Transnational Corporations Review Vol. 2, No. 2, 2010
www.tnc-online.net info@tnc-online.net 1-12

Beyond Markets and States: Polycentric Governance of Complex Economic Systems

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Abstract: This excerpt describes the intellectual journey that I have taken the last half-century from when I began graduate studies in the late 1950s. The early efforts to understand the polycentric water industry in California were formative for me. In addition to working with Vincent Ostrom and Charles Tiebout as they formulated the concept of polycentric systems for governing metropolitan areas, I studied the efforts of a large group of private and public water producers facing the problem of an overdrafted groundwater basin on the coast and watching saltwater intrusion threaten the possibility of long-term use. Then, in the 1970s, I participated with colleagues in the study of polycentric police industries serving U.S. metropolitan areas to find that the dominant theory underlying massive reform proposals was incorrect. Metropolitan areas served by a combination of large and small producers could achieve economies of scale in the production of some police services and avoid *dis*economies of scale in the production of others.

Key words: polycentric, common-pool resources, institutional analysis

1. Introduction

Contemporary research on the outcomes of diverse institutional arrangements for governing common-pool resources and public goods at multiple scales builds on classical economic theory while developing new theory to explain phenomena that do not fit in a dichotomous world of "the market" and "the state." Scholars are slowly shifting from positing simple systems, to using more complex frameworks, theories, and models to understand the diversity of puzzles and problems facing humans interacting in contemporary societies. The humans we study have complex motivational structures and establish diverse private-for-profit, governmental, and community institutional arrangements that operate at multiple scales to generate productive and innovative as well as destructive and perverse outcomes (North 1990, 2005).

In this lecture, I describe the intellectual journey that I have taken the last half-century from when I began graduate studies in the late 1950s. The early efforts to understand the polycentric water industry in California were formative for me. In addition to working with Vincent Ostrom and Charles Tiebout as they formulated the concept of polycentric systems for governing metropolitan areas, I studied the efforts of a large group of private and public water producers facing the problem of an overdrafted groundwater

basin on the coast and watching saltwater intrusion threaten the possibility of long-term use. Then, in the 1970s, I participated with colleagues in the study of polycentric police industries serving U.S. metropolitan areas to find that the dominant theory underlying massive reform proposals was incorrect. Metropolitan areas served by a combination of large and small producers could achieve economies of scale in the production of some police services and avoid *dis*economies of scale in the production of others.

These early empirical studies led over time to the development of the Institutional Analysis and Development (IAD) framework. A common framework consistent with game theory enabled us to undertake a variety of empirical studies including a meta-analysis of a large number of existing case studies on common-pool resource systems around the world. Carefully designed experimental studies in the lab have enabled us to test precise combinations of structural variables to find that isolated, anonymous, individuals overharvest from common-pool resources. Simply allowing communication, or "cheap talk," enables participants to reduce overharvesting and increase joint payoffs contrary to game-theoretical predictions. Large studies of irrigation systems in Nepal and forests around the world challenge the presumption that governments always do a better job than users in organizing and protecting important resources.

Currently, many scholars are undertaking new theoretical efforts. A core effort is developing a more general theory of individual choice that recognizes the central role of trust in coping with social dilemmas. Over time, a clear set of findings from the microsituational level have emerged regarding structural factors affecting the likelihood of increased cooperation. Due to the complexity of broader field settings, one needs to develop more configural approaches to the study of factors that enhance or detract from the emergence and robustness of self-organized efforts within multilevel, polycentric systems. Further, the application of empirical studies to the policy world leads one to stress the importance of fitting institutional rules to a specific social-ecological setting. "One-size-fits-all" policies are not effective.

2. Current theoretical developments

Given the half-century of our own extensive empirical research and that of many distinguished scholars (e.g., Baland and Platteau 2005; Berkes 2007; Berkes, Colding, and Folke 2003; Clark 2006; Marshall 2008; Schelling 1960, 1978, 1984), where are we now? What have we learned? We now know that the earlier theories of rational, but helpless, individuals who are trapped in social dilemmas are not supported by a large number of studies using diverse methods (Faysse 2005; Poteete, Janssen, and Ostrom 2010). On the other hand, we cannot be overly optimistic and presume that dilemmas will always be solved by those involved. Many groups have struggled and failed (Dietz, Ostrom, and Stern 2003). Further, simple

policy prescriptions to turn over resources to a government, to privatize, or more recently to decentralize, may also fail (Berkes 2007; Brock and Carpenter 2007; Meinzen-Dick 2007).

We thus face the tough task of further developing our theories to help understand and predict when those involved in a common-pool resource dilemma will be able to self-organize and how various aspects of the broad context they face affect their strategies, the short-term success of their efforts, and the long-term robustness of their initial achievements. We need to develop a better theoretical understanding of human behavior as well as of the impact of the diverse contexts that humans face.

2.1. Developing a more general theory of the individual

Efforts to explain phenomena in the social world are organized at three levels of generality. Frameworks, such as the IAD that have been used to organize diverse efforts to study common-pool resources, are metatheoretical devices that help provide a general language for describing relationships at multiple levels and scales. Theories are efforts to build understanding by making core assumptions about specific working parts of frequently encountered phenomena and predicting general outcomes. Models are very specific working examples of a theory—and they are frequently confused with being theories themselves. As Alchian (1950) pointed out long ago, what is called "rational choice theory" is not a broad *theory* of human behavior but rather a useful *model* to predict behavior in a particular situation—a highly competitive market for private goods. Predictions derived from the rational choice model are empirically supported in open markets for private goods and other competitive environments (Holt 2007; Smith and Walker 1993; Satz and Ferejohn 1994). Thus, it is a useful model to retain for predicting outcomes in competitive settings related to excludable and divisible outcomes.

While it is not possible yet to point to a single *theory* of human behavior that has been successfully formulated and tested in a variety of settings, scholars are currently positing and testing assumptions that are likely to be at the core of future developments (Smith 2003, 2010). These relate to (1) the capability of boundedly rational individuals to learn fuller and more reliable information in repeated situations when reliable feedback is present, (2) the use of heuristics in making daily decisions, and (3) the preferences that individuals have related to benefits for self as well as norms and preferences related to benefits for others (see Poteete, Janssen, and Ostrom 2010: chap. 9; E. Ostrom 1998).

The assumption that individuals have complete information about all actions available to them, the likely strategies that others will adopt, and the probabilities of specific consequences that will result from their own choices, must be rejected in any but the very simplest of repeated settings. When boundedly rational individuals do interact over time, it is reasonable to assume that they learn more accurate information about the actions they can take and the likely actions of other individuals (Selten 1990; Simon 1955, 1999). Some highly complex common-pool resource environments, however, approach mathematical

chaos (Wilson et al. 1994) in which resource users cannot gain complete information about all likely combinations of future events.

In many situations, individuals use rules of thumb—heuristics—that they have learned over time that work relatively well in a particular setting. Fishers end up "fishing for knowledge" (Wilson 1990) where using heuristics over time enables them to recognize diverse clues of environmental processes that they need to take into account when making their own decisions. When individuals do interact repeatedly, it is possible to learn heuristics that approach "best-response" strategies and achieve close to local optima (Gigerenzer and Selten 2001). In eras of rapid change or sudden shocks, however, heuristics may not enable individuals to achieve high payoffs.

Individuals also learn norms—internal valuations that are negative or positive related to specific actions such as lying or being brave in particular situations (Crawford and Ostrom 2005). The strength of an internal commitment (Sen 1977) may be represented in the size of the internal weight that an individual assigns to actions and outcomes in a particular setting. Among individual norms are those related to valuing outcomes achieved by others (Cox and Deck 2005; Cox, Sadiraj, and Sadiraj 2008; Andreoni 1989; Bolton and Ockenfels 2000). Fehr and Schmidt (1999) propose that individuals dislike unequal outcomes of interactions and thus have an internal norm of "inequity aversion." Axelrod (1986) posits that individuals who adopt meta norms related to whether others follow the norms that have evolved in a group, increase the probability that norms will be followed. Leibbrandt, Gneezy, and List (2010) show that individuals who regularly work in teams are more likely to adopt norms and trust each other, compared to individuals working alone. Frohlich and Oppenheimer (1992) posit that many individuals adopt norms of fairness and justice. Not all individuals have the same norms or perceptions of a situation (Ones and Putterman 2007) and may differ substantially in whether they consider a way of sharing costs to be fair (Eckel and Grossman 1996).

Simply assuming that humans adopt norms, however, is not sufficient to predict behavior in a social dilemma, especially in very large groups with no arrangements for communication. Even with strong preferences to follow norms, "observed behavior may vary by context because the perception of the 'right thing' would change" (de Oliveira, Croson, and Eckel 2009: 19). Various aspects of the context in which individuals interact affect how individuals learn about the situation they are in and about the others with whom they are interacting. Individual differences do make a difference, but the context of interactions also affects behavior over time (Walker and Ostrom 2009). Biologists recognize that an organism's appearance and behavior are affected by the environment in which it develops.

For example, some plants produce large, thin leaves (which enhance photosynthetic photon harvest) in low light, and narrow, thicker leaves (which conserve water) in high light; certain insects develop wings only if they live in crowded conditions (and hence are likely to run out of adequate food in their current location). Such environmentally contingent development is so commonplace that it can be regarded as a universal property of living things. (Pfennig and Ledón-Rettig 2009: 268)

Social scientists also need to recognize that individual behavior is strongly affected by the context in which interactions take place rather than being simply a result of individual differences.

2.2. The central role of trust in coping with dilemmas

Even though Arrow (1974) long ago pointed to the crucial role of trust among participants as the most efficient mechanism to enhance transactional outcomes, collective-action theory has paid more attention to payoff functions than to how individuals build trust that others are reciprocators of costly cooperative efforts. Empirical studies, however, confirm the important role of trust in overcoming social dilemmas (Rothstein 2005). As illustrated in Figure 1, the updated theoretical assumptions of learning and norm-adopting individuals can be used as the foundation for understanding how individuals may gain increased levels of trust in others leading to more cooperation and higher benefits with feedback mechanisms that reinforce positive or negative learning. Thus, it is not only that individuals adopt norms but also that the structure of the situation generates sufficient information about the likely behavior of others to be trustworthy reciprocators who will bear their share of the costs of overcoming a dilemma. Thus, in some contexts, one can move beyond the presumption that rational individuals are helpless in overcoming social dilemma situations.

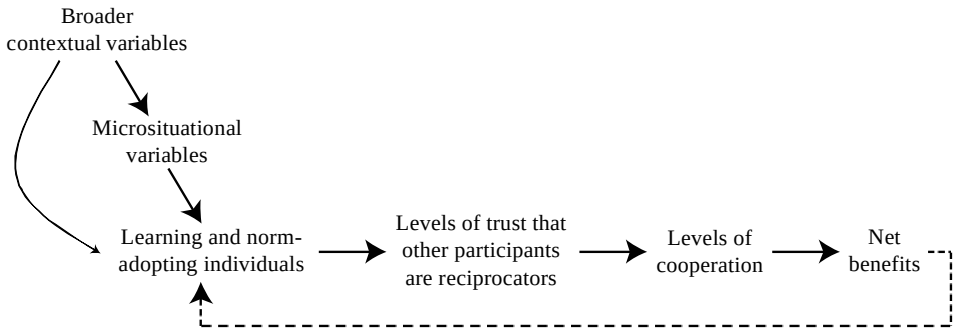

Figure 1. Microsituational and broader contexts of social dilemmas affect levels of trust and cooperation. *Source*: Poteete, Janssen, and Ostrom (2010: 227).

2.3. The microsituational level of analysis

Asserting that context makes a difference in building or destroying trust and reciprocity is not a sufficient theoretical answer to how and why individuals sometimes solve and sometimes fail to solve dilemmas. Individuals interacting in a dilemma situation face two contexts: (1) a microcontext related to the specific attributes of an action situation in which individuals are directly interacting and (2) the broader context of the social-ecological system in which groups of individuals make decisions. A major advantage of studies conducted in an experimental lab or in field experiments is that the researcher designs the micro setting in which the experiment is conducted. Thus, empirical results are growing (and are summarized in Poteete, Janssen, and Ostrom 2010) to establish that the following attributes of microsituations affect the level of cooperation that participants achieve in social dilemma settings (including both public goods and common-pool resource dilemmas).

1. Communication is feasible with the full set of participants. When face-to-face communication is possible, participants use facial expressions, physical actions, and the way that words are expressed to judge the trustworthiness of the others involved.

2. Reputations of participants are known. Knowing the past history of other participants, who may not be personally known prior to interaction, increases the likelihood of cooperation.

3. High marginal per capita return (MPCR). When MPCR is high, each participant can know that their own contributions make a bigger difference than with low MPCR and that others are more likely to recognize this relationship.

4. Entry or exit capabilities. If participants can exit a situation at low cost, this gives them an opportunity not to be a sucker and others can recognize that cooperators may leave (and enter other situations) if their cooperation is not reciprocated.

5. Longer time horizon. Participants can anticipate that more could be earned through cooperation over a long time period versus a short time.

6. Agreed-upon sanctioning capabilities. While external sanctions or imposed sanctioning systems may reduce cooperation, when participants themselves agree to a sanctioning system they frequently do not need to use sanctions at a high volume and net benefits can be improved substantially.

Other microsituational variables are being tested in experiments around the world. The central core of the findings is that when individuals face a social dilemma in a microsetting, they are more likely to cooperate when situational variables increase the likelihood of gaining trust that others will reciprocate.

2.4. The broader context in the field

Individuals coping with common-pool resource dilemmas in the field are also affected by a broader set of contextual variables related to the attributes of the social-ecological system (SES) in which they are interacting. A group of scholars in Europe and the United States are currently working on the further development of a framework that links the IAD and its interactions and outcomes at a micro level with a broader set of variables observed in the field.[1] As illustrated in Figure 2, one can think of individuals interacting in an Action Situation generating Interactions and Outcomes that are affected by and affect a Resource System, Resource Units, Governance System, and Users who affect and are affected by Social, Economic, and Political Settings and Related Ecosystems (see E. Ostrom 2007, 2009). Figure 2 provides an overview of the highest tier of variables that exist in all field settings. The highest tier can be unpacked several times when one is trying to analyze specific questions related to SESs in the field, but there is not enough time or space to undertake a thorough unpacking in this article.

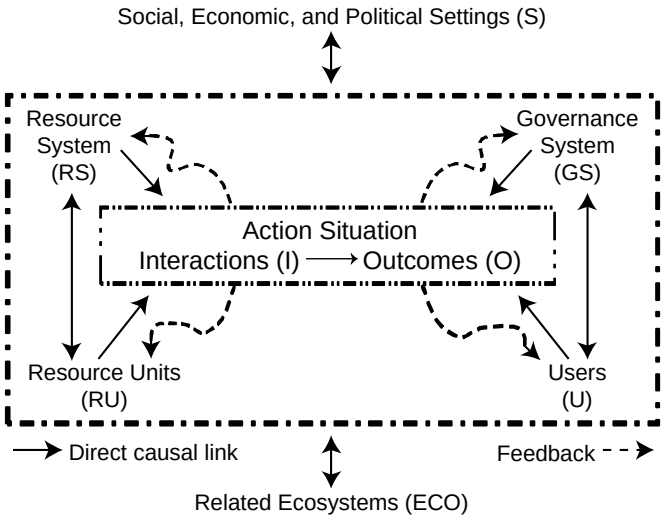

Figure 2. Action situations embedded in broader social-ecological systems. *Source*: Adapted from E. Ostrom (2007: 15182).

Experimental researchers have reached a higher level of agreement about the impact of microsituational variables on the incentives, levels of trust, and behavior of individuals in dilemma situations than exists

[1] Scholars at the Stockholm Environment Institute, the International Institute for Applied Systems Analysis, Delft University of Technology, the University of Zurich, the Nordland Research Institute of Bodø University College, the Potsdam Institute for Climate Impact Research (PIK), Humboldt University, Marburg University, and the EU NeWATER project located at the University of Osnabrück have had several meetings in Europe to begin plans for using a common framework (initially developed by E. Ostrom 2007) to study a variety of resource systems. Scholars at the Workshop in Bloomington and the Center for the Study of Institutional Diversity at Arizona State University will also participate in this effort. A core problem identified by these scholars is the lack of cumulation across studies on diverse natural resource systems as well as humanly engineered resources.

among field researchers. Few SES variables have a fully independent impact on the action situations that participants face and their likely behavior. The SES variables that are most important differ depending on which interactions (such as monitoring, conflict, lobbying, self-organization) or longer-term outcomes (such as overharvesting, regeneration of biodiversity, resilience of an ecological system to human and nature-induced disturbances) one wishes to predict. A set of ten variables have been identified across many field studies as impacting the likelihood of users self-organizing in order to overcome a common-pool resource dilemma (E. Ostrom 2009; Basurto and 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 users (the number, the existence of leadership/entrepreneurship, knowledge about the SES, and the importance of the SES to the users). Linking the broader contextual variables and microcontextual variables is one of the major tasks facing scientists who work across disciplinary lines to understand how both social and ecological factors affect human behavior.[2]

3. Complexity and reform

The economic and social sciences have significantly moved ahead over the past five decades since scholars posited two optimal organizational forms, two types of goods, and one model of the individual. Extensive empirical research documents the diversity of settings in which individuals solve common-pool resource problems on their own, when these solutions are sustainable over long periods of time, and how larger institutional arrangements enhance or detract from the capabilities of individuals at smaller scales to solve problems efficiently and sustainably (see, for example, Agrawal and Gibson 2001; Gibson et al. 2005; Schlager and Blomquist 2008). While there is not yet a single well-developed theory that explains all of the diverse outcomes obtained in microsettings, such as the experimental lab, or broader contextual settings of fisheries, irrigation systems, forests, lakes, and other common-pool resources, considerable agreement does exist. Nor do we have a single normative theory of justice that can unambiguously be applied to all settings (Sen 2009).

Building trust in one another and developing institutional rules that are well matched to the ecological systems being used are of central importance for solving social dilemmas. The surprising but repeated finding that users of resources that are in relatively good condition—or even improving—do invest in various ways of monitoring one another relates to the core problem of building trust.

[2] See Stewart (2009) for an important study that links size of group, acceptance of norms of cooperation, and support of property rights in twenty-five mining camps in the American Southwest.

Unfortunately, policy analysts, public officials, and scholars who still apply simple mathematical models to the analysis of field settings have not yet absorbed the central lessons articulated here. All too often a single policy prescription—such as Individual Transferable Quotas (ITQs)—is recommended for all resources of a particular type, such as all fisheries. While several ITQ systems are working successfully, the time and effort needed to tailor the broad theoretical concept of an ITQ system into an operational system in a particular location involves multiple years of hard work by the fishers involved as well as the government officials (see Clark 2006; Yandle 2007; Yandle and Dewees 2003; Eggertsson 1990).

The most important lesson for public policy analysis derived from the intellectual journey I have outlined here is that humans have a more complex motivational structure and more capability to solve social dilemmas than posited in earlier rational-choice theory. Designing institutions to force (or nudge) entirely self-interested individuals to achieve better outcomes has been the major goal posited by policy analysts for governments to accomplish for much of the past half-century. Extensive empirical research leads me to argue that instead, a core goal of public policy should be to facilitate the development of institutions that bring out the best in humans. We need to ask how diverse polycentric institutions help or hinder the innovativeness, learning, adapting, trustworthiness, levels of cooperation of participants, and the achievement of more effective, equitable, and sustainable outcomes at multiple scales (Toonen 2010).

To explain the world of interactions and outcomes occurring at multiple levels, we also have to be willing to deal with complexity instead of rejecting it. Some mathematical models are very useful for explaining outcomes in particular settings. We should continue to use simple models where they capture enough of the core underlying structure and incentives that they usefully predict outcomes. When the world we are trying to explain and improve, however, is not well described by a simple model, we must continue to improve our frameworks and theories so as to be able to understand complexity and not simply reject it.

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Acknowledgement

This article is an excerpt from the Nobel Prize Lecture in Economic Sciences delivered at the Royal Swedish Academy of Sciences, Stockholm, Sweden, December 8, 2009. Copyright © 2009 by The Nobel Foundation. I wish to thank Vincent Ostrom and my many colleagues at the Workshop who have worked with me throughout the years to develop the research program that is briefly discussed herein. I appreciate the helpful suggestions given me by Arun Agrawal, Andreas Leibbrant, Mike McGinnis, Jimmy Walker, Tom Wisdom, and by the Applied Theory Working Group and the Experimental Reading Group, and the excellent editing skills of Patty Lezotte. Essential support received over the years from the Ford Foundation, the MacArthur Foundation, and the National Science Foundation is gratefully acknowledged.

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