A Grammar of Institutions

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A GRAMMAR OF INSTITUTIONS

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*T*he institutional grammar introduced here is based on a view that institutions are enduring regularities of human action in situations structured by rules, norms, and shared strategies, as well as by the physical world. The rules, norms, and shared strategies are constituted and reconstituted by human interaction in frequently occurring or repetitive situations. The syntax of the grammar identifies components of institutions and sorts them into three types of institutional statements: rules, norms, and shared strategies. We introduce the grammar, outline methods for operationalizing the syntax, apply the syntax to an analysis of cooperation in collective dilemma situations, and discuss the pragmatics of the grammar for analyses of behavior within complex institutional settings.

The core of traditional political science was the study of institutions and of political philosophy. The behavioral revolution swept both aside and focused political scientists on the study of political behavior. Then came the onslaught of rational choice theory. To the surprise of political scientists, these efforts concluded that many fond beliefs about the effects of institutions lacked firm theoretical foundations based on individual choice. The past decade has witnessed a flurry of new scholarship in the rational choice tradition flying the banner of "The New Institutionalism." The flood of work produced in this tradition facilitates a return to the core of the discipline, namely institutions and the nature of political orders.

Renewed interest in institutions has, however, generated a simmering theoretical debate about what institutions are. The debate is healthy and likely to lead to a clarification of core concepts used in political science. The institutional grammar introduced here is based on a view that institutions are enduring regularities of human action in situations structured by rules, norms, and shared strategies, as well as by the physical world. The rules, norms, and shared strategies are constituted and reconstituted by human interaction in frequently occurring or repetitive situations.[1] Where one draws the boundaries of an institution depends on the theoretical question of interest, the time scale posited, and the pragmatics of a research project. One example of an institution encompasses the regularities of action and outcomes in the U.S. Congress. Another limits the focus to only one house or one committee or subcommittee. Likewise, analysis of institutional statements can target broad prescriptions (e.g., Congress may pass legislation regulating interstate commerce) or focus on a narrower prescription (e.g., a cloture rule). We shall introduce a grammar that provides a theoretical structure for analysis of the humanly constituted elements of institutions (i.e., rules, norms, and shared strategies).

INSTITUTIONS

Several approaches have been taken to answer the question, What is an institution? One major approach to this question is the *institutions-as-equilibria* approach drawing on the work of Menger (1963) and von Hayek (1945, 1967) for its intellectual foundations and Schotter (1981), Riker (1980), and Calvert (1992) for contemporary views. Works in this approach focus on the stability that can arise from mutually understood actor preferences and optimizing behavior. Scholars in this tradition treat these stable patterns of behavior as institutions. Lewis (1969), Ullmann-Margalit (1977), and Coleman (1987) articulate an *institutions-as-norms* approach. A third approach, the *institutions-as-rules* approach, draws on Hohfeld (1913) and Commons (1968) for its roots and Shepsle (1975, 1979, 1989), Shepsle and Weingast (1984, 1987), Plott (1986), Oakerson and Parks (1988), North (1986, 1990), E. Ostrom (1986, 1990), V. Ostrom (1980, 1987, 1991, n.d.), Williamson (1985), and Knight (1992) for contemporary developments. The institutions-as-norms and institutions-as-rules approaches both focus on linguistic constraints (spoken, written, or tacitly understood prescriptions or advice) that influence mutually understood actor preferences and optimizing behavior.

All three approaches offer institutional explanations for observed regularities in the patterns of human behavior. The differences among the approaches relate primarily to the grounds on which explanations for observed regularities rest. Viewing institutions as equilibrium behavior rests on an assumption that rational individuals, interacting with other rational individuals, continue to change their planned responses to the actions of others until no improvement can be obtained in their expected outcomes from independent action. To understand why regularized patterns of interaction exist, one needs to ask why all actors would be motivated to produce a particular equilibrium.

There are important philosophical reasons for look-ing at institutions as equilibria. This view places the responsibility for a social order on the individuals who are part of that order, rather than on some external "state" or "third-party enforcer." It inte-grates analysis of behavior *within* institutions with analysis of how institutions come into being. By focusing on mutually understood actor expectations, preferences, and optimizing behavior, the analyst can examine institutions that do not require outside en-forcement nor irrational commitments to following rules. An institution can be viewed as no more than a regular behavior pattern sustained by mutual expec-tations about the actions that others will take: "The institution is just an equilibrium" (Calvert 1992, 17).[2] Starting from this position, one avoids the trap of reifying institutions by treating them as things that exist apart from the shared understandings and re-sulting behavior of participants.

While the institutions-as-equilibria approach offers advantages, disadvantages exist as well. Stable out-comes resulting from shared understandings about the appropriate actions for a particular situation are all treated as if they had similar foundations. Lump-ing together all shared understandings fails to clarify the difference between shared advice based on pru-dence, shared obligations based on normative judge-ments, and shared commitments based on rules created and enforced by a community.

The grounds for looking at institutions as norms rest on an assumption that many observed patterns of interaction are based on the shared perceptions among a group of individuals of proper and improper behavior in particular situations. To understand why some regularized patterns of interaction exist, one needs to go beyond immediate means-ends relation-ships to analyze the shared beliefs of a group about normative obligations. The grounds for looking at institutions as rules rest on an assumption that many observed patterns of interaction are based on a com-mon understanding that actions inconsistent with those that are proscribed or required are likely to be sanctioned or rendered ineffective if actors with the authority to impose punishment are informed about them. To understand regularized patterns of interac-tion affected by rules, one needs to examine the actions and outcomes that rules allow, require, or forbid and the mechanisms that exist to enforce those rules.

The three approaches are not mutually exclusive. All start from the individual and build social orders on individualistic and situational foundations. The first approach focuses more on the regularities of outcomes in structured situations. The other two focus on linguistic constraints that influence these regularities. If one slightly refocuses the institutions-as-equilibria approach to one of institutions-as-equi-librium-strategies or, more generally, institutions-as-shared-strategies, the three approaches can be directly compared. Focusing on shared strategies shifts the emphasis away from the outcomes obtained and back to the shared understandings and expecta-tions that influence behavior leading to outcomes. In all three cases, then, constraints and opportunities can be articulated as institutional statements. Each approach, in our view, focuses on a different type of constraint or opportunity.

In light of the merits of each approach, we propose not to argue about whether institutions are rules, norms, or strategies. We use the broad term *institu-tional statement* to encompass all three concepts. *Insti-tutional statement* refers to a shared linguistic con-straint or opportunity that prescribes, permits, or advises actions or outcomes for actors (both individ-ual and corporate).[3] Institutional statements are spo-ken, written, or tacitly understood in a form intelli-gible to actors in an empirical setting. In theoretical analyses, institutional statements will often be inter-pretations or abstractions of empirical constraints and opportunities. We develop a grammar of institutions as a theory that generates structural descriptions of institutional statements.[4] The syntax of this grammar operationalizes the structural descriptions; it identi-fies common components of institutional statements and establishes the set of components that comprise each type of institutional statement. We shall focus primarily on the syntax of the institutional grammar and only briefly discuss semantics and pragmatics.

Three disclaimers apply. First, we do not argue that the institutional statements explaining behavior are always articulated easily and fully by participants. Knowledge of institutional statements is often habit-uated and part of the tacit knowledge of a commu-nity. Moreover, we do not assume that all individuals recognize the existence of an institutional grammar and explicitly use it to formulate institutional state-ments. Second, a statement that fits the grammatical structure is not necessarily a meaningful or signifi-cant institutional statement.[5] Third, to explain behav-ior in institutions, one needs to combine the grammar of institutions with a theory of action, just as to understand a language one requires a grammar and a theory of language use (Chomsky 1965, 9). The theory of action animates the structural model of a situation generated by the grammar and by relevant attributes of a physical world (Popper 1967).

The grammar facilitates analysis of the content of institutional statements of distinctions among types of institutional statements, and of the evolution of institutional statements. As with any grammar, its application to existing statements sometimes yields tough judgement calls and counterexamples. The principles that guide the identification of components and the classification of statements cannot eliminate all ambiguity.

THE SYNTAX OF A GRAMMAR OF INSTITUTIONS

The general syntax of the grammar of institutions contains five components: ATTRIBUTES, DEONTIC, AIM, CONDITIONS, and OR ELSE. The five letters (ADICO)

provide a shorthand way of referring to the components. Regardless of how institutional statements are expressed in natural language, they can be rewritten in the ADICO format, where:

A ATTRIBUTES is a holder for any value of a participant-level variable that distinguishes to whom the institutional statement applies (e.g., 18 years of age, female, college-educated, 1-year experience, or a specific position, such as employee or supervisor).

D DEONTIC is a holder for the three modal verbs using deontic logic: *may* (permitted), *must* (obliged), and *must not* (forbidden).

I AIM is a holder that describes particular actions or outcomes to which the deontic is assigned.

C CONDITIONS is a holder for those variables which define when, where, how, and to what extent an AIM is permitted, obligatory, or forbidden.

O OR ELSE is a holder for those variables which define the sanctions to be imposed for not following a rule.

All shared strategies can be written as [ATTRIBUTES] [AIM] [CONDITIONS] (AIC); all norms can be written as [ATTRIBUTES] [DEONTIC] [AIM] [CONDITIONS] (ADIC); and all rules can be written as: [ATTRIBUTES] [DEONTIC] [AIM] [CONDITIONS] [OR ELSE] (ADICO). The syntax is cumulative: norms contain all of the components of a shared strategy plus a DEONTIC; rules contain all the components of a norm plus an OR ELSE.[6]

In linguistic terms, the components operate as phrasemarkers and the AIC, ADIC, and ADICO are the basis of shared strategies, norms, and rules respectively (see Chomsky 1965, 17). Linguists focus on the transformations that create spoken sentences from base strings. Institutional analysts will focus more on transforming rules and norms as practiced in ongoing situations to base strings in order to capture the core advice or prescription of the institutional statement in use. The ability to translate existing institutional statements and formal representations of institutional statements into an established format provides many advantages for comparison, analysis, and synthesis that we discuss throughout.

To ease the discussion of the syntax components, we refer throughout to the following examples:

1. All male U.S. citizens, 18 years of age and older, must register with the Selective Service by filling out a form at the U.S. Post Office or else face arrest for evading registration.

2. All senators may move to amend a bill after a bill has been introduced, or else the senator attempting to forbid another senator from taking this action by calling him or her out of order will be called out of order or ignored.

3. All villagers must not let their animals trample the irrigation channels, or else the villager who owns the livestock will be levied a fine.

4. All neighborhood residents must clean their yard when the neighborhood organization organizes a major neighborhood cleanup day.

5. The person who places a phone call calls back when the call gets disconnected.

ATTRIBUTES

All institutional statements for a group apply to a subset of participants from that group. The subset can range from one participant to all participants of the group. A set of ATTRIBUTES establishes the subset of the group affected by a particular statement. If individuals make up the group, the ATTRIBUTES will be individual-level values. Individual-level ATTRIBUTES include values assigned to variables such as age, residence, gender, citizenship, and position. When members of a group governed by a set of institutions are corporate actors, rather than individuals, the ATTRIBUTES are organizational variables (e.g., size of membership, geographic location, or ownership of the residuals). In the first example, the relevant ATTRIBUTES are male, citizen of the United States, and over 18 years old. In the last example, the ATTRIBUTE is the caller who placed the call. The other examples list no specific attribute. When no specific attribute is listed, the default value for the ATTRIBUTES component is all members of the group.[7] This means that the ATTRIBUTES component always has something in it, even when a specific attribute is not contained in the statement. Thus the second example applies to all senators in a legislature, and the third example applies to all villagers in a particular village.

DEONTIC

The DEONTIC component draws on the modal operations used in deontic logic to distinguish prescriptive from nonprescriptive statements (see Hilpinen 1971, 1981; Wright 1951). The complete set of DEONTIC operators (D) consists of permitted (P), obliged (O), and forbidden (F). Institutional statements use the operative phrases *may*, *must*, and *must not* to assign these operators to actions and outcomes. Thus the statement that all members *may* vote assigns the DEONTIC permitted, P, to the action of voting. We represent the assignment of a DEONTIC operator to an action $[a_i]$ as $[D][a_i]$, where D stands for P, O, or F. Similarly, $[D][o_i]$ represents the assignment of a deontic to an outcome.[8]

The three DEONTIC operators are interdefinable (von Wright 1968, 143). If one of the deontics is taken as a primitive, the other two can be defined in terms of that primitive. For example, let us use P as a primitive. $[P][a_i]$ would be read, "One is permitted to do a_i" or "One *may* do a_i." The statement that an act is forbidden $[F][a_i]$ can be restated using P as the primitive as $[\sim P][a_i]$. In other words, when $[a_i]$ is forbidden, one is not permitted to do $[a_i]$. On the other hand, if the negation of an action $[\sim a_i]$ is forbidden, one is obliged to take the action. The statement that an act must be done, $[O][a_i]$, can be defined as $[\sim P][\sim a_i]$. If an action is obligatory, one is not permitted not to do $[a_i]$. Alternatively, we could use F as the primitive. Then $P[a_i]$ can be defined as $[\sim F][a_i]$, and $O[a_i]$ can be defined as $[F][\sim a_i]$. With O

as the primitive, $P[a_i]$ can be defined as $[\sim O][a_i$ or $\sim a_i]$, while $F[a_i]$ can be defined as $[O][\sim a_i]$. Interdefinability also exists for prescriptions that refer to outcomes instead of actions. Any prescription with a DEONTIC assigned to some outcome, o_i, can be restated using either of the other two DEONTIC operators.

The meaning of the deontics obliged (*must*) and forbidden (*must not*) fit well into most conceptions of normative statements. The meaning of permitted (*may*) is more perplexing (Schauer 1991). Susan Shimanoff, for example, concludes that "it is incongruous to talk of rules prescribing behavior which is merely permitted" (Shimanoff 1980, 44). However, statements that assign permission (*P*) to an action are meaningful in at least two ways. In many instances, assigning a *may* to an action is the equivalent of "constituting" that action (Searle 1969). For example, a law stating that an individual may vote in an election is meaningful. It creates an action—voting— that did not exist before. Permission establishes qualifications for positions (i.e., who may vote and who may hold offices). Furthermore, when one speaks of a "right" to take an action or effect an outcome, the person with the right is permitted (rather than required or forbidden) to take that action or effect an outcome. Others, who have a duty to recognize that right, are the ones who are forbidden or required to take actions or effect outcomes.[9]

The interdefinability of deontics plays a key role in unraveling another meaning of permission. Any rule or norm that assigns permission, *P*, can be restated using the logical equivalent $\sim F$. If an action is permitted, then that same action is not forbidden. Those who share a common understanding of that institutional statement recognize that the action is not forbidden. Measures that would be taken to prevent that action—or to react to that action as if it were forbidden—are no longer acceptable. In other words, any institutional statement that assigns *may* or *not forbidden* to an action implies that at least some action that could otherwise be taken by others to prevent or punish the permitted action is forbidden. In the second example, senators must not treat the action of amending a bill as a forbidden action. The OR ELSE indicates the institutional consequence of attempting to treat the permitted action as forbidden (the senator is called out of order or ignored).

The assignment of $\sim F$ operates in a similar manner in institutional statements without an OR ELSE. Consider a legislative body that shares an institutional statement like the following: [All junior members] [*P*] [contest senior members] [in committee hearings]. This is the equivalent to [All junior members] [$\sim F$] [contest senior members] [in committee hearings]. This prescription implies a prescription on senior members not to reprimand or castigate junior members who challenge them in committee hearings. The existence of such a norm does not ensure that all senior members will follow it. However, there will be a shared notion that a rebuke based on seniority alone is inappropriate or unacceptable. If a senior member reprimands a junior member for challenging him or her, then we would expect the junior member to invoke the grant of permission to defend against the senior member's actions. It means something for the junior member to say, "Everyone here knows that I am permitted to challenge senior members in committee hearings."

AIM

The AIM is the specific action or outcome to which an institutional statement refers. Anything thought of as an AIM must be physically possible (von Wright 1963). An individual cannot logically be required to undertake a physically impossible action or effect a physically impossible outcome. Further, in order for any action to be conceived of as an AIM, its negation [$\sim a_i$ or o_i] must also be physically possible. In other words, including an action or outcome in the AIM component implies that it is avoidable. Thus the capability of voting implies the capability of not voting. Voting for candidate A implies the option of not voting for candidate A.

In the first example given earlier, the AIM is the action of registering for the Selective Service and the DEONTIC operator required, *O*, is assigned to the action for all individuals with the ATTRIBUTES listed in the rule. In the second example, the AIM is the action of offering a motion to amend a bill, the DEONTIC operator is *P*, or permitted for all senators. The AIM in the fourth example also includes an action. The norm requires the action of cleaning up the yard. The third example assigns the DEONTIC *F* to the outcome of livestock damage. The AIM of the rule does not specify actions that an irrigator must, may, or may not take. The AIM only specifies the forbidden outcome. Villagers may select any actions that are not forbidden by another rule to keep their livestock from damaging the irrigation channel. In the fifth example, the AIM is the action of calling back.

CONDITIONS

CONDITIONS indicate the set of variables that define when, where, and how an institutional statement applies. The CONDITIONS for a statement might indicate when a statement applies, such as during certain weather conditions or at a particular stage in the legislative process. Likewise, the CONDITIONS might indicate where a statement applies (e.g., within a particular jurisdictional area) or how a statement is to be followed (e.g., through a defined process). If an institutional statement does not specify a particular condition, the default value for the condition is "at all times and in all places." Thus, like the ATTRIBUTES, the CONDITIONS component always has some value, regardless of whether an institutional statement overtly specifies conditions.

The CONDITIONS component in the first example states how the statement is to be followed, namely, by filling out a form at the U.S. Post Office. It does not restrict when or where the statement applies. The

CONDITIONS component in the second and the fourth example indicate when the prescription applies. After a bill has been introduced, the prescription of the second rule applies. Any senator may move to amend a bill after it has been introduced. The fourth example applies on the days designated as cleanup days by a neighborhood organization, and the fifth example applies when a phone call is disconnected. The third example does not specify any specific CONDITIONS. We assume that the rule applies for members of the village at all times and in all places with no additional restrictions on how the rule is to be followed.

OR ELSE

The final component of our institutional syntax, the OR ELSE, is the sanction assigned to detected noncompliance with an institutional statement. Only rules include this component. The content of the OR ELSE affects the very nature of a rule. Rowe (1989) discusses the difference between a speed-limit law with minor sanctions and a speed-limit law with a severe penalty as the sanction. The prescription is the same. For both laws, the severity of the sanction in the OR ELSE is the only difference, but expected behavior is different.[10]

In order for threats associated with prescriptions to qualify as an OR ELSE, they must meet three qualifications. First, the threat must be backed by another rule or norm that changes the DEONTIC assigned to some AIM, for at least one actor, under the CONDITIONS that an individual fails to follow the rule to which the threat applies. The rule or norm backing an OR ELSE establishes both a range of punishments available and assigns the authority and procedures for imposing an OR ELSE. Often the actions threatened in the OR ELSE are forbidden under most CONDITIONS (e.g., imposing a fine, incarcerating a citizen, or putting someone's livestock in a village pen). The prescription backing the OR ELSE makes these actions permitted in the CONDITION that someone breaks a rule. However, the shift in the DEONTIC is not always from F to P or O. The OR ELSE might involve forbidding some action that is usually permitted or obligatory, a shift from P or O to F. For example, a license branch official could be forbidden to issue a drivers license to a citizen after that citizen has been convicted of repeated drunken driving offenses. Although the OR ELSE often refers to physical punishments, the OR ELSE may also refer to institutional actions such as taking away a position or refusing to accept an amendment as legal. For example, one of the rules governing the amendment process could state that legislators with [ATTRIBUTES] [must] [obtain positive votes from at least a majority] [when voting for an amendment] or [the amendment fails].

Second, institutional statements must exist that affect the constraints and opportunities facing actors who monitor conformance to the prescription. Monitoring institutions may assign these tasks to specialized individuals or authorize all participants to engage in these activities. Although the actors who monitor also frequently sanction nonconforming actors, they may only report nonconformance to someone else who is responsible for sanctioning.

Third, the OR ELSE must be crafted in an arena used for discussing, prescribing, and arranging for the enforcement of rules. This arena may be a legislature or a court, but we do not consider government sponsorship or government backing to be a necessary condition for an institutional statement to be a rule. Many self-organized, communal, or private organizations develop their own rules that include (1) sanctions backed by another rule or norm that change the DEONTIC assigned to some AIM for at least one actor under the condition that individuals fail to follow the rule and (2) institutional statements that affect the constraints and opportunities of actors to take the responsibility to monitor the conformance of others to the prescription.[11] For some research questions, it may be useful to divide rules into those made within governmental arenas and those made outside of government arenas. The syntax in no way prevents this distinction.

The first four examples have the syntax of a rule, if we assume that all three qualifications for the OR ELSES in these statements are met. For example, the potential punishment for villagers who let their livestock trample the irrigation channels qualifies as an OR ELSE only when a second rule or norm accepted in that village prescribes others to employ the sanctions defined in the OR ELSE, an institutional statement prescribes or advises monitoring, and these arrangements were made in a setting considered by the villagers to be a rule-making arena.

OPERATIONALIZING THE SYNTAX

All linguistic statements that explain shared strategies contain three of the syntax components (AIC), those that explain norms contain four (ADIC), and those that explain rules contain all five (ADICO). Parsing the five examples using F as the primitive DEONTIC yields the following:

1. U.S. citizens [age $\geq$ 18, gender = male] [F] [~(register with Selective Service)] [filling out form at U.S. Post Office] [face arrest].
2. Senators [all] [~F] [move an amendment] [after bill introduced] [called out of order or ignored].
3. Villagers [all] [~F] [irrigation channel trampled by their animals] [at all times] [fine].
4. Neighborhood residents [all] [F] [~(clean yard)] [organized cleanup day] [ ].
5. Person [placed call] [ ] [calls back] [call disconnected] [ ].

Now, how can the syntax be operationalized in empirical or theoretic research? In empirical studies, the researcher's task is to discover the linguistic statements that form the institutional basis for shared expectations that influence observed regularities in behavior. Essentially, this entails discovering which ADICO components exist in these statements and the

contents of those components. Determining the existence of a component requires knowledge about whether individuals in a group share some level of common understanding of its content. In the case of an OR ELSE, complementary institutional statements are needed, as well as evidence that individuals crafted the OR ELSE in a rule-making arena. Uncovering components requires qualitative research methods, including in-depth interviews or archival retrieval. Using the syntax to structure game-theoretic analysis requires the researcher to identify how the components of the institutional statements assumed in the game are reflected in the structure of a game and in the payoffs assigned to actions and outcomes.

Operationalizing the ATTRIBUTES, AIM, and CONDITIONS

The AIM usually supplies the focus for theoretical and empirical studies. Scholars decide to study the impact of institutions on behavior for some subset of actions or outcomes. Studies of agenda setting and voting institutions, for example, focus on institutional statements with AIMs that relate to setting agendas and voting. Once researchers select the focal set of actions or outcomes for their studies, the next step is developing the analysis of institutional statements with AIMs that relate to those actions or outcomes.

The existence of the ATTRIBUTES and CONDITIONS components is fairly straightforward; they always exist if an institutional statement exists. In some cases they exist in their most general form—all individuals or all organizations and under all conditions.[12] Discovering the contents of the ATTRIBUTES and CONDITIONS components requires the empirical researcher to inquire about the actors to whom particular institutional statements apply and the conditions under which they apply. The syntax reminds formal theorists that there are assumptions about ATTRIBUTES and CONDITIONS built into the games that they model. Game-theoretical models that are constructed to provide an institutional explanation for observed regularities of behavior make explicit assumptions about the ATTRIBUTES and the CONDITIONS included in the institutional statements of interest. Recognizing the implicit existence of these components helps scholars to discover and explicitly state those assumptions.

Operationalizing the DEONTIC

The first step in operationalizing the DEONTIC is deciding whether the institutional statement contains one. In empirical studies, the researcher listens for normative discourse. Is there an articulated sense of moral or social obligation expressed? If the individuals in a study share only AIC statements, then their discussion of why they would follow such advice focuses only on prudence or wise judgement: "The best thing to do when faced with a choice between A and B under condition Y is to choose A, because one is usually better off with this choice." When individuals shift to a language of obligation, they use terms

such as *must, must not, should,* or *should not* to describe appropriate behavior (Orbell, van de Kragt, and Dawes 1991): "The obligatory action when faced with a choice between A and B under condition Y is to choose A, because this is the proper action." In other words, one looks for institutional statements that are used to evaluate behavior (Collett 1977). When social and moral obligations are discussed, an empirical researcher initially assumes that it is appropriate to include a DEONTIC in institutional statements used to explain behavior.

When a DEONTIC exists, one expects negative repercussions to follow behaviors that do not conform to the prescription and positive rewards to follow compliance. We use a delta parameter concept to capture the costs or benefits of these inducements and deterrents for any particular DEONTIC. Usually, we expect the severity of the delta parameters to provide some indication of the importance or valence of the DEONTIC to the community.[13]

Delta parameters may reflect internal and/or external effects of a DEONTIC. The distinction between external and internal sources of delta parameters is similar to the one that Coleman (1987) makes between "internalized norms" and "externally sanctioned norms" and that Kerr and his colleagues (1994) make between a "personal" and a "social" norm. Delta parameters originating from external sources are a way to represent the benefits and costs of establishing a reputation (see Kreps 1990). The delta parameters originating from internal sources can be thought of as the guilt or shame felt when breaking a prescription and the pride or "warm glow" felt when following a prescription, particularly if it is costly to follow in a particular situation (Andreoni 1989; Frank 1988; Ledyard 1995).

If an action is forbidden by a norm and an individual engages in that action, then we expect that person to experience some type of cost represented by at least one delta parameter. If norms indicate that an AIM is *permitted,* then we expect others, who treat that action as if it were forbidden, to experience some cost. In other words, norms or rules that forbid or require some AIM will be reflected in a cost parameter to the individuals to whom the prescription applies, while prescriptions that establish permission for an action place the cost parameter on others. Others may experience a cost if they try to obstruct an individual when a shared norm indicates that the individual is permitted to take that action.[14]

Using delta parameters brings normative considerations overtly into the analysis of action and consequences, rather than employing ad hoc interpretations. Adding overt consideration of nonmaterial costs and benefits is not the same as assuming that individuals incorporate the welfare or utility of other actors into their own calculus; nor is it the same as substituting the collective benefits for individual utility. We prefer the delta parameter interpretation of "other" or "normative" motivation because it ties that motivation to institutions by representing individual commitments to the norms or rules of a

situation. Our preference for the delta parameter interpretation is bolstered by recent evidence that group discussion affects cooperation in social dilemma experiments in a manner that supports the logic of a delta effect and disputes a group identification effect (Kerr n.d.).

In field research, the deltas are frequently not observable, especially in situations where behavior prescribed by a norm is habituated. First, one may not observe any instances of nonconformance so that no opportunity exists to witness reactions to deviations. Second, few external rewards for conformance occur in situations where everyone expects conformance. In an empirical setting where one cannot observe repercussions or see tangible rewards, one has to rely primarily on the accounts that participants give as to the normative content of their actions and the repercussions of nonconformance.

In formal analyses, one can model the DEONTIC by adding delta parameters to the players' payoffs to represent the perceived costs and rewards of obeying (δ^o) or breaking (δ^b) a prescription. The delta parameters can be defined as:

$$\Delta = \delta^o + \delta^b, \text{ where}$$

Δ = the sum of all delta parameters

δ^o = the change in expected payoffs from obeying a prescription

δ^b = the change in expected payoffs from breaking a prescription.

One can further divide these rewards and costs into those that arise from external versus strictly internal sources of valuation. Thus:

$$\delta^o = \delta^{oe} + \delta^{oi} \text{ and } \delta^b = \delta^{be} + \delta^{bi}, \text{ where}$$

e = the change in expected payoffs originating from external sources

i = the change in expected payoffs originating from internal sources.

The analyst may not wish to focus on all four parameters in any particular analysis. Three of the four delta parameters could be assigned a zero value in a game-theoretic analysis involving a norm or a rule. In order to analyze the impact of a DEONTIC on expected outcomes of a game, however, at least one of the delta parameters must have a nonzero value. The payoff structures for individuals who share prescriptions must differ from those of players in a similar situation in which players merely accept a shared understanding of prudent action.

In situations where it is reasonable to assume that all players who break the prescription feel the same cost, the delta parameters can be modelled as if they were the same for all players and as if their magnitude is public information. Alternatively, the theorist can model players as being different types who react differentially to breaking prescriptions (see Harsanyi

1967–68). One type of player can perceive the costs of breaking a prescription (δ^{bi} or δ^{be}) to be high while another type perceives costs (δ^{bi} or δ^{be}) to be low. Coleman's (1988) zealot, for example, is a player with high external deltas for obeying norms (a high positive δ^{oe}).

The existence of a DEONTIC implies the presence of additional information that individuals use in developing their expectations about others' behavior and thus their own best response. If players all adopt a norm, the payoff structure differs from the payoff structure for a similar situation in which the players do not adopt a norm. The payoffs may even change enough so that the predicted outcome of the game changes. Uncertainty about the presence of actors who have accepted certain norms may be sufficient grounds for changing the behavior of other players. Kreps and his colleagues (1982) have analyzed repeated prisoner's dilemma games where information asymmetries exist among players concerning the probability that other players will play Tit-for-Tat.[15] In such games, players who are "perfectly rational" (i.e., the players' payoff functions have a zero value for all four delta components associated with playing Tit-for-Tat) will adopt behavior consistent with the norm for most of the game, due to their changed expectations about the behavior of others.

Operationalizing the Concept of OR ELSE

The criteria for indicating that an OR ELSE exists are (1) a known range of sanctions, (2) a norm or rule that prescribes sanctions, and (3) some provision for monitoring—all emanating from a rule-making arena. We wish to emphasize that the sanction in an OR ELSE differs from a logical consequence or an interpersonal threat or retaliation. Neither of these repercussions fit the OR ELSE criteria. In empirical analyses, researchers determine whether observed regularities in behavior are based on a shared understanding about the sanctions associated with a rule and whether there is a shared norm or rule that changes the DEONTIC associated with the sanctioning act for some player that can be traced to a rule-making arena. If so, explanations of behavior would consider the attitudes or feelings about following rules (the value of internal delta parameters), the reputation effects of compliance or noncompliance (the external delta parameters), the chance of being observed, the probability that the OR ELSE sanction would be imposed, and the size of the OR ELSE sanction.

In the ADICO syntax, a prescription used to explain the behavior that fails to meet the OR ELSE test is a norm. In other words, a written law could be a norm rather than a rule if the law does not meet the OR ELSE requirements. Analysis of the decisions that individuals make to follow or break such a norm (written as a law) would be based primarily on their own feelings about conformance (δ^{oi} and δ^{bi}) and their appraisal of potential reactions from others (δ^{oe} and δ^{be}), their estimates of the values that other players place on conformance (the other players' δ^{oi} and δ^{bi}),

and their estimates of the values that other players place on feedback (the other players' δ^{oe} and δ^{be}).

To incorporate the syntax into formal analysis of rules and behavior, the payoffs for actions governed by rules need to include delta parameters that reflect the DEONTIC and a parameter representing the sanction defined in the OR ELSE. If the enforcing players are brought into the analysis, the enforcing players would have delta parameters in their payoffs since there is a rule or norm that prescribes sanctioning. If the OR ELSE is backed by rule, then we expect the payoffs for sanctioning or not sanctioning to include delta parameters and a variable representing the punishment defined in the OR ELSE of the sanctioning rule. If it is costly to monitor the actions of others and/or to impose sanctions on them, those assigned these tasks may not be motivated to undertake these assignments unless (1) the monitor and sanctioner face a probability of an OR ELSE, (2) social pressure to monitor and sanction is large and is salient to the monitor and sanctioner (large δ^{oe} or δ^{be}), (3) the monitor and sanctioner hold some strong moral commitment to their responsibilities (large δ^{oi} or δ^{bi}), and/or (4) the payment schemes for the monitor and sanctioner create prudent rewards high enough to offset the costs. When a norm backs an OR ELSE, enforcement rests solely on the value of the delta parameters and on the payment scheme for the monitor and sanctioner.

USING THE SYNTAX FOR SYNTHESIS

In any science, understanding what others have already discovered is an important part of research. Synthesizing findings from the different subfields that relate to each type of institutional statement is an important task for those interested in institutions. The similarities between rules, norms, and shared strategies in the ADICO syntax illustrate why the literature so frequently mixes the concepts or uses them interchangeably. They do share several of the same features. Table 1 sorts the concepts that other authors use into the types of institutional statements created by our syntax. In other words, all of the terms used by other authors, shown in the top section of the table, appear to describe institutional statements that are shared strategies according to the syntax; they contain AIC components. The need for a consensus in the use of terms is vividly illustrated by examining the number of different terms in each section of the table. Moreover, several terms appear in all three sections. Notice that some of the terms used by an author appear in more than one of the categories. This means that the term could fit either of the categories in the syntax given the diverse ways that the author uses the term in the work cited. That these terms have been used in so many different ways is not a criticism of past work. Rather, it portrays the difficulty of untangling these concepts so that a less ambiguous set of definitions can be used as the foundation for further theoretical work.

TABLE 1	
Shared Strategies, Norms, and Rules as Used in ADICO Syntax and in Recent Literature	
TERMS	CITATIONS
AIC	
Shared strategies	The Present Article
Norms	Axelrod 1986
Rules, strategies	Axelrod 1981
Doxic elements of action	Bourdieu 1977
Equilibrium strategies	Calvert 1992
Norms	Levi 1990
Rules	March and Olsen 1989
Taken-for-granted actions	Meyer and Rowan 1991
Rules	Myerson 1991
Rules of action	Rowe 1989
Scripts	Schank and Abelson 1977
Focal points	Schelling 1978
Institutions	Schotter 1981
Conventions	Ullmann-Margalit 1977
ADIC	
Norms	The Present Article
Conventions	Braybrooke 1987
Rules	Braybrooke 1994
Norms	Coleman 1987
Institutions	DiMaggio and Powell 1991
Conventions	Lewis 1969
Norms	Levi 1990
Rules	March and Olsen 1989
Taken-for-granted actions	Meyer and Rowan 1991
Ethical codes	North 1981
Obligations	Rowe 1989
Institutions	Schotter 1981
Conventions	Sugden 1986
Social norms	Ullmann-Margalit 1977
Conventions	Weber 1947
ADICO	
Rules	The Present Article
Norms backed by metanorms	Axelrod 1986
Working rules	Commons 1968
Norms	Coleman 1987
Legalistic institutions	Levi 1990
Rules	Knight 1992
Rules	North 1990
Rules	Shepsle 1979, 1989
PD norms, decrees	Ullmann-Margalit 1977
Laws	Weber 1947
Rules of the game-form	Hurwicz 1994

A growing body of work considers the mix of normative and material motivations that individuals consider when faced with choices (Coleman 1988; Ellickson 1991; Elster 1989a, 1989b; Etzioni 1988; Hirschman 1985; Knack 1992; Mansbridge 1990, 1994; Margolis 1991; Offe and Wiesenthal 1980; E. Ostrom 1990; V. Ostrom 1986; Udéhn 1993). These works treat the normative aspects of decisions up front as a significant part of the analysis. Margolis argues for the necessity of such an approach: "If we analyze everything in terms of strict self-interest and then

TABLE 2

Delta Parameters and Normative Concepts Used in Recent Literature

DELTA PARAMETERS	CONCEPTS USED BY OTHER AUTHORS	CITATIONS
Size, sign, and interpretation of delta parameters		
$+\delta^{oi}$	warm glow	Andreoni 1989; Ledyard 1995
$+\delta^{oe}$	encouragement	Coleman 1988
	status improvement/ reputation enhancement	Coleman 1988
	honor	Ullmann-Margalit 1977
$-\delta^{bi}$	duty	Knack 1992
$-\delta^{be}$	cost of being punished (P & P')	Axelrod 1986[a]
	social sanctions	Knack 1992
	third-party sanctions	Bendor and Mookherjee 1990[b]
$+\delta^{oi}$ and $-\delta^{bi}$	internalized norms	Coleman 1987
	public spiritedness	Mansbridge 1994
	moral duty	Etzioni 1988
	duty	Commons 1968
$+\delta^{oe}$ and $-\delta^{be}$	externally sanctioned norms	Coleman 1987
	reputation	Kreps 1990
	responsibility	Commons 1968
	moral judgment	Sugden 1986
Types of players		
$+\delta^{oe}$ large	zealot	Coleman 1988
$\Delta = 0$	selfish rational individual	Elster 1989a
$+\delta^{oi}$ and/or $-\delta^{bi}$ large	Everyday Kantian	Elster 1989a
$+\delta^{o}$ large when # of cooperators low	Elite participationists	Elster 1989a
$+\delta^{o}$ large when # of cooperators high	Mass participationists	Elster 1989a
Δ larger when # of cooperators > threshold	People motivated by fairness	Elster 1989a
Creation and maintenance of delta parameters		
Δ affected by labor union activities		Offe and Wiesenthal 1980
Δ are scarce resources that erode with use		Olson 1991
Δ are resources that increase with use		Hirschman 1985; Mansbridge 1994
Δ affected by external fines		Frey 1994
Δ lower when rules come from outside authority		Frey 1994

[a]In some cases, these sanctions may meet the criteria of an OR ELSE.
[b]As with the P and P' of Axelrod's, the third-party sanctions may at times meet the criteria of an OR ELSE.

include some social motivation only if we get stuck or if there is something left over, it is not likely to lead to nearly as powerful a social theory as if the two things are built in at the base of the analysis" (1991, 130). Delta parameters provide a conceptual language with which to build normative considerations into analysis from the beginning and to discuss differences in studies that incorporate normative incentives.

Table 2 lists studies that have addressed three types of questions about normative motivations. The top section of the table lists different assumptions regarding the meaning and sign of delta parameters. Knack's (1992) analysis of voter turnout, for example, illustrates the insight possible from a careful study of internal and external normative influences. He offers empirical evidence of the substantive content of internal and external pressures associated with a turn-

out norm and of the influence of these pressures on the probability that an individual will vote. Interestingly, his interpretation of the declines in voter turnout echoes the importance of monitoring. He finds that social sanctions (external deltas) are a key influence on voting turnout. Social pressure only operates, however, when voters expect to be in situations where someone will ask them if they voted. As the percentage of individuals in organizations, in relationships with neighborhood residents, in extended family situations, and in marriages decreases, this monitoring decreases and the power of the social sanction (an external delta) diminishes.

The middle section of Table 2 cites work that addresses the implications of various mixes of different types of individuals or players. For example, a selfish rational individual would be a type that as-

signs a zero value to praise or blame for obeying or breaking prescriptions. One interesting variant of types ties the size of the delta to the number of others who conform to the prescription; its size is conditional. Elster (1989a) examines the consequences of communities with various mixes of types with conditional and constant deltas.

Scholars cited in the bottom section of Table 2 discuss variables that influence the direction and size of delta parameters. Offe and Wiesenthal (1980) examine the costs that labor unions face to build and maintain a shared commitment to participation norms as this in turn affects their ability to compete with other interest groups. Several other authors ask whether normative incentives increase or decrease with use. Olson (1991) views the delta parameters as scarce resources that can be dissipated with too much use, while Hirschman (1985) and Mansbridge (1994) come to the opposite conclusion. They argue that the normative constraints increase in size as they are used repeatedly by individuals in a group. Frey (1994) contends that external interventions, such as fines, adversely affect the size of delta parameters, particularly the internal deltas. He also speculates that the deltas associated with rules will be higher when individuals participate in making their own rules than when rules are made by higher authorities.

USING THE GRAMMAR FOR ANALYSIS

Now our applications of the grammar move from synthesis to analysis of collective-action problems. The issue of how individuals solve collective-action problems is at the forefront of attention across the social sciences. The disjunction between theoretical predictions of complete free-riding in Prisoner's Dilemma situations and the rates of cooperation that case studies and laboratory experiments reveal provokes much discussion (Udéhn 1993; Weiss 1991). The scholarly discourse about these issues involves terms such as common understandings, shared beliefs, scripts, norms, rules, procedures, institutions, informal rules, informal institutions, conventions, internal solutions, external solutions, as well as a wide diversity of highly technical terms related to particular solution theories.

To illustrate how the ADICO syntax clarifies such analysis, we model the effect on behavior of three structural adjustments (represented by additions of an ADICO component) to a social dilemma situation. This application of the grammar employs game theory and stresses formal analysis. We use existing game theory as our illustrative theory of action. However, the logic discussed in the application applies to nonmathematical analyses as well.

Collective-action problems can be represented by many different game structures (see Taylor 1987). However, because most social scientists know the Prisoner's Dilemma game well, we use a Prisoner's Dilemma game so that we can more easily jump into

existing debates and rely on extensive prior work. We start with a simple two-person Prisoner's Dilemma game and use the ADICO format to illustrate the research issues, the game structures, and the predicted outcomes that arise from Prisoner's Dilemma situations when we add: (1) shared expectations of other players' behavior only (AIC statements), (2) normative views of the appropriate actions to be taken (ADIC statements), and (3) rules (ADICO statements). Table 3 summarizes the institutional and payoff characteristics of four games based on a two-person Prisoner's Dilemma situation.[16] The first game is the base two-person Prisoner's Dilemma game. The *shared strategies* game adds a set of shared strategies that equate to the *grim trigger* strategy. The *norms* game adds a cooperating norm to the base situation. The *rules* game adds a cooperating rule, a monitoring norm, and a sanctioning norm to the base Prisoner's Dilemma game. These four examples represent only one way to add the ADICO statements to a two-person Prisoner's Dilemma game.

The Base Game

In the two-person Prisoner's Dilemma base game, we assume that $1 > c > d > 0$. The best payoff (1) comes from choosing D while the other player chooses C; the second best payoff (c) occurs for both players choosing C; third is the payoff (d) resulting from both players choosing D; and the worst payoff (0) comes from choosing C while the other player chooses D. Given these payoffs, both players are better off choosing D no matter what the other player chooses. The solution to this game, if played only once, is for both players to choose D and receive d, instead of the more desirable c that they could have received if they had both chosen C. Even if repeated a finite number of times, the solution is for both players to always choose D.

The Shared Strategies Game

Predictions that individuals will select C rather than D in a Prisoner's Dilemma game based on shared strategies rely upon changes in players' expectations about each other's future behavior. In order to incorporate those expectations into formal analysis, we use an indefinitely repeated version of the base game in which future expected payoffs are part of a player's calculation at any one round. In the shared strategies game in Table 3, the players all use a grim trigger: all players cooperate in each round of the game until someone defects, after which players defect for the rest of the game.[17] Assuming that players do not discount future payoffs, both players cooperating in every round is predicted if and only if the expected payoffs from cooperating are greater than the expected payoffs for defecting: $c + t(c) > 1 + t(d)$. This simplifies to

$$c > \frac{1+d}{1+t},$$

TABLE 3

Game Summaries

INSTITUTIONAL STATEMENTS	PAYOFFS

Base Game
NONE (physical world)
	Player 1 or 2
	C = c if other C
	  = 0 if other D
	D = 1 if other C
	  = d if other D

Shared Strategies Game
AIC statements
 [All players] [ ] [C] [first round] [ ]
 [All players] [ ] [C] [if all C in previous round] [ ]
 [All players] [ ] [D] [all rounds after a D] [ ]
	Players 1 or 2
	C = c + t(c) if other C
	  = 0 + t(d) if other D
	D = 1 + t(d) if other C
	  = d + t(d) if other D

Norms Game
ADIC statement
 [P1[a] & P2] [must] [C] [always] [ ]
	Players 1 or 2
	C = base game payoffs + δ^{oi} + δ^{oe} if P3 → M[b]
	  = base game payoffs + δ^{oi} if P3 → ~M
	D = base game payoffs + δ^{bi} + δ^{be} if P3 → M
	  = base game payoffs + δ^{bi} if P3 → ~M
	
	Player 3
	M = E if (P1 & P2)→ C
	  = R–E if (P1 or P2) → D
	~M = 0

Rules Game
ADICO statement
 [P1 & P2] [must] [C] [always] [f]
 	
ADIC statements
 [P3] [must] [monitor] [always] [ ]
 [P4] [must] [impose f on defector]
  [when P3 reports a D] [ ]
	Players 1 and 2
	C = norm game payoffs
	D = norm game payoffs + f if (P3 → M) & (P4 → S)
	  = norm game payoffs if (P3 → ~M) or (P4 → ~S)
	
	Player 3
	M = norm game payoffs + δ^{o}_{m}
	~M = norm game payoffs – δ^{b}_{m}
	
	Player 4
	Only plays if P3 → M
	S = δ^{o}_{s} – E_{s}
	~S = $-\delta^{b}_{s}$

[a]P1 refers to player 1 and so on.
[b](P3 → M) indicates that player 3 chooses M.

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where t is the expected number of future rounds.[18]

All players must share common knowledge that all have adopted a trigger in order for it to be an institutional statement. If all players do not consider it prudent to defect for all rounds after someone initially defects, the trigger strategy is not shared and will not work. Little empirical evidence exists that individuals share a belief in the prudence of a grim trigger (Ostrom, Gardner, and Walker 1994). Herein lies the frailty of the grim trigger as either a resolution of the Prisoner's Dilemma game or a possible institution.
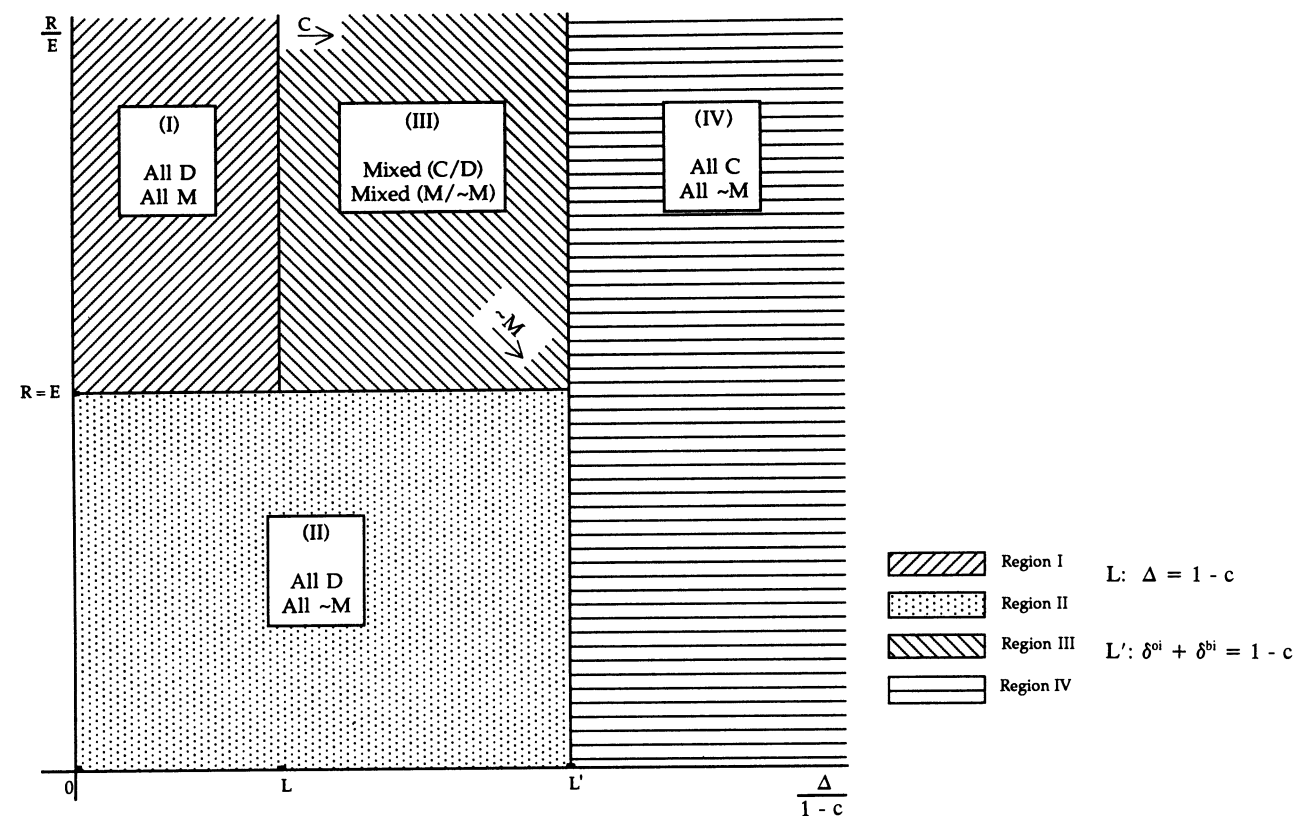
The Norms Game

Predictions that individuals will select C rather than D in a Prisoner's Dilemma base game based on norms rely upon changes in players' payoffs because of the addition of at least one delta parameter. To avoid the case of predicting cooperation as a dominant strategy through only internal commitments to norms, we add both external and internal delta parameters. We allow nonzero internal and external delta parameters for both obeying the cooperation norm (δ^{oi} and δ^{oe}) and for breaking the cooperation norm (δ^{bi} and δ^{be}).

In order to make the discussion more applicable to situations with more than two players, we add a third player, a *monitor*, who chooses to monitor (M) or not to monitor (~M). We assume that external reinforcements for obeying (δ^{oe}) or for breaking (δ^{be}) a norm only occur when the monitor detects the choices of a player. In the simple two-person game, this assumption is not necessary. Players 1 and 2 know whether the other player cooperated by simply looking at their own payoffs. However, as soon as the number of players in a Prisoner's Dilemma is larger than 2,

FIGURE 1

Equilibrium Diagram: Game with a Norm and Monitoring

identifying who cooperates and who defects is no longer trivial.[19] The monitor in this game is motivated solely by prudential rewards associated with discovering defection.[20] There is no monitoring norm or rule.

In the norms game, predictions about players' strategies depend on the relationships among the original payoffs in the base game, the added delta parameters, and the benefits that the monitor receives for reporting nonconformance. This game has many equilibria. Assuming that all of the delta parameters are symmetric (player 1 and player 2 have the same values for each delta parameter) and that the sum of the external parameters is greater than the sum of the internal parameters (i.e., the social pressure to follow the prescription is greater than the internal pressure), four equilibrium regions exist as shown in Figure 1.

The vertical axis is the ratio of the monitor's reward for detecting defection to the expense of monitoring (R/E). The vertical axis is divided into regions above and below the point at which the reward to the monitor equals the expense ($R = E$). The reward is higher than the cost above this point and lower than the cost below this point.

The horizontal axis is the ratio of the sum of all delta parameters to the advantage of choosing D [$\Delta/(1 - c)$]. Since we assume that players 1 and 2 have the same values for each of the delta parameters and that

both internal and external delta parameters increase monotonically from left to right, a single axis represents the relationship between the sum of all the delta parameters and the advantage of defecting. As one moves to the right, the size of the delta parameters relative to the advantage of D increases. At point L, the sum of the delta parameters equals the advantage of defection when the other player cooperates ($\Delta = 1 - c$). Point L' on the horizontal axis represents that point where the portion of the sum of delta parameters derived from the internal deltas equals the advantage of defection ($\delta^{oi} + \delta^{bi} = 1 - c$). Thus the area to the right of L' represents the region where the internal deltas offset the advantage of defecting and the value of the external deltas becomes irrelevant. In this area (equilibrium region IV on Figure 1), both players choose C. This is the trivial case in which C is the dominant strategy because the internal costs and rewards for players 1 and 2 are sufficiently high to offset the fact that 1 is greater than c.

In region III, both players 1 and 2 select a mixed strategy between C and D.[21] As one moves from left to right in region III, the sum of the delta parameters increases and thus the probability that players 1 and 2 assign to selecting C increases. In this region, the monitor also selects a mixed strategy. The *relative amount* of the monitor's reward decreases as one moves from north to south. Since the monitor re-

ceives a reward only if defection is detected, the *probability* of obtaining a reward decreases as one moves from west to east because the probability of defection decreases. The combined effect is that the monitor has the least incentive to monitor when relative rewards are low and the probability of defection is low (in the southeast corner) and the greatest incentive to monitor when the relative rewards are high and the probability of defection is high (in the northwest corner of this region). Thus, as one moves from northwest to southeast in this region, the probability assigned to $\sim M$ increases.

In equilibrium regions I and II of Figure 1, D remains the dominant strategy for players 1 and 2 as it is in the base game, but for different reasons. In region II, the expenses of monitoring are higher than the expected rewards to the monitor. Thus the monitor will choose $\sim M$ in region II. Since $\sim M$ is the dominant strategy, players 1 and 2 need not consider the external cost parameters (δ^{oe} and δ^{be}). Given that the internal deltas are relatively low in relation to the advantage of defecting $[(\delta^{oi} + \delta^{bi}) < (1 - c)]$, D is the dominant strategy for players 1 and 2. Region I, on the other hand, represents a socially perverse outcome whereby players 1 and 2 always defect because the advantage of defecting $(1 - c)$ is greater than the sum of all delta parameters. At the same time, the monitor has a dominant strategy of M because the rewards received from detecting defection exceed the monitoring costs and are guaranteed to occur (assuming perfect detection), because players 1 and 2 face the dominant strategy of D.

This analysis demonstrates that (1) introducing norms and monitoring is not sufficient to change predicted results in a Prisoner's Dilemma base game and (2) a change in predicted results may not be socially beneficial. No set of equilibria exists where the actions of the monitor totally prevent defection. The only equilibrium region in which players 1 and 2 select a pure strategy of cooperating occurs where the value of the internal normative parameters exceeds the advantage of defecting (IV). The presence of a monitor who is motivated to select a mixed strategy boosts the level of cooperation in one region (III) but does not ensure cooperation. Moreover, the lower the probability of defection, the higher the monitoring rewards (R) need to be to offset the reduced probability of receiving the reward.

The results in Figure 1 hold because the reward to the monitor comes only if there is defection to be reported. If the monitor is rewarded specifically for monitoring, regardless of whether defection is discovered, there is an additional equilibrium region in which the monitor ensures cooperation. In this region, the reward for monitoring exceeds the cost of monitoring regardless of whether defection occurs. Thus the monitor chooses a pure strategy of M, which makes C a dominant strategy for players 1 and 2 whenever the sum of their internal and external delta parameters exceeds the advantage of D.[22]

Empirical studies and formal models suggest several other motivational schemes for monitors. Some motivate monitors by embedding them in a series of nested institutions that reward monitors who actively and reliably monitor with positive returns from the increased productivity that the rules generate (see Greif, Milgrom, and Weingast 1990; Milgrom, North, and Weingast 1990). Monitors may also be direct participants in ongoing relationships where efforts are made to reward one another for monitoring and to ensure that monitors participate in the greater returns that all achieve when temptations to defect are reduced. In such situations, monitors may achieve sufficient benefits from monitoring to induce a high level of conformance (but never 100%) in an isolated system without recourse to central authorities (Weissing and Ostrom 1991a, 1993). If one wanted to analyze the incentive structure found in many field settings where monitors are hired as external, disinterested guards, one could change the game so that the monitor receives a salary regardless of whether he or she catches a defection or shirks. In such a setting, the monitor has little incentive to monitor, so that the rate of cooperation depends heavily on the size of the internal delta parameters for players 1 and 2.

The Rules Game

Predictions that individuals will select C rather than D in the rules game rely upon (1) the base game payoffs, (2) changes in players' payoffs because of the addition of at least one delta parameter, (3) changes in the players' payoffs due to the addition of an objective and institutionally created consequence for breaking a rule, (4) the probability of detection, and (5) the probability of sanctioning.

The rules game shifts the norms game to a game with a rule backed by two norms. The rule that structures this game is, [Players 1 and 2] [must] [C] [always] [f]. The rule adds a fine (f) to the payoffs for players 1 and 2 for D if their defection is monitored and sanctioned. A sanctioning norm creates this fine and assigns the responsibility of imposing it on player 4: [Player 4] [must] [impose f on a defector] [when player 3 reports a D] [ ]. The rule is also backed by a monitoring norm: [Player 3] [must] [monitor] [always] [ ].

The monitoring norm adds delta parameters to player 3's payoffs. Whereas the monitor was rewarded only by prudential rewards in the norms game, now the monitor considers both prudential rewards and normative rewards as well as the costs of monitoring. The sanctioning norm adds another player, player 4 (the *sanctioner*), whose payoffs include delta parameters reflecting the sanctioning norm DEONTIC.[23] The cost of sanctioning is the only other parameter in player 4's payoffs. In other words, player 4 is a volunteer sanctioner "rewarded" solely by normative interests.

A wide variety of mixed strategy equilibria are possible that depend on (1) the relative expected value of the fine and the relative size of the external delta parameters for players 1 and 2, (2) the size of the

reward and deltas associated with monitoring as compared to the costs of monitoring, and (3) the sign and size of the deltas associated with sanctioning minus the costs of sanctioning as compared to the value of the delta parameters for not sanctioning.[24]

We set aside the tasks of analyzing the many possible equilibrium regions of the rules game and focus here on the simpler task of establishing conditions for equilibria in which players 1 and 2 always cooperate. The rule adds a fine and a new player, yet the monitor still plays a crucial role. The parts of the game that come from the OR ELSE (the fine and the sanctioning norm) do not even enter the payoffs for players 1 and 2 unless the monitor chooses M.[25] As in the norms game, we assume that player 1 and player 2 do not see each other's choices and that the external delta components occur only when player 3 monitors.

Cooperation is a pure strategy for players 1 and 2 if and only if either of the following conditions is met:

$$\delta^{oi} + \delta^{bi} > 1 - c \quad \text{or}$$

$$[(\delta^{oi} + \delta^{bi}) + (p(M)^*(\delta^{oe} + \delta^{be})$$

$$+ (p(S)^*f)) > 1 - c], \quad \text{where}$$

$$f = \text{fine for breaking the rule}$$

$$p(M) = \text{probability of being monitored}$$

$$p(S) = \text{probability of being sanctioned}.$$

The first condition is the same as in the norms game. The second condition figures in the effect of the monitor and sanctioner. The probability of monitoring [p(M)] and sanctioning [p(S)] depends upon the payoffs to player 3 (the monitor) and player 4 (the sanctioner). In order for the monitor and the sanctioner to be motivated, the values of following the monitoring and sanctioning norms have to be greater than the relative cost of doing their jobs. In the case of the sanctioner, the value of the delta parameters needs to be greater than the expense for imposing the sanction (E_s): ($\delta^o_s + \delta^b_s$) > E_s. The monitor balances both delta parameters and material rewards against the expense of observing players 1 and 2 (E_m). Player 3 monitors when p(D)$R_m + \delta^o_m + \delta^b_m > E_m$, where p($D$) is the probability that either player 1 or player 2 will choose D.

In settings where players develop a strong internalization of norms (high internal delta parameters), the presence of even a low-to-moderate sanction (f) may be sufficient when combined with reliable monitors and sanctioners [high p(M) and p(S)], to encourage a high rate of cooperation. If players 1 and 2 expect either the monitor or the sanctioner to break their respective norms, then the expected probability of the sanctioner choosing to sanction [p(S)] tends toward zero, and f drops out of the decision calculus for players 1 and 2. Even in a rule-governed game, if monitors are not motivated to monitor and sanctioners are not motivated to sanction, cooperation rests substantially on internalized norms of the players. Clearly, recognizing rules in formal analysis of di-

lemma situations does not automatically "solve" the dilemma and end analysis. Instead, adding rules suggests a whole new set of research questions. For example, How do changes in the level of internalization of rules (δ^{bi} and δ^{oi}) affect the levels of monitoring and sanctioning required to bolster cooperation at given levels of social pressure (δ^{oe} and δ^{be})? What size do external delta parameters need to be in order to ensure cooperation at various rates of monitoring and sanctioning with a given value of f? How do the incentives to monitor and sanction differ if we assume that players 3 and 4 are the same person? What are the empirical equivalents of delta parameters and OR ELSES in field situations?

MOVING BEYOND SYNTAX

Although our focus is mainly on the syntax of a grammar of institutions, the grammar of institutions, as is the case with other grammars, also includes semantics (i.e., the meaning of statements) and pragmatics (i.e., how to apply the syntax and semantics in practice). The delta parameters provide one example of the semantics of the grammar. Discussing how to operationalize the syntax components begins to address the pragmatics of the grammar. Analyses of many issues of interest to scholars of institutions will delve more deeply into pragmatic issues such as (1) the effects of configurations of institutional statements, (2) the consistency and completeness of the institutional statements of an institution, and (3) legitimacy and compliance.

Institutional Configurations

The descriptions of the components of rule and norm statements (except the OR ELSE) have focused on single statements as if the contents of the institutional statements were independent. The focus on single statements is for expository reasons only. When we examine the interactions of individuals in an empirical situation, we often find that a configuration of rules, norms, and shared strategies influences the choices of individuals at any one point of time. In fact, we often find institutional configurations, such as shared strategies and professional norms, nested within enforced government regulations.[26]

In some cases, the CONDITIONS component of an institutional statement explicitly states the linkages between statements in a configuration. For example, a rule permitting some action may state, as CONDITIONS of the rule, that the individual must follow a procedure outlined in another rule. In other cases, the linkage between statements is implicit. For example, the CONDITIONS component of a voting rule for legislation may not overtly make reference to the quorum rule, but the specific quorum rule in place strongly influences the effects of the voting rule. A rule stating that a majority must approve before a bill becomes a law differentially affects behavior depending upon (1) the quorum rule that states how many

members must be present and voting for a vote to be legal and (2) the rule that states what happens if no positive action is taken (e.g., the OR ELSE rule that states whether the outcome is a return to the status quo or some other alternative).

Analyzing complex institutional configurations will require new capabilities. We are currently in the process of developing a classification system that identifies types of rules or norms according to their function in a configuration. Our current efforts integrate the institutional grammar with extensive work that outlines levels of action and the elements of an action situation that have been elucidated elsewhere (Kiser and Ostrom 1982; E. Ostrom 1986; Ostrom, Gardner, and Walker 1994).[27] The classification system seeks to enhance efforts to place individual institutional statements in the context of the mix of institutional statements that structure a situation.

Institutional Consistency and Completeness

When an institutional statement assigns a DEONTIC operator to an action or outcome, then that action or outcome becomes obliged, permitted, or forbidden for those with the listed ATTRIBUTES under the specified CONDITIONS. Thus, institutional statements with DEONTICS can be thought of as transformations that partition sets of possible actions or outcomes into subsets of obligatory, permitted, and forbidden actions and outcomes. Recognizing this set logic based on DEONTICS provides a tie to the works in philosophy of law and logic (Braybrooke 1994; Ellickson 1991; Gibbard 1990; V. Ostrom 1995; Tyler 1990; von Wright 1951, 1963). Moreover, the rigor of the logic-based system disciplines discourse by making inconsistencies more apparent.

Set logic, combined with the organizational capacity of the syntax, identifies inconsistencies and incompleteness in rule systems. We presume that most rule systems are incomplete. The existing rules do not cover all possible combinations of ATTRIBUTES, CONDITIONS, and AIM. The incompleteness of most existing rule systems becomes even more apparent when we recognize that the attributes and conditions of situations may be interpreted in different ways.[28] In complex situations, we presume that inconsistent rules develop; an action may be required under one rule and forbidden under another. Inconsistent systems may snare the unwary and trap others in Catch-22 situations. In political arenas, conflict plays an important role in generating information about inconsistencies. With effective conflict-resolution arenas, some inconsistencies can be tackled and resolved. Conflict also plays a role in addressing incompleteness. Much of political persuasion involves efforts by actors to convince others that new circumstances match the CONDITIONS of a rule that assigns a DEONTIC to the action that is in their best interest (McGinnis. 1993).

Legitimacy and Compliance

If rulers enforce rules primarily by physical force and fiat, individuals subject to these rules are unlikely to develop internal deltas associated with breaking the rules; nor are external deltas likely to enhance the rate of rule conformance (Tyler 1990). If those who are supposed to follow a rule view it as illegitimate, they may even reward one another for actions that break the rules (a positive δ^{be}) instead of adopting the type of metanorm envisioned by Axelrod (1986) (a negative δ^{be}).

The complementarity of deltas and the OR ELSES emerges in the analysis of compliance. When delta parameters are close to zero, the costs of maintaining compliance through the OR ELSE drastically increase (Ayers and Braithwaite 1992; Levi 1988; Margolis 1991). Without a relatively high level of voluntary, contingent compliance to rules, Levi (1988) explains that rulers can rarely afford the continuing costs involved in hiring enough monitors and sanctioners, motivating them, and imposing sanctions in a manner sufficient to ensure that citizens conform to the rules rather than risk the chance of detection and punishment (see also Frey 1994). On the other hand, if violators can expect to reap the benefits of violating prescriptions without facing the probability of some established punishment (if there is no OR ELSE), then the experience of feeling like a "sucker" may erode the value of the delta parameters (Levi 1988, 1990; Mansbridge 1994; E. Ostrom 1990; Ostrom, Gardner, and Walker 1994).

The ADICO syntax illustrates the cumulative manner in which institutional statements affect individuals' expectations about the actions of others and the consequences of their own actions. We started this enterprise as an effort to define clearly the concept of rules and to create a grammar of rules.[29] We found that in order to do this we needed to clarify how rules were related to norms and shared strategies. Fitting this all into a syntax helped us to catch inconsistencies, which further tested and refined our understanding of each type of institutional statement and each component.

Delving deeper into each of the syntax components brought to light connections among these concepts that, at least for us, had not previously been linked. Further applications and developments of the grammar can strengthen our understanding of the link between institutions and theories of action. Attending to a grammar of institutions equips us to return to the core issues of institutions and political order with a respect for the complexities involved.

Notes

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1. Our concept of institutions parallels Gidden's (1979, 1984) concept of system. Another similarity to Gidden's work is our stress on the constitutive character of rules (see also V. Ostrom 1980). Our concept of situations draws on Popper 1967.

2. Calvert indicates: "There is, strictly speaking, no separate animal that we can identify as an institution. . . . 'Institution' is just a name we give to certain parts of certain kinds of equilibria" (1992, 18).

3. These are "forms of *talk about* experience" in the sense that Burke views the study of human relations in terms of linguistic instruments (1969, 317).

4. Chomsky defines the grammar of a language as the theory of that language (1957, 49). Burke explains his use of the term *grammar* as a theory to explain "what people are doing and why they are doing it" and uses a syntax composed of five terms that he posits to be the generating principles of his investigation (1969, xv).

5. This also applies to grammars in linguistic studies as Chomsky indicates (1957, 15; idem 1965, 11).

6. A formal syntax can be compared with that of other scholars. We have just learned about the Dalhousie logic of rules, which uses a syntax without an OR ELSE and requires that prescriptive statements be recast to use the forbidden DEONTIC operator (see Braybrooke 1994). Our concept of ATTRIBUTES is the same as the *wenn* component of the Dalhousie syntax.

7. The largest group to which a prescriptive statement could apply is the *folk* component in the Dalhousie system (Braybrooke 1994).

8. The logical relationships among the deontic operators include the following: (1) $D = P \cup O \cup F$; (2) $F \cap P = \varnothing$, $F \cap O = \varnothing$, and $O \cap P = O$; and (3) O implies P.

9. John R. Commons (1968) stresses the correlative nature of rights. To state that someone has a right, someone must have a duty to observe that right. The person with a right is permitted to do something, while those with a duty are forbidden or required to do something.

10. Tsebelis (1989, 1991) argues that in a game with only mixed strategy equilibria, increasing the size of the OR ELSE does not reduce the level of rule infraction but rather reduces the level of monitoring. Weissing and Ostrom (1991b) have shown that Tsebelis' results hold in many but not all cases.

11. The complexity of modern economies is so great that centralized law creation cannot effectively cope with the need to achieve normative regulation among communities of individuals who repeatedly face collective-action problems (Cooter 1993; Ellickson 1991).

12. Universal statements are relatively rare explanations for human behavior. The shared strategy that all rational players should adopt a dominant strategy or the norm that all actors are always obliged to tell the truth, exemplify unqualified institutional statements.

13. The logic of the delta parameter is similar to Etzioni's (1988) discussion of deontology.

14. Societies undergoing substantial "liberalization" could be thought of as developing shared understandings that individuals who had been forbidden to take certain actions in earlier times are now permitted to do so. When the new norm is shared, individuals who still attempt to obstruct the previously restricted actions now face a cost for breaking the new

norm. Thus, changes in norms over time will be reflected both in the particular DEONTIC assigned to an action and in to whom the cost of breaking the norm is assigned.

15. Kreps and his colleagues do not assume that the basis for one actor playing tit-for-tat is necessarily the acceptance of a norm. They simply assume that some players only have available to them a tit-for-tat strategy or that there is some probability that one player's payoffs are such that tit-for-tat is strongly dominant (1982, 247). The latter condition would be the case if some players in a population have some combination of delta parameters associated with playing tit-for-tat whose values are high.

16. An appendix with the extensive form of each game is available from the Workshop in Political Theory and Policy Analysis at Indiana University.

17. The punishment in the grim trigger might cause one to wonder whether the retaliation is an OR ELSE. The shared strategy is not a rule, using the ADICO syntax, unless the prescription to punish someone who deviates is backed by another rule or norm. An institutional statement that could back a trigger rule might be a sanctioning rule such as, "All other players must defect for the rest of the game (or, in not-so-grim triggers, for *n* rounds) when one player defects in any of the rounds, OR ELSE the other players face the probability of a further sanction," and a monitoring norm that "all players must monitor all other players." Notice that the sanctioning rule changes the DEONTIC assigned to C from *permitted* or *obligatory* to *forbidden* in the CONDITION of a defection in the prior round. If the advice to cooperate to avoid a trigger response is not backed by monitoring and sanctioning institutions, the massive defection that is threatened by the trigger is either a prudent response to defection or a norm of retaliation.

18. It would, of course, be possible to include discount rates in the analysis, but we assume they are zero here to keep the focus on other questions and not those related to the size of the discount rate. For a discussion of the importance of discount rates in the analysis of cooperation, see Axelrod 1981, 1986.

19. It is possible to illustrate the addition of norms without a player who is assigned the specialized role of a monitor by simply assuming that players monitor each other (Weissing and Ostrom 1991a, 1993). To do this, however, one needs to model a sequential structure that introduces more complexity than we desire in this initial application.

20. Freelance reporters are an example of this type of monitor. They receive payment for detecting and reporting nonconformance with accepted norms. Rewards include fees for stories and increased probabilities of receiving prizes for good reporting.

21. A mixed strategy is a probability distribution over the pure strategies for a player. In a static game, one may view the mixed strategy as the probability of choosing one of the other pure strategies. One can also intepret mixed strategies as behavioral tendencies in a repeated context where the probability of choosing a pure strategy, say C, is viewed as a cooperation rate.

22. The extensive form of this game and the equilibrium diagrams are available from the Workshop in Political Theory and Policy Analysis at Indiana University.

23. The delta parameters for players 3 or 4 could be disaggregated into their internal and external components for an analysis that wished to focus on questions that distinguished between internal and external pressures on the monitor or sanctioner.

24. In this game, player 3 always correctly detects whether defection has occurred, and player 4 only has the option of sanctioning players who have defected. If players 1 and 2 cooperate, player 4 does not have a choice of whether or not to sanction. This eliminates issues of false detection and corrupt sanctioners from the current analysis. Future efforts will address questions related to monitoring and sanctioning errors.

25. One could argue that when prescriptions are rules, individuals will place higher values on the deltas than when

the prescriptions are norms (see Braybrooke 1987). If one assumes that the presence of rules influences the internal deltas, that δ^{oi} are higher in the rules game than in the norms game, then the rule would influence the structure of the game even when the monitor fails.

26. See E. Ostrom 1986 for a discussion of the configurational aspect of rules.

27. The element of the action situation that best fits the contents of the AIM of the prescription is the first part of the classification; the match between the elements and the CONDITIONS provides the second part of the classification. Further refinements in the classification focus either on the other components in the institutional statements or on creating subdivisions within the basic categories provided by the elements of an action situation.

28. For a philosophical discussion of uncertainty and incompleteness in the applications of rules, see Heritage 1984.

29. For earlier efforts to address the concept of rules, see Black 1962, Collett 1977, Ganz 1971, and Harré 1974.

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- Page 1 of 4 -

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