
Choice, Rules and Collective Action

The Ostroms on the Study
of Institutions and Governance

Elinor Ostrom and Vincent Ostrom

Introduced and Edited by
Filippo Sabetti and Paul Dragos Aligica



© Elinor Ostrom and Vincent Ostrom 2014

Cover image – *Fotolia.com* © dedoma

Photographs courtesy of the Ostrom Workshop and Indiana University

Published by the ECPR Press in 2014

The ECPR Press is the publishing imprint of the European Consortium for Political Research (ECPR), a scholarly association, which supports and encourages the training, research and cross-national co-operation of political scientists in institutions throughout Europe and beyond.

ECPR Press
University of Essex
Wivenhoe Park
Colchester
CO4 3SQ
UK

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

Typeset by ECPR Press

Printed and bound by Lightning Source

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

Paperback ISBN: 978-1-910-259-13-9
PDF ISBN: 978-1-910-259-15-3
Kindle ISBN: 978-1-910-259-16-0
ePub ISBN: 978-1-910-259-17-7

www.ecpr.eu/ecprpress

ECPR Press Series Editors:

Dario Castiglione (University of Exeter)
Peter Kennealy (European University Institute)
Alexandra Segerberg (Stockholm University)
Peter Triantafillou (Roskilde University)

ECPR Essays:

Croce, Gramsci, Bobbio and the Italian Political Tradition (ISBN: 9781907301995)
Richard Bellamy

From Deliberation to Demonstration: Political Rallies in France, 1868–1939 (ISBN: 9781907301469) Paula Cossart

Hans Kelsen and the Case for Democracy (ISBN: 9781907301247) Sandrine Baume
Is Democracy a Lost Cause? Paradoxes of an Imperfect Invention
(ISBN: 9781907301247) Alfio Mastropaoletti

Just Democracy (ISBN: 9781907301148) Philippe Van Parijs

Learning About Politics in Time and Space (ISBN: 9781907301476) Richard Rose
Maestri of Political Science (ISBN: 9781907301193) Donatella Campus,
Gianfranco Pasquino, and Martin Bull

Masters of Political Science (ISBN: 9780955820335) Donatella Campus, and
Gianfranco Pasquino

The Modern State Subverted (ISBN: 9781907301636) Giuseppe Di Palma

ECPR Classics:

Beyond the Nation State (ISBN: 9780955248870) Ernst Haas

Citizens, Elections, Parties: Approaches to the Comparative Study of the Processes of Development (ISBN: 9780955248887) Stein Rokkan

Comparative Politics The Problem of Equivalence (ISBN: 9781907301414) Jan Van Deth
Democracy Political Finance and state Funding for Parties (ISBN: 9780955248801)
Jack Lively

Electoral Change: Responses to Evolving Social and Attitudinal Structures in Western Countries (ISBN: 9780955820311) Mark Franklin, Thomas Mackie, and Henry Valen

Elite and Specialized Interviewing (ISBN: 9780954796679) Lewis Anthony Dexter
Identity, Competition and Electoral Availability: The Stabilisation of European Electorates 1885–1985 (ISBN: 9780955248832) Peter Mair and Stefano Bartolini

Individualism (ISBN: 9780954796662) Steven Lukes

Modern Social Policies in Britain and Sweden: From Relief to Income Maintenance
(ISBN: 9781907301001) Hugh Heclow

Parties and Party Systems: A Framework for Analysis (ISBN: 9780954796617)
Giovanni Sartori

Party Identification and Beyond: Representations of Voting and Party Competition
(ISBN: 9780955820342) Ian Budge, Ivor Crewe, and Dennis Farlie

People, States and Fear: An Agenda for International Security Studies in the Post-Cold War Era (ISBN: 9780955248818) Barry Buzan

Political Elites (ISBN: 9780954796600) Geraint Parry

Seats, Votes and the Spatial Organisation of Elections (ISBN: 9781907301353)
Graham Gudgin
State Formation, Parties and Democracy (ISBN: 9781907301179) Hans Daalder
System and Process in International Politics (ISBN: 9780954796624) Mortan Kaplan
Territory and Power in the UK (ISBN: 9780955248863) James Bulpitt
The State Tradition in Western Europe: A Study of an Idea and Institution (ISBN: 9780955820359) Kenneth Dyson

Please visit www.ecpr.eu/ecprpress for up-to-date information about new publications.

Contents

List of Figures and Tables	vii
Acknowledgements	ix
Foreword by Dario Castiglione	xi
Elinor and Vincent Ostrom and the Workshop	xix
Introduction: The Ostroms' Research Program for the Study of Institutions and Governance: Theoretical and Epistemic Foundations <i>Paul Dragos Aligica and Filippo Sabetti</i>	1
Part One: Public Choice and Political Economy	
Chapter One: Public Choice: A Different Approach to the Study of Public Administration <i>Vincent Ostrom and Elinor Ostrom</i>	23
Chapter Two: Polycentricity: The Structural Basis of Self-Governing Systems <i>Vincent Ostrom</i>	45
Chapter Three: The Quest for Meaning in Public Choice <i>Elinor Ostrom and Vincent Ostrom</i>	61
Part Two: Beyond Public Choice: Institutions, Rules and Governance Systems	
Chapter Four: An Agenda for the Study of Institutions <i>Elinor Ostrom</i>	97
Chapter Five: A Behavioural Approach to the Rational Choice Theory of Collective Action <i>Elinor Ostrom</i>	121
Chapter Six: Beyond Markets and States: Polycentric Governance of Complex Economic Systems <i>Elinor Ostrom</i>	167

Part Three: Epistemic and Social Philosophical Perspectives

Chapter Seven: Beyond Positivism <i>Elinor Ostrom</i>	213
Chapter Eight: A Conceptual-Computational Logic for Federal Systems of Governance <i>Vincent Ostrom</i>	227
Chapter Nine: Epistemic Choice and Public Choice <i>Vincent Ostrom</i>	243
Index	271

List of Figures and Tables*Figures*

Figure 3.1: A Framework for Institutional Analysis	68
Figure 3.2: Levels of Analysis and Outcomes	82
Figure 4.1: Predicted Equilibrium Budget/Output Combinations Under Different Rule Configurations	105
Figure 5.1: N-person Social Dilemma	125
Figure 5.2: The Core Relationship	144
Figure 5.3: A Simple Scenario	148
Figure 6.1: Four Types of Goods	172
Figure 6.2: A Framework for Institutional Analysis	174
Figure 6.3: The Internal Structure of an Action Situation	176
Figure 6.4: Rules as Exogenous Variables Directly Affecting the Elements of an Action Situation.	180
Figure 6.5: Microsituational and Broader Contexts of Social Dilemmas Affect Levels of Trust and Cooperation	191
Figure 6.6: Action Situations Embedded in Broader Social-Ecological Systems:	195
Figure 9.1: A Framework of Elements and Stages in Institutional Analysis and Development.	255

Tables

Table 9.1: Hobbes's Laws of Nature [The Way to Peace]	248
Table 9.2: Types of Goods	260

References

- Berman, H. (1983) *Law and Revolution: The Formation of the Western Legal Tradition*, Cambridge, Mass.: Harvard University Press.
- Boulding, K. E. (1963) 'Toward a Pure Theory of Threat Systems', *American Economic Review* 53 (May): 424–34.
- Dardess, J. W. (1983) *Confucianism and Autocracy: Professional Elites in the Founding of the Ming Dynasty*, Berkeley and Los Angeles: University of California Press.
- Hamilton, A., Jay, J. and Madison, J., *The Federalist*, New York: Modern Library, (First published in 1788)
- Hayek, F. von (1973) *Rules and Order*, vol. 1 of *Law, Legislation and Liberty*, Chicago: University of Chicago Press.
- Mandeville, Bernard (1970) *The Fable of the Bees*, New York: Penguin. (First published in 1714)
- Ostrom, V., Tiebout, C. M. and Warren, R. (1961) 'The Organization of Government in Metropolitan Areas: A Theoretical Inquiry', *American Political Science Review* 55 (Dec.): 831–42.
- Piaget, J. (1969) *The Moral Judgment of the Child*, New York: Free Press. First published in 1932.
- Polanyi, M. (1951) *The Logic of Liberty: Reflections and Rejoinders*, Chicago: University of Chicago Press.
- Smith, A. *The Wealth of Nations*, London: Ward, Lock & Tyler. (First published in 1776)
- Tocqueville, Al. de *Democracy in America*, New York: Knopf. (First published in 1835 and 1840)

Chapter Three

The Quest for Meaning in Public Choice¹

Elinor Ostrom and Vincent Ostrom

Logical foundations of democracies

In our efforts to understand the logical foundations of constitutional democracy, we both found that *The Calculus of Consent* (Buchanan and Tullock 1962) gave us basic tools for acquiring some analytical leverage in addressing particular problems that people are required to address about public affairs. Vincent had, for example, served as a consultant to the Alaska constitutional convention, working with others in committees and subcommittees to prepare the draft of Article VIII on Natural Resources. The principle of conceptual unanimity gave meaning to what he had observed and what was accomplished. The physical and cultural exigencies of Alaska loomed large in considering the juridical principles of property relationships to apply to the appropriation of natural resources in the public domain.

Elinor explored the way that pumpers in West Basin, California, used equity jurisprudence to engage efforts to craft public enterprises for governing and managing groundwater basins as common-pool resources. The processes of equity jurisprudence sought to achieve conceptual unanimity in establishing the nature of the problem, in adjudicating water rights, in formulating the rules that were constitutive of water user associations, the way they related to one another, and in monitoring performance.

Adjudicating water rights, establishing pump taxes, and developing exchange relationships suggested efforts to minimize the costs of time and effort to be expended and potential deprivation costs. Public enterprises capable of levying taxes and enforcing regulations became the essential complement of private for-profit enterprises and voluntary nonprofit enterprises. Public entrepreneurs in the Southern California region crafted numerous, diversely constituted enterprises to facilitate the development of that region. Water supply depended on extensive analytical capabilities worked out in different political arenas (E. Ostrom 1965 1990).

These tiny events in the sea of human endeavours impelled us to explore efforts to address the logical foundations for order in human societies. In addition to

1. Ostrom, Elinor, and Ostrom, Vincent (2004) 'The Quest for Meaning in Public Choice'. *American Journal of Economics and Sociology* 63 (1): 105–47. Special Invited Issue: The Production and Diffusion of Public Choice Political Economy: Reflections on the VPI Center (Jan., 2004).

reading what authors had to say, we devoted ourselves to efforts to understand the logic and the presuppositions that authors were using in what they had to say. The authors of *The Federalist* (n.d. [1788]) developed and used a theory of constitutional choice to explain the draft constitution formulated by the constitutional convention held in Philadelphia in 1787. The essays initially prepared as newspaper articles were addressed 'To the People of the State of New York' as an effort to inform their deliberations about the ratification of the Constitution of the United States. Vincent's *The Political Theory of a Compound Republic* (1987 [1971]) is an effort to expound the theory used by Alexander Hamilton and James Madison as they sought to address themselves to the theoretical architecture of a federal republic known as the United States of America.

The works of Thomas Hobbes, John Locke, the Baron de Montesquieu, David Hume, Emmanuel Kant, Adam Smith, and many others provide a longer-standing tradition of inquiry about the logical foundations of order in human societies. All of these efforts sought to contribute to and elaborate a *calculus of consent*. In many ways, Hobbes's *De Cive or the Citizen* (1949 [1642]) and *Leviathan* (1960 [1651]) are remarkable efforts to deal with the logical foundations of political order. His treatment of the human condition, the place of language in understanding the human condition, and the dilemma of individuals who seek their own good and who in the presence of scarcity wind up fighting with one another and enduring the misery of war are efforts to clarify the logical foundations of commonwealths.

Hobbes's way of resolving the dilemma of those who seek their own good but realize the misery of war was to consider how men might achieve peace as an alternative to war. His resolution was to use the Golden Rule – '*Do not that to another, which thou wouldest not have done to thyself*' (1960 [1651]: 103); emphasis in original – as a method of normative inquiry to establish the basic principles that would serve as the articles of peace. This is a method for making interpersonal comparisons and striving for conceptual unanimity.

[If,] when weighing the actions of other men with his own, they seem too heavy [...] put them into the other part of the balance, and his own into their place, that his own passions, and self-love, may add nothing to the weight; and then there is none [of the conditions of peace] that will not appear unto him very reasonable. (*Ibid.*)

These articles of peace, also referred to as 'natural laws' and 'God's law', were clearly insufficient because words alone cannot bind people to perform without means of enforcement: 'And Covenants, without the sword, are but words, and of no strength to bind a man at all' (p. 109). Hobbes expounded a theory of a unitary sovereign, presuming that the unity of law and the unity of a commonwealth depended on the unity of a sovereign representative. It follows that Hobbes's sovereign is the source of law, is above the law, and cannot be held accountable to law. His theory of democracy in which an assembly of citizens would exercise sovereign prerogative was clearly inadequate. *Rule by assembly* cannot occur in the absence of a common understanding about the *rules of assembly*. Such a common

understanding to prevail would need to meet the requirement of conceptual unanimity. Indeed, the play of any game marked by winning and losing is viable only when the players agree on the rules of the game. A sense of justice depends on standards of fairness that apply to human relationships.

Locke, Montesquieu, Hume, Smith, Kant, and the American federalists were able to conceptualize aspects in the logical foundation of constitutional democracies. Montesquieu expressed the basic anomaly in a straightforward way. Virtue is the basic motive governing republics in which each individual is presumed to be self-governing and the legislative power is presumed to reside in the whole community. But to prevent the abuse of power, it is necessary that the architecture of authority relationships be fashioned on the principle that 'power should be used to check power'. Madison in Essay 51 of *The Federalist* expressed the same principle in the following language:

This policy of supplying, by opposite and rival interests, the defect of better motives, might be traced through the whole system of human affairs, private as well as public. We see it particularly displayed in all the subordinate distributions of power, where the constant aim is to divide and arrange the several offices in such a manner as that each may be a check on the other – that the private interest of every individual may be a sentinel over the public rights. These inventions of prudence cannot be less requisite in the distribution of the supreme powers of the State (n.d.[1788]: 338).

Dilemmas confronting human beings can be resolved to mutual advantage, but all resolutions are subject to threats. Wherever we turn, human beings are plagued by many of the following anomalies:

- Languages greatly enhance human capabilities for learning that can be accrued across successive generations, but language can also be used to create false illusions, deceive, misinform, and amplify errors.
- The amplification of knowledge and action possibilities creates potential for chaos unless the language of rule-ordered relationships can be used to establish mutual expectations about how to behave in hypothetical situations.
- To make rules binding in human relationships requires that some be assigned authority to impose sanctions (evils) on others. All human societies are Faustian bargains; potentials for doing evil are necessary to achieving the common good.
- The rule-ruler-ruled relationship is the most fundamental source of inequalities in human societies.
- If the unity of law depends on a single ultimate centre of authority, then those who are the source of law cannot themselves be held accountable to a rule of law.
- Those who exercise the prerogatives of rulership and control the instruments of coercion in a society are in a position to dominate the allocation of values and to use the instruments of ruler-ship to oppress and exploit those who are subject to those rulership prerogatives.

- The quest for rule-ordered relationships creates opportunities for oppression and tyranny.
- The character of this Faustian bargain leaves human beings in a difficult dilemma. They have the choice of submitting to those who are their rulers or to try to find ways to bind those who exercise rulership prerogatives to a rule of law.
- Submission to dominance is destructive of innovative potentials. Immobility prevails.
- The long-standing quest to achieve a just state and covenantal system of governance turns on placing enforceable limits on the exercise of rulership prerogatives by allocating agency relationships subject to veto capabilities.
- Any system subject to an assignment of limited authority is vulnerable to stalemate.
- Strong incentives exist for some individuals in the presence of recurrent stalemates to form organisations to slate candidates, fabricate slogans, mobilize votes, win elections, dominate the various instrumentalities of government, and enjoy the fruits of victory. Systems grounded in limitations on power associated with such concepts as separation of powers, checks and balances, and federal distributions of authority give way to machine politics and boss rule.

What was expounded by Alexander Hamilton as a general theory of limited constitutions remained to be construed by Alexis de Tocqueville in his *Democracy in America* (1990 [1835, 1840]). He recognized the innovative and experimental character of the undertaking in the concluding remarks at the end of the chapter on the physical features of the North American continent:

In that land the great experiment of the attempt to construct society upon a new basis was to be made by civilized man; and it was there, for the first time, that theories hitherto unknown, or deemed impracticable, were to exhibit a spectacle for which the world had not been prepared by the history of the past (*Ibid.* 1: 25).

Tocqueville referred to the aggregate structure of the great experiment to construct society on a new basis as a *self-governing society*: 'there society governs itself for itself' (1: 57). Larry Siedentop in his biography entitled *Tocqueville* asserts that '[b]y writing *Democracy in America* [1835] Tocqueville attempted something extraordinary – the overturn of the established European idea of the state' (1994: 41). Rather than a state-governing society, the possibility exists of societies governing themselves for themselves.

The principle of using power to check power might be reiterated in all their political experiments with processes of *constitutional choice* setting the terms and conditions of *collective choice* and carried through to the *operational choices* that people make in their everyday life. Buchanan and Tullock's *The Calculus of Consent* (1962) helped to clarify the logical foundations of constitutional democracy if extended throughout the whole system of human affairs.

By contrast, Milovan Djilas, writing in the 1950s, observed in his analysis of the Soviet experiment:

Everything happened differently in the U.S.S.R. and other Communist countries from what the leaders – even such prominent ones as Lenin, Stalin, Trotsky, and Bukharin – anticipated. They expected that the state would rapidly wither away, that democracy would be strengthened. *The reverse happened*. They expected a rapid improvement in the standard of living – there has been scarcely any change in this respect and, in the subjugated Eastern European countries, the standard has even declined. In every instance, the standard of living has failed to rise in proportion to the rate of industrialization, which was much more rapid. It was believed that the differences between cities and villages, between intellectual and physical labor, would slowly disappear; instead these differences have increased. Communist anticipations in other areas – including their expectations for development in the non-Communist world – have failed to materialize.

The greatest illusion was that industrialization and collectivization in the U.S.S.R. and destruction of capitalist ownership, would result in a classless society. In 1936, when the new Constitution was promulgated, Stalin announced that the 'exploiting class' had ceased to exist. *The capitalist and other classes of ancient origin had in fact been destroyed, but a new class, previously unknown to history, had been formed* (1957: 37–38; emphasis added).

The viability of American experiments in Tocqueville's analysis was subject to certain risks marked by the collusive efforts of politicians to gain dominance over all decision structures. These efforts came to fruition in the post-Civil War era with the reign of machine politics and boss rule. Constitutional remedies were achieved by the Progressive Reform Movement during the late 19th and early 20th centuries. Tocqueville was convinced that if citizens act on their natural inclinations that centralization of government and the abandonment of self-governing capabilities would be the result; and that the exercise of self-governing capabilities would depend on the exercise of an artisanship grounded in an art and science of association. Maximizing utility without attention to the way that ideas shape deeds leads people to trample civilization underfoot.

F. A. Hayek in his essay on 'The Use of Knowledge in Society' (1945) advanced the thesis that all artisanship requires the application of generalities to time and place specificities. The logical foundation of constitutional democracy requires that generalizations be applied to the specificities of time and place exigencies. Local knowledge is a necessary complement to the generalities that accrue from scientific knowledge.

The specificities associated with contingencies of time are subject to dynamic patterns of change. Tocqueville, for example, in the opening paragraphs of his 'Introduction' to *Democracy in America* advances the conjecture that 'a great democratic revolution' was occurring in western Christendom. Efforts to apply the logical foundation of constitutional democracy to heterogeneous time and

place exigencies and to avoid the manifold threats to the viability of democratic undertakings will assume such complexities that they will exceed human understanding. Karl Popper in *The Open Society and Its Enemies* presents a comparable assertion when he writes that '[t]he open society can be described as one of the deepest revolutions through which mankind has passed' (1963 [1945] 1:175). The meaning of deepness is suggested by Tocqueville when he writes that the 'great democratic revolution' is marked by basic long-term transformations in human societies:

Gradually enlightenment spreads, a reawakening of the taste for literature and the arts became evident, intellect and will contributed to success, knowledge became an attribute of government, intelligence a social force; the educated man took part in the affairs of state. (*Ibid.* 1: 4)

Harold Lasswell and Abraham Kaplan (1950) have suggested that the different social sciences apply to different aspects of the same social reality. Alexander Hamilton had raised the question of whether good government could be shaped by reflection and choice. James Buchanan (1979), in turn, suggested that the character of individuals is an artificial creation fashioned by reflection and choice.

Frameworks, theories, and models for studying public choice

Explaining the anomalies presented above, the multiple levels of analysis, and the complexities and dynamic aspects of public choices depend on theoretical work undertaken at three levels of specificity that are often confused with one another. These essential foundations include: (1) frameworks, (2) theories, and (3) models. Analyses conducted at each level provide different degrees of specificity related to particular problems.

The development and use of a general *framework* help to identify the elements, and relationships among these elements, that one needs to consider in doing any analysis. Frameworks organise diagnostic and prescriptive inquiry. They provide the most general list of variables that should be used to analyse all types of institutional arrangements. Frameworks provide a metatheoretic language that can be used to compare theories. They attempt to identify the *universal* elements that any theory relevant to the same kind of phenomena would need to include. Many differences in surface reality can result from the way these variables combine with or interact with one another. Thus, the elements contained in a framework help the analyst generate the questions that need to be addressed when first conducting an analysis.²

The development and use of *theories* enable the analyst to specify which elements of the framework are particularly relevant for certain kinds of questions and to make general working assumptions about these elements. Thus, theories include elements of a framework and make specific assumptions that are

necessary for an analyst to diagnose a phenomenon, explain its processes, and predict outcomes. Several theories are usually compatible with any framework. Economic theory, game theory, public choice theory, transaction cost theory, covenantal theory, and theories of public goods and common-pool resources are all compatible with the Institutional Analysis and Development (IAD) framework that has been developed over the years at the Workshop in Political Theory and Policy Analysis at Indiana University (Kiser and E. Ostrom 1982; Oakerson 1992; E. Ostrom, Gardner, and Walker 1994).

The development and use of *models* make precise assumptions about a limited set of parameters and variables. Logic, mathematics, game theory, experimentation and simulation, and other means are used to explore systematically the consequences of particular assumptions on a limited set of outcomes. Multiple models are usually compatible with any one theory. Slight changes in the assumptions made about the shape of a production function or the payoff function of a particular player change the structure of a model without changing the structure of the broader theory generating the model.

For policy makers and scholars interested in issues related to how different governance systems enable individuals to solve problems democratically, the IAD framework helps to organise diagnostic, analytical, and prescriptive capabilities. It also aids in the accumulation of knowledge from empirical studies and in the assessment of past efforts at reforms. Markets and hierarchies are frequently presented as fundamentally different 'pure types' of organisation. Such a view precludes the use of a more general explanatory framework and closely related theories that help analysts make cross-institutional comparisons and evaluations.

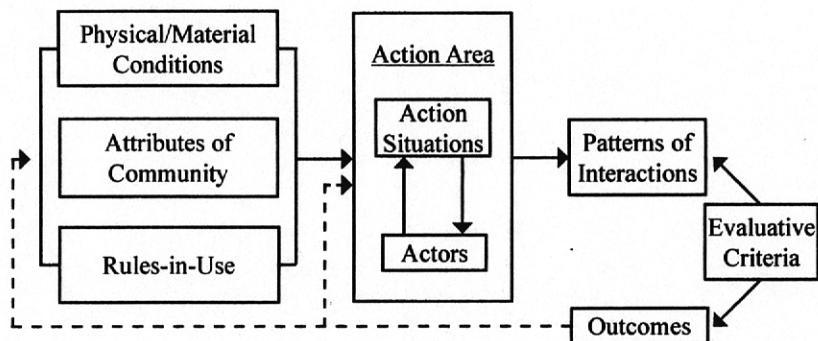
Without the capacity to undertake systematic, comparative institutional assessments, recommendations of reform may be based on naive ideas about which kinds of institutions are 'good' or 'bad' and not on an analysis of performance. One needs a common framework and family of theories in order to address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

The institutional analysis and development (IAD) framework

As indicated earlier, an institutional framework should identify the major types of structural variables present to some extent in *all* institutional arrangements but whose values differ from one type of institutional arrangement to another. The IAD framework is a multi-tier conceptual map (see Figure 3.1). One part of the framework is the identification of an action arena, the resulting patterns of interactions and outcomes, and evaluating these outcomes (see right half of Figure 3.1). The problem could be at an operational tier where actors interact in light of the incentives they face to generate outcomes directly in the world.

2. This section draws on E. Ostrom (1999).

Figure 3.1: A Framework for Institutional Analysis



Source: E. Ostrom (1999: 42).

The problem could also be at a policy (or collective-choice) tier where decision makers repeatedly have to make policy decisions within the constraints of a set of collective choice rules. The policy decisions then affect the structure of arenas where individuals are making operational decisions and thus impacting directly on a physical world. The problem could as well be at a constitutional tier where decisions are made about who is eligible to participate in policy making and the rules that will be used to undertake policy making.

The first step in analysing a problem is to identify a conceptual unit – called an *action arena* – that can be utilized to analyse, predict, and explain behavior within institutional arrangements. Action arenas include an *action situation* and the *actors* in that situation. An action situation can be characterized using seven clusters of variables: (1) participants, (2) positions, (3) outcomes, (4) action-outcome linkages, (5) the control that participants exercise, (6) information, and (7) the costs and benefits assigned to outcomes. An actor (an individual or a corporate actor) includes assumptions about four clusters of variables:

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

An action arena refers to the social space where individuals interact, exchange goods and services, solve problems, dominate one another, or fight (among the many things that individuals do in action arenas). Considerable theoretical work in the public choice tradition focuses only on one arena and takes the variables specifying the situation and the motivational and cognitive structure of an actor as

givens. The task of analysis is then to predict the behavior of individuals, assuming that some kind of equilibrium is likely in a fixed situation.

Two additional steps could also be taken. One step digs deeper and inquires into the factors that affect the structure of an action arena. From this vantage point, the action arena is viewed as a set of variables dependent upon other factors. These factors affecting the structure of an action arena include three clusters of variables: (1) the rules used by participants to order their relationships, (2) the attributes of states of the world that are acted upon in these arenas, and (3) the structure of the more general community within which any particular arena is placed (see Kiser and E. Ostrom 1982). This step is examined in the next section of this paper. Then one can move outward from action arenas to consider methods for explaining complex structures that link sequential and simultaneous action arenas to one another (see the left side of Figure 3.1).

Diagnosis and explanation within the frame of an action arena

As mentioned earlier, the term *action arena* refers to a complex conceptual unit containing one set of variables called an *action situation* and a second set of variables called an *actor*. One needs both components – the situation and the actors in the situation – to diagnose, explain, and predict actions and results.

An action situation

The term *action situation* is used to refer to an analytic concept that enables an analyst to isolate the immediate structure affecting a process of interest to the analyst for the purpose of explaining regularities in human actions and results, and potentially to reform them. A common set of variables used to describe the structure of an action situation includes: (1) the set of participants; (2) the specific positions to be filled by participants; (3) the set of allowable actions and their linkage to outcomes; (4) the potential outcomes that are linked to individual sequences of actions; (5) the level of control each participant has over choice; (6) the information available to participants about the structure of the action situation; and (7) the costs and benefits – which serve as incentives and deterrents – assigned to actions and outcomes. In addition, whether a situation will occur once, a known finite number of times, or indefinitely affects the strategies of individuals. When explaining actions and cumulated results within the framework of an action arena, these variables are the ‘givens’ that one works with to describe the structure of the situation. These are the common elements used in game theory to construct formal game models.

The actor: theories and models of the individual

The *actor* in a situation can be thought of as a single individual or as a group functioning as a corporate actor. The term *action* refers to those human behaviours for which the acting individual attaches a subjective and instrumental meaning. All analysts of microbehaviour use an implicit or explicit theory or model of the actors in situations in order to derive inferences about the likely behavior of each actor in a situation (and, thus, about the pattern of joint results that may be produced). The analyst must make assumptions about what and how participants value; what resources, information, and beliefs they have; their information-processing capabilities; and the internal mechanisms they use to decide upon strategies.

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

Alternatively, one could assume that the individuals who calculate benefits and costs are fallible learners who vary in terms of the number of other persons whose perceived benefits and costs are important to them and in terms of their personal commitment to keeping promises and honouring forms of reciprocity extended to them (E. Ostrom 1990). Fallible learners can, and often do, make mistakes. Settings differ, however, as to whether the institutional incentives involved encourage people to learn from these mistakes. Fallibility and the capacity to learn can thus be viewed as assumptions of a more general theory of the individual. One can then presume that the various institutional arrangements that individuals use in governing and managing common-pool resources (or other problematic situations) offer them different incentives and opportunities to learn.

When fallible, learning individuals interact in frequently repeated and simple situations, it is possible to model them as if they had complete information about the relevant variables for making choices in those situations. 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 are maximizers of a key variable associated with survival in that environment (e.g. profits or fitness) (Alchian 1950; Dosi and Egidi 1987). When individuals face a relatively simple decision situation where institutions generate accurate information about the variables relevant to a particular problem, that problem can be adequately represented as a straightforward, constrained maximization problem.

Many of the situations of interest in understanding public choices about common-pool resources, however, are uncertain, complex, and lack the selective pressure and information-generating capabilities of a competitive market. Therefore, one can substitute the assumption of bounded rationality – that persons are intendedly rational but only limitedly so – for the assumptions of perfect information and utility maximization used in axiomatic choice theory (see Simon 1965, 1972; Williamson 1985; E. Ostrom, Gardner and Walker 1994: ch. 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. Reciprocity may develop, rather than strictly narrow, short-term pursuit of self-interest (Oakerson 1993; E. Ostrom 1998).

Predicting outcomes within an action arena

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

When there is no limit on the number of appropriators from a common-pool resource or on the amount of harvesting activities they undertake, for example, one can develop a mathematical model of an open-access, common-pool resource (see, for example, E. Ostrom, Gardner and Walker 1994). When the net benefits of harvesting to each entrant increase for the initial set of resource units sought and decrease thereafter, each appropriator acting independently tends to make individual decisions that jointly yield a deficient (but stable) equilibrium. A model of an open-access, common-pool resource generates a clear prediction of a race to use up the resource, leading to high social costs. Both field research and laboratory experimental research strongly support the predictions of overuse and potential destruction of open-access, common-pool resources where appropriators do not share access to collective-choice arenas in which to change the open-access structure they face (E. Ostrom, Gardner and Walker 1994).

Many arenas, however, do not generate such unambiguous results. Instead of completely independent decision making, individuals may be embedded in communities where initial norms of fairness and conservation may change the structure of the situation dramatically. Within these situations, participants may adopt a broader range of strategies. Further, they may change their strategies over time as they learn about the results of past actions. The analyst examining these

more open, less-constrained situations makes weaker inferences and predicts the patterns of outcomes that are relatively more or less likely to result from a particular type of situation. In laboratory experiments, for example, giving subjects in a common-pool resource situation opportunities to communicate generally increases the joint outcomes they achieve (see E. Ostrom, Gardner and Walker 1994 and cites contained therein). In field settings, multiple studies have shown that individuals have far more capabilities to change rules to reduce the incentives to overproduce and in many cases achieve sustainable use of renewable resources (Tang 1992; Bromley *et al.* 1992; Lam 1998).

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

Evaluating outcomes

In addition to predicting outcomes, public choice theorists may also evaluate the outcomes that are being achieved, as well as the likely set of outcomes that could be achieved under alternative institutional arrangements. Evaluative criteria are applied to both the outcomes and the processes of achieving outcomes. While there are many potential evaluative criteria, let us briefly focus on (1) economic efficiency, (2) equity through fiscal equivalence, (3) redistributional equity, (4) accountability, (5) conformance to general morality and (6) adaptability.

Economic efficiency

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

Fiscal equivalence

There are two principal means to assess equity: (1) on the basis of the equality between individuals' contributions to an effort and the benefits they derive and (2) on the basis of differential abilities to pay. The concept of equity that underlies an exchange economy holds that those who benefit from a service should bear the burden of financing that service. Perceptions of fiscal equivalence or a lack thereof can affect the willingness of individuals to contribute toward the development and maintenance of resource systems.

Redistributional equity

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

Accountability

In a democratic polity, officials should be accountable to citizens concerning the development and use of public facilities and natural resources. Without accountability, actors can engage successfully in the various strategic behaviours. Concern for accountability need not conflict greatly with efficiency and equity goals. Indeed, achieving efficiency requires that information about the preferences of citizens be available to decision makers, as does achieving accountability. Institutional arrangements that effectively aggregate this information assist in realizing efficiency at the same time that they serve to increase accountability and to promote the achievement of redistributional objectives.

Conformance to general morality

In addition to accountability, one may wish to evaluate the level of general morality fostered by a particular set of institutional arrangements. Are those who are able to cheat and go undetected able to obtain very high payoffs? Are those who keep promises more likely to be rewarded and advanced in their careers? How do those who repeatedly interact within a set of institutional arrangements learn to relate to one another over the long term?

Adaptability

Finally, unless institutional arrangements are able to respond to ever-changing environments, the sustainability of resources and investments is likely to suffer. Rural areas of developing countries are often faced with natural disasters and highly

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

Trade-offs are often necessary in using performance criteria as a basis for selecting from alternative institutional arrangements. It is particularly difficult to choose between the goals of efficiency and of redistributive equity. The trade-off issue arises most explicitly in considering alternative methods of funding public projects. Economically efficient pricing of the use of an existing resource or facility should reflect only the incremental maintenance costs and any external or social costs associated with its use. This is the well-known, efficiency-pricing principle that requires that prices equal the marginal costs of usage. The principle is especially problematic in the case of goods with non-subtractability attributes. In such instances, the marginal cost of another user utilizing the good is zero; hence, the efficient price is also zero. Zero user prices, however, require that all sources of resource mobilization are tax-based, which induces other kinds of perverse incentives and potential inefficiencies. Evaluating how institutional arrangements compare across overall criteria is quite a challenge. Analytical examination of the likely tradeoffs between intermediate costs is valuable in attempting to understand comparative institutional performance (see E. Ostrom, Schroeder and Wynne 1993: ch. 5).

Explanation viewing action arenas as dependent variables

Underlying the way analysts conceptualise action arenas are implicit assumptions about the *rules* individuals use to order their relationships, about attributes of *states of the world and their transformations*, and about the *nature of the community* within which the arena occurs. Rules, states of the world, and the nature of the community all jointly affect the types of actions that individuals can take, the benefits and costs of their attributes to these actions and resulting outcomes, and the likely outcomes achieved.

The concept of rules

Rules are shared understandings among those involved that refer to enforced prescriptions about what actions (or states of the world) are *required*, *prohibited*, or *permitted*. All rules are the result of implicit or explicit efforts to achieve order and predictability among humans by creating classes of persons (positions) who are then required, permitted, or forbidden to take classes of actions in relation to required, permitted, or forbidden states of the world (Crawford and E. Ostrom 1995; V. Ostrom 1991).

In an open and democratic governance system, there are many sources of the rules that individuals use in everyday life. It is not considered illegal or improper

for individuals to self-organise themselves and craft their own rules, if the activities they engage in are legal. In addition to the legislation and regulations of a formal central government, there are apt to be laws passed by regional, local and special governments. Within private firms and voluntary associations, individuals are authorized to adopt many different rules for who is a member of the firm or association, how profits (benefits) are to be shared, and how decisions will be made. Each family constitutes its own rule-making body.

When individuals genuinely participate in the crafting of multiple layers of rules, some of that crafting will occur using pen and paper. Much of it, however, will occur as problem-solving individuals interact trying to figure out how to do a better job in the future than they have done in the past. Colleagues in a work team are crafting their own rules when they might say to one another: 'How about if you do A in the future, and I will do B, and before we ever make a decision about C again, we both discuss it and make a joint decision'. In a democratic society, problem-solving individuals do this all the time. They also participate in less fluid decision-making arrangements, including elections to select legislators.

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

Once we understand the working rules, then, we attempt to understand where those rules come from. In a system governed by a 'rule of law', the general legal framework in use will have its source in actions taken in constitutional, legislative, and administrative settings augmented by decisions taken by individuals in many different particular settings. In other words, the rules-in-form are consistent with the rules-in-use (Sproule-Jones 1993). In a system that is not governed by a 'rule of law', there may be central laws and considerable effort made to enforce them, but individuals attempt to evade rather than obey the law.

Rule-following or conforming actions are not as predictable as biological or physical behavior explained by scientific laws. All rules are formulated in human language. As such, rules share problems of lack of clarity, misunderstanding, and change that typify any language-based phenomenon (V. Ostrom 1980, 1997). Words are always simpler than the phenomenon to which they refer.

The stability of rule-ordered actions is dependent upon the shared meaning assigned to words used to formulate a set of rules. If no shared meaning exists when a rule is formulated, confusion will exist about what actions are required, permitted, or forbidden. Regularities in actions cannot result if those who must

repeatedly interpret the meaning of a rule within action situations arrive at multiple interpretations. Because 'rules are not self-formulating, self-determining, or self-enforcing' (V. Ostrom 1980: 312), it is human agents who formulate them, apply them in particular situations, and attempt to enforce performance consistent with them. Even if shared meaning exists at the time of the acceptance of a rule, transformations in technology, in shared norms, and in circumstances more generally change the events to which rules apply. 'Applying language to changing configurations of development increases the ambiguities and threatens the shared criteria of choice with an erosion of their appropriate meaning' (*Ibid.*).

What rules are important in public choice? A myriad of specific rules are used in structuring complex action arenas. Scholars have been trapped into endless cataloguing of rules not related to a method of classification most useful for theoretical explanations. But classification is a necessary step in developing a science. Anyone attempting to define a useful typology of rules must be concerned that the classification is more than a method for imposing superficial order onto an extremely large set of seemingly disparate rules. The way we have tackled this problem is to classify rules according to their impact on the elements of an action situation.

Rule configurations

A first step toward identifying the working rules can be made, then, by overtly examining how working rules affect each of the variables of an action situation. A set of working rules that affect these variables should constitute the minimal but necessary set of rules needed to offer an explanation of actions and results based on the working rules used by participants to order their relationships within an action arena. Because states of the world and their transformations and the nature of a community also affect the structure of an action situation, working rules alone never provide both a necessary and sufficient explanation of the structure of an action situation and results.

Adopting this view of the task, seven types of working rules can be said to affect the structure of an action situation. These are: *entry and exit rules, position rules, scope rules, authority rules, aggregation rules, information rules, and payoff rules*. The cumulative effect of these seven types of rules affects the seven elements of an action situation.

Entry and exit rules affect the number of *participants*, their attributes and resources, whether they can enter freely, and the conditions they face for leaving. Position rules establish *positions* in the situation. Authority rules assign sets of *actions* that participants in positions at particular nodes must, may, or may not take. Scope rules delimit the *potential outcomes* that can be affected and, working backward, the actions linked to specific outcomes. Authority rules, combined with the scientific laws about the relevant states of the world being acted upon, determine the shape of the decision tree the *action-outcome linkages*. Aggregation rules affect the level of *control* that a participant in a position exercises in the selection of an action at a node. Information rules affect the *knowledge contingent*

information sets of participants. Payoff rules affect the *benefits and costs* that will be assigned to particular combinations of actions and outcomes and establish the incentives and deterrents for action. The set of working rules is a *configuration* in the sense that the effect of a change in one rule may depend upon the other rules-in-use.

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

Physical and material conditions

While a rule configuration affects all of the elements of an action situation, some of the variables of an action situation are also affected by attributes of the physical and material world. What actions are physically possible, what outcomes can be produced, how actions are linked to outcomes, and what is contained in the actors' information sets are affected by the world being acted upon in a situation. The same set of rules may yield entirely different types of action situations depending upon the types of events in the world being acted upon by participants.

The attributes of states of the world and their transformation are explicitly examined when the analyst self-consciously asks a series of questions about how the world being acted upon in a situation affects the outcome, action sets, action-outcome linkages, and information sets in that situation. The relative importance of the rule configuration and states of the world in structuring an action situation varies dramatically across different types of settings. The relative importance of working rules to attributes of the world also varies dramatically within action situations considered to be part of the public sector. Rules define and constrain voting behavior inside a legislature more than attributes of the world. Voting can be accomplished by raising hands, by paper ballots, by calling for the ayes and nays, by marching before an official counter, or by installing computer terminals for each legislator on which votes are registered. However, in regard to organising communication within a legislature, attributes of the world strongly affect the available options. The principle that only one person can be heard and understood at a time in any one forum strongly affects the capacity of legislators to communicate effectively with one another (see V. Ostrom 1987).

Let us consider several attributes that are frequently used to distinguish public goods and services. Goods that are generally considered to be 'public goods' yield non-subtractive benefits that can be enjoyed jointly and simultaneously by many people who are hard to exclude from obtaining these benefits. Common-pool resources yield benefits where beneficiaries are hard to exclude but each person's use of a resource system subtracts units of that resource from a finite total available for harvesting.

Excludability and the free-rider problem

When it is difficult or costly to exclude beneficiaries from a good once it is produced, it is frequently assumed that such a good must be provided publicly, rather than privately. When the benefits of a good are available to a group, whether or not members of the group contribute to the provision of the good, that good is characterized by problems with excludability. Where exclusion is costly, those wishing to provide a good or service face a potential free-rider or collective-action problem (Olson 1965). This is not to say that all individuals will free-ride whenever they can. A strong incentive exists to be a free-rider in all situations where potential beneficiaries cannot easily be excluded for failing to contribute to the provision of a good or service.

Public sector provision of common-pool resources or infrastructure facilities raises additional problems in determining preferences and organising finances. When exclusion is low-cost to the supplier, preferences 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 complex, regardless of whether the providing unit is organised in the public or the private sphere. 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, decisions about infrastructure are apt to be made through mechanisms such as voting or the delegation of authority to public officials where the difficulties of translating preferences into collective choices that adequately reflect individual views are present (Arrow 1951; Shepsle 1979).

Subtractability of the flow

The withdrawal of a quantity of water from an irrigation canal by one farmer means that there is that much less water for anyone else to use. Most agricultural uses of water are fully subtractive, whereas many other uses of water – such as for power generation or navigation – are not. Most of the water that passes through a turbine to generate power, for instance, can be used again downstream. When the use of a flow of services by one individual subtracts from what is available to others and when the flow is scarce relative to demand, users will be tempted to try to obtain as much as they can of the flow for fear that it will not be available later.

Effective rules are required if scarce, fully subtractive service flows are to be allocated in a productive way. Charging prices for subtractive services obviously constitutes one such allocation mechanism. Sometimes, however, it is not feasible (or legal) to price services. In these instances, some individuals will be able to grab considerably more of the subtractive services than others, thereby leading to noneconomic uses of the flow and high levels of conflict among users.

Allocation rules also affect the incentives of users to provide and maintain a system. Farmers located at the tail end of an irrigation system that lacks effective

allocation rules have little motivation to contribute to the maintenance of that system because they only occasionally receive their share of water. Similarly, farmers located at the head end of such a system are not motivated to provide maintenance services voluntarily because they will receive disproportionate shares of the water whether or not the system is well maintained (E. Ostrom 1996b).

Consequently, for common-pool resources whose flows are highly subtractive, institutional arrangements related to the allocation of the flow of services are intimately tied to the sustainability of the resource. It is highly unlikely that one can achieve sustainability without careful attention to the efficiency, fairness, and enforceability of the rules specifying who can appropriate how much of the service flow, at what times and places, and under what conditions. Furthermore, unless responsibilities are linked in a reasonable fashion to benefits obtained, the beneficiaries themselves will resist efforts to insist that they take responsibilities.

Additional attributes

In addition to these general attributes of physical and material conditions that affect the incentives of participants, resource systems are also characterized by a diversity of other attributes that affect how rules combine with physical and material conditions to generate positive or negative incentives. Whether resource units are *mobile* or *stationary* and whether *storage* is available somewhere in a system affect the problems that individuals governing and managing common-pool resources face (Schlager, Blomquist and Tang 1994). The problems of regulating a lobster fishery, for example, are much simpler than those of regulating a salmon fishery. Similarly, allocating water in a predictable and efficient manner is easier to achieve when there is some storage in the system than when it is a run-of-the-river system.

The size of a resource system can also have a major impact on the incentives facing participants. The length and slope of a main canal of an irrigation system not only affects the cost of its maintenance but also the strategic bargaining that exists between headenders and tailenders on an irrigation system (Lam 1998; E. Ostrom 1996b). Increasing the number of participants is associated with increased transaction costs. How steeply the costs rise depends, to a large extent, on the rules-in-use and the heterogeneity of the users.

The productivity, predictability, and patchiness of a resource affects the likelihood that private-property arrangements will be successful and enhances the likelihood that common-property arrangements will be necessary (Netting 1982). Similarly, the resilience of a multispecies ecosystem affects the sensitivity of the system to both the rules used to govern the particular system and to changes in economic or environmental conditions elsewhere (Holling 1994).

Attributes of the community

A third set of variables that affect the structure of an action arena relates to the community. The attributes of a community that are important in affecting the structure of an action arena include the norms of behavior generally accepted in the community, the level of common understanding potential participants share about the structure of particular types of action arenas, the extent of homogeneity in the preferences of those living in a community, and the distribution of resources among those affected. The term *culture* is frequently applied to this bundle of variables.

For example, when all appropriators from a common-pool resource share a common set of values and interact with one another in a multiplex set of arrangements, the probabilities of their developing adequate rules and norms to govern resources are much greater (Taylor 1987). The importance of building a reputation for keeping one's word is important in such a community, and the cost of developing monitoring and sanctioning mechanisms is relatively low. If the appropriators of a resource come from many different communities and are distrustful of one another, the task of devising and sustaining effective rules is substantially increased.

Whether individuals use a written vernacular language to express their ideas, develop common understanding, share learning, and explain the foundation of their social order is also a crucial variable of relevance to institutional analysis (V. Ostrom 1997). Without a written vernacular language, individuals face considerably more difficulties in accumulating their own learning in a usable form to transmit from one generation to the next.

Multiple levels of analysis

As all public choice theorists have learned from the work of Buchanan and Tullock, all rules are nested in another set of rules that define how the first set of rules can be changed. The nesting of rules within rules at several levels is similar to the nesting of computer languages at several levels. What can be done at a higher level depends on the capabilities and limits of the rules (or the software) at that level and at a deeper level. Whenever one addresses questions about *institutional change*, as contrasted to choices within institutional constraints, it is necessary to recognize the following:

Changes in the rules used to order action at one level occur within a currently 'fixed' set of rules at a deeper level.

Changes in deeper-level rules usually are more difficult and more costly to accomplish, thus increasing the stability of mutual expectations among individuals interacting according to a set of rules.

It is useful to distinguish three levels of rules that cumulatively affect the actions taken and outcomes obtained in any setting. *Operational rules* directly affect day-to-day decisions made by the participants in any setting. *Collective-choice rules* affect operational activities and results through their effects in

determining who is eligible and the specific rules to be used in changing operational rules. *Constitutional-choice rules* affect operational activities and their effects in determining who is eligible and the rules to be used in crafting the set of collective-choice rules that in turn affect the set of operational rules. There is even a 'metaconstitutional' level underlying all the others that is not frequently analysed.

At each level of analysis there may be one or more arenas in which the types of decisions made at that level will occur. In the collective-choice, constitutional, and metaconstitutional situations, activities involve prescribing, invoking, monitoring, applying, and enforcing rules (Lasswell and Kaplan 1950; Oakerson 1994). The concept of an 'arena' as described earlier does not imply a formal setting, but can include such formal settings as legislatures and courts. Policy making (or governance) regarding the rules that will be used to regulate operational-level choices is usually carried out in one or more collective-choice arenas, as shown in Figure 3.2.

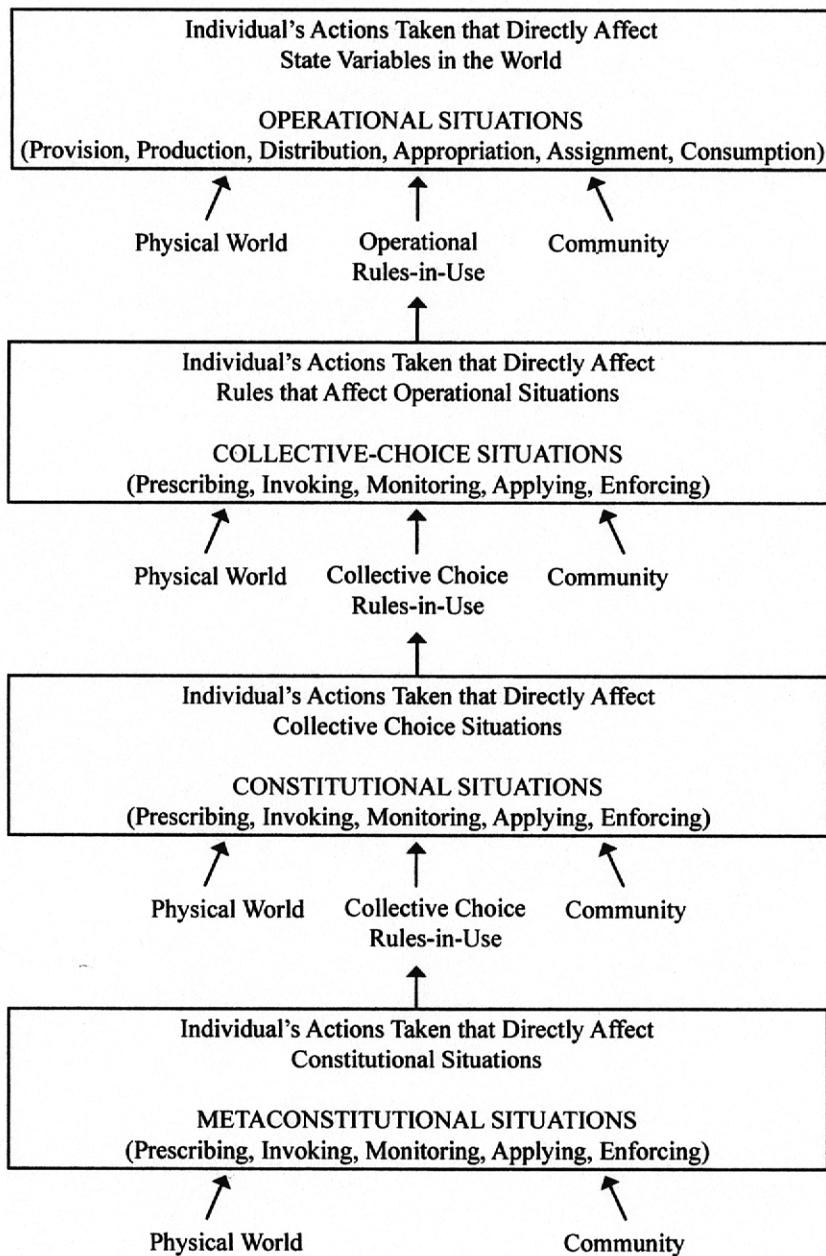
Uses of the IAD framework

The IAD framework is thus a general language about how rules, physical and material conditions, and attributes of community affect the structure of action arenas, the incentives that individuals face, and resulting outcomes. It has been used extensively in teaching (see, for example, the syllabi for the year-long Workshop seminar at our website: <http://www.indiana.edu/~workshop>). In the early 1970s, when the IAD framework was first being developed, we were simultaneously trying to understand how the diverse paradigms in political science affected the way we conceptualized public administration and metropolitan organisation (see V. Ostrom and E. Ostrom 1971; E. Ostrom 1972). Then, for a decade and a half, we used the nascent framework as a foundation for the conduct of an extensive number of empirical studies of police service delivery in metropolitan areas. During the past 15 years, the IAD framework has been used as the language to develop a theory of common-pool resources and link formal models of appropriation and monitoring with empirical work conducted in an experimental laboratory and in field settings.

In crafting empirical studies using the IAD framework, a key question has always been the appropriate units and levels of analysis for any particular type of question (see Gregg 1974). For example, when we studied police services, the police department was only one of the units of analysis included in our work. Rather, we tried to understand who the actors involved were in diverse service situations such as immediate response services, homicide investigation, laboratory analysis, training, and communication services.

We found different sets of actors involved in each of the service situations. In some, citizens as well as police officers as street-level bureaucrats were key participants. In others, we found participants from many different urban service agencies. We had to examine interorganisational arrangements to understand patterns of interaction and results. Using this perspective, we found highly

Figure 3.2: Levels of Analysis and Outcomes



Source: E. Ostrom (1999: 60)

structured patterns of relationships where others had found only chaos. The highest levels of police performance existed, for example, in those metropolitan areas where small-scale, immediate-response units worked along with large-scale investigatory, laboratory, and communication units (Parks 1985). Ongoing research by Roger B. Parks in the Indianapolis area is providing strong evidence that many of the patterns we observed in the 1970s and 1980s are still in evidence in the 1990s. Efforts to understand who was involved in producing public safety led us to formulate a theory of co-production of urban public services (Parks *et al.* 1982; Percy 1984; Kiser 1984; Lam 1996; Whitaker 1980). The theory of co-production has now been applied to a wider set of phenomena (E. Ostrom 1996b). In light of the extensive empirical research, colleagues were able to achieve a far better understanding of the patterns of metropolitan organisation and local government more generally (ACIR 1987, 1988; V. Ostrom, Bish and E. Ostrom 1988; Oakerson and Parks 1988; Parks and Oakerson 1989; Stein 1990).

The second broad area in which the IAD framework has played an important organising role has been the study of common-pool resources. In the early 1980s, the National Academy of Sciences organised a research panel on the study of common property. Ronald Oakerson (1992) wrote a framework paper for the panel that was used in the organisation of a series of case studies of how diverse peoples had devised institutional arrangements related to common-pool resources (*see also* Thomson, Feeny and Oakerson 1992; E. Ostrom 1992). Oakerson's presentation of the framework has influenced an untold number of studies of common-property regimes in many diverse sectors in all regions of the world. The intellectual productivity stimulated by the work of the NAS panel has led to the formation of an International Association for the Study of Common Property (IASCP).

Colleagues at Indiana University have developed a theory of common-pool resources and a series of theoretical models of appropriation from a common-pool resource and tested these in experimental laboratory settings (*see* E. Ostrom, Gardner and Walker 1994; E. Ostrom, Walker and Gardner 1992; Walker and Gardner 1992; Hackett, Schlager and Walker 1994). When laboratory subjects are not allowed to communicate, their behavior closely approximates the behavior that is predicted using finitely repeated, non-cooperative game theory. When allowed to communicate or to use sanctioning mechanisms, the behavior observed in the lab is not consistent with these theoretical models but is similar to what we have observed in field settings. We have consequently developed a theory of how boundedly rational individuals use heuristics such as 'measured responses' to stabilize agreements achieved in settings where there are no external enforcers to impose rules on participants (E. Ostrom, Gardner and Walker 1994).

The IAD framework has now been used to develop three major databases related to the study of common-pool resources and diverse property regimes. The first 'CPR Database' drew on the cases produced for the NAS panel and on the extremely large number of individual case studies that we discovered had been written by historians, sociologists, engineers, political scientists, anthropologists, and students of environmental science (Hess 1999). We used the IAD framework overtly to create a structured database for appropriation and collective-choice

arenas. Schlager (1990, 1994) and Tang (1991, 1992) studied approximately 50 in-shore fisheries and irrigation systems, respectively, and were able to isolate key rules that were positively associated with higher performance levels. In *Governing the Commons* (E. Ostrom 1990), I was able to draw on the framework and on an analysis of the extensive case studies we were all reading at that time to elucidate some aspects of a theory of common-pool resources. In particular, I examined the key design principles that characterized robust, self-organised institutions for achieving sustainable resource use of very long periods of time as well as developing an initial theory of institutional change.

The second database focused entirely on irrigation systems and has been used to code more than 175 irrigation systems in Nepal (Benjamin *et al.* 1994). That database has enabled us to test many propositions growing out of both our own theoretical efforts and those of development scholars more generally (see Schweik, Adhikari and Pandit 1997; Lam 1994; E. Ostrom, Lam and Lee 1994; E. Ostrom and Gardner 1993; E. Ostrom 1994, 1996a). We have been able to challenge many of the empirical assumptions used by development scholars who have presumed that farmers are unable to self-organise and engage in costly collective action without the imposition of rules from external authorities (see also Thomson 1992). We have found that farmer-managed irrigation systems in Nepal are able to outperform agency-managed systems in regard to agricultural productivity when we have controlled for factors such as size of group, length of canal, and type of terrain (Shivakoti and Ostrom 2002).

The third database is an integral part of the International Forestry Resources and Institutions (IFRI) research program, which is a major ongoing research program of the Workshop and of the Centre for the Study of Institutions, Population, and Environmental Change (CIPEC).

This research program is designed to address knowledge and information gaps about how institutions affect the incentives of forest users and result in substantial levels of deforestation in some locations while forest conditions are improving in other locations. Collaborative research centres are now functioning in Bolivia, Guatemala, India, Kenya, Nepal, Tanzania, and Uganda and several more are under consideration (see Gibson, McKean, and E. Ostrom 2000). In Uganda, Banana and Gombya-Ssembajjwe (2000) have shown in their initial studies that the only forests where deforestation is not extensive are where local institutional arrangements are viewed by local residents as legitimate and are monitored extensively. In India, Agrawal (2000) provides an empirical challenge to the presumption of many scholars that collective action becomes progressively more difficult as the size of the group increases from a very small face-to-face group. He shows that moderately sized villages are better able to generate the labour needed to protect local forests than are very small villages. Schweik (2000) has examined the geographic distribution of *Shorea robusta*, a highly valued species. He found that neither population density of the villages adjacent to the three forests he studied in Nepal nor predictions from optimal foraging theory adequately predict the spatial distribution of the species. The most robust explanation for the distribution of this species relates to the institutional rules that allow higher-caste villagers to

access their 'own' forests as well as forests located near villages where lower-caste villagers live but not vice versa.

In addition to these research programs, the IAD framework has also influenced a variety of other studies, including those developing models of social-choice situations and then subjecting them to empirical tests in experimental laboratories (Herzberg 1986; Wilson and Herzberg 1987; Herzberg and Wilson 1988; Herzberg and V. Ostrom 1991); other empirical questions include the study of rural infrastructure in developing countries (E. Ostrom, Schroeder and Wynne 1993); privatization processes (S. Walker 1994a, 1994b); development processes more generally (V. Ostrom, Feeny and Picht 1993; Wunsch and Olowu 1995); constitutional dynamics in the American federal system (Jillson and Wilson 1994; V. Ostrom 1987, 1991) as well as in the Canadian federal system (Sproule-Jones 1993); linking local and global commons (McGinnis and E. Ostrom 1996; Keohane and Ostrom 1995; E. Ostrom *et al.* 1999; Dolšak and Ostrom 2003); and how rules, norms, and equilibrium strategies are related (Crawford and E. Ostrom 1995).

Conclusion

The quest for meaning in the constitution of order in human societies cannot rely on the methods of the natural sciences. Instead, we face the challenge of developing and working with what might be called 'the sciences of the artifactual' that are broadly applicable to the cultural and social sciences and the humanities. Herbert Simon has addressed what we call the sciences of the artifactual in *The Sciences of the Artificial* (1981[1969]). We prefer the term *artifactual* to *artificial*. He addresses the basic issues that need to be emphasized. The architectonics that apply to the constitution of open, democratic, self-governing societies involve extraordinary complexities confronting both scholars and those engaged in entrepreneurial efforts to create the enterprises necessary to address common problems confronting people in discrete ecological niches.

The condition of openness implied by the term *res publica* facilitates opportunities for an awareness of contingencies bearing on human interest evoking satisfaction, indifference, or dissatisfaction. Potentials for human communication allow discussion, contestation, and the use of the human imagination to stimulate innovation and conflict resolution. Such processes establish the grounds for reflection and choice in the realization of both objective and subjective potentials.

The availability of alternatives set in the context of multifaceted contingencies that vary in scope and depth is still subject to critical scrutiny in light of consequences realized. When ideas are used to realize potentials and the reverse happens, a negative test of hypotheses would suggest a refutation of the conjectures that shaped the work of those undertaking the endeavour. This is especially difficult when those engaged in the undertaking propose to use the instruments of violent force to save the oppressed from their oppressors. Such Faustian bargains yield oppression instead of liberation. Moral hazards abound. Misconceptions reinforced by oppression transform relationships into networks of lies.

The conditions of open societies are where democratic citizens develop analytical capabilities that are commensurate with the complexities that abound in human relationships that reach from the specificities of everyday life to global proportions. No theory or model will suffice. Instead, we face the problem of dealing with frameworks, theories, and models used in comparative assessment of human endeavours.

Human societies endure across decades, centuries, and millennia. Citizens in democracies are mortal and endure only for a generation, so to speak. Memory, knowledge, and skills are erased with death. Open, democratic, self-governing societies face the challenge of transmitting information, knowledge, and skills from one generation to the next. Civic knowledge is necessary to sustain the continuity of civil relationships in the conduct of civic affairs by both drawing on past achievements and realizing new potentials. Human rationality is grounded in the condition of fallibility, with potentials for learning. How to realize such potentials will engage each of us in our quest for meaning about the conditions of life that we share with others.

References

- Advisory Commission on Intergovernmental Relations (R. J. Oakerson) (1987) *The Organisation of Local Public Economies*, Washington, DC: ACIR.
- Advisory Commission on Intergovernmental Relations (R. J. Oakerson, Roger B. Parks, and Henry A. Bell) (1988) *Metropolitan Organisation: The St. Louis Case*. Washington, DC: ACIR.
- Agrawal, A. (2000) 'Small is Beautiful, But is Larger Better? Forest-Management Institutions in the Kumoon Himalaya, India', in Clark, C. Gibson, M. A. McKean, and E. Ostrom (eds) *People and Forests: Communities, Institutions, and Governance*, Cambridge: MIT Press.
- Alchian, Armen A. (1950) 'Uncertainty, Evolution, and Economic Theory', *Journal of Political Economy*, 58 (3): 211–21.
- Arrow, Kenneth (1951) *Social Choice and Individual Values*, 2nd ed. New York: Wiley.
- Banana, A. Y. and Gombya-Ssembajjwe, W. (2000) 'Successful Forest Management: The Importance of Security of Tenure and Rule Enforcement in Ugandan Forests', in Clark C. Gibson, M. A. McKean, and E. Ostrom (eds) *People and Forests: Communities, Institutions, and Governance*, Cambridge: MIT Press.
- Benjamin, P., Lam, Wai, F., Ostrom, E. and Shivakoti, G. (1994) *Institutions, Incentives, and Irrigation in Nepal*. Decentralization: Finance & Management Project Report. Burlington, VT: Associates in Rural Development.
- Breton, A. and Wintrobe, G. (1982) *The Logic of Bureaucratic Conduct: An Economic Analysis of Competition, Exchange, and Efficiency in Private and Public Organisations*, Cambridge: Cambridge University Press.
- Bromley, D. W. et al. (eds) (1992) *Making the Commons Work: Theory, Practice, and Policy*, San Francisco: ICS Press.
- Buchanan, J. M. (1979) 'Natural and Artifactual Man', in *What Should Economists Do?*, Indianapolis: Liberty.
- Buchanan, J. M. and Tullock, G. (1962) *The Calculus of Consent: Logical Foundations of Constitutional Democracy*, Ann Arbor: University of Michigan Press.
- Crawford, S. E. S. and Ostrom, E. (1995) 'A Grammar of Institutions', *American Political Science Review* 89 (3): 582–600.
- Djilas, M. (1957) *The New Class: An Analysis of the Communist System*, New York: Praeger.
- Dolšak, N. and Ostrom, E. (eds) (2003) *The Commons in the New Millennium: Challenges and Adaptations*, Cambridge, MA: MIT Press.
- Dosi, G. and Egidi, M. (1987) 'Substantive and Procedural Uncertainty: An Exploration of Economic Behaviours in Complex and Changing Environments', Paper prepared for the International Workshop on Programmable Automation and New Work Modes, Paris, April 2–4.

- Gibson, C., McKean, M. and Ostrom, E. (eds) (2000) *People and Forests: Communities, Institutions, and Governance*, Cambridge: MIT Press.
- Gregg, P. M. (1974) 'Units and Levels of Analysis: A Problem of Policy Analysis in Federal Systems', *Publius* 4 (4): 59–86.
- Hackett, S., Schlager, E. and Walker, J. (1994) 'The Role of Communication in Resolving Commons Dilemmas: Experimental Evidence with Heterogeneous Appropriators', *Journal of Environmental Economics and Management* 27:99–126.
- Hamilton, A., Jay, J. and Madison, J. (n.d.[1788]) *The Federalist*, Edward, M. E. (ed.) New York: Modern Library.
- Harré, R. (1974) 'Some Remarks on 'Rule' as a Scientific Concept', in T. Mischel (ed.) *Understanding Other Persons*, Oxford: Basil Blackwell.
- Hayek, F. A. von (1945) 'The Use of Knowledge in Society', *American Economic Review* 35 (September): 519–30.
- Herzberg, R. (1986) 'Blocking Coalitions and Policy Change', in G. C. Wright, L. Rieselbach and L. Dodd (eds) *Congress and Policy Change*, New York: Agathon Press.
- Herzberg, R. and Ostrom, V. (1991) 'Votes and Vetoes', in F.-X. Kaufmann (ed.) *The Public Sector – Challenge for Coordination and Learning*, Berlin and New York: de Gruyter, W.
- Herzberg, R. and Wilson, R. (1988) 'Results on Sophisticated Voting in an Experimental Setting', *The Journal of Politics* 50 (2): 471–86.
- Hess, C. (1999) *A Comprehensive Bibliography of Common-Pool Resources*. (CD-ROM) Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.
- Hobbes, T. (1949[1642]) *De Cive or the Citizen*, in S. P. Lamprecht (ed.) New York: Appleton-Century-Crofts.
- (1960[1651]) *Leviathan or the Matter, Forme and Power of a Commonwealth Ecclesiasticall and Civil* in M. Oakeshott (ed.) Oxford: Basil Blackwell.
- Holling, C. S. (1994) 'An Ecologist View of the Malthusian Conflict', in K. Lindahl-Kiessling and H. Landberg (eds) *Population, Economic Development, and the Environment*, New York: Oxford University Press.
- Jillson, C. C. and Wilson, R. K. (1994) *Congressional Dynamics: Structure, Coordination, and Choice in the First American Congress, 1774–1789*. Stanford, CA: Stanford University Press.
- Keohane, R. O. and Ostrom, E. (eds) (1995) *Local Commons and Global Interdependence: Heterogeneity and Cooperation in Two Domains*, London: Sage.
- Kiser, L. L. (1984) 'Toward an Institutional Theory of Citizen Coproduction', *Urban Affairs Quarterly* 19 (4): 485–510.
- Kiser, L. L. and Ostrom, E. (1982) 'The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches', in E. Ostrom (ed.) *Strategies of Political Inquiry*, Beverly Hills: Sage.

- Lam, W. F. (1994) 'Institutions, Engineering Infrastructure, and Performance in the Governance and Management of Irrigation Systems: The Case of Nepal', PhD diss., Indiana University.
- (1996) 'Institutional Design of Public Agencies and Coproduction: A Study of Irrigation Associations in Taiwan', *World Development* 24 (6): 1039–54.
- (1998) *Governing Irrigation Systems in Nepal: Institutions, Infrastructure, and Collective Action*, Oakland, CA: ICS Press.
- Lasswell, H. D. and Kaplan, A. (1950) *Power and Society: A Framework for Political Inquiry*, New Haven: Yale University Press.
- McGinnis, M. and Ostrom, E. (1996) 'Design Principles for Local and Global Commons', in O. R. Young (ed.) *The International Political Economy and International Institutions*, Volume II, Cheltenham, UK: E. Elgar.
- Netting, R. McC. (1982) 'Territory, Property, and Tenure', in R. McC. Adams, N. J. Smelser and D. J. Treiman (eds) *Behavioural and Social Science Research: A National Resource*, Washington, DC: National Academy Press.
- Oakerson, R. J. (1992) 'Analysing the Commons: A Framework', in D. W. Bromley et al. (eds) *Making the Commons Work: Theory, Practice, and Policy*, San Francisco: ICS Press.
- (1993) 'Reciprocity: A Bottom-Up View of Political Development', in V. Ostrom, D. Feeny, and H. Picht (eds) *Rethinking Institutional Analysis and Development: Issues, Alternatives, and Choices*, San Francisco: ICS Press.
- (1994) 'The Logic of Multi-Level Institutional Analysis', Paper presented at the 'Workshop on the Workshop' conference, Indiana University, Workshop in Political Theory and Policy Analysis, Bloomington, Indiana, June 15–19.
- Oakerson, R. J. and Parks, R. B. (1988) 'Citizen Voice and Public Entrepreneurship: The Organisational Dynamic of a Complex Metropolitan County', *Publius* 18 (Fall): 91–112.
- Olson, M. (1965) *The Logic of Collective Action: Public Goods and the Theory of Groups*, Cambridge: Harvard University Press.
- Ostrom, E. (1965) 'Public Entrepreneurship: A Case Study in Ground Water Management', PhD diss., University of California, Los Angeles.
- (1972) 'Metropolitan Reform: Propositions Derived from Two Traditions', *Social Science Quarterly* 53 (Dec.): 474–93.
- (1990) *Governing the Commons: The Evolution of Institutions for Collective Action*, New York: Cambridge University Press.
- (1992) 'The Rudiments of a Theory of the Origins, Survival, and Performance of Common-Property Institutions', in D. W. Bromley et al. (eds) *Making the Commons Work: Theory, Practice, and Policy*, San Francisco: ICS Press.
- (1994) 'Neither Market Nor State: Governance of Common-Pool Resources in the Twenty-First Century', International Food Policy Research Institute Lecture Series No. 2, presented June 2, 1994, Washington, D.C.

- (1996a) 'Crossing the Great Divide: Coproduction, Synergy, and Development', *World Development* 24 (6): 1073–87.
- (1996b) 'Incentives, Rules of the Game, and Development', *Proceedings of the Annual World Bank Conference on Development Economics 1995*, Washington, DC: World Bank.
- (1998) 'A Behavioural Approach to the Rational Choice Theory of Collective Action', *American Political Science Review* 92 (1): 1–22.
- (1999) 'Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework', in P. A. Sabatier (ed.) *Theories of the Policy Process*. Boulder, CO: Westview Press.
- Ostrom, E., Burger, J., Field, C., Norgaard, R. B. and Policansky, D. (1999) 'Revisiting the Commons: Local Lessons, Global Challenges', *Science* 284 (5412) (April 9): 278–82.
- Ostrom, E. and Gardner, R. (1993) 'Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work', *Journal of Economic Perspectives* 7 (4): 93–112.
- Ostrom, E., Gardner, R. and Walker, J. (1994) *Rules, Games, and Common-Pool Resources*, Ann Arbor: University of Michigan Press.
- Ostrom, E., Lam, Wai, F. and Lee, M. (1994) 'The Performance of Self-Governing Irrigation Systems in Nepal', *Human Systems Management* 14 (3): 87–108.
- Ostrom, E., Schroeder, L. and Wynne, S. (1993) *Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective*, Boulder, CO: Westview Press.
- Ostrom, E., Walker, J. and Gardner, R. (1992) 'Covenants with and without a Sword: Self-Governance Is Possible', *American Political Science Review* 86 (2): 404–17.
- Ostrom, V. (1980) 'Artisanship and Artifact', *Public Administration Review* 40 (July/Aug.): 309–17.
- (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.
- (1978[1971]) *The Political Theory of a Compound Republic: Designing the American Experiment*, 2nd edn. San Francisco: ICS Press.
- (1991) *The Meaning of American Federalism: Constituting a Self-Governing Society*, San Francisco: ICS Press.
- (1997) *The Meaning of Democracy and the Vulnerability of Democracies: A Response to Tocqueville's Challenge*, Ann Arbor: University of Michigan Press.
- Ostrom, V., Bish, R. and Ostrom, E. (1988) *Local Government in the United States*, San Francisco: ICS Press.
- Ostrom, V., Feeny, D. and Picht, H. (eds) (1993) *Rethinking Institutional Analysis and Development: Issues, Alternatives, and Choices*, 2nd edn., San Francisco: ICS Press.

- Ostrom, V. and Ostrom, E. (1971) 'Public Choice: A Different Approach to the Study of Public Administration', *Public Administration Review* 13 (March/April): 203–16.
- Parks, R. B. (1985) 'Metropolitan Structure and Systematic Performance: The Case of Police Service Delivery', in K. Hanf and T. A. J. Toonen (eds) *Policy Implementation in Federal and Unitary Systems*, Dordrecht, the Netherlands: M. Nijhoff.
- Parks, R. B., Baker, P. C., Kiser, Larry, L., Oakerson, R. J., Ostrom, E., Ostrom, V., Percy, S. L., Vandivort, M., Whitaker, G. P. and Wilson, R. (1982) 'Coproduction of Public Services', in R. C. Rich (ed.) *Analysing Urban-Service Distributions*, Lexington, MA: Lexington Books.
- Parks, R. B. and Oakerson, R. J., (1989) 'Metropolitan Organisation and Governance: A Local Public Economy Approach', *Urban Affairs Quarterly* 25 (1): 18–29.
- Percy, S. L. (1984) 'Citizen Participation in the Coproduction of Urban Services', *Urban Affairs Quarterly* 19 (4): 431–46.
- Popper, K. (1963[1945]) *The Open Society and Its Enemies*, 2 vols., New York: Harper and Row.
- Radnitzky, G. (1987) 'Cost-Benefit Thinking the Methodology of Research: The "Economic Approach" Applied to Key Problems to the Philosophy of Science' in G. Radnitzky and P. Bernholz (eds) *Economic Imperialism: The Economic Approach Applied Outside the Field of Economics*, New York: Paragon House.
- Schlager, E. (1990) 'Model Specification and Policy Analysis: The Governance of Coastal Fisheries', PhD diss., Indiana University.
- (1994) 'Fishers' Institutional Responses to Common-Pool Resource Dilemmas', in E. Ostrom, R. Gardner and J. Walker (eds) *Rules, Games, and Common-Pool Resources*, A. Arbor: University of Michigan Press.
- Schlager, E., Blomquist, W. and Tang, S. Y. (1994) 'Mobile Flows, Storage, and Self-Organised Institutions for Governing Common-Pool Resources', *Land Economics* 70 (3): 294–317.
- Schweik, C. M. (2000) 'Optimal Foraging, Institutions, and Forest Change: A Case from Nepal' in C. G. Clark, M. A. McKean and E. Ostrom (eds) *People and Forests: Communities, Institutions, and Governance*, Cambridge: MIT Press.
- Schweik, C. M., Adhikari, K. and Pandit, K. N. (1997) 'Land-Cover Change and Forest Institutions: A Comparison of Two Sub-Basins in the Southern Siwalik Hills of Nepal', *Mountain Research and Development* 17 (2): 99–116.
- Shepsle, K. A. (1979) 'The Role of Institutional Structure in the Creation of Policy Equilibrium' in D. W. Rae and T. J. Eismeier (eds), *Public Policy and Public Choice*, Sage Yearbooks in Politics and Public Policy, vol. 6. Beverly Hills: Sage.
- Shimanoff, S. B. (1980) *Communication Rules: Theory and Research*, Beverly Hills: Sage.

- Shivakoti, G. and Ostrom, E. (eds) (2002) *Improving Irrigation Governance and Management in Nepal*, Oakland, CA: ICS Press.
- Siedentop, L. (1994) *Tocqueville*, Oxford and New York: Oxford University Press.
- Simon, H. A. (1965[1947]) *Administrative Behavior: A Study of Decision-making Processes in Administrative Organisation*, New York: Free Press.
- (1972) 'Theories of Bounded Rationality' in C. B. McGuire and R. Radner (eds) *Decision and Organisation: A Volume in Honor of Jacob Marschak*, Amsterdam: North Holland.
- (1981[1969]) *The Sciences of the Artificial*, 2nd edn., Cambridge, MA, and London: MIT Press.
- Sproule-Jones, M. (1993) *Governments at Work: Canadian Parliamentary Federalism and Its Public Policy Effects*, Toronto: University of Toronto Press.
- Stein, R. (1990) *Urban Alternatives: Public and Private Markets in the Provision of Local Services*, Pittsburgh, PA: University of Pittsburgh Press.
- Tang, S. Y. (1991) 'Institutional Arrangements and the Management of Common-Pool Resources', *Public Administration Review* 51:42–51.
- (1992) *Institutions and Collective Action: Self-Governance in Irrigation*, San Francisco: ICS Press.
- Taylor, M. (1987) *The Possibility of Cooperation*, New York: Cambridge University Press.
- Thomson, J. T. (1992) *A Framework for Analysing Institutional Incentives in Community Forestry*, Rome, Italy: Food and Agriculture Organisation of the United Nations, Forestry Department, Via delle Terme di Caracalla.
- Thomson, J. T., Feeny, D. and Oakerson, R. J. (1992) 'Institutional Dynamics: The Evolution and Dissolution of Common-Property Resource Management', in D. W. Bromley *et al.* (eds) *Making the Commons Work: Theory, Practice, and Policy*, San Francisco: ICS Press.
- Tocqueville, A. de (1990 [1835, 1840]) *Democracy in America*. 2 vols, B. Phillips (ed.) New York: A. A. Knopf.
- Toulmin, S. (1974) 'Rules and Their Relevance for Understanding Human Behavior' in T. Mischel (ed.) *Understanding Other Persons*, Oxford: Basil Blackwell.
- Walker, J. and Gardner, R. (1992) 'Probabilistic Destruction of Common-Pool Resources: Experimental Evidence', *Economic Journal* 102 (414): 1149–61.
- Walker, S. T. (1994a) *Crafting a Market: A Case Study of USAID's Fertilizer Sub-Sector Reform Program*, Decentralization: Finance & Management Project Report. Burlington, VT: Associates in Rural Development.
- (1994b) *Pitfalls of Privatization: A Case Study of the European Community's Programme Spécial d'Importation d'Engrais*, Decentralization: Finance & Management Project Report. Burlington, VT: Associates in Rural Development.
- Whitaker, G. P. (1980) 'Coproduction: Citizen Participation in Service Delivery', *Public Administration Review* 40 (4): 309–17.
- Williamson, O. E. (1979) 'Transaction Cost Economics: The Governance of Contractual Relations', *Journal of Law and Economics* 22 (2): 233–61.
- (1985) *The Economic Institutions of Capitalism*, New York: Free Press.
- Wilson, R. and Herzberg, R. (1987) 'Negative Decision Powers and Institutional Equilibrium: Experiments on Blocking Coalitions', *Western Political Quarterly* 40 (4): 593–609.
- Wunsch, J. S. and Olowu, D. (eds) (1995 [1990]) *The Failure of the Centralized State: Institutions and Self-Governance in Africa*, 2nd edn., San Francisco: ICS Press.