

## Spotlight presentation draft

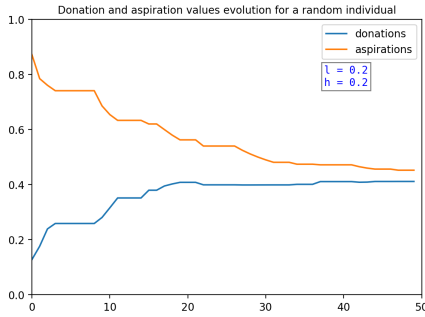
## The emergence of altruism as a social norm

20 March 2020

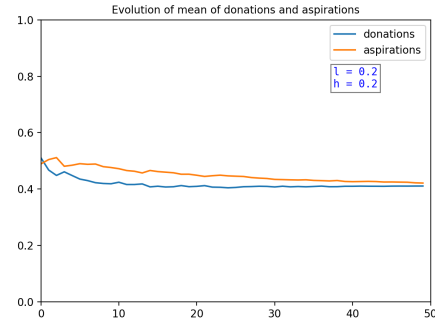
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In this work, I have implemented the code needed to replicate the paper by [Pereda et al.: The emergence of altruism as a social norm](#). Models exposed in this paper have been developed with Python, in an object oriented design where we can find two kind of objects, coming from the classes **Individual**, representing the agents, and **PairEnvironment**, composed by two objects from **Individual**, and where methods defining the interaction between them are implemented.

Code has been implemented in order to allow for keeping the donations and aspirations evolution for every agent (see Figure 1a) and therefore for keeping the widespread behavior of the whole society. This common evolution will be represented by the evolution of the mean of all the donations and aspirations over the iterations (see Figure 1b).

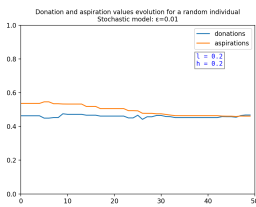


(a) Evolution of donation and aspiration values over iterations for a random individual, for deterministic model, for a concrete values of  $l$  (learning rate) and  $h$  (habituation parameter)

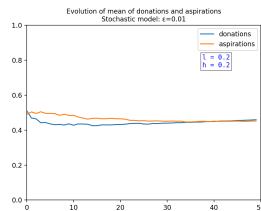


(b) Evolution of the mean of all donations and aspirations given in the whole society, over iterations, for deterministic model, for a concrete values of  $l$  (learning rate) and  $h$  (habituation parameter)

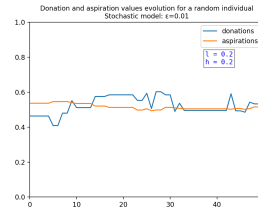
All models exposed in the paper have been implemented: Deterministic model, stochastic model and the model extensions, including the incorporation of envious agents and *free-riders*. Results obtained are pretty similar to the ones exposed in the paper: For the stochastic model with a low *trembling hand* ( $\varepsilon = 0,01$ ), results are very similar to the ones found with the deterministic model (see Figures 2a and 2b). Differences appear when *trembling hand* is increased ( $\varepsilon = 0,1$ ) (see Figures 2c and 2d).



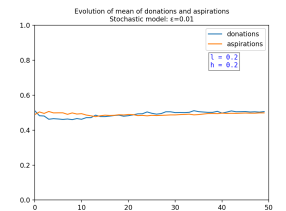
(a) Evolution of donation and aspiration values over iterations for a random individual, for stochastic model ( $\varepsilon = 0,01$ ), for a concrete values of  $l$  (learning rate) and  $h$  (habituation parameter)



(b) Evolution of the mean of all donations and aspirations given in the whole society, over iterations, for stochastic model ( $\varepsilon = 0,01$ ), for a concrete values of  $l$  (learning rate) and  $h$  (habituation parameter)

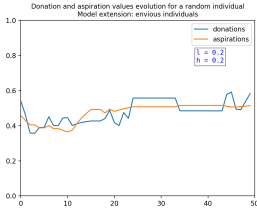


(c) Evolution of donation and aspiration values over iterations for a random individual, for stochastic model ( $\varepsilon = 0,1$ ), for a concrete values of  $l$  (learning rate) and  $h$  (habituation parameter)

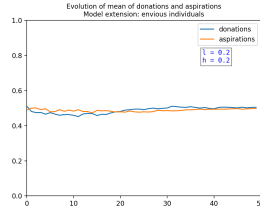


(d) Evolution of the mean of all donations and aspirations given in the whole society, over iterations, for stochastic model ( $\varepsilon = 0,1$ ), for a concrete values of  $l$  (learning rate) and  $h$  (habituation parameter)

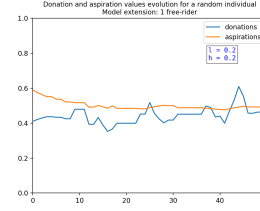
For the model extensions, envious behavior has been introduced by a probability of being envious of 0,05 for every agent (see Figures 3a and 3b). *Free-rider* behavior has been incorporated by introducing 1 *free-rider* (see Figures 3c and 3d).



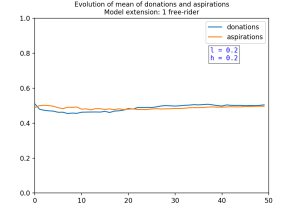
(a) Evolution of donation and aspiration values over iterations for a random individual, for model extension (probability of being envious equal to 0,05), for a concrete values of 1 (learning rate) and  $h$  (habituation parameter)



(b) Evolution of the mean of all donations and aspirations given in the whole society, over iterations, for model extension (probability of being envious equal to 0,05), for a concrete values of 1 (learning rate) and  $h$  (habituation parameter)

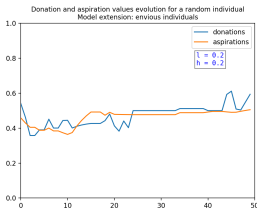


(c) Evolution of donation and aspiration values over iterations for a random individual, for model extension (1 *free-rider*), for a concrete values of 1 (learning rate) and  $h$  (habituation parameter)

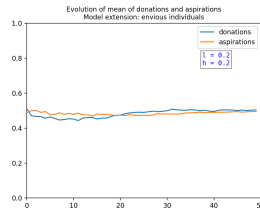


(d) Evolution of the mean of all donations and aspirations given in the whole society, over iterations, for model extension (1 *free-rider*), for a concrete values of 1 (learning rate) and  $h$  (habituation parameter)

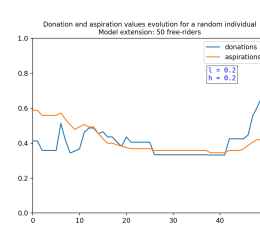
As we can see, results are different from the ones obtained for the stochastic model, but not such dramatic as we could expect. But if we increase the probability of being envious (see Figures 4a and 4b) and the number of *free-riders* (see Figures 4c and 4d), we can observe this expected drastic change.



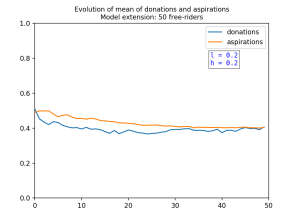
(a) Evolution of donation and aspiration values over iterations for a random individual, for model extension (probability of being envious equal to 0,2), for a concrete values of 1 (learning rate) and  $h$  (habituation parameter)



(b) Evolution of the mean of all donations and aspirations given in the whole society, over iterations, for model extension (probability of being envious equal to 0,2), for a concrete values of 1 (learning rate) and  $h$  (habituation parameter)



(c) Evolution of donation and aspiration values over iterations for a random individual, for model extension (50 *free-riders*, 10% of the society), for a concrete values of 1 (learning rate) and  $h$  (habituation parameter)



(d) Evolution of the mean of all donations and aspirations given in the whole society, over iterations, for model extension (50 *free-riders*, 10% of the society), for a concrete values of 1 (learning rate) and  $h$  (habituation parameter)

More details and results with a wider diversity of parameters (for instance, variability of learning rate and habituation parameter) will be exposed in the final presentation.