TO: Coproduction Study Group

FROM: Larry Kiser

DATE: 3-3-80

RE: Attached Paper

I have thought long and talked much about developing an institutional model of coproduction. Such a model has not appeared as yet, because I have not felt comfortable with available bases for institutional analysis. I have wanted a comprehensive framework, on the order of Lin's 1967 "Strategy and Structure" paper, that develops incentives derived from various institutional configurations.

The attached paper is the first part of a conceptual apparatus suggesting a way to look at institutional configurations. I am presently working on the second part that shows how the concepts developed in this first part can be used to derive incentives consistent with a variety of institutional arrangements. The framework is general and can be adapted, I will argue, to a model showing the influence of institutional structure on selection of production methods including regular and consumer production.

Rick Wilson and I (and 4 others in our E306) are in the middle of an empirical effort to study the relationship between institutional structure and production methods, as appears in housing complexes in the Bloomington area. We have a vaguely-developed institutional model of regular and consumer production that underlies this research; both the empirical research and model development are occurring simultaneously. This primitive effort is built on concepts appearing in the attached paper.

If this conceptual apparatus is to continue to support such model development, the apparatus is in need of critical review. Some of you have expressed an interest; thus the paper is distributed to you for comment. The work will no doubt benefit from your attention. Will be able to discuss this on Wednesday (March 12) at 1:30?

A CONCEPTUAL APPARATUS FOR INSTITUTIONAL ANALYSIS

The relationship between social structure and individual decision making is attracting increasing attention among social scientists. Their work to date, however, has proceeded without the aid of a fully developed theoretical framework. Significant progress in constructing such a framework appears in Ostrom (1967) and Hurwicz (1973). This paper attempts to advance that work.

Hurwicz calls institutional arrangements governing interaction among individuals, decision mechanisms. His term is apt, because it conveys the image of a device constraining and guiding the choices that individuals make. The nexus of constraints shows participants in the mechanism the behavior with which others would like to deal and enable individuals to develop expectations regarding the behavior of others.

Thus, decision mechanisms simultaneously restrict and expand freedom in individual decision making. Freedom is restricted by the limitations on the behaviors from which individuals can select, and freedom is expanded by the increased predictability of responses by others. Unstructured interaction prohibits individuals from determining the probable consequences of alternative actions. Consequences become random providing, in effect, no real choices for the individuals to make.

Another view of the function of decision mechanisms is to focus on possibilities for mutual gains and for competing gains and losses among individuals. Formal game theory notes these possibilities in the payoffs to individuals engaged in joint decision situations. Some joint decisions produce constant-sum results with some individuals gaining and other individuals losing. Other joint decisions produce positive-sum results.

Individuals, therefore, create decision mechanisms constraining choices to produce those results.

Development of a conceptual apparatus to aid theorizing about the effects that decision mechanisms have on decision making proceeds according to the following outline. Reasoning begins with an assumption of Buchanan and Tullock's (1962) conceptual unanimity, where a community of individuals unanimously agrees to a set of rules to guide decision making about various matters. Reasoning also assumes a prevailing state of knowledge (technology) in the exogenous environment. These two assumptions combined with the possibilities for mutual advantage among individuals in the community explain the configurations of rules describing various decision mechanisms. This step is represented in Segment A of Figure 1.

Discussion proceeds, as illustrated in Segment B, to identify the minimum set of rules essential to the description of a decision mechanism. The rules are also presented as constraints, the form in which individuals recognize the rules. Once the essential rules or constraints are determined, a matrix showing possible rule configurations is constructed to distinguish among the variety of decision mechanisms.

Referring to the three rules pictured in Figure 1, the rule matrix combines simultaneous variation in each of the hypothetical Rules 1, 2, and 3. The matrix is drawn in Figure 2. Rule 1 is described by constraints in either Condition A or Condition B, Rule 2 in Condition C or D, and Rule 3 in Condition E or F. The matrix rows indicate the configurations resulting when Rule 1 shifts from Condition A to B, with the other two rules unchanged. Configuration S shows Rule 1 in Condition A, Rule 2 in Condition C, and Rule 3 in Condition E. The shift to Configuration T

General Framework For
Constructing Conceptual Apparatus

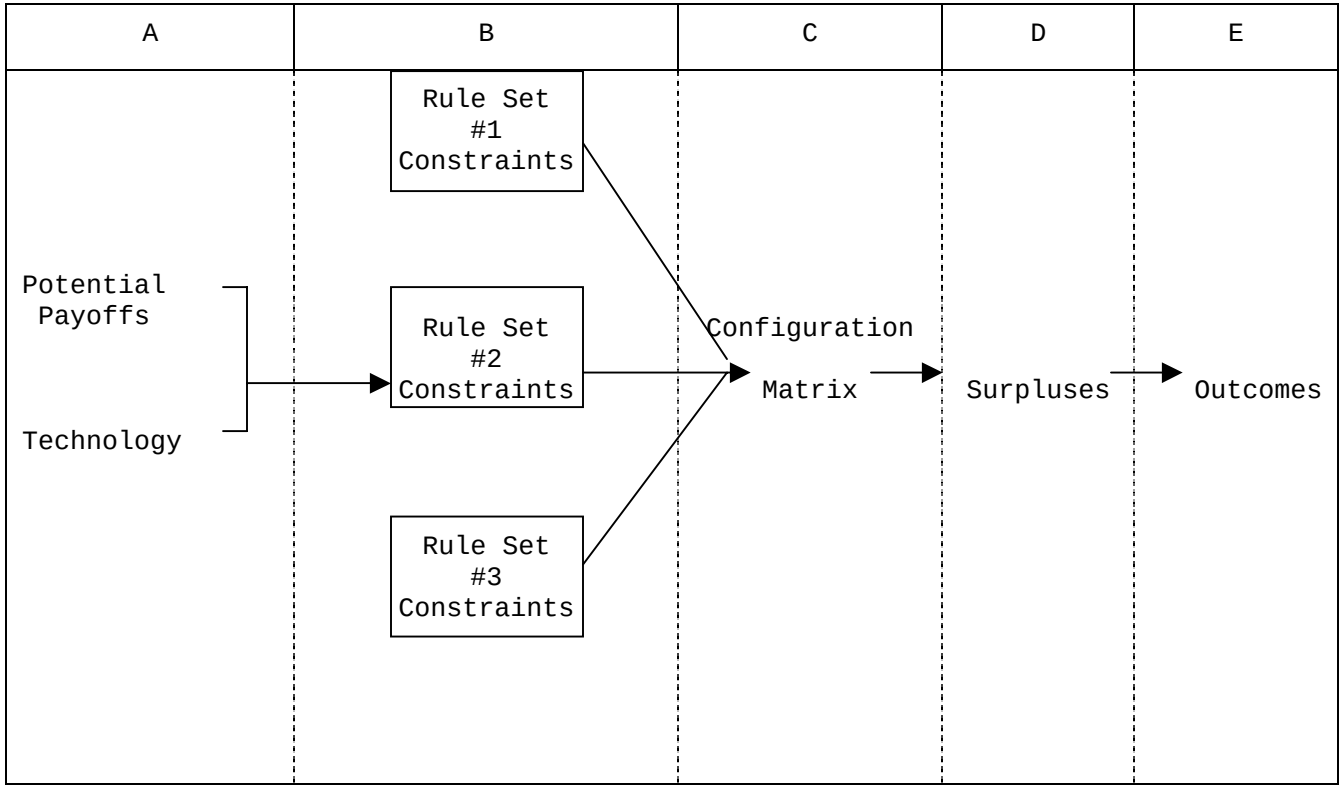


Figure 1

Figure 2

Hypothetical Rule Configuration Matrix

				Condition A	Condition B
Rule #2	Condition C	Rule # 3	Condition E	S	T
			Condition F	U	V
	Condition D	Rule # 3	Condition E	W	Y
			Condition F	X	Z

results when Rule 1 changes to Condition B and the other rules remain in their original conditions. The matrix columns indicate the configurations when either Rule 2 or 3 change conditions, with Rule 1 remaining constant. The shift from S to U results when Rule 3 changes from Condition E to F, while Rule 1 remains in Condition A and Rule 2 in Condition C. The shift from S to W results when Rule 2 changes from Condition C to D, while Rule 1 remains in Condition A and Rule 3 in Condition E.

The next step in the discussion, as shown in Segment D of Figure 1, develops the payoffs to individuals operating within the various rule configurations. Payoffs, expressed as net benefits or surpluses when costs imposed by the constraints are balanced against the expected benefits, determine individuals' decisions with respect to alternatives permitted by each rule. Surpluses are argued to change in predictable ways with changes in rule configurations. Thus, individuals' decisions also change in predictable ways.

Segment E in Figure 1 shows that individuals' decisions in the arrangement lead to actions or outcomes. Sometimes the outcomes flow directly from an individual's decision; sometimes the outcome flows from the combination of decisions by individuals in the mechanism. This depends, as is noted later, on aggregation procedures.

An additional point concerning the consequences of decisions should be stressed before discussion turns to developing the components of the conceptual apparatus. The apparatus begins with an assumption that participants unanimously agree to a set of rules to facilitate cooperation with one another. But that does not imply that all existing arrangements achieve cooperation nor that all participants in existing arrangements have

agreed to those rule configurations. Arrangements change over time as an inevitable consequence of the human ability to learn and to adjust to the social environment. Individuals learn to bend arrangements to their own advantage rather than to the mutual advantage of all participants.

Many decisions that individuals make are simply operations, meaning that individuals abide by the rules and pursue the objectives for which the mechanism was designed. But other decisions are extra-operational resulting in the evolution of new rule configurations for the mechanism. Individuals may choose to disregard some of the rules, and when this occurs frequently and in consistent ways, such decisions create in effect new rules. The process, as far as the group is concerned, is probably unconscious, for individuals can regularly violate a certain rule with no intention of changing the rule for everyone else in the group, or they can violate a rule because others violate that rule with apparent impunity. But intentional or not, these decisions accumulate over time into new behavioral norms or rules for the group, and the rule configuration is changed.

Alternatively, individuals in positions of special influence within the mechanism can consciously seek to construct rules augmenting that influence. This might result in new rules to guide individuals' decisions in the mechanisms, or this can occur in the construction of additional mechanisms through which decisions in the original mechanism are effectuated. In the latter case, the decision mechanism is a superstructure to the original arrangement functioning within the larger mechanism. The super-structure handled only a portion of the matters that concern decision making in the larger mechanism.

Decisions, thus, fall basically into either of two classes: operational and constitutional decisions. Decisions that change the rules of the mechanism, regardless of intention, are classified as part of the constitutional process.

Essential Rules

The task in this section is to identify rules necessary to the functioning of a wide variety of decision mechanisms. Emphasis, therefore, is on general rule sets rather than on specific rules. The problem is to construct a list of rule sets sufficient to describe constraints within any decision mechanism without regard to the particular function of the mechanism. Yet the list should include only necessary rules, as unnecessary ones make the analytical apparatus unwieldy.

The discussion that follows includes five essential rules: (1) boundary rules, (2) information rules, (3) rules concerning the number of decision points, (4) aggregation rules, and (5) position rules. Each rule set is defined and defended as necessary to the identification of alternative decision mechanisms. Suggestions are also made about measuring the constraint imposed by each rule set.

Boundary Rules

Organizations of individuals requires some means for determining who is to be included in and who is to be excluded from the group. All decision mechanisms imply rules to set the boundaries of the group. These rules guide the selection among individuals to enter the decision mechanism and the selection among individuals to exist from the mechanisms.

Boundary rules may be characterized by the particular purpose toward which a decision mechanism is directed. Individuals join with others in

the mechanism because they wish to consume the same bundle of goods, or they wish to produce the same good or bundle of goods. Sometimes individuals organize to facilitate exchange between producers and consumers. A useful distinction, then, is to indicate whether the mechanism is designed for consumption, production, or provision activities. Mechanisms can specialize functions or can combine functions and activities within a single arrangement.

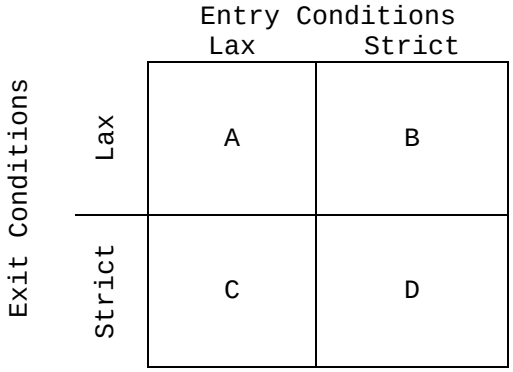
Boundary rules can also be characterized without reference to the particular purpose of the group, but according to the difficulty of entering or exiting the group. The conditions range from strict to lax, with strict indicating difficult entry or exit and lax indicating easy entry or exit. The range is continuous. Also, conditions of entry need not correlate with conditions of exit. The variety of boundary conditions can be visualized by considering a two-part classification of strict and lax in a two by two matrix with each of the four cells representing a separate boundary condition. This is shown in Figure 3. Mechanisms in Cell A are easy to enter and easy to exit. Mechanisms in Cell B are difficult to enter, but easy to exit. Mechanisms in Cell C are easy to enter, but difficult to exit. And mechanisms in Cell D are difficult to enter and to exit.

Strictness of the boundary rules can be measured in a variety of ways depending on the particular standard. Individuals may have to meet certain physical standards, such as height and weight, or they may have to meet a certain wealth standard. Individuals may be required to possess a certain range of experiences, to know certain people, to have graduated certain schools, to possess certain abilities, or to live in certain geographic areas. Almost any criterion can apply.

Figure 3

Boundary Rule Configurations

Entry Conditions



A common denominator for many of these standards is the cost of meeting the standard, where higher costs are associated with increased strictness. A wealth standard, for example, is lax when set low and strict when set high. But other standards may have little variation with respect to costs. A height standard is costly at any level, as individuals can do little to meet such a standard.

Another measure of boundary rule strictness is the proportion of the population that can meet the standard. Entry conditions are strict if only a small proportion of the population meet the standard and lax if a large proportion of the population meet the standard. Or, getting at the same notion, strictness can be measured by the deviation of the standard from the population average. A standard set well above the average is strict and well below the average is lax.

The brief survey of entry and exit conditions suggests that some standards may not be uniformly strict or lax for all individuals. Individuals may be advantaged by natural physique, innate intelligence, wealth, social status, or geographic residence. But boundaries are characterized here by a general condition of strictness. The distribution of the strictness across individuals, which is also important to rule configurations, is developed later in the position rules.

Information Rules

Information derives from a variety of sources, exogenous and endogenous to decision mechanisms. Rules of the mechanisms address information retrieval from both sources. Some mechanisms grow insular, eventually losing touch with the exogenous environment, but other mechanisms interact closely with that environment. Some mechanisms inexpensively generate vast amounts

of information internally for participants; other mechanisms seem to conceal information.

If decision mechanisms are to increase the predictability of individuals' interactions with one another, the mechanisms must generate information for participants. Individuals considering alternative actions need to understand each other's preferences, constraints, and motives. The extent of that understanding depends on rules governing the activities available to individuals for searching out information and on rules governing participants' willingness to reveal information to each other. Both are included in the information rules of the decision mechanism.

The importance of information to decision making only recently has gained recognition in formal decision models.[1] The literature on the rule of information has expanded so greatly during recent years that a sub-discipline around the economics of information and uncertainty has developed. Some writers, particularly Leonid Hurwicz (AER, 1973), have attempted to give this literature some structure.

Hurwicz develops concepts basic to decision mechanisms' information generating capabilities. One concept is language, which is the nature and content of the messages transmitted among participants of the mechanism. Some languages are dense, with high quantities of information contained in a small message space. Other languages require a much larger space to convey the same amount of information. Economic mechanisms, for example, frequently use dense languages, such as numbers, which are particularly effective for transmitting information about prices and quantities of goods. Other mechanisms employ sparse languages, such as verbal expressions, conveying complicated descriptions, sometimes subject to considerable range of interpretation.

Another concept is the number of iterations. This is the number of messages transmitted between the same parties within a given period of time to establish a pool of information. Iterations often interact with language affecting the ability of the language to convey information. A dense language may require a high number of interactions to convey the same information that another language requiring more space may convey in a single iteration.

A third concept is the response rules. According to Hurwicz, response rules determine the portion of potential information actually transmitted during a given exchange. An individual who has been approached for information may choose to transmit only a portion of the information requested, withholding other information until a later request or even permanently.

The generation of information also depends on the message receiver's ability to process and interpret the information. A language may be capable of efficiently transmitting information with few iterations, and the respondents may transmit 100 percent of the information requested, but the transmission does not become useful information until the recipient effectively translates the message. The translation involves storing data for later use and combining data from different messages. Information rules of a mechanism will often affect that process. Some information, for example, is transmitted through individual experience, but if the mechanism allows only for widely spaced experience, but if the mechanism allows only for widely spaced experiences, data may not accumulate to develop useful information. Each experience's data fades or grows obsolete before they can be combined with data from other experiences.

Information rules, then, are a composite of message language, the number of message interactions, response rules, and translation rules.

Each component guides individuals' search for, dissemination of, and interpretation of information. This applies both to exogenously and endogenously developed information.

Information rules act as constraints upon individual decisions within the mechanism. Information is scarce, with the relative scarcity varying across decision mechanisms according to the information rules. In some arrangements the information is inexpensive relative to its value, and in other arrangements information is expensive relative to its value. The result is that decisions are based on fairly complete information in the inexpensive arrangements and on fairly incomplete information in the inexpensive arrangements and on fairly incomplete information in the expensive arrangements.

An index of constraints imposed by information rules incorporates costs stemming from language, message iteration requirements, response rules, and translations rules. Costs are inversely related to language density and directly related to the number of message iterations. These components can sometimes interact. The concept of sufficient statistics employed by Truman and Levy (19), where a set of numbers transmits complete information relevant to a decision in a single iteration is an example of interaction producing inexpensive information.

The effect of response rules on information costs can be assessed by the degree of forthrightness and completeness in the messages transmitted among participants. Some arrangements encourage complete honest responses to informational requests. Other arrangements encourage caginess and the withholding of information and, in some instances, transmission of false information. The translation rules interact with the forthrightness of the responses by indicating whether recipients of messages should act

upon the messages sent or should attempt to validate them. This interaction probably affects the number of message interactions.

For present purposes, these information rule components are characterized simply as creating easy (inexpensive) or difficult (expensive) access to information. The characterization applies in a general way to all participants within the decision mechanism. Variation in access among individuals is discussed later in the position rules.

Multiplicity of Decision Points

Institutional arrangements vary according to the multiplicity of points to which individuals can appeal for a group decision. This multiplicity is another essential part of the rule configuration for different mechanisms. Some mechanisms have a single point at which decisions are made; all decisions are final and no appeal is possible. Other mechanisms provide for numerous decision points.

Mechanisms with numerous decision points also vary according to flexibility in sequencing the points. Rigid sequencing requires that the decision points be used in a particular order; flexible sequencing requires no particular order; and mechanisms vary in the degree of interdependence among decisions points. In some mechanisms, decisions made at one point influence decisions made at other points. In others, the decisions at all points are mutually independent.

These aspects variously constrain individuals' interactions with one another. The greater the number of decision points and the easier the access to each point the weaker is the constraint. Group outcomes unfavorable to an individual can be appealed to different points for more favorable results. Each additional point increases the individual's

potential for altering the group decision. This potential is enhanced with easy access to each point. Access barriers established by rigid sequencing or other means discount the effects of additional decision points.

As in other rules, the general level of access to multiple points is emphasized. Variation of access among individuals within a decision mechanism is developed along with interdependence among decision points in the position rules later in the paper.

Aggregation Rules

Decision mechanisms differ fundamentally in the way in which individual decisions are aggregated to produce an outcome. At one extreme no aggregation occurs as outcomes flow directly from each individual's decision. At the other extreme, each individual's decision is combined with all other members of the mechanism to produce an outcome. Intermediate ranges require varying numbers of individuals to decide before an out outcome can result. The minimum number of individuals required to produce an outcome is captured in the popular notion of quorum. The maximum is captured in the concept of voter eligibility or franchise. Other aggregation rules include the proportion of decision makers required to enact change, and the specificity of the issue being decided.

The number of individuals eligible to participate in the decision making is an easily understood component of the aggregation rules. The range in number is limited only by the number of individuals in the decision mechanism, although the number of decision makers and the size of the decision mechanism are not necessarily correlated. Large decision mechanisms can have small numbers of eligible decision makers, and smaller

mechanisms can have large numbers of decision makers. But since aggregation rules are discussed from the perspective of the general level of individual influence by decision makers, rather than by all members of the decision mechanism, the absolute size of the decision making group is the relevant factor. The relative sizes of the decision-making group and the mechanism's membership are relevant to a later discussion of position rules.

The second component of the aggregation rules, the proportion of decision makers required to enact change, is probably the most commonly discussed of the rules. The possibilities range from the fraction represented by a single individual (a dictator) to a 100 percent requirement (unanimity). The simple majority rule is the most common within this range, although other fractions, such as extraordinary majorities, are equally possible. Moreover, a decision mechanism can employ a number of these rules simultaneously to aggregate individual decisions on different issues (Buchanan and Tullock,).

The specificity aspect of the aggregation rules deals with the possibility for combining issues for a single decision.[2] Individual decisions regarding single issues are feasible, of course, but aggregation rules may force individuals to consider simultaneously many issues, sometimes unrelated, when enacting group outcomes. In the extreme, specific group actions can be completely obscured during the voting process, as when decision makers are restricted to casting votes on ideological symbols. Decisions on specific issues are made in another part of the mechanism.

Aggregation rules constrain the ability of individuals in a decision mechanism to advance personal welfares within the group context. The

constraint is presented here as a general condition affecting all decision makers in the mechanism. The general level of individual influence on group outcomes is inversely related to each of the constraints imposed by the aggregation rules. The constraint exercised by the proportion of decision makers required for enactment is diagrammed in Figure 3. The vertical axis measures the individual's influence, and the horizontal axis measures the percent of the group required for enactment. Curve AA shows the relationship between the percent required for enactment and the individual's influence on enactment. Curve AA begins at a high level of influence corresponding to a rule that permits a single individual to enact a change. This could represent a decision by a single consumer purchasing an item in the market place or a decision by a dictator enacting policy for a group. The curve falls rapidly to the right showing that individual influence declines steeply as individuals' decisions are aggregated with decisions by others to enact change. Gradually the rate of decline diminishes as the group of aggregated decision makers grows larger. Minimum individual influence, (maximum individual constraint) is reached at the point where 100 percent of the members must agree before change is enacted.

Mirroring this relationship is the influence that individuals have in preventing change. Figure 4 measures this influence along Curve BB. When a single individual can enact change for all decision makers -- the extreme left of the diagram -- individual influence to prevent change is at a minimum. This influence rises toward the right, gradually at first then more steeply, as the percent of members required to enact change increases. Individual influence on preventing change is maximized at the point of a 100 percent requirement, where a single individual, like a dictator, can veto a group decision.

Curves AA and BB slope in opposite directions, but their shapes are otherwise identical; intersection, thus, occurs at the 50 percent point. At that point, which is in the vicinity of a simple majority rule, the individual's influences on enacting and preventing change are equal. At rules less than a simple majority, Point A for example, the individual's influence on enactment (Ea) is greater than influence on prevention (Pa). At extraordinary majorities, such as Point B, the influences are reversed. Individual influence on enactment measures Eb and the influence on prevention measures Pb. The difference between the two influences increases with the distance from the 50 percent vote level.

The individual's total influence (enactment plus prevention) is illustrated by the broken curve, which is the vertical summation of AA and BB. Figure 4 shows that total influence is maximized (constraint is minimized) at the two extremes, and total influence is minimized (total constraint is maximized) at the 50 percent voting rule.

Stipulating a quorum of anything less than the entire membership of the group has the effect, when combined with the enactment requirement, of creating a range of constraint on individual's influence. Figure 4 implies a 100 percent quorum if the horizontal axis corresponds to the number of eligible voters in a decision mechanism; a 51 percent requirement for enactment means 51 percent of eligible voters. If the quorum is less than the total number of eligible voters, the requirement for enactment, while still at 51 percent, is possibly shifted to the left of 51 percent in Figure 4, depending on the number of eligible voters who actually vote. The maximum shift depends on the ratio of the quorum to eligible voters -- the smaller the ratio the greater the shift.

With the introduction of a quorum, the individual voter's influence on enactment and prevention at any given voting requirement depends on the voter turnout. If the quorum in Figure 4 is 50 percent and the voting requirement is 51 percent, the individual's total influence will range as high as Tq, with only a quorum deciding, and as low as Tm, with a 100 percent turnout. Lower quorums increase this range, and higher quorums reduce it.

Figure 4 implies a given number of eligible voters, but the diagram can be modified to show the effect of different group sizes. See Figure 5. This is done by specifying on the influence curves the number of individuals (N) eligible to participate in the decision. Curves AA and BB, for example, show that N equals 1,000. As the number of eligible voters decreases, the individual influence curves shift upward. Curves A'A' and B'B' drawn with N equal to 500 are twice the vertical distance at each voting requirement as curves AA and BB. Individual influence doubles as the group size is cut in half. This is also reflected in the total influence curves as illustrated by TT and T'T'. Individual influence is increased (constraint is reduced) in proportion to the reduction in the number of eligible voters.

Constraint imposed by the specificity of the voting issue is a straightforward function of the number of uses combined for a single vote. The individual decision maker's influence on the outcome is maximized in a single issue votes and becomes increasingly diffused with the addition of issues. Constraint on the individual decision maker, therefore, increases with the number of issues decided by a single vote. At some large number of combined issues the individual decision maker's influence on a particular outcome becomes negligible.

Discussion of the aggregation suggests that the constraints imposed by the various rules be indexed according to some measure of individual influence. A precise index involves weighting the various aspects of the aggregation rules and requires analysis beyond the scope of this paper; thus, present discussion assumes the weights are equal. A matrix results with aggregation rules classified as yielding high, medium, or low general influence on the mechanism's outcomes and as biased toward enacting or preventing change or as unbiased.

Figure 6 shows such a matrix, with the individual decision maker's general level of influence distinguished by the columns and the bias of the influence distinguished by the rows. A mechanism with a smaller number of eligible voters, an extraordinary majority voting rule, a 75 percent quorum, and specific voting issues would exist in Cell 1. The smaller number of voters and the specific voting issues classifies the mechanism as yielding generally high individual voter influence. The extraordinary majority voting rule and the high quorum combine to bias the influence toward preventing change.

A change to nonspecific voting issues reduces the general level of voter influence tending to cancel the effect of the small number of eligible voters and, thereby, shifting the mechanism leftward in the matrix to Cell H. An additional change to a simple majority voting rule would shift the mechanism upward to Cell E, where the individual voter's influence is generally medium and unbiased toward enacting or preventing change. A reduction in quorum permits the mechanism to slide between Cells E and B depending on voter turnout. High turnout puts the mechanism in Cell E, and low turnout puts the mechanism in Cell B. The addition of increasing the number of eligible voters shifts the mechanism into the low influence column.

Figure 6

Bias of the Influence	Level of Individual Influence: Low	Medium	High
Toward Change	A	B	C
Neutral	D	E	F
Toward Prevention	G	H	I

Position Rules

The distribution of decision making authority is an important characteristic of decision mechanisms. This aspect appeared in previous discussion about the proportion of numbers in a mechanism eligible to vote. A major function of decision mechanisms is to determine which individuals have the authority to make which decisions.

John R. Commons ( ) provides guidance for investigating this characteristic of decision mechanisms with his concepts of authoritative and authorized transactions among individuals within institutional arrangements. Authoritative transactions distinguish officials from citizens by describing officials' power versus citizens' liabilities, and authorized transaction distinguish among citizens by describing each citizen's right versus another citizen's duty. Officials' power and citizens' liabilities are correlative, as increases in officials' power corresponds directly to increases in citizens' liability to officials' decisions. Citizen rights and duties are also correlative, as increases in rights corresponds directly to increases in the duty of others to respect those rights. Commons understood authoritative and authorized transactions as interdependent, so that patterns in the power-liability correlatives interact with patterns in the rights-duties correlatives. (See V. Ostrom, 1976.)

Commons's concepts are useful for specifying the position rules of a decision mechanism, particularly as the rules develop from formal constraints on decision making authority. Decision mechanisms, through assignment of official positions versus the positions of ordinary members, create unequal distributions of authority to make decisions.

The degree of inequality is indicated in the power-liability patterns stemming from the manner in which officials assume office, the number of officials relative to the number of members, authority relationships among officials, and the extent to which official decisions are subject to member vetoes. Power-liability patterns are also determined by relationships among different decision mechanisms, when decisions by officials in one mechanism are subject to review or veto by decisions in another mechanism.

Constraint on officials' power tends to strengthen as officials are subject to election by members of the mechanism, and the constraint increases with the frequency of those elections and the extension of suffrage. Members can turn officials from office when those officials attempt to expand their power at the expense of the mechanism's membership. Constraint also increases with the imposition of checks and balances among officials, where decisions by some officials are countered by other officials in the mechanisms. And the constraint is further increased, if officials in these counterbalancing positions are also independent of each other in selection and reward procedures for the various offices. Officials in such positions are not encouraged to work in concert against the interests of the membership.

The number of officials relative to the number of members tends to relate non-monotonically to the degree of constraint on official power. Initially constraint increases with increases in the number of officials, as each official represents smaller proportions of the membership, each represented individual, therefore, exerts greater influence on the representation and has a incentive to monitor the representative's

official decisions. But after reaching some critical size, the decision making body within the mechanism becomes unwieldy and individual officials' power is diffused. Large numbers of officials in large decision making bodies become redundant and powerless, and decision making authority gravitates to a few officials. Constraint on official power in small decision mechanisms, then, is more effective as the ratio of officials to members increases, but this constraint weakens in large decision mechanisms after the number of officials reaches the critical level.

Vincent Ostrom (1976) argues that the degree to which official decisions are subject to veto by the mechanism's members is a very important constraint on officials. This constraint prohibits officials who make the operational decisions in a mechanism from rising above the governing effects of those decisions. Constraint on officials' power increases in those mechanisms with increased possibilities for such vetoes.

But decision making authority is also determined informally, in ways distinct from the designation of official positions. Formal authoritative and authorized transactions in decision mechanism are modified by the distributions of other constraints in the rules configuration. Earlier remarks noted that all individuals are not affected to the same degree by the rules. Rules generally imposing strict constraints may be lax for some individuals, and rules generally imposing lax constraints may be strict for some individuals. Boundary rules, information rules, rules establishing decision points, and aggregation rules all may be distributed in non-uniform patterns across members of the

mechanism. Such non-uniformity is included here as an important aspect of the position rules. Individuals favored in the distribution assume pseudo-official positions in the decision mechanism. That this aspect is not usually developed in the formal designation of official positions is the reason for identifying the distributions as informal position rules.

The formal and informal aspects of the positions rules may, but need not, develop mutually reinforcing patterns. Officials' power will be augmented by non-uniform distributions of constraints in the other rules when officials are favored relative to ordinary members by lax constraints. If officials can exit the decision mechanism more easily than other members can, officials can exercise the threat of exit more readily and thereby shift decisions toward more favorable results for themselves. Officials may also have easier access to information than other members of the mechanism thereby increasing the decision making effectiveness of officials relative to members. Officials may even be able to trade their store of information for increased power over members, or officials may withhold information to increase members' difficulty of access. Officials may also have easier access to additional decision points inside and outside the decision mechanism increasing officials' chances for decisions favorable to themselves. And officials may exercise votes that carry heavier weights in the aggregation process than the votes of ordinary members, again increasing the opportunity for officials to glean favors in group decisions.

Whatever the method, the informal aspects of position provide opportunity for shifting the power-liabilities pattern between officials

and members. Officials through their formal and informal power are able to manipulate authorized transactions among members, increasing the rights of some members and the duties others. Members, therefore, have incentives to trade immunities, which translate to increased power to officials, for increased rights relative to other members. This is an important aspect of discrimination. Such trades mean increased member liabilities to officials' actions, but these losses may be less than the gains to members with increased rights. Officials may even be able to induce various members into competitive bidding for such trades.

Alternatively, formal and informal position rules may check each other. This occurs when selected members of the decision mechanism are favored relative to officials by non-uniform distributions of constraint imposed by other rules in the configuration. These individuals may have especially easy exit possibilities and thus possess an especially credible threat to exit when dissatisfied with officials' decisions. This threat can be parlayed into favorable treatment in officials' decisions. Or these favored individuals may have unusually easy access to information, which they can use to improve their treatment in the officials' decisions. Similarly, advantages to these individuals in access to a variety of decision points or in voting influence can be used to direct officials' decisions.

Such members can potentially decrease their liabilities to officials' decisions and to prevent this officials will redistribute rights toward these individuals in return for assurance that official power will be maintained. Weaker members of the decision mechanism may even perceive this bargaining between officials and the stronger members as an additional

decision point in the mechanism and being to regard the stronger members as competing officials. When this happens, transactions between members become pseudo-official transactions and in Commons's terminology shift from the authorized to authoritative category.

Both formal and informal position rules are relevant to the allocation of decision making authority within a mechanism; thus, an index is required to characterize the balance among the various constraints on such authority. The discussion suggests that a common element in all of the authority constraints is the equality of the distribution among the members of the mechanism. The exact manner in which these constraints balance requires more analysis than can be developed at this point, but their interactions can generally be summarized with the aid of Figure 7.

Figure 7 is a Lorenz diagram measuring the percent of total group membership along the horizontal axis and the accumulated percent of the mechanism's decision making authority along the vertical axis. If members are arrayed in ascending order of decision making authority, a single curve can be generated from both the formal and informal position rules to show the equality of decision making authority within the mechanism. The broken diagonal shows perfect equality. The first 25 percent of the membership possesses 25 percent of the total authority; the first 50 percent of the membership possesses 50 percent of the total authority, and so on. The more usual case will be something less than perfect equality.

A perfectly uniform distribution of constraints in the rule configuration combined with strong formal constraints, such as frequent elections,

checks and balances in the relationships among officials, and numerous veto opportunities for members would produce a fairly equal distribution of authority among members of the mechanism. This is shown with the solid curve. Introduction of non-uniformity in the distribution of constraints, while leaving the formal positions unchanged, produces either broken or solid curve in Figure 8. The appropriate curve depends on the individuals favored in the non-uniform distribution of constraints. If the individuals are officials, the formal and informal position rules are mutually reinforcing. The distribution of authority is thereby made less equal than when the favored individuals are among the ordinary members of the mechanism. The first case give the solid line, and the second the broken line.

Non-uniform distribution of constraints combined with weak formal constraints tends to decrease equality in the distribution of authority. Representative patterns are shown in Figure 9. The solid curve shows the distribution when the formal and informal position rules are mutually reinforcing -- officials, relatively unchecked by formal position rules are also favored by the informal rules. The broken curve shows the distribution when informal position rules authority with favored members in the mechanism. Authority of unfavored members is also redistributed to the favored members, as shown by the relative positions of the curves toward the left side of the diagram.

Rule Configurations

The purpose for designating sets of rules essential to decision mechanisms is to develop an apparatus that shows how mechanisms differ from one another. The apparatus is to help predict behavioral differences among the various mechanisms. If rules guide behavior, then changes in rules should result in different behaviors.

Prior discussion identifies five essential sets of rules, each set governing a particular aspect of decision making within the arrangement by constraining the choices to individuals. As noted, the constraint exercised by each rule set ranges over a continuum, but for purposes of the configuration matrix these constraints are dichotomized. Entry and exit rules are characterized as either lax or strict, information rules as permitting easy or difficult access, aggregation rules as yielding high or low individual influence with the influenced biased toward enacting or presenting change; decision points as permitting access to many or few opportunities to influence decisions, and position rules as producing equal or unequal distributions of authority. Such classification produced a rule matrix with 128 unique configurations shown in Figure 10.

The matrix appears complicated, but is simple to use. Furthermore, additional analysis will probably indicate that some of the configurations are especially unstable, suggesting that classification of decision mechanisms in some of the matrix cells is only transitory, thus not worth much attention. The variety of configurations for analytical purposes would, then, be less than 128.

The matrix is used by pairing configurations according to a ceteris paribus procedure, where all rule sets, except one, maintain a single

constraint condition. Thus, the decision mechanism described by rule Configuration 2 is paired with Configuration 10, showing that constraints on entry into the mechanism shift from lax in Configuration 2 to strict in Configuration 10. Other constraints retain their conditions, for their conditions are the same in both configurations. Exit constraints are lax, information constraints permit easy access to information, participants can select among a variety of decision points, participants exert relatively low individual influence in the voting process with that influence biased toward enacting change, and decision-making authority is distributed among individual members in markedly unequal manner. A ceteris paribus change in exit constraints is shown by a comparison between Configurations 2 and 66. A ceteris paribus change in information constraints is shown by a comparison between Configurations 2 and 6. A ceteris paribus change in the variety of decision points is shown by a comparison between Configurations 2 and 1. A ceteris paribus change in the aggregation constraints is shown by a comparison between Configurations 2 and 34, or 2 and 4, depending whether the change affects the level of individual influence or the bias of the influence. And a ceteris paribus change in the distribution of authority is shown by a comparison between Configurations 2 and 18.

The matrix, of course, permits non-ceteris paribus comparisons as well. Configurations 2 and 127, for example, can be compared showing that all constraints change condition. Entry conditions shift from lax to strict, exit conditions from lax to strict, information constraints from easy to difficult, individual voting influence from low to high, the bias of that influence from enactment to prevention, the number of decision points

from many to few, and the distribution of decision-making authority from unequal to equal. Comparisons of such comprehensive difference in rule configurations, however, are difficult to use analytically.

Footnotes

[1] Past economic modeling of choice avoided the problem of information by assuming it away. Many economic models of choice are based on an assumption of perfect information.

[2] This aspect could also be considered a part of information rules or even an element of position rules. Specificity of voting issues is included in the aggregation rules because the effect specificity has on the general level of individual decision maker's influence on outcomes within a mechanism.