The Prisoner's Dilemma

You and your buddy have been arrested for pirating software.

>You are both guilty.

>The police speak to you separately and offer you a deal.

>If you both independently claim innocence (ie lie) then you both get a 3 year sentence.

> If you both plead guilty (the truth), then you both get 1 year.

> If you claim innocence (lie) and your buddy claims quilt (the truth), then you get off free and buddy gets 5 years (and vice versa).

> Would you plead innocent or quilty?

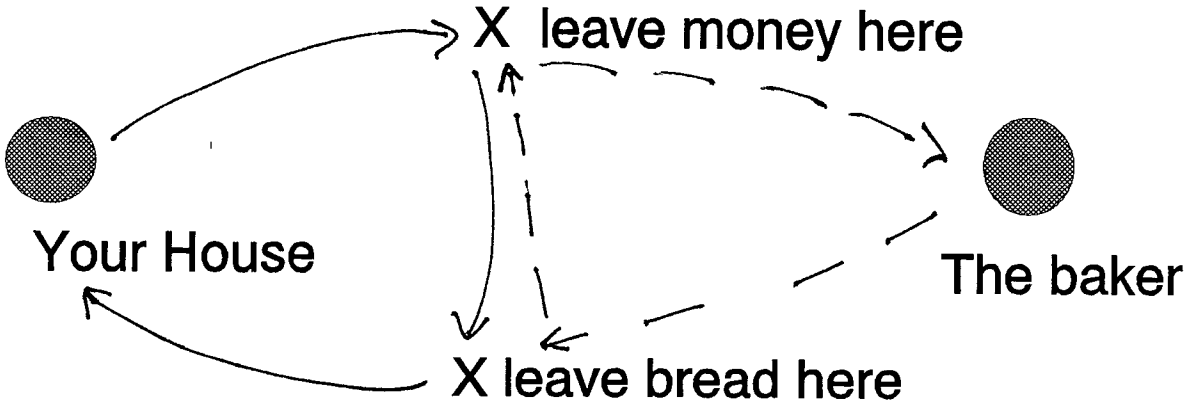
The Baker's Dilema

> You buy bread from a baker.

> The exchange of bread and money takes place at separate spots at the same time.

> Thus you leave the money at the same time as the baker leaves the bread.

> What are you going to do? Leave money or not?



The Law of the Commons

> You and the other shepards in your village use common land (called "the commons") for grazing sheep.

> The commons is being over grazed.

> Thus everyone is asked to cut grazing in half.

> It is hard to tell the sheep apart.

> What will you do?

Payoff Matrix

		Column Player	
		Cooperate	*Defect*
Row Player	Cooperate	$R=3, R=3$ Reward for mutual cooperation	$S=0, T=5$ Sucker's payoff, and temptation to defect
	Defect	$T=5, S=0$ Temptation to defect and sucker's payoff	$P=1, P=1$ Punishment for mutual defection

NOTE: The payoffs to the row chooser are listed first.

$$T > R > P > S$$

$$R > (T + S) / 2$$

> Open or closed game?

> How big a shadow does the future cast?

> Discount factor, w, between 1 and infinity. The promises of tomorrow are not worth as much as the spoils of today.

> Future worth = Current worth / w.

> So what is the best strategy?

What is your objective?

> to prevent the other from winning? (if I can't win then you won't either)

> to maximize your gains? (I don't care what you get as long as I get the most I can)

> to maximize the differential in your gain over his? (I want more than you)

> to maximize the gain of the system? (I can't win if that means you lose)

> Who is the enemy?

> Is there an enemy?

Given the choice of :

win - win

win - lose

lose - lose

we would probably agree that win - win is the most desirable.

Ie: We desire the emergence of cooperative strategies.

Thus, we need a strategy, call it "S", that:

can emerge (S can invade the host, S is a minority)

can thrive (S lives in a heterogeneous society)

can protect itself from invasion (S is the host)

The Computer Tournaments

Round 1:
> Each entry was paired with each other entry (Round Robin), itself and RANDOM
> 200 moves
> 14 entries

Result:
> TIT for TAT won.
> T-T simplest and best.
> Many of the strategies were varients on T-T.

Analysis:
> T-T is nice. This property distinguishes high scores from low ones.
> Performance depends on environment.
> TIT for 2 TATS would have won if entered.
> Results published.

NICE
PROVOCATIVE
FORGIVING
CLEAR

The Contestants: Round One

Rank	*Name*	*Discipline (if faculty)*	*Length of Program*	*Score*
1	Anatol Rapoport	Psychology	4	504.5
2	Nicholas Tideman & Paula Chieruzzi	Economics	41	500.4
3	Rudy Nydegger	Psychology	23	485.5
4	Bernard Grofman	Political Sci.	8	481.9
5	Martin Shubik	Economics	16	480.7
6	William Stein & Amnon Rapoport	Mathematics Psychology	50	477.8
7	James W. Friedman	Economics	13	473.4
8	Morton Davis	Mathematics	6	471.8
9	James Graaskamp		63	400.7
10	Leslie Downing	Psychology	33	390.6
11	Scott Feld	Sociology	6	327.6
12	Johann Joss	Mathematics	5	304.4
13	Gordon Tullock	Economics	18	300.5
14	Name withheld		77	282.2
15	RANDOM		5	276.3

The Computer Tournaments

Round 2:
> 62 entries

Result:
> TIT for TAT won again.

Analysis:
> Apparently, some people looked at Round 1 and concluded:
Be nice and forgiving (lesson 1)
> Others concluded:
If others are going to be nice and forgiving, take advantage of them (lesson 2)

> Those who drew lesson 1 suffered under those who drew lesson 2.

> But lesson 2 codes didn't do very well (mutual punishment).

> T-T got along well with almost everyone, ie is ROBUST

The Computer Tournaments

Round 3: Simulation of Life

> Growth / death based on scores.

Result:
> T-T wins again.

Analysis:
> T-T wins because:

Niceness prevents it from getting into unnecessary trouble.

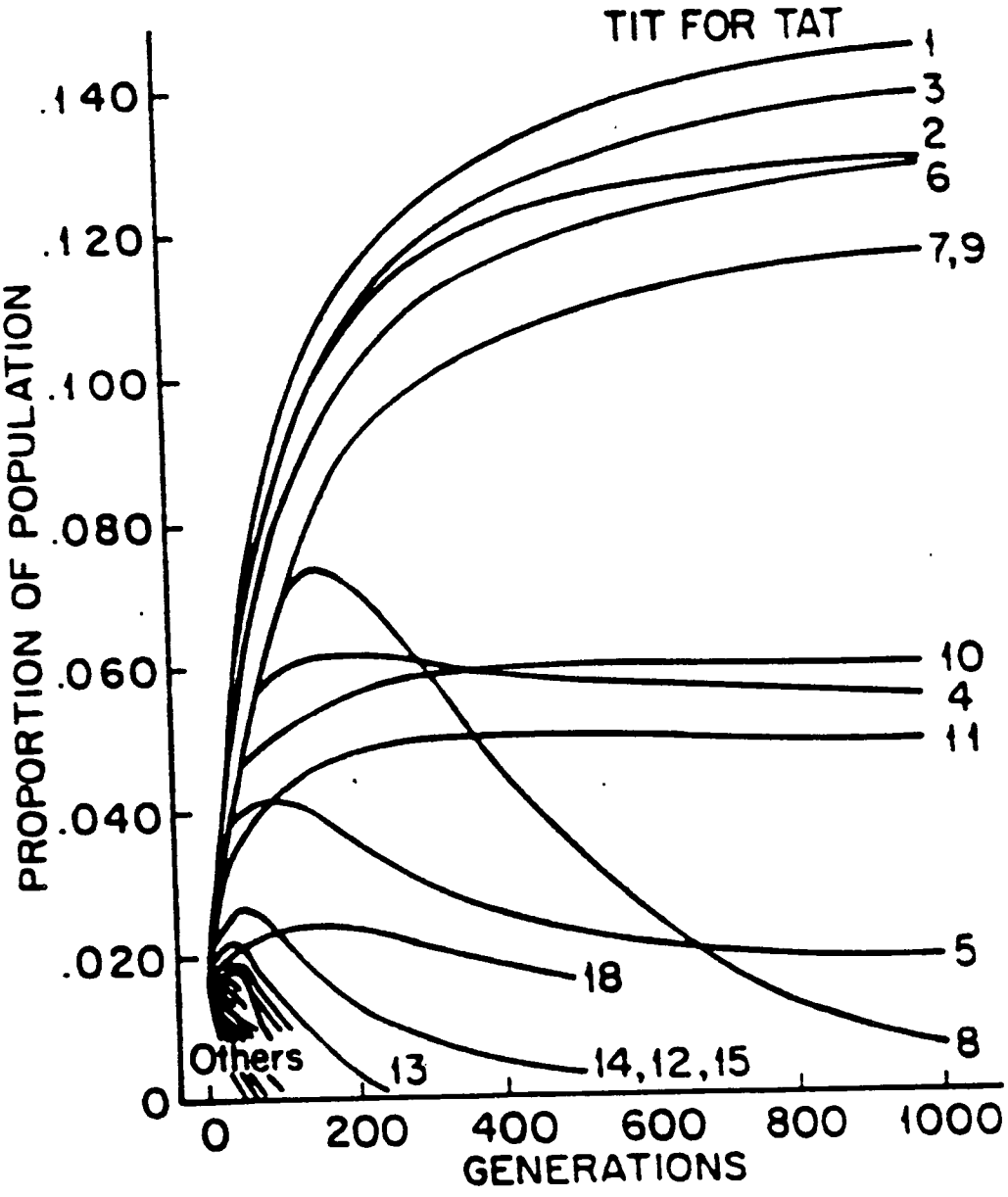
Retaliation discourages defection.

Forgiveness helps restore long-term cooperation.

Clarity elicits long-term cooperation.

> All this makes T-T robust.

Simulated Ecological Success of the Decision Rules



Conclusions, etc.

> T-T has been seen in:
  Trench Warfare
  Biological Systems

> Cooperation can get started by even a small cluster of individuals who are prepared to reciprocate cooperation, even in a world where no one else will cooperate.

> The players do not need to exchange messages or committments. They do not need words because their deeds speak for themselves.

> There is no need to assume trust.

> Altruism is not needed.

> No central authority is needed: cooperation based on reciprocity can be self-policing.