ALTRUISM AND REPUTATION
– cooperation within groups

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Complex are: text, mind, **community**, society...

The Prisonner's Dilemma: most hard formulation of the problem of **cooperation**.

Payoff: a necessary ingredient of game theory.

Our aim: a **minimal** model of cooperation, payoffs unspecified.

Motivation: to include **norms**, not only strategies.

> **Strategies**: *complete, specified, depend on payoff and information*
> **Norms**: *uncomplete, general, less dependent on payoff and info*
>
> [Gary Goertz, in „*International norms and decision making: a punctuated equilibrium model", Rowman & Littlefield Publishers, Portland 2003*]
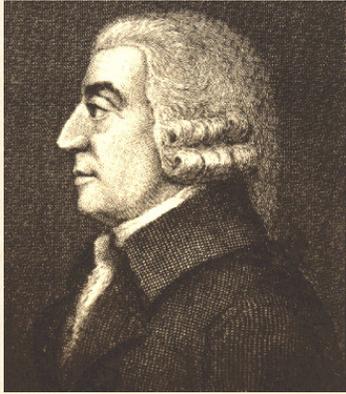
Homo Economicus
- a creature who is rational and purely self-regarding

Homo Sociologicus
- a creature who follows prevailing social norms without regards to self-interest

E. Fehr, H. Gintis, *Human motivation and social cooperation*, Ann. Rev. Soc. 2007

outline

1. Intro: **competitive altruism**

2. **Minimal model of cooperation**

3. **Numerical results**

4. **In-group preference**

Why to cooperate?
kinship, reciprocity, indirect reciprocity, punishment…

The Prisoner's Dilemma:

|	cooperate	defect
cooperate	R,R →	S,T
defect	↓ T,S →	U,U ↓

Rational choice ⇒ both defect

Individuals (…) feel a need of social approval to such a degree that there is a little conflict between self-interest and social values. [Talcott Parsons]

Change means movement. Movement means friction. Only in the frictionless vacuum of a nonexistent abstract world can movement or change occur without that abrasive friction of conflict. [Saul Alinsky]

„…a babbler who finds food may not swallow it right away but instead it may hold it in its beak and look around to see whom it can feed."

[Amotz and Avishag Zahavi, *The handicap principle: a missing piece of Darwin's puzzle*, Oxford UP, 1997]
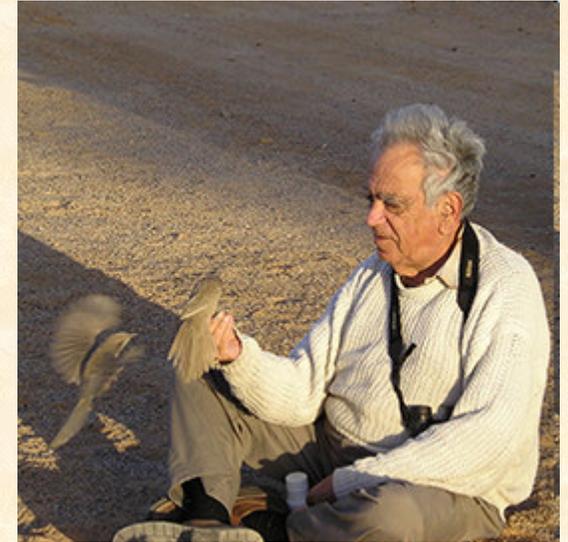
I interpret the altruistic behaviour of the babblers (...) as selfish investments in advertising the claim of the altruist for its social prestige.

What will happen to *me* if I stop to help him?

The handicap principle :
RELIABLE SIGNALS MUST BE COSTLY TO THE SIGNALER

„individuals compete to be and to be seen as altruistic"

[G. Roberts, *Competitive altruism: from reciprocity to the handicap principle*, Proc. R. Soc. London B 1998]

„honest broker"

„Land Rover Defender"

A minimal model of cooperation

1. Individuals $i = 1,\ldots,N$ are characterized by two parameters:

- altruism $\mathcal{E}(i) = const, -1/2 < \mathcal{E}(i) < 1/2$
- time-dependent reputation $W(i), 0 < W(i) < 1$

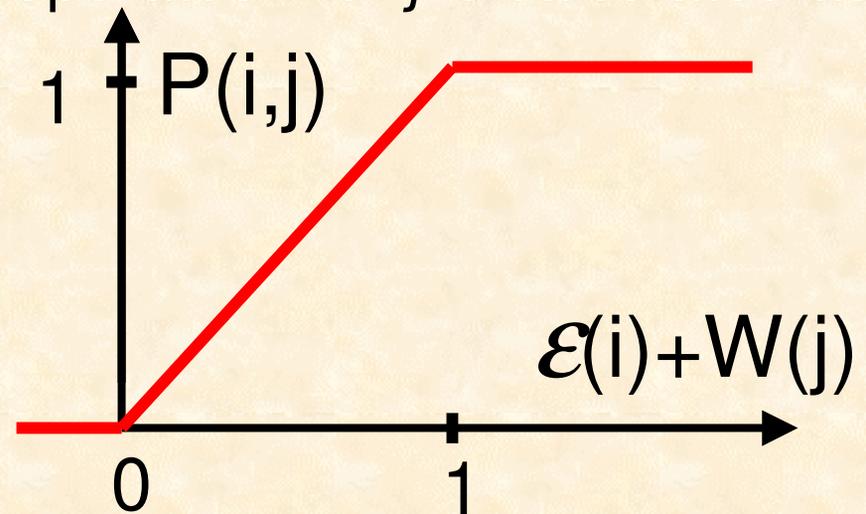2. The probability $P(i,j)$ that i cooperates with j is calculated as

3. When i cooperates, her/his reputation $r(i)$ increases
$W(i) \Rightarrow (W(i)+1)/2$

3. When i defects, her/his reputation $r(i)$ decreases
$W(i) \Rightarrow W(i)/2$

$P(i,j)$

$\mathcal{E}(i)+W(j)$

0   1

[K. K., P. Gawronski, *To cooperate or to defect? Altruism and reputation*, Physica A 2009]

Interpretation of the minimal model : competitive altruism

„Competitive altruism theory is based on two simple premises.

First it assumes that there are individual differences in altruism (...).

Second, in forming alliances there is competition for the most moral and cooperative partners. As a consequence, people compete to behave more altruistically than others and establish an altruistic reputation.

Competitive altruism is just one of several pathways to the development of cooperation in human groups."

[M. Van Vugt, G. Roberts, C. Hardy, *Competitive altruism: development of reputation-based cooperation in groups*, in Oxford Handbook of Evolutionary Psychology, R. Dunbar and L. Barrett (Eds.), Oxford UP, 2007
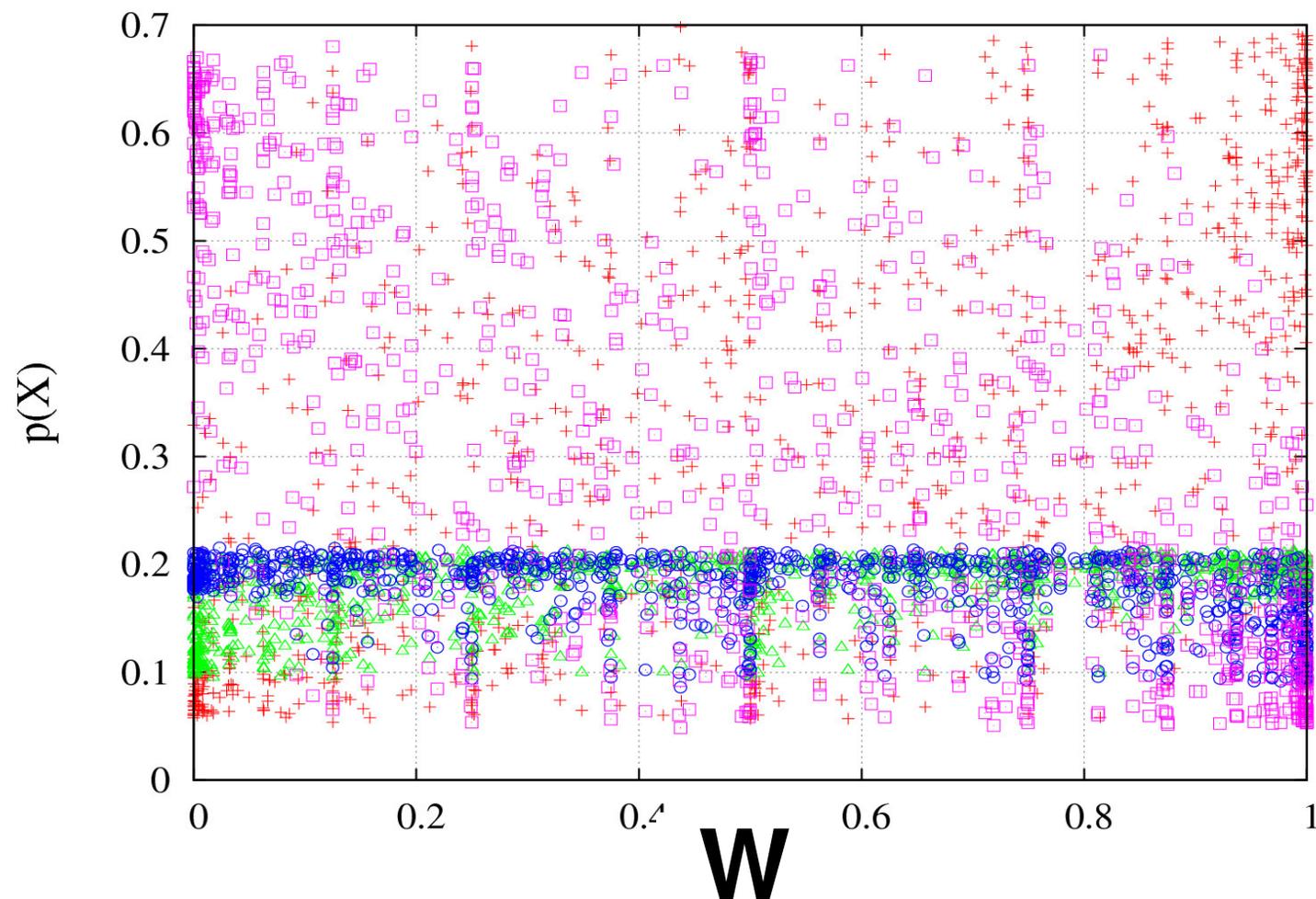
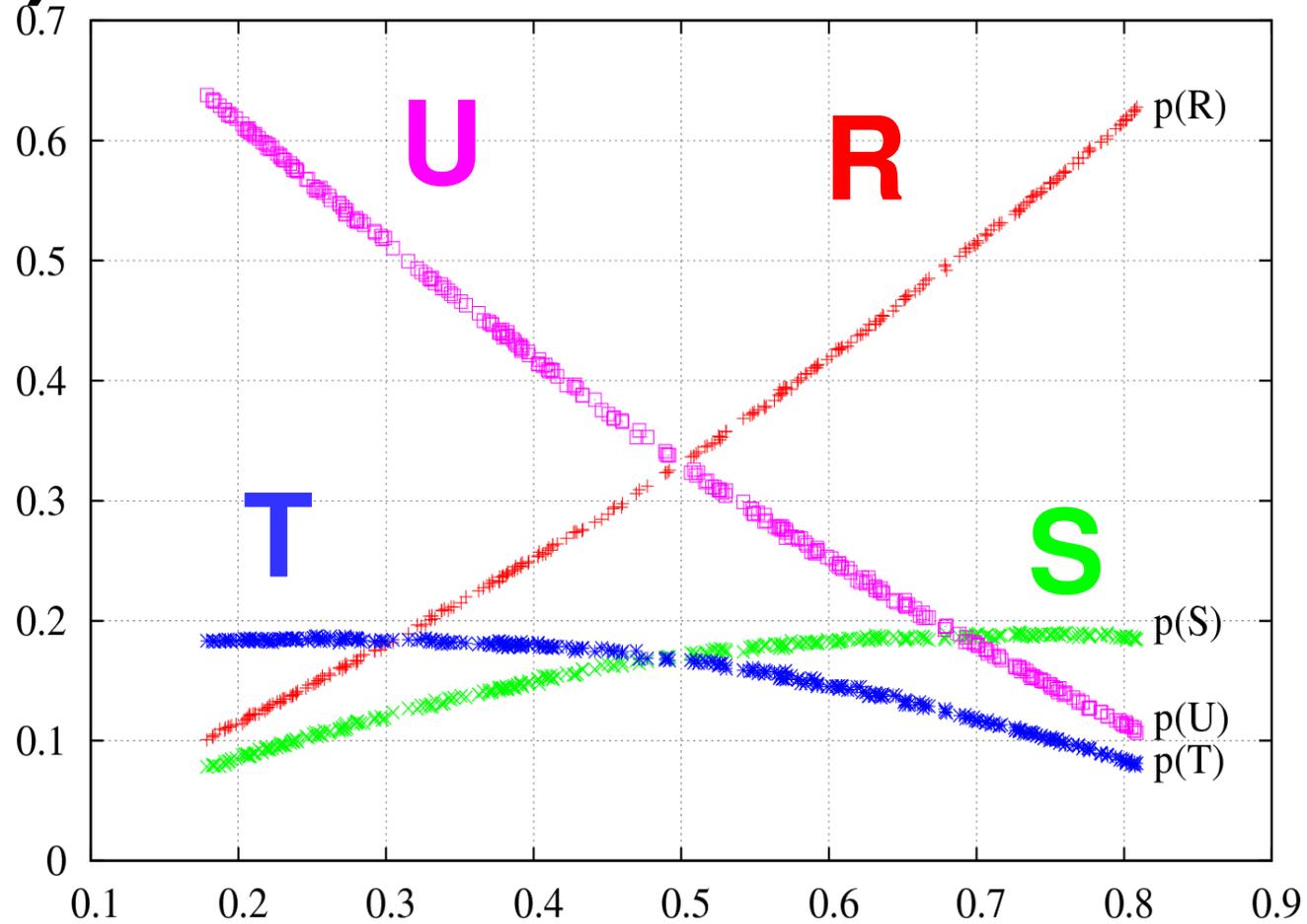Probability of successful cooperation (R) against altruism.
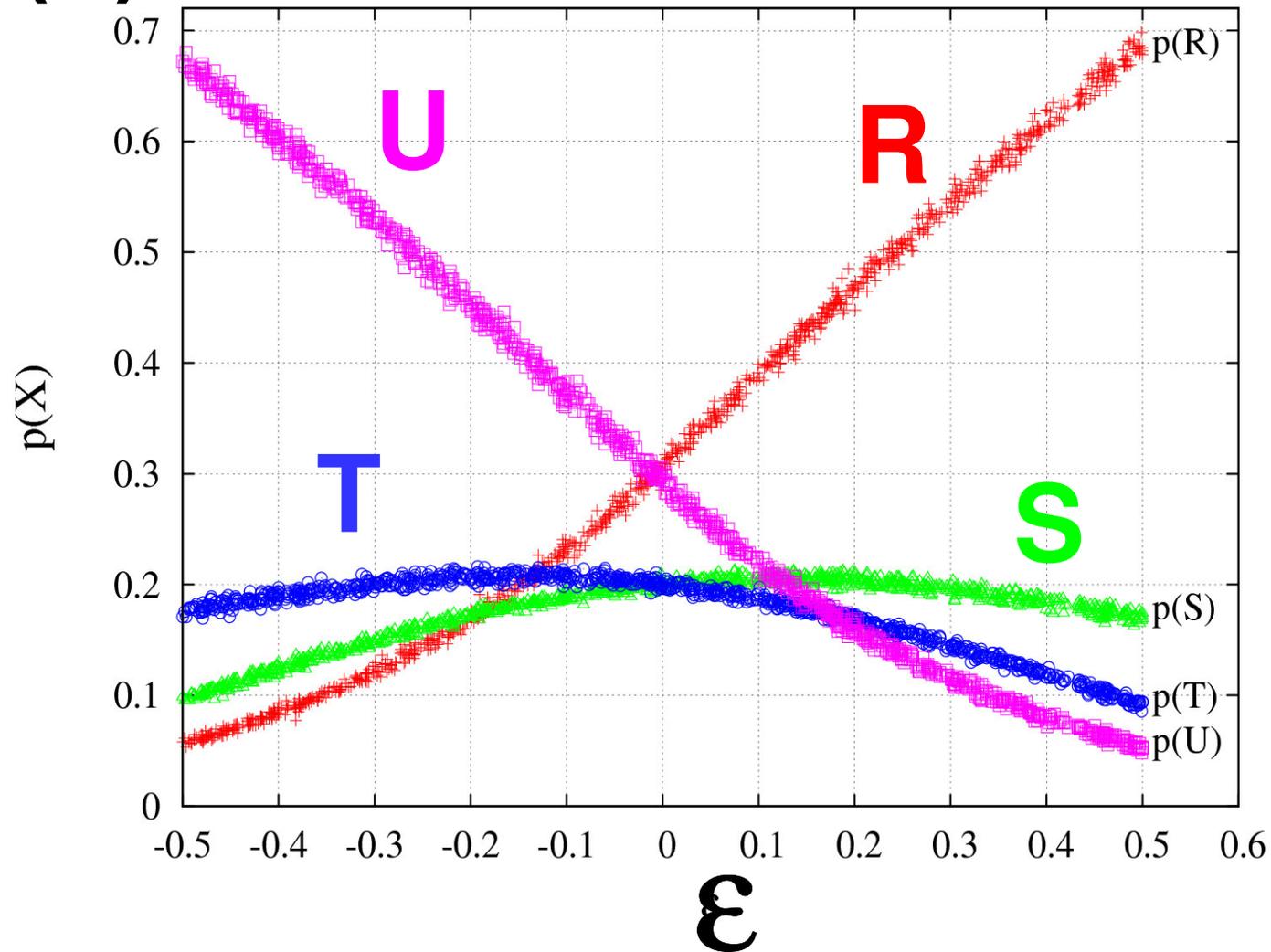
The outcome is weakly correlated with temporary reputation.

P(X)

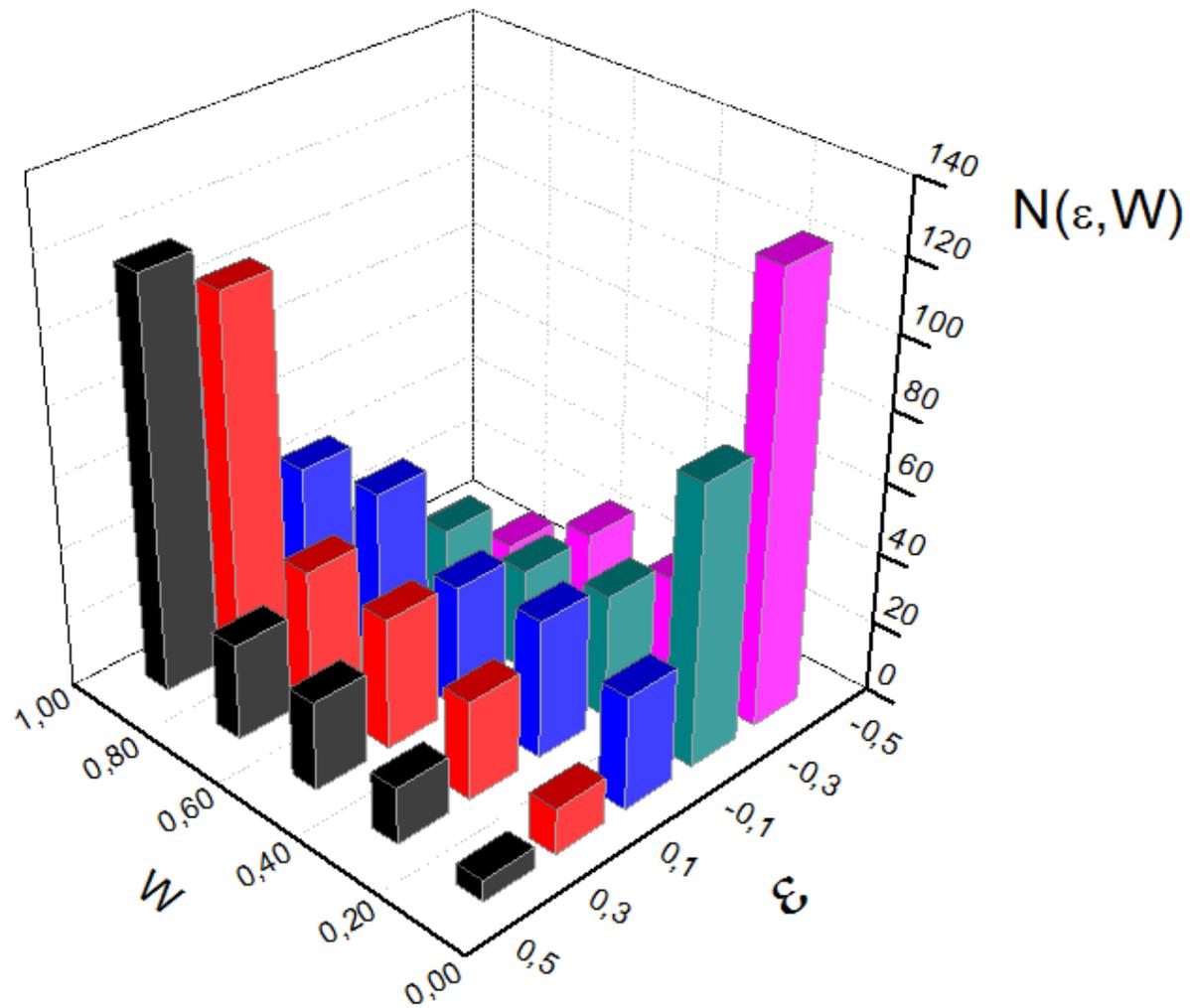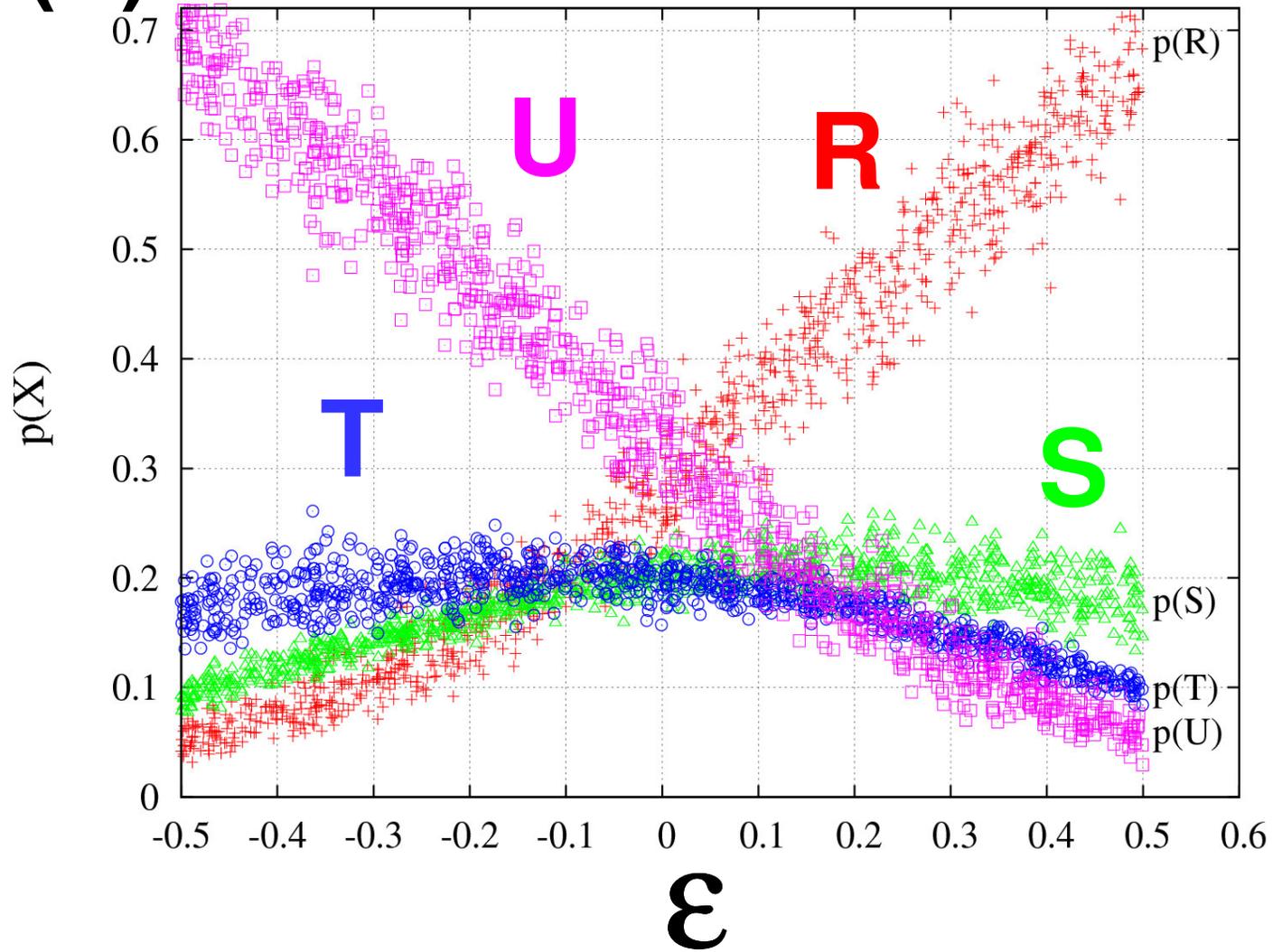Probability of successful cooperation (R) against mean reputation.

Correlation between altruism and reputation

P(X)

a short time or a sparse network

COOPERATION WITHIN GROUPS

Prisoner's Dilemma experiment with platoons of males formed for 4-week period of officer training in the Swiss army

1. **The intra-group cooperation was found to be clearly stronger than the inter-group one.**
2. **Individuals believed that members of their own platoons were more willing to cooperate.**

L.Goette, D.Huffman, S.Meier, *The impact of group membership on cooperation and norm enforcement,* (March 2006), FRB of Boston Working Paper No 06-7.

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In-group preference: $N \Rightarrow N/2 + N/2$

Implementation of the bias:

$\mathcal{E}(i)+W(j) \Rightarrow \mathcal{E}(i)+W(j) + \kappa$ if i,j belong to the same group

$\mathcal{E}(i)+W(j) \Rightarrow \mathcal{E}(i)+W(j) - \kappa$ if i,j belong to different groups

The outcome is
> the frequency-of-cooperation-matrix $F(i,j)$

and we search for the communities in this matrix, i.e. for clusters which are connected more tightly.

Identification of communities:

1. To define the time-dependent weighted connectivity matrix C_{ij}
2. To set the initial value of $C_{ij} = F(i,j)$
3. The time evolution of C_{ij} is governed by the equation of motion

$$\frac{dC_{ij}}{dt} = \Theta(C_{ij})\Theta(1 - C_{ij})\sum_k (C_{ik}C_{kj} - \beta)$$

4. Along with **C**, we calculate the time dependence of the modularity **Q**

$$Q = \frac{1}{m}\sum_{ij}[C_{ij} - \frac{k_i k_j}{m}]\delta(g_i, g_j) \quad \text{where } k_i = \sum_j C_{ij} \quad m = \sum_{ij} C_{ij}$$

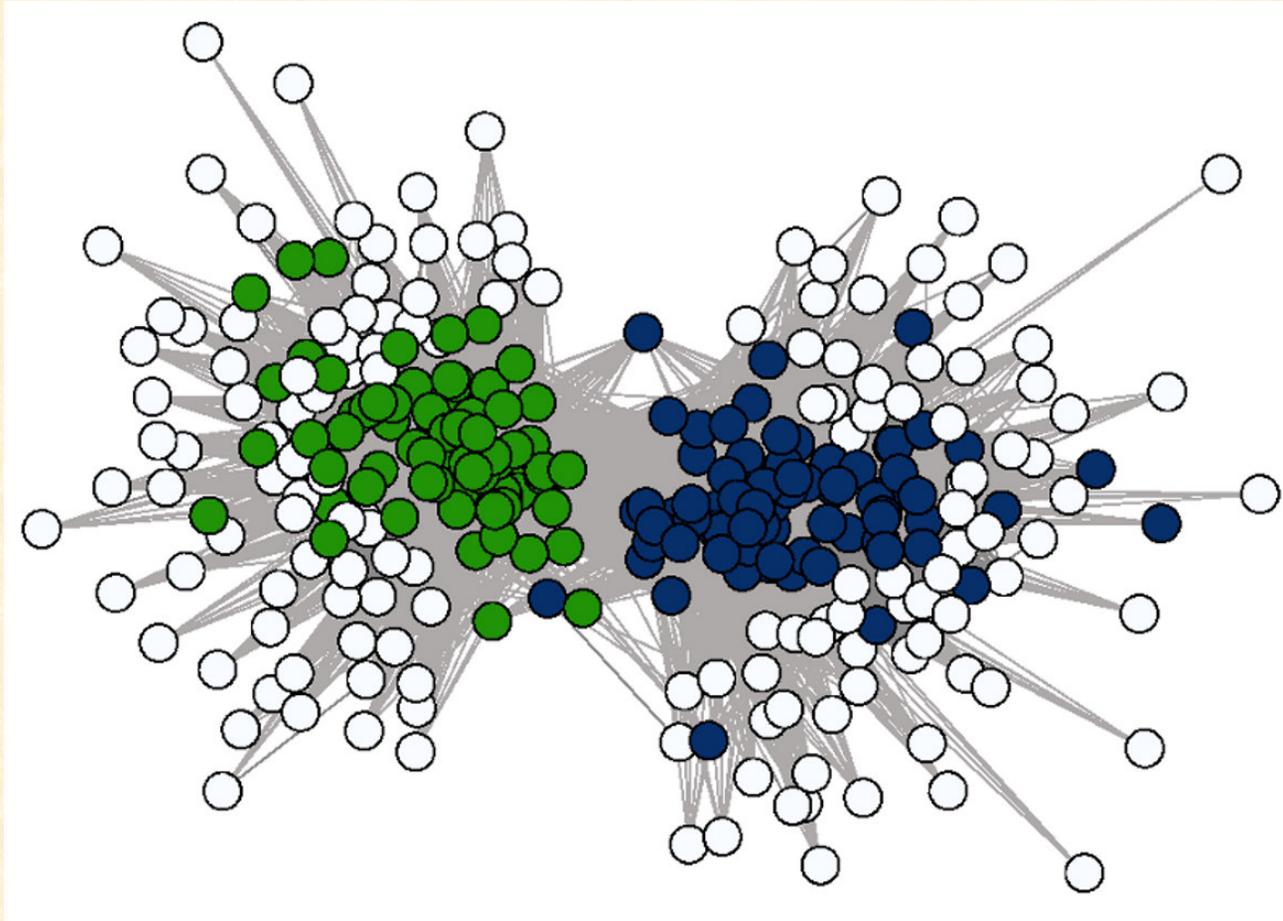and $\quad \delta(g_i, g_j) = 1 \quad$ iff *i,j* belong to the same cluster.

5. We adopt the structure of communities when **Q** is maximal.

[M.E.J.Newman, *Analysis of weighted networks*, PRE 2004;
M.J.Krawczyk, *Differential equations as a tool for community identification*, PRE 2008]

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Simulation: *N* = 300, $\mathcal{K}$ = 0.3 , # of games = 15 x 10^5

Results: *two clusters of ≈ N/4 nodes each, with < $\mathcal{E}$ >≈ 0.25*

conclusions

1. Our minimal model of cooperation driven by altruism and reputation has a sociological counterpart in the theory of competitive altruism.

2. Simulations show that the model is able to reproduce the phenomenon of cooperation.

3. The model can be generalized to describe the process of group formation, as observed by Goette et al.

4. In a more realistic version, the model should allow to refrain from playing with agents with bad reputation.

[S. Ohtsuki, Y. Iwasa, *How should we define goodness?* J. Theor. Biol. 2004]

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The following webpages are acknowledged:

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THANK YOU