

# Challenges and growth: the development of the interdisciplinary field of institutional analysis

ELINOR OSTROM\*

*Workshop in Political Theory and Policy Analysis, Indiana University; Center for the Study of Institutional Diversity, Arizona State University*

**Abstract:** This article briefly describes some of the intellectual challenges during the last half-century to the traditional fields of economics and political science: the public choice approach, the tragedy of the commons debate, the ‘new’ institutional economics, and behavioral game theory. Then, the components of a basic institutional analysis framework are presented that provide a general method for analyzing public economies and diverse forms of collective action. Empirical research related to metropolitan public economies, common-pool resources, and behavioral game theory is summarized that has contributed to the field of institutional analysis. The last section concludes that the macro foundations of institutional analysis appear firmer than the micro foundations related to the model of the individual to be used and discusses this puzzle.

## 1. Introduction

In his interesting and controversial review article, Fabio Rojas (2006) refers to the ‘imperialism’ of sociological theories of market behavior and argues for recognizing the essential importance of culture and social structure in explaining economic behavior and outcomes. Political scientists have also worried about imperialism – both in their studies in international relations and in regard to a fear of takeover by economists and rational choice theory. The Perestroika movement within political science condemned the growing acceptance of formal models and statistics in political science journals as an imperial methodological takeover.<sup>1</sup>

Looking at the positive side of interdisciplinary relationships, Herbert Simon (1999) called the exchange between economics and political science a ‘potlatch’ where each discipline has brought ‘gifts’ to the other. After many years of suspicions regarding the ‘gifts’ brought by the other discipline, Simon concludes that the extensive methodological and empirical development of the last fifty

\*Support from the National Science Foundation and the MacArthur Foundation is gratefully acknowledged, as is Patty Lezotte’s careful editing and the detailed comments of the reviewers.

<sup>1</sup> The debate generated by the Perestroika movement did have some healthy consequences (Monroe, 2005).

years has prepared all of the social sciences for a better interaction in the future. ‘Gift-giving between economics and the other social sciences can become a genuine exchange, going in both directions’ (ibid.: 117).

The metaphor of a potlatch, rather than one of imperialism, best describes what we have achieved in the relationship between economics and political science after a half-century or more of challenges. At first, the new interdisciplinary approaches explored by venturesome and imaginative scholars shocked the mainstream of both disciplines given the new questions, methods, and research strategies. Challenges frequently provoke growth, and the eventual development of an interdisciplinary field of ‘institutional analysis’ has indeed developed out of these challenges. While institutional analysis builds on the gifts provided by economists and political scientists, it also draws inspiration and methods from the other social sciences as well as biology to provide a general framework for the analysis of humanly designed institutions at multiple levels and their consequences. In this review article, I will briefly describe four interdisciplinary approaches that were perceived by many traditional scholars as major challenges during the last half-century to the traditional disciplinary fields. The four challenges are: the public choice approach, the tragedy of the commons debate, the ‘new’ institutional economics, and behavioral game theory.

Second, I will discuss the components of a basic institutional analysis framework that provides a general method for starting the analysis of diverse types of collective action. Third, I will review empirical research related to metropolitan public economies, common-pool resources, and testing theories of individual behavior that have contributed to the field of institutional analysis. I will conclude with a brief synthesis of the central lessons that have emerged as a result of the ‘institutional analysis potlatch’ between economics and political science.

## 2. Intellectual challenges

Let us briefly examine the challenges resulting from the emergence of the public choice approach, the tragedy of the commons debate, the ‘new’ institutional economics, and behavioral game theory.

### 2.1. *The public choice approach*

Important developments in science frequently occur at the boundaries of disciplines when scholars from two or more fields address old questions in new ways. Important scholarly works at the borders of economics and political science included the publication of Kenneth Arrow’s *Social Choice and Individual Values* in 1951, Anthony Down’s *An Economic Theory of Democracy* in 1957, Duncan Black’s *The Theory of Committees and Elections* in 1958, James Buchanan and Gordon Tullock’s *The Calculus of Consent* in 1962, and Mancur Olson’s *The Logic of Collective Action* in 1965. This generated a new

approach – called public choice – to be developed by a group of economists, political scientists, and sociologists who have used methods originally developed in economics to examine the constitution of order in the public sector.

An organizing question underlying work in the public choice tradition has been: What incentives do actors face when making decisions in the public sector? Having identified these incentives, public choice theorists predict how different individuals will act and how individual behavior will aggregate into collective outcomes (see, for example, Shepsle, 1979, 1986; Weingast, 1989; Weingast, Shepsle, and Johnsen, 1981; Krehbiel, 1988; Diermeier, 1995; Acemoglu and Robinson, 2006, as a small sample of this important work). Incentives result from the structure of a situation that is affected by the type of goods involved, combined with attributes of a community and the rules used for making decisions about allocation, production, distribution, and consumption of those goods.

The early work of public choice theorists challenged the notion that order in the public sector stemmed only from central direction. Instead of prejudging the performance of complex organizations in metropolitan areas, Vincent Ostrom, Charles Tiebout, and Robert Warren proposed in 1961, for example, that the multiplicity of local jurisdictions in a metropolitan area be conceived as a ‘polycentric political system’.

‘Polycentric’ connotes many centers of decision-making which are formally independent of each other... To the extent that they take each other into account in competitive relationships, enter into various contractual and cooperative undertakings or have recourse to central mechanisms to resolve conflicts, the various political jurisdictions in a metropolitan area may function in a coherent manner with consistent and predictable patterns of interacting behavior. To the extent that this is so, they may be said to function as a system. (p. 831)

This brought a different perspective to the study of governance. Instead of presuming the existence of only two kinds of order – the market and the government – political economists have come to recognize that order can be achieved in *public economies* where large, medium, and small governmental and nongovernmental enterprises engage in both competitive and cooperative relationships.

The public choice or ‘rational choice’ approach was quickly adopted by many political scientists who rapidly developed and applied it to the study of many different types of institutional arrangements, including legislatures (Riker, 1962; Shepsle, 1989), voting rules (Rae, 1969), and bargaining (Riker, 1967) (for an excellent overview of rational choice theory as of the early 1980s, see Barry and Hardin, 1982). The approach was strongly criticized by other political scientists, however, because it was thought to portray all human behavior as narrowly self-interested and shortsighted (Green and Shapiro, 1994).

## 2.2. *The tragedy of the commons*

Another important interdisciplinary development is the analysis by both ecologists and economists of ‘the tragedy of the commons’ (Hardin, 1968; Gordon, 1954). This theory, like that of Mancur Olson, challenged the earlier ‘group theorists’ (e.g. Truman, 1951; Bentley, 1935) who presumed that individuals were motivated to contribute to efforts to solve common problems when it was in their long-term interest to do so. Gordon and Hardin saw individuals as focused on maximizing their immediate short-term benefits. This meant that they were helpless to do anything else but overharvest when they jointly used a resource system that was not privately owned or the property of a governmental unit. The prediction that individuals would destroy the very resources on which they depended was consistent with that of noncooperative game theory models of one-shot or finitely repeated dilemma settings where everyone pursuing their own short-term benefits ended up achieving far less individually and together than was feasible if they had found a way of cooperating with one another.

This work opened up a new body of theoretical and empirical work to challenge the presumption that individuals were forever trapped in a remorseless tragedy (McCay and Acheson, 1987; Berkes, 1985; National Research Council, 1986). Many common-property institutions around the world were documented where individuals had overcome the tragedy. No ‘sure cures’ for the problem were found, however, as failure occurred in regard to private property, government property, and common property. Overharvesting was assured whenever a resource was effectively an open-access resource. Gordon and Hardin, and the myriad of scholars and policymakers from multiple disciplines who accepted this theory as a general theory, were thus correct in identifying a challenging problem, but their analysis was incomplete.

## 2.3. *‘New’ institutional economics*

The ‘new’ institutional economics field has been a major challenge to both economists and political scientists (even though two of its key progenitors – Coase and North – received the Nobel Prize in Economics).<sup>2</sup> Ronald Coase started the first foray in 1937 with his article on ‘The Nature of the Firm’. By asking ‘Why do firms exist?’, he asked an embarrassing question for economists. Why should one find firms existing in the midst of highly competitive markets for strictly private goods? He challenged the presumed dichotomy of the world into markets for production, allocation, and distribution of private goods and hierarchies for the production, allocation, and distribution of collective goods. Coase answered his own question by pointing to the costs that are associated with all forms of organization that had not been included in economic models of the market. These transaction costs could be substantial and would lead

<sup>2</sup> See the discussion of Douglass North’s work in Alt, Levi, and Ostrom (1999).

entrepreneurs to try out alternative forms of organization even when they were dealing with private goods.

Influenced by Coase, Douglass C. North (1981, 1990a, 1990b) initiated a series of studies of institutional change that challenged the static focus of both political science and economics. He examined the growth of the transaction sector in the American economy over century-long periods and demonstrated that transaction costs were a more important factor than production costs in a modern economy. Then he and colleagues turned to the evolution of property rights in the Middle Ages and how the evolutionary process was affected by the need to reduce uncertainty in relationships and the costs of transactions (Milgrom, North, and Weingast, 1990). They demonstrated that a variety of self-organized institutions had guaranteed the property rights of merchants long before the creation of a state. He and other scholars in this tradition are currently trying to expand the model of human behavior used to explain institutional behavior so as to be broadly consistent with important developments in cognitive science (Denzau and North, 1994; North, 2005). Oliver Williamson (1975, 1985) also took up Coase's challenge to examine a diversity of internal mechanisms within firms to keep agents accountable and to reduce transaction costs. Williamson provides one of the clearest presentations in the literature of the dysfunctions of a strict hierarchy. Research in political science on principal-agent theory (Moe, 1984; Miller, 1992) owes a great deal to the pathbreaking work of the transaction cost economists.

#### *2.4. Behavioral game theory*

By the 1960s, game theory became one of the standard tools used by many political economists, while game theory was frequently dismissed by some political scientists as just another form of rational choice theory. While some economists had dismissed game theory in its early days as irrelevant given the theoretical tools already developed to explain market behavior, it has become one of the accepted tools used by most economists.

That one can use the same set of tools to analyze a game of tennis, the decision of when to run for office, how much to trust a stranger, and how much to contribute to a public good or to sustain a common-pool resource, makes this one of the most important analytical tools available to all of the social sciences. What has made game theory such an important tool for institutional analysts, however, is not just the theory but the development of an experimental tradition that enables scholars to test predictions under controlled settings that can be replicated by others and modified to examine the impact of specific rules or other important elements that affect decisions and outcomes in complex settings. Behavioral game theorists have slowly developed an extremely careful set of methods that have greatly improved the reliability and veracity of their results over time. Vernon Smith (1976) first developed an early 'rule book' for how experiments should be run (to see how the method has

evolved, see Davis and Holt, 1993; Kagel and Roth, 1995; Camerer, 2003; Holt, 2007).

Behavioral game theory has evolved into a useful empirical body of research that has supported many propositions derived from noncooperative game-theoretical models as well as challenging others. Because experimentalists have consistently found game theory predictions to hold in regard to many market-like settings (see, for example, Smith and Walker, 1993), behavioral game theory has not been a major challenge to the core of economic theory related to markets. On the other hand, very simple games that generate crystal-clear predictions have not been supported in a large number of experimental settings around the world – including the extension of trust and the division of benefits in settings that lack external enforcement, the provision of public goods, and the appropriation from common-pool resources (Henrich *et al.*, 2004; E. Ostrom, Gardner, and Walker, 1994). Findings from multiple experiments have been inconsistent with a theory that presumes individuals maximize short-term, objective payoffs to self alone. Thus, findings from these experiments challenged the core assumptions of microeconomics as well as those of public choice and rational choice theorists in political science.

The last half of the twentieth century was a time of challenge. Political scientists and economists have reacted in multiple ways to these challenges. Some have continued on their own paths, undaunted by the calls for change. On the other hand, many have attempted to build on the core of the challenges to craft an interdisciplinary approach to the study of the governance of public economies. New frameworks, theories, and models have been developed and now underpin considerable empirical research in both the field and the experimental laboratory.

Slowly, a new foundation for the social sciences – and hopefully for public policy – is emerging. It is not yet broadly accepted, but many scholars are independently drawing on, improving, and extending this work. In Section 3, I will provide a brief overview of some of the conceptual tools that have cumulated during the last several decades of the study of self-governance and public economies that are the foundation for the empirical results presented in Section 4.

### **3. Components of institutional analysis applied to complex public economies**

To study public economies, one has to examine multiple levels of organization ranging from small neighborhoods to international regimes, rather than focusing on only one level of a single, isolated, government. System-level outcomes are generated through a series of linked action situations that exist in both public and private realms of activity and generate both upward and downward causal processes. The old-fashioned dichotomy between ‘the market’ and ‘the state’

has been replaced. Institutional analysts recognize that markets cannot exist without well-defined property rights, police to enforce these rights, and courts that enforce contracts. Nor can a centralized government do all of the above by itself!

### *3.1. An action arena at the core of analysis*

The core analytical unit of institutional analysis is an ‘action arena’ in which participants (e.g. individuals, families, firms, voluntary associations, governmental units) interact in a structure of incentives generated by the characteristics of the goods involved, the rules-in-use, and the attributes of the community of participants involved (E. Ostrom, 2005). Participants possess varying levels of information, potentially diverse preferences and norms of behavior, and diverse time horizons. The arena may be represented as a formal game, an agent-based model, a detailed case study, or an analytical narrative.

An action arena is affected by three clusters of variables that are treated as exogenous for any specific analysis of the incentives and likely behavior *within* an arena, but become endogenous variables when analyzing institutional change. These variables are the characteristics of goods, the rules-in-use, and the attributes of the community of participants. Performance in regard to efficiency, equity, adaptation, and robustness is not only an attribute of the human system of relationships that is generated but how that system is related to specific biophysical and social domains.<sup>3</sup>

### *3.2. Characteristics of goods*

Two basic attributes are now widely used to distinguish among goods and services in regard to their provision and production: difficulty of exclusion and subtractability (V. Ostrom and E. Ostrom, 1977).

#### *Excludability and the free-rider problem*

When the benefits of a good are available to all members of a group – whether or not they contribute to providing the good – that good is characterized by the problem of excludability. The group may be small, such as all those who live in a particular neighborhood, or may be national or international in scale. When excluding beneficiaries from a group is costly, those wishing to provide a good or service face potential free-rider problems (Olson, 1965). Individuals who gain from the safety of a community or the protection of the atmosphere, for example, may not contribute resources to provision activities, hoping that others will bear the burden. This is not to say that all individuals will free-ride whenever they can. A strong incentive exists, however, to free-ride in all situations where

<sup>3</sup> See Janssen (2006) and the August 2006 issue of this journal, where applications of institutional analysis are made to the history of social-ecological systems in diverse ecological domains.

potential beneficiaries cannot easily be excluded for their failure to contribute to the provision of a good or service.

*Joint use and subtractability*

Jointness of consumption occurs whenever multiple individuals use a good at the same time. Lakes, theaters, and the level of peace and security in a nation are jointly consumed. On the other hand, bread is an example of a good that is not jointly consumed. All private goods, like bread, are fully subtractive. Once a loaf of bread is obtained by one individual or family, that loaf of bread is no longer available to others.

Jointly used facilities frequently generate subtractive goods. A diversion dam at the head of an irrigation system, for example, produces agricultural uses of water that are fully subtractive. When the use of a resource unit by one individual subtracts from what is available to others and exclusion is costly, there is a strong incentive to overuse the common-pool resource. Unproductive races to obtain resource units can lead to the destruction of highly valued natural resources such as fisheries, wildlife, and forests. When resource users are able to design appropriate resource regimes, sustainable outcomes are more likely (Vatn, 2005; Prakash and Potoski, 2006).

**3.3. *The difference between the provision and production of goods***

A crucial problem in obtaining public goods and common-pool resources relates to the *provision* of the good rather than to the *production* of the good. If large groups of individuals wish to consume collective goods, it is difficult to rely on voluntary arrangements over long periods of time to (1) obtain revenue in a fair and equitable manner, (2) articulate demands, (3) allocate the goods and services to some individuals and exclude others, (4) regulate the patterns of use among the community of users, and (5) monitor the performance of producers. These five activities relate to the provision side of a public economy and not to the production side. The production side involves the transformation of input units (land, labor, and capital) into particular goods and services.

In a private market, provision activities take place as individual buyers engage in *quid pro quo* relationships with sellers of goods and services. When exclusion is low-cost to the supplier, preferences for the amount and quantity of a good are revealed as a result of many *quid pro quo* transactions. Producers learn about preferences through the consumers' willingness to pay for various goods offered for sale. Where exclusion is difficult, designing mechanisms that honestly reflect beneficiaries' preferences and their willingness to pay is difficult and complex. In very small groups, those affected are usually able to discuss their preferences and constraints on a face-to-face basis and to reach a rough consensus. In larger groups, provision decisions are apt to be made through mechanisms such as voting or the delegation of authority to public

officials. The extensive literature on voting systems demonstrates how difficult it is to translate individual preferences into collective choices that adequately reflect individual views (Arrow, 1951; Shepsle, 1979; Buchanan and Tullock, 1962).

When citizens establish an organization with the authority to use sanctions against those who do not contribute resources toward the provision of a collective good, they constitute a *provision or collective consumption unit*. Many provision units have the formal status of a government established at a local, regional, or national scale. Governmental units may be general-purpose or organized as a special district or regime for the purpose of providing one or a limited range of collective goods. Private associations that sanction, or even expel, those who do not contribute their share of resources to provide for a collective good are also collective consumption units. Sports leagues and housing condominiums are two types of private associations that provide collective goods for their members.

Once a collective consumption unit is established, how production is organized is an entirely *separate* question. A collective consumption unit is faced with at least six different institutional arrangements for arranging for the supply of local public goods. These include: (1) establishing and operating its 'own' production unit, (2) contracting with a private firm, (3) contracting with another governmental unit, (4) obtaining some services from its own production unit and other services from other governmental or private producers, (5) establishing standards of service that must be met by authorized producers and allowing each consumer to select a private vendor and to procure services from an authorized supplier, and (6) issuing vouchers to families and permitting them to purchase service from any authorized supplier. All of these arrangements are used by collective consumption units at a local, regional, national, or international level to arrange for the production of particular collective goods (Gibson *et al.*, 2005). Given both the diversity of collective consumption units and the diversity of mechanisms each can use to arrange for production, institutions for the governance of public economies and other regions could be expected to derive significant advantage through complex patterns of organization.

Provision systems often do not resemble the textbook versions of either a government or a strictly private-for-profit firm, especially when participants have constituted their own self-governing units. Thus, scholars drawing on traditional conceptions of 'the market' and 'the state' have not recognized them as potentially viable forms of organization and have either called for their consolidation into a centralized government (as metropolitan reformers continue to do) or ignored their existence (as many resource economists have done). It is a bit ironic that many vibrant self-governed institutions have been misclassified or ignored in an era that many observers consider one of ever-greater democratization.

### 3.4. *Further attributes of collective goods affecting the organization of provision and production units*

To explain why citizens and their officials have organized such diverse sets of enterprises in local, regional, and international systems, one needs to examine attributes of collective goods, in addition to those of exclusion and jointness, which affect the costs and benefits of provision and production activities. Goods that are capital-intensive, for example, can achieve economies of scale in larger production units, while labor-intensive services can be produced at lower average costs in smaller production units. In addition to economies of scale in production, other attributes of goods may affect how provision and production activities are accomplished.

Whether a good needs to be coproduced or not is an important factor leading to different outcomes depending on the way public economies are organized (see Parks *et al.*, 1999; E. Ostrom, 1996). Education and other public *services* cannot be fully *produced* by a production unit entirely by itself. The teacher in the classroom is an essential aspect of the production of education but so is the effort made by students and their parents, siblings, and friends. Coproduction of services is more difficult to maintain when provision units are extremely large and heterogeneous and production units are isolated from the input of those for whom the service is intended.<sup>4</sup>

Given that the size of the group jointly consuming a good may vary from a small neighborhood to an entire nation or larger, one should expect to find citizens creating small, medium, and large collective consumption units and not relying on a single scale of organization. Unless appropriate boundaries can be established, effective means for gaining information about citizen preferences can be devised, and appropriate means for generating revenue can be designed, instruments of coercion can be used to create more harm than good. This is particularly a problem when individuals have little choice about whether they consume particular local collective goods or not.

### 3.5. *Commonly understood and enforced rules*

A key finding of empirical field research is the multiplicity of specific rules-in-use found in operational settings related to the provision and production of collective goods. An important type of rules is *boundary* rules, which determine who and what is in and out of a provision organization. The important attribute of boundary rules is the degree of match between the provision organization and the local situation rather than the specific rule used (E. Ostrom, 2005, 2007).

Some provision units face considerable biophysical constraints when the good is a natural common-pool resource such as a groundwater basin or a river. Such resources have their own geographic boundary. Creating a match between the boundary of those who benefit and are required to contribute and the boundary of the resource may be impossible in a highly centralized regime.

<sup>4</sup> Heterogeneity is a challenge at all levels of organization (see Keohane and Ostrom, 1995).

Further, common-pool resources may themselves be nested in an ever-larger sequence of resource units. A micro watershed is nested in a system of ever-larger watersheds that eventuates into a major river system such as the Rhine or the Mekong River (Myint, 2003). On the other hand, the biophysical world does not have a strong impact on the efficacy of using diverse boundaries for the provision of public education or police response services. One is constrained more by the transaction costs of reaching decisions and monitoring performance.

Once basic boundary rules define who is a legitimate beneficiary and who must contribute to the provision of a collective good, provision units frequently create rules related to the information that must be made public or kept secret, to the actions that must or may be taken or are forbidden, and the outcomes (and resulting benefits and costs) to be achieved and distributed. To be effective, rules must be generally known and understood, considered relatively legitimate, and thus in general to be followed and enforced. Written legislation or contract provisions that are not common knowledge do not affect the structure of a particular action situation unless someone involved in the situation invokes the rule and finds someone to enforce it. Thus, a problem with doing research on the effect of diverse institutional arrangements is sorting out the rules that exist on paper but are not used by participants as contrasted with rules that are common knowledge of the participants and enforced locally but not part of the formal legal structure. When scholars refer to a system as having a 'rule of law', they mean that most of the rules used in practice are consistent with the rules-in-form detailed in legislation, court decisions, and administrative procedures (Sproule-Jones, 1993).

In the interests of space, and since I have discussed rules in considerable detail elsewhere, the reader is referred to Crawford and Ostrom (2005) where detailed analyses of rules are presented. The crucial point is that rules affect the structure of the situation under analysis. One should expect to see differences in the incentives and likely behavior when one configuration of rules is used versus another (see also Aoki, 2001, for a good discussion of the diversity of rules needed to cope with the array of problems humans face).

### *3.6. Attributes of a community*

Many attributes of a community are also likely to affect provision activities, including the size of the group affected, the homogeneity or heterogeneity of interests, the patterns of migration into or out of a community, and the discount rate used by individuals in ongoing situations. The specific attributes of a community that might affect outcomes could be very large. An institutional analyst, however, needs to know answers to the following set of questions to begin an analysis of an action arena:

- Is there general agreement on the rules related to who is included as a member with both benefits and responsibilities?

- Do participants have a shared understanding of what their mutual responsibilities are as well as the formulae used for distribution of benefits?
- Are these rules considered legitimate and fair?
- How are the rules transmitted from one generation to the next or to those who migrate into the group?

A diversity of community attributes affects the answers to these questions.

### 3.7. *Polycentric-linked systems*

Once one recognizes that the organization of the *provision* of collective goods is the crucial step in obtaining or sustaining collective goods, one can begin to build a different theoretical explanation of political orders. One form of political order is created when a central power uses a monopoly of force to impose its central will on its subjects. The work of Margaret Levi (1988) convincingly demonstrates how costly and unstable it is to rely strictly on a central monopoly of force to govern effectively.

Other forms of order at all levels of organization exist and need serious study. Robert Putnam (2000; Putnam *et al.*, 1993) has demonstrated the importance of networks in the creation of social capital that enables complex governance systems to evolve without all links being planned from the top (see also E. Ostrom and Ahn, 2003). Robert Keohane (1984, 2001) views political order at the international level without depending on the hegemony of one state dominating the entire system.

We need to include in our analyses institutional arrangements that are not encountered in basic economics and political science textbooks that tend to focus exclusively on markets or the state. In addition to general-purpose governments, a host of other organizations may undertake the provision of collective goods. Sometimes these will be bowling leagues. Other times they will be groups of lobster fishermen (Acheson, 2003). They may be international regimes (McGinnis and Williams, 2001). And, given that the appropriate scale for organizing the provision side is not always the same scale as for organizing the production side of any collective good, one should expect to find messy polycentric systems of provision and production units operating at multiple scales in regard to almost any collective good.

## 4. Empirical research relevant to institutional analysis

Considerable empirical research has provided strong support for a multi-disciplinary study of institutional analysis.

### 4.1. *Public economies in metropolitan areas*

In regard to the organization of governments serving a metropolitan area, scholars in the public choice and new institutional economics tradition have analyzed why complex systems perform better than simple and highly centralized

systems. The optimal scale of organization for the production and provision of goods and services differs radically for different types of collective goods and services. This leads to the prediction that public economies in metropolitan areas with many governmental enterprises organized at diverse scales will perform more effectively than either one large-scale (metropolitan-wide) government or a large number of governments organized only at a small scale.

Considerable research on local public economies, and multi-level systems more generally (see Houghe and Marks, 2001), has demonstrated that effective social order can emerge from polycentric systems and need not be imposed by a centralized system (Poel, 2000; McGinnis, 1999). Individuals are not able to engage in a wide diversity of independent *quid pro quo* relationships with any vendor they choose, but rather receive collective goods from the producer chosen by a provision unit. Unlike markets, however, thick relationships exist among entities in a local public economy. One must examine structure and performance at an interorganizational level of analysis as well as the level of a single firm or governmental units.

As an illustration of the research undertaken in this vein, allow me to briefly present the core results of a 15-year research program that examined the impact of the structure of public economies related to the provision of police in metropolitan areas.

#### *The public economy of police services*

It is, of course, difficult for any scholar who has spent more than fifteen years gathering data (including riding in police cars in major urban centers on Saturday night!), developing theory, and testing that theory to summarize that research quickly. Let me simply state that in a wide diversity of studies – ranging from carefully matched neighborhoods in one metropolitan area to a random sample of 80 metropolitan areas – we consistently found:

1. Small- to medium-sized police departments outperform large police departments serving similar communities – and at similar or lower costs.
2. In polycentric systems, services that are characterized by substantial economies of scale (e.g. crime lab, dispatching) are produced by large units, and services characterized by diseconomies of scale were produced by smaller units outside of the center city. In other words, polycentric systems enable police departments to search out more efficient modes of production than described in the textbooks.
3. Citizens living in the most fragmented metropolitan areas receive more police presence on the streets for their tax expenditures than do citizens living in the most consolidated areas. The most efficient producers supply more output for given inputs in high multiplicity metropolitan areas than do the most efficient producers in lower multiplicity areas. Thus, the presence of many other producers for comparison enhances the efficiency of direct-service producers (see McGinnis, 1999, for multiple chapters presenting the findings from these earlier studies).

*Other public services*

In addition to the research on police, scholars have conducted rigorous empirical research on a variety of questions related to the polycentric organization of public economies. Early empirical studies challenged the presumption that fragmentation of governments leads to higher costs (Wagner and Weber, 1975; DiLorenzo, 1983; Schneider, 1986). Boyne (1992: 352) conducted a meta-analysis of 20 studies of the effect of local government structure in the United States and summarizes his analysis with the following conclusions:

First, the horizontal fragmentation of multi-purpose governments leads to lower spending. Second, local government units compete in a market which is geographically limited: competition between units is present at a relatively small spatial scale but not across wide areas. Third, the vertical concentration of market share in the large 'top tier' units is associated with higher spending. Finally, the establishment of barriers to entry is positively related to expenditures by the local government units that are protected by the barriers.

In sum, the broad pattern of the evidence suggests that lower spending is a feature of fragmented and deconcentrated local government systems. By contrast, consolidated and concentrated structures tend to be associated with higher spending.

In regard to schooling, scholars have found that larger public school districts have not achieved higher performance as was predicted when massive school consolidation was undertaken in the 1950s and 1960s (Niskanen and Levy, 1974; Hanushek, 1986; Teske *et al.*, 1993). Summers and Wolfe (1977) found that smaller schools were associated with higher student performance and that the positive impact of smaller schools was even stronger for black pupils. Participation in high school curricular and extracurricular activities yields significant returns for college matriculation and completion as well as better economic returns later in life (Swanson, 2002). More students can engage in such activities when the schools in a metropolitan area have not been consolidated. Langbein and Bess (2002) also found an association between size of school and proportion of students involved in school activities yielding higher returns later in life (see also Dávila and Mora, 2007).

As a result of extensive empirical and theoretical research, the presumed self-evident truth that constructing one government for each metropolitan area is the best way to achieve efficiency and equity, has slowly been replaced with a recognition that judging 'structure directly on the single criterion of uniformity contributes little to the advancement of research or reform' (Oakerson, 1999: 117). Instead of a single best design that would have to cope with the wide variety of problems faced in different localities, a polycentric theory generates core principles that can be used in the design of effective local institutions when used by informed and interested citizens and public officials (*ibid.*: 122–124). Further insights into the way diverse local governments are constituted have been

provided by Oakerson and Parks (1989), Stephens and Wikstrom (2000), and Hawkins and Ihrke (1999).

#### 4.2. *Studying common-pool resources*

Since the dramatic metaphor created by Hardin (1968), many theoretical studies of common-pool resources have continued to analyze simple systems using relatively similar assumptions. Users are assumed to be short-term, profit-maximizing actors who have complete information and are homogeneous in terms of their assets, skills, discount rates, and cultural views. In this theory, *anyone* can enter the resource and take resource units and overharvesting results.

##### *Empirical anomalies from the field*

Contrary to this well-accepted theory, however, a large number of studies have demonstrated that many resource users have crafted institutions to govern their own resources and in many instances have sustained these regimes for very long periods of time.<sup>5</sup> The design principles that characterize robust, long-lasting institutional arrangements for the governance of common-pool resources have been identified (E. Ostrom, 1990) and supported by further testing (Morrow and Hull, 1996; De Moor, Shaw-Taylor, and Warde, 2002).

Quantitative studies have shown that local-scale common-pool resources, such as irrigation systems, tend to be better organized and sustainable than large-scale government systems (Tang, 1992; Lansing and Kremer, 1993; Araral, 2005). Lam (1998) examined the performance of over 100 irrigation systems in Nepal that are either self-organized by the farmers or constructed and operated by the national government. In a multiple regression analysis, controlling for the size of the system and several physical variables, Lam shows that the farmer-managed systems outperform the government-managed systems in terms of a composite score based on productivity and water distribution. The difference in performance is particularly striking since the farmer-managed systems tend to be constructed using primitive techniques, including brush, stone, and mud diversion works, while government systems have largely been constructed with donor assistance using modern engineering designs (see also Lam's (2006) study of robust irrigation systems in Taiwan).

Well-crafted empirical studies have also begun to identify variables that are associated with a higher probability of successful organization or failure (Bardhan and Dayton-Johnson, 2002; Berkes, forthcoming; Meinzen-Dick, forthcoming; Dayton-Johnson, 2000; Nagendra, forthcoming). A National Research Council report (2002) provides an excellent overview of the substantial research showing both that many common-pool resources are governed successfully by nonstate provision units as well as by government and private

<sup>5</sup> McCay and Acheson (1987); Wade (1988); Berkes (1989); Pinkerton (1989); Tang (1992); Blomquist (1992); E. Ostrom (1990); V. Ostrom, Feeny, and Picht (1993); Netting (1993); Folke and Berkes (1998); Lam (1998). See Digital Library of the Commons, <http://dlc.dlib.indiana.edu>.

property. No type of governance system has been shown to be successful in all implementations (Dietz, Ostrom, and Stern, 2003; E. Ostrom and Nagendra, 2006).

#### *Common-pool resource experiments*

The structure of a finitely repeated common-pool resource game has also been examined in experimental laboratory studies. In this setting, it has been shown that when appropriators from a common-pool resource are in a minimal institutional situation without any capacity to communicate, signal, and know who each other are, outcomes approach the predicted outcome of the conventional theory. On the other hand, as soon as subjects are allowed to communicate, they achieve better outcomes than predicted by the conventional theory. In noncooperative game theory, communication is viewed as ‘cheap talk’ and makes no difference in predicted outcomes in social dilemmas. If individuals are allowed to talk, the presumption is that they will use the opportunity to try to convince others to contribute but then not contribute at all themselves (Farrell and Rabin, 1996). Thus, communication should make no difference to the outcomes achieved.

Once communication is allowed, however, subjects spend time and effort assessing each other’s trustworthiness and reaching agreements about the best strategies they should jointly take. Further, individuals in a laboratory setting are willing to monitor each other and invest in costly sanctions in order to punish those who overappropriate as well as in devising specific rules that they themselves enforce on each other (see Cardenas, 2000; Cardenas, Stranlund, and Willis, 2000; E. Ostrom, Gardner, and Walker, 1994). In other words, in a controlled laboratory setting, individuals solve social dilemmas and achieve substantially greater payoffs than predicted once communication is allowed.

The positive impact of communication has been shown in other experimental settings as well (see E. Ostrom and Walker, 1997; Walker and Ostrom, 2007). The efficaciousness of communication holds for both one-shot and finitely repeated experiments. Sally (1995) conducted a meta-analysis of more than 100 experiments involving more than 5,000 subjects and found that opportunities for communication in one-shot experiments significantly raised the cooperation rates, on average, by more than 45 points.

#### *4.3. Testing predictions of the standard model of the individual*

In addition to experimental research that has examined the level of cooperation achieved in stark collective-action settings that has challenged the validity of the standard theory, research in the behavioral game theory tradition, focusing on ultimatum, dictator, and trust games, examines whether individuals behave as the neoclassical model of individual choice predicts.

Based on repeated experiments conducted in Germany, Indonesia, Israel, Japan, Slovenia, Slovakia, and the United States (Güth, Schmittberger, and

Schwarze, 1982; for a review, see Camerer and Thaler, 1995; Camerer, 2003), subjects in these experiments do not behave as classical game theory predicts. Modest differences do occur in the average sum offered or rejected in different cultures (Roth *et al.*, 1991; Slonim and Roth, 1998). The overwhelming finding is, however, that Proposers in ultimatum games tend to offer around half of the sum and Responders tend to reject low but positive offers. This is even true when the amount of payoff is very high. When a sample of Indonesian subjects was assigned a provisional sum of three-months wages (200,000 Rp), 56% of the Proposers allocated between 40 and 50% of this substantial sum to the Responder (Cameron, 1995).

Evidence from field and experimental research thus challenges the basic underlying model of individual behavior used in neoclassical economics, public choice theory, and game theory. In some settings, individuals do contribute to public goods, do restrict their use of a resource, and do trust one another contrary to theoretical predictions. This evidence has generated another period of turmoil as scholars have tried to understand why predictions derived from the theory of individual rational behavior are supported in some settings and not in others.

## **5. Continuing puzzles regarding the micro foundations of institutional analysis**

Considerable agreement now exists related to the importance of diverse institutional arrangements in public economies ranging from local to national to global (Aoki, 2001; Ruttan, 2003, 2006; E. Ostrom, 2005; Young *et al.*, 2006). Empirical evidence has steadily mounted that demonstrates the capability of humans to design complex systems. Substantial variance in performance has been measured in regard to efficiency, equity, accountability, and resilience or these nonmarket and nonstate institutions, but many of them achieve very high levels of performance. What has not been observed, however, is a strong negative association between polycentric organization and performance that underlay the massive earlier campaigns to eliminate multiplicity of governmental units (Oates, 2005). Instead of presuming that all complex systems need to be replaced with centralized orders, growing evidence has mounted that the challenge is developing well-tested theories that enable us to harness complexity (see, for example, Axelrod and Cohen, 2000; Bickers and Williams, 2001; Houghe and Marks, 2001; Kuhnert, 2001).

Consequently, considerable evidence has been amassed to support theories related to the structure of public economies and of the capabilities of individuals to self-organize a wide diversity of governance mechanisms. Substantial debate still exists, however, about the micro foundations of these evolving theories. In some field settings, the classical theory of individual behavior generates empirically confirmed explanatory and diagnostic results. When analyzing commodity auction markets that are run repeatedly in a setting where property

rights to private goods 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 very well (Smith and Walker, 1993; Plott, 1986). In highly competitive environments, we can make the further assumption that the individuals who survive the selective pressure of the environment act as if they maximized their individual utility dependent on a key variable, such as profits, associated with survival in that environment (Alchian, 1950).

Many of the situations of interest in understanding how public economies govern and manage collective goods, however, are uncertain, complex, and lack the selective pressure and information-generating capabilities of a competitive market. Therefore, one strategy for dealing with this problem has been to assume bounded rationality – that persons are intendedly rational but only limitedly so – rather than the assumptions of perfect information and utility maximization used in the classical theory (see Simon, [1947]1965, 1972; Williamson, 1985; E. Ostrom, Gardner, and Walker, 1994: chap. 9). 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, all individuals may make mistakes in choosing strategies designed to realize a set of goals (V. Ostrom, 1986). Over time, however, they can acquire a greater understanding of their situation and adopt strategies that result in higher returns. Bounded rationality is highly likely to be an effective tool for studies of field settings where the researchers may not be able to specify the specific structure of the situations participants face anymore than the participants themselves. Bounded rationality, however, deals primarily with the information condition related to individual choice. A key problem for many scholars has been, however, the appropriate assumptions to make about the values that individuals place on benefits obtained by others.

The challenge of behavioral game theory has generated results consistent with a richer theory of individual valuation. Scholars are now positing a family of individual models that change the basic assumptions of the classical model (see Rabin, 1993; Ito, Saijo, and Une, 1995; Chan *et al.*, 1997; Levine, 1998; Fehr and Gächter, 2000; Bolton and Ockenfels, 2000; Gintis, 2000; Casari and Plott, 2003; Cox, 2004). Several assumptions are shared across these new theories of individual behavior:

1. Individuals are assumed to have heterogeneous preferences in the same objective situations.
2. Some individuals may include the payoffs obtained by others in their own utility calculation while others may not, and payoffs to others may bring positive, negative, no utility to an individual.
3. Preference may change over time in light of interactions among participants.

The classical model of noncooperative game theory has now become a special case useful when individuals attach no utility to the payoffs of others (Hodgson, 1998, 2004). Once scholars begin to assume that there are multiple ‘types’ of players interacting in a setting, attention can then be focused on how specific aspects of the structure of the situation affect behavior over time, such as sequential moves, type of feedback, forms of communication, and how individuals were assigned to a position.

Assuming that all individuals have altruistic utility functions is also not a sufficient explanation for experimental findings (Ahn, Ostrom, and Walker, 2003). ‘Most data support either inequality-aversion or the reciprocal approaches. Altruism theories do not explain both negative and positive behavior toward others without crudely changing the signs of coefficients exogenously’ (Camerer, 2003: 113). Camerer (*ibid.*: 117) has well captured the broad understanding of many institutional theorists when he commented that: ‘Institutional arrangements can be understood as responding to a world in which there are some sociopaths and some saints, but mostly regular folks who are capable of both kinds of behavior.’

The structure of action arenas is thus created both by the biophysical world (such as the size of a resource, advantages due to location, and predictability) and by the rules used (such as the boundary rules affecting who can be a legitimate participant, whether individuals can communicate and observe each other’s actions, and the specific rules used related to positive payoffs and negative sanctions). The possibility that there are individuals who take into account the payoffs of other individuals changes theoretical foundations greatly (Hodgson, 1998). Now one needs to ask how individuals provide reliable signals to each other about their preferences and intentions and how they gain information about the actions and outcomes of others. How individuals learn about these factors also strongly affects predicted and actual outcomes (Janssen and Ahn, 2006). Further, behavior that evolves over time in different structures is also of considerable importance where those who are inclined to seek jointly beneficial outcomes may achieve significantly higher payoffs over time if they are able to identify one another. Once successful ‘contingent cooperators’ are noticed by others, these successful strategies may be learned and adopted more widely in a population (Güth and Kleimt, 1998). Some of the intriguing rules devised by users of common-pool resources through the ages can now be integrated into contemporary theory (see, for example, Casari and Plott, 2003) rather than being relegated to an irrational and incomprehensible past.

Institutional analysis has come a long way from the initial reactions to challenges derived from the public choice approach, the debate over the tragedy of the commons, the innovative work of the new institutional economics, and the challenge of behavioral game theory. At the beginning of the twenty-first century, however, strong foundations have been achieved for further research on

complex, multitier, institutional arrangements and their consequences. Let the potlatch continue.

## References

- Acemoglu, D. and J. A. Robinson (2006), *Economic Origins of Dictatorship and Democracy*, Cambridge: Cambridge University Press.
- Acheson, J. (2003), *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*, Hanover, NH: University Press of New England.
- Ahn, T. K., E. Ostrom, and J. Walker (2003), 'Heterogeneous Preferences and Collective Action', *Public Choice*, **117**: 295–314.
- Alchian, A. A. (1950), 'Uncertainty, Evolution, and Economic Theory', *Journal of Political Economy*, **58**: 211–221.
- Alt, J., M. Levi, and E. Ostrom (eds) (1999), *Competition and Cooperation: Conversations with Nobelists about Economics and Political Science*, New York: Russell Sage Foundation.
- Aoki, M. (2001), *Toward a Comparative Institutional Analysis*, Cambridge, MA: MIT Press.
- Araral, E. (2005). 'Bureaucratic Incentives, Path Dependence, and Foreign Aid: An Empirical Institutional Analysis of Irrigation in the Philippines', *Policy Sciences*, **38**(2–3): 131–157.
- Arrow, K. (1951), *Social Choice and Individual Values*, 2nd edition, New York: Wiley.
- Axelrod, R. and M. D. Cohen (2000), *Harnessing Complexity: Organizational Implications of a Scientific Frontier*, New York: The Free Press.
- Bardhan, P. and J. Dayton-Johnson (2002), 'Unequal Irrigators: Heterogeneity and Commons Management in Large-Scale Multivariate Research', in E. Ostrom, T. Dietz, N. Dolsak, P. Stern, S. Stonich, and E. Weber (eds), Washington, DC: National Academy Press, pp. 87–112.
- Barry, B. and R. Hardin (1982), *Rational Man and Irrational Society? An Introduction and Source Book*, Beverly Hills, CA: Sage.
- Bentley, A. (1935), *The Process of Government*, Evanston, IL: Principia Press.
- Berkes, F. (1985), 'Fishermen and 'the Tragedy of the Commons'', *Environmental Conservation*, **12**: 199–206.
- Berkes, F. (ed.) (1989), *Common Property Resources: Ecology and Community-Based Sustainable Development*, London: Belhaven Press.
- Berkes, F. (Forthcoming), 'Community-Based Conservation in a Globalized World', *Proceedings of the National Academy of Sciences (USA)*, **104**.
- Bickers, K. and J. T. Williams (2001), *Public Policy Analysis: A Political Economy Approach*, New York: Houghton Mifflin.
- Black, D. (1958), *The Theory of Committees and Elections*, Cambridge: Cambridge University Press.
- Blomquist, W. (1992), *Dividing the Waters: Governing Groundwater in Southern California*, San Francisco, CA: ICS Press.
- Bolton, G. E. and A. Ockenfels (2000), 'ERC: A Theory of Equity, Reciprocity and Competition', *American Economic Review*, **90**: 166–193.
- Boyer, G. A. (1992), 'Local Government Structure and Performance: Lessons from America?', *Public Administration*, **70**: 333–357.
- Buchanan, J. M. and G. Tullock (1962), *The Calculus of Consent*, Ann Arbor: University of Michigan Press.

- Camerer, C. F. (2003), *Behavioral Game Theory: Experiments in Strategic Interaction*, Princeton, NJ: Princeton University Press.
- Camerer, C. F. and R. H. Thaler (1995), 'Anomalies: Ultimatums, Dictators and Manners', *Journal of Economic Perspectives*, **9**: 109–120.
- Cameron, L. (1995), 'Raising the Stakes in the Ultimatum Game: Experimental Evidence from Indonesia', discussion paper, Princeton, NJ: Princeton University.
- Cardenas, J.-C. (2000), 'How Do Groups Solve Local Commons Dilemmas? Lessons from Experimental Economics in the Field', *Environment, Development and Sustainability*, **2**: 305–322.
- Cardenas, J.-C., J. K. Stranlund, and C. E. Willis (2000), 'Local Environmental Control and Institutional Crowding-Out', *World Development*, **28**(10): 1719–1733.
- Casari, M. and C. R. Plott (2003), 'Decentralized Management of Common Property Resources: Experiments with a Centuries-Old Institution', *Journal of Economic Behavior and Organization*, **51**: 217–247.
- Chan, K. S., R. Godby, S. Mestelman, and R. A. Muller (1997), 'Equity Theory and the Voluntary Provision of Public Goods', *Journal of Economic Behavior and Organization*, **32**: 349–364.
- Coase, R. (1937), 'The Nature of the Firm', *Economica*, **4**: 386–405.
- Cox, J. (2004), 'How to Identify Trust and Reciprocity', *Games and Economic Behavior*, **46**: 260–281.
- Crawford, S. E. S. and E. Ostrom (2005), 'A Grammar of Institutions', in E. Ostrom (ed.), *Understanding Institutional Diversity*, Princeton, NJ: Princeton University Press, pp. 137–174. Originally published in *American Political Science Review*, **89** (1995): 582–600.
- Dávila, A. and M. T. Mora (2007), 'Civic Engagement and High School Academic Progress', CIRCLE working paper no. 52, College Park, University of Maryland, School of Public Policy.
- Davis, D. D. and C. Holt (1993), *Experimental Economics*, Princeton, NJ: Princeton University Press.
- Dayton-Johnson, J. (2000), 'Choosing Rules to Govern the Commons: A Model with Evidence from Mexico', *Journal of Economic Behavior and Organization*, **42**: 19–41.
- De Moor, M., L. Shaw-Taylor, and P. Warde (eds) (2002), *The Management of Common Land in Northwest Europe, c. 1500–1850*, Belgium: BREPOL Publishers.
- Denzau, A. T. and D. C. North (1994), 'Shared Mental Models: Ideologies and Institutions', *Kyklos*, **47**: 3–31.
- Diermeier, D. (1995), 'Commitment, Deference, and Legislative Institutions', *American Political Science Review*, **89**: 344–355.
- Dietz, T., E. Ostrom, and P. Stern (2003), 'The Struggle to Govern the Commons', *Science*, **302**: 1907–1912.
- DiLorenzo, T. (1983), 'Economic Competition and Political Competition: An Empirical Note', *Public Choice*, **40**: 203–209.
- Downs, A. (1957), *An Economic Theory of Democracy*, New York: Harper & Row.
- Farrell, J. and M. Rabin (1996), 'Cheap Talk', *Journal of Economic Perspectives*, **10**: 103–118.
- Fehr, E. and S. Gächter (2000), 'Cooperation and Punishment in Public Goods Experiments', *American Economic Review*, **90**: 980–994.
- Folke, C. and F. Berkes (1998), *Linking Social and Ecological Systems*, Cambridge: Cambridge University Press.

- Gibson, C., K. Andersson, E. Ostrom, and S. Shivakumar (2005), *The Samaritan's Dilemma: The Political Economy of Development Aid*, New York: Oxford University Press.
- Gintis, H. (2000), 'Beyond *homo economicus*: Evidence from Experimental Economics', *Ecological Economics*, **35**: 311–322.
- Gordon, H. S. (1954), 'The Economic Theory of a Common Property Resource: The Fishery', *Journal of Political Economy*, **62**: 124–142.
- Green, D. and I. Shapiro (1994), *Pathologies of Rational Choice Theory: A Critique of Applications in Political Science*, New Haven, CT: Yale University Press.
- Güth, W. and H. Kliemt (1998), 'The Indirect Evolutionary Approach: Bridging the Gap Between Rationality and Adaptation', *Rationality and Society*, **10**: 377–399.
- Güth, W., R. Schmittberger, and B. Schwarze (1982), 'An Experimental Analysis of Ultimatum Bargaining', *Journal of Economic Behavior and Organization*, **3**: 367–388.
- Hanushek, E. A. (1986), 'The Economics of Schooling: Production and Efficiency in Public Schools', *Journal of Economic Literature*, **24**: 1141–1177.
- Hardin, G. (1968), 'The Tragedy of the Commons', *Science*, **162**: 1243–1248.
- Hawkins, B. W. and D. M. Ihrke (1999), 'Reexamining the Suburban Exploitation Thesis in American Metropolitan Areas', *Publius*, **29**: 109–121.
- Henrich J., R. Boyd, S. Bowles, C. Camerer, E. Fehr, and H. Gintis (eds) (2004), *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*, Oxford: Oxford University Press.
- Hodgson, G. M. (1998), 'The Approach of Institutional Economics', *Journal of Economic Literature*, **36**: 166–192.
- Hodgson, G. M. (2004), 'Opportunism Is Not the Only Reason Why Firms Exist: Why An Explanatory Emphasis on Opportunism May Mislead Management Strategy', *Industrial and Corporate Change*, **13**: 401–418.
- Holt, C. A. (2007), *Markets, Games, and Strategic Behavior*, Boston, MA: Pearson-Addison Wesley.
- Houghe, L. and G. Marks (2001), *Multi-Level Governance and European Integration*, Lanham, MD: Rowman & Littlefield.
- Ito, M., T. Saijo, and M. Une (1995), 'The Tragedy of the Commons Revisited: Identifying Behavioral Principles', *Journal of Economic Behavior and Organization*, **28**: 311–335.
- Janssen, M. (2006), 'Historical Institutional Analysis of Social Ecological Systems', *Journal of Institutional Economics*, **2**(2): 127–131.
- Janssen, M. A. and T. K. Ahn (2006), 'Learning, Signaling, and Social Preferences in Public-Good Games', *Ecology and Society* **11**(2): 21. [online]: <http://www.ecologyandsociety.org/vol11/iss2/art21/>
- Kagel, J. and A. E. Roth (eds) (1995), *Handbook of Experimental Economics*, Princeton, NJ: Princeton University Press.
- Keohane, R. O. (1984), *After Hegemony: Cooperation and Discord in the World Political Economy*, Princeton, NJ: Princeton University Press.
- Keohane, R. O. (2001), 'Governance in a Partially Globalized World', *American Political Science Review*, **95**: 1–13.
- Keohane, R. O. and E. Ostrom (eds) (1995), *Local Commons and Global Interdependence: Heterogeneity and Cooperation in Two Domains*, London: Sage.
- Krehbiel, K. (1988), 'Spatial Models of Legislative Choice', *Legislative Studies Quarterly*, **8**: 259–319.
- Kuhnert, S. (2001), 'An Evolutionary Theory of Collective Action: Schumpeterian Entrepreneurship for the Common Good', *Constitutional Political Economy*, **12**: 13–29.

- Lam, W. F. (1998), *Governing Irrigation Systems in Nepal: Institutions, Infrastructure, and Collective Action*, Oakland, CA: ICS Press.
- Lam, W. F. (2006), 'Foundation of a Robust Social-Ecological System: Irrigation Systems in Taiwan', *Journal of Institutional Economics*, 2: 203–226.
- Langbein, L. I. and R. Bess (2002), 'Sports in School: Source of Amity or Antipathy?', *Social Science Quarterly*, 83(2): 436–454.
- Lansing, J. S. and J. Kremer (1993), 'Emergent Properties of Landscape', *American Anthropologist*, 95: 97–115.
- Levi, M. (1988), *Of Rule and Revenue*, Berkeley: University of California Press.
- Levine, D. K. (1998), 'Modeling Altruism and Spitefulness in Experiments', *Review of Economic Dynamics*, 1: 593–622.
- McCay, B. and J. M. Acheson (1987), *The Question of the Commons: The Culture and Ecology of Communal Resources*, Tucson: University of Arizona Press.
- McGinnis, M. (ed.) (1999), *Polycentricity and Local Public Economies: Readings from the Workshop in Political Theory and Policy Analysis*, Ann Arbor: University of Michigan Press.
- McGinnis, M. D. and J. T. Williams (2001), *Compound Dilemmas: Democracy, Collective Action, and Superpower Rivalry*, Ann Arbor: University of Michigan Press.
- Meinzen-Dick, R. (Forthcoming), 'Beyond Panaceas in Water Institutions', *Proceedings of the National Academy of Sciences (USA)*, 104.
- Milgrom, P. R., D. C. North, and B. R. Weingast (1990), 'The Role of Institutions in the Revival of Trade: The Law Merchant, Private Judges, and the Champagne Fairs', *Economics and Politics*, 2: 1–23.
- Miller, G. (1992), *Managerial Dilemmas: The Political Economy of Hierarchy*, New York: Cambridge University Press.
- Moe, T. (1984), 'The New Economics of Organization', *American Journal of Political Science*, 28: 739–777.
- Monroe, K. R. (2005), *Perestroika! The Raucous Revolution in Political Science*, New Haven, CT: Yale University Press.
- Morrow, C. E. and R. W. Hull (1996), 'Donor-Initiated Common Pool Resource Institutions: The Case of the Yanasha Forestry Cooperative', *World Development*, 24: 1641–1657.
- Myint, T. (2003), 'Democracy in Global Environmental Governance: Issues, Interests, and Actors in Mekong and Rhine Basins', *Indiana Journal of Global Legal Studies*, 10: 287–314.
- Nagendra, H. (Forthcoming), 'Drivers of Reforestation in Human-Dominated Forests', *Proceedings of the National Academy of Sciences (USA)*, 104.
- National Research Council (1986), *Proceedings of the Conference on Common Property Resource Management*, Washington, DC: National Academy Press.
- National Research Council (2002), 'The Drama of the Commons', in E. Ostrom, T. Dietz, N. Dolsak, P. Stern, S. Stonich, and E. Weber (eds), *Committee on the Human Dimensions of Global Change*, Washington, DC: National Academy Press.
- Netting, R. McC. (1993), *Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture*, Stanford, CA: Stanford University Press.
- Niskanen, W. A. and M. Levy (1974), 'Cities and Schools: A Case for Community Government in California', University of California, Graduate School of Public Policy, Berkeley.
- North, D. C. (1981), *Structure and Change in Economic History*, New York: Norton.
- North, D. C. (1990a), *Institutions, Institutional Change, and Economic Performance*, Cambridge: Cambridge University Press.

- North, D. C. (1990b), 'A Transaction Cost Theory of Politics', *Journal of Theoretical Politics*, 2: 355–367.
- North, D. C. (2005), *Understanding the Process of Institutional Change*, Princeton, NJ: Princeton University Press.
- Oakerson, R. J. (1999), *Governing Local Public Economies: Creating the Civic Metropolis*, Oakland, CA: ICS Press.
- Oakerson, R. J. and R. B. Parks (1989), 'Local Government Constitutions: A Different View of Metropolitan Governance', *American Review of Public Administration*, 19: 279–294.
- Oates, W. E. (2005), 'Toward a Second-Generation Theory of Fiscal Federalism', *International Tax and Public Finance*, 12: 349–374.
- Olson, M. (1965), *The Logic of Collective Action: Public Goods and the Theory of Groups*, Cambridge, MA: Harvard University Press.
- Ostrom, E. (1990), *Governing the Commons: The Evolution of Institutions for Collective Action*, New York: Cambridge University Press.
- Ostrom, E. (1996), 'Crossing the Great Divide: Coproduction, Synergy, and Development', *World Development*, 24: 1073–1087.
- Ostrom, E. (2005), *Understanding Institutional Diversity*, Princeton, NJ: Princeton University Press.
- Ostrom, E. (2007), 'Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework', in P. A. Sabatier (ed.), *Theories of the Policy Process*, 2nd edition, Boulder, CO: Westview Press, pp. 21–64.
- Ostrom, E. and T. K. Ahn (eds) (2003), *Foundations of Social Capital*, Cheltenham: Edward Elgar.
- Ostrom, E., R. Gardner, and J. Walker (1994), *Rules, Games, and Common-Pool Resources*, Ann Arbor: University of Michigan Press.
- Ostrom, E. and H. Nagendra (2006), 'Insights on Linking Forests, Trees, and People from the Air, on the Ground, and in the Laboratory', *Proceedings of the National Academy of Sciences*, 103(51): 19224–19231.
- Ostrom, E. and J. Walker (1997), 'Neither Markets nor States: Linking Transformation Processes in Collective Action Arenas', in D. C. Mueller (ed.), *Perspectives on Public Choice: A Handbook*, Cambridge: Cambridge University Press, pp. 35–72.
- Ostrom, V. (1986), 'A Fallibilist's Approach to Norms and Criteria of Choice', in F. X. Kaufmann, G. Majone, and V. Ostrom (eds), *Guidance, Control, and Evaluation in the Public Sector*, Berlin and New York: Walter de Gruyter, pp. 229–249.
- Ostrom, V., D. Feeny, and H. Picht (eds) (1993), *Rethinking Institutional Analysis and Development: Issues, Alternatives, and Choices*, 2nd edition, San Francisco, CA: ICS Press.
- Ostrom, V. and E. Ostrom (1977), 'Public Goods and Public Choices', in E. S. Savas (ed.), *Alternatives for Delivering Public Services: Toward Improved Performance*, Boulder, CO: Westview Press, pp. 7–49.
- Ostrom, V., C. Tiebout, and R. Warren (1961), 'The Organization of Government in Metropolitan Areas: A Theoretical Inquiry', *American Political Science Review*, 55: 831–842.
- Parks, R. B., P. Baker, L. Kiser, R. J. Oakerson, E. Ostrom, V. Ostrom, S. L. Percy, M. Vandivort, G. P. Whitaker, and R. Wilson (1999), 'Consumers as Coproducers of Public Services: Some Economic and Institutional Considerations', in M. McGinnis (ed.), *Polycentricity and Local Public Economies: Readings from the Workshop in Political Theory and Policy Analysis*, Ann Arbor: University of Michigan Press, pp. 381–391.

- Pinkerton, E. (ed.) (1989), *Co-operative Management of Local Fisheries: New Directions for Improved Management and Community Development*, Vancouver: University of British Columbia Press.
- Plott, C. R. (1986), 'Rational Choice in Experimental Markets', *Journal of Business*, 59: 301–327.
- Poel, D. H. (2000), 'Amalgamating Perspectives: Citizen Responses to Municipal Consolidation', *Canadian Journal of Regional Sciences*, 23: 31–48.
- Prakash, A. and M. Potoski (2006), *The Voluntary Environmentalists: Green Clubs, ISO 14001, and Voluntary Environmental Regulations*, Cambridge: Cambridge University Press.
- Putnam, R., with R. Leonardi and R. Nanetti (1993), *Making Democracy Work*, Princeton, NJ: Princeton University Press.
- Putnam, R. (2000), *Bowling Alone: The Collapse and Revival of American Community*, New York: Simon & Schuster.
- Rabin, M. (1993), 'Incorporating Fairness into Game Theory and Economics', *American Economic Review*, 83: 1281–1302.
- Rae, D. W. (1969), 'Decision-Rules and Individual Values in Constitutional Choice', *American Political Science Review*, 63: 40–53.
- Riker, W. H. (1962), *A Theory of Political Coalitions*, New Haven, CT: Yale University Press.
- Riker, W. H. (1967), 'Bargaining in a Three-Person Game', *American Political Science Review*, 61: 642–656.
- Rojas, F. (2006), 'Sociological Imperialism in Three Theories of the Market', *Journal of Institutional Economics*, 2: 339–363.
- Roth, A., V. Prasnikar, M. Okuno-Fujiwara, and S. Zamir (1991), 'Bargaining and Market Behavior in Jerusalem, Ljubljana, Pittsburgh, and Tokyo: An Experimental Study', *American Economic Review*, 81: 1068–1095.
- Ruttan, V. W. (2003), *Social Science Knowledge and Economic Development: An Institutional Design Perspective*, Ann Arbor: University of Michigan Press.
- Ruttan, V. W. (2006), 'Social Science Knowledge and Induced Institutional Innovation: An Institutional Design Perspective', *Journal of Institutional Economics*, 2: 249–272.
- Sally, D. (1995), 'Conversation and Cooperation in Social Dilemmas: A Meta-Analysis of Experiments from 1958 to 1992', *Rationality and Society*, 7: 58–92.
- Schneider, M. (1986), 'Fragmentation and the Growth of Government', *Public Choice*, 48: 255–263.
- Shepsle, K. A. (1979), 'Institutional Arrangements and Equilibrium in Multidimensional Voting Models', *American Journal of Political Science*, 23: 27–60.
- Shepsle, K. A. (1986), 'Institutional Equilibrium and Equilibrium Institutions', in H. Weisberg (ed.), *Political Science: The Science of Politics*, New York: Agathon Press.
- Shepsle, K. A. (1989), 'Studying Institutions: Some Lessons from the Rational Choice Approach', *Journal of Theoretical Politics*, 1: 131–149.
- Simon, H. A. ([1947] 1965), *Administrative Behavior: A Study of Decision-making Processes in Administrative Organization*, New York: Free Press.
- Simon, H. A. (1972), 'Theories of Bounded Rationality', in C. B. McGuire and R. Radner (eds), *Decision and Organization: A Volume in Honor of Jacob Marschak*, Amsterdam: North-Holland, pp. 161–176.
- Simon, H. A. (1999), 'The Potlatch between Economics and Political Science', in J. Alt, M. Levi, and E. Ostrom (eds), *Competition and Cooperation: Conversations with Nobelists*

- about Economics and Political Science*, New York: Russell Sage Foundation, pp. 112–119.
- Slonim, R. and A. Roth (1998), 'Learning in High Stakes Ultimatum Games: An Experiment in the Slovak Republic', *Econometrica*, **66**: 569–596.
- Smith, V. (1976), 'Experimental Economics: Induced Value Theory', *American Economic Review*, **66**: 274–279.
- Smith, V. and J. M. Walker (1993), 'Rewards, Experience and Decision Costs in First Price Auctions', *Economic Inquiry*, **31**: 237–244.
- Sproule-Jones, M. (1993), *Governments at Work: Canadian Parliamentary Federalism and Its Public Policy Effects*, Toronto: University of Toronto Press.
- Stephens, G. R. and N. Wikstrom (2000), *Metropolitan Government and Governance: Theoretical Perspectives, Empirical Analysis, and the Future*, New York: Oxford University.
- Summers, A. A. and B. Wolfe (1977), 'Do Schools Make a Difference?', *American Economic Review*, **67**(4): 639–652.
- Swanson, C. B. (2002), 'Spending Time or Investing Time? Involvement in High School Curricular and Extracurricular Activities as Strategic Action', *Rationality and Society*, **14**(4): 431–471.
- Tang, S. Y. (1992), *Institutions and Collective Action: Self-Governance in Irrigation*, San Francisco, CA: ICS Press.
- Teske, P., M. Schneider, M. Mintrom, and S. Best (1993), 'Establishing the Micro Foundations of a Macro Theory: Information, Movers, and the Competitive Local Market for Public Goods', *American Political Science Review*, **87**: 702–713.
- Truman, D. B. (1951), *The Government Process*, New York: Knopf.
- Vatn, A. (2005), *Institutions and the Environment*, Cheltenham, UK: Edward Elgar.
- Wade, R. (1988), 'The Management of Irrigation Systems: How to Evoke Trust and Avoid the Prisoners' Dilemma', *World Development*, **16**: 489–500.
- Wagner, R. E. and W. E. Weber (1975), 'Competition, Monopoly, and the Organization of Government in Metropolitan Areas', *Journal of Law and Economics*, **18**: 661–684.
- Walker, J. and E. Ostrom (2007), 'Trust and Reciprocity as Foundations for Cooperation: Individuals, Institutions, and Context', Working Paper, Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.
- Weingast, B. R. (1989), 'Floor Behavior in the US Congress: Committee Power under the Open Rule', *American Political Science Review*, **83**: 795–816.
- Weingast, B. R., K. A. Shepsle, and C. Johnsen (1981), 'The Political Economy of Benefits and Costs: A Neoclassical Approach to Distributive Politics', *Journal of Political Economy*, **89**: 642–664.
- Williamson, O. E. (1975), *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organization*, New York: Free Press.
- Williamson, O. E. (1985), *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*, New York: Free Press.
- Young, O., F. Berkhout, G. Gallopin, M. Janssen, E. Ostrom, and S. Van Der Leeuw (2006), 'The Globalization of Socio-Ecological Systems: An Agenda for Scientific Research', *Global Environmental Change*, **16**: 304–316.