) and Dahl (1956) question the value of these classical concerns when studying the world about them. These "empirical" theorists of democracy contend that little support is found for classical democractic values. As a result, democratic theory needs to be restructured in order to approximate the possible instead of the ideal. Indeed, Dahl (1970) points to a number of external forces which appear to rigidly constrain the full participation of citizens in making policy decisions. He includes such things as constraints on information, opportunity costs, and economies of scale in decision-making arrangements. Generally, the empirical theorists suggest that in a complex "democratic" society we may find many phenomenon which classical theorists would not expect to occur. We find that citizens are not concerned with participation. We find that citizens are not aware of who represents their wishes. We find that citizens are not models of liberal values encouraging and respecting diversity.[2]

This raises an important question. Although critics of empirical and "elitist" democratic theory assail those theorists on the basis of the assumptions they make about the role of the citizenry (Pateman, 1970) and conclusions reached based on a particular social and economic order (Joseph, 1981), little empirical work has been undertaken to counter these claims. Such claims directly address the static conceptions empirical theorists have of the institutions within which individuals participate. Clearly when Schumpeter writes about a competitive party system, ha has a particular model- of political society in mind. Where Dahl writes concerning the limitations to democratic decision-making, he is modeling large-scale political units which are constrained by production and organizational features peculiar (although perhaps ubiqutous) to modern society. However, in neither case is there concern with the ideals of classical theory. The result, of course, is a constrained vision of democracy. Indeed, the possibilities for alternative political modes of organization are thrown out for the static picture envisioned by such theorists. Clearly, the empirical evidence exists that under a particular set of conditions a citizenry is not terribly interested in the functioning of the polity. What is important to understand is the set of conditions under which a polity more closely approximates the ideals offered under classical democratic theory. This is what this paper will develop: a way of understanding the effect of institutions on individual behavior. We will then examine what changes are wrought in that behavior when institutional rules are changed. More generally, we wish to understand the intersection between empiricism and normative ideals.

The context of the decision-making situation, it will be argued, has important implications for determining who will take part in determining outcomes, how proposed outcomes are ordered, and how an outcome is reached. Further, there is no reason to expect these institutions to be static. A literature deriving from Arrow (1963) and Buchanan and Tullock (1962) suggests that institutions are configurations of rules, and that these rules provide much of the context for decision-making arrangements. Arrow provides us with a

particular type of democratic institution, and then traces the logical implications arising from such an institution. Buchanan and Tullock suggest that institutions are orderings of rules which achieve particular outcomes for individuals. Ostrom (1980) carries the point further, suggesting that institutions are artifacts which are designed by individuals to provide predictability in the relations between individuals when confronting collective decisions.

The presumption behind this literature is that a discrete set of elements are important for the outcomes of any decision-making process. Among this set of elements are: the environment constraining the decision — including such things as the characteristic nature of the outcome being sought and the technological and economic feasibility of some decision; the structure of preferences that individuals bring with them in making a decision; and finally, the structure of the decision-making institution itself. Each of these elements are presumed to have important impacts on the outcomes and in turn to have important implications for the democratic involvement of individuals in the decision process.

A good deal of literature has been developed on the first two of these elements. The question of whether goods have public or private characteristics was initially adressed by Samuelson (1956). The implications of the characteristics of goods was in turn discussed at length by Olson (1965), and Olson's free-rider thesis has been explored at length in many different forms.[3] Other work has been undertaken on the question of how preferences affect the outcomes of ordered institutions. Clearly the early work by Arrow (1963) and Black (1958) center on how distributions of preferences affect outcomes. More recent work by Enelow and Hinich (1981) has tested the implications of various distributions of preferences in affecting outcomes. Meanwhile, there exists a number of surveys of this work and its implications for outcomes.[4]

The least considered branch of this general work concerns that which is of the greatest interest to political scientists: the examination of the structure of the decision-making institutions themselves. Some work has been undertaken, notably by Shepsle (1979) and Shepsle and Weingast (1981), in which the elemental structure of decision-making institutions are examined in an effort to understand the implications of structure for outcomes. This work has remained largely conceptual, and so far, little attempt has been made to test the impact of institutions on outcomes.[5] Testing the effects of structure is the empirical focus of this paper.

An Interesting Problem

While the claim was earlier made that little has been done to focus on the question of how institutional structure affects outcomes, some work has been undertaken which implies the effects of structure. This work has been found primarily in the experimental study of political science — work which has its primary focus testing game theoretic solutions. Solution concepts are important, as von Nuemann and Morgenstern (1944) argue, in that they are "plausibly a set of rules for each participant which tell him how to behave in every situation which may conceivably arise" (p. 31). Thus, the mathematical structure of any solution emerges as a prescriptive rationale for individuals in how to order their available strategies

within the context of a defined conflictual or decision-making arrangement. The application of this abstraction to political science is best given by Riker (1967). Riker contends that two questions need to be addressed:

1) What is the mathematical solution to a game?
2) What is the strategy which will ensure players of achieving the solution?

Riker then argues:

> An answer to the first question indicates what may be anticipated as the outcome of political events. If we know it, then, if also we can assume players are rational maximizers of utility, we can predict the political future with some confidence. An answer to the second question (about strategies) permits political engineers to give advice to politicians about how to behave successfully (p. 642).

Political contexts then are thought to closely resemble the games modeled by game theory. Game theoretic modeling of decision-making situations is thought to allow the derivation of solutions which provide prescriptive advice to individuals confronted with a large number of potential strategies. Further, such solutions are thought to be capable of predicting the outcomes of decision-making situations.

A good deal of experimental work has been undertaken during the past 15 years, with very mixed results. Political scientists have turned their attention to a variety of game theoretic solutions — using experimental studies — in order to find a solution which provides the best fit to the data. Studies have examined the Core (Berl et. al., 1976), the von Neumann-Morgenstern Y-set (Riker, 1967; Westen and Buckley, 1974), the Bargaining Set (Buckley and Westen, 1976), and the Competitive K-set (Mckelvey et al., 1978; Ordeshook and

Winer, 1980). Others have simultaneously attempted to test a series of these concepts (Fiorina and Plott, 1978). And still other research has begun to examine outcomes where many game theoretic solutions exist (McKelvey and Ordeshook, 1979a). Yet, as one example will demonstrates the results of these tests are less than conclusive. Instead, it appears that a variety of solutions work. Further, the implication of the results of these experiments — as it will be argued — demonstrates that the outcomes vary with the specific structural components modeled into the experiment.

A set of experiments by McKelvey and Ordeshook (1979b) examine two different committee games with an eye toward finding which solution concept fits. Briefly, both of these games were simple majority rule committee games in which individuals had defined preferences over a finite set of proposals. The first game concerned vote trading in which players select the alternatives that they will either pass or fail. Although a Core exists, the initial set of trials found that the Core was chosen by players only 45 percent of the time.[6] This was when players disaggregated the choices available to them in making pair-wise comparisons between alternatives. By a simple change in the rules — where McKelvey and Ordeshook forced comparisons of bundles of passing and failing alternatives — the Core was obtained 100 percent of the time. The conclusion by McKelvey and Ordeshook is that the alternative space under this type of game was far too complex. Changing the structure of the game to allow consideration of only bundles of alternatives (which simplified individual choices) resulted in outcomes which fell in the Core.

In a similar game, McKelvey and Ordeshook found that where players had complete ordinal information over the preferences of other players (although not knowledge of their payoffs), the Core appeared only 43 percent of the time. However, where individuals did not have this information the Core was obtained 74 percent of the time. McKelvey and Ordeshook argue that this interesting result is largely due to the complexity of the dominance relations between the alternatives they employ. Their claim is that:

> The effect of incomplete information seems to be that subjects are then forced to internalize the relevant preferences of other players and, in doing so, learn better the dominance relations in the game. They are forced to consider all alternatives in the process of collecting information and do not have the visual signal of alternative E [an obvious alternative to the Core] "high" on the list for a majority. (p. 15)

The tentative conclusion that they reach, although as they admit it is not readily susceptible to theoretical consideration, holds that where individuals have a great deal of information about preferences, but no incentive to uncover dominance structures, the Core is less likely to occur. Where individuals do not have information concerning the ordinal preferences of others the game converges to outcomes in the Core.

The implication of these two experimental games is that where changes in the structure of the game occur, one might expect perturbations in outcomes (here — in and out of the Core). McKelvey and Ordeshook admit that they have no theoretical tool available to them which would explain this variation. Nonetheless, a close examination of the institutional structure of these games (holding preferences and external characteristics of the environment constant) might yield a means of coming to grips with these variations. Such an examination might also aid in explaining the anomoly that political scientists have found a variety of (often mutually exclusive) game theoretic solutions useful in predicting outcomes for their experiments. Further, an understanding of the effect of structure on explaining this variation might provide a useful heuristic in developing the larger implication of the effect of structure on democratic practice. That is the concern of the next section.

Institutional Structure

If institutional structure is in fact important, then it is necessary to model a structure which is subject to empirical testing. A propiptious way of proceeding is to develop a game theory experiment which may test differences in institutional structure. After all, in the real world, testing differences among institutions requires a substantial investment in research effort and dollars. Further, all too often different institutional arrangements in the real world are accompanied with a large variety of confounding elements which are not subject to the researcher's control, and which may dramatically affect the results obtained from the research.

Experimentation, then, has a number of advantages. First, it allows control over the context. In other words, the variables of interest are those that the researcher is able to choose to study (assuming that proper controls are offered over internal validity). Second, while preferences are something which are generally considered to be unknowable (or at least confound research problems), preferences can be induced and controlled within the context of experimentation (see Smith, 1976). Third, a structure of an institution may be

carefully modeled in order to study particular changes. The advantage here is that institutions may be created and then recreated. Control is enhanced over elements which are deemed important. Finally, the measurement of outcomes can be precisely located, since along with preferences, the type of outcomes can be well specified. Measurement problems, then, are substantially reduced.

A Set of Assumptions

In this section we are concerned with formulating the elements of a generic decision-making arrangement in which individuals are required to arrive at a collective decision. The model will be that of a committee process in which there exists a defined procedural operation. As will be shown, we will not be concerned with the effects of different structures of preferences for outcomes, nor with the "environmental" impact of a wide variety of contextual variables. Instead, the emphasis will be on only the structural variables of a generic decision-making institution. We will begin by discussing a set of assumptions about what individuals know concerning the arrangement.

Assumption 1:

Individuals know the number of people in the arrangement. Very simply this can be represented by:

$N = (1,2,\ldots,n)$.

Assumption 2:

Individuals know the boundaries of feasible alternatives. These alternatives are represented as 'A' which is a compact, convex set of R^m -- an m-dimensional Euclidean space.

Assumption 3:

Individuals know their preferences over 'A'. This is a strong assumption which requires that 3 conditions be met:

A. There exists a set of strategies 'S' associated with each alternative in 'A' such that where $a \in A$ and $S = (s_1, s_2, \ldots, s_n)$ is a vector of strategies for the n members of the decision-making arrangement, we can write a function $f(S;a)$ which gives the strategies available to each individual given some alternative in A.

B. Second, there exists a set of outcomes. Further, there is a mapping of alternatives onto outcomes such that:

$$a,b \in A \longrightarrow x,y \in \Omega$$

C. Third, there exists some set of binary preference relations such that:

$\succeq_i$ is defined on all $x,y \in \Omega$. And the i^{th} individual has an ideal point p_i such that: $x \succeq_i y$ is equivalent to $||p_i - x|| < ||p_i - y||$ where $||\bullet||$ is the standard Euclidean norm.

Assumption 4:

Individuals have a set of dominance relations such that:

A. for $x,y \in \Omega$; xDy if $[(i|x \succeq_i y)] > [(i|y \succeq_i x)]$; and

B. $\not\exists x \in \Omega$: $xDy \; \forall y \in \Omega - \{x\}$.

This second condition merely says that there does not exist any outcome which purely dominates all other outcomes. In a game theoretic sense, this means that the Core does not exist. In effect, this asumption complicates the conditions under which outcomes are arrived at.

Assumption 5:

Individuals obtain real-value payoffs from each outcome, although these payoffs are not transferable, nor are side payments allowed. Simply, then, for each point $x \in \Omega$ there exists a mapping of payoffs to individuals such that:

$x \longrightarrow \vec{\omega}$ where $\vec{\omega} = (\omega_1, \omega_2, \ldots, \omega_n)$ the payoff to the i^{th} individual for some point $x \in \Omega$ is ω_i. There is, then, an ordinal utility function for an individual $u_i(x) = \omega_i$ such that, given assumption 3c above for a pair of outcomes:

$$x,y \in \Omega;\; x \succeq_i y \text{ iff } u_i(x) > u_i(y) \iff ||p_i - x|| < ||p_i - y||.$$

Assumption 6:

Finally, individuals know the context within which they make decisions, i.e., they know those institutional rules affecting the decision-making process.

Minimal Institutional Rules

The concern in this paper is with the effect of institutional structure on decision outcomes. In order to tackle only the effects of structure, we have assumed that individual preferences are well specified and ordered. Further, locating an agreeable point over some space of alternatives is not conditioned by the externtal characteristics of the point. The point has no baggage accompanying it — no ideological predispositons, no public/private goods, characteristics, etc.

Because of control of external variables, it is possible to turn attention to the structure of the decision-making arrangement. First, we will argue that many different types of structures are possible. However, there seems to be a set of underlying dimensions to any decision-making arrangement. The structural dimensions include:

1) Who can be considered "covered" by the arrangement. (Boundary)

2) What can be considered by individuals in the arrangement. (Scope)

3) The aggregation rule used to implement some decision.

4) Communications channels available to transmit preferences, threats, etc.

5) Procedural rules to determine the method by which proposals are compared.

6) Position of players that constitute inequalities in considering, ordering, or implementing proposals.

IR 1,2: Boundary and Scope Rules

We will not concern ourselves with these first two elements. Firsts by Assumption 1, members are presumed to know many individuals are in the decision-making arrangement. We also assume those individuals make decisions for themselves, or at least solely on the basis of the value they derive from the proposals selected (this is an implication of Assumption 3). Seconds we have assumed that the scope of the decision which can be examined is fixed. This is derived from Assumption 2 in which some 'A' is defined as the set of admissable proposals (see Shelpsle, 1979, on ways to model "germaneness" in institutions).

Now we can turn our attention to the remaining four minimal elements of institutions.

IR 3: Aggregation Rules

These rules define what can be considered a winning proposal. In order to do so, we must specify coalitions of players, since most decision-making arrangements of interest require more than a single individual to enact a proposal. A coalition is some:

$B = (C_1, C_2, \ldots, C_s)$

Let: $\{C_j\}$ = n of persons in coalition C_j

Further: $(C_1 \cap C_2 \cap \cdots \cap C_s) = N$

Where: B is the set of all possible combinations of individuals varing from size 1 to n.

However, not all coalition are "winning." Let us redefine the set of winning coalitions 'W' such that:

$W \subset B$; and

$W = (C_j \subseteq N \mid \{C_j\} \geq \frac{n+i}{k})$

Where: i=0 if odd, 1 if even; k=a decision rule for aggregation votes, i.e. k=2 for simple majority rule, and k=1.5 for extraordinary majority, etc.

Our aggregation rule, $\frac{n+i}{k}$, then limits the set of coalitions to:

$B \cap W$ (or W).

IR 4: Communications Rules

Communications channels are fundamentally concerned with providing information to proto-coalitions. Generally, communications channels do two thing in passing preplay communications:

1) Constrain the <u>number</u> of the messages sent.

2) Constrain the <u>clarity</u> of the messages sent.

The effect of constraining the number of messages sent is a straightforward proposition. Institutions all impose some control over the number of messages which can be transmitted between and among members.

Where few messages are transmitted, the total amount of information is limited. Where the number of messages increases, a potentially greater amount of information can be transmitted.[7]

The communications channels can also limit or increase the clarity of a message sent. Communications channels can be conceived as a series of relays through which messages are passed. In such cases, one could assign some 'e' as a paramenter indicating the fraction of the message which is transmitted (whether whole or in part with $0<e\leq 1$). One can also define some 'c' as the communications channels, with 'n' equal to the number of such channels. If 'e' is strictly less than 1, then the clarity of the message received by the c^{n-1} channel will be $(ec)^{n-1}$, which means some cumulative loss will occur in the information transmitted in the message (see the discussion by Williamson, 1967, on control loss). No matter what the structure of the relationship of 'e' to c^{n-1} (whether strictly cumulative, additive, or some markov correction process), when $e<1$, the clarity of messages will deteriorate as channels increase. In this case, both the number of channels <u>and</u> the level of 'e' matter for the clarity of the message.

<u>IR 5: Procedural Rules</u>

Fundamental to any decision-making arrangement is the manner in which proposals are arranged and the order in which they appear. Farquharson (1969) points to two different "core" binary voting procedures: the amendment procedure and the successive procedure. We assume some binary procedure:

$P(x,y)$ which determines choices between pairs of alternatives.

Further, some $x \in \Omega$ is a winning proposal iff $\{x \in W | \nexists\, xDy\}$.

Miller (1977; 1980) outlines in detail the different choice procedures and their implications. Basically:

1) Amendment -- Two proposals are paired for a majority vote, the defeated proposal being eliminated with the surviving proposal being paired with a third proposal for a second vote. The proposal surviving the (m-1)<u>th</u> vote is the winning vote.

2) Successive — Proposals are voted simply on their own basis. The first proposal is voted up or down. If eliminated, the second proposals is considered and voted up or down, etc. if voted up, that proposal becomes the decision and voting stops. If the first (m-1) proposals are voted down, the one remaining proposal — generally, some implicit status quo — is the decision.

The upshot of these procedures is that under noncooperative voting (where voters are acting either strategically or sincerely) the amendment procedure results in outcomes in the pareto optimal space, and hence, is "better" than the successive procedure which may not have outcomes in this set (see Proposition 3; Miller, 1977). Meanwhile, as a corollary to his Theorem 6, Miller (1980) suggests that under any majoritarian procedure, cooperative voting assures pareto optimality (p. 89).

<u>IR 6: Position Rules</u>

Position rules enable particular individuals (or set of individuals) either to enjoy powers shared or not shared by other members. The results, of course, are institutionalized equalities and inequalities among members of the decision-making arrangement. I will suggest two ways in which inequalities are institutionalized.

First, one member (or set of members) could be given excess votes. So, with $N = (1,2,\ldots,n)$ members of the arrangement, the i<u>th</u> member could be given (1+e) votes such that the set of winning proposals is transformed from:

$x \in W$ where $W = (C_j \subseteq N \mid \{C_j\} \geq \frac{n+i}{k})$ as previously defined

to

$x \in W^*$ where $W^* = (C_i \subseteq N \mid \{C_i\} \geq \frac{(n-e)+i}{k})$

We now have the results: $\{C_i\} \leq \{C_j\}$

with the case $\{C_i\} = \{C_j\}$ where no real advantage accures to the members of (C_i)

and the case $\{C_i\} < \{C_j\}$ where the members of (C_i) should be able to select points closer to their ideal points.

However, our concern is with decision-making arrangements which approximate democratic institutions. Weighted voting, although occupying some space in democratic theory (see Mill, Representative Government) has never gained widespread acceptance.

The second approach to modeling institutional inequality is via defining control over the agenda, i.e., who is able to set up the proposals under consideration. This will be the approach here. A good deal of research has been expended on this question (cf. Plott and Levine, 1977). Shepsle and Weingast (1981) suggest that agenda setting involves three elements:

1) adding alternatives to the agenda;
2) deleting alternatives to the agenda; and
3) ordering the elements of the agenda (p. 34).

They formalize and develop a set of implications in their paper, and the reader is referred to it. A flavor of their development is briefly outlined here. First, assume some unique player (or subset of players) is provided with one or more of the following agenda-setting elements:

First, there exists some X which is a "proto-agenda." Second, $D \subseteq B$ where $D = (D_1, D_2, \ldots, D_r)$ subsets of coalitions composed either of one player or more.

1) Adding - Some (D_i) is empowered with selecting $F(X) \subset X$. (The subset (D_i) can develop a subset of proposals to X.)
2) Deleting - Some (D_i) is empowered with selecting $G(F(X)) \subset F(X)$. (The subset (D_i) can selectively eliminate proposals by developing a subset of proposals to F(X)).
3) Ordering - Some (D_i) is empowered to select $H(G(F(X))) \subset G(F(X))!$ (The subset (D_i) can order the subset of proposals G(F(X)) in any permutation of the elements contained in the subset).

In the rare case where $(D_i) = 1$, outcomes are likely the agenda-setter's ideal point. However, where $(D_i) \neq 1$, it appears that the result is less constrained and will often fall into the pareto optimal set (though it need not).

Predicting Outcomes

Briefly, we have developed an n-person, m-dimensional voting model. This model varies in some respect from similar models (e.g., McKelvey, 1976; Cohen, 1979) in that it more fully describes the set of institutional structures which may affect the process of formulating, debating, and ratifying a proposal. Two things have been observed about such models. Where the aggregation rule is simple majority, the communications channels are open, the procedural rules are a modified successive process, and position rules reflect equality; we find:

1) Proposals may appear all over the alternative space unless particular symmetry properties are met (Plott, 1967; McKelvey 1976); or

2) Proposals converge to a game theoretic solution (see MeKelvey, Ordeshook, and Winer, 1978). In other words, an equilibrium emerges.

The first expectation is derived theoretically. The seconds while resting on some theoretical properties, has been supported by a good deal of research (McKelvey, et al., 1978; Laing and Olmsted, 1978; McKelvey and Ordeshook, 1979).

Given recent concerns voiced by many over the absence of equilibrium and the special role played by institutional structure (see Riker, 1980; Fiorina and Shepsle, 1981), we will turn toward a different set of questions. We will ask whether changes in the rules of a decision-making arrangement result in differences in outcomes. Further, we will attempt to predict the outcomes emerging from particular changes in structure. Developing a full set of predictions for every change in institutional structure is a time consuming process involving more space than available here. The object of this section is to provide some flavor of the institutional modeling approach. We will discuss only the effects of changes in communication rules on outcomes. All other institutional rules will be held constant. This is consciously done in order to impute any changes in outcomes to the institutional rules being manipulated.

First, we need to establish the general space of alternative from which individuals will choose. Then, we may look at the effects

accompanying rule changes. Recall our previous mapping of alternatives and strategies onto outcomes, and a fixed set of dominance relations, we may establish a covering of subspaces which are optimal for each coalition. Let us begin with some:

$T_j \subseteq \Omega$

T_j is the convex hull of the ideal points of the members of the coalition

C_j where $C_j \in W$. This convex hull has the property that:

$$T_j = \{x \in T_j ; y \notin T_j | xDy\}$$

It is <u>not</u> the case that:

$$u_i(x) > u_i(y) \; \forall x \atop i \in C_j$$

In characteristic function form, however:

$$T_j \subseteq X \text{ where } V(C_j) = \max_i \min_k (x) \qquad \text{If: } i \in C_j, \; k \notin C_j$$

This establishes that the set of points contained in the covering T_j are pareto optimal. However, it can also be shown that this set is not stable for the members of the coalition C_j as:

$$u_i(p_i) > u_i(x) \; \forall x \atop i \in C_j \qquad \text{Where: } x \neq p_i$$

But:

$$u_j(p_j) > u_j(p_i) \qquad \text{Where: } j \neq i$$

And:

$$u_i(p_i) > u_i(p_j) \qquad \text{Where: } i \neq j$$

Similarly, there exist points in other coalitions such that they are preferred to points in the T_j. In effect, then, there exists a large set of pareto optimal coalitions defined by the convex hull of all the players ideal points. The general set 'T' consists of:

$$T = \bigcup_{B \supset W^m} T$$

We expect that members of coalitions would choose strategies which will yield them outcomes somewhere in 'T' (and possibly some subset of 'T').

As noted, these points lack stability. However, von Neumann and Morgenstern have developed stability criterion which require internal and external stability in dominance relations. There criterion have been adapted and utilized in many subsequent solution concepts. Where we have:

$\hat{T} \subseteq T$ Where: $\hat{T}$ is a stable set

Then conditions 1 and 2 must be satisfied:

1) Internal Stability

If $x,y \in \hat{T}$, then neither $u_i(x) > u_i(y)$ or $u_i(y) > u_i(x)$ $\forall\, i \in C_j;\ C_j \in W$

2) External Stability

If $x,y \in \hat{T}$ and $z \notin \hat{T}$ and $u_i(z) > u_i(x); \exists\ u_i(y) > u_i(z)$ $\forall\, i \in C_j;\ C_j \in W$

This brings us to a treatment of communicatioins rules. We will argue that individuals go through a two-step process. First, they attempt to locat 'T' (or coalition specific subset of 'T') which enjoy optimality properties. Second, they try to develop stable proposals in the set $\hat{T}$. To take either step (and they are lexicographically ordered) requires information. The case in which no information is known to members of the decision making arrangement is where:

1) The distribution of other individuals preferences is unknown; and
2) The pre-voting proposals offered by other individuals is unknown.

Individuals do not act under complete ignorance since they know their payoffs accruing to any point selected in the space. Further, they know the proposals being voted on.

As a result, individuals are faced with some probability (unknown to them) of locating the pareto region. Note, this region may be very small compared with the total space over which an individual has preferences. The probability of guessing a point in this pareto region would be:

$pr(\frac{T}{A})$.

Where 'A' approaches infinity, the probability of selecting a pareto point approaches zero. Where additional information is obtained, individuals use the cues derived from such information to more clearly estimate the surface of 'T'.

In effect, as the communications channels allow more information flow, the likelihood of an individual selecting a choise in the optimal region increases. This can easily be represented:

Let some 's' possible communications be represented by an ordered vector $\vec{I} = (I_1, I_2, \ldots, I_s)$.
Let $\{I_j\}$ be some 'j' number of communications.
Further, let ψ be some potentially identifiable probability density function (we can debate its shape) over $\vec{I}$ of selecting a pareto optimal region.
We then have:

$$\text{as } \{I_j\} \longrightarrow 0 \qquad \int_{I_0}^{I_j} f(\psi)d\psi = pr(I_j) = \frac{T}{A} \xrightarrow[A\to\infty]{} 0;$$

and at the other extreme:

$$\text{as } \{I_j\} \longrightarrow s \qquad \int_{I_j}^{I_s} f(\psi)d\psi = pr(I_j) \longrightarrow 1.$$

This basically says that as communications increases, so does the likelihood that some optimal outcome will be selected. By the same reasoning, as the number of communications increases, the probability of locating points in T (which is a subset of T) increases.

Hypotheses

We are now in a position to develop a set of hypotheses subject to empirical test. We will deal with two different decision-making arrangements. In the first, all institutional rules are held constant with communications being unrestricted. The second arrangement holds all institutional rules constant with the exception that communications are restricted. This enables a test of only the effects of the communications rules on outcomes across two different institutions. Our hypotheses, suggested by the model outline above, states:

H_o^1: Where communications are unrestricted, the outcomes of a defined decision making arrangement will appear in $\hat{T}$. In this particular case $\hat{T}$ = the Competitive K set.[8]

H_o^2: Communications are restricted, the outcomes of a defined decision-making arrangement will appear in T. In this case T = the set contained in the convex hull defined by the ideal points of the players.

Note that the outcomes of these hypotheses are not completely mutually exclusive. '$\hat{T}$' is contained in 'T'. However, in an empirical test we will examine the variance of outcomes for expected sets of solutions. This will allow some (albeit imperfect) comparability.

Gaming and Empirical Testing

This section of the paper will turn to the experimental apparatus used to test the hypotheses listed above and will provide a set of results developed from an experimental series. First, we will examine the structure of the experiment, then we will turn toward analysis of the results.

The Experimental Game:

The experimental structure of the game resembles the committee games utilized by Berl et al. (1976), Fiorina and Plott (1978), McKelvey et al. (1978), and Laing and Olmsted (1978). The experiment has the general form of a majority rule committee game. Participants are charged with selecting a point in a two-dimensional policy space. Each individual has induced preferences over all points in the policy space (the set of alternatives) while a subset of individuals (a committee) must arrive at a collective decision selecting a point in the policy space. Typically, this involves participants introducing a series of proposals until agreement is reached. Briefly, the game includes eight elements:

1) Individuals select a policy from a set of clear alternatives.

2) Individuals have well-defined preferences over the set of alternatives.

3) Sidepayments are not allowed.

4) The aggregation rule is simple majority rule.

5) The procedural rule is a modified "successive" rule.

6) All individuals are empowered to add alternative proposals; no individual is empowered to delete or order the proposals under consideration.

7) Committee members make a sequence of decisions on separate policy issues. In other words, the members play a sequence of games, rather than a single game.

As mentioned, the decision-making arrangements under scrutiny vary in terms of the communications channels available. This means:

8) All members are allowed an unlimited number of messages to other players.

8*) All members are limited to a finite number of communications to other players.

The primary difference of this game with other similar experimental games is in structuring changes across institutional rules and in the controls over the experiment. The game is conducted over an inter-active, computer system, PLATO. The program was designed and instituted by the author.

The Set-Up:

Each player is connected to a computer terminal. The program allows individuals to utilize three different screens, the first for geometrically observing where proposals appear relative to one's own ideal point, a second for communicating with other players, and a third for voting on proposals. The first screen, the "proposal screen", has overlaid on it a series of circular indifference curves around an ideal point with payoffs monotonically decreasing from the point. All points proposed by players appear on this screen. The screen consists of a 350 by 350 point graphs with axes marked off in increments of 25 points. Players are able to choose freely over any of the 122,500 points which exist in this space. In addition each player had access to a calculation routine which computes the value of any point to the individual. However, the ideal points of other players and their respective set of indifference curves are not displayed. Further, before beginning each round, the preferences of each player is shifted.[9]

Players are able to communicate with one another in a highly routinized and constrained manner. Players are able to send four types of messages: general proposals, bargaining proposals, accept-ance proposals, and rejection proposals. The message structure enables individuals to obtain and send key bits of information about

the points they will accept, reject, prefer, or points over which they wish to bargain. Further, a complete listing of who sent which types of messages and those messages' content is provided. Since the con-tent of these messages is encapsulated and PLATO is capable of handling a large message traffic and provides fast turn around on all messages, a limit of fifteen minutes was placed on each round of the game. Part of the rationale was suggested by the need to efficiently utilize the resources of the computer system. Also, since players played multiple rounds of the game, this ensures that players do not reach a level of boredom often occuring with people spending large periods of time at a computer terminal. In order to ensure that players are making substantively different decisions, the ideal points and payoffs for each player are changed during each round. Therefore, no player uses a similar set of preferences during the game.

As part of the proposal procedure, any point on the screen is acceptable. No voting action is taken until two members agree on a particular point. This is accomplished when one player accepts another's proposal. Once this occurs, all players are shifted to a ratification stage. There the proposal is voted up or down. In this respect the voting procedure resembles a modified successive proce-dure. Any proposal, then, before facing a vote must meet some minimal agreement. This is purposively done to encourage the formation of coalitions and to encourgae bargaining. In a sense, this modified procedure enables individuals to distinguish between proposals which are informative (and informal) in character, and proposals which are serious bids for acceptance. Similarly, since the system is easily susceptible to providing individuals with far more messages than they are capable of handling this system was designed to introduce voting. In essence, proto-coalitions intially form around two players.

The gaming structure is in its initial stages of development, and the results reported here are derived from a single pretest. Five players were recruited from an undergraduate political science class on game theory and political decision-making offered at Indiana University. The use of "sophisiticated" players in the experiment was deliberate —- not only were a set of results to be generated, but criticism of the format was solicited. The payoffs to the players were based on the ranked finishing place of each player. Players did not know how others were ranked relative to their own position until the conclusion of the game. They were merely instructed to accumulate as many points as possible, and that payoffs would be based on how many points they accumulated at the conclusion of the four rounds.

Results

The hypotheses suggest that with unlimited communications, players will select points close to the Competitive K-set. In this experimental series the K-set was:[10]

Table 1

Competitive K-set Solutions

Coalition	Point
(5 1 2)	θ_1: (142,224)
(1 2 3)	θ_2: (184,226)
(2 3 4)	θ_3: (217,206)
(3 4 5)	θ_4: (185,165)
(4 5 1)	θ_5: (152,173)

The K-set solutions and the actual outcomes of the game are contained in Figure 1.

The hypotheses also suggest that where communications are limited, outcomes will occur more broadly in the interior of the convex hull defined by the ideal points of the players. The convex hull is illustrated in Figure 1 as the connected line segments joining together player's ideal points.

Insert Figure 1 here.

We expected rounds 1 and 2 to fall near the Competitive set, and rounds 3 and 4 to vary outside it. However, such was not the case. Although Figure 1 indicates the results clustered around the Competitive solution, Table 2 shows that only round 3 had a coalition which selected a winning proposal which fell near the Competitive solution (using the generous measure of a 10 percent maximum error rate).[11] Round 1 found a coalition not predicted by the Competitive solution. Round 2 obtained a competitive coalition, but the point was a large distance from the expected solution. Round 3 obtained a competitive coalition and a solution close to that expected. Finally, round 4 obtained a competitive coalition, but a point far from the expected solution. What emerged, then, from this experimental series are mixed results.

Explanation

The hypotheses were not confirmed in this series of experiments. However, this seemed to be more a function of the structure of the game than misspecification of the hypotheses. First, adding a time constraint on the game had the effect of limiting communications. Players complained that they felt constrained in sending proposals and that not enough time was allowed for bargaining. Second, rank ordered payoffs gave individuals little incentive to pursue better proposals -- especially when not knowing the current totals of other players. As a result players often seemed to pick points disadvantageous to them in an effort merely to add to their stock of points.

Table 2

Outcomes From an Experimental Series

	Winning Coalition	Winning Proposal	Distance From K-set Solution
Round 1 [full communications]	(1 3 5)	(120,200)	*
Round 2 [full communications]	(5 1 2)	(175,250)	42.0
Round 3 [limited communications]	(1 2 3)	(185,250)	24.0
Round 4 [limited communications]	(2 3 4)	(190,150)	62.2

* Coalition not in K-set

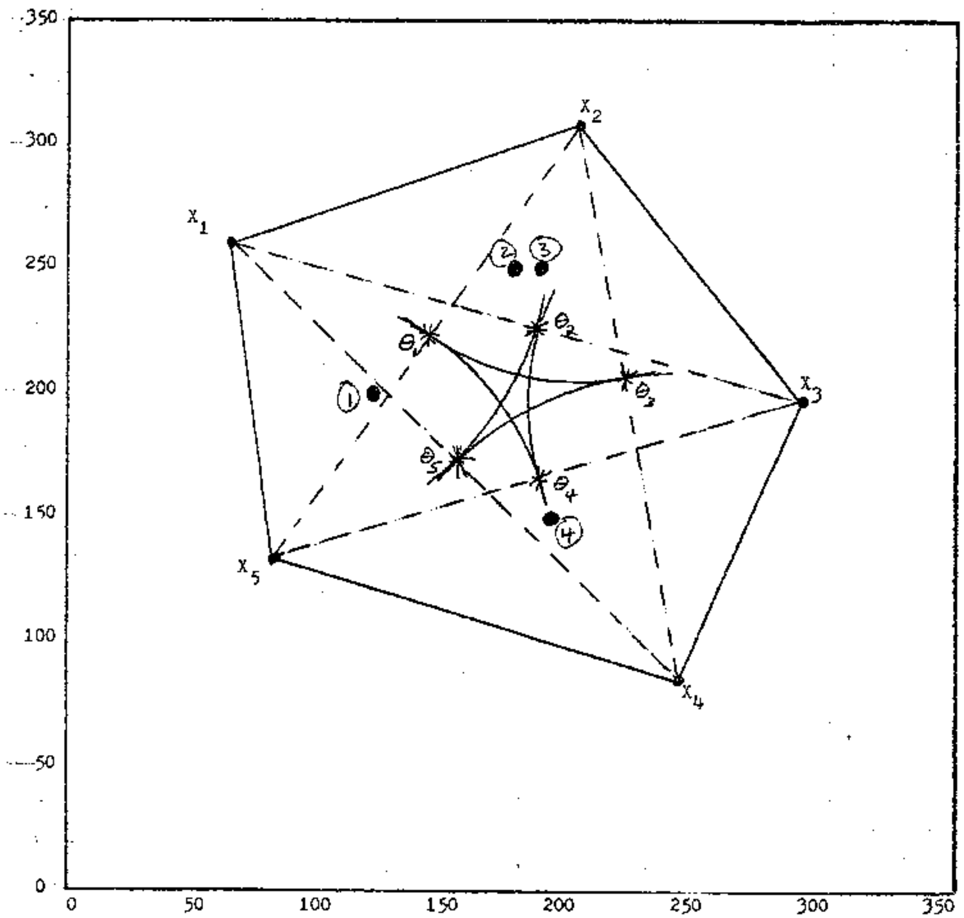
In a sense, nothing earthshaking emerges from this series of experiments. However, it must be recalled that this is an initial pretest of an experimental tool. Further, it appeared that inadvertant constraints on communications were added during the course of developing the experiment. This suggests that the formal model of structure might correctly point to an underlying phenomenon of committee behavior. Further experiment is warranted.

Conclusion

The question of how institutional structure affects the workings of decision-making is an intriguing one, with many implications. Formal work and experimental research can focus on some of the questions concerning what we might expect from the functioning (or disfunctioning) of institutional arrangements. Additionally, these methodologies are capable of pointing out the role of structure in affecting outcomes. If institutions are not "neutral umpires," then attention should be focused on how institutions work to satisfy normatively valued goals. Debates over the applicability of normative ideals can be informed by experience (as empirical democratic theorists claim). However, we must not constrain our own vision of the admissable set of collective arrangements to what currently exists. This is the value of normative ideals.

Figure 1

Game Theoretic Solutions and Experimental Outcomes



Competitive K-set Solutions

Experimental Outcomes

Footnotes

[1]See Skinner, 1973, for an excellent summary of these positions. Also, see Joseph, 1981.

[2]Empirical theorists generally conclude that the United States approximates some mixed form of a democratic polity. And, the empirical evidence suggests little participation (Verbs and Nie, 1972; Milbrath and Goel, 1977), little political awareness (Stokes and Miller, 1962; Wahlke, 1971), and little "constraint" in value systems (Nie, Verba and Petrocik, 1979; McClosky et al., 1980).

[3]One might begin by looking at the formally developed responses to Olson's work — work by Moe (1980), by Schofield (1975), and by Groves and Ledyard (1978). Further, one might want to examine the experimental work which has attempted to test under controlled conditions Olson's thesis. Included is work by Smith (1978), and Marwell and Ames. (1979; 1980).

[4]See for instance the general works by MacKay (1980) and Kelly (1978) examining Arrow's impossibility theorems. Also more specific, work by Harsanyi (1976). Also, see the general review article by Riker (1980) on the general effects of this work for "the dismal science of politics."

[5] A few field experiments, largely dealing with urban service delivery, have been conducted comparing different institutions as to their output. See Ahlbrandt, 1973; Ostrom et al., 1973; 1978; Savas, 1977; and Wilson, 1981.

[6]In a sense this result itself was of interest. Theoretically, where the Core exists in a game, it will always be selected. The Core has the virtue of being a dominant strategy for any set of players and exhibits important stability properties. This has been borne out in a good deal of research. See for instance, Berl et al., 1976; Fiorina and Plott, 1978.

[7]It might be noted that where the number of the message is unlimited, some problems might arise with information overload. That is to say, too much information may be as confusing as too little.

[8]The competitive set is a logical outcome for the 5-person game described below. First, the solution requires substantial bargaining on the part of the players. This is aided by the unrestricted nature of the communications rules. Second, the K-set yields a narrow set of coalition pairs and points over the alternative space (see McKelvey and Ordeshook, 1978). Third, the K-set has been found to obtain in similar 5-person games with great regularity (see McKelvey, Ordeshook, and Winer, 1978; Laing and Olmsted, 1978; and Ordeshook and Winer, 1980). Finally, the K-set exists for five different coalitions at five different points in the game described.

[9]This was done so that players would encounter a different situation each round. In the series, players simply traded preference positions -- although they did not know this was the case. The players, in fact, expressed surprise at the conlcusion of the experiment that this was so.

[10]For a set of algorithms for calculating the K-set, see McKelvey and Ordeshook, 1978.

[11]Error rates were calculated on the basis of the maximum possible distance from the competitive solution for each coalition to an extreme point in the corner of the alternative space.

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