The norm game - - how a norm fails

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1. Some mean field
2. Some simulations
3. Some examples

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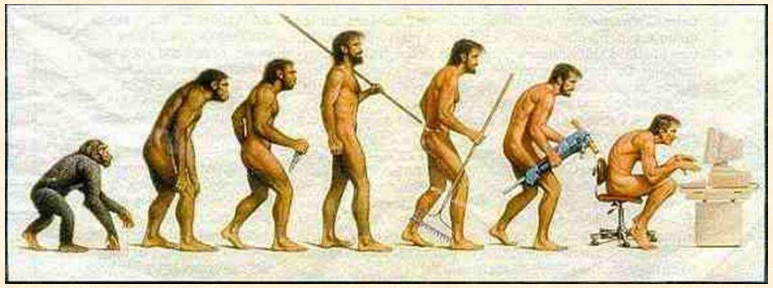
Three mechanisms of an evolutionary change



1. More effective individuals are more likely to survive and reproduce.

2. The players learn by trial and error, keeping effective strategies and altering ones that turn out poorly.

3. The players observe each other, and those with poor performance tend to imitate the strategies of those they see doing better.

[Robert Axelrod]

norms appear with social systems

„The first need of any social system is to create incentives to make people do more work than that required by their immediate wants.”

[*Elias J. Bickerman*]

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norms are restored by punishment

„Don't you be cutting up or otherwise harming any whores, or I'll come back and kill all you sons-a-bitches."

[Eastwood as Munny, in *Unforgiven*, 1992]

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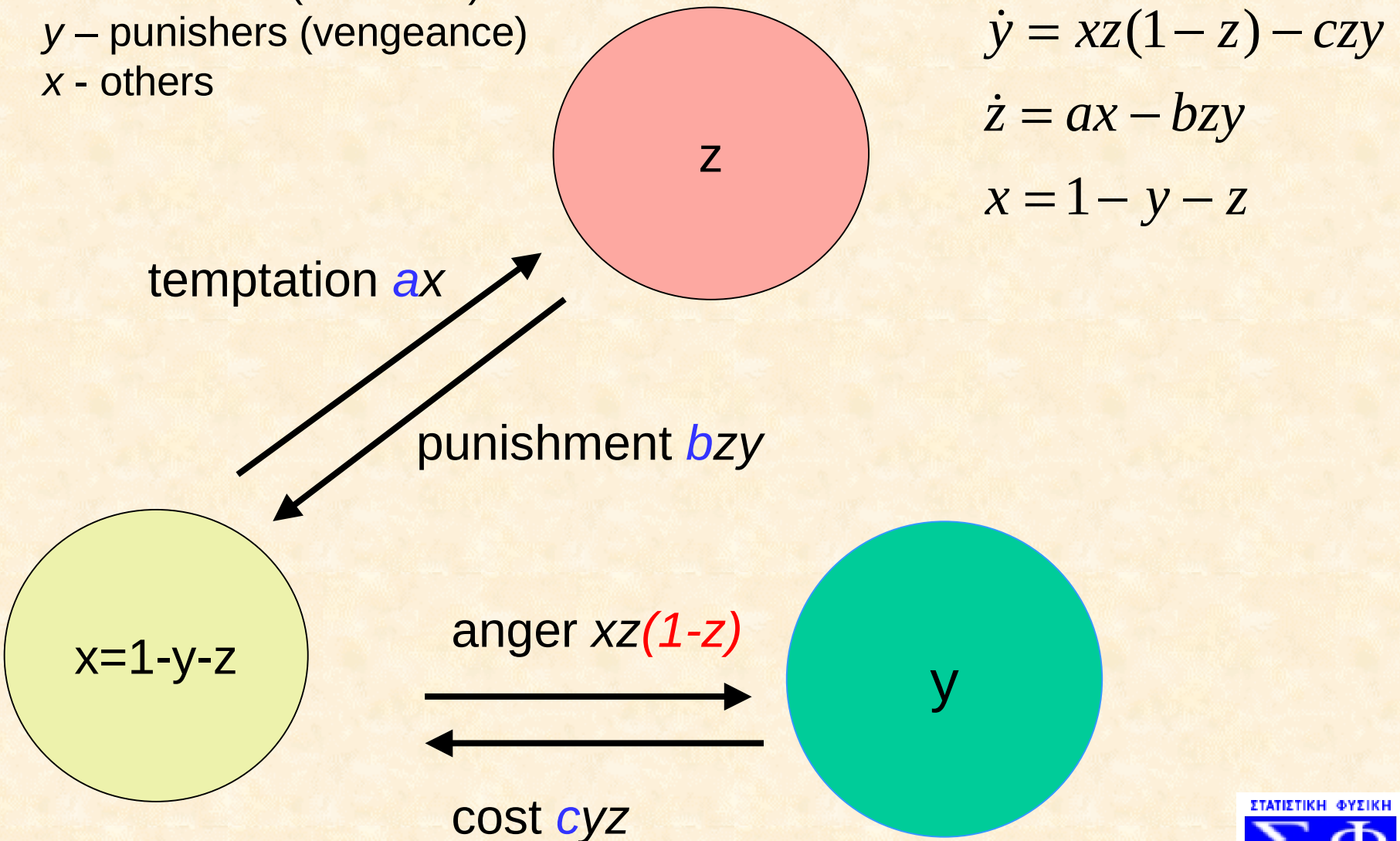
Defecting and punishing mutually exclude

z – defectors (boldness)
y – punishers (vengeance)
x - others



$$\dot{y} = xz(1-z) - czy$$

$$\dot{z} = ax - bzy$$

$$x = 1 - y - z$$

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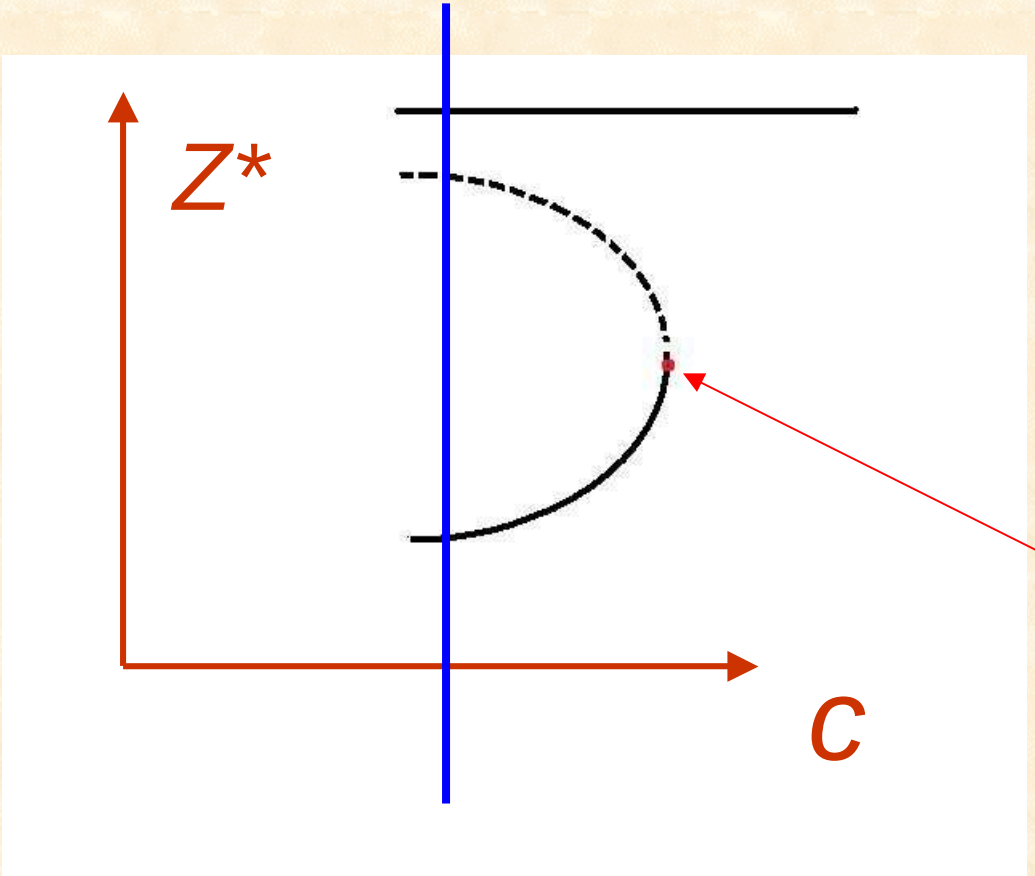
Stationary solution: fixed points



$$z^* = 1$$

$$z^* = \frac{1}{2}\left(1 \pm \sqrt{1 - 4\frac{ac}{b}}\right)$$

saddle-node bifurcation
at 4ac=b

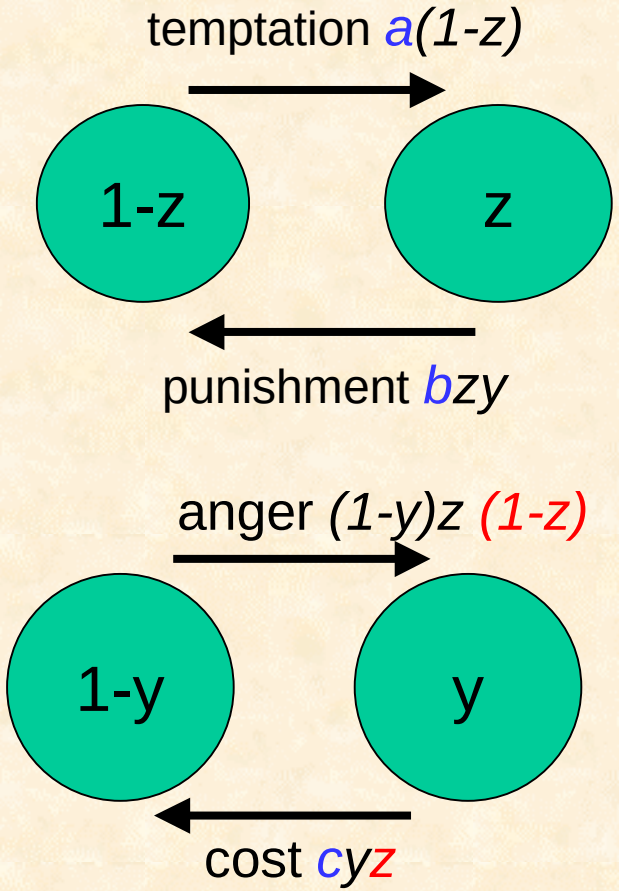
$$x^* = \frac{1 - z^*}{1 + \frac{a}{bz^*}} \qquad y^* = \frac{1 - z^*}{1 + \frac{bz^*}{a}}$$

Defecting and punishing uncorrelated

z – defectors (boldness)
y – punishers (vengeance)

$$\dot{z} = a(1-z) - bzy$$

$$\dot{y} = -cyz + (1-y)z(1-z)$$



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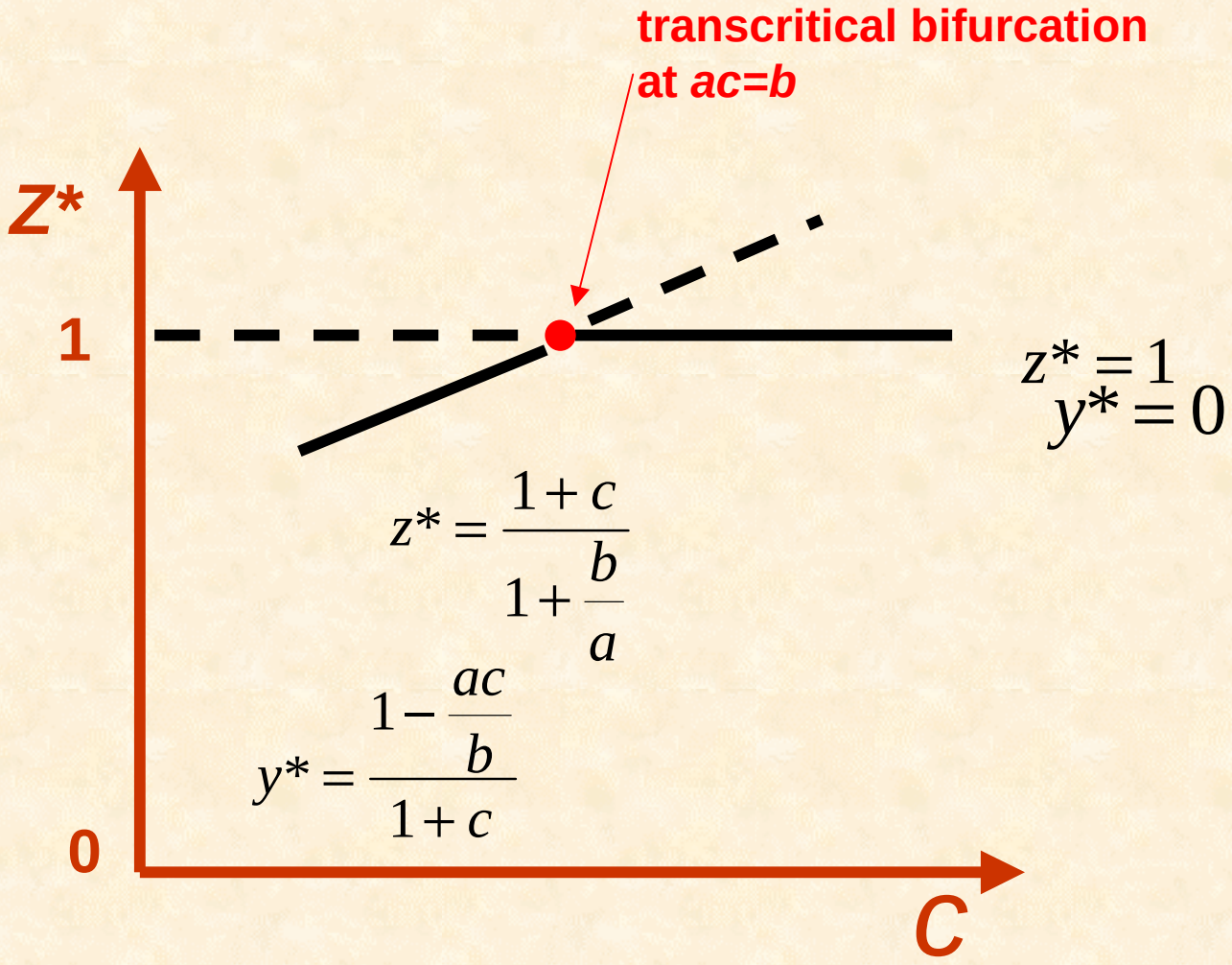
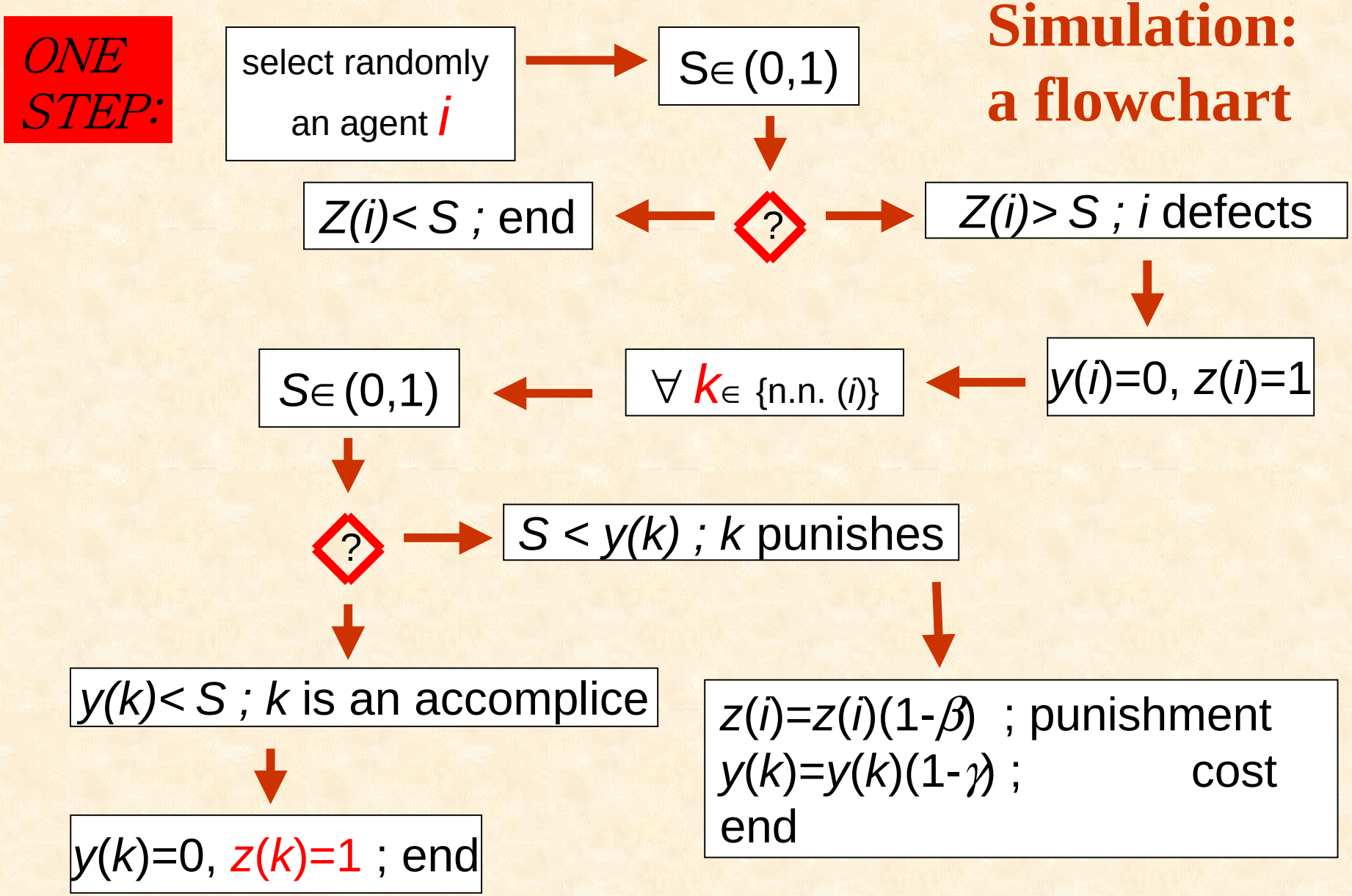
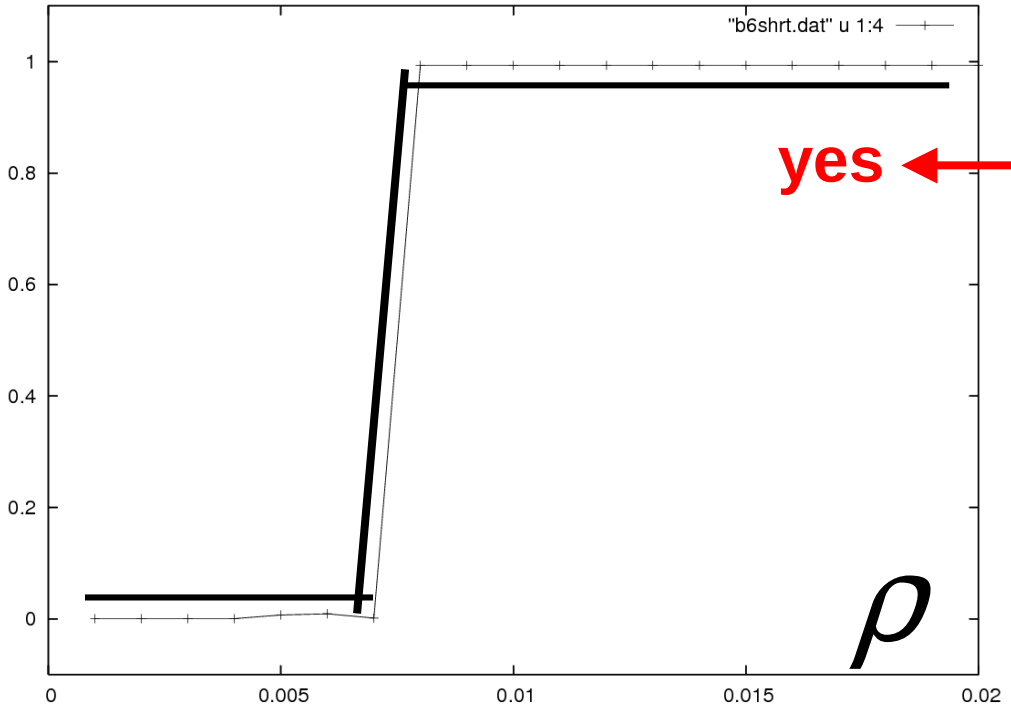
Stationary solution: fixed points



Simulation: a flowchart



<z>

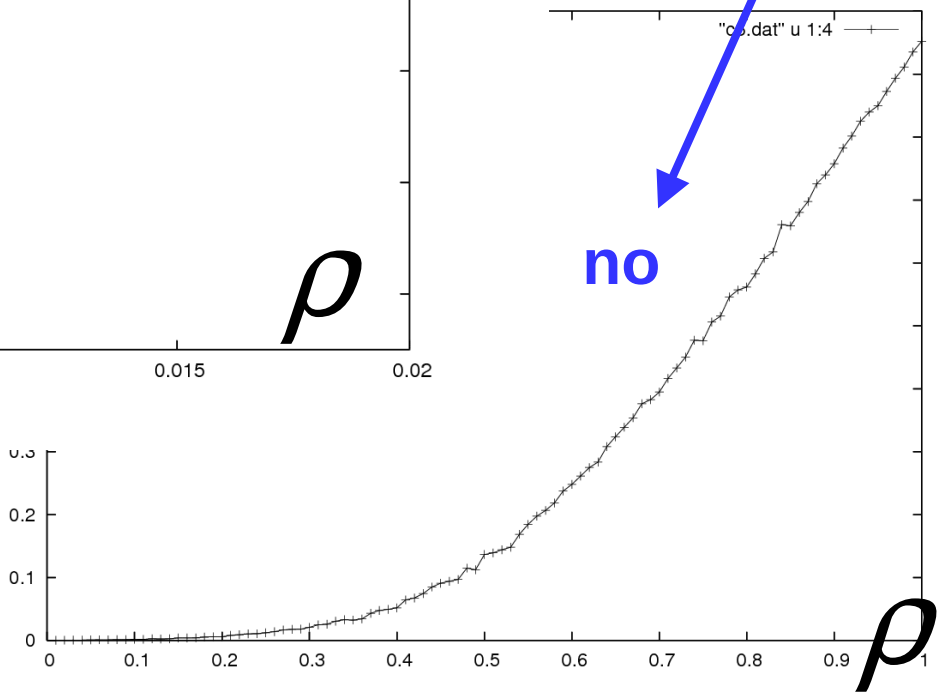


k did not punish

yes

z(*k*)=1

no



ρ - initial boldness

§: „*k* did not denounce = *k* is guilty"

⇒ the bistability

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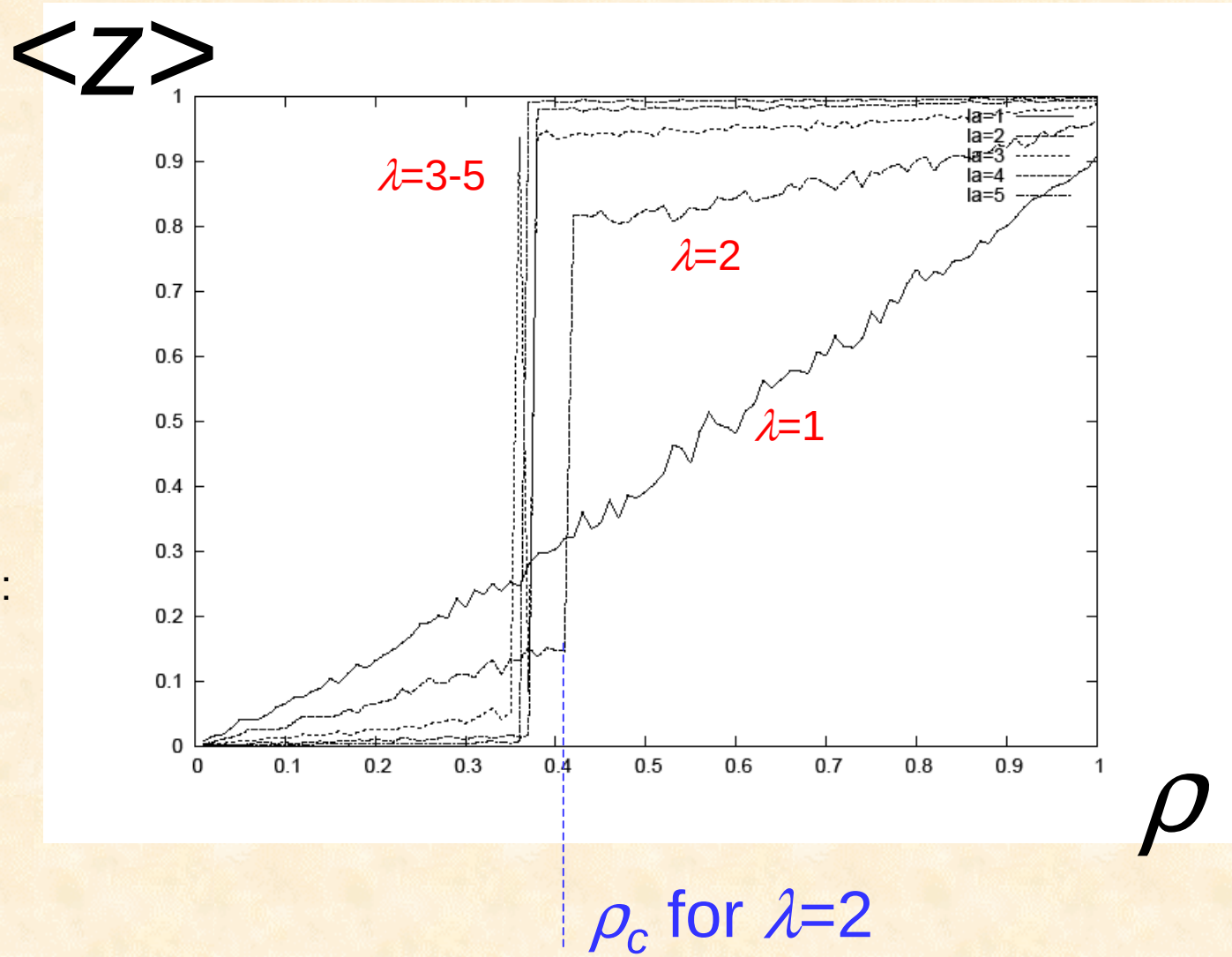
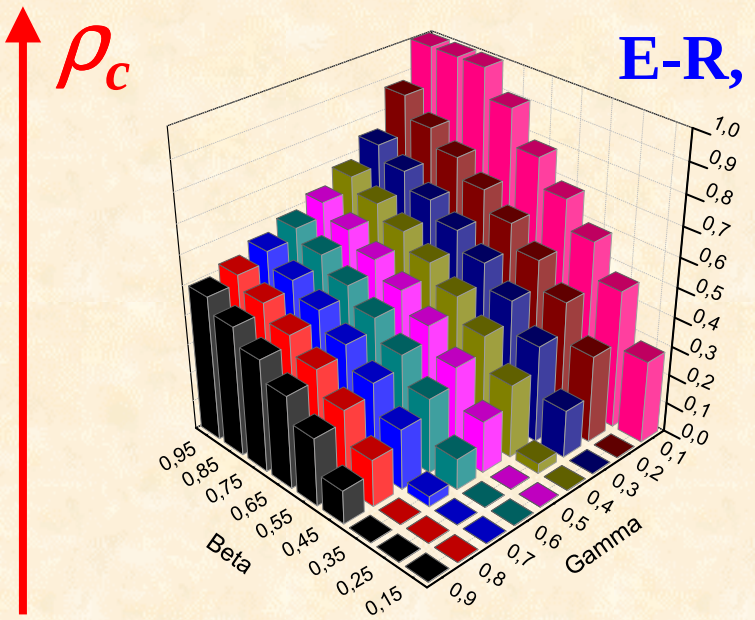
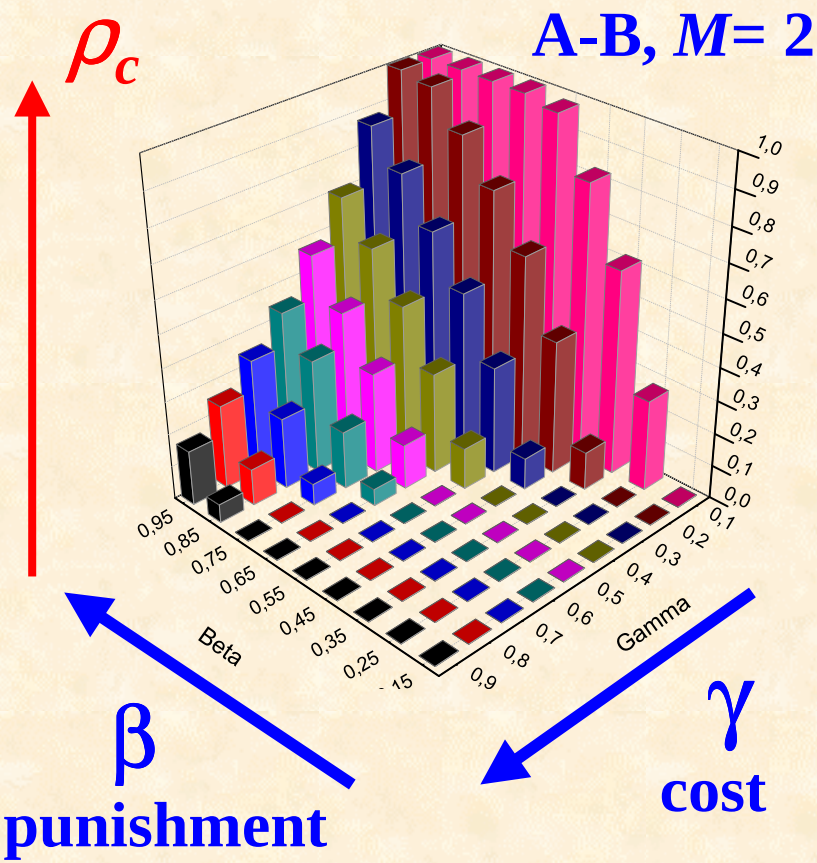


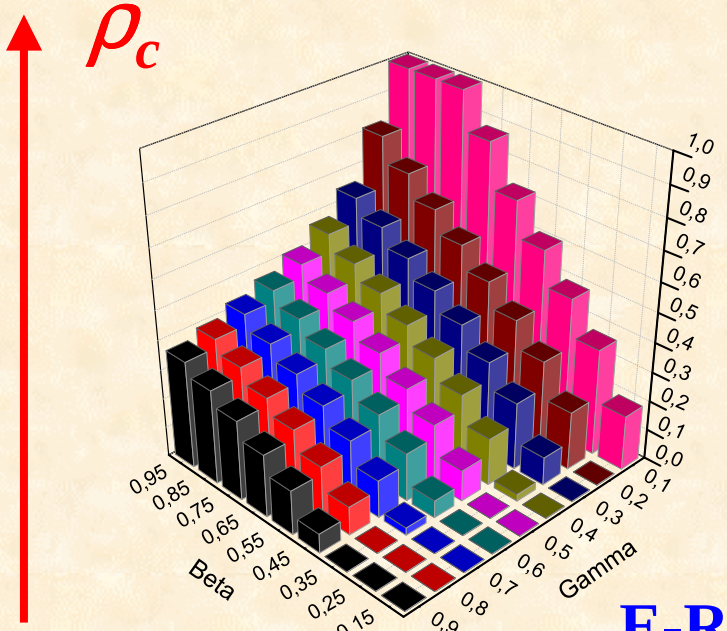
Initial distribution :
$0.9\rho < z(i) < \rho$
$y(i) = (1-z(i))/\mu$

Equilibrium value of the mean boldness <z> at the stationary state. A sharp transition is observed except the case $\lambda=1$, where $exp(-1)\approx 0.36$ nodes cannnot be punished.

ρ_c – the separatrice







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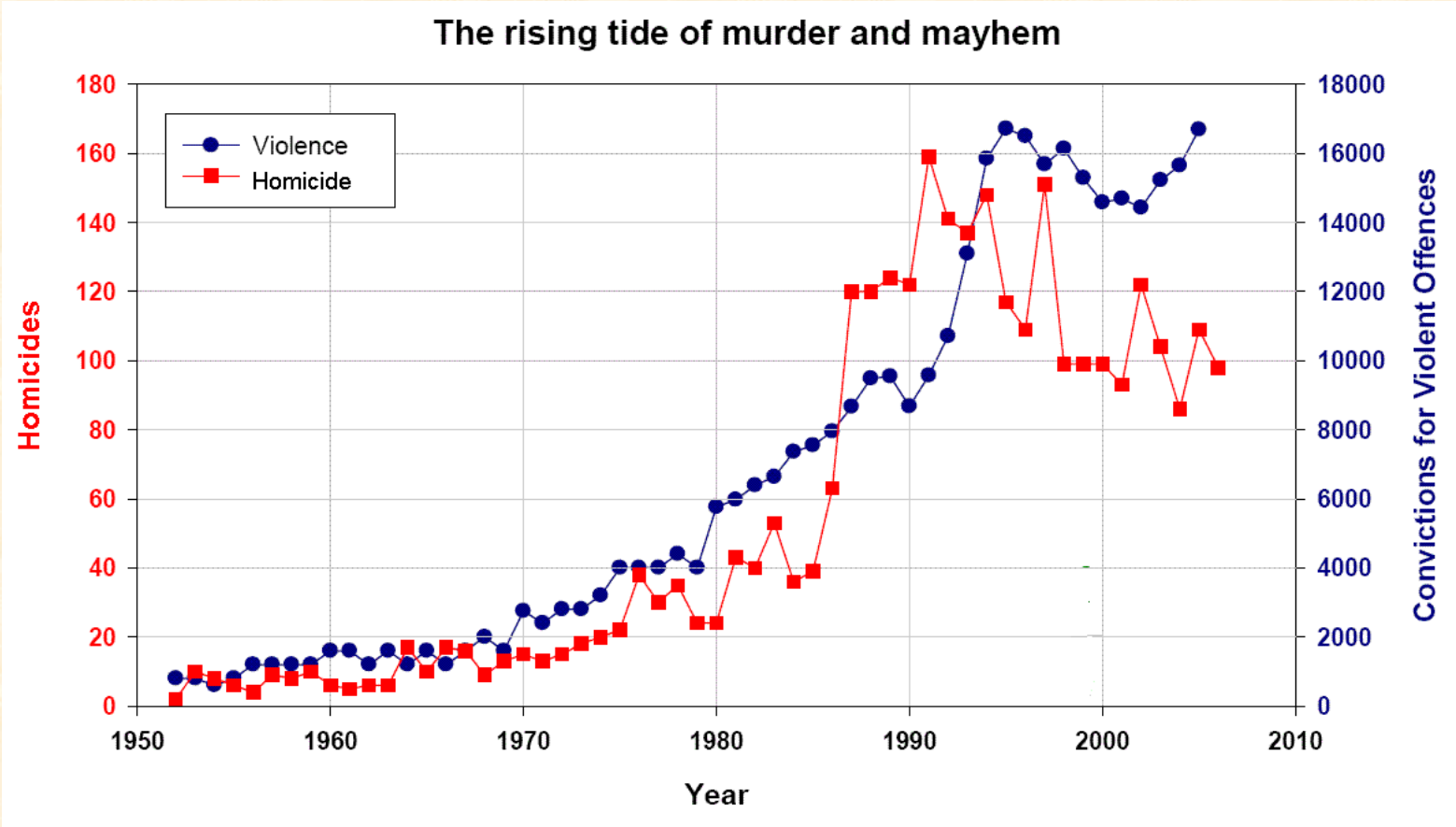
model results

1. Analytical considerations indicate, that the saddle-node bifurcation and the bistability appear if the roles of defectors and punishers are separated,
   Otherwise the bifurcation is transcritical and the boldness z^* varies continuously at the bifurcation point.

2. The bistability of the stationary phase appears also as a result of the simulation on a directed Erdös-Rényi network. There is no saddle-node bifurcation. If the non-punishers do not become defectors, the bistability vanishes.

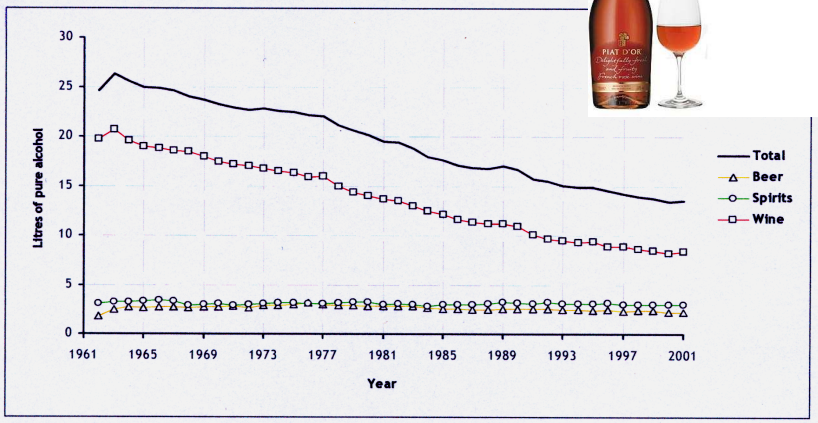
A change: murders in New Zealand



Since 1984, successive governments have engaged in major macroeconomic restructuring, transforming New Zealand from a highly protectionist and regulated economy to a liberalised free-trade economy. These changes are commonly known as Rogernomics and Ruthanasia after Finance Ministers Roger Douglas and Ruth Richardson. [Wikipedia]

FRANCE

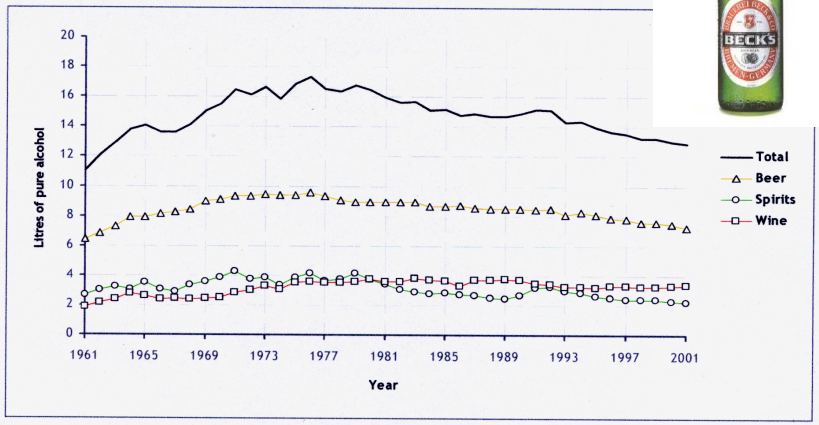
Recorded adult per capita consumption (age 15+)



Sources: FAO (Food and Agriculture Organization of the United Nations), World Drink Trends 2003

GERMANY

Recorded adult per capita consumption (age 15+)

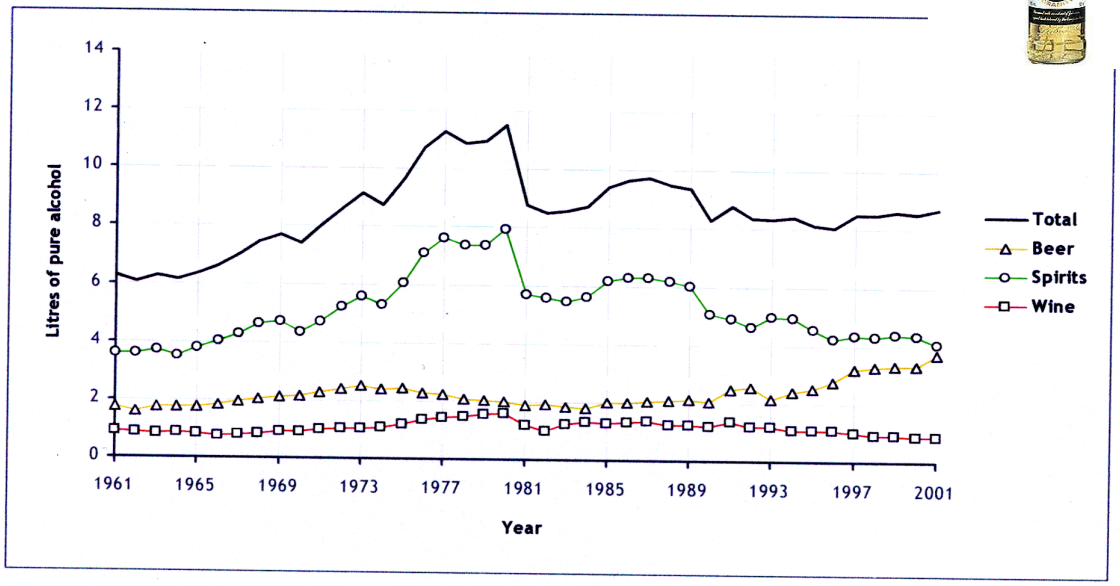


Sources: FAO (Food and Agriculture Organization of the United Nations), World Drink Trends 2003

A change: drinking vodka in Poland

POLAND

Recorded adult per capita consumption (age 15+)



Sources: FAO (Food and Agriculture Organization of the United Nations), World Drink Trends 2003

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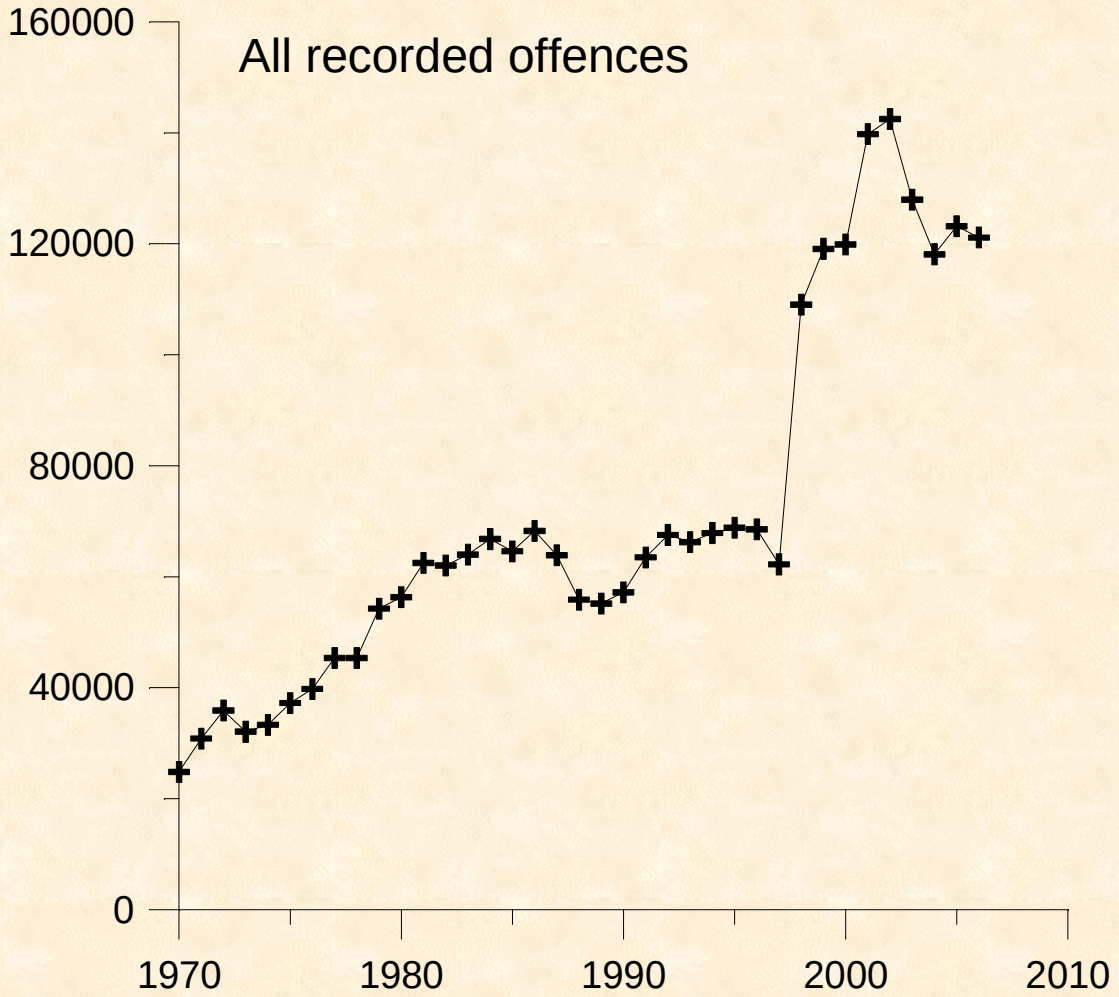
A change: crime in Northern Ireland

Since mid-1997, the main paramilitary group, the Provisional IRA, has observed a ceasefire.

[Wikipedia]



http://epp.eurostat.ec.europa.eu/

A change: divorces in USA

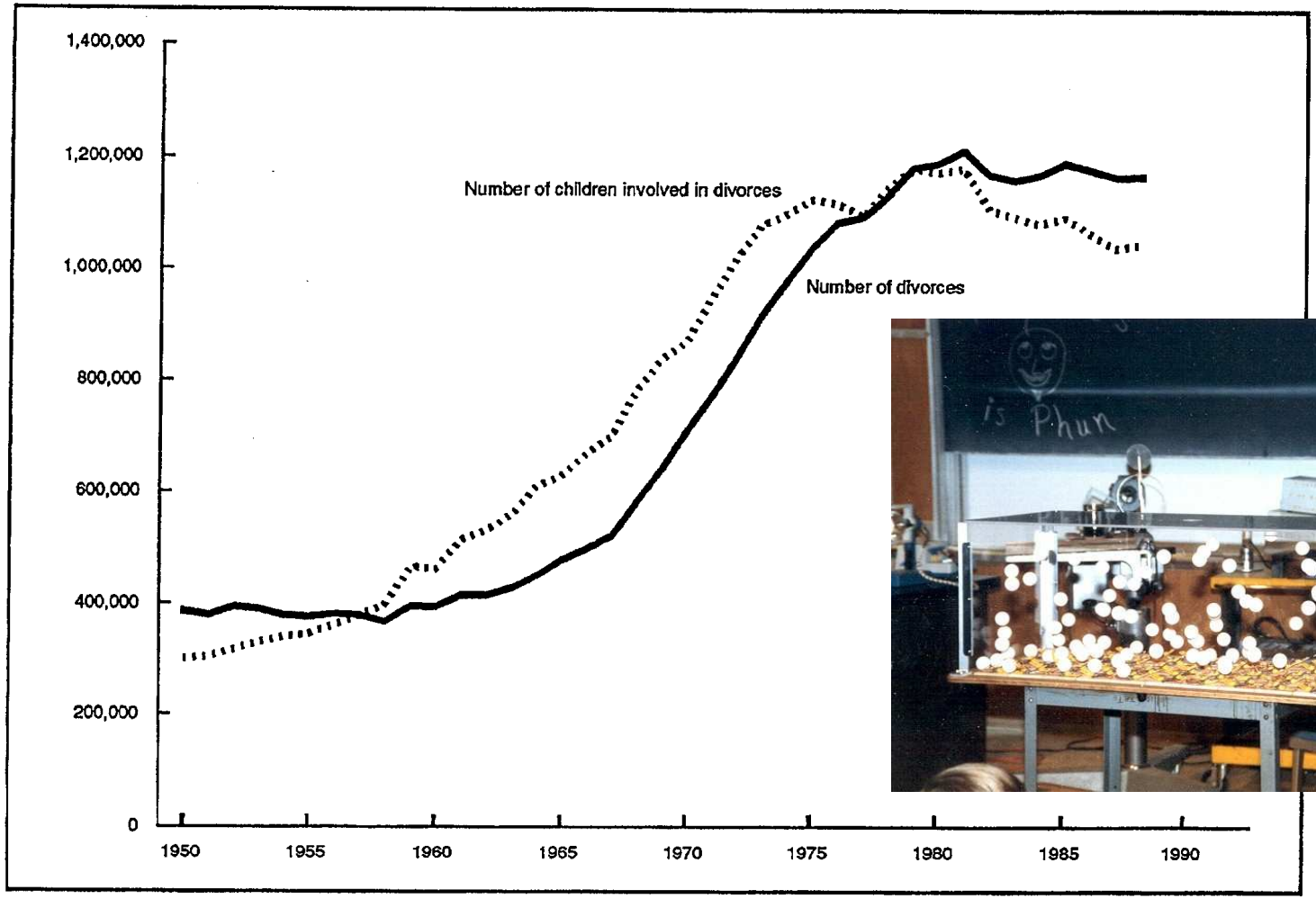
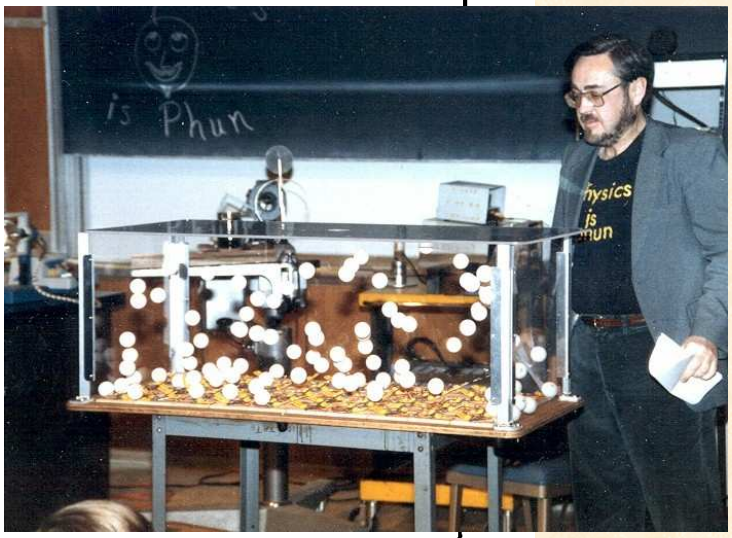


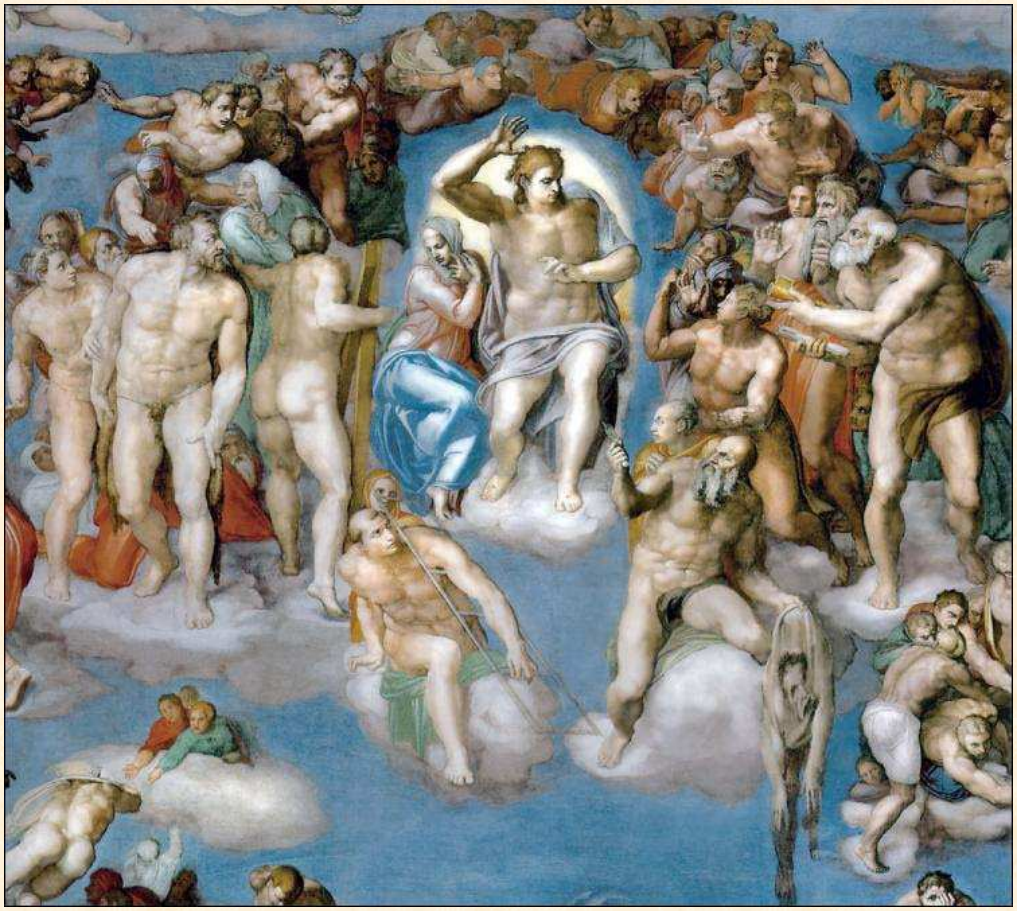
Figure 1. Estimated number of divorces and children involved in divorces: United States, 1950–88



[Monthly Vital Statistics Report, Vol. 39 No 12 Suppl. 2, May 21, 1991; www.physics.umd.edu]

And he shall set the sheep on his right hand, but the goats on the left
[King James Bible, Matthew 25:33]

How a norm cannot be restored:



...- this division is not recommended BEFORE the end of time.

final comments

Our examples suggest that indeed a separation of roles can be relevant. One cannot:

- be a murderer and punish crime,
- be a teetotaller and punish abstaining from drinking,
- use his gun from IRA to rob banks and punish this,
- divorce and punish divorcing.

Once a group of defectors appears, punishment is no more evolutionarily stable.

It is less clear if non-punishers could be classified as defectors. This is true with crimes, but what about non-drinking vodka? In the last case a sexual promiscuity seems to be a better group trait than the formal divorce.

a norm ≡ to punish ?

Ευχαριστώ