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LABORATORY EXPERIMENTS AS A TOOL FOR INSTITUTIONAL ANALYSIS AND DESIGN

by

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Introduction

Vincent Ostrom (1993) has issued an important call to social scientists to "interpret social experiments." In part he laments the growing specialization in the social sciences, which removes researchers from one another, and in part he laments the growing chasm between experts and the public. Nowhere is this more keenly felt than in the advice that social scientists can offer to those currently engaged in social experiments. Those experiments reflect efforts by individuals to define the institutional structure within which collective choices are made. Surely, he suggests, the efforts to build new institutions in Eastern Europe, the efforts to reform political institutions in the Western Hemisphere, and the efforts to define local self-governing institutions throughout the world can benefit from the ongoing dialogue by scholars seeking to understand the fundamentals of institutional design. As he points out, the efforts of many connected with the Workshop in Political Theory and Policy Analysis are focused precisely on institutional analysis and design (IAD). How can what we do best be disseminated so as to influence other scholars and provide guidance to practitioners?

This paper offers our own response to Vincent Ostrom's call for a research program. We are keenly aware of the need for institutional analysis and for practical advice in natural settings. At the same time, we are quite concerned with making certain that we understand the theoretical foundations of the IAD framework. We feel that essential elements of that framework be subject to rigorous empirical test — tests that allow us to be certain about our causal claims. To accomplish these ends, we rely on a different methodology from most. Our focus is on formal models of institutions. Our analysis is primarily analytic, although we turn to laboratory experiments to provide empirical corroboration or refutation for those models.

We feel that laboratory experiments are similar in kind to the social experiments called for by Vincent Ostrom. In these experiments we are able to build (largely) self-contained systems ~ complete with their own cultures and institutions. By systematically changing institutional components we can develop a sense of how institutional variations affect individual behavior and in what ways. However, given that there is literally an infinity of institutional variations (even with relatively simple institutions), we rely on theoretical models to guide us to those institutional features which are most promising for study. We have chosen a particular methodology with which to probe the boundaries of the IAD framework and with which to generate corroborating findings.

Three Dilemmas

It is clear to us thafsocieties are differently organized, that individuals in societies have different traditions, conventions and norms, and that the institutions in which people interact vary considerably across societies. Nonetheless we begin from a fundamental premise. Human societies confront three central dilemmas: problems of coordination, collective action, and collective choice. Although these dilemmas are solved in a variety of ways, ranging from instilling and enforcing social norms to building and imposing institutions, it is nonetheless the case that no society can overlook these problems.

The first dilemma we characterize as the *coordination* problem. It stems from autonomous actors holding shared concerns, but independently being unable to arrive at a common means for action. This problem is especially vexing, since individuals clearly have an incentive to solve it. Yet they cannot easily do so through spontaneous joint action. Something as simple as choosing a side of the road on which to drive is an example of a coordination problem. It doesn't matter whether one drives on the right or the left side, so long as all others do the same. This seems almost a trivial problem, since it has long been resolved via legal stricture. But absent cultural norms or institutional rules, uncoordinated action can become problematic (see Schelling's (1960) discussion of focal points as one possible solution).

The second organizational dilemma is characterized as the *collective action* problem. It is a function of independent actors making individually rational decisions, yet being left collectively worse off when everyone makes the same set of decisions. Common pool resources are one example of a collective action problem, and one which has received a good deal of attention from those using the IAD framework (see Ostrom, 1990). A particular example might be the overharvesting of fish from an open body of water. While no single fisher makes a significant dent in reducing the population, the joint harvesting by all fishers decimates the population. Moreover, no single fisher has an incentive to cut back in harvesting. The problem only manifests itself through the collective action of all (and sometime with the collective inaction of all). Such problems are difficult to solve without recourse to institutions and have often led scholars to assert that they can be resolved only by centralized institutions (Hardin, 1968).

The final dilemma is known as the *collective choice* problem. The crux of this problem is that if actors do not have identical interests *and* if they are required to collectively make decisions then any coalition of those actors can be formed and reformed. As a consequence there will be little coherence to collective decisions. Worse, even if individuals have shared concerns, they will quickly unravel. These problems are

pathological. This dilemma is not limited to democracies, although much of the impetus behind this work derives from such settings. Collective decisions must occasionally be made in any social organization ~ even the most despotic. How those decisions are made (and how interests are weighed and aggregated) is of central concern. Much of the literature on the U.S. Congress in the past 15 years has focused on the scope and nature of collective choice problems.

As can be seen from our brief discussion we think that political institutions provide a central means for solving these problems. It is true that individuals' values could be changed so as to overcome these problems. However, we expect that changing peoples' values is exceedingly difficult — it involves a considerable change in existing cultural norms. Moreover, we are uncomfortable with such proposals, since minimizing the diversity of tastes in the world strikes us as counterproductive. Nor are we comfortable with mandating which values and tastes should predominate to the exclusion of all others. However, as political scientists we are perfectly willing to consider different institutional mechanisms and how each operates with respect to the three dilemmas detailed above.

It is clear to us that there are an infinite number of institutional variations. Moreover, no single institutional mechanism will resolve the problems noted above. What is clear from IAD framework developed in the Workshop is that it is absolutely critical to map an appropriate institution onto a specific cultural milieu. Since institutions provide incentives and disincentives for actors, they must fit with what those actors value. Put very simply, no single institutional pattern best fits every setting.

This paper owes a rich debt to the IAD framework. Throughout we borrow heavily from a way of thinking about institutional design that is exemplified in Ostrom et al. (1994, see especially Chapter 2). In this paper we fix, both theoretically and empirically, the attributes of the environment under study as well as the rules in use. What we change are aspects of the action situation, particularly the rule configuration. As Ostrom et al. argue, the rule configuration of any institution constitutes important boundaries for any action situation (1994: p. 41). Within a well-defined context we explore the consequences of different rule configurations for outcomes.

In our discussion we focus on only one of the three fundamental problems for a social organization: the collective choice problem. Others, particularly in the Workshop, have analyzed problems associated with collective action (see surveys by Ostrom, 1990 and Ostrom et al., 1994). The coordination problem is interesting, but has not yet received the attention it deserved. For us the collective choice problem is fascinating because it has been so daunting for much of the formal literature in political science.

Over the past 15 years this problem has been central for guiding the understanding of legislatures (for example, see the survey by Krehbiel, 1988). Of course, the problem of collective choice need no be limited to this narrow part of the field. Any setting in which individuals make collective choices applies ~ whether it be decisions in City Councils or in the Boardrooms of Fortune 500 Industries.

Theoretical Overview.

The collective choice problem has its modern intellectual origins in the work by Arrow (1965). Quite simply and elegantly put by Riker (1980), this work implies disequilibrium in collective choices. Basically, under most settings, no matter what the decision rule (read: position, authority and aggregation rules) the resulting outcomes will fail to be in equilibrium. For a democratic theorist this means that if something like simple majority rule is used to decide an outcome, there is no guarantee that the majority will settle on the *same* outcome each time. If consistency is a normatively valued criteria, and it should be if the majority is empowered to govern, then this is highly problematic.[1]

As many have noted, the collective choice problem throws into relief an important baseline for understanding most institutions. First, it suggests that there will be little coherence to collective choices. This means that equilibrium will be rare and that we should expect little patterning to outcomes. Second, it suggests that if there are no equilibria, then any outcome can be selected. This implies that outcomes are "up for grabs" and can easily be manipulated (see McKelvey, 1976). Finally, it suggests that if disequilibrium over outcomes is the norm, then decision making will be characterized by interminable haggling over outcomes. Riker and others have pointed to voting cycles as emblematic of the collective choice problem. If no proposal can win, then some proposal can always be brought forward by which to continue the decision process.

What is problematic about this approach is the fact that we seldom observe the kinds of voting cycles and incoherence in choice suggested under models of collective choice. Some, like Shepsle (1979), suggest that the stability we see in the world is due to institutional constraints on individual strategy choices. It is exactly this approach that we take, using the IAD framework, to try and understand how rule configurations matter and shape outcomes.

We next turn to defining the basics of a simple collective choice institution. Rather than introduce a complex technical language to characterize that institution, we

[1] Of course, Arrow (1965) brings a good deal more into his discussion. The interested reader is referred to the original. Riker (1980; 1982) provides a useful discussion of the implications of numerous problems stemming from collective choice.

borrow liberally from Ostrom et al. (1994) who paint the general boundaries on an action situation (see especially their Chapter 2, footnote 5). Throughout we use a simple institutional device — a committee. The committee's task is also simple; it is charged with making a collective choice.

Ostrom et al. (1994) characterize a set of seven minimal rules that define an institution embedded in an action situation. The first, boundary rules, defines *who* is considered part of the decision settings. For most of our analytic work, we assume that there are N actors, a finitely large, but denumerable set, each of whom are committee members. In our simplified committee setting, it is a simple matter to label each of the committee members.

The second set of rales, position rales, indicate which slots authorize which actions in the decision setting. In our basic committee setting, there is only a single position ~ that of a committee member. All members are authorized to perform the same actions.

The third set of rales specify the range of outcomes available to members. In this committee setting the outcomes are represented as an abstract policy space. Usually that policy space is considered to be multidimensional with an infinite set of dimensional combinations. These complex policy spaces representing outcomes have given rise to spatial models of political processes. At the same time an outcome space could just as easily be represented by two alternatives over which the committee makes some choice.

This brings up the fourth component of the committee, its authority rules. Those rules specify the allowable set of moves for a member. In this committee setting there are two general sets of actions allowed: building an agenda and voting. Building an agenda amounts to proposing amendments to an arbitrarily fixed status quo. Voting involves casting a ballot between the proposed amendment and the status quo.

The fifth set of rales, the transformation rales, specify how actions are mapped onto outcomes. So, for the case of voting noted above, the transformation rale usually employed is simple majority rale. So long as the number of votes in favor of the amendment exceeds 50 percent plus one, the status quo is replaced. Simple majority rale, however, is not the only transformation rule that could be used. Extraordinary (two-thirds) majority rules are commonly used in many settings ~ especially where minority rights are paramount.

The sixth rule concerns the information available to a member at each stage in the decision process. In our setting members have complete information about all of the preceding rales. They know who the other committee members are, the common position

they all occupy, the structure of the policy space, all allowable actions, and the transformation rules.

The final rule deals with payoffs to members. In this committee setting the payoffs are a mapping from individual preferences to the policy space. For every policy, members have well-defined (and possibly unique) payoffs. It is these differences in payoffs for policies that creates conflict within the committee. Of course, as many have shown (see McKelvey, 1979), as the alternative space becomes multidimensional, conflict becomes more likely, even if there are only small divergences in taste.

In sum, these rules help to minimally characterize the committee setting we rely on in this research. The simplicity of this setting has long been used as a baseline for modeling the collective choice process. Its value is largely a function of its simplicity and the ease with which complications can be added. For instance, later in our discussion we make small modifications to the position rales and are able to tease out very different models.

The principle focus of theorists has been with the position, authority and transformation rules defining this simplified setting. The findings are quite robust Given the committee characterized above, no transformation rale will yield consistent outcomes without violating authority or position rales (Arrow, 1965). Unless the institution is dramatically tinkered with, disequilibrium is expected to be the norm. Little of the formal theoretical results explicitly draw on the IAD framework. Yet in thinking about the collective choice problem, most implicitly dissect institutions, focusing on these rules as fundamental building blocks. This systematic breaking apart of institutions has allowed theorists to uncover important interactions in institutional structure. Most, however, have remained focused on the basic committee setting sketched above and worried about incoherence in outcomes. Much of that work has remained theoretical and without empirical reference. It is toward empirical analysis that we next turn.

Experimental Design.

Spatial models of committees tell us a great deal about the types of problems that dominate collective choice settings. These models have been used to successfully analyze natural settings as diverse as the U.S. Continental Congresses (Jillson and Wilson, 1994), contemporary committee systems in the U.S. Congress (Kieweit and McCubbins, 1991), and party leadership in the U.S. Congress (Cox and McCubbins, 1993). Yet spatial models are quite abstract and their full implications are very difficult to test. For an analyst to gain any purchase in explanation, the detail of the institution must be laid bare, the preferences of actors must be well specified, and the mapping from

action to outcome must be explicit. In natural settings, with all of its uncontrolled variation, disentangling causes is extraordinarily difficult.

At the same time there are an unlimited number of spatial models that can describe various settings. This only complicates the task of developing explanations of particular settings. Which models are the best approximations, especially if postdiction is relied upon for providing an empirical test?

Because of these problems (and others) several researchers have turned toward laboratory experiments in order to focus on spatial models and their applicability to natural settings. Such experiments rely on human subjects participating in highly controlled environments, making decisions that matter for them. As we point out below, a laboratory experiment assures that the researcher can connect theoretical terms to empirical referents (solving the internal validity problem). Such experiments also allow a researcher to investigate many alternative theoretical models to pinpoint those that best match the behavior under investigation. In turn this provides an empirical shortcut to model building, in which models with little empirical content can be discarded in favor of those which gain some corroboration in the laboratory.

In the mid-1970's several groups of researchers developed a widely emulated experimental design with which to understand collective choice problems (see in particular Fiorina and Plott, 1978 and McKelvey, Ordeshook and Winer, 1978). These have become widely known as "committee" experiments. Typically such experiments involve small groups of participants (ranging from three to seven) convening as a committee to make a decision from an abstract policy space. Individuals are allowed to make proposals from that policy space, vote over proposals, and eventually settle on some outcome for which they are paid. One such variant of a committee experiment is elaborated below.

Collective Choice Problems in the Laboratory.

Earlier we identified three distinct problems pinpointed by theories of collective choice. While most scholars accept that these formal models imply a set of social pathologies, most also doubt their relevance to the natural world. For instance, while it is easy to accept in the abstract that institutions with open agendas will yield inconsistent social choices, most natural settings produce considerable consistency in choice. To what extent, then, does incoherence in choice, possibilities for manipulation and costly transactions matter for the way we understand political institutions? In this section several examples are pulled from our own experimental work to show that such problems occur in empirical settings and that they pose a serious threat to the collective choice.

Across the next several sections we detail the results of several different experimental manipulations. Since they all draw on a common design framework, a brief overview of the experimental design is given here. Further elaboration can be found in Herzberg and Wilson (1991). In many ways this setting is isomorphic with that introduced in the previous section.

We rely on five-person committee experiments in which subjects choose proposals, call votes and decide between different alternatives. Only "naive" participants were used in the experiment ~ individuals who had not previously participated in a spatial voting experiment. Subjects were recruited through advertisements posted around the campus and in the student newspaper at Indiana University. Subjects volunteered to participate at a particular time and date and experimental manipulations were randomly assigned to each group. AH participation in these experiments took place at computer terminals which were physically separated. Players could not see one another's terminals and their identities were randomized and kept anonymous. This minimized the possibility that groups of players successfully colluded using prearranged coalition strategies.

Participants were given both oral and machine-based instructions designed to familiarize them with the experiment and test their comprehension. Each individual was then assigned an ideal point in the two-dimensional space and was given a payoff function based on circular indifference contours (see Herzberg and Wilson, 1991). In the experiment, participants collectively chose an alternative from a two-dimensional policy space. Alternatives were represented as Cartesian coordinates from orthogonal dimensions labeled X and Y. These abstract dimensions were chosen in order to prevent participants from attaching any subjective value to them (see Smith, 1982). All experiments used a forward moving agenda procedure in which proposing alternatives and voting was governed under a modified version of *Robert's Rules of Order.* At the outset of the experiment a fixed status quo was introduced by the experimenter (see Table 1 for a listing of player positions, the status quo and payoff functions used in these experiments).

In the decision process any player could place a proposal on the floor and once proposed it remained there throughout the decision period. A vote to amend the status quo was not considered unless a proposal was "seconded" by another decision maker. Once seconded, a vote was called between the amendment and the status quo. All amendments were treated as an amendment in the nature of a substitute. When voting, subjects considered whether to retain the status quo or substitute the amendment for the status quo. Subjects were equally weighted in their votes. If a majority voted to retain the status quo, the experiment continued, with the floor open to new amendments. If a

majority voted for the amendment, it became the new status quo. The experiment continued in this fashion until a motion was offered to adjourn the meeting. If a majority voted to adjourn, the decision period came to an end and subjects were paid their value for the current status quo. Otherwise the decision period continued. In many of the experiments subjects participated in several distinct periods. Typically the initial period was reserved for instructions and subjects received no payment for the outcome. In subsequent periods (generally no more than two), the earnings across periods were tallied and paid to subjects at the conclusion.

<Table 1 About Here>

This laboratory experimental mechanism, then, is quite simple. Using a well-understood, forward-moving agenda mechanism, equally weighted subjects bring proposals to the floor and vote on them. This simple institution resembles that detailed in the theoretical section. In experiments discussed below, new institutional features are added in order to test specific theoretical claims. However, the basics of this institutional design remains the same across experiments. This lets us use a comparative statics framework to gauge the effect of institutional variation.

Inconsistency in Choice.

The first problem raised in the social choice literature pertains to inconsistency over outcomes. This is the crux of "Arrow's paradox" in which individuals, with fixed preferences under the same institutional mechanism, fail to choose the same outcomes. For those who believe that the same institutional mechanisms should yield consistent outcomes (or that unique social welfare functions exist), this is a very disturbing finding. However, is this a common empirical problem?

The laboratory experimental literature is clear about when we will observe consistent collective choices. As McKelvey and Ordeshook (1990) observe, if a preference-induced equilibrium exists (a Core) then subjects will pick it or settle on outcomes very close to it. The conditions for obtaining a majority rule equilibrium are extraordinarily restrictive requiring that some status quo defeat every other alternative in a pairwise vote (Plott, 1967; Cox, 1987). We focus on settings in which *every* status quo can be defeated by at least one other alternative. Work by McKelvey (1979), Schofield (1978), and Cohen and Mathews (1980), implies that in such an instance outcomes will be chaotically ordered in the space. What happens when subjects face such a setting?

In the five person committee experiments reported here, subjects were randomly assigned ideal points ensuring that no majority rule equilibrium (a Core) existed. These ideal points, as well as outcomes, are plotted on Figure 1. By and large these outcomes

focus on the central portion of the policy space. Half (9 of 18) of the outcomes are located in the (small) interior pentagon made up by finding the convex hulls of all possible winning coalitions. Surprisingly, outcomes are not widely scattered throughout the alternative space. In-and-of-itself, this might lead us to conclude that these data disconfirm our conjecture concerning incoherence in choice. Yet there is a good deal of evidence pointing to problems encountered by these subjects in settling on outcomes.

<Figure 1 About Hero

First, as theoretically predicted, subjects amended the status quo quite often in these open agenda experiments. In another experiment we tested the extent to which the Core was selected (Wilson and Herzberg, 1994). Consistent with findings by others, we discovered that when the Core exists, outcomes converge on it In those trials subjects averaged just over 3 successful amendment votes. By comparison, our open agenda trials averaged 6.67 successful amendment votes. Moreover, the amended status quo was never stable, even with the limited number of proposals on the floor. On average, 12.7 proposals were on the floor which could defeat the final outcome. By comparison, there rarely was a proposal on the floor that could have beaten the final outcome for our Core experiment

The second hallmark of instability lies in the fact that we observed a number of voting cycles in these trials. Half of the 12 trials with sufficiently long agendas (at least four successful votes) included at least one voting cycle. For instance, trial BSTAR4 characterizes how such cycles unfolded. Figure 2 plots the agenda trajectory for this particular trial. The numbers on the figure indicate the sequence in which successful amendments to the status quo were made (and not the vote number). On the very first vote, the initial agenda step, the status quo moved toward the center of the alternative space. Subsequent motions to amend failed until the eighth vote, when alternative (204,216) succeeded (step number 2 on the figure). The next three votes completed the voting cycle. The proposal (140,213) won by the coalition {1,2,5}. Yet it was quickly replaced by alternative (172,210) under the coalition {2,3,4}. But, the same coalition also preferred (204,216) and it was again voted the status quo. Member 1 quickly brought a new amendment to the floor -- (137,230) ~ which handily defeated (204,216). However, subjects had no problem amending it with (172,210). On the subsequent vote they settled on that alternative as the final outcome for the trial. The figure illustrates that subjects uncovered two complete voting cycles in this trial. Once identifying key elements of the cycle it was relatively easy for subjects to manipulate the agenda. As noted above, half of the trials with at least four agenda steps included voting cycles. This example is representative of how the agenda wandered across the alternative space. Even

though the final outcomes for all of our trials appear to converge to the central portion of the space, the agendas resemble the chaotic, inconsistent and cyclic trajectories suggested by a number of theorists.

<Figure 2 About Hero

Results from these open agenda trials support several claims about incoherence in collective choices. First, outcomes do not end up at the same place in the alternative space, even though they begin from the same initial status quo. Second, outcomes are scattered in the alternative space. However, those outcomes tend to cluster in the central part of the policy space, a finding that has generated considerable additional study (see Ferejohn, Fiorina and Packel, 1980; McKelvey, 1986; and Grofman, Owen, Noviello and Glazer, 1987). Finally, even though subjects have tens of thousands of potential proposals from which to choose, they often build voting cycles across a limited number of alternatives placed on the floor. It is the presence of voting cycles that best highlights the fears of collective choice theorists for democratic practices.

Manipulation.

A second problem associated with collective choice concerns manipulation of the agenda. In an important paper, McKelvey (1976), as an afterthought, noted that if any agenda was manipulable, then a monopoly agenda setter would enjoy an extraordinary advantage (see also Gibbard, 1973 and Satterthwaite, 1975). That is, if any point in some multi-dimensional policy space can be reached via some agenda, then surely an agenda setter can construct an agenda leading to her most preferred position. In part this requires a modification of the institutional setting in which a single position is assigned to build the agenda. Subsequent to McKelvey's paper, several theorists showed that when a monopoly agenda setter exists, that member's ideal point is the equilibrium solution for the game (Schofield, 1985; Schofield et al., 1988). To what extent does this represent a serious problem for collective choice?

Beginning with the same experimental design noted in the previous section, we modified the institution so that *only a single actor* was granted the power to call votes. In this setting *any* subject could bring a proposal to the floor. However, only a single subject was granted the right to bring an amendment to a vote or to bring a vote to adjourn. That agenda setter was able to "second" her own alternatives as well as those by others. At the outset of each trial all subjects were notified that one subject was randomly selected to call votes. They were informed as to that member's nominal identity ~ that is, the letter identifying that subject In this sense subjects only knew whether or not they were the agenda setter *and* they knew the location of the agenda setter's ideal point.

The alternative space used for these agenda setter trials mirrors that used for the open agenda trials. The coordinates for subjects' ideal points match those represented on Figure 1. All agenda setters, while randomly selected among the subjects, were assigned to the position of member 5. Given the agenda setting mechanism described here that member's ideal point, (43,75), is the unique equilibrium. That alternative was deliberately selected so as to be at some distance from the initial status quo.

A total of seven trials were run under this condition. The final outcomes are plotted on Figure 3. Only one outcome is at x^5, the equilibrium for this experimental condition. Yet outcomes are clustered closer to the player at the equilibrium than to any other player. To make this easier to see, we compare these results with those presented above in the open agenda experiment. On the figure we plot, for each experiment, the estimated confidence interval ellipsoid (CIE) for the distributions. We assume that the outcomes are approximately bivariate normally distributed in the alternative space and then calculate a 50 percent CIE for the two different experiments. As can be seen from the figure, these distributions are quite different When there is an agenda setter, outcomes are pulled toward that individual's ideal point. However, this certainly does not mean that the agenda setter always gets what she wants. This is illustrated by the dispersion of outcomes away from the agenda setter's most preferred point.

<Figure 3 About Hero

Interestingly, even though only a single outcome ended up at the agenda setter equilibrium, given the proposals on the floor agenda setters were unlikely to have improved their lot In five of seven trials there was no proposal on the floor which could have defeated the final outcome by a majority including the agenda setter. This point is elaborated by Table 2. The table reports in the rightmost column the frequency of non-repeated proposals by treatment. In general 40 percent of the proposals on the floor were preferred by some majority to the final outcome. Yet the number of alternatives preferred by the agenda setter to the final outcome was considerably less (trial CVSTAR2C is an outlier). But, the agenda setter could only bring amendments to a vote and could not obstruct a vote. This meant that alternatives the agenda setter preferred were irrelevant unless they attracted a majority. The third column points out how many proposals could have defeated the final outcome via a majority coalition supported by the agenda setter. In only two instances were proposals on the floor which could have defeated the final outcome. Almost overwhelmingly these were from trial CVSTAR2C.

<Table 2 About Hero

Key to understanding these results is the complex task facing the agenda setter when fixing the agenda. While free to build any agenda, few agenda setters picked their

ideal point at the outset/ However, the closer they moved the status quo to their ideal point the more difficult it was to build an agenda leading to the equilibrium. To illustrate this point we plot the agenda path for trial CVSTAR2A on Figure 4. Beginning with the initial status quo at (280,280), subject 5 quickly moved an amendment to (82,73). This was a move favored and voted for by the coalition {1,4,5}. However, once at that point, the status quo was in the pareto optimal subspace for those same players.[2] The agenda setter now had to find another coalition that would support an amendment. That amendment led to alternative (66,99), which was favored by the coalition of players {1,2,5}. This move represented only modest gains for the agenda setter ($.82). In order to move the agenda setter closer to her ideal point, player 5 now had to find an alternative preferred by the coalition of players {3,4,5}. No such proposal was made, as can be seen from the full set of proposals plotted on Figure 4. Several alternatives theoretically were possible, although the gains to the agenda setter would have been quite small, and would have required a sequence of amendments oscillating between coalition partners {1,2} and {3,4} in order for the agenda to lead to x^5. In unsuccessful attempts to amend the status quo, the agenda setter brought alternatives (60,59) and (52,59) to a vote, both of which she, but not a majority coalition, preferred. The point to carry away is that as the agenda drew closer to x^5 it became more difficult to construct a path converging to the equilibrium. In other trials almost invariably the initial agenda step jumped into the pareto set for players {1,4,5} which meant that subsequent amendments required a careful balancing of coalitions.

<Figure 4 About Here>

What we find from this experiment is that the manipulation of outcomes is a possibility. Fears that collective choice theorists hold concerning the manipulability of the collective choice appear to be well founded. In particular, if specialized position rules are granted, then those protected by such rules will be advantaged. Perhaps more disconcerting, a clever individual without specialized agenda power, can enjoy a tremendous advantage over others, especially if the others are willing to cede agenda power. This may imply that democratic institutions, with open agendas, require extraordinary vigilance by a well-informed citizenry to prevent manipulation over outcomes. But, political scientists have not been optimistic about the general tendency of the populace to constantly defend its interests.

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[2]That subspace is easily defined by drawing lines connecting player 1,4, and 5's ideal points. This yields a triangle with the ideal points as vertices. This subspace is pareto optimal for these players since any move from any point in the subspace would result in at least one player being left worse off.

Costly Transactions.

The final problem for collective choice, which has not been addressed by researchers, points to the transaction costs for decision making. Buchanan and Tullock (1962), Williamson (1985) and North (1988) all point to the centrality of transaction costs for decision settings. Yet theorists focusing on collective choice typically assume that the process of reaching decisions is frictionless. This seems unreasonable given that many institutional innovations aim at reducing decision costs. For example, in the U.S. Senate, Unanimous Consent Agreements are often used to minimize the amount of time given over to a bill on the floor (as well as defining boundaries on discussion once that bill comes to the floor). While decision costs are ubiquitous, to what extent are they problematic for the collective choice? Theoretical work by Wilson, Herzberg and Elliot (1993) suggests that for a class of transaction costs the problems can be severe. If costs are collectively borne, then individuals have powerful incentives to continue with the decision process. When coupled with an open agenda process and no preference-induced equilibrium, this can lead to complete dissipation of any gains from decision making.

Capturing decision costs is complicated because there are many such costs and they are difficult to measure. In the experimental setting detailed here, a specific type of decision cost is considered. Our design resembles the forward moving open agenda mechanism we first described. However, when a vote is called by a subject, *all subjects* are charged a fixed fee. Two levels of cost are examined — a charge of either $. 15 or $.30 per vote called. Regardless of the treatment, these costs are accumulated over the course of the trial and are subtracted from subject's earnings at the conclusion. Throughout the trial subjects are reminded of the costs they bear for calling a vote and the total costs borne to that point.

Figure 5 displays the outcomes under this experiment. Given this array of preferences and institutional mechanism, no equilibrium exists. As expected, those outcomes are scattered across the alternative space. Other than some convergence on the central portion of the alternative space we find no pattern to the dispersion of outcomes attributable to our two cost treatments.

<Figure 5 About Hero

Did these costs have any impact on behavior? As Wilson, Herzberg and Elliot (1993) predict, because at least one subject can expect to gain by calling a vote, imposing costs fails to limit the number of votes called. In fact, subjects averaged just over 21 votes per trial (at a cost of $6.30 in the high cost treatment). By comparison, in the costless open agenda experiment subjects averaged just under 21 votes per trial. This is not to say that these costs had no impact The key decision facing subjects was *when* to

adjourn. As the costs mounted, the decision rules subjects used for ending the trial became increasingly erratic. In large part this was due to the steady erosion of any gains from decision making. To illustrate this we estimated a PROBIT of all subjects' votes on adjournment as a function of their payoff for the status quo. The estimated probabilities for different dollar payoffs under each of the cost treatments and the costless open agenda experiment are given on Figure 6. The S-shaped curve for the no-cost trials indicates a very strong fit. Our estimate shows that such subjects, were "indifferent" between voting for or against adjournment when the status quo was worth $5.64. A similar story is true for those subjects under the $.15 cost treatment. Those subjects were indifferent as to whether to adjourn at $5.28. Yet the displayed probability function has a less pronounced S-shape (although the fit is still quite good for our estimated parameters). Part of this is explained by the fact that subjects faced real losses in these trials. Their payoffs could end up negative (in 17 percent of the cases they did, losing $2.44 on average) and subjects exhibited greater uncertainty in deciding when to halt the trial. Even so, subjects in these trials did not call fewer votes. When the costs for voting were doubled, voting became very erratic. Subjects were indifferent between staying or ending the trial at $7.90, a value considerably higher than under the other two cost manipulations. By inspection, the fit for this high cost trial is quite poor. Over 48 percent of the subjects lost money in these trials (on average losing $11.93). Paradoxically, even though subjects knew they were losing money with each vote, they continued to call votes, anticipating future gains.

<Figure 6 About Hero

This experiment illustrates how problematic transaction costs can be for collective choice processes. Although the location of outcomes did not look different from those in the costless open agenda experiment (compare Figures 1 and 5) the payoffs differ dramatically. In this costly setting, even when facing steadily decreasing earnings, subjects ordinarily chose to continue the trial and bring forward another vote. The decision calculus about when to quit became increasingly erratic as costs increased. Costs, then, can matter in socially destructive ways.

Collective Choice Problems Reconsidered.

What our laboratory experiments allow us to do is to demonstrate the serious nature of these three collective choice problems. While these same problems may be common in natural settings, they are quite difficult to disentangle from other complicating features. These laboratory experiments also allow us to probe the boundaries of these problems in order to gauge he degree to which they affect the

collective choice. Finally, and possibly most importantly, these laboratory experiments allow us to explore the issue of reform.

If these three problems of collective choice pose serious threats to democratic practice, then where do we turn to explore solutions? The laboratory is uniquely suited for exploring institutional solutions to these problems. First, it is difficult (and quite likely undesirable) to impose institutional changes on a natural setting - especially if such changes yield unanticipated outcomes. Toying with institutional change in the laboratory is simple and imposes little cost on subjects if the theorist is wrong. Second, causality is difficult to pinpoint in natural settings. Observed changes in behavior or outcomes may be unrelated to the machinations of the social engineer. The laboratory requires strict attention to questions of internal validity that enable the researcher to sort out causal direction. Finally, the laboratory, unlike natural settings, allows the researcher to consider untried and untested institutional mechanisms. Again, if mistakes are made or calculations are off, subjects will not suffer in the same way that citizens might. Generally, then, laboratory experiments can serve as a valuable tool for exploring institutional reform.

The IAD Framework in the Laboratory

To this point the focus has been with collective choice problems. Yet in dealing with those problems we have gained insight into the potential power of the IAD approach for understanding institutional variation and outcomes. Below we touch on two experiments that demonstrate the impact of changing the authority and position rules.

Authority Rules.

The IAD framework directs us to pay attention to the "authority" rules characterizing any institution. Those rules stress who gets to act at which point in a decision process. In this section we consider a very simple shift in the authority rules. While we allow any actor to place alternatives on the floor, we alter the way in which proposals are considered. Instead of relying on the forward moving agenda mechanism used in the experiments detailed above, we shift to using a "backward moving" agenda.

In a seminal theoretical article Shepsle and Weingast (1984) show that different voting mechanisms can lead to quite different outcomes. Importantly, they show that if actors are constrained by an institutional rule requiring an agenda be considered in reverse order (backward), then even when no preference-induced equilibrium (a Core) exists, a set of outcomes will be in equilibrium. They argue that most political institutions require that outcomes be voted on in reverse order of how they are proposed.

Typically, the status quo is always on the table. A bill is proposed with an eye toward replacing the status quo. An amendment may then be offered to the bill as well as an amendment to the amendment. In this case, the amendment to the amendment would be paired with the amendment to the bill. The winner would then be paired with the bill. Finally, the winner would then be voted up or down (in effect, paired with the status quo). Where there is no preference-induced equilibrium then a minimal condition for a bill to succeed is that it be an element of the winset of the status quo. Shepsle and Weingast (1984) go on to show that for some kth (ordered) alternative to succeed under sophisticated voting, then the amendment must be able to beat all subsequent amendments, as well as the status quo.

This form of voting radically alters the game considered by various actors. No longer should the agenda wander across the policy space and no longer can any actor be assured of finding a proposal that easily defeats the current status quo. Instead, the agenda greatly limits the kinds of amendments that actors can bring forward. This simple change in the authority rules directly and quickly transforms the decision setting.

Wilson (1986) designed an experiment to test Shepsle and Weingast's conjecture that a backward moving agenda affects outcomes. This experiment is similar to those reported above. Two experimental manipulations were imposed. The first simply replicated the forward moving agenda mechanism we have already discussed above. The results noted here differ from those reported above, since a slightly different alternative space was used. The second manipulation required that amendments be placed on a list, with the list then voted on in reverse order. When a proposal on the floor was seconded, it was added to the top of the list. Subjects were told that they would not vote until the list had been filled and then they would begin voting with the last proposal added to the list. The status quo was always voted last The outcome for the trial was that proposal receiving a majority at the final vote.

The two manipulations involve very different agenda processes and predict very different outcomes. Under the backward moving agenda process outcomes are predicted to appear at either the status quo or in the win-set of the status quo. Under the forward moving agenda process, outcomes are predicted to be unconstrained by the status quo or its win-set.

The outcomes from both manipulations are given on Figure 7. Additional detail concerning those outcomes is given in Wilson (1986). Also noted on the figure is the status quo and the win-set of that status quo. One point is clear from this figure. The backward voting agenda procedure imposes a powerful constraint on outcomes. Eight of twelve outcomes appear at the status quo, while the remaining four are in the win-set of

the status quo. Under the forward moving agenda, no outcomes appear at the final status quo even though 7 of 12 outcomes are in its win-set

<Figure 7 About Here>

Wilson (1986) details additional analysis of these results, showing that the large number of alternatives falling in the winset of the status quo for the forward agenda setting manipulation is not problematic for interpreting these results. He concludes that structure matters. Indeed, this simple change in the authority rules dramatically affects the distribution of outcomes.

Expertise.

In a final setting we focus on changing the position rules. Previously, when discussing the impact of an agenda setter, we also touched on position rules. Here, however, we treat two distinct positions in a very different context. The first position is that of a proposer to an agenda. As before, any participant is able to add an amendment to a forward moving agenda. The second position assigns one of the actors the role of an expert for a portion of the alternative space. The position of an expert is operationalized in three steps. First, we define a region in the alternative space over which an individual holds expertise; second, we characterize a function assessing costs to others for challenging expertise; and finally, we endow a specific subject with expertise. The theoretical basis for this expertise model is found in Herzberg and Wilson (1992).

In our experiment we wish to ensure that the outcomes we observe are a function of the experimental manipulation and not confused with a different process. Consequently, we have gone to great length to build an equilibrium set, derived from the model, that is removed from alternative solutions. To this end we have derived a Retentive Informational Equilibrium (RIE) that is removed from the center of the alternative space and is removed from the expert's ideal point. While there is little analogy between this design and a natural setting, our concern at this point is not with replicating any particular natural environment. Instead, we are concerned with testing the robustness of the theoretical model and ensuring that what we test is not confused with other plausible explanations.

We induce an RIE by arbitrarily fixing *& policy focal point,* x*. Given our design, x* is where subjects without expertise face maximal costs for making an amendment. That is, if the status quo was located at that point, $x^\circ = x^*$, then each non-expert voting to move from the status quo to an amendment bore a cost of $5.00. Costs, then, are implemented in a straightforward way. For every successful motion changing the status quo, a fee is subtracted from the earnings of each subject *voting for the change to the*

status quo.[3] Costs are subtracted following each successful vote and are represented as a decrease in a member's payoff. Consequently, if an individual voted in favor of a change with costs equal to $1.00 and the change was successful, then her payoff for any alternative across the space was decreased by that amount. For example, a subject with an ideal point initially worth $22.00 subsequently would have an ideal point worth (and displayed as) $21.00. In each of the experimental designs these fees varied from $. 10 to $5.00, depending on the location of the status quo.[4] Subject's were told at the outset of the experiment the range of costs and the fee associated with changing the current status quo was noted in the upper right corner of each subject's screen.

The final feature to this expertise manipulation is that one player, always located at the position of player 5, bore only minimal costs for the decision process. That subject, in all preference configurations, was assessed a fee of only $.10 for any change. This trivial fee was used so that all subjects were aware that costs were charged for successful amendments to the status quo. Only non-experts bore increasing costs for challenging expertise. This is in line with our model whereby non-experts must invest their own private resources in order to credibly challenge an expert in her specialized arena.

Implementing expertise in this manner ensures that an RIE exists. This equilibrium is a function of the placement of x*, the cost function for changing the status quo, and the location of the member with special expertise. In the setting detailed here the RIE represents the only set of stable alternatives. Otherwise, as with any other forward moving agenda without a Core, alternatives have a non-empty win set.

Our results from this experiment are plotted on Figure 8, along with outcomes from a control setting in which no expertise position was assigned. The ellipse near player 5, the "expert" player, defines the RIE equilibrium boundary.

<Figure 8 About Here>

At first glance we note that only one outcome falls into the expertise equilibrium set. Otherwise, outcomes are scattered throughout the policy space. However, the scatter of outcomes is not random. Outcomes where the position of an expert have been assigned are closer to the induced equilibrium than are outcomes under the control

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[3] The only requirement in the model for an RIE is that costs are sufficiently high so that no minimum winning coalition prefers a movement from the status quo. We deliberately chose to charge the fee only to those voting in favor of such a movement. In this way we sought to avoid individuals violating one axiom of induced valuation theory (Smith, 1982) in which by voting in favor of a move, an individual could gain personal satisfaction knowing she imposed costs on even those not in favor of a move. This means of imposing fees is also used in Herzberg and Wilson (1991).

[4] Costs for any $x \in X$ and the policy focal point x* are given by: $\text{Cost} = \$5.00 * \exp\left(-\left[\frac{\|x - x^*\|}{30}\right]^3\right) + \$.10$.

manipulation. Splitting the alternative space in half illustrates a rough division between outcomes under the two experimental treatments. If the outcomes are measured by their minimized distance from the boundary of the induced equilibrium set, there is a statistically significant difference between experimental manipulations ($t = 3.168$, $p < .01$) A This is compelling evidence supporting the claim that position rules matter — even in a fairly complex setting. Given the way this experiment was designed, the member with expertise held no strong powers. We deliberately limited the expert's agenda powers by keeping the agenda setting position equally shared among subjects. Moreover, the RIE was removed from the expert's own ideal point Even so, outcomes favored the expert.

Generally these experiments, which are part of a much larger research agenda by the authors, show that institutions make a difference for outcomes. Even so, we have only begun to scratch the surface of possible institutional variations. Here we have detailed two distinct changes to authority and position rules. The change to authority rules made a good deal of sense, because most decision makers use some form of a backward voting mechanism. That mechanism alone may be important for helping us to understand the degree of consistency we observe in collective choices. The change to position rules was of a different sort. We doubt there are any mechanisms that resemble what was tested here. And yet we were very concerned with the underlying theoretical point - that expertise in-and-of-itself is crucial. In that experimental setting we were able to design an institution that allowed us to control a large number of potentially contaminating variables. That setting allowed us to isolate a key concept that has both theoretical and practical importance. Yet without worrying about the complete configuration of institutional rules, we might not have been as careful.

Experimentation and the Possibility of a Science of Politics

We began this paper thinking about Vincent Ostrom's injunction to interpret social experiments. We have slightly turned the tables, asking readers to think about laboratory experiments as a means of informing our understanding of social experiments. Institutional reform is a serious business — something anyone who has given any thought to institutional design quickly realizes.

It is important that we have a framework and a theoretically meaningful way of thinking about institutions. The IAD framework certainly provides important grist for the

[5] A test was also performed using a non-parametric measure (Wilcoxon) of the ranked orderings of the distance of each observation from the equilibria set by experimental manipulation. The same results were obtained; there is a statistically significant difference between the sets of outcomes.

intellectual mill. Yet that framework needs considerable theorizing in order to make useful contributions to practice. At the same time, theorists need some discipline. There are unnumbered combinations of institutional structures sitting in the minds of theorists. We need a means for quickly and cleanly sorting between different types of theoretical models. Part of the argument made here is that laboratory experiments contribute in important ways to disentangling important theoretical insights. In many ways laboratory experiments allow us to empirically test things that might be impossible in natural settings. Controlled experiments allow us to make certain that our theories have specified the appropriate causal directions. This can be critical when considering institutional reform.

Laboratory experiments, by emphasizing a comparative statics approach to understanding institutional variation, allows us to do something else. Once we understand institutions, we need to raise obvious normative issues. For those of us concerned with collective choice problems, it is not enough to show that institutional structure leads to differences across outcomes. We need to take the next step and talk about who is advantaged and disadvantaged by those institutional variations.

In conclusion it seems safe to state that IAD is not sufficiently developed to understand all of the nuances of institutional variation. While the IAD approach looks promising and should be built up as a research program, it should also be seeking help from all quarters. Laboratory experiments offer a valuable methodology for understanding institutional analysis. Laboratory experiments ought to be considered as one of many tools in our IAD toolkit.

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Table 1

Parameters Used in Experiments

Member	*Ideal Points*	*Max. Value*	*Loss Rate (γ)*
A	(22,214)	$25.00	-.013
B	(171,290)	$25.00	-.013
C	(279,180)	$25.00	-.013
D	(225,43)	$25.00	-.013
E	(43,75)	$25.00	-.013

Status Quo = (280,280)

Utility for any **X** and for the ith's member's ideal point, $\mathbf{X_i}$, is given by:

Non-linear Payoff: $U_i = (\text{Max. Value}) * \exp(\gamma * (\|\mathbf{X} - \mathbf{X_i}\|))$

Table 2

Distribution of Proposals in Agenda Setter Experiment

Trial	*# Preferred by Majority*	*# Preferred by Agenda Setter*	*# Preferred by Both*	*Total # of Proposals*
CVSTAR2A	52	6	0	102
CVSTAR2B	21	9	0	33
CVSTAR2C	37	82	20	184
CVSTAR2D	67	21	0	157
CVSTAR2E	19	2	0	27
CVSTAR2F	21	0	0	30
CVSTAR2G	12	9	1	36

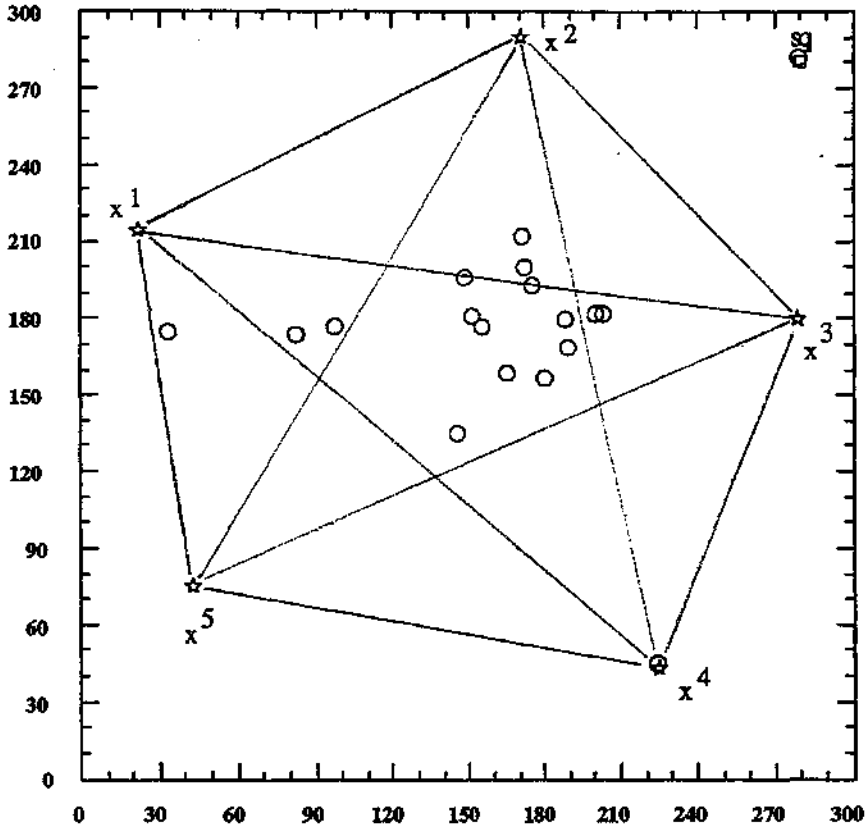

Figure 1. Outcomes from Open Agenda Experiment

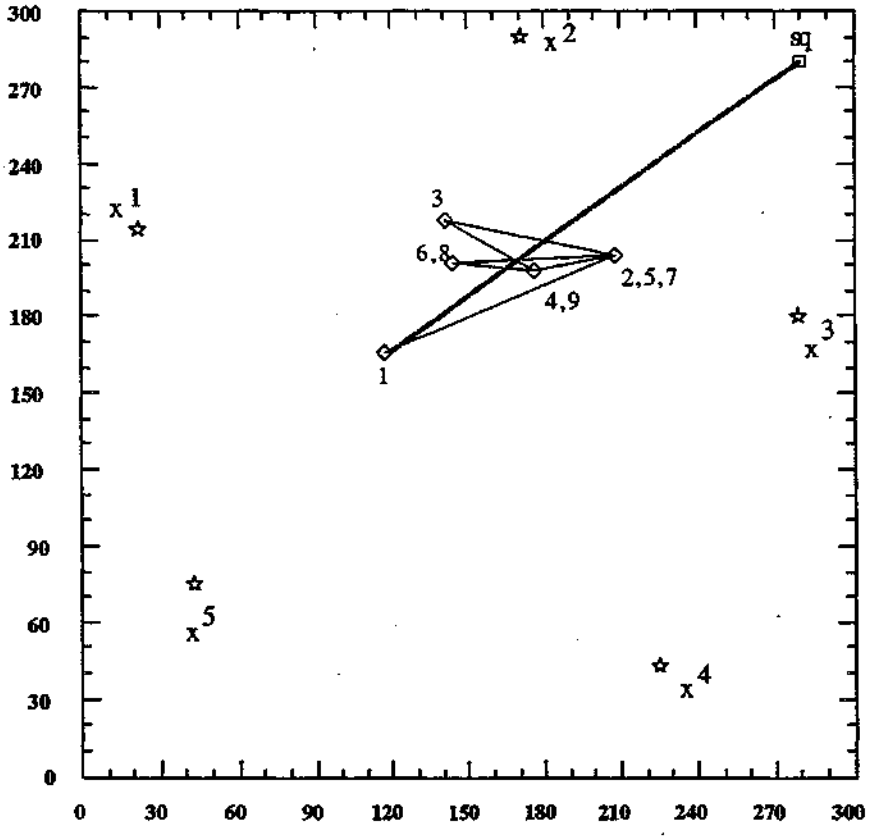

Figure 2. Agenda of Successful Amendments in BSTAR4

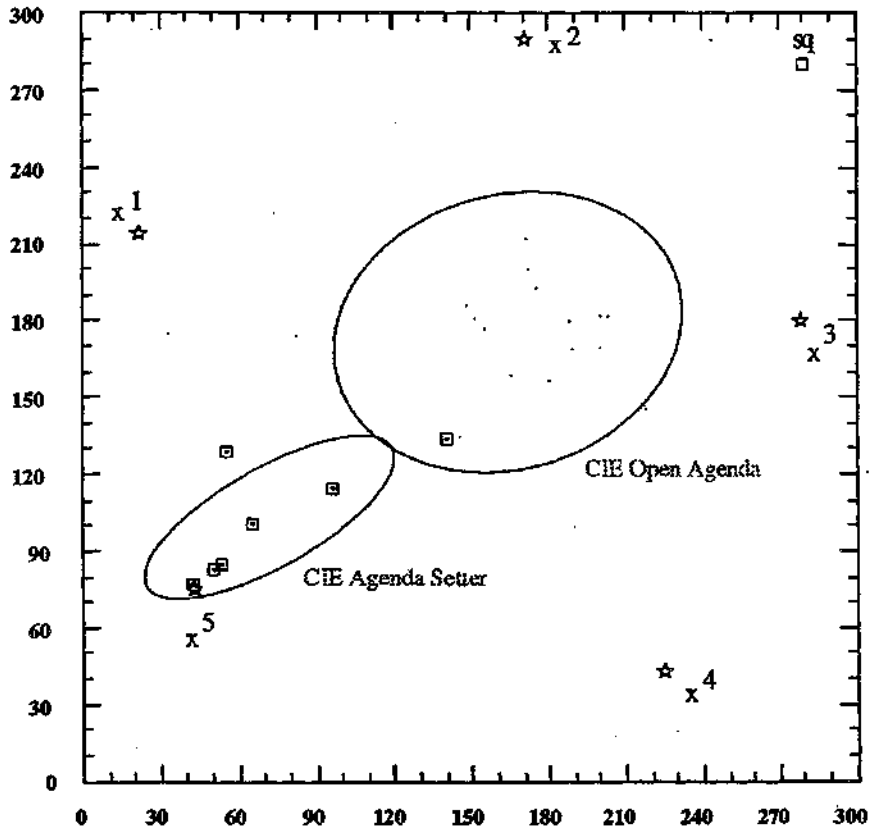

Figure 3. Outcomes from Agenda Setter Experiment

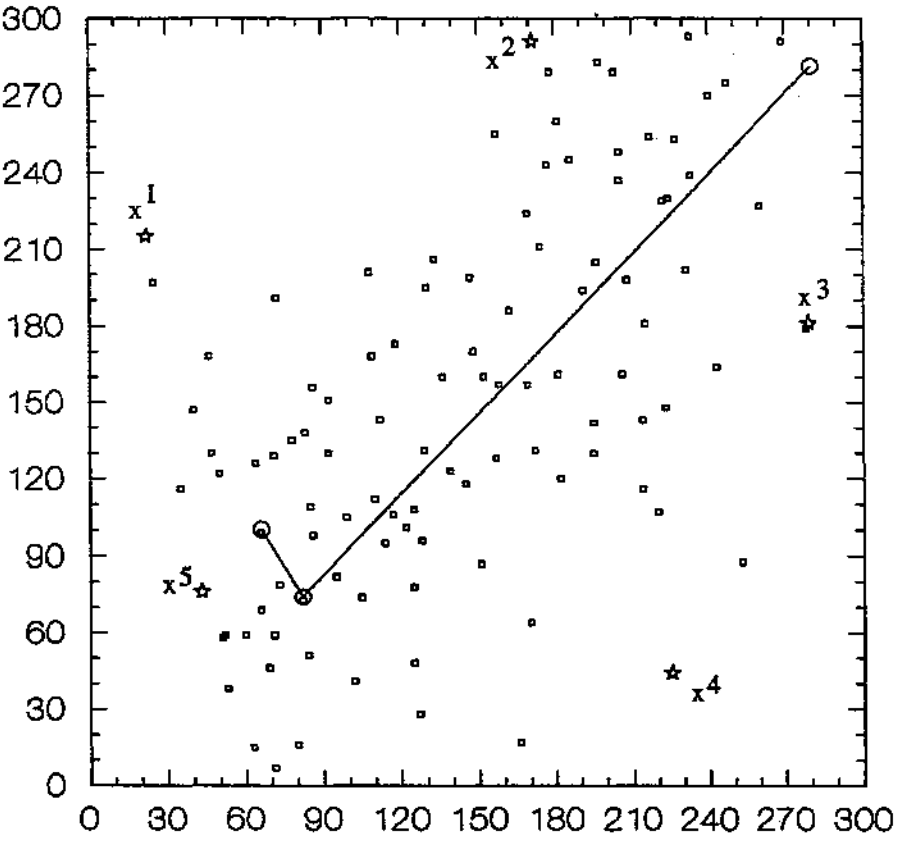

Figure 4. Agenda Path and Proposals for Trial CVSTAR2A

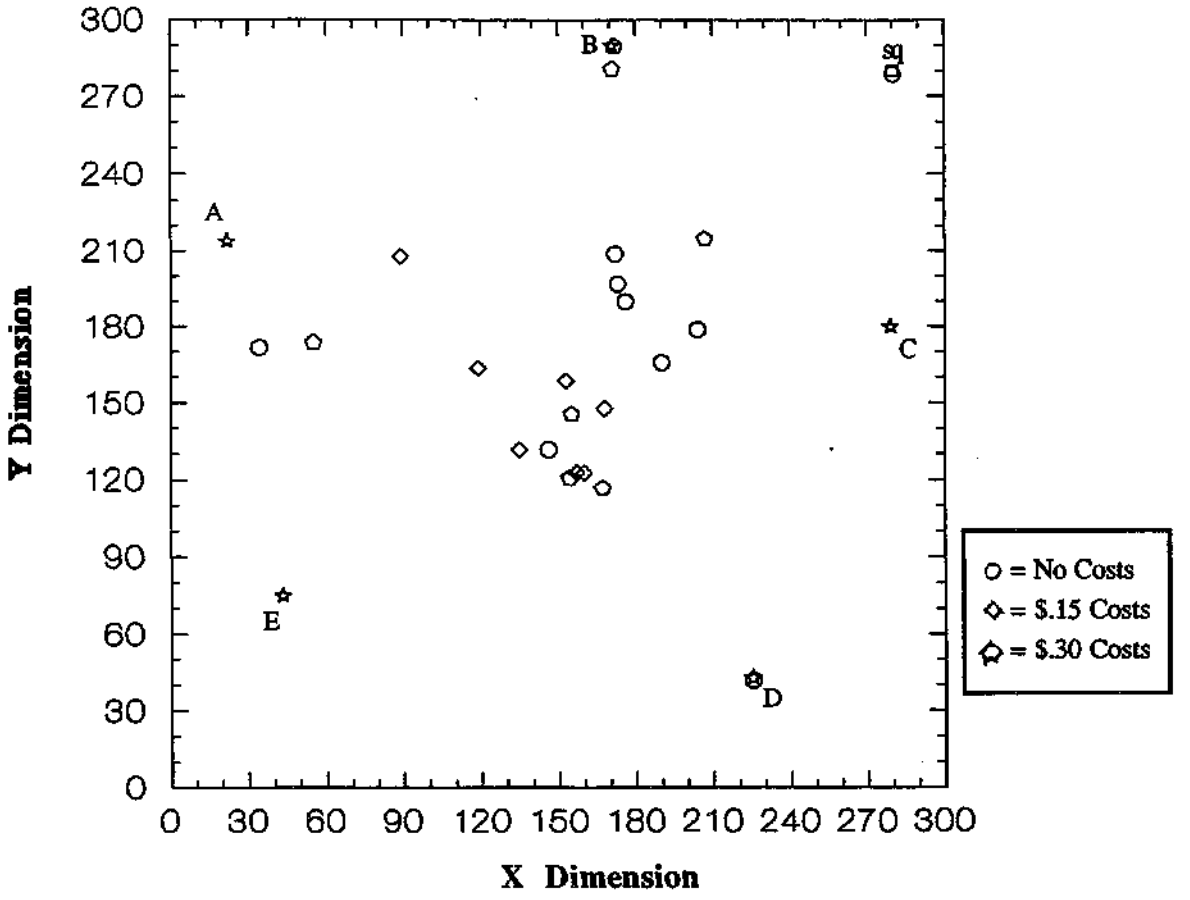

Figure 5. Outcomes from Costly Voting Experiment

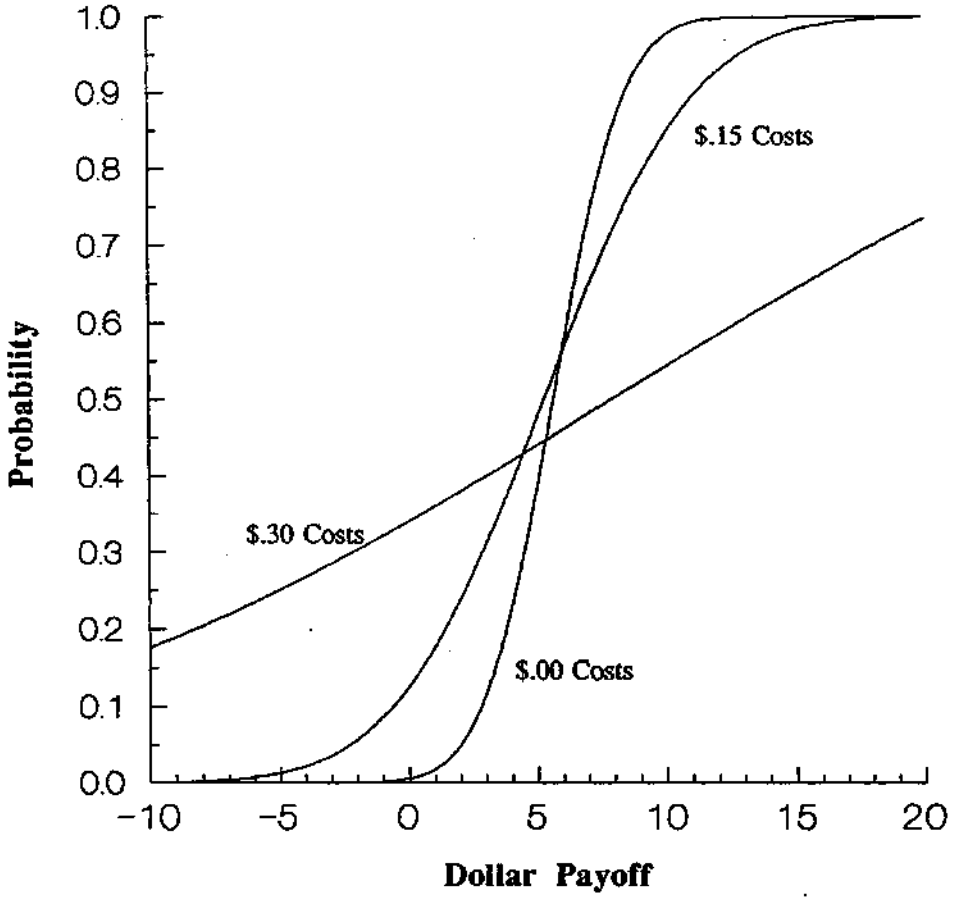

Figure 6. Estimated PROBIT Results from Member Decisions to End the Experiment

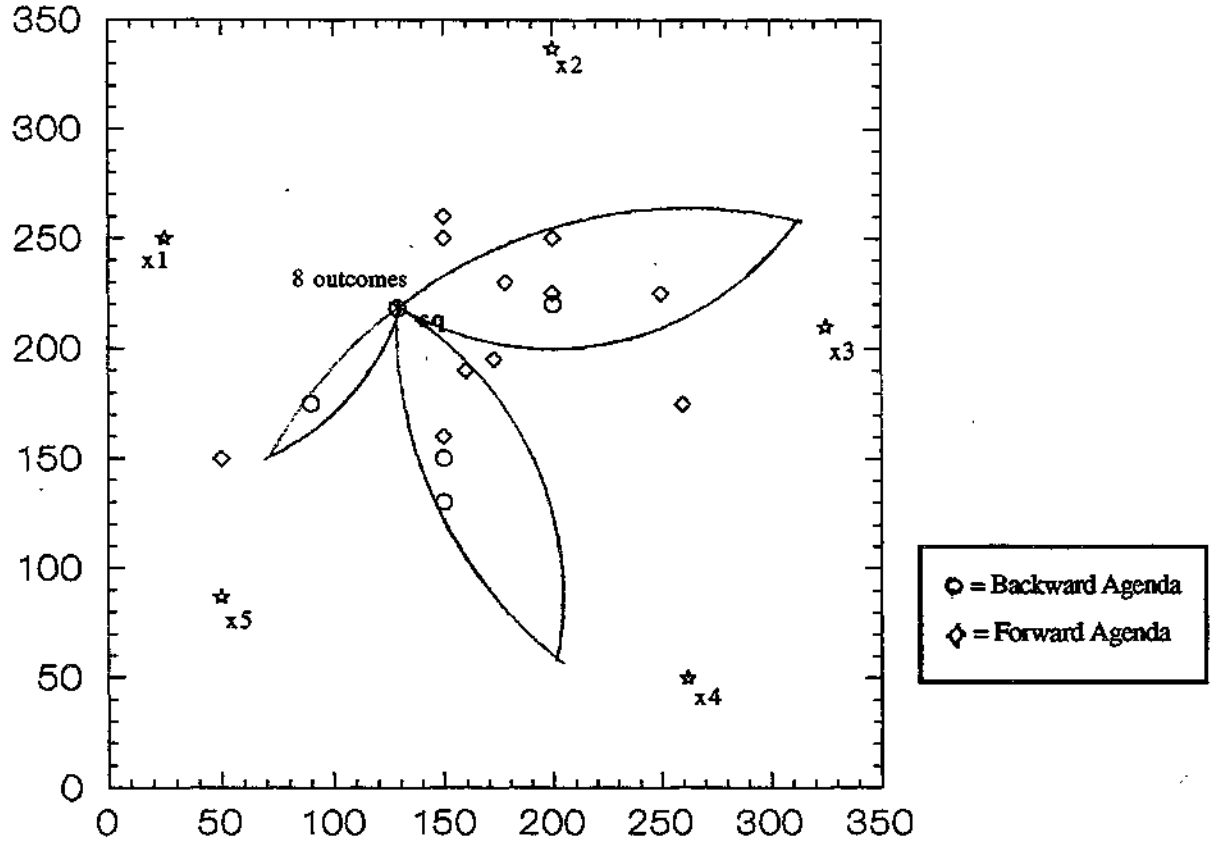

Figure 7. Outcomes from Backward Voting Experiment

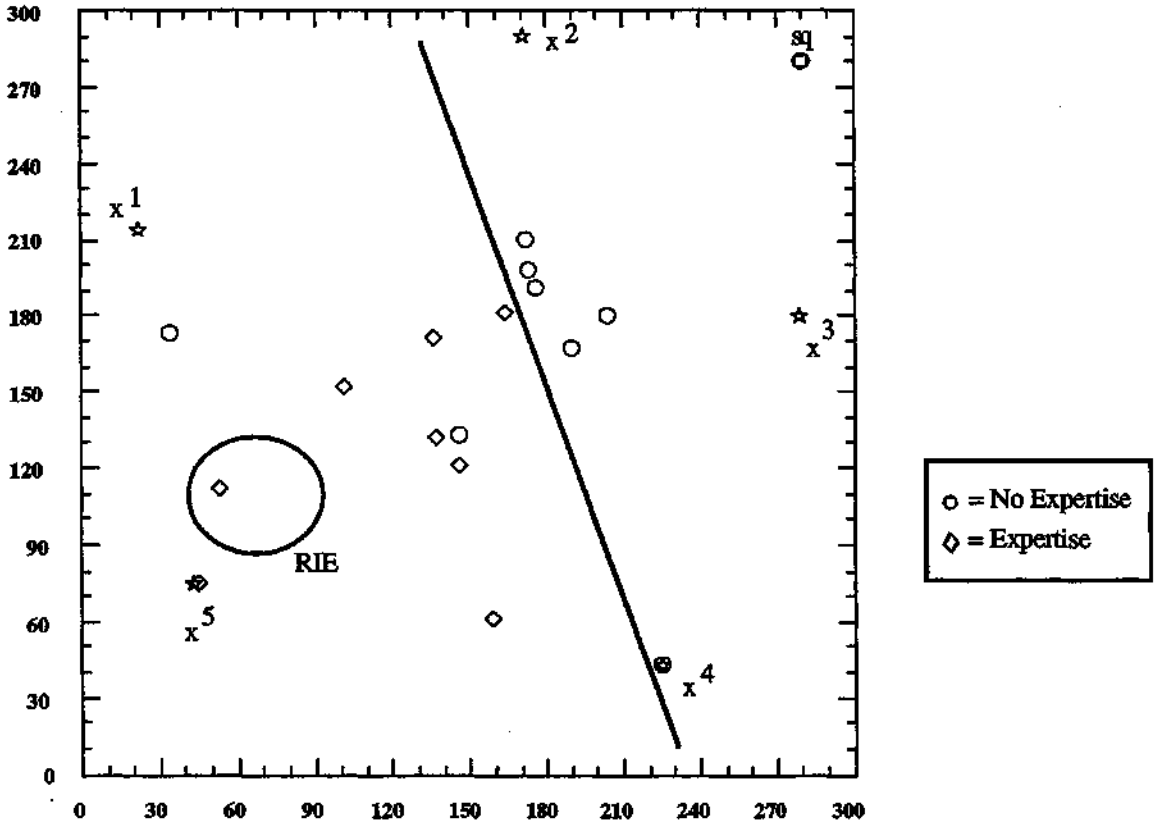

Figure 8: Outcomes from Expertise Experiment