

## Game Theory and Trust

Von Neumann and Morgenstern (1947):

Social events can best be described by models taken from suitable games of strategy.

These games are susceptible to thorough mathematical analysis.

### The Prisoner's Dilemma Game

A two-person, non-zero-sum game

Payoff matrix for the prisoner's dilemma game

The payoff result of C and D for each party, however, will be dependent upon the simultaneous decision of the other party.

C-C (mutual cooperation) = 3 for both parties;

C-D (sucker's payoff) = 0 for the cooperator and 5 for the defector;

D-C (temptation) = 5 for the defector and 0 for the cooperator; and

D-D (mutual defection) = 1 for both parties.

This is a non-zero sum game. The dilemma faced with each party is how to maximize the expected value at the risk of being defected or revenged.

		<b>The Other</b>	
		C	D
<b>You</b>	C	3-3 mutual cooperation	0-5 sucker's payoff
	D	5-0 temptation	1-1 mutual defection

The sums of the payoff in outcomes C<sub>1</sub>C<sub>2</sub> and D<sub>1</sub>D<sub>2</sub> are not zero.

#### Payoff requirements for a true Prisoner's Dilemma:

- ✓ The sums of the payoff in outcomes CC and DD are not zero.
- ✓ Temptation payoff > Reward for mutual cooperation.
- ✓ (Temptation + Sucker's payoff) / 2 ≤ Reward

#### 1. Why the "dilemma"?

Rational analysis:

When the other cooperates, you get more by defecting than cooperating. When the other defects, you get more by defecting than cooperating.

Thus, one should always defect regardless of what the other does.

However, mutual cooperation always yields a better outcome than mutual defection for both players.

#### 2. Is there any way out of the dilemma?

Iterated (Repeated) Prisoner's Dilemma gives us the opportunity to build up trust or mistrust, to reciprocate or placate, forgive or avenge.

Iteration allows lots of conceivable strategies.

Life is riddled with Iterated Prisoner's Dilemma games.

3. Can we work out which strategy is best?

Axelrod's computer tournament:

15 strategies against each other: 225 games each with 200 moves.

Each computer program is tested against others.

Q: Which strategy accumulates the most points?

Maximum possible score: 15,000

Benchmark score: 600

### **Nice Guys Finish First**

The winning strategy was the simplest of all:

Tit for Tat: Begins by cooperating on the first move and thereafter simply copies the previous move of the other player.

4. How might Tit for Tat proceed?

5. What defines a winning strategy?

a.

b.

c.

d.

6. The evolution of cooperation (Axelrod & Hamilton, 1981):

"With two individuals destined never to meet again, the only strategy that can be called a solution to the game is to defect always despite the seemingly paradoxical outcome that both do worse than they could have had they cooperated."

Preconditions for cooperation:

a.

b.

Mutual benefits are possible.

Nature often plays a role of a "banker".

### **Even Better Strategies**

**Generous Tit-for-Tat** - 100% C-C, less than 100% D-D

In case of errors, the strategy reduces locking into mutual punishment.

**Pavlov's Strategy** - Win-Stay, Lose-Shift (bully the weak, avoid the strong)

One should cooperate if and only if in the previous round you and your co-player have done the same thing.

The strategy dominates in an environment where mistakes were likely.

### **Evolution of Cooperation (Martin Nowak)**

**Direct Reciprocity:** You do me a favor, I pay you back

**Indirect Reciprocity** (reputation effects):

I defect with someone who defected with others

I help you, someone will help me

If  $(b/c > 2)$  and  $w > c/b$ , cooperation can evolve

$w$  = prob. of another round (a responsibility factor) of Cooperation (Martin Nowak)

When D and C form clusters in a network, selection favors cooperators

If  $b/c > k$  ( $k$  = number of neighbors)

### **Payoff structures that allow evolution of cooperation**

- ❖ Kin Selection  $b/c > 1/r$
- ❖ Direct Reciprocity  $b/c > 1/w$
- ❖ Indirect Reciprocity  $b/c > k$  and  $b/c > q$

$q$  = prob. of getting reputation information

$w$  = prob. of another round

$k$  = number of neighbors

### **Implication for OCB in**

Reputation and group size

Cheating can be profitable for peddlers but fatal for large corporations.

Honesty can be a liability for one time transaction but capital for long-term deals.

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- Cheating can be profitable for peddlers but fatal for large corporations.

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Tit-for-Tat is the best to initiate cooperation in a defective environment.

However, errors or noise destroy Tit-for-Tat.

## Economic Games

### Dictator Game

You are given an opportunity to divide a \$10 of ("lab money). You choose any allocation you want: you can propose to keep it all yourself, to give all of it to your partner, or to give your partner any fraction of the money. The other party must accept whatever proposal you make.

PF Version:

Suppose you are given \$10 (\$100, or \$10,000) and have to split the money between yourself and an already-chosen recipient. You can keep the recipient any amount that is greater than zero.

NF Version:

Suppose you are given \$10 (\$100, or \$10,000) and have to split the money between yourself and an already-chosen recipient. You can give the recipient any amount that is greater than zero.

### Ultimatum Game

You are given an opportunity to divide a \$10 of ("lab money). You choose any allocation you want: you can propose to keep it all yourself, to give all of it to the other party, or to give the other any fraction of the money. But there is a catch: Neither of you get anything unless the other person agrees to your proposal.

Allocator Version:

Imagine that you are given \$10 (\$100, or \$10,000) to allocate between yourself and one other person, and the recipient has the option of either accepting or rejecting your offer. If the recipient accepts the amount that you offer, you both get the corresponding portions of the \$10 (\$100, or \$10,000) that you had selected to allocate. However, if the recipient rejects your offer, you both get nothing.

Receiver Version:

Imagine that a pre-selected person, called an allocator, has been given \$10 (\$100, or \$10,000) and is instructed to allocate the money between his- or her-self and you, and *you* have the option of either accepting or rejecting the amount offered to you. If you accept the amount that is offered to you, you both get the corresponding portions of the \$10 (\$100, or \$10,000), which had been selected by the allocator and approved by you. However, if you reject the allocator's offer, you both get nothing.

Data is inconsistent with rational solution.

- The average offers are in the region of 40-50% of the pie
- About half of the responders reject offers below 30%

When a responder rejects a positive offer, he signals that his utility function has non-monetary argument.

When an allocator makes high offer it is a result of

- preference for fairness or/and
- fear of rejection

- concerns about reputation

Will proposers be fair even if their offers can not be rejected?

Will subjects sacrifice money to punish a proposer who behaved unfairly to someone else?

### **Trust: The Foundation of Leadership**

#### **Dimensions of Trust**

- *Integrity*
  - honesty and truthfulness.
- *Competence*
  - an individual's technical and interpersonal knowledge and skills.
- *Consistency*
  - an individual's reliability, predictability, and good judgment in handling situations.
- *Loyalty*
  - the willingness to protect and save face for another person.
- *Openness*
  - reliance on the person to give you the full truth.

#### **Three Types of Trust**

Deterrence-based Trust - Trust based on fear of reprisal if the trust is violated.

Knowledge-based Trust - Trust based on behavioral predictability that comes from a history of interaction.

Identification-based Trust - Trust based on a mutual understanding of each other's intentions and appreciation of the other's wants and desires.

#### **Basic Principles of Trust**

- Mistrust drives out trust.
- Trust begets trust.
- Growth often masks mistrust.
- Decline or downsizing tests the highest levels of trust.
- Trust increases cohesion.
- Mistrusting groups self-destruct.
- Mistrust generally reduces productivity.

### **Organizational Justice**

#### **Distributive Justice**

Perceived fairness of the amount and allocation of rewards among individuals.

#### **Procedural Justice**

The perceived fairness of the process to determine the distribution of rewards.

**Interpersonal Justice**

Perceived fairness of the manner in which they are treated by other people.

**Informational Justice**

Perceived fairness of the information used as the basis for making decision.