INSTITUTIONS AND INSTITUTIONAL DESIGN

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Lecture notes on
Ostrom 2005 Understanding Institutional Diversity

Ostrom Ch 1-4

Ostrom, Elinor 2005, *Understanding Institutional Diversity*, Princeton University Press, Princeton, Ch 1-4

- Understanding the Diversity of Structured Human Interactions
- Zooming in and Linking Action Situations
- Studying Action Situations in the Lab
- Animating Institutional Analysis

What are institutions?

- Institutions are the prescriptions that humans use to organise all forms of repetitive and structured interactions, including those within families, neighbourhoods, markets, firms, sports leagues, churches, private associations, and governments at all scales
  - Great diversity of institutions
  - Great diversity of scientific approaches
  - IAD (institutional analysis and development) framework

Holons

- The term holon may be applied to any stable sub-whole in an organism or social hierarchy, which displays rule-governed behaviour and/ or structural Gestalt constancy
  - Environment
  - System
  - Sub-system

In repeated layers: multilevel complex systems

The action arena

The action situation:

- Positions
- Potential outcomes
- Available actions and action-outcomes linkages
- Control over outcomes
- Information generated in the situation
- Cost-benefit attached to actions and outcomes

The participant (individual or corporate unit)

- Preferences
- Status/ command of resources
- Individual attributes
  - Age, sex, education, culture, etc
- # participants in the situation

Rules I

- Rules, written or unwritten, may be used about
  1. Regulations (prescriptions, prohibitions, permissions)
  2. Instructions/ recipes/ strategies
  3. Precepts/ advice for moral behaviour (norms)
  4. Principles/ laws of nature
- Regulations provide the participants with a shared understanding of what actions/ outcomes are prescribed/ prohibited or permitted

Rules II

- Rules are the result of explicit or implicit efforts to create order and predictability among humans by
- Creating positions who are required, permitted or forbidden to take classes of
- Actions in relation to outcomes that are required, permitted or forbidden, or face the likelihood of being
- Monitored and sanctioned in a predictable fashion

Rules III

- Origin of rules
  - Self-organised groups
  - Externally imposed rules
  - Evolution (from problem solving to designed rules)
- Working rules
  - Rules justifies actions
- Predictability of rules
  - Depends on shared meanings since rules are not self-formulating, self-determining, or self-enforcing
  - System of enforcement
  - System of creation

Biophysical and material conditions

Attributes of goods produced, distributed or consumed
  - Excludability of outcomes
    - Free riders
- Divisibility of outcomes (subtractability)
- Transferability of utility

Classification of goods (bads), entities that people want to obtain (or avoid)

- **Subtractability**
  - Intrinsic
  - Technology dependent
  - Depletable or reproducible
- **Excludability**
  - Intrinsic
  - Technology
  - Political choice

		Sub tract ability	
		Low	High
Ex clud ability	Low	Public	?
	High	?	Private

Community and culture

COMMUNITY
- Size and composition of population
- Values in the local culture
- Common knowledge and understanding of various action situations
- Degree of homogeneity of preferences

CULTURE
- Affects costs of interaction
- Reputation, trust, etc

LANGUAGE

Action situations

- Two or more individuals facing a set of actions that jointly produce outcomes can be analysed by studying

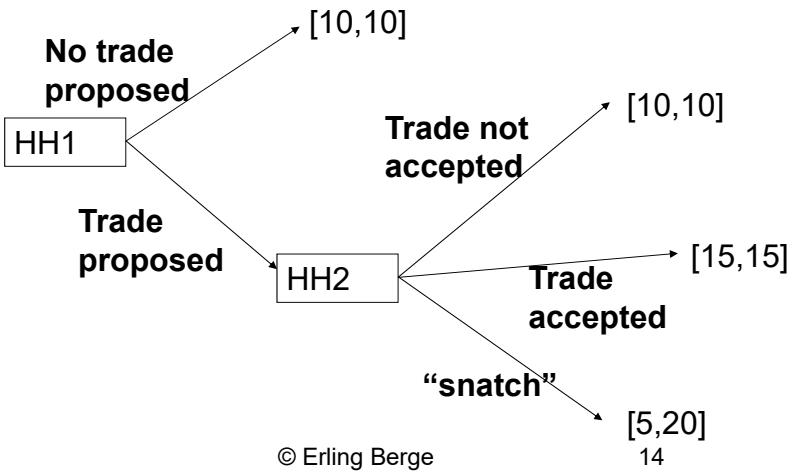
- Participants
- Positions
- Potential outcomes
- Available actions and action-outcomes linkages
- Control over outcomes
- Information generated in the situation
- Cost-benefit attached to actions and outcomes

- They can be evaluated empirically by observation of interactions and outcomes (use of implicit models)
- They can be evaluated theoretically by predicting interactions and outcomes (use of theory)

The "snatch" game

- "state-of-nature" = no rules apply, no common understanding or norms
- Household 1 (HH1) produce 10 bags of potatoes
- Household 2 (HH2) produce 10 chickens
- Both HH1 and HH2 prefer to eat chicken and potatoes
- In the "state-of-nature" they have a social dilemma:
  - That is a situation where the private return to an optimal strategy based on the assumption that all follow their optimal strategy without regard to what others do is greater than a share from the joint product of a cooperative strategy

The “snatch” game: illustration of action situation



The working parts I

- **Participants**
  - Numbers, individuals or teams
    - A team require collective action, members intend a joint product or have a common purpose
  - Groups, aggregates of individuals or teams
    - If there is variable strength of interest we may get frequency dependent behaviour
  - Attributes: sex, age, education, ...
- **Positions authorise actions**
  - Roles, participants may have more than one
  - Roles allows, prescribes of prohibit actions
  - Participants may or may not choose entry or exit from positions

The working parts II

- **Potential outcomes**
  - Status quo outcome
  - Biophysical outcomes, external payoffs, internal valuations may have to be assessed separately
  - The opportunity of a situation: range of value in outcomes
- Available actions and action-outcomes linkages
  - Actions: actors choose one from the set of possible actions. The choice of no action is an option
  - Action-outcome linkages: action(s) will "produce" the outcome to some degree (transformation function), control variables
  - Certainty, link is known
  - Risk, probability distribution of outcomes are known
  - Uncertainty, the relation between action and outcome is indeterminate (interdependent actions, number of possible outcomes too large)
  - Uncertainty, risk and certainty are structural characteristics of the situation (not dependent on information)

The working parts III

- Control over outcomes
  - Power = control * opportunity
- Information generated in the situation
  - Complete
    - Perfect: all actions known to all participants
    - Imperfect: the complete situation but not the decisions of other participants
- Incomplete "Who knows what at what juncture"
  - Opportunistic behaviour: deceitful behaviour to improve ones own outcome to the detriment of others
  - Asymmetric information problems
    - Principal — agent problems when the boss do not know completely what his agent does
    - Moral hazard — whenever risk is to be shared based on asymmetric information

Principal-agent problem

- The principal-agent problem or agency dilemma arise under conditions of incomplete and asymmetric information when a principal hires an agent,
- The two may not have the same interests. While the principal is, presumably, hiring the agent to pursue the interests of the former, the agent may shirk some duties to pursue his/her own interests

What is moral hazard?

- Moral hazard is a special case of information asymmetry, a situation in which one party in a transaction has more information than another.
- The party that is insulated from risk generally has more information about its actions and intentions than the party paying for the negative consequences of the risk.
- More broadly, moral hazard occurs when the party with more information about its actions or intentions has a tendency or incentive to behave inappropriately from the perspective of the party with less information.

The working parts IV

- Cost-benefit attached to actions and outcomes
  - Material costs from choosing particular actions
  - Internal valuations of particular actions
  - Material rewards from particular outcomes
  - Internal valuations of particular outcomes
  - Material or internal valuations of the action path chosen
  - Internal valuations: shame, regret, joy, guilt
  - Decisions based on net value (utility)
- Number of repetitions of action situation
  - One time, finite number of times, indefinite repetition
  - Tit-for-tat in symmetric social dilemmas
  - Heuristics for asymmetric social dilemmas

Linking Action Arenas

- Sequential linkages of arenas
  - Facilitates building of reputation for reciprocity
- Simultaneous arenas
- Organisational links, (appears as trees or lattices) long complex chains where output from one arena is input to another
- Competitive links
  - Adaptations to other participants
  - Market interactions (rule governed competition)
- Levels of action arenas: rules at deeper levels are part of the structure of action arenas at a given level
  - Operational — interpreting rules
  - Collective-choice — making rules
  - Constitutional choice — making rules about rules making
  - Meta constitutional choice — procedures for making rules about rule-making

Levels of analysis

Environmental characteristics that directly affects the situation

For level 1-3:
- RULES IN USE
- BIOPHYSICAL WORLD
- COMMUNITY

For level 4:
- BIOPHYSICAL WORLD
- COMMUNITY

Individual actions taken that directly affects state variables in the world or the situation:

1. OPERATIONAL SITUATION
   - Provision, production, distribution, appropriation, assignment, consumption
2. COLLECTIVE CHOICE SITUATION
   - Prescribing, invoking, monitoring, applying, enforcing
3. CONSTITUTIONAL CHOICE SITUATION
   - Prescribing, invoking, monitoring, applying, enforcing
4. METACONSTITUTIONAL CHOICE SITUATION (no rules in use)
   - Prescribing, invoking, monitoring, applying, enforcing

Level shifting strategies

- Contemplating changes in the rules defining permitted, prohibited and proscribed actions in operational situations
- The cost (including transaction costs) of actually changing the rules varies dramatically from arena to arena
  - Costly formal requirements may lead to informal de facto changes at the operational level

Predicting and evaluating outcomes

- Predicting
  - Only very simple situations allow strong predictions
  - Interdependent decisions, linked arenas, communication, learning, changes in strategy: all make it difficult to predict
- Evaluating
  - Economic efficiency, benefits from reallocation of resources
  - Equity, matching ability and requirements, equality of outcomes
  - Adaptability, resilience (from ecosystem), and robustness (from engineering)
  - Accountability
  - Conformance to general morality
  - Needs for trade-offs

Additional readings

- Instead of reading again the same book, read another one with a similar content. Sometimes one needs to read a the precursor to get a perspective on the later work:
  - To understand North 2005 read North 1990
  - To understand Ostrom 2005 read Ostrom 1990

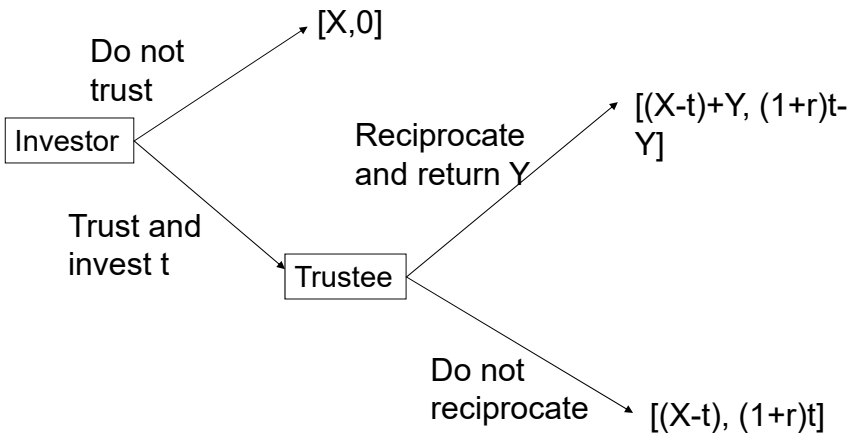
Experimental studies of action situations

- Using social dilemma games to illustrate action situations
  - Showing that small changes in the action situation can produce big differences in outcomes
  - Illustrate how experimental results challenge the presumption that all use the same internal rationality to make decisions
  - Will use the trust game (similar to the snatch game) and
  - The commons dilemma game

The trust game: the baseline

- Participants: two subjects
- Positions: investor and trustee
- Actions:
  - Investor has X. Can choose between
    - Keeping X
    - Giving t to the trustee and keeping X-t
    - Give all X to the trustee (t=X)
  - Trustee can subsequently choose how much to return to investor (Y)
- Outcomes: size of funds resulting from actions
- Action-outcome linkages: rate of return on investment = (1+r)
- Information: all possibilities are known, assurance of anonymity both to players and experimenter
- Potential payoffs (possibilities) [(X-t)+Y] and [(1+r)t-Y]; t>0
  - Often r=2

The trust game: illustration of decisions and outcomes



The trust game: Malawi 2007

- Participants: 30 subjects (15 pairs) in 18 villages
- Positions: investor and trustee
- Actions:
  - Trustee has 80. Investor has 80. Investor can choose between
    - Keeping 80
    - Giving t to the trustee and keeping 80-t
    - Give all 80 to the trustee (t=80)
  - Trustee can subsequently choose how much to return to investor (Y)
- Outcomes: size of funds resulting from actions
- Action-outcome linkages: rate of return on investment = 3
- Information: all possibilities are known, assurance of anonymity both to players and experimenter
- Potential payoffs (possibilities) [(80-t)+Y] and [3*t-Y]; t>0

The trust game: variations

- Positions changing to worker-employer
- Participants from different cultures
- Number of repeated plays: building reputation?
- Information:
  - Investor stipulates minimum returns
  - Investor may apply or refrain from applying costly punishment tied to minimum returns. Applying punishment was found to reduce reciprocity.
  - Highest return when punishment was possible but not used: **external sanctions crowd out reciprocity**
- Small changes in conditions create large differences in outcomes (relative positions, information and sanctions available)
- Results challenge the self-interested actor model: high level of trust in situations where none should have been

Prisoners dilemmas, Public goods, Common pool resources

Definition
- T>H
- H>L
- L>S

- T= temptation
- S= succer

Social dilemmas	Cooperate	Defect
Cooperate	H ; H	S ; T
Defect	T ; S	L ; L

Common-pool resources

- A common-pool resource is a natural or man-made resource from which it is difficult or very costly to exclude or limit users once the resource is provided by nature or produced by humans and removal of a resource unit makes that unit unavailable for others
  - Unregulated access leads to overuse and possibly destruction
  - Lack of exclusion leads to free-riders in provision

Basics of a commons dilemma I

- Participants: n symmetric subjects without any outside relations with each other
- Positions: appropriator
- Actions: each is endowed with e (=effort, or endowment) units (e.g. working hours) and have to decide on how much to spend on appropriation and how much on earning income from an external source (w = wage rate)
- Outcomes: actions affect the number of resource units that can be appropriated or the returns for working outside
- Action-outcome linkages: 1) wage*work hours 2) the resource function (F) is concave and depends on the total effort allocated to appropriation ($\Sigma_i x_i$): $F(\Sigma_i x_i)$

Basics of a commons dilemma II

- Information: participants know that they are all alike (symmetric) and they know the function linking aggregate effort to individual payoff
  - Information about outcomes are available after each round of allocation
  - No communication is allowed
- Potential payoff with n players
  - Payoff for individual i : $w*e$ if $x_i = 0$
  - It is $w*(e - x_i) + r*(\Sigma_i x_i)$ if $x_i > 0$ and $r<1<r*n$

Behaviour in a basic commons dilemma

- Comparing two games with 10 or 25 tokens endowment
- Overuse of the resource is usually the case
- 25 token experiments do considerably worse than 10 token
- Observes an unpredicted pulsing pattern (increasing investment until declining returns, then reducing it)
- No theoretically satisfactory explanation exist
- Some subjects say they use CPR return over or below 0.05 as guide to investment in the next round (w=0.05)
- Results replicated by agent based simulation
- Social psychology suggests cognitive processes are important to outcomes
- Subjects use heuristics in complex problems

Variations on a basic commons dilemma I

that should not affect outcomes but does

1. Allowing face-to-face communication before each session of investment
2. Allowing costly sanctions increase compliance
3. Allowing subjects to covenant to determine investment levels and adopt sanctioning

- Communication improves outcomes where there is heterogeneity of endowments
  - If subjects are kept out of the communication much less compliance is observed for all

Variations on a basic commons dilemma II

- Voluntary sanctions is chosen even if it is costly to the person proposing it, sanctioning and fines wipe out gains from better performance
- Crafting rules to solve commons dilemmas is costly (second order dilemma) but do occur frequently. Those who covenant do considerably better than those who do not
- Electronic communication do not do as well as face-to-face
- Experiments using real farmers replicate findings
- Experiments based on heterogeneous preferences giving incentives to inspect and punish deviations from covenants explained by a heterogeneous, linear other-regarding model

Animating institutional analysis

Rational choice:

- Starting with the full-information, rational behaviour focusing on material outcomes in open, competitive, posted price markets
- Adding complications
  - **Information processes**
  - **Valuation mechanisms used by individuals (preferences)**
  - **Selection processes used by individuals (choice of actions)**

Open competitive processes

- Repetitive situations where complete information and adequate models of the situation can be assumed
  - Explaining learning has proved very difficult
- Assumptions for a rational egoist
  1. Individuals possess as much information about the structure of a situation as is contained in the situation
  2. Internal valuations of outcomes are complete and consistent based on a monotonous mapping of external payoff
  3. Individuals choose actions to maximise expected net benefits based on what resources they have and the actions others are expected to take

Challenges

- It has been shown that it is the structure of the situation that produces efficient choices, not the internal calculations of individuals
- Social dilemmas evoke positive or negative internal valuations not conforming to assumption 2 above
- Imperfect information is rampant, including
  - Asymmetric information,
  - Risk and uncertainty
  - Repetitions and constancy of participants

Extending rational choice

- Modelling how participants acquire, process, represent, and use information
- Modelling how participants value actions and outcomes
- Modelling the processes participants use (maximizing, satisficing or using diverse heuristics) to select particular actions or strategic chains of actions in light of their resources

Information processing and mental models

- Due to individual limits on cognitive capacity in pursuing goals, analysts may have to assume bounded rationality rather than full information
- Mental models develop and change from
  - Feedback from the world
  - Shared culture/ belief system
  - ---
- See next slide

Differences in mental models

- Number of participants large
- Situation is complex
- Situation change frequently or participation is infrequent
- Externally induced need for increased performance
- Information is costly
- Information processing capabilities limited
- Errors of perception
- Errors in understanding a complex structure
- Errors in prediction
- Each participant may choose among several models of
- the situation
  - What determines the choice? Paying attention is costly.
  - See next slide

Change in mental models

- Disproportionate information processors (information and decision making do not link directly to output)
- Adaptive strategies and information do not match
- The inner cognitive and emotional architecture of the brain is "showing through" in responding to information
- Change in human institutions tends to be conservative but is subject to occasional large punctuations: "punctuated equilibrium“
- Internal models tend to be stable, until some event triggers a large change
- Rules and routines may help to structure a situation so as to increase the likelihood that individuals will share a mental model of the situation

Valuation processes

- Why trust and reciprocity?
- Why other-regarding preferences and norms backed by emotions (pride, guilt, shame, anger)?
- Why the consistent differences in response to the same conditions?
- Special neural/ emotional reactions to cooperative behaviour is documented

The dark side of trust

- The dark side of reciprocity, trust, and emotional actions: envy, vengeance, and desire to dominate
- Intrinsic motivations are increased if subjects feel self esteem and self determination is enhanced
  - External interventions crowd out intrinsic motivations if they are perceived as controlling
  - External interventions crowd in intrinsic motivations if they are perceived as supportive
- People must be expected to differ in the ways they value trust, reciprocity, the welfare of others, equity, etc.

The selection process

- Heuristics studied
  - Measured reaction (subjects seemed to follow this)
  - Grim trigger (after discussions this was rejected)
- Inherent problems of inference in studies of "black boxes" by observing external behaviour

Heuristics tested

- Eight heuristics tested with variable time constraints, based on cue-values
  - LEX the lexicographic strategy ("take the best")
  - LEX-semi (small differences are not ranked)
  - EBA elimination by aspects
  - FEATURES Take alternative with highest no of good features
  - ADD highest sum of cue values
  - LEX-ADD LEX-semi used to select two alternatives, ADD to choose one
  - PROS highest no of "pros" (as in pro&contra)
  - WADD weighted ADD
- LEX do very well compared to an optimised regression approach

Variety and complexity

- The diversity of assumptions must be consistent with deeper more general patterns of human behaviour
- Need to understand how specific situations trigger internal models for selecting actions and valuing outcomes
- Humans are fallible and learning
  - With complex motivations including narrow self-interest, norms of proper behaviour and other-regarding preferences
- Institutions matter!

Collective action and social dilemmas

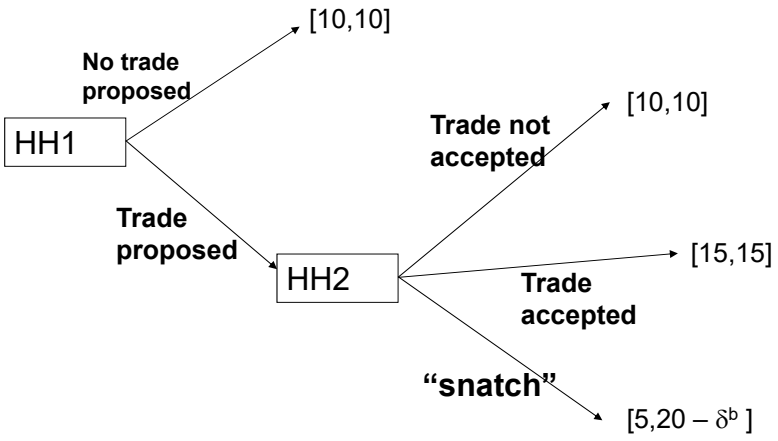
- Also outside the market there are highly competitive situations where rational choice theory applies (voting, legislative decisions)
- Engagement in collective action to overcome social dilemmas is not among these
- Behaviour in social dilemmas needs much better explanations
  - Evolution of norms for trust, other-regarding preferences
  - Rules regulating norms: e.g. backing good or counteracting bad reciprocity

Norms

- Norms in formal theory is currently problematic but not inherently impossible
- Norms are individual beliefs about permitted, prohibited or possible actions or outcomes in particular situations
- Snatch game with norms
  1. Utility of HH2: $U_2 = \pi_2 - \delta^b$
  2. π_2 = payoff obtained by HH2
  3. δ^b = decrease in the value of π_2 due to breaking of norms
- This means that not only presence of norms but also strength matters to behaviour

The "snatch" game with norms

Is δ^b >5 or <5 ?



Heterogeneity

- Heterogeneity of norms
  - Individual variations
  - Situational variations
- Strength of norms
  - Socialization
  - Type of community
  - Institutional backing or counteracting
- Saints, conditional co-operators, sociopaths
  - Cooperators need to be able to find each others
  - Spatial and/ or institutional clustering
- Institutions matter!

Evolution of norms I

- Model: individuals inherit strategies, individuals with more successful strategies have a higher rate of reproduction and increase in frequency in the next generation
  - Good at face recognition
  - Good at detecting cheating
  - Keep internal accounts of goodwill and threats
  - Deontic reasoning (permitted, prohibited or proscribed) looks for cheating and violations
  - Reasoning about what is true or false looks for confirmation
  - Good at learning language

Evolution of norms II

- Language represents a new way of inheriting strategies: "genetic change ceases to be the main basis of change: history begins" (Maynard Smith and Harper 2003:140)
  - Good at learning norms and rules
  - Cultural and situational variations
- Norm of reciprocity is often (always?) present
  - Reward cooperation
  - Punish defectors and those who do not punish defectors

Indirect evolutionary approach to adaptation through experience

- Model: players receive objective payoffs but make decisions based on the transformation of these material rewards into their own intrinsic values. Over a generation the intrinsic values are adjusted in the direction of the objective payoff

Evidence suggest

- With full information or knowledge of past history of the players rational egoists will not survive in an indefinitely played game
- With no information and many players rational egoists will dominate
- Known probabilities of trustworthy players or a “noisy” signal (better than random) of trustworthiness (e.g. from face-to-face communication) may help *conditional cooperators* to survive in substantial proportions

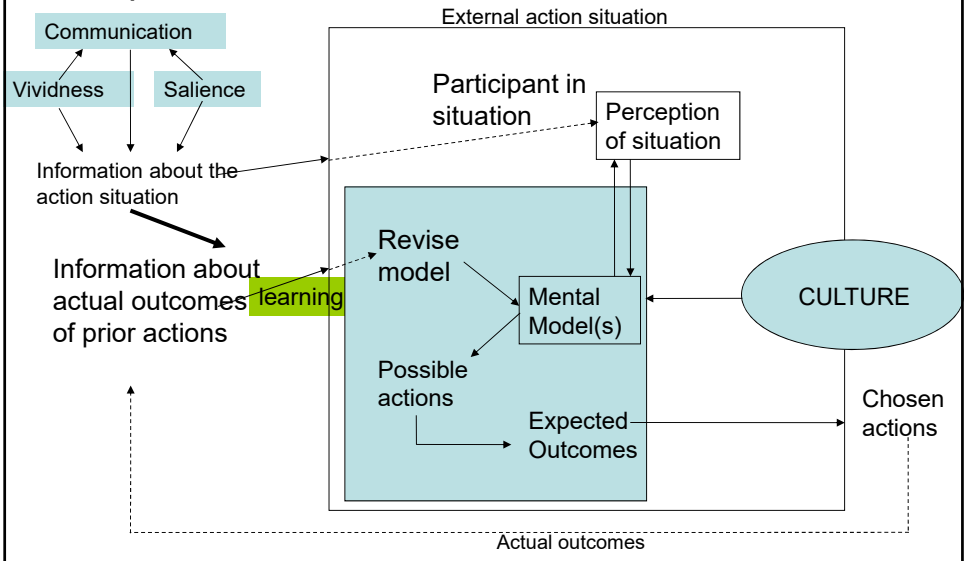
More on informal institutions …

- The nature of informal institutions:
- Probably the most important aspects of institutions are in peoples heads and exist only because we believe them to be real
- Searle, John R. 1995, *The Construction of Social Reality*, The Free Press, New York

Literature

Ostrom, Elinor 2005, *Understanding Institutional Diversity*, Princeton University Press, Princeton, Ch 5-7

Impact of communication, vividness and salience



Adapted from Figure 4.2 from Ostrom 2005:108

Institutional statements

- Shared strategies, norms, rules: what is the difference?
- Rules-in-force vs Rules-in-use
- Institutional statements as attributes of a community (norms, shared strategies)
- Institutional statements as rules
- Changing rules is often easier than changing the bio-physical world
- Two ways of expressing rules:
  - Generative rules: “Let there be an X” (e.g. creating positions)
  - Regulative rules: regulative rules will be the focus …

The Syntax of a Grammar of Institutions

- ADICO
- A: attribute [default: all participants/ positions]
  - Any value of a participant level variable that distinguishes to whom the institutional statement applies
- D: deontic (déon= that which is binding or proper)
  - One of three modal verbs: may (or permitted), must (or obliged), must not (or forbidden)
- I: *ai*m
  - Describes particular actions or outcomes of actions to which the AD is assigned
- C: conditions [default: everywhere and all the time]
  - Variables describing where and when the ADI applies
- O: or else
  - Consequences of not following the ADIC stipulations

Shared strategies, Norms, Rules

There are 5 elements of ADICO

- **Shared strategies** contains 3 elements: AIC
- **Norms** contain 4 elements: ADIC
- **Rules** contain all 5 elements: ADICO

- All rules can be rewritten as [attributes] [deontic] [aim] [conditions] [or else]

Attributes

- Defines how an institutional statement applies to all or to a subset of the participants/ positions in an action situation
- Default: if nothing is said all participants/ positions are included
- The attribute component maps the authority or prescription of an institutional statement to particular positions or to all positions
- This implies that there are other institutional statements assigning participants to positions
- There is always a default value of the attribute

Deontic logic

- D (= the set of deontic operators) = (P, O, F)

- P (=permitted) [= tillate] (action a can be done if the actor wants)
- O (=obliged) [= påbode] (action a has to be done by the actor)
- F (=forbidden) [= forbode] (action a cannot be done by the actor)
  - Actor is defined by the attribute

- Deontic operators are logically interrelated. Symbols used are to be read:
  - ∩ = intersection: only elements from both sides are valid,
  - U = union: all elements from both sides are valid,
  - Ø = empty set)
  - ~ means negation , sometimes it is written □
  - See http://en.wikipedia.org/wiki/Table_of_mathematical_symbols

Deontic operators (D)

- D = P U O U F
- F∩P = Ø
- O∩P = O
- F∩O = Ø
- If O then P

- Deontic operators relate to the physically possible (e.g. in actions, outcomes, communication channels, …)
- Deontic operators are interdefinable: based on
- [P][a] [= action a is permitted], then it follows
  - [F][a] = [~P][a] and [O][a] = [~P][~a]

Permission rules affect actions situations

Permission rules affect opportunities and constrains in action situations

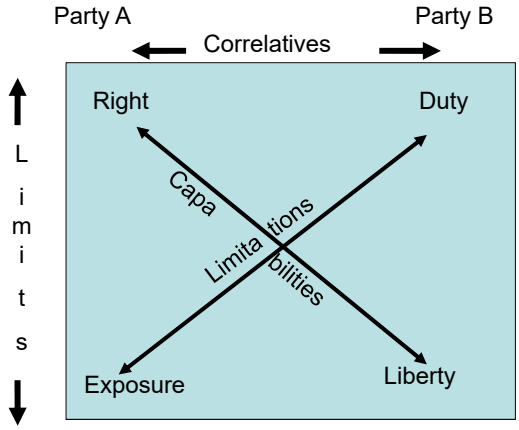
- Permission rules usually establish conditions where permission exist
- Permission rules may sometimes constitute an action (create a social reality) [citizen X may **vote** for candidates to the Parliament]
- If permission is defined as a right to act it implies that others have duties to recognize this right

Rights and duties
The "Hohfeld-Commons" conception

Defining the relation (jural correlates)		**and it's limit** (jural opposite)
OWNER	NON-OWNER	
claim-rights	duties	exposure
liberty	exposure	duties
powers/ authority	liability	disability/ no authority
immunity	disability/ no authority	liability

Ref.: Hohfeld, W. N. 1913. & .1917. *Yale Law Journal*
Commons, John R. 1932. Legal Foundation of Capitalism.

Authorised relationships: authority to act



- Rights depends on correlative duties.
- Rights have limits. Stepping over the limit the claimant is exposed.
- Duties have limits. Outside the limit the duty bearer has liberties.
- Liberties depend on correlative exposures.

Source: V.Ostrom and E.Ostrom 1999:46

Deontic: limits and correlatives

- Correlatives –means reciprocity in relations
  - If something is permitted for actor A it implies that some actor that is not A (~A) has an obligation, or duty, to ~F (not forbid) this something for A
- Limits – of a right defines the area of decision making outside of which a claimant stands exposed. Non-claimants are at liberty to inspect and verify that the claimant is within the bounds of his or her rights. If that is verified they have the duty not to interfere with the exercise of the right. If the claimant is not within the bounds of his rights the non-claimant is at liberty to act on that information

Deontics in formal game analysis

- Institutional statements including deontics imply that payoffs are seen as different from situations where there just is a shared understanding of the situation
- This is captured by adding a **delta parameter** representing the rewards or costs of obeying (o) or breaking (b) a prescription:

Delta parameters added to payoffs I

- $\Delta = \delta^o + \delta^b$
- Δ = sum of all the delta parameters
- δ^o = the change in expected payoff from *obeying* a prescription
- δ^b = the change in expected payoff from *breaking* a prescription

Delta parameters added to payoffs II

- The changes in payoff can further usefully be divided into externally and internally generated payoffs, indexed by e and i (ref.: Coleman 1987)
- $\delta^{o} = \delta^{oe} + \delta^{oi}$
- $\delta^{b} = \delta^{be} + \delta^{bi}$
  - Internal forces affecting the size of the delta
    - If breaking the norm: shame, guilt;
    - If obeying the norm: pride, warm glow
  - External forces affecting the size of the delta
    - If breaking the norm : fine, exclusion, ostracism, physical punishment;
    - If obeying the norm : pride, warm glow

A/M, CONDITIONS, OR ELSE

- The A/M part of an institutional statement specifies the actions or outcomes to which the action is directed (process, formula, state of the world, outcome). It must be physically possible, more than one outcome must be possible and both action and inaction must be allowed.
- CONDITIONS defines when and where the institutional statement applies. **Default** is everywhere and all the time.
- OR ELSE specifies what happens in case of non-compliance

Rules defined by “OR ELSE”

1. **Requires a sanction** that is decided in a collective choice situation, often sanctions are graduated depending on some conditions
2. Must be backed by another rule or norm that changes the DEONTIC assigned to some A/M for at least one actor if individuals fail to follow the rule: This is the **sanctioning prescription**
3. This SP requires a norm or rule that affects the constraints and opportunities facing an actor or actors to take the responsibility to monitor the conformance of others to the prescription: the **monitoring prescription**

Using the grammar in game-theoretic analysis I

- In game theory the games without norms or rules uses a concept of strategy conforming to AIC [attribute][a*i*m][conditions]
- To analyse games with norms or rules delta parameters need to be included
- Including players doing enforcing requires a delta parameter assigned to the action “not sanctioning”
- Using enforcement players also requires a monitoring rule and a monitoring player

Using the grammar in game-theoretic analysis II

- Costly sanctioning/ monitoring may require that
  - Monitors/ sanctioners face the possibility of being subject to sanctions
  - There is a large and salient pressure to monitor/ sanction (large external deltas)
  - Monitors/ sanctioners hold strong moral commitment (large internal deltas)
  - Payments to monitors/ sanctioners create prudent awards high enough to offset costs
- When an "OR ELSE" clause is backed by norms, the monitoring and enforcement rests solely on normative delta parameters and payment schemes for monitors and sanctioners

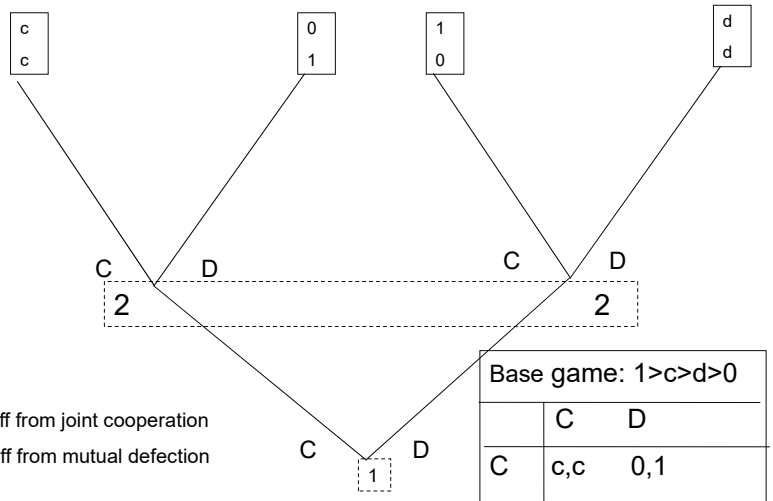
Collective action problems

- Two person prisoner dilemma

Statements about rules are on the form [A][D][I][C][O]

1. Base game: No institutional statements
2. Shared strategies game: AIC Statements:
   a. [All players] [] [Cooperate] [first round] []
   b. [All players] [] [Cooperate] [if all C in previous round] []
   c. [All players] [] [Defect] [all rounds after a D] []
3. Norms game: ADIC statement:
   a. [P1 and P2] [must] [Cooperate] [always] []
4. Rules game: ADICO statements:
   a. [P1 and P2] [must] [Cooperate] [always] [f(= fine)]
   b. ADIC statements:
      1. [P3] [must] [monitor] [always] []
      2. [P4] [must] [impose f on defector] [when P3 reports a D] []

Base game payoff



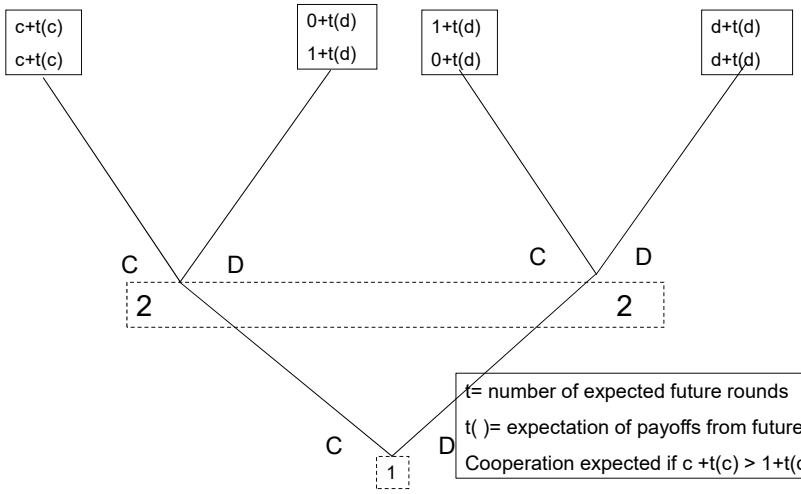
c= payoff from joint cooperation

d= payoff from mutual defection

Base game: 1>c>d>0

	C	D
C	c,c	0,1
D	1,0	d,d

Shared strategies payoff

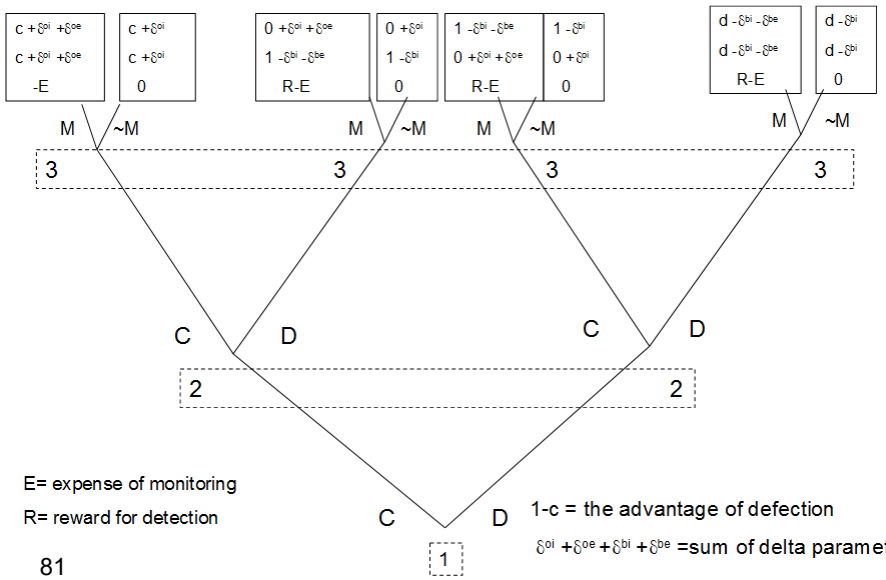


t= number of expected future rounds

t( )= expectation of payoffs from future rounds

Cooperation expected if c +t(c) > 1+t(d)

Game with a norm and monitoring



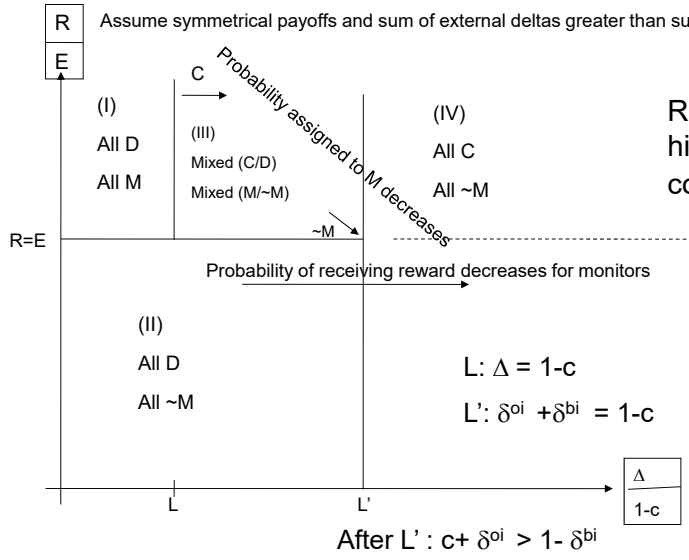
E= expense of monitoring

R= reward for detection

1-c = the advantage of defection

$\delta^{oi} + \delta^{oe} + \delta^{bi} + \delta^{be}$ =sum of delta parameters

Equilibrium diagram in game with norm and monitoring



Reward (R) higher than cost (E)

From L' on the sum of internal deltas is larger than the advantage of defection

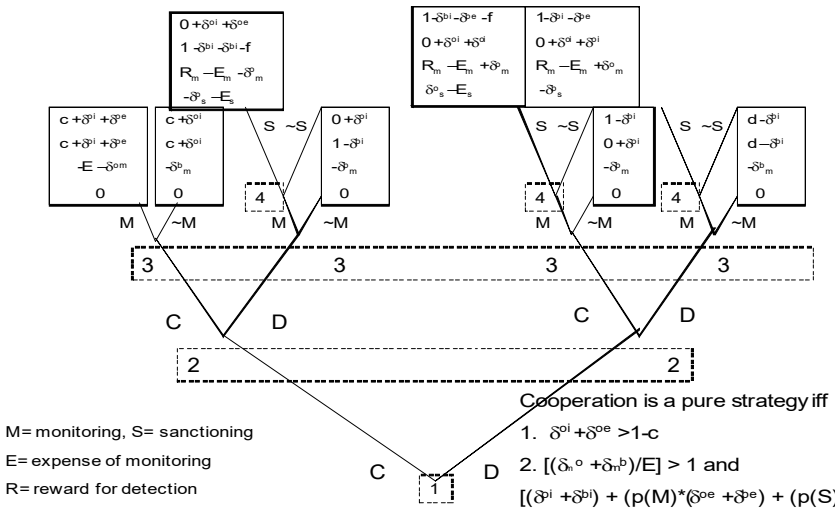
After L' : c+ δ^{oi} > 1- δ^{bi}

Rules changing a PD base game

Predictions of cooperation must be based on

- Changes in payoffs due to at least one delta parameter
- Addition of institutionally assigned consequences for breaking a rule: e.g.
  - Rule: [Players 1&2] [must] [cooperate] [always] [OR ELSE f]
- The possibility of detection
- At least one player has the authority to monitor:
  - Norm: [Players 3] [must] [monitor] [always] [ ]
- At least one player has authority to impose the fine [OR ELSE f]:
  - Norm: [Players 4] [must] [impose f on a player] [when player 3 reports that player has defected] [ ]
- The base game payoffs

Game with a rule; monitoring and sanctioning norms



M= monitoring, S= sanctioning

E= expense of monitoring

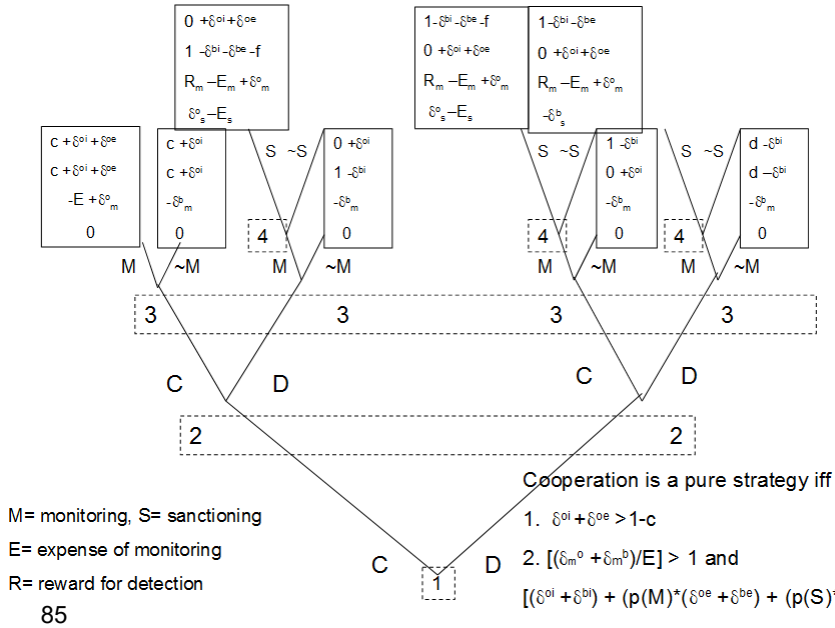
R= reward for detection

Cooperation is a pure strategy iff

1. $\delta^{oi} + \delta^{oe} > 1-c$
2. $[(\delta_n{}^o + \delta_n{}^b)/E] > 1$ and

$[(\delta^{bi} + \delta^{bi}) + (p(M)*(\delta^{oe} + \delta^{be}) + (p(S)*f)) > 1-c]$

Game with a rule, monitoring and sanctioning norms



M= monitoring, S= sanctioning

E= expense of monitoring

R= reward for detection

Cooperation is a pure strategy iff

1. $\delta^{oi} + \delta^{oe} > 1-c$
2. $[(\delta_m{}^o + \delta_m{}^b)/E] > 1$ and

$[(\delta^{oi} + \delta^{bi}) + (p(M)*(\delta^{oe} + \delta^{be}) + (p(S)*f)) > 1-c]$

Using the grammar I

Disentangling formal laws, informal institutions and ordered behaviour: ADICO and delta parameters

- Is there a shared understanding?
- If there is an “OR ELSE” clause, what about monitoring and sanctioning?

< p167 note a printing error: b^e should be δ^{be} >

- Legitimacy and compliance (legitimacy linked to internal δ)
  - How are internal deltas and “OR ELSE” related?
  - Are there limits to formal rules?

Using the grammar II

- Basic normative assumptions
  - Sign, size and interpretation of deltas
    - Warm glow, honour, duty, social sanctions, moral duty, reputation, fairness, ---
  - Types of players and numbers conforming reflected in deltas
    - Zealot, egoist, everyday Kantian, elite, or mass participant,
  - Creation and maintenance of deltas
    - Are Δ resources that deteriorate or increase by use? Impact of external agents?

Using the grammar III

- Freedom and constraint (Ulysses and the Sirens)
  - Rules define rights and duties
- Institutional configurations (systems of rules, norms, etc.)
  - Rules are nested and linked
- Field studies:
  - Listen for normative discourse (prudence or obligation)
    - From what is “best” to what is “proper” signify a shift from strategy to norm
  - The “know and use” condition for formal/ written prescriptions
  - Precision of institutional statements and scale of problem

Next steps

- Delta parameters arise from commitments to the norms and rules of a community
- They do not incorporate concern for the welfare of other community members
- How can this be incorporated?
- How does this way of analysing institutions relate to a theory of knowledge and a theory of action?

Why classify generic rules? I

- Solve babbling equilibrium problems: clarify meaning
  - Case: North clarifying the difference between organisation and institution
- Needs of policy analysts in reforms
  - Syntax and semantics of rules, or
  - How to write rules achieving a purpose
- Moving beyond slogan words in descriptions
  - What do we mean when we say privatization or centralization?

Why Classify Rules? II

- Coping with the diversity of rules
  - Diversity needs trial-and-error approaches to rule change
  - Reversion levels, default rules, lack-of-agreement rules determining outcomes of negotiations
- Rules as information/ transformation/ transmission mechanisms have errors in reproduction
  - Rules repeated across a diversity of rule configurations work better
- Universality of rules structure in action situations

Classifying rules

- The horizontal approach (at operational choice level):
  - Using the direct A/M for classification (main focus here)
- Also the vertical approach (collective and constitutional choice levels):
  - J. R. Commons: authorised vs. authoritative relationships
  - Levels of authoritative relations (operational, collective choice, constitutional choice)
- The ADICO formula for a regulatory rule suggests that classifying by the AIM might be most useful
  - "[ATTRIBUTES of participants] who are [OBLIGED, FORBIDDEN, OR PERMITTED] to [ACT in a certain way or AFFECT an outcome)] under specified [CONDITION], [OR ELSE]"

Elements of action situations

Participants and ***actions*** are assigned to ***positions***

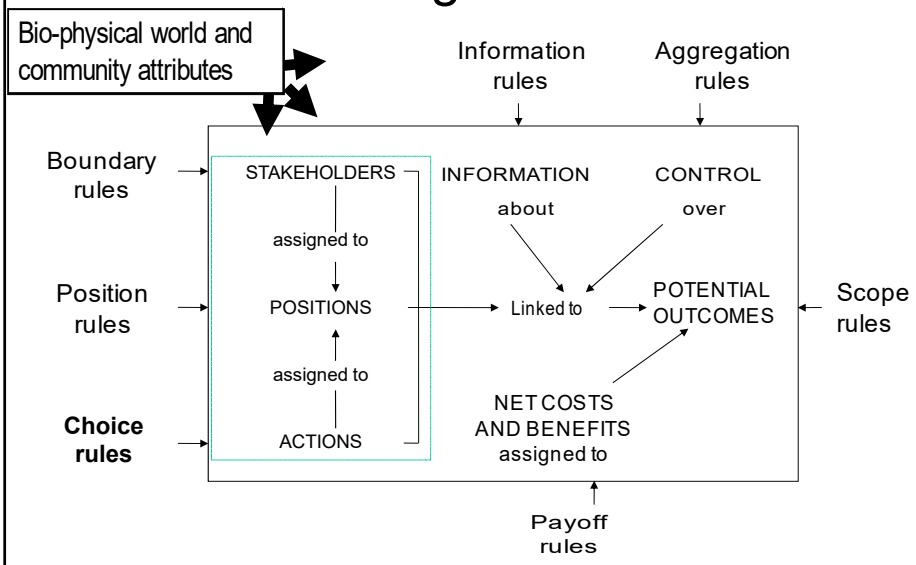
Outcomes are linked to actions

Information is available about ***action-outcomes linkages***

Control is exercised over action-outcome linkages

Costs and benefits are assigned to action-outcome linkages

Rules affecting action situations



The AIM component of each type of rule

Type of rule	Basic AIM verb	Regulated component of the action situation
Position	Be	Positions
Boundary	Enter or leave	Participants
Choice	Do	Actions
Aggregation	Jointly affect	Control
Information	Send or receive	Information
Payoff	Pay or receive	Costs/Benefits
Scope	Occur	Outcomes

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Types of rules (1)

- Position rules
  - Creates positions to which participants are assigned and where sets of actions are authorised
  - Number of participants: limits?
- Boundary rules
  - Specify who may or must enter positions, the process of determining eligibility, and how to leave
  - Rules related to multiple positions (e.g. soccer team)
  - Succession rules
  - Exit rules

Types of rules (2)

- Choice rules (of actions)
  - Says what a participant in a particular position must, must not or may do under specified conditions
  - Actions (AIM) relating to Position, Boundary, Aggregation, Information, Payoff, or Scope rules are not included in choice rules
  - Choice rules create power that may be distributed equally or unequally

Types of rules (3)

- Aggregation rules when joint decisions are required
  - Non-symmetric aggregation rules (expert/ dictator, oligarchy, weighted votes)
  - Symmetric aggregation rules (unanimity, majority, anyone)
  - Lack of agreement rules - also called default condition - (e.g. continue as before, no one receives any outcome, assign state variables at random, external decision maker) **Type of no agreement rule heavily affects outcomes in experiments**

Types of rules (4)

- Information rules
  - Channels of information flows (required, prohibited, permitted)
  - Frequency and accuracy of information
  - Subject of communication
  - Official language
- Payoff rules
  - Paying or receiving something of potential value

Types of rules (5)

- Scope rules (define the set of outcome variables that must, must not or may be affected by actions taken within the situation, including their permitted rang of variation)
  - Rules with AIMs tied to positions, boundaries, information, payoffs or aggregation are not counted as scope or choice rules
  - Rules with action AIMs are choice rules,
  - Rules with outcome AIMs are scope rules
  - In the real world choice rules are more used and studied than scope rules

The default condition when no rules exist: The Hobbesian "state of nature" (the "snatch" game)

Default Position Condition	**One position exist.**
Default Boundary Condition	**Anyone can hold this position.**
Default Choice Condition	**Each player can take any physically possible action (this requires default aggregation).**
Default Aggregation Condition	**Players act independently. Physical relationships present in the situation determine the aggregation of individual moves into outcomes.**
Default Information Condition	**Each player can communicate any information via any channel available to the player.**
Default Payoff Condition	**Any player can retain any outcome that the player can physically obtain and defend.**
Default Scope Condition	**Each player can affect any state of the world that is physically possible.**

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Rules defining property rights for exchange of agricultural commodities in the Snatch game

Position Rules	**There exist two positions:** • **an eligible exchange participant and (2) a judge**
Boundary Rules	• **All farmer households are permitted to become exchange participants or else those refusing their entry may be punished** • **The judge must be elected on the basis of merit and integrity by the households in the community or else the other rules will not be in effect.**
Choice Rules	• **All exchange participants are permitted to offer to exchange goods they own for goods owned by others or else those forbidding the exchange must be punished** • **If a household's goods are snatched, the household can report to a judge or else those preventing the report may be punished** • **If a judge finds that a household has snatched goods illegally, the judge must ensure that the illegal household returns the goods and forfeits its own commodities or else the judge will be sanctioned.**
Aggregation Rules	**All parties to an exchange must agree before a legal exchange can occur or else the exchange does not occur.**

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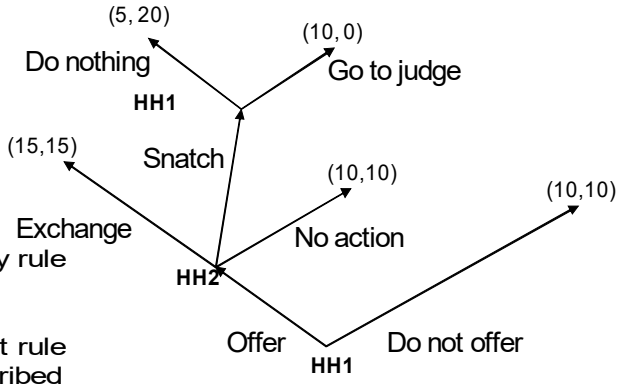
Transforming the snatch game



1. In the absence of any rule directly affecting an element of an action situation, the relevant rule in place can be described by a default rule.
2. **When all rules are in their default, the attributes of the physical world generate all aspects of the structure of the action situation. This is the Hobbesian "state of nature".**
3. **Rules operate together with the attributes of a physical world to create a structure**

The vertical dimension of rules

- Authorised relationships occur by using
- Operational rules created by
- Collective choice rules crafted by
- Constitutional rules accepted by all
- Collective choice and constitutional choice create authoritative relations
- **Policy implications**
- Changing rule configurations to achieve agreed upon policy objectives is no simple task

Literature

Ostrom, Elinor 2005, *Understanding Institutional Diversity*, Princeton University Press, Princeton, Ch 8-9

- Using Rules As Tools to Cope with the Commons
- Robust Resource Governance in Polycentric Institutions

Rules As Tools

Changing rules to optimise or to improve at the margin?

Rule changing initiated from the central government or from the user level?

How difficult can it really be to craft rules to solve a social dilemma such as the usage of a common pool resource?

<say on a scale from 1 to 10?>

Rules in self-organised CPR regimes

- Boundary rules in CPR regimes will for example define attributes and conditions for those entering a position as authorised appropriators (AA) in an action situation
- Groups with boundary rules do better in managing their resources than those without
- Should AA be community members with reputation as trustworthy or license paying strangers?
- Community devised boundary rules tend to increase the proportion of users with long term interests in the resource. Central government devised rules do so in less degree, and often the tendency is in to opposite direction
- Empirically the diversity of rules is very large:

Table 8.1 Attributes and conditions used in boundary rules

ATTRIBUTES	ATTRIBUTES	CONDITIONS
Residency or membership	**Personal characteristics**	**Relationship with resource**
National	Ascribed	Use of specified technology
Regional	Age	Continued use of the resource
Local community	Caste	Long term rights based on
Organisation (e.g., co-op)	Clan	Ownership of a proportion of annual flow of resource units
	Ethnicity	Ownership of land
	Gender	Ownership of non-land asset
	Race	Ownership of shares in a private organisation
	Acquired	Ownership of a share of the resource system
	Educational level	Temporary use rights acquired through
	Skill test	Auction
		Per-use fee
		Licenses
		Lottery
		Registration
		Seasonal fees

Rules creating monitors

- Self-organised resource user systems often employ or use guards/ monitors
- In many systems the presence of a monitor is the difference between a well kept sustainable system and a badly degraded system (forests, large irrigation systems)
- Some groups use a system of self-monitoring (fisheries, small irrigation systems)

Choice rules used to allocate CPRs

- The most frequently found policy advice of individual quotas based on an estimate of the optimal quantity of fish to be harvested in the long run has NOT been found in self-organised coastal fisheries, neither do irrigation systems allocate fixed quotas of water
- Allocation rules will often be designed to economise on monitoring costs and will usually be tailored to ecological conditions
- Many systems will also have choice rules for the maintenance of the resource system, often creating duties congruent with the rights enjoyed
- Allocation formulas and conditions for using these may vary from resource type to resource type and may vary from actor type to actor type in the same area:

Table 8.2 Choice rules used to allocate CPRs

Allocation formula for appropriation rights	**Basis for allocation formula**
Percentage of total available units per period	Amount of land held
Quantity of resource units per period	Amount of historical use
Appropriate only from a specific location	Location of appropriator
Appropriate only from a specific time slot	Quantity of shares of resource owned
Rotate in time and space	Proportion of resource flow owned
Appropriate only during open season	Purchase of periodic rights at auction
Appropriate only resource units meeting criteria	Rights acquired through periodic lottery
Appropriate whenever and wherever	Technology used
	License issued by government authority
	Equal division to all appropriators
	Needs of appropriators (e.g. type of crop)
	Ascribed characteristics of appropriator
	Membership in organisation
	Assessment of resource condition

Payoff and position rules

- Norms of ostracism and shunning
- Frequently used sanctions in field settings
  - Fines, usually graduated
  - Loss of appropriation rights
  - Incarceration
- Use of guards require payoff rules to motivate the guard
  - Fixed wage independent of performance (central government managed systems)
  - In kind or in money from each household
  - In kind or in money from local user organisation
- Monitoring costs must roughly match benefits

Information, Scope, and Aggregation rules

- These rules tend to complement boundary, choice, position and payoff rules
- The more valuable resource units are and the more appropriators there are the more information has to be kept by appropriators and their officials
- Scope rules often used to limit harvesting (creating refugia)
- Aggregation rules most frequently used in collective choice situations, less in appropriation
  - But sometimes it is required that harvesting is done in teams

Assumptions about resource policy that needs revision

- Common bureaucratic assumptions that is challenged
- Resources are so interconnected that only central coordination can manage them
  - National governments have been notably unsuccessful in governing nationalised resources such as forests and fisheries, in effect creating open access resources and alienating local communities in the process
- Resource users are incapable of designing appropriate rules of management
  - Users are not all rational egoists and bureaucrats do not always work unfailingly for the common good.
  - Bureaucrats will in most complex problems know as little about what is a better strategy as the average practitioner
  - Local groups have created viable institutions for local governance, but the conditions for successful local organisation is not well understood
- Designing appropriate rules is a rather simple analytical exercise
  - Available evidence says this is a very challenging task. The number of possible rule configurations will usually far exceed available time for analysis. In addition there are a multitude of unique links to the bio-physical environment. Practical experiments with goal directed adaptation of rules work better and faster

Rule configurations

Grether, Isaac, and Plott 1979/81 studies allocation of airport slots.

- Developed formal model of alternative rules' impact on incentives
- Simulated the decision setting in an experimental laboratory

Ostrom 1996 studied rules affecting an action situation of farmers constructing an irrigation system

- Using a series of formal games
- Had to make multiple assumptions about both farmers (7 assumptions) and their environment (5 assumptions)
- Investigates 7 rules
- Finds two rule configurations as producing the best results seen from the farmers side

Conclude: even simple rule problems create complex analytic exercises

Complexity and adaptation

Coping with complexity

- Learn from students of complex systems
- Be aware that small perturbations may cascade into major failures
- All politically engineered change should be viewed as an experiment designed to provide information for improvement of performance

Rule change as an adaptive process

- Persuade all that rules are necessary for preserving the resource
- Adapting rules, norms, strategies

Success in self- governing associations

Resource

Improvement of resource is feasible

Reliable indicators of resource conditions

Flow of resource units is predictable

Spatial extent of resource system is congruent with social system (not too big)

Appropriators

Resource is salient for the appropriators

There is a common understanding of the resource dynamic

A low discount rate

Trust and reciprocity

Access and harvesting rules are determined locally

Appropriators have prior organisational experience and local leadership

Performance of a local system is conditioned by the larger syst

A rule change calculus

Incentive to change rules (R) :

$G_i = \text{Perception}_i\ (R_{new} - R_{old})$

Costs: costs of creating new rules (C1), short term costs from change (C2), long term from monitoring and system maintenance (C3)

To change requires $G_i > C1 + C2 + C3$ for a sufficient number of members in the group

A minimum coalition will depend on the kind of collective choice rule used in deciding

If for all coalitions $G_m \leq C1_m + C2_m + C3_m$ no new rule is adopted

If more participants benefit, the enforcement costs will be lower

External enforcement will distribute costs unjustly

Resource attributes and costs

Attributes affect benefits and costs of institutional change

- Relative abundance on the one hand or basically destroyed on the other do not generate much benefit form organising. Only scarcity that can be fixed do so
- Good indicators make appropriate response easier sooner
- Predictable flows are easier to manage than erratic
- Smaller spaces are less costly to monitor

Appropriator attributes and costs

- If resource is of less importance to income, efforts to organise may not be worth it
- Without a common understanding of resource dynamics, agreeing on joint strategies will be very difficult
- Access to several resource pools (fish for example) may make it more profitable to mine one now without incurring costs of long term maintenance
- Trust and reciprocity lowers costs of monitoring
- Autonomy tends to lower costs of organising
- Prior experience with organising also lowers costs
- Central government may facilitate local efforts (fair courts and conflict resolution) or hinder them
- Self-governance is not to be taken for granted

Theoretical puzzles in self-organisation

- Size – many attributes change with size
  - Large groups make communication and agreement on strategies more difficult
  - Some find no correlation, one find curvilinear relation (smaller as well as larger have difficulties)
- Heterogeneity (cultural background, interests, endowments) – contradictory and context dependent impacts
  - Privileged groups
  - Rules may take into account a diversity of heterogeneity compensating for them or accentuating them

Robust resource governance

- Making rules will always be a limited analysis of a small part of the ecological, economic, political, and social setting
- No rule configuration produces the same outcomes in different settings
- Knowledge of how to govern complex non-linear systems will probably improve but it will never be complete or good enough to avoid disastrous mistakes
- To improve policy we need to make all policy interventions into experiments from which we can learn

Design principles 1990

Boundaries of ecosystems should approximate boundaries of governance

From 1990:

1. Clearly defined boundaries of resource and social group utilising it
2. Proportional equivalence between benefits and costs
3. Collective choice arrangements
4. Monitoring: users monitored can as a group instruct monitors
5. Graduated sanctions
6. Conflict resolution mechanisms
7. Minimal recognition of rights to organise
8. For larger resource systems: Nested enterprises

Design principles 1990 new evidence (1)

1. Well defined boundaries (avoids free riding)
   1. Externally imposed boundaries does not work well compared to locally legitimised
   2. Boundaries needs to be defendable by the users

   Rephrased: “The resource itself and the users of the resources are clearly defined, and the appropriators are able to effectively defend the resource from outsiders”
2. Equivalence of benefits and costs

   As sign of fairness supports participation and rule following among conditional co-operators
3. Collective choice arrangements
   1. Farmer designed rules work better than village elite designed rules that work better than central government designed rules

Design principles 1990 new evidence (2)

4. Monitoring
   1. Monitoring by locals or on contract with locals work better than external monitoring
5. Graduated sanctions
   1. Most self-governed groups rely on quasi-voluntary cooperation (the Ulysses technique) rather than voluntary or coercion
6. Conflict resolution mechanisms
   1. May involve levels above the village to counteract elite capture
7. Minimum recognition of rights to organise
   1. Making rules in the extra legal sector is more difficult (will usually require unanimity) than in the legal sector
   2. Local rule makers can more efficiently take into account new knowledge
8. Nested enterprises, multiple layers, polycentricity

Design principles 1990 new evidence (3)

Design principles in practice

- DP should not be used in blueprint designs
- DPs are a beginning point for a search of means to solving a rule design problem:
  - How do we define boundaries? Clarify relations between costs and benefits? Enhance participation in decisions? Who monitors and what are their incentives? What are the goals of sanctions? How are conflicts resolved?
  - How can local rule makers be recognized? How do we make a polycentric system of resource governance?

Threats to robust governance (1)

1. Rapid exogenous changes
   - Collective action based on trust and reciprocity may unravel rapidly by immigration
   - Changes in technology, populations (human, animal, plant), factor availability, usage of monetary transactions, heterogeneity of participants
   - The faster key variables change and the more variables that change the more difficult is the adaptation of the system

Threats to robust governance (2)

2. Transmission failures
   1. Rapid cultural change or turnover in population threaten learning and understanding of rules
   2. Reliance on minimal winning coalitions in rule change or interpretation may erode good will and legitimacy of rules in use
3. Blueprints and external funds
   1. Assume the locals have failed and external intervention necessary. Usually one see that
      1. Local property rights are seen as unimportant
      2. Previous (local) investors have lost and are unwilling to contribute
      3. Local knowledge and institutions disregarded
   2. These problems are shared in general with all welfare motivated governmental interventions

Threats to robust governance (3)

4. Corruption and rent seeking
   1. External funds for infrastructure is a powerful motor for opportunistic behaviour, rent seeking and corruption.
   2. Pricing policy and subsidisation is another
5. Lack of large-scale supportive institutions
   1. Provision of impartial accurate information on complex resources
   2. Mechanisms for conflict resolution for conflicts with external actors

Coping with threats

1. Creating associations of community governed entities instead of cooperating through external NGOs
2. Comparative institutional research to find ideas for alternative designs and operation: what works? and why?
3. Develop high school courses on local governance. Today it mostly discuss central government.
4. Create polycentric governance systems:

Polycentric governance systems (1)

Advantages of local level organisation

Local knowledge

Inclusion of trustworthy participants

Reliance on disaggregated knowledge

Adaptation of rules is better

Lower enforcement costs

Parallel autonomous systems reduces chance of large scale failure

Polycentric governance systems (2)

Limits of local level organisation

Some appropriators will not organise

Some self-organised efforts will fail

Local tyrannies

Stagnation

Inappropriate discrimination

Limited access to scientific information

Conflict among appropriators

Inability to cope with large scale resource systems

Coping with tragedies of the commons in polycentric systems

Polycentric systems consist of mixtures of general and special purpose governance units with varying scales

More diversity of expertise and information give better chance of hitting a workable solution

Such systems look terribly messy and hard to understand. But

“The scholars’ love of tidiness needs to be resisted.”