Cooperation, punishment, emergence of government and the tragedy of authorities

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- *Theorem: (Nash)* Every N-player game, with finite strategies, has at least one equilibrium, in pure or mixed strategies
- In economy, Nash equilibrium $\equiv$ Self-regarding rational decisions (*Homo Oeconomicus*). Provides a sound basis for (almost) the whole of (rigorous) economic theory

Deviations from Nash equilibrium in human games

The ultimatum game (monopoly pricing of perishable good)

Acceptance $\rightarrow$ (a,c)

$\uparrow$

Proposer $\begin{matrix} a \\ c \end{matrix} \rightarrow$ Responder $\Rightarrow$ Payoff

$\downarrow$

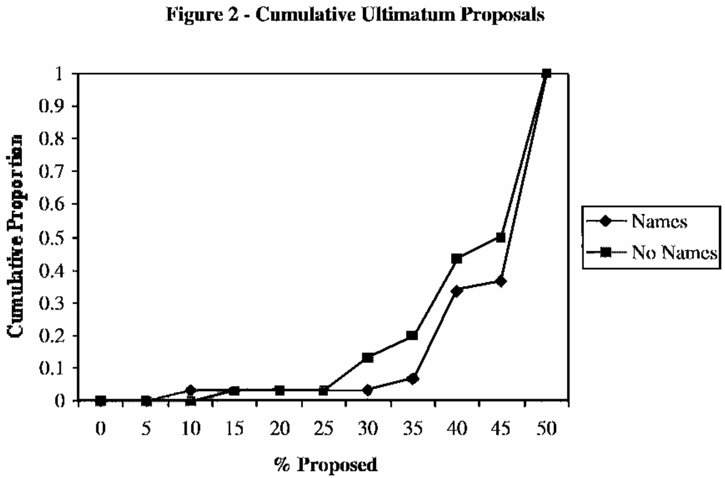
Non-accept. $\rightarrow$ (0,0)

$a + c = 2b, \;\; a \gg c$

$(a = 99, c = 1, b = 50)$

	R0	R1
P0	(a,c)	0,0
P1	b,b	0,0

Deviations from Nash equilibrium in human games



Context dependence

Deviations from Nash equilibrium in human games

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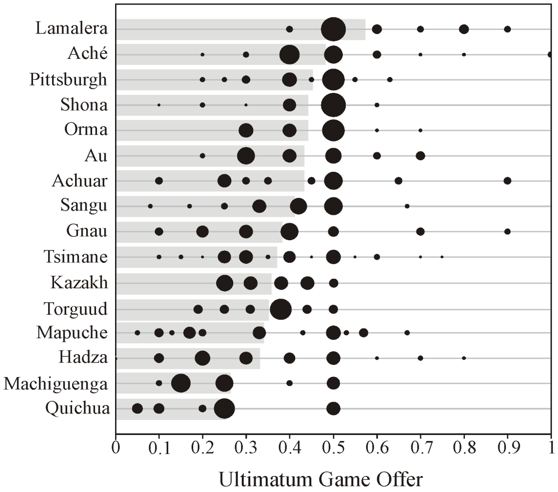

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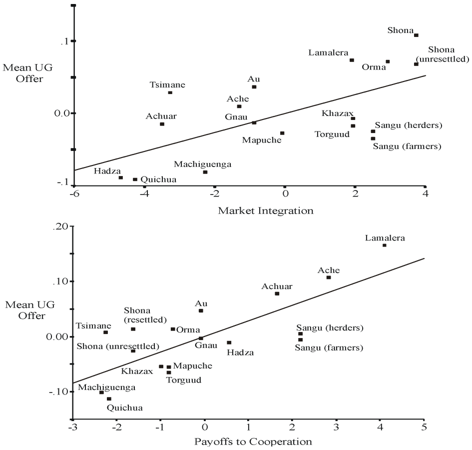

Fair offers correlate with market integration and cooperativeness in everyday life

Deviations from Nash equilibrium in human games

Likewise, strong deviations from Nash equilibrium are found in other experimental games :

- The public goods game (with and without punishment)
- Dictator game
- Gift exchange game
- Third party punishment game
- The trust game

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- Strong reciprocity is a form of altruism in that it benefits others at the expense of the individual that exhibits this trait.
- From the biological point of view, human cooperation is an evolutionary puzzle.

Deviations from Nash equilibrium in human games

- Unlike other creatures, humans cooperate with:
  - genetically unrelated individuals,
  - with people they will never meet again,
  - when reputation gains are small or absent,
  - even engage in altruistic punishment of defectors.

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- They are cooperative in helping each other, cooperative in achieving material and intellectual achievements unmatched by other species, but also cooperative in war and genocide

Is strong reciprocity evolutionary stable?

A model ($\backsim$ Bowles and Gintis, JTB 2004)

- A population of size N with two types of agents:
  Reciprocators (R-agents)
  Self-regarding (S-agents)
  A *public goods* activity: each agent can produce a maximum amount of goods q at cost b.

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- An S-agent benefits from shirking by decreasing the cost of effort to $b(\sigma)$, σ being *the fraction of time the agent shirks*
  $b(0) = b, \qquad b(1) = 0, \qquad b^{'}(\sigma) < 0, \qquad b^{''}(\sigma) > 0$
  $q(1-\sigma) > b(\sigma)$, at every level of effort, working helps the group more than it hurts the worker.

$$b(\sigma) = \frac{2}{2\sigma - 1 + \sqrt{1 + 4/b}} - \frac{2}{1 + \sqrt{1 + 4/b}}$$

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- R-agents never shirk and punish each free-rider at cost $c\sigma$, the cost being shared by all R-agents.

Is strong reciprocity evolutionary stable?

- For an S-agent the estimated cost of being punished is $s\sigma$ Punishment and cost of punishment are proportional to σ. Each S-agent chooses σ to minimize the function

$$B(\sigma) = b(\sigma) + sf\sigma - q(1-\sigma)\frac{1}{N}f$$

f = fraction of R-agents in the population, $f\sigma$ = probability of being monitored and punished. The value σ_S that minimizes $B(\sigma)$ is

$$\sigma_S = \max\left(\min\left(\frac{1}{2} - \sqrt{\frac{1}{4} + \frac{1}{b} + \frac{1}{\sqrt{sf + \frac{q}{N}}}}, 1\right), 0\right)$$

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$$\begin{aligned} \pi'_S(f) &= q(1-(1-f)\sigma_S) - b(\sigma_S) - \gamma f \sigma_S \\ \pi'_R(f) &= q(1-(1-f)\sigma_S) - b - c(1-f)\frac{N\sigma_S}{Nf} \end{aligned}$$

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- One-dimensional map for the evolution of the fraction f of R-agents

$$f_{new} = f\frac{\Pi_R(f)}{(1-f)\Pi_S + f\Pi_R(f)}$$

Is strong reciprocity evolutionary stable?

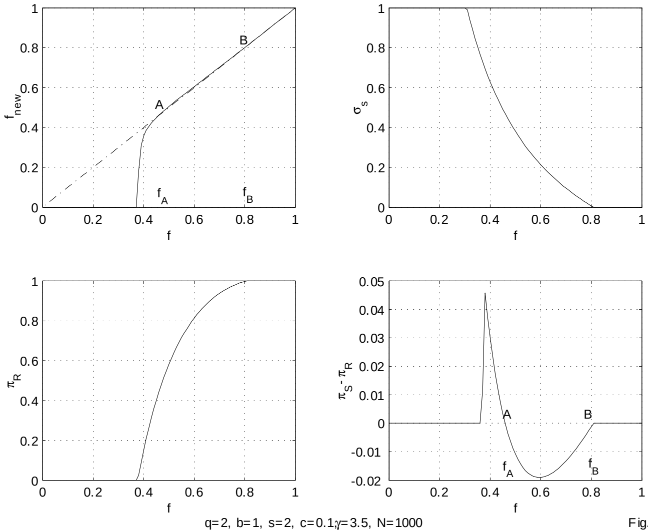

Fig.1

Is strong reciprocity evolutionary stable?

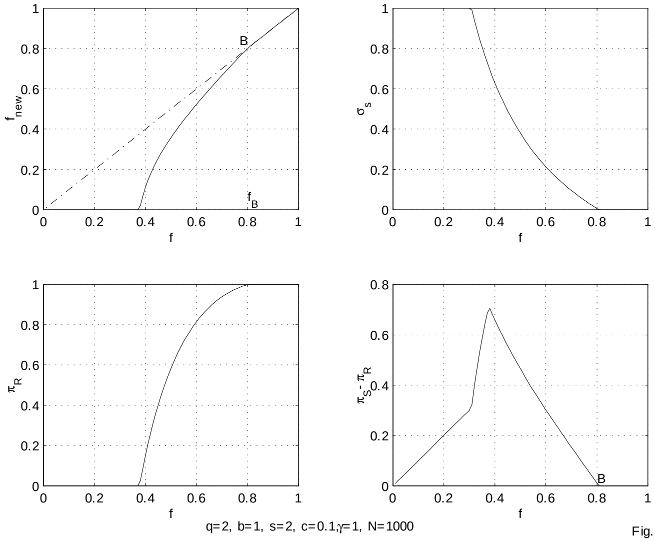

Fig. 2

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- However, this idea felt in disrepute because evolution does not pitch groups again groups, nor individuals against individuals, but genes against genes.
- A "selfish gene" analysis makes the *altruistic good-of-the-group* outcome virtually impossible to achieve. In particular because the late Pleistocene groups of modern man were not believed to be genetically sufficiently different to favor group selection. Therefore, human cooperation is still considered an evolutionary puzzle.

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- A *multilevel evolutionary dynamics* involving *gene-culture coevolution* could account for the development of the cooperative altruistic trait, because:

  - The cost of the group beneficial behavior of an individual would be limited by the emergence of *group-level social norms*.

  - On the other hand, even in the absence of these group-level norms, group selection pressures would support the evolution of the cooperative-altruistic punishment trait if *intergroup conflicts* were very frequent.

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- That is, egalitarian practices among ancestral humans reduces the force of individual selection against altruists, while frequent warfare makes altruistic cooperation among group members essential to survival. *Parochial altruism and warfare could have coevolved.*

Network dependence of strong reciprocity

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- A reciprocator, detecting an S-agent k, looks for another reciprocator in his neighborhood, also connected to k. If he finds one, he punishes k by an amount proportional to the fraction of shirking.
- The work of an S-agent is inversely proportional to the number of reciprocators in his neighborhood. Lack of communication between neighboring reciprocators makes the probability of punishment smaller.

The structure of the network plays an important role (clustering). Uses the $\beta-$model of Watts and Strogatz

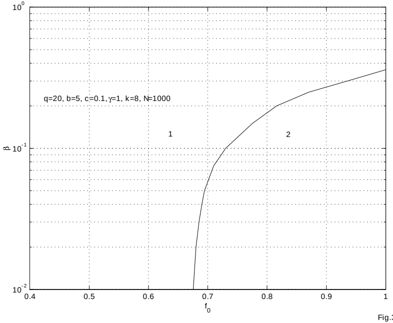

Fig.3

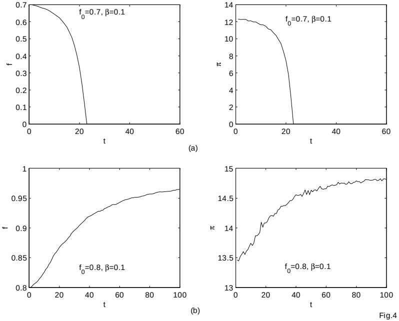

Fig.4

Conclusion: The reciprocator trait cannot not be maintained in a two-agent model with high β

Emergence of government

- Three types of agents:

  - R-agents
  - S-agents
  - A-agents

$$\begin{aligned} \pi_R' &= q\left(1 - f_A - f_S\sigma_S\right)x - b - cp\left(N\right)f_S\frac{N\sigma_S}{Nf_R} \\ \pi_S' &= q\left(1 - f_A - f_S\sigma_S\right)x - b\left(\sigma_S\right) - \gamma p\left(N\right)f_R + \gamma_A f_A\sigma_S \\ \pi_A' &= q\left(1 - f_A - f_S\sigma_S\right)wx - c_A f_S\frac{N\sigma_S}{Nf_A} \end{aligned}$$

The factors x and wx with $x = \frac{1}{wf_A + 1 - f_A}$ account for the fact that the amount of public goods given to R- and S-agents is the same, but might be different for A-agents.

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- $p\left(N\right)$ = punishment probability by R-agents, decreasing with N. Choose a simple function

$$p\left(N\right) = \sqrt{\frac{1+\delta}{1+\delta N/N_0}}$$

Emergence of government

- Evolution

$$f_{\alpha,new} = f_\alpha \frac{\Pi_\alpha (f)}{f_R \Pi_S + f_s \Pi_S + f_A \Pi_A}$$

$\alpha = R, S, A.$

Emergence of government

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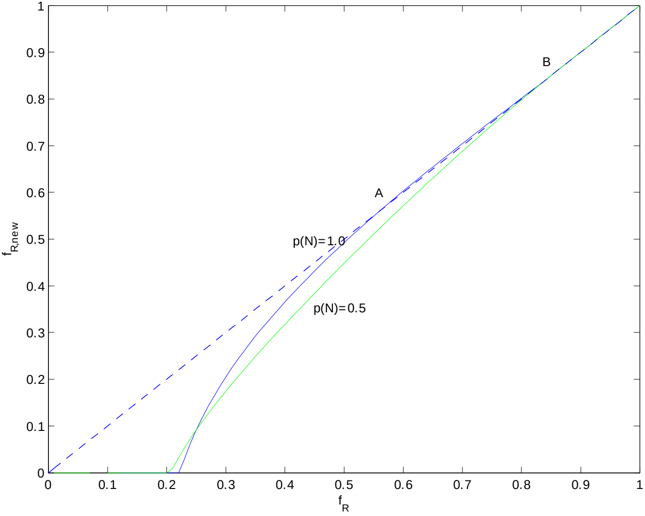
- Population increasing in time according to a global fitness dependent law

$$N(t+1) = N(t) e^{\beta\pi}$$

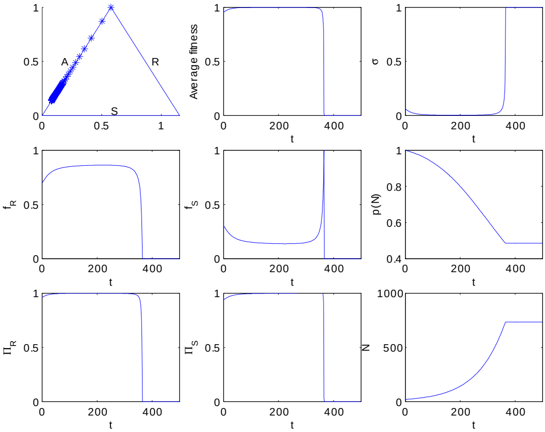
with $\pi = \sum_\alpha f_\alpha \pi_\alpha$

$\boxed{f_A = 0}$, The one-dimensional map for two values of $p\,(N)$



Emergence of government

$N_0 = 20,\ f_R^{(0)} = 0.7,\ f_S^{(0)} = 0.3,\ \boxed{f_A(t) = 0\ \forall t}$



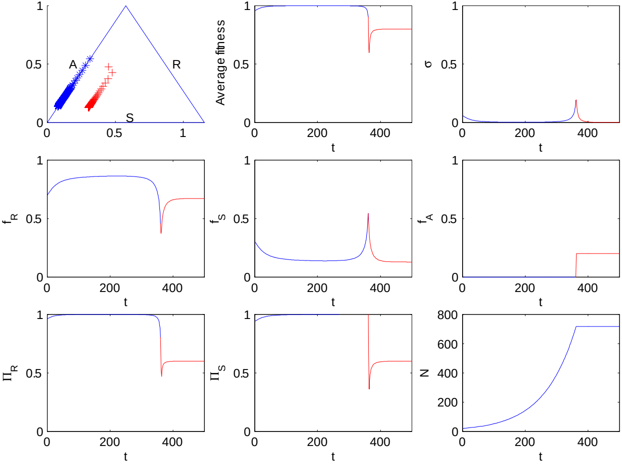
$q = 2, b = 1, c = 0.1, \gamma = 4, s = 3$

Tragedy of the commons

Emergence of government

$N_0 = 20,\ f_R^{(0)} = 0.7,\ f_S^{(0)} = 0.3,$

Switching on A-agents if $f_R < 0.5$, but keeping $f_A(t) \leq 0.2$



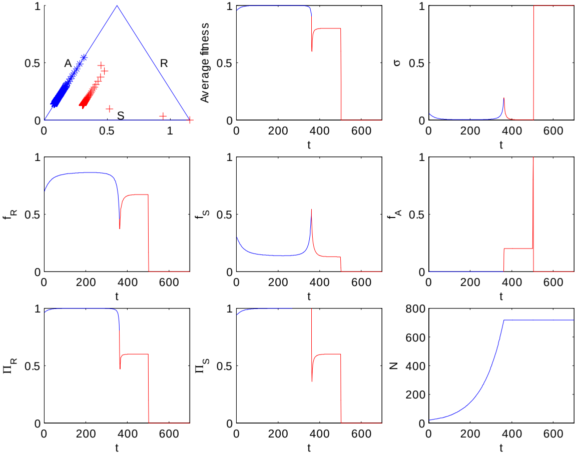
Emergence of government




The tragedy of authorities

$N_0 = 20,\ f_R^{(0)} = 0.7,\ f_S^{(0)} = 0.3,$

Same as before but $f_A(t)$ not constrained



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- Large human societies tend to be “small worlds” in the sense of short path lengths, but do not necessarily with a high degree of clustering. Therefore norm monitoring and enforcing requires *new special institutions of governance*.
- The new institutions bring with them social hierarchies, which imply inequalities. Therefore acceptance of the new institutions must have been possible only if in the majority of the population *the reciprocator trait had become an internalized norm*.

Conclusions

- The evolutionary dynamics of the agents associated to governance, that is *the ruling class*, may, by its proliferation or by assigning to itself a higher share of the production (an high w factor in the model) provoke a decrease of the average fitness, a crisis or even a collapse of the society. This is what was called the *tragedy of authorities*.

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- Some authors (Turchin, Korotayev) have studied the historical effects of *élite overproduction* as generating crisis and revolutions. However not all cases of élite overproduction that they characterize can be identified with the phenomena of the tragedy of authorities.
- If élite overproduction is the proliferation of an aristocratic class that, under the protection of the ruler, lives from the society production without contributing to it, then it has all the marks of a tragedy of authorities.

Conclusions

- However, when élite overproduction is associated, for example, to a greater access of the youth to higher education, this is not a tragedy of authorities. The eventual crisis that may occur in this case results from the fact that the new educated agents are not incorporated neither in the productive sector nor as beneficiaries of the society production. Hence it is not a tragedy of authorities.

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Conclusions

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- Evolutionary stability of the reciprocator trait depends on social norms and transmission of culture. It depends as much on genetics as on culture. Culturally-inherited traits have a faster dynamics than gene-based ones. *Therefore it is critical to understand how modern society might be acting and modifying it this trait*. A considerable loss of cooperative behavior might change society in many unexpected ways. *Could less altruism come along with less hostility to strangers*? If contemporary man is becoming more Homo Economicus, maybe it would not be necessary to rewrite the classical economy books.

References

S. Bowles and H. Gintis; *The evolution of strong reciprocity:Cooperation in heterogeneous populations,*Theor. Pop. Bio. 65 (2004) 17-28

S. Bowles, J.-K. Choi and A. Hopfensitz; *The co-evolution of individual behaviors and social institutions*, J. Theor. Biology 223 (2003) 135-147.

S. Bowles and H. Gintis; *A cooperative species: Human reciprocity and its evolution*, a forthcoming book.

R. V. M.; *Network dependence of strong reciprocity*, Advances in Complex Systems 7 (2004) 357-368.

R. V. M. and C. Aguirre; *Cooperation, punishment, emergence of government and the tragedy of authorities,* arXiv:0908.4408

P. Turchin; *Arise cliodynamics*, Nature 454 (2008) 34-35.

P. Turchin; *Modeling periodic waves of integration in the Afro-Eurasian world system*, pp. 161-189 in *Globalization as evolutionary process*, G. Modelski, T. C. Devezas, W. R. Thompson (Eds.), Taylor & Francis, 2007.

A. Korotayev and D. Khaltourina; *Introd. to Social Macrodynamics. Secular Cycles and Millennial Trends in Africa*, Moscow 2006.