The HCO model of social norm violation and punishment

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We analyze the population dynamics of social-norm-violating (corrupt) behaviors when social punishment is present, with the use of a simple compartmental model where social agents can be in three possible states: *honesty, corruption and ostracism* (social isolation), wherefrom the name HCO.

Most of the litterature on modeling corruption is framed in either classical or evolutionary game theory. At least in the simplest game-theoretical settings, the *honest versus corrupt* behavioral dilemma is somewhat identified with the *cooperator versus defector* strategic dilemma, which has become the standard interpretation of the two-person-two-strategies normal form of games (Prisoner's dilemma, Stag-hunt, etc.) or group games (Public goods). Nonetheless, the generalization to $n \geq 3$ strategies is needed if punishment (the hallmark of norm violation) has to be introduced in a stronger way than a mere penalty in the benefit received by wrongdoers. Besides, the incorporation of social ingredients eventually relevant through payoff matrix coefficients easily leads to the practical difficulties posed by a large parametric space and strategic space that often render impractical a desirable thorough analysis of model computations.

The HCO model [1] adopts a different, almost minimalistic approach, where norm-violating behavior is not assumed to be a greedy strategy in a population game dynamics, but a simpler formal entity: an infectious state. The transitions from honesty to corruption and from corruption to ostracism are modeled as pairwise interactions, i.e. honest agents can imitate corrupt peers while corrupt individuals pass to ostracism due to the delation by honest acquaintances. These *corruption and delation flows* are assigned transition probabilities that are functions of the local environmental states. Individuals in the state of ostracism do not interact and transit to the honest state at a constant rate.

On top of this basic modeling framework one can easily incorporate different social ingredients in order to analyze their relevance and effects into the stationary states of the social dynamics, by e.g. incorporating additional compartmental flows or judiciously modifying the transition probability functions. The structure (network) of agents' contacts can be chosen at will.

After introducing the HCO model and presenting results (obtained through stochastic simulations and different approximations) that incorporate a variety of social ingredients (e.g. warning to wrongdoers [1], social intimidation [2], among others), I will discuss an interesting extension of the model, where two different "gangs of corruption" are allowed to compete each other [3].

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[1] Dan Lu, F. Bauzá, D. Soriano-Paños, J. Gómez-Gardeñes, and L.M. Floría, , Phys. Rev. E **101**, 02336 (2020).

[2] F. Bauzá, D. Soriano-Paños, J. Gómez-Gardeñes, and L.M. Floría, Chaos **30**, 063107 (2020).

[3] H. Pérez-Martínez, F. Bauzá, D. Soriano-Paños, J. Gómez-Gardeñes, and L.M. Floría (submitted).