# SUPPORTING INFORMATION – TEXT S1

# From Local to Global Dilemmas in Social Networks

Flávio L. Pinheiro[1], Jorge M. Pacheco[2,1] and Francisco C. Santos[3,1, ‡]

[1] ATP-group, CMAF, Instituto para a Investigação Interdisciplinar, P-1649-003 Lisboa Codex, Portugal.

[2] Departamento de Matemática e Aplicações, Universidade do Minho, 4710 - 057 Braga, Portugal.

[3] Departamento de Engenharia Informática, Instituto Superior Técnico, Av. Rovisco Pais, 1, 1049-001 Lisboa, Portugal.

[‡] **Corresponding Author**: Francisco C. Santos, ATP-Group, Centro de Matemática e Aplicações Fundamentais, Complexo Interdisciplinar da Universidade de Lisboa, Av. Prof. Gama Pinto, 2,1649-003 Lisboa, Portugal, email: xsantos@gmail.com; tel: +351.21.7904891; fax:+351.21.7954288/89

## Evolutionary steady states in homogeneous networks

As we argue in the main text, the shape of the time independent $G^A(j)$ obtained for homogeneous networks indicates that these topologies induce a co-existence game dynamics in a population of individuals engaging in a Prisoner's Dilemma (**PD**). Moreover, the stationary regime is associated with the interior root of $G^A(j)$. Thus, it is reasonable to expect that the stable roots of $G^A(j)$ will coincide with the steady states obtained from computer simulations carried out on the same networks.

In Fig. S1 we compare the interior roots of $G^A(j)$ (circles) with the stationary states (lines) obtained via computer evolutions [1-5] carried out for several values of the benefit ***B*** and for homogenous networks, ranging from ordered lattices (*Lattice*) to random networks (*HoRand*). Fig. S1 confirms that the information offered by $G^A(j)$ remains valid and strikingly accurate for a broad range of game parameters for both types of networks. In accord with the results in the main text, the stationary states were computed for networks with $N$=1000 individuals and an average connectivity of $z$=4. As before, each individual revise his or her strategy adopting the one of a randomly selected neighbour with probability given by the Fermi function (see Methods) [2,6]. Each equilibrium fraction of cooperators in a simulation was obtained by averaging over 500 generations after a transient period of $10^4$ generations starting from 50% of ***C***s randomly placed on the network. Both red and black lines in Fig. S1 correspond to a subsequent average over $10^4$ simulations.

$G^A(j)$ and its interior roots (full circles in Fig. S1) were computed for the same game and network parameters by averaging $G^A(j,t)$ over 100 generations after a transient of 50 generations (see Methods for details of computation of $G^A(j,t)$).

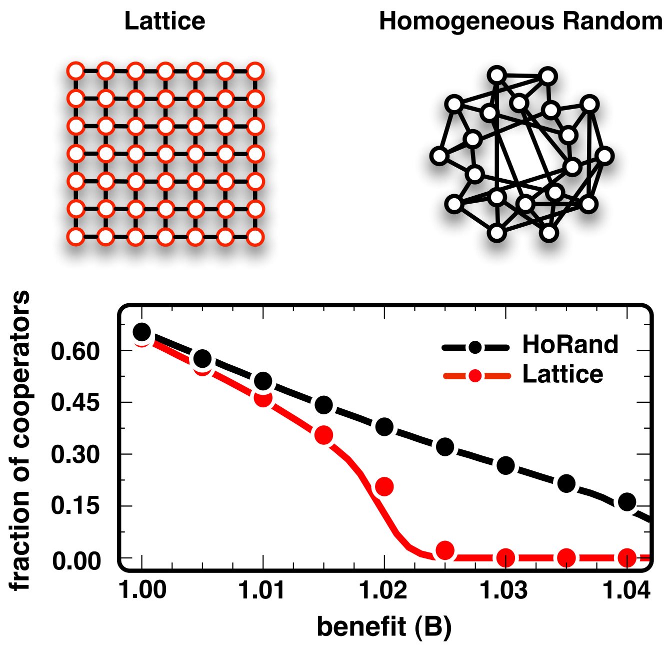


**Fig.S1.** Evolutionary dynamics cooperation in homogeneous networks. We plot the interior roots $x_R$ of $G^A(j)$ (circles) for a **PD** (*T=B*, *R=1*, *P=0*, *S=1-B*) in homogeneous networks, from random networks (black circles) to ordered lattices (red circles), as a function of the benefit *B*. $G^A(j)$ indicates that the population evolves towards a stationary fraction $x_R$ of ***C***s. This is confirmed by the stationary states (lines) obtained via computer simulations starting from 50% of ***C***s and ***D***s randomly placed in each network. ($N=10^3$, $k=4$ and $\beta=0.1$).

## References

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