A Model of Agenda Influence on Committee Decisions

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Within a range of circumstances it appears to be possible to control a group's decision by controlling only the agenda. The boundaries of the range over which the agenda is such an overwhelmingly important parameter are not yet known, and the exact principles upon which the influence rests have not been identified. However, the research results reported below provide a first step in answering these questions.

Our approach to this problem originated in both practical and theoretical considerations. As a practical matter, we were involved in an important and complex committee decision. A large flying club in which we held membership was meeting to vote upon the size and composition of the aircraft fleet which would be available to the membership for flying. As members we had preferences about the fleet available to us and an opportunity to shape the agenda. Preliminary discussions and meetings had narrowed the range of possibilities greatly from hundreds of thousands of competing alternatives to a few hundred. Over these remaining possibilities, however, there were conflicting and strongly held opinions. The group was to meet once and decide the issue by majority vote.

Principles of economics and game theory suggest that the procedures and other institutional aspects of committee processes should be important in determining the outcome. Axiomatic social choice theory and voting theory also suggest the importance of these variables. Yet, models which characterize the subtle features of parliamentary procedures and the behavior they induce do not exist. Thus the practical problem was accompanied by an intriguing theoretical problem that presented us with the possibility of developing a mathematical theory of procedures and procedural influences on group decisions.

The meeting was held. The group used our agenda. The decision was the one we predicted.[1] With this apparent success, we then faced a perplexing problem of proof. Was the result a happy accident or was the decision a direct consequence of our efforts? In order to partially resolve this question, we turned to experimentation. If by using the methods we developed we were unable to influence groups involved in conflicts similar to the club meeting, then we would be willing to dismiss the club experience as an accident.

The experimental results below indicate that the club decision cannot be dismissed as accidental. The principles we outline for determining the agenda's influence are in need of improvement, but their fundamental importance within a range of circumstances is established. A more refined and accurate identification of the principles and the ranges over which they are operative awaits further research. Even as it stands our research has important implications for process evaluation and design (see the authors).

The paper is outlined as follows. In Section I, we outline a basic theory and a model. Section II includes our experimental design and Section III contains the results. The last section is a summary of conclusions.

[1] The details of this meeting and a discussion of many of the problems of applications of the theory are reported in our referenced paper.

I. Theory and Model

First, we will develop a formal representation of an agenda. Then we will outline an intuitive theory about the nature of an agenda's influence, after which we will formally state a model.

A. *The Agenda*

The form of agenda we used in resolving the club problem can be represented abstractly as a series of partitions (into two sets) of the feasible set of alternatives. Each item on the agenda was designed to eliminate by majority vote some set of alternatives from further consideration. Our experimental agendas were similarly constructed.

We used the following example to explain the agenda to subjects during some of our experiments. Suppose that we are deciding what kind of banquet to give. The agenda reads: Item 1. Shall the dress be formal or informal? Item 2. Shall the cuisine be French or Mexican? This agenda is modeled by Diagram 1. The vote is first on item 1 and then on item 2.

Each item on the agenda is designed to eliminate some of the alternatives which have survived the previous votes. This continues until a single alternative remains which is the choice of the group. For a fixed set of alternatives, the set of all agendas corresponds to the set of all such "trees," where each tree that can be formed from a given set of alternatives represents a different agenda. If, for example, the items above
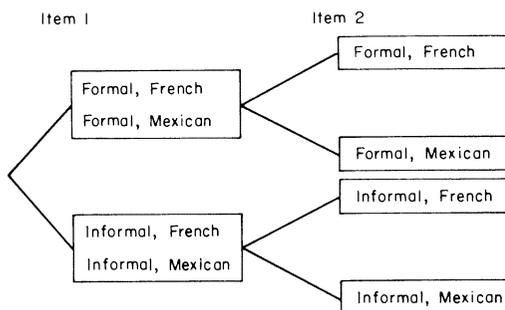
are reversed so the first vote is on cuisine and the second on attire, then the tree would be altered accordingly.[2]

B. *Basic Theory*

Our basic theory is simple. Where an agenda is fixed, it influences outcomes in two ways: first, it limits the information available to individual decision makers about the patterns of preference in the group. The primary means available for preference revelation is voting, and the content of each vote is specified by the form of the agenda. In some settings, other means of preference revelation such as verbal communication and/or straw votes can be ruled "out of order" by strict adherence to an agenda and therefore provide a limited means for information generation. And where there are many alternatives and many people, verbal communications may be of limited importance whether permitted or not. In addition, on-the-spot coordination of decisions among individuals through any type of binding agreement is nearly impossible in most meetings. This generally precludes expressly collusive behavior unless it is the result of a premeeting meeting and, even then, to be effective in planning strategy the coalition often needs to know both the patterns of preference among the group and the agenda to be used. Thus, each individual usually finds himself in a position of decision making under uncertainty. The preferences of others will have limited opportunity to influence his behavior.

Second, the agenda determines the set of strategies available to the individual. He always has the opportunity to choose among outcomes, but which outcomes he may choose among at any point is deter-

Item 1 — Item 2

Formal, French / Formal, Mexican
— Formal, French
— Formal, Mexican
— Informal, French
Informal, French / Informal, Mexican
— Informal, Mexican

DIAGRAM 1

[2] It is always possible to represent a tree so that the corresponding agenda presents a set of choices the group will find acceptable or "natural"? We occasionally had to expend considerable effort on the wording of the agendas we used in experiments and suspect that some results cannot be reached using a natural appearing agenda. The agenda used during the club meeting is reproduced in the authors' paper.

mined by the agenda. The individual always must pick the particular strategy he prefers from among those available. The agenda determines what strategies are available. So, by reducing the influence of others' preferences and by determining the set of strategies available to him, the agenda effectively influences the voting pattern of each individual in the group. It thereby influences the choice made by the group.

C. *The Model*

The model is constructed to apply to a very broad range of circumstances as well as to our experimental setting. However, as will be explained below, certain very specific operational assumptions were made when applying the model in the experimental environment.

1. *Individual Voting Rules*

As indicated above an agenda item partitions the set of alternatives into two sets, one of which will be eliminated by vote. What decision rule will the individual use? We have postulated a universe limited to three rules.

Rule 1. *The sincere-voting hypothesis:* This hypothesis holds that an individual faced with two sets of alternatives will vote for the set which contains his most preferred alternative. If he is indifferent between the two best alternatives he then decides on the basis of a comparison between the second ranked alternatives. If he is indifferent between these two, then we define the rule to be ambiguous.[3]

Rule 2. *The avoid-the-worst hypothesis:* Here the individual votes to avoid the alternative he likes the least. When faced with a choice between two sets, he compares the least-preferred alternative in each set and votes against the set which contains the

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[3] The hypothesis as first developed by Robin Farquharson continues in the lexicographic fashion. An ambiguity in his procedure can occur when the sets are of different sizes. This was called to our attention by Steven Matthews.

worst of these two. The case of ties is treated similarly to the above.

Rule 3. *The average value hypothesis:* This hypothesis holds that the individual treats the group choice as a lottery that will choose any alternative in a particular set with equal probability. The choice between two sets is like a choice between two lotteries (with uniform distribution over the outcomes) and he chooses (votes for) the one with the higher expected utility. The case of ties is treated as in rule 1 above.

Clearly, these three decision rules do not exhaust the set of imaginable decision rules. For example, the decision could also be affected by the variance of the payoff in a set, attitudes toward risk, past decisions made by the group, or subjective estimates of future decisions. If the model were to be refined further, this might be one of the places where it could be improved.

Our approach to the problem differs from that found in economics. We postulate the individual as a random variable over these decision rules. That is, we as experimenters do not know which rule he will use at a given point, but we are willing to speculate about the probability with which he will use a rule. In this "stochastic man" approach we are close to models which have had successful applications in marketing (see Frank Bass).

Some notation is needed.

Ω = the universal set of alternatives

$\alpha = (J_1, J_2, \ldots, J_m)$ is an *agenda* where J_k is a partition of each of the partitionable sets of J_{k-1} into two sets, and $J_0 = \Omega$

I = the set of all individuals

$u^i(x)$ is a von Neumann-Morgenstern utility function over Ω for $i \in I$

$S(S, \overline{S}) = \{\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7, \alpha_8, \alpha_9\}$ = the set of "states" in which an individual may find himself relative to two sets S and $\overline{S}$ of alternatives. These are defined as follows.

α_1 = All decision rules dictate a vote for S over $\overline{S}$; or one (or more) decision rule dictates a vote for S and the other two

(or one) are ambiguous between S and $\overline{S}$.

α_2 = All decision rules dictate a vote for $\overline{S}$ over S; or one (or more) decision rule dictates a vote for $\overline{S}$ and the other two (or one) are ambiguous between $\overline{S}$ and S.

α_3 = One decision rule dictates a vote for S, another dictates a vote for $\overline{S}$, and the other is ambiguous between S and $\overline{S}$, or all three rules are ambiguous.

α_4 = Decision rule 1 dictates a vote for S and both rules 2 and 3 dictate a vote for $\overline{S}$.

α_5 = Decision rule 2 dictates a vote for S while both rules 1 and 3 dictate a vote for $\overline{S}$.

α_6 = Decision rule 3 dictates a vote for S while both rules 1 and 2 dictate a vote for $\overline{S}$.

α_7 = Both decision rules 1 and 2 dictate a vote for S while rule 3 dictates a vote for $\overline{S}$.

α_8 = Both decision rules 1 and 3 dictate a vote for S while rule 2 dictates a vote for $\overline{S}$.

α_9 = Both decision rules 2 and 3 dictate a vote for S while rule 1 dictates a vote for $\overline{S}$.

$P_i(S, \overline{S} \mid \alpha_k, \mathbf{\alpha})$ = the probability that individual i will vote for the set S over the set $\overline{S}$ given that they are imbedded at some stage in agenda $\mathbf{\alpha}$ and that he finds himself in the situation described by α_k.

AXIOM 1: *Independence from Environment: The probability distributions* $P_i(S, \overline{S} \mid \alpha_k, \cdot)$ *are parameterized only by* α_k *and for all* $\hat{S}, \hat{\hat{S}}, S', S''$, $P_i(\hat{S}, \hat{\hat{S}} \mid \alpha_k) = P_i(S', S'' \mid \alpha_k)$.

This means that the individual does not act strategically by anticipating upcoming votes; his probability of voting is not affected by previous votes; his probability is not affected by discussion at any stage of the meeting, set sizes, set labels, etc. It is as though he always uses one of the decision rules above, and he chooses from among them with fixed probabilities.

AXIOM 2: *Stochastically Identical Individuals:*

$$P_i(S, \overline{S} \mid \alpha_k) = P_j(S, \overline{S} \mid \alpha_k) \text{ for all } i, j, S, \overline{S}, k$$

This axiom postulates a certain similarity among individuals. It says that the probability that any individual votes "yes" when he finds himself in any given situation is the same for anyone who finds himself in that same situation. In addition, this axiom declares that the universe of parameters on the probability distribution is exhausted by the situations enumerated above.

2. The Strength of S against $\overline{S}$

Suppose the voting rule is a majority rule and that in the agenda the set $\overline{S}$ has been pitted against the set S. What is the probability that S will win? This probability will be called the strength of S against $\overline{S}$ and can be calculated as follows.

$V(S, \overline{S}, \alpha_k)$ = the set of people who find themselves in situation α_k; $\alpha_k \in \mathbf{s}(S, \overline{S})$

N_k = the number of people in the set $V(S, \overline{S}, \alpha_k)$

n = the total number of people [note: $\sum_{k=1}^{9} N_k = n$]

W = $(z_1, \ldots, z_9)$: $z_i \in$ integers; and $0 \le z_k \le N_k$; and

$$n \ge \sum_{i=1}^{9} z_i \begin{cases} \ge \dfrac{n+1}{2} \text{ if } n \text{ is odd} \\[2ex] > \dfrac{n}{2} \quad \text{ if } n \text{ is even} \end{cases}$$

$P(S, S)$ = the probability that the set S receives a majority vote over the set $\overline{S}$ in a contest between the two.

THEOREM:

$$(1) \quad P(S, \overline{S}) = \sum_W \prod_{k=1}^{9} \frac{N_k!}{(N_k - z_k)! z_k!} \cdot$$
$$P(S, \overline{S} \mid \alpha_k)^{z_k} (1 - P(S, \overline{S} \mid \alpha_k))^{N_k - z_k}$$

That this is the appropriate probability can be seen by application of the binomial probability distribution, the independence assumptions and the appropriate area of summation. Notice that all we need to know to calculate this number is the number of people in each set $V(S, \overline{S}, \alpha_k)$ and the nine probability numbers represented by $P(S, \overline{S} \mid \alpha_k)$, $k = 1, \ldots, 9$.

3. *Strength of an Agenda*

We turn now to the model of primary interest. What agenda is most likely to yield a given alternative x as the group's choice? We answer this question by calculating the strength of an agenda for an alternative x. We do this by first calculating the probability under a given agenda that x will be the group's choice. With that formula in hand, we can then survey all possible agendas (which is incidentally no simple problem) to find the one which maximizes the chance of getting x.

Consider the agenda $\mathcal{Q} = (J_1, \ldots, J_m)$. We assume there are m items. Each item J_k is a partitioning of each set in J_{k-1} into two sets. The original set $J_0 = \Omega$ is the set of all alternatives. Now since the items of the agenda are *partitions*, each element $x \in \Omega$ appears in one and only one set in any given item. Call this set $S(x, J_k)$ and the set which is pitted against it $\overline{S}(x, J_k)$.

Our previous formula (1) allows us to state the probability $P(S(x, J_k), \overline{S}(x, J_k))$ for any given x and any given J_k. From the independence axioms above we know immediately then that:

(a) $P(x \mid \mathcal{Q})$ = the probability that x is chosen by a group given that the agenda is $\mathcal{Q}$

(b) $P(x \mid \mathcal{Q}) = \Pi_{J_k \in \mathcal{Q}} \, P(S(x, J_k), S(x, J_k))$

This is the formula we were seeking at the beginning.

4. *Influencing the Group*

In order to apply the theory, we face four more problems. First, we must obtain preference estimates. The experiments explained below involved money payments. To simplify, we assumed that people were "risk neutral" so utility was linear in money payment. The second problem involves obtaining estimates of the nine numbers $P(S, \overline{S} \mid \alpha_k)$, $k = 1, \ldots, 9$. The numbers we used were estimated from the pilot experiments and are provided in Section III.

The third problem involves the interesting mathematical problem of finding the optimum agenda. For each alternative we can compute the probability that it will win under any given agenda. Choice of an agenda then will be like the choice of a lottery so in general the "best" agenda would depend upon attitudes toward risk, etc. The objective function we use simply dictates finding the $\mathcal{Q}$ which maximizes $P(x \mid \mathcal{Q})$. The hard part occurs because of the *very* large number of potential $\mathcal{Q}$'s.

Fourth, we must be able to get the group to adopt and adhere to the agenda we have chosen. This involves devising an agenda which presents choices in an acceptable or "natural" way, preventing alternative motions from reaching the floor.

II. Experimental Procedures

We experimented by creating groups which had important features of the naturally occurring processes we wish to understand. We deduced these features from the club experience: 1) the group uses majority rule and a prearranged agenda which is followed closely; 2) there is little opportunity for premeeting meetings or predesigned coalitions to form prior to the meeting; 3) there is little or no uncertainty among the participants as to their attitudes toward the various candidate alternatives; 4) individuals are not indifferent among alternatives.

The first two conditions were easy to meet. Student subjects were recruited from Caltech, the University of Southern California, and the University of California-Los Angeles. An announcement was made in classes about the opportunity to participate in a "decision-making experiment." They were told that they would attend a meeting which would last approximately an hour, discuss some issue which had no political overtones, and that they would

have the *opportunity* to make "well over the hourly wage which any of them might be receiving." They were told that the experimenters were interested in certain logistical and technical problems about group decision processes; that there was no interest in psychological variables or personal variables; and that they would be subject to no harm or embarrassment.

Meetings took place in a classroom beginning at noon. As participants arrived they were assigned to seats in accord with a function which resulted from a random number table. When all participants were seated, they were asked to read the instructions which had been placed face down on their desks.

We adapted the theory of induced preference developed by Vernon Smith to take care of third and fourth conditions. The set of alternatives Ω was a subset of the letters of the alphabet. The task of the group was to use the appropriate procedures and choose one letter from this set. Each individual $i \in \{1, 2, \ldots, n\}$ was given a payoff function $u^i(x)$, $x \in \Omega$, which indicated the amount of money he would receive from the experimenter as a function of the alternative chosen by the group. He could not mention the amounts of money reflected by his payoff and no side payments, bribes, or threats were permitted. So, as long as an individual preferred more money to less, his preference relation over Ω is given by $xR_iy \Longleftrightarrow u^i(x) \geq u^i(y)$. In our case, the amounts involved seemed to us to induce well-defined preferences and nonindifference between alternatives. We assumed in addition that people were risk neutral.

The instructions were read by the experimenter, who did not know at the time which alternative the agenda was designed to produce. These are included in the Appendix. After reading the instructions the experimenter answered any questions, turned the meeting over to the chairman, and seated himself at the back of the room. He said nothing during the remainder of the experiment except when voting took place. He then stood up and recorded votes.

The chairman for Series 2, 3, and the final Series 4 was a Caltech senior majoring in physics. He was paid \$4.00 per hour. He was given the instructions labeled "chairman's instructions" in the Appendix. He was not told the purposes of the experiment or that we had any expectations about which alternatives the group might choose. In the debriefing which occurred after the final experiment, it was evident that he did not know the purposes of the experiments and did not suspect that the agenda was a key variable.

The only person present during the experiment who was aware of which alternative was theoretically supposed to occur was the graduate research assistant, Steven Matthews. He was introduced along with the chairman, as a recording secretary. The only things he said during the meetings were functional to the general task of recording votes.

After the procedures had been fully discussed and the "test"[4] had been administered, the meeting began. The chairman took up the first item on the agenda and opened the floor for discussion. We asked him to encourage discussion on the first item. Participants tended to be a little hesitant to speak up ("What can I say about an A?"), but once discussion started, they often were moved to comment.

After the first item was voted upon, the group considered the next item on the agenda. On two or three occasions someone asked if items could be changed. This was not allowed. We suspect that certain types of straw votes are effectively changes in the agenda and may affect outcomes. Although we never prohibited a straw vote, we were prepared to rule one out of order if it was put in the form of a substitute agenda; for example, "If it comes down to box A versus box B later, how many will go for A?" We did allow one straw vote in this series and

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[4] We found the test to be very useful. On several occasions during our pilot experiments we had reason to suspect that participants did not fully understand the agenda and/or motions. After we adopted this test, mistakes seldom occurred.

TABLE 1—ESTIMATES OF $P(S, \overline{S} \mid \alpha_i)$ MEASURED FROM SERIES 1–3

α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	α_9
.96	.04	.50	.38	.17	.61	.39	.83	.62

we think it did affect the outcome (see Table 2).

When the meeting was over, all subjects were paid in cash the amount dictated by their payoff sheet and the alternative chosen by the group.

III. Results

A total of four experimental series were conducted. The first three series, which are treated as pilots, served two functions. First, the procedures as reported here and the instructions (used in the fourth series) had been revised to take account of problems encountered in these first three series.

The second function of the pilot experiments was to provide data from which the probability parameters used in the model could be estimated. Both the numbers reported in Table 3 and the design of the Series 4 experiments were based on these estimates (see Table 1).

Series 4 consisted of four experimental sessions. The set of alternatives, Ω, contains five elements. The payoff schedules used in all four sessions are listed in Table 2. The majority-rule relation is also shown there. Alternative 1 beats all others in any binary contest and Alternative 5 is beaten (unanimously) by any of the others in a binary contest. The other three alternatives are involved in a cycle. For each of the first four alternatives, an agenda exists which would yield that alternative with a probability equal to one according to our model. We would have preferred to avoid the cycle, but we were unable to find a noncyclic example for which a probability one agenda could be constructed according to our model for each feasible[5] item, given the probabilities measured from Series 1.
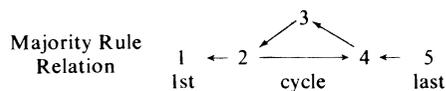
[5] Alternative 5 is possible only with extremely low probabilities.

The results of these experiments are in Figure 1; Experiments 1, 3, and 4, which were designed to get Alternatives 3, 2, and 1, respectively, performed exactly as anticipated. Each resulted in the choice of alternatives for which the agenda was designed.

The agenda for Experiment 2 was designed for Alternative 4, but the group chose Alternative 1. This resulted because a straw vote revealed the fact that Alternative 5 (labeled D in this experiment) was least preferred by *all* individuals. Does this call into question the basic assumptions of our model? We think not. This straw vote, we claim, effectively changed the agenda to one on the figure labeled "Alternate Specification: Series 4–Experiment 2." For this

TABLE 2—SERIES 4 PAYOFFS IN DOLLARS

Person	Alternative				
	1	2	3	4	5
1	6.00	7.00	5.00	8.00	0.50
2	6.00	7.00	5.00	8.00	0.50
3	6.00	7.00	5.00	8.00	0.50
4	6.00	7.00	5.00	8.00	0.50
5	6.00	7.00	5.00	8.00	0.50
6	6.00	7.00	5.00	8.00	0.50
7	7.50	7.75	6.75	5.75	0.25
8	7.50	7.75	6.75	5.75	0.25
9	7.50	7.75	6.75	5.75	0.25
10	7.50	7.75	6.75	5.75	0.25
11	7.50	7.00	6.00	8.00	0.50
12	8.00	7.50	7.00	6.00	0.50
13	8.00	7.50	7.00	6.00	0.50
14	8.00	7.50	7.00	6.00	0.50
15	7.00	5.50	7.50	6.50	0.25
16	7.00	5.50	7.50	6.50	0.25
17	7.00	5.50	7.50	6.50	0.25
18	7.00	5.50	7.50	6.50	0.25
19	7.00	5.50	7.50	6.50	0.25
20	7.00	5.50	7.50	6.50	0.25
21	7.00	5.50	7.50	6.50	0.25

Majority Rule Relation

$$1 \leftarrow 2 \xrightarrow{\quad 3 \quad} 4 \leftarrow 5$$
1st   cycle   last

Key:

(x) means that x is the strength of the set over its complement as determined by the model.

(x) ⬅ means that x is the strength of the agenda in getting this alternative. Each agenda was designed to get the alternative so marked.

x⌣y means that at this stage the vote went "our way" by a vote of x to y.

x⌢y means that at this stage we "lost" by a vote of x to y.

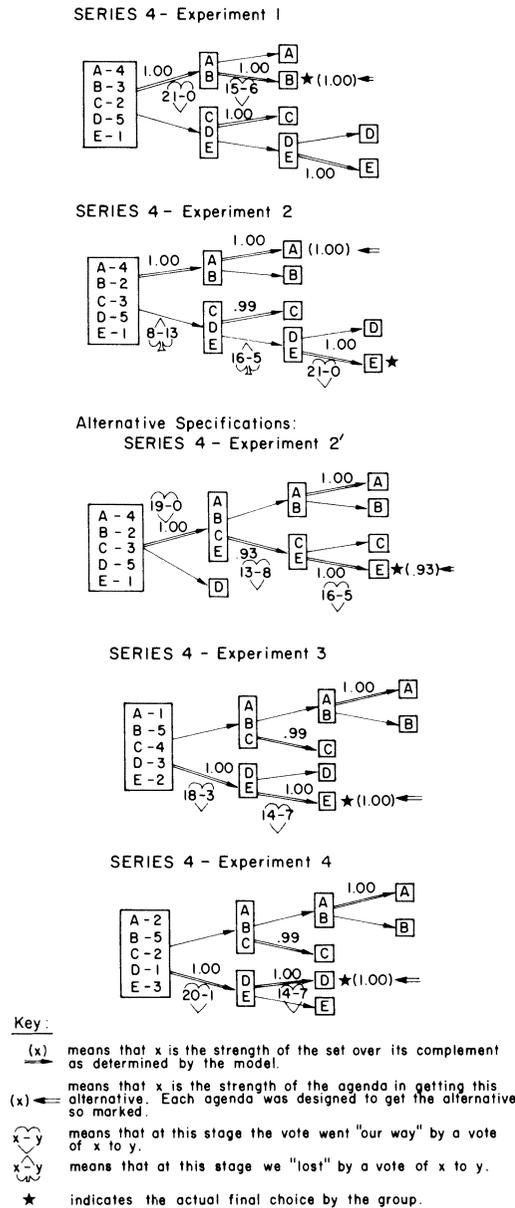★ indicates the actual final choice by the group.

FIGURE 1

alternate agenda the model predicts letter E, the one actually chosen with a .93 probability.

We now come to the most basic of questions. What are we prepared to say we have learned about our general theory and how can we easily summarize our beliefs? The following Bayesian argument is enlightening if we start from the two competing generalizations which existed before the research was initiated:

θ_0: The outcome of the process *does not* depend upon the agenda. That is, there exists a probability distribution $P(x)$ over outcomes $x \in \Omega$ which *is not* functionally dependent upon the agenda, although it may depend on other parameters.

θ_1: The outcome of the process *does* depend upon the agenda. That is, there exists a probability distribution $P(x \mid \mathbf{a})$ over outcomes $x \in \Omega$ which *is* functionally dependent upon the agenda in addition to other parameters.

Cast in this framework the arguments in favor of θ_1 are very persuasive if we adopt the position of a critic who initially had low expectations about the truth of θ_1. Suppose, for example, we make the following assumptions where x is the observed sequence of outcomes:

i) The a priori probabilities are $P(\theta_0) = .8$ and $P(\theta_1) = .2$

ii) $P(x \mid \theta_0)$ is the maximum likelihood estimate .015625

iii) $P(x \mid \theta_1)$ is the prediction of the model

With these assumptions the a posteriori probability that θ_1 is true is .94. This critic is certainly impressed.

If our critic would not allow our explanation of Series 4–Experiment 2, then a repetition of the argument above would show that he has learned much less from Series 4. Our own priors which had resulted from observing pilot experiments were on the order of $P(\theta_1) = .9$ so without our Experiment 2 explanation, we learned very little from the experimental series. Since the cost of an additional experiment is about $170 and any critic can study the pilot runs, we elected not to try to convince this critic until we found a setting within which we could learn something additional ourselves. We conclude that the agenda influences the outcome.

Even though our general theory may be right, the specific means of expressing or

TABLE 3: DISTRIBUTION OF OUTCOMES[c]

Series Experiment Item	Mean of Win Votes[a] μ	Standard Deviation σ	$\sqrt[3]{\mu_3}$	Number of Win Votes[a] x	$(x-\mu)/\sigma$	Probability of Direction Actually Taken	Probability of Final Outcome
1-1-1	11.57	1.67	-.48	12	.257	.90	
1-1-2	13.83	1.16	-.71	15	1.01	1.00	
1-1-3	10.84	1.71	-.65	11	.094	.79	.65
1-1-4	10.85	.95	-.47	11	.158	.93	
1-2-1	11.57	1.67	-.48	15	2.06	.90	
1-2-2	13.83	1.16	-.71	19	4.46	1.00	
1-2-3	10.84	1.71	-.65	12	.679	.79	.65
1-2-4	10.85	.95	-.47	13	2.27	.93	
1-3-1[b]	10.85	1.67	-.48	9	-1.54	.10	
1-3-2	10.54	1.15	-.41	11	.400	.83	.08
1-3-3	12.20	1.38	-.62	11	-.869	.97	
1-4-1	11.57	1.67	-.48	11	-.341	.90	
1-4-2	11.48	1.37	-.69	13	1.11	.93	.82
1-4-3	12.37	1.16	-.65	14	1.40	.99	
1-5-1	11.00	1.59	-.78	13	1.26	.83	
1-5-2	11.17	1.52	-.34	16	3.18	.87	
1-5-3	12.21	1.48	-.72	13	.534	.97	.58
1-5-4	10.40	1.05	-.40	10.5	.095	.82	
1-6-1	11.03	1.43	-.45	12	.679	.86	
1-6-2	10.58	1.46	-.64	11	.288	.78	
1-6-3	11.21	1.16	-.77	12	.682	.93	.61
1-6-4	12.62	1.42	-.88	13	.267	.98	
2-1-1	19.49	1.14	-.94	21	1.32	1.00	
2-1-2[b]	13.34	1.90	-1.11	10	-1.76	.07	.07
2-1-3	11.85	1.00	-.48	13	1.15	.92	
3-1-1	17.42	1.64	-1.10	20	1.58	1.00	
3-1-2(Item 5)[b]	11.85	1.00	-.48	10	-1.85	.08	.08
3-2-1[b]	19.26	1.21	-.98	8	-9.33	.00	
3-2-2	17.19	1.69	-1.13	16	.706	1.00	.00
4-1-1	18.34	1.44	-1.04	21	1.85	1.00	
4-1-2	13.65	1.00	-.64	15	1.35	1.00	1.00
4-2-1[b]	17.65	1.59	-1.09	8	-6.08	.00	
4-2-2[b]	16.73	1.78	-1.16	5	-6.59	.00	.00
4-2-3	19.95	.99	-.87	21	1.06	1.00	
4-2'-1	12.73	1.27	-.77	13	.213	.96	
4-2'-2	13.65	1.00	-.64	16	2.35	1.00	.96
4-3-1	17.65	1.59	-1.09	18	.220	1.00	
4-3-2(Item 3)[b]	13.65	1.00	-.64	14	.350	1.00	1.00
4-4-1	17.42	1.64	-1.10	20	1.58	1.00	
4-4-2	13.65	1.00	-.64	14	.350	1.00	1.00

[a]"Win" means that vote went in the direction indicated most probable by the model.
[b]These experiments did not result in the anticipated outcome.
[c]Data were pooled from all experiments except 1-3, 3-2, 4-2, 4-2'.

modeling it that we have developed is imperfect. First, the model made a probability one prediction which did not occur. Modifications to allow for straw votes may eliminate the problem. Secondly, we can, from Series 4, test the values of two parameters. The hypothesis that $P(S,\overline{S} \mid \alpha_1) = .96$, the number used in the model is accepted at the .01 level of significance. This is particularly interesting since it indicates that when individuals are in certain circumstances, our model of individual decisions is very good indeed. Psychological or other theoretical modifications are unnecessary. When all three rules cast compatible decisions, almost all behavior is explained. However, there were 32 votes cast from α_9 of which 27 were cast in the proper direction. According to the model these constituted 32 Bernoulli trials, each of which had a probability P of going in the proper direction. The hypothesis that $P(S,\overline{S} \mid \alpha_9) = .62$, the value used in the model, is rejected at the .01 level of significance. From this we know that our model could be improved by modifying the parameter values.

TABLE 4—CONSISTENT USE OF VOTING RULES
(Number of Individuals in Y^*)

Series and Experiment Number	Behavior Consistent with Rule 1	Behavior Consistent with Rule 2	Behavior Consistent with Rule 3	Behavior Consistent with None of the Rules	Total
1–1	1	1	6	2	10
1–2	4	1	1	4	10
1–3	0	0	0	1	1
1–4	0	0	6	0	6
1–5	1	0	1	2	4
1–6	1	0	3	2	6
Total	$\frac{7}{37} = .19$	$\frac{2}{37} = .05$	$\frac{17}{37} = .46$	$\frac{11}{37} = .30$	37

Note: Rule 1 = Sincere; Rule 2 = worst avoidance; Rule 3 = average value.

Y^* = the set of individuals for which the consistent use of any of the three voting rules would have been inconsistent with the consistent use of either of the other two voting rules.

Table 3 provides a comparison between the actual vote and the predicted vote for each item of each experiment including all pilot series. The most significant thing about this table is the apparent conservatism in the model suggested by the very infrequent instances of the actual vote falling short of the expected vote (8 out of 40 cases). This conservatism shows up again on the histogram of Figure 2. If the theoretical distribution of votes for each item was normal, then the histogram should approach a normal distribution curve. But, for all items the theoretical distribution of votes was significantly skewed to the left (as shown by $\sqrt[3]{\mu_3}$ on the table). Since the histogram is strongly skewed to the right, the accuracy of the model is in even more doubt than the nonnormality of the histogram suggests. We suspect that this is a type of "bandwagon effect," but we have not tested for this.

Of particular interest to us were the patterns of individual decisions. Does an individual always use the same decision rule? Of the 261 individuals who participated in these experiments, only 37 were involved in a series of voting situations which would *necessarily*[6] reveal the individual's voting rule. Table 4 indicates 70 percent of these 37 subjects exhibited consistent behavior. The average value hypothesis was the most popular with about 46 percent of these subjects using it. The next largest group, 30 percent, used none of the rules consistently. The fact that so many individuals did not consistently use any of the rules suggests that some sort of probabilistic treatment of individual decision rules may always be necessary.

IV. Concluding Remarks

Our research incorporates several features not found (at least all in one place) in the economics and politics literature. First, our characterization of voting procedures is

Histogram Normalized Deviations from Theory

$Y_i = (x_i - \mu_i)/\sigma_i$

FIGURE 2

[6]Any individual from among the 37 who consistently used any of the three rules would have exhibited behavior inconsistent with the use of either of the other two rules.
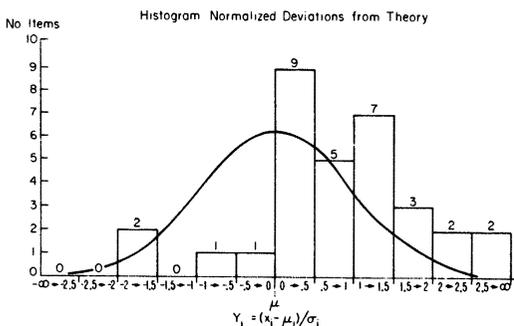
different from that found in the social choice and voting literature. With the exception of Farquharson, research in those areas focuses on processes in which alternatives are considered in a series of binary (two at a time) contests. The voting procedure we study involves voting between *sets* of issues. Our theory is decision theoretic in origin, but we depart from the traditional decision-theoretic mode of analysis by treating individuals as random variables over decision rules. Finally, our choice of an experimental methodology is certainly not typical of modes of analysis used by economists. Our posture is simple. If by using our ideas about the influence of the agenda, we are unable to influence the decisions of groups in a simple laboratory setting, then we cannot in good faith claim that our theory works in the more complicated "real world" case.

Experimental results indicate that within a range of circumstances the agenda can indeed be used to influence the outcome of a committee decision. Although the model we present needs improvement, the basic theory seems correct.

APPENDIX
INSTRUCTIONS USED IN SERIES 4

Chairman Instructions

You are employed to serve as chairman of several committee meetings. The time and location of these meetings are on the attached page. Each meeting will last about forty-five minutes. You should be at the designated location thirty minutes before the meeting starts and you should have familiarized yourself with the rules of order which are attached. For your participation you will be paid $5.00 per hour plus any necessary expenses, for example, parking, which you incur.

These meetings are part of a series of experiments designed to test theories about decision processes. Beyond this introductory remark, you will not be made aware of the purposes of the experiments until after the entire series has been completed. You should

avoid talking with anyone about *any* aspects of the experiments, your employment, or about any possibly related theories. You should avoid circumstances in which you might inadvertently become informed. Do not try to guess the nature of the hypotheses or supply your own theories. After the final meeting you will receive a detailed explanation.

The first thing to do is check the dates and the times. Make sure you can be there. They are listed here as "Attachment No. 1." Attachment 2 is a copy of the instructions that members of the committee will receive. You should read these instructions now.

Here are some things that should be underlined:

1. People are free to say anything they wish which pertains to the motion on the floor. If discussions are "out of order," you can make that judgment. In particular, the following are not to be allowed:
   a) Statements which contain dollar or quantitative references;
   b) Straw votes on issues other than the current issue to be discussed and voted upon, as will be explicitly described on the agenda; and
   c) Threats or dealings between committee members to be carried through, during, or after the experiment is over.
2. Majority rule means a majority of those present. A vote passes if it receives 11 or more votes. If an item on the agenda fails both votes, you call for more discussion. After discussion another vote is taken. If neither passes you move to the next item on the agenda. An ambiguity after all items on the agenda are covered, can be resolved by a motion from the floor.

Parliamentary Rules for Chairman

Read the appropriate portions at the appropriate times.

Recognition Rule: Raise your hand to be recognized by the chair.

Voting Rule: The basic voting rule is simple majority rule. An issue passes if it passes by a majority of those voting.

Rule to Break Ties (read this if neces-

sary): If a tie vote occurs, discussion of the motion is again opened. After debate a second vote is taken. If a tie occurs again, debate is opened again and a vote is taken. If a tie occurs again, the committee moves to consider the next issue. Any ambiguity at the end of the last item can be removed by a motion from the floor.

Rule to End Debate: If someone wishes to end the debate on an item they simply move to end debate. If there is no objection to ending debate the item is voted upon.

(Read if necessary): If there is objection to ending debate, the motion to end debate will be recognized by the chair. A vote on the motion to end debate will be taken. If it passes by 2/3 majority of those voting the debate ends. If the motion to end debate fails, debate on the main motion continues.

AGENDA: The agenda committee has adopted the agenda which is before you. Notice that each item on the agenda is designed to restrict the number of programs which may receive further consideration. Example: Choice of banquet

Alternative	Type of Food	Dress
1	Mexican	Formal
2	Mexican	Informal
3	French	Formal
4	French	Informal

Item 1. Shall we have a formal dress banquet or not? Notice that an answer to this question will restrict further deliberation to either

$$\boxed{1,3} \quad \text{or} \quad \boxed{2,4}$$
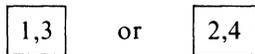
Item 2. What type of food? Notice that an answer to this question is now all that we need to decide upon a specific alternative, as shown in Diagram 2.

Instructions for Committee Members

1. We would like for you to participate in a committee process experiment. The purpose of the experiment is to help us understand certain technical aspects of the
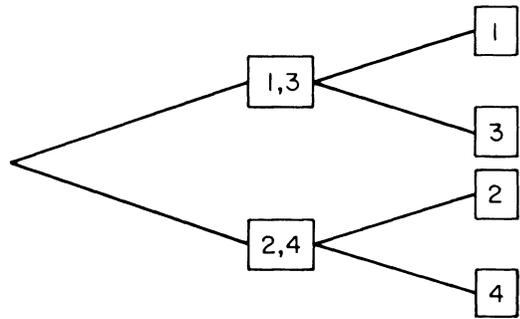

DIAGRAM 2

generally complex ways in which committees operate. Support for this research was supplied by the National Science Foundation and the Henry Luce Foundation.

2. All you have to do is attend a committee meeting and for this participation you will be paid. The purpose of the meeting is to choose by majority rule a letter from the set of letters [A, B, C, D, E]. Only one of the five letters will be chosen and the payment you receive for participation depends entirely upon which one it is. For example, on the table on page 3, the amount listed beside the letter A is the amount you will receive if it is chosen by the committee; the amount beside B is the payment you will receive if it is the majority decision, etc.

Different individuals will receive different payoffs depending upon which letter the committee chooses. The letter which would result in the highest payment to you may not result in the highest payment to someone else. You should decide after deliberation how you wish the committee to vote and make whatever efforts you might want to get the vote to go that way. However, in general, we as experimenters are not concerned with whether or how you participate in the committee's effort to select a letter.

We want the meeting to proceed in an orderly fashion so we have provided a few parliamentary procedures which must be followed. These will be explained by the chairman. We also want to make sure that you understand the consequences of your

votes and any resulting committee decision. For this purpose we ask you to answer the question on page 4 after the chairman has reviewed the rules and the agenda.

3. Here are some incidentals:

a) The basic procedure will be simple majority rule. We will also follow the agenda prepared by an agenda committee. This agenda is outlined on page 3 and should be studied carefully. It will also be covered by the chairman.

b) You will from time to time be voting. We have appointed a recording secretary to record all votes. This can take some time so we ask you to hold your hands high until all votes are recorded.

c) You will be paid in cash immediately after the meeting. You may not reveal any *quantitative* information about your payment. If you wish you can say that one yields more than another, but you may not say how *much* more. The amounts may differ among committee members and *only you* are to know anything about how *much* you may receive.

d) Before or during the meeting please do not discuss with other committee members any activity to take place after the meeting which may involve you jointly. Under no circumstances may you make threats or "deals" to split your payment from the meeting with another committee member.

4. Are there any questions?

SERIES 4: EXPERIMENTS 1 AND 2

Individual Payment and Agenda Section of Individual Instructions. Committee Member _____ .

Letter	Payment to you
A	
B	
C	
D	
E	

AGENDA are shown in Diagram 3.
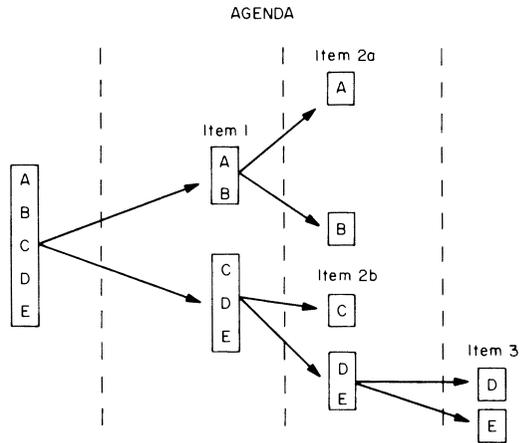
AGENDA

DIAGRAM 3

Item 1. Do we want to consider further only the letters *A* and *B*, or only the letters *C*, *D*, and *E*? (Check your vote.)

_____ I am in favor of considering further only the letters *A* and *B*.

_____ I am in favor of considering further only the letters *C*, *D*, and *E*.

Item 2a. (If the letters *A*, *B* are chosen at Item 1, then this item is applicable—if not, then go to 2b.) Which do we want, *A* or *B*?

_____ I am in favor of *A*.

_____ I am in favor of *B*.

Item 2b. (If the letters *C*, *D*, and *E* are chosen at Item 1, then this item is applicable—otherwise go to 2a.) Do we want to consider further only the letters *D* and *E*, or do we want to stop with *C*?

_____ I am in favor of *C*.

_____ I am in favor of considering further only the letters *D* and *E*.

Item 3. Do we want *D* or *E*?

_____ I am in favor of *D*.

_____ I am in favor of *E*.

*Agenda Test Section of
Individual Instructions*

1. Suppose the top box at Item 1, the one that contains the letters *A* and *B*, received a majority of the votes, then the next item to be considered on the agenda is _____ , and it consists of a vote between the letter(s) _____ and the letter(s) _____ .

2. Suppose at Item 1 the box of letters that contains the letters C, D, and E is chosen by a majority. Then the next item to to be considered on the agenda is _____, and it consists of a vote between the letter(s) _____ and the letter(s) _____.

3. If the box of letters that contains A and B received a majority vote at Item 1, would there be a vote at Item 3? Answer Yes or No: _____. If it happened that the box of letters containing C, D, and E received a majority of votes at Item 1, and a vote was not needed at Item 3, then the box containing the letter _____ must have received the majority of votes and thus would be the committee's final choice.

4. If at each item the lower arrow was followed by the majority of votes, then the committee will have made _____ the final choice and you will receive the amount _____ as your payoff.

5. How much will you receive if the committee's final choice is: D?_____ B?_____ C?_____ A?_____

<h3>SERIES 4: EXPERIMENTS 3 AND 4</h3>

Individual Payment and Agenda Section of Individual Instructions. Committee Member No. _____.

Letter	Payment to You
A	
B	
C	
D	
E	

AGENDA are shown in Diagram 4.

Item 1. Do we want to consider further only the letters A, B, and C, or only the letters D and E? (Check your vote.)
_____ I am in favor of considering further only the letters A, B, and C.
_____ I am in favor of considering further only the letters D and E.
Item 2a. (If the letters A, B, and C are chosen at Item 1 then this item is applicable—if not then go to 2b.) Do we want to con-
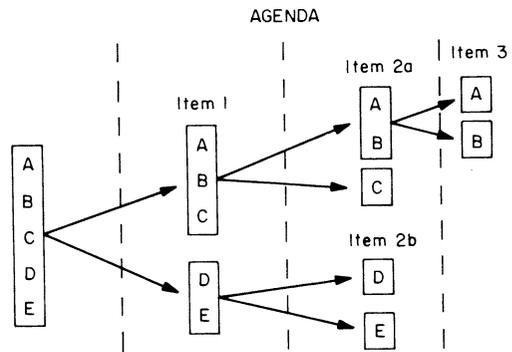

DIAGRAM 4

sider further only the letters A and B, or do we want to stop with C?
_____ I am in favor of considering further only the letters A and B.
_____ I am in favor of C.
Item 2b. (If the letters D and E are chosen at Item 1, then this item is applicable—otherwise go to 2a.) Which do we want, D or E?
_____ I am in favor of D.
_____ I am in favor of E.
Item 3. Do we want A or B?
_____ I am in favor of A.
_____ I am in favor of B.

<h3>Agenda Test Section of Individual Instruction</h3>

1. Suppose the box at Item 1, the one that contains the letters A, B, and C, received a majority of the votes. Then, the next item to be considered on the agenda is _____, and it consists of a vote between the letter(s) _____ and the letter(s) _____.

2. Suppose at Item 1 the box of letters that contains the letters D and E is chosen by a majority. Then the next item to be considered on the agenda is _____, and it consists of a vote between the letter(s) _____ and the letter(s) _____.

3. If the box of letters that contains D and E received a majority vote at Item 1, would there be a vote at Item 3? Answer Yes or No _____. If it happened that the box of letters containing A, B, and C received a majority of votes at Item 1, and a vote was not needed at Item 3, then the box contain-

ing the letter ____ must have received the majority of votes and thus would be the committee's final choice.

4. If at each item the lower arrow was followed by the majority of votes, then the committee will have made ____ the final choice and you will receive the amount ____ as your payoff.

5. How much will you receive if the committee's final choice is:

D? ____ *B*? ____ *C*? ____ *E*? ____

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