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Background on the Institutional Analysis and Development Framework

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This article provides an overview of the structure and evolution of the Institutional Analysis and Development (IAD) framework and a short introduction to its use by scholars to analyze a diversity of puzzles. It then addresses the relationship of IAD to a more complex framework for the analysis of social-ecological systems and concludes with a short discussion of future challenges facing IAD scholars.

KEY WORDS: policy analysis, institutional analysis, frameworks, social-ecological systems

Introduction

It is a great privilege and pleasure to have an issue of *Policy Studies Journal* devoted to a set of excellent articles illustrating how the Institutional Analysis and Development (IAD) framework can be applied to a variety of important policy questions. In this article, I plan to expand on earlier articles on the framework (Kiser & Ostrom, 1982; E. Ostrom, 2009) as well as discuss how and why the framework itself has changed over time. As more scholars use the IAD framework, as well as the more recent outgrowth of it—the social–ecological system (SES) framework—useful suggestions are made for ways to improve this theoretical foundation for research in policy analysis.

A continuing puzzle for many scholars is determining the difference between frameworks, theories, and models. The three terms are used almost interchangeably by scholars coming from different theoretical backgrounds. Basically, frameworks, theories, and models are nested concepts related to explaining human behavior. Colleagues who were trained at or are associated with the Workshop in Political Theory and Policy Analysis at Indiana University use all three concepts in our efforts to analyze policy processes and outcomes. In the first section, I will define the three types of theoretical analysis, how they relate to one another, and how they differ.

The second section will provide a general overview of the IAD framework and how it helps a policy analyst address key questions. The third section addresses how

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attributes of the biophysical world affect action situations and provides a brief introduction to the SES framework. A short concluding section reviews some of the future challenges facing IAD scholars.

Institutional Frameworks, Theories, and Models

The study of institutions depends on theoretical work undertaken at three levels of specificity that are often confused with one another. These essential foundations are (i) frameworks, (ii) theories, and (iii) models. Analyses conducted at each level provide different degrees of specificity related to a particular problem.

The development and use of *frameworks* are the most general forms of theoretical analysis. Frameworks identify the elements and general relationships among these elements that one needs to consider for institutional analysis and they organize diagnostic and prescriptive inquiry. They provide a general set of variables that can be used to analyze all types of institutional arrangements. Frameworks provide a metatheoretical language that can be used to compare theories. They attempt to identify the universal elements that any theory relevant to the same kind of phenomena needs to include. Many differences in surface reality can result from the way these variables combine with or interact with one another. The extent of shared information available to actors needs to be thought about when asking theoretical questions as well as the flow of activities and who pays what benefits and receives what costs. Thus, the elements contained in a framework help analysts generate the questions that need to be addressed when they conduct an analysis (see McGinnis, 2000).

The development and use of *theories* enable the analyst to specify which elements of a framework are particularly relevant to particular questions and to make general working assumptions about the shape and strength of these elements. Theories make assumptions that are necessary for an analyst to diagnose a specific phenomenon, explain its processes, and predict outcomes. Multiple theories are usually compatible with one framework. Economic theory, game theory, transaction cost theory, social choice theory, covenantal theory, and theories of public goods and common-pool resources are all compatible with the IAD framework.

The development and use of *models* involve making precise assumptions about a limited set of variables and parameters to derive precise predictions about the results of combining these variables using a particular theory. Logic, mathematics, game-theory models, agent-based models, experimentation and simulation, and other means are used to explore systematically the consequences of these assumptions on a limited set of outcomes. Multiple models are compatible with most theories. An effort to understand the strategic structure of the games that irrigators play in differently organized irrigation systems, for example, developed four families of models in order to begin exploring the likely consequences of different institutional and physical combinations relevant to understanding how successful farmer organizations arranged monitoring and sanctioning activities (Weissing &

Ostrom, 1991). Gardner and Ostrom (1991) developed additional models to explore the differences in predicted behavior to follow from self-conscious changes in the assumption of game-theoretic models.

For scholars and policymakers interested in issues related to how different governance systems enable individuals to solve problems democratically, the IAD framework helps to organize diagnostic, analytical, and prescriptive capabilities. It also aids in the accumulation of knowledge from empirical studies and in the assessment of past efforts at reforms. Markets and hierarchies are frequently presented as fundamentally different "pure types" of organization. Not only are these types of institutional arrangements perceived to be different but each is presumed to require its own explanatory theory. Such a view precludes a more general explanatory framework and closely related theories that help analysts make cross-institutional comparisons and evaluations.

Without the capacity to undertake systematic, comparative institutional assessments, recommendations of reform may be based on naive ideas about which kinds of institutions are "good" or "bad" and not on an analysis of performance (Olowu & Wunsch, 2004). One needs a common framework and family of theories in order to address questions of reform and transition. Particular models then help the analyst to deduce specific predictions about likely outcomes of highly simplified structures. Models are useful in policy analysis when they are well tailored to the particular problem at hand. Models can be used inappropriately when applied to the study of situations that do not closely fit the assumptions of the model.

The Institutional Analysis and Development Framework

As indicated, an institutional framework should identify the major types of structural variables that are present to some extent in all institutional arrangements, but whose values differ from one type of institutional arrangement to another. The IAD framework is thus a multi-tier conceptual map. Recently, the IAD has been integrated into a broader framework for examining SESs and I will discuss this later in the article. There have, however, been a few small changes made in the earlier way the framework was represented, which I will introduce here.

The terms "action arena" and "action situation," used until recently when arraying the IAD framework, have confused many readers. I have repeatedly been asked, what in the world is the difference? In the 1980s, Workshop colleagues were concerned that "the actor" be separated from "the situation" so that diverse theories of behavior would all be consistent with the framework. Thus, it was posited that the action arena contained an action situation and actors. When integrating the IAD into a broader framework for social–ecological systems, it was not possible to keep as much detail about the difference between actors and the situation. Thus, as shown in Figure 1 and discussed by McGinnis (2011), the IAD is simplified to focus on the action situation leading to interactions and outcomes. Then, as shown later in Figure 2, when one opens up the action situation and looks at the component parts of it, one can specify how one is analyzing the actor at that level.

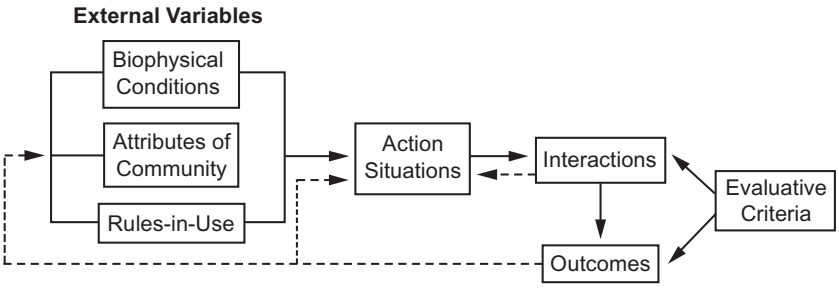

Figure 1. A Framework for Institutional Analysis.
Source: Adapted from E. Ostrom (2005, p. 15).

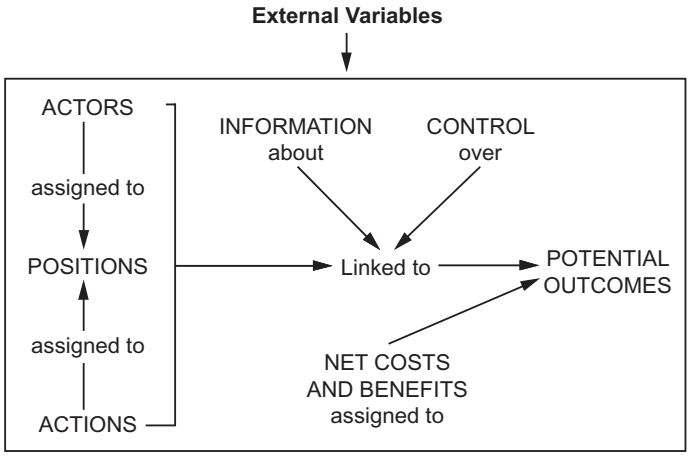

Figure 2. The Internal Structure of an Action Situation.
Source: Adapted from E. Ostrom (2005, p. 33).

Thus, a key part of the framework is the identification of an action situation and the resulting patterns of interactions and outcomes, and evaluating these outcomes (see right half of Figure 1). The problem could be at an operational tier where actors interact in light of the incentives they face to generate outcomes directly in the world. Examples of operational problems include:

- Evaluating the service production agencies serving metropolitan areas (Oakerson & Parks, 2011).
- Exploring why day care centers vary substantially in delivering child care services (Bushouse, 2011).
- The question of how to invest in irrigation infrastructures so that capital investments enhance, rather than detract from, the organizational capabilities of local farmers (Joshi, Ostrom, Shivakoti, & Lam, 2000; Shivakoti et al., 2005).

The problem could also be at a policy (or collective-choice) tier where decision makers repeatedly have to make policy decisions within the constraints of a set of collective-choice rules. The policy decisions then affect the structure of situations, or at a constitutional tier that affects who participates in policymaking. The problem could as well be at a constitutional tier where decisions are made about who is eligible to participate in policymaking and about the rules that will be used to undertake policymaking.

The first step in analyzing a problem is thus to identify a conceptual unit—called an action situation—that can be utilized to describe, analyze, predict, and explain behavior within institutional arrangements. An actor within an action situation (an individual or a firm) includes assumptions about four clusters of variables:

1. The resources that an actor brings to a situation;
2. The valuation actors assign to states of the world and to actions;
3. The way actors acquire, process, retain, and use knowledge contingencies and information; and
4. The processes actors use for selection of particular courses of action.

Action situations are the social spaces where individuals interact, exchange goods and services, solve problems, dominate one another, or fight (among the many things that individuals do in action situations). A major proportion of theoretical work stops at this level and takes the variables specifying the situation and the motivational and cognitive structure of an actor as givens. Analysis proceeds toward the prediction of the likely behavior of individuals in such a structure.

An institutional analyst can take two additional steps after making an effort to understand the initial structure of an action situation. One step digs deeper and inquires into the factors that affect the structure of the situation (Kiser & Ostrom, 1982). A second step explores how an action situation changes over time in light of how the outcomes at an earlier time affect perceptions and strategies over time (Cox & Ostrom, 2010).

Diagnosis and Explanation within the Frame of an Action Situation

The term "action situation" is used to refer to an analytic concept that enables an analyst to isolate the immediate structure affecting a process of interest to the analyst for the purpose of explaining regularities in human actions and results, and potentially to reform them. As illustrated in Figure 2, a common set of variables used to describe the structure of an action situation includes (i) the set of actors, (ii) the specific positions to be filled by participants, (iii) the set of allowable actions and their linkage to outcomes, (iv) the potential outcomes that are linked to individual sequences of actions, (v) the level of control each participant has over choice, (vi) the information available to participants about the structure of the action situation, and (vii) the costs and benefits—which serve as incentives and deterrents—assigned to actions and outcomes. In addition, whether a situation will occur once, a known

finite number of times, or indefinitely affects the strategies of individuals. When one is explaining actions and cumulated results within the framework of an action situation, these variables are the "givens" that one works with to describe the structure of the situation. These are also the common elements used in game theory to construct formal game models.

To illustrate the relation of IAD, let us use the working parts of an action situation to help organize an analysis of the appropriation (harvesting) activities related to natural resources (see E. Ostrom, Gardner, & Walker, 1994; E. Ostrom, Schroeder, & Wynne, 1993). In an analysis of appropriation problems concerning overharvesting from a common-pool resource situation, for example, answers to the following questions are needed before one can proceed far with analysis:

- The set of actors: Who and how many individuals withdraw resource units (e.g., fish, water, fodder) from this resource system?
- The positions: What positions exist (e.g., members of an irrigation association, water distributors-guards, and a chair)?
- The set of allowable actions: Which types of harvesting technologies are used? (e.g., are chainsaws used to harvest timber? Are there open and closed seasons? Do fishers return fish smaller than some limit to the water?)
- The potential outcomes: What geographic region and what events in that region are affected by participants in these positions? What chain of events links actions to outcomes?
- The level of control over choice: Do appropriators take the above actions on their own initiative, or do they confer with others? (e.g., before entering the forest to cut fodder, does an appropriator obtain a permit?)
- The information available: How much information do appropriators have about the condition of the resource itself, about other appropriators' cost and benefit functions, and about how their actions cumulate into joint outcomes?
- The costs and benefits of actions and outcomes: How costly are various actions to each type of appropriator, and what kinds of benefits can be achieved as a result of various group outcomes?

The Actor

The actor in a situation can be thought of as a single individual or as a group functioning as a corporate actor. The term "action" refers to those behaviors to which the acting individual or group attaches a subjective and instrumental meaning. All analysts of microbehavior use an implicit or explicit theory or model of the actors in situations in order to derive inferences about the likely behavior in a situation (and thus about the pattern of joint results that may be produced). The analyst must make assumptions about how and what participants value; what resources, information,

and beliefs they have; what their information-processing capabilities are; and what internal mechanisms they use to decide upon strategies.

For many problems, it is useful to accept the classical political economy view that an individual's choice of strategy in any particular situation depends on how he or she perceives and weighs the benefits and costs of various strategies and their likely outcomes (Radnitzky, 1987). The most well-established formal model of the individual used in institutional analysis is *homo economicus* as developed in neoclassical economics and game theory. To use *homo economicus*, one assumes that actors have complete and well-ordered preferences and complete information, and that they maximize the net value of expected returns to themselves. All of these assumptions are controversial and are being challenged on many fronts. Many institutional analysts tend to use a broader conception of individual actors. Many stress that perceived costs and benefits include the time and resources devoted to establishing and maintaining relationships (Williamson, 1979), as well as the value that individuals attach to establishing a reputation for being reliable and trustworthy (Breton & Wintrobe, 1982).

Alternatively, one could assume that the individuals who calculate benefits and costs are fallible learners who vary in terms of the number of other persons whose perceived benefits and costs are important to them and in terms of their personal commitment to keeping promises and honoring forms of reciprocity extended to them (E. Ostrom, 1998; 2010; Simon, 1972). Fallible learners can, and often do, make mistakes. Settings differ, however, in whether the institutional incentives involved encourage people to learn from these mistakes. Fallibility and the capacity to learn can thus be viewed as assumptions of a more general theory of the individual. One can then presume that the various institutional arrangements that individuals use in governing and managing public goods, common-pool resources, toll goods (or other problematic situations) offer them different incentives and opportunities to learn. In some settings, the incentives lead them to repeat the mistakes of the past. In others, the rate of effective learning about how to improve performance over time is rapid.

When fallible, learning individuals interact in frequently repeated and simple situations, it is possible to model them as if they had complete information about the variables relevant to making choices in those situations. In highly competitive environments, a further assumption can be made that the individuals who survive the selective pressure of the environment act as if they are maximizers of a key variable associated with survival in that environment (e.g., profits or fitness) (Alchian, 1950; Dosi & Egidi, 1991). When individuals face a relatively simple decision situation where institutions generate accurate information about the variables relevant to a particular problem, that problem can be adequately represented as a straightforward, constrained maximization problem.

The most fully developed, explicit theories of individual choice compatible with the IAD framework—game theory and neoclassical economic theory—involve strong assumptions such as unlimited computational capability and full maximization of net benefits. For some field settings, these theories generate empirically confirmed explanatory and diagnostic results. When analyzing commodity auction

markets that are run repeatedly in a setting where property rights are well defined and enforced at a relatively low cost to buyers and sellers, theories of market behavior and outcome based on complete information and maximization of profits predict outcomes well (Banks, Plott, & Porter, 1988; Kagel, Levin, & Harstad, 1995). Using these assumptions about individual choice turns out to be a very useful way of doing institutional analysis when the problematic settings closely approximate this type of very constrained and competitive choice.

Many of the situations of interest in understanding social dilemmas, however, are uncertain and complex. Therefore, one needs to substitute the assumption of bounded rationality—that persons are intendedly rational but only limitedly so—for the assumptions of perfect information and utility maximization used in axiomatic choice theory (see Jones, 2003; Simon, [1947], 1965, 1972; Williamson, 1985). Information search is costly, and the information-processing capabilities of human beings are limited. Individuals therefore often must make choices based on incomplete knowledge of all possible alternatives and their likely outcomes. With incomplete information and imperfect information-processing capabilities, individuals may make mistakes in choosing strategies designed to realize a set of goals (V. Ostrom, 2010). Over time, however, they can acquire a greater understanding of their situation and adopt strategies that result in higher returns. Reciprocity may develop, rather than strictly narrow, short-term pursuit of self-interest (Hyden, 1990; Oakerson, 1993; Walker & Ostrom, 2009).

Individuals rarely have access to the same information known by others with whom they interact. For example, how much any one individual contributes to a joint undertaking is often difficult for others to judge. When joint outcomes depend on multiple actors contributing inputs that are costly and difficult to measure, incentives exist for individuals to behave opportunistically (Williamson, 1975). Opportunism—deceitful behavior intended to improve one's own welfare at the expense of others—may take many forms, from inconsequential, perhaps unconscious, shirking to a carefully calculated effort to defraud others with whom one is engaged in ongoing relationships. The opportunism of individuals who may say one thing and do something else further compounds the problem of uncertainty in a given situation. The level of opportunistic behavior that may occur in any setting is affected by the norms and rules used to govern relationships in that setting, as well as by attributes of the decision environment itself.

Predicting Outcomes within an Action Situation

Depending upon the analytical structure of a situation and the particular assumptions about the actor used, the analyst makes strong or weak inferences about results. In tightly constrained, one-shot, action situations under conditions of complete information, where participants are motivated to select particular strategies or chains of actions that jointly lead to stable equilibria, an analyst can frequently make strong inferences and predict the likely patterns of behavior and outcomes.

When no limit exists on the number of appropriators from a common-pool resource or on the amount of harvesting activities they undertake, for example, one

can develop a mathematical model of an open-access, common-pool resource (see, for example, E. Ostrom et al., 1994). When the net benefits of harvesting increase for the initial set of resource units withdrawn and decrease thereafter, each appropriator acting independently tends to make decisions that jointly yield a deficient equilibrium. A model of an open-access, common-pool resource generates a clear prediction of a race to use up the resource, leading to high social costs. Both field research and laboratory experimental research strongly support the predictions of overuse and potential destruction of open-access, common-pool resources where appropriators cannot communicate and learn about each other's behavior and/or do not share access to collective-choice situations in which to change the open-access structure they face (Janssen, Holahan, Lee, & Ostrom, 2010; E. Ostrom et al., 1994).

Many situations, however, do not generate such unambiguous results. Instead of making completely independent or autonomous decisions, individuals may be embedded in communities where initial norms of fairness and conservation may change the structure of the situation dramatically. Within these situations, participants may adopt a broader range of strategies. Further, they may change their strategies over time as they learn about the results of past actions (Boyd & Richerson, 1985). The institutional analyst examining these more open, less-constrained situations makes weaker inferences and predicts the patterns of outcomes that are more-or-less likely to result from a particular type of situation. In laboratory experiments, for example, giving subjects in a public good or common-pool resource situation opportunities to communicate generally increases the joint outcomes they achieve (Isaac & Walker, 1988; E. Ostrom & Walker, 1991). In field settings, enabling individuals to engage in face-to-face discussions for only a few meetings will usually not increase the probability of improved outcomes, but repeated opportunities will (Ghate, 2004; Mwangi, 2007; Shivakumar, 2005). Many factors affect the likelihood of successful long-term governance of resources.

In field settings, it is hard to tell where one action situation starts and another stops. Life continues in what appears to be a seamless web as individuals move from home to market to work (action situations typically characterized by reciprocity, by exchange, or by team problem solving or command). Further, within situations, choices of actions within a set of rules as contrasted to choices among future rules are frequently made without a recognition that the level of action has shifted. So, when a "boss" says to an "employee," "How about changing the way we do X?" and the two discuss options and jointly agree upon a better way, they have shifted from taking actions within previously established rules to making decisions about the rules structuring future actions. In other words, in IAD language, they have shifted to a collective-choice situation.

Evaluating Outcomes

In addition to predicting outcomes, the institutional analyst may evaluate the outcomes that are being achieved as well as the likely set of outcomes that could be achieved under alternative institutional arrangements. Evaluative criteria are applied to both the outcomes and the processes of achieving outcomes. Although analysts

may use many evaluative criteria, let us briefly focus on (i) economic efficiency, (ii) equity through fiscal equivalence, (iii) redistributional equity, (iv) accountability, (v) conformance to values of local actors, and (vi) sustainability.

Economic Efficiency. Economic efficiency is determined by the magnitude of net benefits associated with an allocation of resources. The concept of efficiency plays a central role in studies estimating the benefits and costs or rates of return to investments, which are often used to determine the economic feasibility or desirability of public policies. When considering alternative institutional arrangements, therefore, it is crucial to consider how revisions in the rules will alter behavior and hence the allocation of resources.

Fiscal Equivalence. Two principal means exist for assessing equity: (i) on the basis of the equality between individuals' contributions to an effort and the benefits they derive and (ii) on the basis of differential abilities to pay. The concept of equity that underlies an exchange economy holds that those who benefit from a service should bear the burden of financing that service. Perceptions of fiscal equivalence or a lack thereof can affect the willingness of individuals to contribute toward the development and maintenance of resource systems.

Redistributional Equity. Policies that redistribute resources to poorer individuals are of considerable importance. Thus, although efficiency would dictate that scarce resources be used where they produce the greatest net benefit, equity goals may temper this objective, and the result is the provision of facilities that benefit particularly needy groups. Redistributional objectives may in some settings conflict with the goal of achieving fiscal equivalence.

Accountability. In a democratic polity, officials should be accountable to citizens concerning the development and use of public facilities and natural resources. Concern for accountability need not conflict greatly with efficiency and equity goals. Indeed, achieving efficiency requires that information about the preferences of citizens be available to decision makers. Institutional arrangements that effectively aggregate this information assist in realizing efficiency at the same time that they serve to increase accountability and to promote the achievement of redistributional objectives.

Conformance to Values of Local Actors. In addition to accountability, one may wish to evaluate how those outcomes fit the values of those involved. Are public officials or local leaders able to cheat and go undetected to obtain very high payoffs? Are those who keep promises more likely to be rewarded and advanced in their careers? How do those who repeatedly interact within a set of institutional arrangements learn to relate to one another over the long term?

Sustainability. Finally, unless institutional arrangements are able to respond to ever-changing environments, the sustainability of situations is likely to suffer. Rural areas

of developing countries are often faced with natural disasters and highly localized special circumstances. If an institutional arrangement is too inflexible to cope with these unique conditions, it is unlikely to prosper. For example, if an irrigation system is centrally controlled and allocates only a specific amount of resources to annual and periodic maintenance, it may not be able to meet the special needs associated with a major flood that destroys a section of the canal system.

Trade-offs are often necessary in using performance criteria as a basis for selecting from alternative institutional arrangements. It is particularly difficult to choose between the goals of efficiency and redistributional equity. The trade-off issue arises most explicitly in considerations of alternative methods of funding public projects. Economically efficient pricing of the use of an existing resource or facility should reflect only the incremental maintenance costs and any external or social costs associated with its use. This is the well-known, efficiency-pricing principle that requires that prices equal the marginal costs of usage. The principle is especially problematic in the case of public goods where the marginal cost of another user utilizing the good is zero; hence, the efficient price is also zero. Zero user prices, however, require that all sources of resource mobilization be tax-based and thereby induce other kinds of perverse incentives and potential inefficiencies. Evaluating how institutional arrangements compare across overall criteria is a challenge. Analytical examination of the likely trade-offs between intermediate costs is valuable in attempts to understand comparative institutional performance (see Eggertsson, 2005; E. Ostrom et al., 1993, chap. 5; Webb & Shivakoti, 2008).

Viewing Action Situations as Partially Dependent on Rules

Underlying the way analysts conceptualize action situations are assumptions about the rules individuals use to order their relationships, about attributes of states of the world and their transformations, and about the attributes of the community within which the situation occurs. Some analysts are not interested in the role of these underlying variables and focus only on a particular situation whose structure is given. On the other hand, analysts may be more interested in one factor affecting the structure of situations than they are interested in others. Sociologists tend to be more interested in how shared value systems affect the ways humans organize their relationships with one another. Environmentalists tend to focus on a wide diversity of physical and biological variables as these interact and create opportunities or constraints on the situations human beings face. Given the importance of rules for policy analysis, let us dig deeper into this important set of variables.

The Concept of Rules

Rules are shared understandings among those involved that refer to enforced prescriptions about what actions (or states of the world) are required, prohibited, or permitted. All rules are the result of implicit or explicit efforts to achieve order and predictability among humans by creating classes of persons (positions) that are then required, permitted, or forbidden to take classes of actions in relation to required,

permitted, or forbidden states of the world (Crawford & Ostrom, 2005; V. Ostrom, 1997; Siddiki, Weible, Basurto, & Calanni, 2011).

In an open and democratic governance system, many sources exist for the rules and norms that individuals use in everyday life. It is not considered illegal or improper for individuals to organize themselves and craft their own rules, if the activities they engage in are legal. In addition to the legislation and regulations of a formal central government, there are apt to be laws passed by regional, local, and special governments. Within private firms and voluntary associations, individuals are authorized to adopt many different rules about who is a member of the firm or association, how profits (benefits) are to be shared, and how decisions will be made. Each family constitutes its own rule-making body.

When individuals genuinely participate in the crafting of multiple layers of rules, some of that crafting will occur using pen and paper. Thus, the IAD can be used to analyze formal laws (Basurto, Kingsley, McQueen, Smith, & Weible, 2010; Heikkila, Schlager, & Davis, 2011; Loveman, 1993). Much of it, however, will occur as problem-solving individuals try to figure out how to do a better job in the future than they have done in the past. Colleagues in a work team are crafting their own rules when they might say to one another, "How about if you do A in the future, and I will do B, and before we ever make a decision about C again, we both discuss it and make a joint decision?" In a democratic society, problem-solving individuals do this all the time. They also participate in less fluid decision-making arrangements, including elections to select legislators, committee structures, and bureaucratic teams.

Thus, a deeper institutional analysis first attempts to understand the working rules and norms that individuals use in making decisions. Working rules are the set of rules to which participants would make reference if asked to explain and justify their actions to fellow participants. Although following a rule may become a "social habit," it is possible to make participants consciously aware of the rules they use to order their relationships. Individuals can consciously decide to adopt a different rule and change their behavior to conform to such a decision. Over time, behavior in conformance with a new rule may itself become habitual (see Harré, 1974; Shimanoff, 1980; Toulmin, 1974). The capacity of humans to use complex cognitive systems to order their own behavior at a relatively subconscious level frequently makes it difficult for empirical researchers to ascertain what working rules underlie an ongoing action situation.

Scholars frequently try to understand where working rules come from. In a system governed by a "rule of law," the general legal framework in use will have its source in actions taken in constitutional, legislative, and administrative settings augmented by decisions taken by individuals in many different particular settings. In other words, the rules-in-form are consistent with the rules-in-use (Sproule-Jones, 1993). In a system that is not governed by a "rule of law," there may be central laws and considerable effort made to enforce them, but individuals attempt to evade rather than obey the law (Guha-Khasnobis, Kanbur, & Ostrom, 2006; Sawyer, 2005).

Rule-following or conforming actions by humans are not as predictable as biological or physical behavior governed by scientific laws. All rules are formulated in human language. Therefore, rules share the problems of lack of clarity, misunder-

standing, and change that typify any language-based phenomenon (Allen, 2005; Gellar, 2005; V. Ostrom, 1980, 1997, 2008). Words are always simpler than the phenomenon to which they refer.

The stability of rule-ordered actions depends upon the shared meaning assigned to words used to formulate a set of rules. If no shared meaning exists when a rule is first formulated, confusion will exist about what actions are required, permitted, or forbidden. Regularities in actions cannot result if those who must repeatedly interpret the meaning of a rule within action situations arrive at multiple interpretations. Because "rules are not self-formulating, self-determining, or self-enforcing" (V. Ostrom, 1980, p. 312), it is human agents who formulate them, apply them in particular situations, and attempt to enforce performance consistent with them (Aligica & Boettke, 2009, 2011). Even if shared meaning exists at the time of the acceptance of a rule, transformations in technology, in shared norms, and in circumstances more generally change the events to which rules apply: "Applying language to changing configurations of development increases the ambiguities and threatens the shared criteria of choice with an erosion of their appropriate meaning" (V. Ostrom, 1980, p. 312).

What rules are important for institutional analysis? A myriad of specific rules are used in structuring complex action situations. Scholars have been trapped into endless cataloging of rules not related to a method of classification most useful for theoretical explanations. But classification is a necessary step in developing a science. Anyone attempting to define a useful typology of rules must be concerned that the classification is more than a method for imposing superficial order onto an extremely large set of seemingly disparate rules. The way this problem has been tackled using the IAD framework is to classify rules according to their impact on the elements of an action situation (see Figure 3).

Rule Configurations

A first step toward identifying the working rules can be made by overtly examining how rules affect each of the variables of an action situation. A set of working rules that affect these variables should constitute the minimal but necessary set of rules needed to offer an explanation of actions and results based on the working rules used by participants to order their relationships within an action situation. Working rules alone, however, never provide a necessary and sufficient explanation of the structure of an action situation and results. The action situation is also affected by a diversity of biophysical variables as well as by the structure of a community in which it operates.

Seven types of working rules can affect the structure of an action situation. As illustrated in Figure 3, these are boundary rules, position rules, scope rules, choice rules, aggregation rules, information rules, and payoff rules. The cumulative effect of these seven types of rules affects the seven elements of an action situation.

Boundary rules affect the number of participants, their attributes and resources, whether they can enter freely, and the conditions they face for leaving. Position rules establish positions in the situation. Choice rules assign sets of actions that actors in

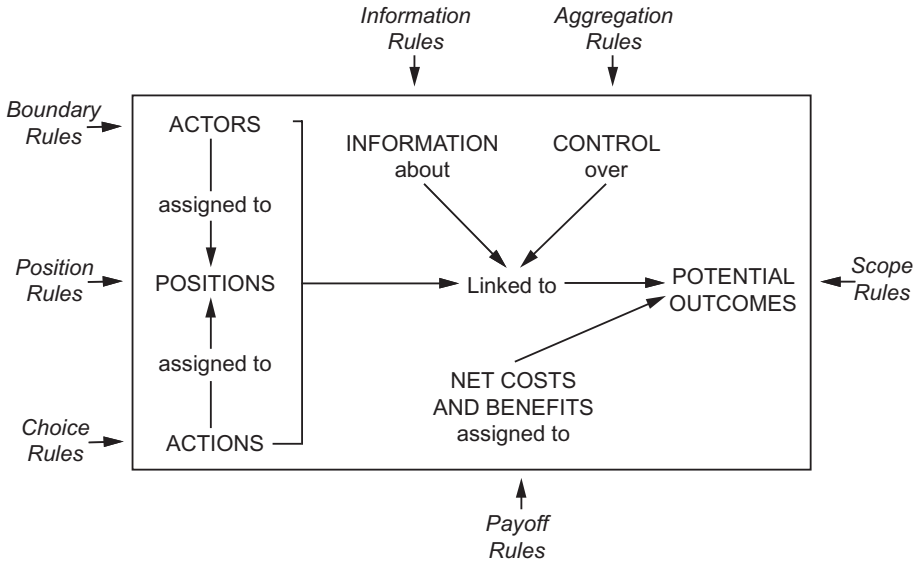

Figure 3. Rules as Exogenous Variables Directly Affecting the Elements of an Action Situation. *Source:* Adapted from E. Ostrom (2005, p. 189).

positions at particular nodes may, must, or must not take. Scope rules delimit the potential outcomes that can be affected and, working backward, the actions linked to specific outcomes. Choice rules, combined with the scientific laws about the relevant states of the world being acted upon, determine the shape of the decision tree that links actions to outcomes. Aggregation rules affect the level of control that a participant in a position exercises in the selection of an action at a node. Information rules affect the knowledge-contingent information sets of participants. Payoff rules affect the benefits and costs that will be assigned to particular combinations of actions and outcomes, and they establish the incentives and deterrents for action. The set of working rules is a configuration in the sense that the effect of a change in one rule may depend upon the other rules-in-use.

Let us return to the example of conducting an analysis of common-pool resources (see Gibson, McKean, & Ostrom, 2000). Now I will focus on a series of questions that are intended to help the analyst get at the rules-in-use that help structure an action situation. Thus, to understand these rules, one would begin to ask questions such as:

- *Boundary rules*: Are the appropriators from this resource limited to local residents; to one group defined by ethnicity, race, caste, gender, or family structure; to those who win a lottery; to those who have obtained a permit; to those who own required assets (such as a fishing berth or land); or in some other way limited to a class of individuals that is bounded? Is a new participant allowed to join a group by some kind of entry fee or initiation? Must an appropriator give up rights to harvest upon migrating to another location?

- *Position rules*: How does someone move from being just a "member" of a group of appropriators to someone who has a specialized task, such as the chair of a management committee or a water distributor-guard?
- *Scope rules*: What understandings do these appropriators and others have about the authorized or forbidden geographic or functional domains? Do any maps exist showing who can appropriate from which region? Are there understandings about resource units that are "off-limits" (e.g., the historical rules in some sections of Africa that particular acacia trees could not be cut down even on land owned privately or communally)?
- *Choice rules*: What understandings do appropriators have about mandatory, authorized, or forbidden harvesting technologies? For fishers, must net size be of a particular grossness? Must forest users use some cutting tools and not others? What choices do various types of monitors have related to the actions they can take?
- *Aggregation rules*: What understandings exist concerning the rules affecting the choice of harvesting activities? Do certain actions require prior permission from, or agreement of, others?
- *Information rules*: What information must be held secret, and what information must be made public?
- *Payoff rules*: How large are the sanctions that can be imposed for breaking any of the rules identified above? How is conformance to rules monitored? Who is responsible for sanctioning nonconformers? How reliably are sanctions imposed? Are any positive rewards offered to appropriators for any actions they can take? (e.g., is someone who is an elected official relieved of labor duties?)

The problem for the field researcher is that many rules-in-use are not written down. Nor can the field researcher simply be a survey worker asking a random sample of respondents about their rules. Many of the rules-in-use are not even conceptualized by participants as rules. In settings where the rules-in-use have evolved over long periods of time and are understood implicitly by participants, obtaining information about rules-in-use requires spending time at a site and learning how to ask nonthreatening, context-specific questions about rule configurations.[1]

Attributes of the World Affecting Action Situations

Given that the IAD framework has been developed and used primarily by social scientists, the focus has frequently been on the working parts of the situation itself rather than on the factors underlying any particular action situation. On the other hand, many scholars who have used IAD have conducted research on resource governance and run into the problem that simply positing a "biophysical world" did not elucidate the array of variables that affected any particular action situation. As a result of working with the Beijer Institute of Ecological Economics, the Resilience Alliance, and the Stockholm Resilience Center for multiple years, I became aware

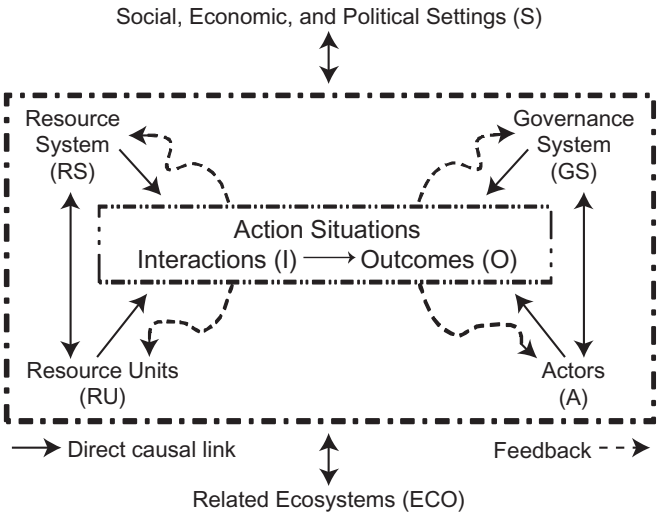

Figure 4. Action Situations Embedded in Broader Social-Ecological Systems.
Source: Adapted from E. Ostrom (2007, p. 15182).

that many ecologists did not find the IAD relevant for their work. They found it difficult that the many variables related to the social world had been unpacked but all of the multiple variables relevant for analyzing ecological systems had been packed into one term—"the biophysical world."

Working with a diverse set of colleagues who participated in the design and contributed articles to a special feature of *PNAS*, we tried to focus on a broader framework that encompassed the action situation as a core part of the analysis (E. Ostrom, Janssen, & Anderies, 2007). In my article for this special feature, I focused on how a Resource System, Resource Units, Governance System, and Users embedded in larger or smaller Social, Economic, and Political Settings and Related Ecosystems might affect interactions and outcomes (E. Ostrom, 2007). In the initial *PNAS* article, I did not include the term "action situations," as I thought interactions and outcomes obviously resulted from action situations. But as the SES framework is developing further, colleagues have been sure to overtly include action situations generating the interactions and outcomes. Also, colleagues have pointed out that there are multiple types of actors affecting outcomes and that the initial focus on resource users limited what could be analyzed.

As illustrated in Figure 4, one can think of Actors interacting in Action Situations generating Interactions and Outcomes that are affected by and affect a Resource System, Resource Units, Governance System, which then affect and are affected by Social, Economic, and Political Settings and Related Ecosystems. Figure 4 provides an overview of the highest tier of variables that exist in all SESs. The highest tier of variables can be unpacked multiple times when one is trying to analyze specific questions related to SESs in the field.

The SES variables that are most important for a particular study depend on the specific research question of interest. A set of 10 variables have now been identified

across many field studies as impacting the likelihood of users self-organizing to overcome a common-pool resource dilemma (Basurto & Ostrom, 2009; E. Ostrom, 2009). These include: the size, productivity, and predictability of the resource system; the extent of mobility of the resource units; the existence of collective-choice rules that the users may adopt authoritatively in order to change their own operational rules; and four attributes of actors (the number, the existence of leadership, knowledge about the SES, and the importance of the SES to the actors). Understanding the challenge of building effective irrigation systems during the nineteenth century in the American West is enhanced by examining the match between diverse governance systems with the attributes of resource systems, resource units, and the actors involved (E. Ostrom, 2011).

Linking the broader contextual variables and microsituational variables is one of the major tasks facing scientists who work across disciplinary lines in efforts to understand how both social and ecological factors affect human behavior (Meinzen-Dick, Devaux, & Antezana, 2009; Poteete, Janssen, & Ostrom, 2010). Many future institutional studies will continue to use the IAD by itself when the setting to be explained is not heavily affected by ecological variables. When action situations are strongly affected by attributes of resource systems and resource units, the evolving SES framework that now overtly includes action situations is likely to be used more frequently (Cox & Ostrom, 2010; McGinnis, 2011; Pahl-Wostl, 2010).

Future Challenges

IAD scholars now have a sufficient grounding as summarized in this issue of the *Policy Studies Journal* and the many articles and books cited herein, to tackle still further questions of substantial importance to the world of policy. One interesting challenge will be developing methods for studying the evolution of action situations over time. Currently, one can descriptively address the question of how changes in the ecological conditions or in broader cultural and/or political settings affect the structure and outcome of particular action situations (Aligica & Boettke, 2009; Boyd & Richerson, 1985). Developing formal methods for examining diverse processes of structure change over time, however, is an important next step for scholars who have mastered some of the new techniques derived from the study of genetics.

Another important area for future work is conducting experiments in the lab and the field that build on the essential foundations of existing work but explore the impact of more complex ecological or social settings on behavior. Janssen et al. (2010) developed a computerized common-pool resource experiment where subjects faced an environment where replenishment depended on the spatial patterns of resource units left untouched rather than simply how many units remained. It will now be possible to explore the challenge of sustainably harvesting from a resource system where the resource units move (such as fish) as contrasted to being stationary (such as trees) or where the growth rate differs substantially. Exploring asymmetric situations where participants are allocated substantially different powers to harvest resources or contribute to the provision of a public good is now also feasible and can be developed further (Cox, Ostrom, & Walker, 2010). Another important step is

taking experiments to the field and examining how those familiar with diverse resource systems cope (or do not cope) with diverse rules for organizing harvesting (Cardenas, Janssen, & Bousquet, 2011).

These are only a few of the future research areas facing us today. The research program facing IAD scholars, as they explore new questions, new research methods, and new modes of analysis, is immense!

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Notes

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1. The International Forestry Resources and Institutions research program has faced this problem in developing research protocols that enable a network of research scholars to gather the "same" information from a sample of forestry sites located in multiple countries of the world. To obtain reliable information about rules-in-use, one has to have several discussions with users where one slowly develops an understanding of the rules-in-use at a particular site. One cannot use a structured survey of respondents to obtain reliable information. Reliability results from coding information about rules-in-use after repeated discussions with users and discussions among members of the research team (see Moran & Ostrom, 2005; E. Ostrom & Wertime, 2000).

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