Representation and the Reduction of Complexity in Lawmaking

Any legislature that allows all members to offer formal proposals, unlimited in number or in content, may be called an open-input system. Requirements that proposals must be filed by a certain date during the session, or even that they be prefiled, may reduce the actual number of proposals, but nevertheless all members have fair warning and are free to submit as much legislation as they wish. Under such a system legislators are free to sponsor legislation emanating from a variety of sources—nationwide or statewide interest groups, government agencies, constituency interest groups, private individuals, or model legislation initiated in other political systems. The same legislators, perhaps with the help of legislative staff, may initiate a variety of legislative measures of personal interest as well.

It can be argued that “open-input” is a necessary if not sufficient requirement for adequate representation. When all elected members of the legislative body can influence to some extent the content of the agenda, the suppression of diverse demands are minimized. The concept of representation goes well beyond what is directly relevant to this point (e.g., see Pitkin, 1967; Eulau, 1978; Wahlke, 1978; Jewell, 1982); it is sufficient to note that rules affecting the agenda are crucial. Under an open-input system, constituents have the opportunity to organize and express their demands in the form of legislative proposals—they need
only a sponsor. And legislators can decide whether such proposals allow them to better represent their constituency.

Because American legislatures, with rare exception, are open-input systems, they are faced with an extraordinary level of demand for action (Rosenthal and Forth, 1978; Francis, 1985b). Each chamber initiates hundreds if not thousands of proposals each legislative session. The great volume of demand can have a number of ramifications. At one extreme, most of the legislation may never come up for consideration. At the other extreme, most of the legislation may be passed through the system with very little quality control. At either extreme there are risks of external costs. The data for American state legislatures in 1981 suggest that both extremes do exist. For bills in the chamber of origin, the chamber passage rate ranges from less than 10 percent to more than 80 percent. Reformers seem to be primarily concerned, however, with quality control and the need for committee screening to hold down the flow of bills (e.g., Rosenthal, 1974). This should not cause us to lose sight of the fact that badly needed legislation can get buried, and often does, in the briefcases of committee chiefs.

How is it possible to have both quality control and the expeditious handling of legislation? The answer to this question may be better understood if we consider the decision-making environment of the typical legislator. Such a legislator will serve on a number of legislative committees and will be confronted by dozens of bills each week, many of which require that he further interact with colleagues in order to obtain their views and to bargain over the outcomes. Faced with excessive amounts of legislation, the legislator will be forced to simplify the way he or she makes decisions. For example, if there are too many bills, the legislator may not read those that appear to be less important, may not attempt to learn about the views of other legislators, or may abandon attempts to bargain. The adverse consequences become apparent if such conditions are extreme. Either most bills are dead at the outset, or most legislative measures are approved in a careless manner. The committee systems are designed to come to the rescue.

An open-input system with procedurally efficient methods of dealing seriously with legislation is likely to be judged more representative

---
1. A "closed-input" system would either place a specific limit on the number of proposals a member may introduce, or would specify who in the chamber is not eligible to sponsor proposals. From time to time some state legislatures have set such limits, but the practice is uncommon. Limits on amendments offer another way of reducing at least ad hoc proposals.
Explorations in Efficiency and Reform

than a system attached merely to notions of full consensus. The external costs resulting from the lack of full participation or unanimity may be small compared to those resulting from inability to review a substantial agenda. When standing committees or subcommittees are given ample autonomy, more legislation can be given serious consideration.

Increasing Representation by Reducing Complexity

If the conditions under which decisions are made are too complex to allow legislators to evaluate information and estimate consequences, how can legislators cope with the problem? In a legislative body it is helpful to distinguish between two types of complexity. The first is introduced by the sheer volume of substantive material put forth as formal proposals. The second type is the result of the collective nature of choice in such an institution.

Volume of Legislation

The volume of material put forth as legislative proposals affects the amount of time and energy necessary to understand and process the material, and it has an impact on what may be called “decision costs.” Decision costs are incurred by learning about the substance of legislative proposals and the affected environment, and by making up one’s mind about their worth. But excessive volume can also create risk and, thereby, external costs. Greater risk is assumed whenever proposal content is ignored or considered carelessly.

What are the coping strategies for dealing with volume in a legislative organization? The most notable are:

1. Devote attention to legislation involving substantial net benefits and/or whose outcome is in doubt. The legislator makes guesses about which alternatives have the greatest $B - C$ values or whose probability of passage is near 0.5 (relative to other alternatives). One of several possible indexes, for example, would be $p(1 - p)(B - C)$, where $p =$ probability that the legislation will be approved, $B =$ benefits, and $C =$ costs. We need not wonder why the lion’s share of legislative attention is given to a small number of controversial issues. While we would expect
Representation and the Reduction of Complexity

legislators in any case to give more attention to such issues, a crowded agenda means that a greater proportion of proposals are never considered. The legislator may not have time to assess the benefits of most legislation, and thus whatever is at the front end of the agenda has the best chance of surviving. This coping strategy is not a solution to the problem but is really an elaboration of why the problem exists.

2. **Increase the length of the legislative session.** Many American states have moved in this direction, but Congress has almost reached its limit. Lengthening the legislative session creates opportunity costs for members with private occupations. A longer session also usually means that additional legislation will be introduced, perhaps at the same rate as in a shorter session.

3. **Increase staffing.** Staff members can aid in the search for and consolidation of policy-related information, or they can free legislators from other duties (e.g., constituency service) to allow legislators to devote more time to legislation. Both Congress and the state legislatures have greatly increased staff support over the last twenty years.

4. **Follow the lead of the chief executive.** Legislators may adopt a simple decision-making rule such as: “Vote the governor’s position on a bill; if the governor has taken no position, vote against it.” Such a rule could be expanded or altered to take into account chamber party leader positions. The rationale for adopting such a rule could be based on the confidence members have in the superior resources such leaders retain for evaluating legislation. The “followers” may also anticipate future side payments in return for their support.

5. **Use autonomous or semiautonomous standing committees and subcommittees.** Most American legislatures employ semiautonomous committees—committees that can kill legislation (with exceptions), but that must send all approved measures to the next highest level for consideration. A legislator can ignore non-personal agenda items held back in those committees of which he is not a member. Such items may constitute two-thirds of the total agenda. For example, if a legislator serves on two of twenty committees in a one-hundred-member chamber, he may review only 10 percent of the legislation in committee. If the other committees report out only 25 percent of their proposals, the legislator needs to review or read only 32.5 percent of the proposals (.25(.9) + .10), plus the few proposals he sponsored that did not make it out of other committees. Of course he may not need to review many proposals assigned to his own committees if subcommittees are employed.
All of the above strategies may have the effect of reducing the complexity of the decision-making environment. This does not mean that all such strategies are necessarily desirable. Legislators can make poor guesses about the value of legislation. They may find that longer legislative sessions create offsetting costs. Increased staffing sometimes creates more problems than it solves. To rely on the positions of the chief executive is to run the risk of alienating the home district. And the use of a committee-subcommittee system can make members vulnerable to the influence of pressure groups. Nevertheless, the problem does not go away by itself. Legislators need ways to simplify their options and to manage an agenda.

Collective Choice

The second source of complexity in legislatures is found in the use of majority voting to determine decision outcomes. This counting rule for tallying preferences is practiced normally on all occasions—floor decisions, standing committee decisions, and subcommittee decisions. In the U.S., only minor variations exist, for example, where a majority of those present is distinguished from an absolute majority, or where larger majorities are needed for certain types of action such as a veto override or constitutional amendment.

Majority voting, in conjunction with substantial quantities of legislation, introduces interpersonal complexities. Interpersonal complexities are of two kinds. The first is encountered in attempts to understand the preferences of other participants. The second is encountered in the process of bargaining and compromise. To understand the significance of these phenomena, it is necessary to refer to individual preference matrices. Making the normal assumption that individuals have transitive preference orderings, we may let \( R(k, A) \) define an ordered matrix, where an individual has preferences of Pass or Defeat over \( M \) issues, \( A(1), \ldots, A(M) \), and where there are \( 2^M \) possible outcomes, \( k(1), \ldots, k(2^M) \). To illustrate we take four proposals and elaborate all possible preference patterns, each of which is a possible outcome:

<table>
<thead>
<tr>
<th>Proposals According to Saliency</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case I</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>P</td>
<td>D</td>
<td>P</td>
</tr>
</tbody>
</table>
Representation and the Reduction of Complexity

127

Preference Order of Possible Outcomes,

\[2^M = 16\]

<table>
<thead>
<tr>
<th>P</th>
<th>P</th>
<th>D</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>D</td>
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<td>D</td>
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<td>P</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
</tr>
</tbody>
</table>

Least preferred outcome

How complex is this preference matrix?²

At first glance it is tempting to define complexity by the size of the matrix, \(M(2^M)\), which gives the number of cells in the matrix. The problem with this formulation, however, is that some \(4 \times 16\) matrices are more complex than others. The above illustration, for example, can be produced uniquely by the person's preference for Pass or Defeat on each proposal, plus the fact that the member

1. prefers to win on proposal \(A(1)\) more than winning on the other three proposals taken together;
2. prefers to win on proposal \(A(2)\) more than winning on proposals \(A(3)\) and \(A(4)\) taken together;
3. prefers to win on proposal \(A(3)\) more than winning on proposal \(A(4)\).

In other words, seven preference relations, one for Pass or Defeat on each of the four proposals and one for each of the above three statements linking the saliency of the proposals, are enough to produce the complete matrix. The simplicity of the array is explained by the fact that the preferences are "separable." The outcome on one proposal has no effect upon the legislator's preferences on the other proposals. He prefers each

---
² The assumption here of strict preference orderings, apparent in these illustrations, was adopted only after considering whether "indifferences" would substantially affect the analysis. There is first the question of whether a person is really very often indifferent between two alternatives when one of the alternatives must be selected, especially in a legislative setting. Second, the use of indifference relationships substantially complicates the model without altering the overall results. In other words, I have selected the simplest model that illustrates the basic features of complexity in a committee decision-making game. This does not preclude experimentation and refinement with weak preference orderings.
to pass regardless of the fate of the others, even though he prefers to win on some proposals more than others. In a situation of this kind, the legislator would have little difficulty in establishing his priorities. Furthermore, it would not be difficult for a colleague to understand the preferences of this legislator.

Another example of separable preferences occurs when a legislator prefers to win on all four issues, but short of that on any three issues, and short of that on any two issues, and so on. Again a unique configuration would be produced from a small number of preference statements. The preference setting can become much more complex, however, if the preferences are "inseparable," where the outcome preference on one proposal depends upon the outcome of another proposal. To illustrate this property of inseparability, a four-issue case will suffice:

<table>
<thead>
<tr>
<th>Proposals</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
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<tr>
<td>D</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
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<tr>
<td>D</td>
<td>D</td>
<td>P</td>
<td>D</td>
<td>D</td>
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<td>D</td>
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<td>D</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>P</td>
<td>P</td>
<td>P</td>
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<td>P</td>
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<td>P</td>
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<td>P</td>
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<td>D</td>
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<tr>
<td>P</td>
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<td>P</td>
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<td>P</td>
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<td>P</td>
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<td>P</td>
<td>D</td>
<td>P</td>
<td>D</td>
<td>P</td>
</tr>
</tbody>
</table>

In this case the legislator prefers most that all proposals are defeated (DDDD), but secondarily that all proposals pass (e.g., a subsidy for one group warrants a subsidy for three other groups, even though it would be better if none had a subsidy). Such contingencies make it impossible to deduce the order of preferred outcomes from the saliency of the proposals. While the above example was made fairly simple in order that it could be explained, inseparable preferences can describe patterns that appear to be nearly random. In such a situation, we have no basis for knowing the order of the outcome preference sets.
In order to understand the complexity of a situation involving the fate of several proposals, it is necessary to consider the structure of preferences. Legislators need to learn about each others’ preference structures in order to bargain efficiently. In sum, there are at least three factors that affect the complexity of the game:

1. The number of proposals.
2. The number of decision makers.
3. The structure of preferences.

Is there some way to minimize complexity? If so, legislators may be able to make decisions that will minimize decision costs per proposal and also the risks of external costs.

Minimum and Maximum Preference Complexity

One of the difficulties in evaluating decision-making complexity is that there is no known feasible way to measure or scale the structural complexity of preferences (as expressed in the preference matrix) in a practical setting. One alternative is to define the extremes mathematically. We can begin by defining preference complexity as

the minimal number of preference inequalities necessary to produce complete information on outcome preferences over $M$ issues.

For convenience of expression, we can let the sign “$>$” substitute for the phrase “is preferred to,” and the use of which represents a preference inequality.

Minimum Preference Complexity is found when the preference structure is in its simplest form, when the complete matrix of outcome preferences can be produced from the fewest possible preference statements. For a single individual this quantity may be defined as

$$C_{min} = 2M - 1$$ \hspace{1cm} 9.1

where $C_{min}$ is the minimum number of preference inequalities necessary to produce the entire preference matrix, and $M$ = the number of

3. It is clear that some proposals are more complex than others because they may include more sub-issues. Such a modification would need to be made in particular applications. The “budget bill” is a typical example.
proposals to be voted upon. For a proof that this is the minimum see Appendix I. For an entire group of legislators the minimum preference complexity is thus:

$$C_{\text{min}} = N(2M - 1)$$ \hspace{1cm} (9.2)

**Maximum Preference Complexity**, as indicated earlier, occurs when the preference outcomes are ordered randomly. In such a case, only the last preference outcome would be deducible, and thus the number of preference statements necessary can be enumerated as follows:

$$k(1) > k(2) > k(3) > \ldots > k(2^M)$$

Thus we may state that for a single individual:

$$C_{\text{max}} = 2^M - 1$$ \hspace{1cm} (9.3)

and for a group the maximum is specified as

$$C_{\text{max}} = N(2^M - 1)$$ \hspace{1cm} (9.4)

The range of complexity between $C_{\text{min}}$ and $C_{\text{max}}$ will depend upon the values of $M$ and $N$, the number of proposals and the number of decision makers. For example, Table 9.1 illustrates the calculations of $C_{\text{min}}$ and $C_{\text{max}}$ values for a variety of conditions. The degree of complexity can vary widely when three or more proposals are considered.

**Table 9.1** Illustrative $C_{\text{min}}$ and $C_{\text{max}}$ Values for Increasing Numbers of Members and Proposals

<table>
<thead>
<tr>
<th>Number of Proposals (M)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_{\text{min}}$</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>15</td>
<td>21</td>
<td>27</td>
</tr>
<tr>
<td>$C_{\text{max}}$</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>21</td>
<td>45</td>
<td>93</td>
</tr>
<tr>
<td>$C_{\text{min}}$</td>
<td>4</td>
<td>4</td>
<td>12</td>
<td>20</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>$C_{\text{max}}$</td>
<td>4</td>
<td>4</td>
<td>12</td>
<td>28</td>
<td>60</td>
<td>124</td>
</tr>
<tr>
<td>$C_{\text{min}}$</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>25</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>$C_{\text{max}}$</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>35</td>
<td>75</td>
<td>155</td>
</tr>
<tr>
<td>$C_{\text{min}}$</td>
<td>6</td>
<td>6</td>
<td>18</td>
<td>30</td>
<td>42</td>
<td>54</td>
</tr>
<tr>
<td>$C_{\text{max}}$</td>
<td>6</td>
<td>6</td>
<td>18</td>
<td>42</td>
<td>90</td>
<td>186</td>
</tr>
<tr>
<td>$C_{\text{min}}$</td>
<td>7</td>
<td>7</td>
<td>21</td>
<td>35</td>
<td>49</td>
<td>63</td>
</tr>
<tr>
<td>$C_{\text{max}}$</td>
<td>7</td>
<td>7</td>
<td>21</td>
<td>49</td>
<td>105</td>
<td>217</td>
</tr>
</tbody>
</table>
Using the Committee System to Minimize Complexity

The above formulations offer a completely explicit way of representing preference complexity. It is apparent that such complexity may be reduced by assigning proposals to different and at least semiautonomous standing committees. In most situations each decision maker would encounter fewer participants and fewer proposals. In addition, it makes sense to assign unrelated proposals to different committees and any set of related proposals to the same committee. In this way the assignments will be more likely to coincide with separable subsets of inseparable preferences. Is there any way to know, however, just how many committees are desirable? In the long term such a question requires a great deal of empirical work, but headway can be made through the use of logical methods as well.

An Example. To illustrate we can let \( S \) = the number of committees, \( N \) = the number of members, and \( M \) = the number of proposals, and assume that:

1. Each committee is assigned the same number of members.
2. Each committee is assigned the same number of proposals.
3. Each member receives one committee assignment.
4. Each committee reports out exactly one bill for floor vote.

We might label this example the “equal work-single assignment” case. Clearly, I have made the above assumptions to produce a nontedious result. More general equations than those below are in Appendix 9.2 of this chapter. Overall conclusions derived here would not be affected by specifying the assumptions differently.

From equations 9.2 and 9.4, the preference complexity of floor consideration has a minimum and maximum of:

\[
C_{\text{min}} = N(2S - 1) \quad \quad C_{\text{max}} = N(2^S - 1)
\]

where Assumption #4 allows the substitution of \( S \) for \( M \).

Since each standing committee has the same number of members, \( N/S \), and the same number of proposals, \( M/S \), the total preference complexity for all committees at minimum and maximum levels may be written as follows (substituting in equations 9.2 and 9.4):

\[
C_{\text{min}} = S(N/S)(2M/S - 1) \quad \quad C_{\text{max}} = S(N/S)((2^{M/S}) - 1)
\]

\[
= N(2M/S - 1) \quad \quad = N((2^{M/S}) - 1)
\]
The above alternatives make it possible to consider combinations of committee and floor conditions, minimum complexity on the floor and in committees, maximum complexity in both, and minimum complexity in one and maximum in the other.

From the above equations we are able to utilize standard minimizing procedures to solve for complexity. In the first case, it is assumed that minimum complexity conditions apply to both floor and committee proceedings, where

$$C_{min} = N(2S - 1) + N(2M/S - 1)$$

and minimizing $C_{min}$ with respect to $S$ (minimizing complexity with respect to the number of committees) we take the partial derivative, where $dC_{min}/dS = 0$ and

$$N(2 - 2M/S^2) = 0$$
$$N2 - N2M/S^2 = 0$$
$$N2 = N2M/S^2$$
$$1 = M/S^2$$
$$S^2 = M$$

$S = \sqrt{M}$ where the second derivative,

$$d^2 C_{min}/dS^2 = N(4MS/S^5)$$

Applying the same procedures when maximum complexity exists on both the floor and in committees, we obtain:

$$C_{max} = N(2^S - 1) + N(2M/S^2 - 1)$$

$$dC_{max}/dS = N(2^S(\ln 2) + 2M/S^2(\ln 2)(-M/S^2)) = 0$$
$$2^S = (2M/S^2(\ln 2)M)/S^2$$

$$(S^2)2^S = M2^{M/S}$$

(Note that for $S^2$ to equal $M$, $2^S$ must equal $2^{M/S}$)

$S^2 = M$  

$S = \sqrt{M}$

The result is the same as for $C_{min}$. Complexity is at a minimum when the number of committees equals the square root of the number of proposals. Conversely, if the number of committees is a given, preference complexity conditions are minimized if the expected number of proposals is that number squared.

A special result like the above is a function of the assumptions, thus we might expect a different solution when minimum complexity conditions exist on the floor but maximum complexity conditions exist in
committees. Referring to these mixed conditions as \( C_{\text{mix}} \) and using the same procedure, we obtain:

\[
C_{\text{mix}} = N(2S - 1) + N(2^{M/S} - 1)
\]

\[
= N(2S + 2^{M/S} - 2)
\]

\[
dC_{\text{mix}}/dS = N[2 + (2^{M/S} \times \ln 2)(-M/S^2)] = 0
\]

which reduces to

\[
2S^2 = 0.69 M 2^{M/S}
\]

\[
S = (0.347 M 2^{M/S})^{1/2}
\]

To illustrate the results in Equations 9.5 and 9.6, we can take as a given the number of committees established by a legislative chamber, and then ask for the number of proposals the system is designed to process in a single "production cycle." That is, assuming that preference complexity is to be minimized, and excluding at this point the use of subcommittees, what advice can be obtained? Taking three examples:

<table>
<thead>
<tr>
<th># of Committees</th>
<th>Eq 9.5</th>
<th>Eq 9.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S = 10 )</td>
<td>( M = 100 )</td>
<td>( M = 32 )</td>
</tr>
<tr>
<td>( S = 20 )</td>
<td>( M = 400 )</td>
<td>( M = 78 )</td>
</tr>
<tr>
<td>( S = 30 )</td>
<td>( M = 900 )</td>
<td>( M = 130 )</td>
</tr>
</tbody>
</table>

As may be observed, when preference complexity structure is the same at the chamber and committee levels, the number of committees relative to the number of proposals is small. But if it is assumed that proposals reaching the floor stimulate separable preferences, while those in each committee stimulate inseparable and highly complex preferences, then a relatively large number of committees is desirable. The average number of proposals per committee under Equation 9.6 ranges only from 3.2 to 4.3, or approximately 3 to 5 proposals per committee.

To take another example, suppose that a production cycle were defined by a "call of the roll," where each member is allowed to introduce one proposal. In a fifty-member group, homogeneous separability conditions would suggest that seven committees would be optimum, whereas for \( C_{\text{mix}} \), fourteen committees would be optimum. These numbers do reflect the very strict constraints set forth earlier. What is important to note, however, is that an organizational decision to separate proposals into separable subsets of inseparable issues, if in fact this can be done, makes a major difference in what is structurally optimal.

To fully illustrate preference complexity under varying conditions, we can utilize the above minimizing solutions to estimate preference
complexity values, first assuming there were no committees, and then assuming chamber review of only committee approved legislation. To illustrate:

Let \( M = 50, N = 50 \)

FULL CHAMBER CONSIDERATION ONLY

A. Separable Preferences (Using \( C_{\text{min}} \))
\[
N(2^M - 1) = 50(2^{(50)} - 1) = 4950
\]

B. Inseparable Preferences (Using \( C_{\text{max}} \))
\[
N(2^M - 1) = 50(2^{30} - 1) = 5.6295 \times 10^7 \text{ (scientific notation)}
\]

COMMITTEE CONSIDERATION AND CHAMBER REVIEW OF APPROVED BILLS

C. Separable Preferences at Both Levels (Using \( C_{\text{min}} \))
\[
N(2^S - 1) + N(2^M/S - 1) = 50(2^{(7)} - 1) + 50(2^{(50/7)} - 1) = 1314
\]

D. Inseparable Preferences at Both Levels (Using \( C_{\text{max}} \))
\[
N(2^S - 1) + N(2^M/S - 1) = 50(2^{(7)} - 1) + 50(2^{(7.14)} - 1) = 13,366
\]

E. Separable on Floor, Inseparable in Committee (Using \( C_{\text{mix}} \))
\[
N(2^S - 1) + N(2^M/S - 1) = 50(2^{(14)} - 1) + 50(2^{3.57} - 1) = 1,894
\]

These abstract solutions illustrate that the impact of committee use is especially dramatic when preferences are inseparable, and when such conditions can be delegated to committees rather than confronted on the floor of the chamber (as in case E).

The above example demonstrates in a precise way the major reductions in complexity that can be achieved by paying attention to the distinction between separable and inseparable preferences. A fair question here is whether legislators have any knowledge of such distinctions until after the fact. That is, can legislative leaders foretell which kinds of proposals are likely to be highly related to each other (thus stimulating inseparable preferences), and thereby construct committee subject-matter areas and assign proposals accordingly? It seems to me that this is exactly what legislators do, but with varying skill and foresight. In fact, we might argue that when related proposals are assigned to different committees very often, it is a signal that reorganization may be desirable in order to bring such proposals to a common forum within a single committee.
Subcommittees

For the American states most observers would probably agree that due to the increased volume of legislation, the use of subcommittees has increased substantially over the last twenty years. In most states, however, their use remains much less formal than in the U.S. Congress. Almost one-third of survey respondents indicated that the use of subcommittees was not very common in their experience, and only 17 percent indicated that subcommittees were required by their chamber rules. Most illustrative of the status of subcommittee use were the responses to the following inquiry:

Some state legislatures now use subcommittees frequently. What is the status of this practice in your chamber? (Please check)

- Subcommittees are an official part of my chamber rules and at least some committees are required to use them. 344
- Subcommittees are used on a regular basis in many committees, but it is really up to the chairman of the committee to decide in each session whether they will be used. 1028
- Subcommittees are not very common but they tend to be used in an informal manner in some committees. 543
- To my knowledge subcommittees have not been used. 95

N = 2010

Subcommittees are used more frequently in the larger lower chambers. For example, in only ten of forty-nine lower chambers did respondents indicate that subcommittees were not very common or not used. In the senate chambers, nearly half (23) were described as having little subcommittee use. In sum, the responses suggest that about one-third of the chambers exhibit low subcommittee use. Two states had unusual practices. In Iowa a subcommittee was appointed for each bill that was assigned to a committee. As a consequence, each member served on a very large number of subcommittees. In the Utah legislature, the members all serve on appropriations "subcommittees," but since the full committee includes the entire membership, the subcommittees are really in fact no different from committees.

Legislators were asked two other questions about subcommittees. They were asked to specify on how many they served and to indicate whether "important committees relied upon subcommittee reports." The correlations between "subcommittee use," reliance upon subcommittee reports, and the mean number of subcommittee assignments
range between 0.59 and 0.65 \((n = 99)\), suggesting that the questions tap into different aspects of the same phenomenon.

Scholars have long noted, especially with regard to Congress, that larger chambers have been more formal and rigid in their rules. Since there are more members to introduce bills and amendments and since the bargaining complexity is geometrically increased, the members in larger chambers are frequently forced to set more severe limits on debate and floor action. The creation of a committee system also takes on greater dimensions in large chambers. In Figure 9.1, we can see that members or leaders in larger chambers appoint more committees \((r = .37)\) and larger committees \((r = .65)\). Larger committees are more likely to utilize subcommittees \((r = .43)\) and to utilize subcommittee reports \((r = .44)\).

The point to be taken from the analysis is that subcommittees follow naturally in an attempt to process the agenda efficiently. Just as a large chamber needs committees, a large committee needs subcommittees. In large chambers the leaders have more members to place on committees and thus must decide whether to accommodate them through size or number. To the extent that they choose the former, subcommittees will follow. Whether any particular committee actually uses subcommittees will depend in part on how many proposals it receives. The decisions about how many committees to have and of what size can have a major impact on the ability of members to cope with the demands made on them.

An effective committee system makes it unnecessary for a legislator to learn about proposals and consequences if the proposals are not on his personal agenda and if the proposals die in committees of which he is not a member. Subcommittees, if they are given similar powers, economize in the same manner. The use of standing committees and subcommittees makes it less complex to bargain and easier to learn about the preferences of other voting members.

Traces of these effects are not so easy to discover, since every chamber employs committees and the amount of legislation they receive varies widely. Nevertheless, we are able to examine the reported time legislators spend in various types of committee activity, allowing “time” to serve as our proxy for costs. Table 9.2 illustrates that the time-costs of seeking information about the positions of other members (taken as a percentage of total time-costs) increases with committee size \((r = .22)\), even though, as shown earlier, increased committee size often leads to increased subcommittee use. Where subcommittee use is a conse-
Frequency of Reliance upon Subcommittee Use

Fig. 9.1 Relationship between Chamber Size and Four Committee System Characteristics

sequence, as demonstrated by the three separate measures in Table 9.2, legislators appear to shift their activities somewhat, from acquiring information about proposals to bargaining over them. We might speculate that the use of subcommittees in and of itself probably means a busy agenda—that is, there are too many proposals or the subject matter is too complex for the committee as a whole to handle. Subcommittees not only reduce the number of proposals each member must consider, but they allow each member the opportunity to bargain with some realistic chance of locating equilibrium choices (e.g., see Shepsle, 1979).

How does the above discussion fit into the previous mathematical analysis of complexity reduction? First, it does appear that the use of subcommittees brings into play the kind of interpersonal behavior that we expect when inseparable issues need to be resolved. Second, it can be seen, theoretically, that subcommittees are to a standing committee what standing committees are to the entire legislature. Presumably, proposals that stimulate inseparable preferences should be assigned to a subcommittee—separable from other subsets of inseparable preferences, since those proposals respectively are assigned to other subcommittees. In an extraordinarily efficient system the proposals are parceled
Table 9.2  Relationship between Committee Characteristics and Time-Costs (correlation matrix, N = 99)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Proposal Information Time-Costs (% of Total)</th>
<th>Member Information Time-Costs (% of Total)</th>
<th>Bargaining Time-Costs (% of Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Committee Size</td>
<td>.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subcommittee Use</td>
<td>-.19</td>
<td>.25</td>
<td></td>
</tr>
<tr>
<td>Number of Subcommittee Assignments</td>
<td>-.29</td>
<td>.31</td>
<td></td>
</tr>
<tr>
<td>Subcommittee Reports in Important Committees</td>
<td>-.29</td>
<td></td>
<td>.25</td>
</tr>
</tbody>
</table>

Only r values where \( p < .05 \) are reported in order to illustrate a pattern. These correlations do not take into account variance within chambers, which cannot be separated from reporting error.

...out such that (See Appendix 9.2 of this chapter for representative equation):

1. The entire legislature receives proposals that elicit separable preferences.
2. The committee receives proposals that elicit separable preferences.
3. The subcommittee receives proposals that elicit inseparable preferences.

It is certainly true that no known legislature is so efficient, and no less true that legislators in any setting can complicate matters by offering amendments or by engaging in logrolling. These truths in no way contradict the argument. Instead they ask for additional analyses that go beyond the scope of this project. We can simply point out here that to minimize complexity, the above conditions may be necessary if not sufficient.4

Conclusion

Concern for representation in American legislatures arises when legislative decisions are delegated to standing committees and their subcom-
Committees. Such delegations mean that fewer elected legislators are likely to have a vote on the outcome of many if not most proposals. The argument is made here that a more serious problem can result from the inability of the legislature to offer serious deliberation over an ample proportion of legislative proposals. The standing committee and subcommittee system allows a division of labor that enhances the processing of the agenda.

In constructing a standing committee-subcommittee system, procedural efficiency is important to the extent that a larger proportion of legislative measures receive formal consideration and resolution. Central to the efficiency of the system is the degree to which the organizational structure accommodates the structure of human preferences. The complexity of the decision-making environment is a significant determinant of the quality of legislative deliberation. The crowded agendas of legislatures make it necessary to seek ways to reduce the complexity of decision making. This is accomplished by applying fewer members to fewer issues, and by taking into account the distinction between separable and inseparable preferences. The restricted complexity minimization model, in its alternative forms, illustrates that it is possible to estimate optimal organizational structures by taking into account the complexity of human preferences.

Relatively little is known about the use of subcommittees in the fifty U.S. state legislatures. Subcommittees have not been standardized or well documented in official records. Evidence in this study does suggest, however, that their use has had an impact upon allocations of time to bargaining and negotiation. In other words, such activities can be conducted most profitably in settings not disadvantaged by overwhelming complexity. Subcommittees are more likely to offer situations wherein inseparable preferences can be negotiated and resolved.
Appendix 9.1

For an informal proof to show that $2M - 1$ is the minimum number of preference inequalities necessary to produce the entire preference matrix, the following steps may be taken:

1. When the preferences on proposals are separable, a member prefers passage ($P > D$) or defeat ($D > P$) on each proposal regardless of the outcome of other proposals, such that

$$A(1), A(2), \ldots, A(M)$$
$$P \text{ or } D, P \text{ or } D, \ldots, P \text{ or } D$$

Thus the number of Pass/Defeat preferences equals $M$.

2. Assuming strict transitivity, a member ranks the proposals according to their saliency, such that

$$A(1) > A(2) > A(3) > \ldots > A(M)$$

Thus there are $M - 1$ necessary preference statements related to saliency.

3. The same number of preference statements are needed to produce

$$A(1) > [A(2) \text{ and } A(3) \ldots \text{ and } A(M)], A(2) > [A(2) \ldots$$
$$\text{ and } A(M)], A(3) \ldots > A(M).$$

which may be reduced to

$$A(1) > [A(2) > [A(3) > \ldots > A(M)] \ldots ]$$

For example, the above formulation solves for the preference matrix in CASE I illustrated earlier. For notational convenience, let the proposals be designated as $A, B, C, \text{ and } D$, where

$$A > B > C > D$$
$$A > (B > (C > D))$$

4. When the number of preference statements due to saliency is added to the number of Pass/Defeat preferences, the preference complexity for one member is

$$M + (M - 1) = 2M - 1$$

5. When there are $N$ members, each having separable preferences of minimum complexity,

$$C_{\text{min}} = N(2M - 1)$$
Appendix 9.2

The assumptions made for the example in the text allow the efficient calculation of partial derivatives according to standard minimization procedures. That is, it was possible to minimize "preference complexity," as explicitly defined, with respect to particular variables such as the number of committees. If these simplifying assumptions are not made for the purpose of examining the relationship between the number of committees and the number of bills when complexity is minimized, it will be necessary to work with the calculation formulas presented below.

I. FULL MEMBERSHIP CONSIDERATION ONLY
   Separable Preferences \( N(2M - 1) \)
   Inseparable Preferences \( N(2^M - 1) \)

II. ASSIGNMENT TO COMMITTEES, FULL MEMBERSHIP REVIEW OF COMMITTEE APPROVED BILLS ONLY
   Separable Preferences \( N(2P - 1) \)
   \[ + \sum_{i} n_i (2m_i - 1) \]
   Inseparable Preferences \( N(2^P - 1) \)
   in Committee Only
   \[ + \sum_{i} n_i (2^{n_i} - 1) \]

III. ASSIGNMENT TO SUBCOMMITTEES, COMMITTEE REVIEW OF SUBCOMMITTEE APPROVED BILLS ONLY, FULL MEMBERSHIP REVIEW OF COMMITTEE APPROVED BILLS ONLY
   Separable Preferences \( N(2P - 1) \)
   \[ + \sum_{i} n_i (2p_i - 1) \]
   \[ + \sum_{i} \sum_{j} n_{ij}(2m_{ij} - 1) \]
   Inseparable Preferences \( N(2^P - 1) \)
   in Subcommittee Only
\[ + \sum_{i=1}^{s} n_i (2p_i - 1) + \sum_{i=1}^{s} \sum_{j=1}^{b} n_i (2m_i - 1) \]

**KEY:**
- \( N \) = Number of Members, \( M \) = Number of Proposals
- \( P \) = Number of Proposals reported out of Committees
- \( n_i \) = Number of members in Committee \( i \)
- \( m_i \) = Number of proposals in Committee \( i \)
- \( p_i \) = Number of proposals reported out of subcommittees in a committee \( i \)
- \( n'_i \) = Number of members in Subcommittee \( i \)
- \( m'_i \) = Number of proposals in Subcommittee \( i \)
- \( s \) = Number of committees in Chamber
- \( b \) = Number of subcommittees in Committee \( i \)