

# Why Is Ethnocentrism More Common Than Humanitarianism?

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## Abstract

A compelling agent-based computer simulation suggests that ethnocentrism, often thought to rely on complex social cognition and learning, may have arisen through biological evolution (Hammond & Axelrod, 2006). From a neutral start, ethnocentric strategies evolve to dominate other possible strategies (selfish, traitorous, and humanitarian) that differentiate patterns of cooperation with in-group and out-group agents. We present new analyses and simulations to clarify and explain this outcome by formulating and testing two hypotheses for explaining how ethnocentrism eventually dominates its closest competitor, humanitarianism. Results indicate support for the *direct* hypothesis that ethnocentrics exploit humanitarian cooperation along the frontiers between ethnocentric and humanitarian groups as world population saturates. We find very little support for the contrasting *free-rider-suppression* hypothesis that ethnocentrics are better than humanitarians at suppressing non-cooperating free riders, although both hypotheses correctly predict a close temporal relation between population saturation and ethnocentric dominance.

**Keywords:** Ethnocentrism; humanitarianism; selfishness; traitorousness; cooperation; defection; Prisoner's Dilemma; evolution; agent-based simulation; minimal cognition.

## Introduction

Ethnocentrism, the tendency to favor one's own group, is implicated in a wide variety of important phenomena from voting patterns to ethnic discrimination and armed conflict (Chirof & Seligman, 2001; Kinder, 1998; van der Dennen, 1995). Many social scientists believe that ethnocentrism derives from cultural learning and depends on considerable social and cognitive abilities (Hewstone, Rubin, & Willis, 2002; LeVine & Campbell, 1972; Sherif, 1966). However, this view is inconsistent with evidence that ethnocentrism is common throughout a diverse range of animal (Keller & Ross, 1998), plant (Dudley & File, 2007), and single-celled species (Lenski & Velicer, 2000). Such evidence suggests that ethnocentrism may have a basis in biological evolution and that it requires fairly minimal cognition. The ability to distinguish in- vs. out-group members and select different behaviors based on that distinction may suffice.

A recent computer simulation with simple abstract agents demonstrates that ethnocentrism can indeed originate

through evolutionary processes (Hammond & Axelrod, 2006). Agents could either defect against, or cooperate with, other in-group or out-group agents, creating four possible strategies: (1) a selfish strategy of universal defection, (2) a traitorous strategy of cooperation with out-group, but not in-group, agents, (3) an ethnocentric strategy of in-group cooperation and defection against agents from different groups, and (4) a humanitarian strategy of universal cooperation.

From a neutral starting point, ethnocentrism evolved to become the dominant strategy, eventually characterizing about 75% of the population, a figure intriguingly close to the incidence of in-group favoritism found in young Canadian children (Aboud, 2003). Ethnically-fueled human conflicts stretch far back into history, are still quite common, and with the waning of the ideologically-motivated cold war, are predicted to be the major source of armed inter-group aggression through the foreseeable future (Huntington, 1993; Kaufmann, 1996).

In this paper, we try to understand how and why ethnocentrism is favored by evolution. First we describe the original simulation that found cooperation to be largely restricted to within-group interactions and then we propose and test two hypotheses that might explain this pattern of ethnocentric dominance.

## The Original Simulation

Interacting agents in virtually any social situation have a basic decision to make, namely whether to cooperate with each other or not. Such interactions have been well characterized in evolutionary game theory, where the opposite of cooperation is usually termed *defection*. The most common game used to study such interactions is the Prisoner's Dilemma (PD). In PD games, two agents decide, independently of the other's decision, whether to cooperate with or defect against the other. In relatively abundant environments with some degree of specialization, the cost of cooperating is less than the benefit of receiving another's cooperation. Table 1 presents the actual payoffs for PD interactions in the original simulation (Hammond & Axelrod, 2006), each payoff being computed as benefit

minus cost for each agent. In this simulation, benefit (.03) is three times as large as cost (.01).

The reward  $R$  for mutual cooperation is  $.03 - .01 = .02$  for each agent. Punishment  $P$  for mutual defection is  $0 - 0 = 0$  for each agent. The other two cells, in which one agent cooperates and the other defects, have asymmetrical outcomes. The cooperating agent gets the so-called sucker's payoff  $S$   $0 - .01 = -.01$ , and the defector receives the temptation for defecting  $T$  of  $.03 - 0 = .03$ . PD games are defined by the following inequality:  $T > R > P > S$ . Actual numerical values can vary as long as this inequality holds.

Table 1: Characteristics of a PD game.

|                   | B Cooperate                 | B Defect                    | Mean <sub>A</sub> |
|-------------------|-----------------------------|-----------------------------|-------------------|
| A Cooperate       | $R_A = .02$<br>$R_B = .02$  | $S_A = -.01$<br>$T_B = .03$ | .005              |
| A Defect          | $T_A = .03$<br>$S_B = -.01$ | $P_A = .00$<br>$P_B = .00$  | .015              |
| Mean <sub>B</sub> | .005                        | .015                        |                   |

The marginal means in Table 1 reveal that individual agents can do three times better by defecting than by cooperating. The well known paradox of cooperation is that, even though the optimal strategy for each individual agent is defection, many agents cooperate (Axelrod & Hamilton, 1981). One particularly interesting explanation of this paradox is that cooperation was selected through biological evolution. The simulation shows that this cooperation is strongly ethnocentric: agents largely restrict their cooperation to members of their own group, who also happen to be the agents with whom they are most likely to interact (Hammond & Axelrod, 2006).

In the simulation, agents possess four simple traits: one of four perceivable tags identifiable to themselves and others, a strategy toward agents possessing the same tag (cooperate or defect), a strategy toward agents with a different tag (again, cooperate or defect), and a probability of reproduction by cloning an offspring (initially set to .12). The agents come to populate a  $50 \times 50$  lattice, with each cell containing at most one agent at a time. Agents do not move and can only interact with agents, if any, in the four neighboring cells. An agent has a chance, its reproductive potential, to generate a clone into an empty neighboring cell. All this creates a so-called *viscous* environment allowing only local interactions. The edges of the lattice wrap around to create a torus (donut) shape, to ensure that each location has the same number of potential neighbors.

Each simulation starts with the lattice empty and runs for 2000 cycles, because stable evolutionary patterns arise well before that point. Each evolutionary cycle has four phases: immigration, interaction, reproduction, and death. In the immigration phase, a new agent is created, with randomly assigned traits for tag and strategy, and placed at a randomly selected empty location somewhere in the lattice. In the interaction phase, each agent's reproductive potential is first set to the default value of .12. Then each agent interacts

with each of its neighbors (up to four) in a one-time PD game in which each agent independently chooses to cooperate or defect based on their own strategy and tag and the tag of the other agent. If an agent cooperates, its reproductive potential is reduced by cost and the reproductive potential of the recipient agent is increased by benefit, as in Table 1.

In a randomized order, each agent is given a chance, based on its current reproductive potential, to clone an offspring if an adjacent empty space is available. Any such clone inherits the parental traits, with each trait (tag, in-group strategy, out-group strategy) subject to a small mutation rate (default value .005). Strategy traits can mutate by switching values (cooperate to defect or vice versa). Tags can mutate to any one of the three other tags with equal probability. In the last phase, death, each agent has a chance of expiring equal to the death rate (default value of .10), which would result in removal from the lattice.

Hammond and Axelrod (2006) found that the average proportions of the four strategies during the last 100 of 2000 evolutionary cycles were .08 selfish, .02 traitorous, .75 ethnocentric, and .15 humanitarian. This outcome was not much affected by doubling and halving of the key parameters, namely lattice size, number of cycles, number of tags, and the benefit and cost of cooperation. Thus, evolution of ethnocentrism is quite robust and not merely a knife-edge phenomenon.

Whereas Hammond and Axelrod (2006) focused only on the last 100 cycles, a follow-up simulation analyzed the distribution of strategies during each evolutionary cycle, testing for the statistically significant dominance of any particular strategy in each evolutionary cycle (Shultz, Hartshorn, & Hammond, 2008). Although the ethnocentric strategy eventually came to dominate all 50 simulated worlds, about one half of the worlds had an early stage of prolonged humanitarian dominance.

An important feature of these simulations is the evolving spatial clustering of agents possessing the same tag and strategy. This is illustrated in Figure 1 for a world with a smaller,  $25 \times 25$  lattice (to better fit the available space), plotted at the 250<sup>th</sup> evolutionary cycle. Tags are represented here by different colors. Strategies are indicated by their first letter: *s* for selfish, *t* for traitorous, *e* for ethnocentric, and *h* for humanitarian. These evolving spatial clusters of homogeneous strains are a function of an abundant and viscous environment and small mutation rate. The clusters are, in turn, critical in the evolution of adaptive strategies. Essentially, agents produce offspring of the same kind in neighboring locations, and fitter agents (i.e., those who do well in PD interactions with their neighbors) are more likely to reproduce, thus winning competitions for placing their own offspring into empty spaces.

### Hypotheses for Ethnocentric Dominance

In this paper, we attempt to understand why ethnocentrism comes to dominate over its closest competitor – humanitarianism. The *direct* hypothesis is that

predominantly ethnocentric groups directly suppress groups of predominantly humanitarian agents with whom they come into contact. This is because humanitarians cooperate across group lines while ethnocentrics do not. Thus, from these interactions along the group frontier, humanitarians receive the disadvantageous sucker's payoff while ethnocentrics receive the favorable temptation payoff (see Table 1). The contrasting *free-rider-suppression* hypothesis is that predominantly ethnocentric groups are uniquely effective at suppressing groups of predominantly free riders. The quintessential free riders are selfish agents who benefit from receiving cooperation without incurring the cost of giving cooperation, thus receiving the relatively high temptation payoff when they interact with a cooperating agent. Agents with traitorous strategies free ride within their own group, but not across groups. Thus, in intergroup interactions, ethnocentrics are less vulnerable to predominantly selfish groups than humanitarians are, essentially because ethnocentrics do not cooperate across group boundaries like humanitarians do. Both ethnocentric and humanitarian groups benefit from intergroup cooperation from traitors, but ethnocentrics more so because ethnocentrics do not cooperate with these traitors while humanitarians do.

Hammond and Axelrod (2006) discussed similar interaction dynamics for ethnocentric suppression of free riders, but because these dynamics do not favor ethnocentrics over humanitarians, they are not relevant to our current concern with explaining how ethnocentric strategies come to dominate over humanitarian ones. Both ethnocentric and humanitarian groups would be equally susceptible to free riders (whether selfish or traitorous) inside their own group. Ethnocentrics and humanitarians would both cooperate with these similar-looking free riders but would not receive cooperation from them, thus incurring the disadvantageous sucker's payoff.

In this paper, we test our two hypotheses by eliminating from 1 to 3 of the 4 possible strategies in order to better isolate competitions between strategies, and by examining patterns of correlations and partial correlations between strategy populations in the full, four-strategy simulation. The free-rider-suppression hypothesis predicts better intergroup suppression of free riders by ethnocentrics than by humanitarians and that this is responsible for ethnocentric dominance. The direct hypothesis predicts that suppression of free riders is irrelevant and that the key factor is direct exploitation of humanitarians by non-cooperating ethnocentrics. Both hypotheses predict a close temporal coincidence of ethnocentric dominance with population saturation because interaction between groups increases as the world fills up.

### Study 1: Timing of Ethnocentric Dominance

Here we assess temporal coincidence between population saturation and the beginnings of the eventual separation of the frequencies of ethnocentric and humanitarian strategies. Both the direct and free-rider-suppression hypotheses

predict a close temporal relation between the beginning of ethnocentric dominance and population saturation.

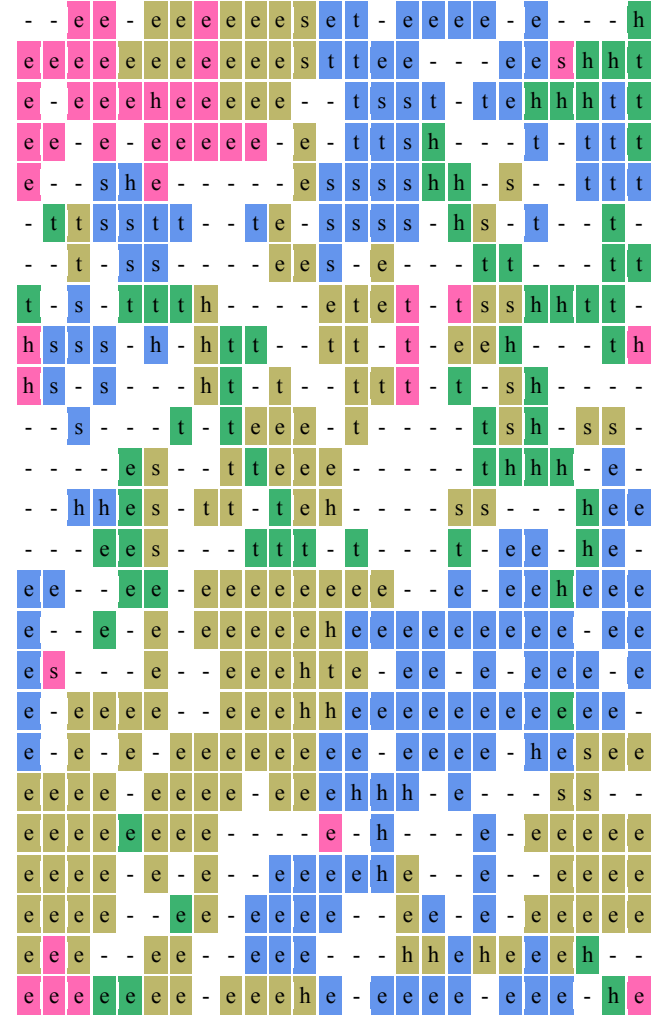


Figure 1: Strategies and groups in world 2 at 250 cycles (Shultz et al., 2008).

### Method

For this study, we reanalyze the 50-world simulation of Shultz et al. (2008), recording the numbers of agents with each of the four strategies and total world populations across the first 1000 evolutionary cycles.

### Results

Mean strategy frequencies across the 50 worlds are plotted in Figure 2. Humanitarian strategies compete well with ethnocentric strategies early on, but at about 300 cycles, strategy frequencies begin to separate, with humanitarians decreasing and ethnocentrics continuing to expand.

A similar plot of mean population sizes in this simulation in Figure 3 reveals that this strategy split coincides with saturation of world population. As world population (the sum of all existing agents) saturates at just under 1600

agents at about 300 cycles, humanitarians begin to drop off, relative to ethnocentric agents.

## Discussion

These results are consistent with both hypotheses, because they both require interaction between adjacent groups. As the world fills in, the different groups collide and compete for the remaining space.

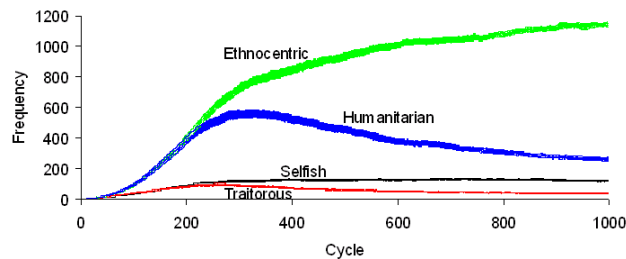


Figure 2. Mean strategy frequencies in 50 worlds  $\pm$ SE.

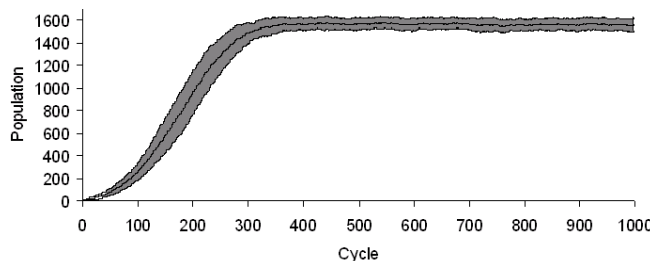


Figure 3. Mean population size in 50 worlds  $\pm$ SE.

## Study 2: Correlations between Strategies

With the data in Study 1, we computed correlations between mean strategy populations across cycles both before and after population saturation. Up to cycle 300, correlations are uniformly highly positive because all populations are still growing. After cycle 300, the correlation patterns become more interesting. As predicted by both the direct and free-rider-suppression hypotheses, the correlation between ethnocentric and humanitarian strategies is highly negative ( $-.992$ ). Importantly, this correlation is unaltered after partialling out correlations with selfish strategies and it remains strongly negative ( $-.764$ ) after partialling out correlations with traitorous strategies.

Selfish strategies correlate with ethnocentric strategies at  $.302$  and with humanitarian strategies at  $-.285$ . Traitorous strategies correlate with ethnocentric strategies at  $-.993$  and with humanitarian strategies at  $.982$ . Due to the high degrees of freedom (698), all these correlations are highly significant,  $p < .001$ .

The partial correlations suggest that the decline of humanitarians is due to direct exploitation by ethnocentrics and is not mediated by any humanitarian deficiencies in suppressing selfish or traitorous agents, as predicted by the free-rider-suppression hypothesis.

## Study 3: Partial Strategy Sets

Here, in new simulations, we test every possible combination of the four strategies independently. This includes testing each strategy individually, all six strategy pairs, and all four strategy triples. The idea is to see whether certain strategies finish differently in the absence of other strategies, and thus to highlight interaction dynamics that can be missed with full four-strategy simulations. Here we focus particularly on strategy combinations that include either humanitarianism or ethnocentrism competing against the free-rider strategies of selfishness and traitorousness. The issue is whether ethnocentrism suppresses free riders better than humanitarianism does, as predicted by the free-rider-suppression hypothesis. In contrast, the direct hypothesis does not predict such differences.

## Method

The simulations are identical to Hammond and Axelrod's (2006) original simulation, except that immigration and mutation are restricted so that all strategies fall within the particular subset of strategies being tested. In every evolutionary cycle, a new immigrant is created with random in-group and out-group strategy traits. If these traits result in a strategy that is disallowed, that agent is aborted and a new agent is created with new random strategy traits. This process is iterated until an immigrant with an allowed strategy is created.

Mutations are treated in similar fashion. Offspring inherit parental traits with each trait subject to a mutation rate of  $.005$ . If a particular mutation produces an offspring with a disallowed strategy, that mutation is ignored.

For each combination of allowed strategies, we record the mean number of agents possessing each strategy over the last 100 of 2000 cycles, and average those over 10 worlds.

## Results

Regardless of which strategies are excluded, the final frequency distribution of strategies nearly always obeys the same ordering as in the original Hammond and Axelrod (2006) simulation: ethnocentric  $>$  humanitarian  $>$  selfish  $>$  traitorous. The one exception is in the simulation without ethnocentrism (humanitarian-selfish-traitorous simulation), where traitorous agents perform better than selfish agents.

Critical to the free-rider-suppression hypothesis is the extent to which humanitarians thrive in the absence of ethnocentrism. In simulations without ethnocentrism, humanitarianism dominates in a manner similar to ethnocentrism. Figure 4 plots the mean frequency of each strategy in the ethnocentric-selfish-traitorous and humanitarian-selfish-traitorous simulations. In those two simulations, humanitarians perform similarly to ethnocentrics by greatly outperforming both traitorous and selfish agents. Although a  $3 \times 2$  chi-square test of the frequencies in Figure 4 is statistically significant,  $\chi^2(2) = 73$ ,  $p < .001$ , suggesting that ethnocentrics might suppress traitors a bit more than humanitarians do,  $\chi^2(1) = 72$ ,  $p < .001$ , this does not diminish the numbers of humanitarians

relative to ethnocentrics,  $X^2(1) = 0.04$ , *ns*, or the numbers of selfish agents when humanitarians or ethnocentrics are included in the simulation,  $X^2(1) = 2.45$ , *ns*. In short, in the absence of ethnocentric strategies, humanitarians dominate either traitorous or selfish agents about as effectively as ethnocentrics do when humanitarian strategies are excluded.

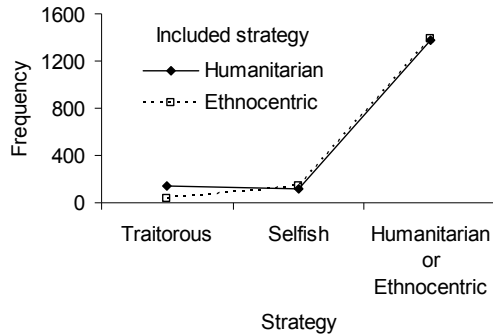


Figure 4: Mean strategy frequencies in the ethnocentric-selfish-traitorous and humanitarian-selfish-traitorous simulations.

Figure 5 plots the mean frequency of each strategy in the humanitarian-traitorous and ethnocentric-traitorous simulations. A 2x2 chi-square test on these strategy frequencies is insignificant,  $X^2(1) = .08$ , *ns*. Humanitarian agents are just as effective against traitorous agents as ethnocentric agents are.



Figure 5: Mean strategy frequencies in humanitarian-traitorous and ethnocentric-traitorous simulations.

Figure 6 reveals an analogous finding for the humanitarian-selfish and ethnocentric-selfish simulations. A 2x2 chi-square test on these strategy frequencies is insignificant,  $X^2(1) = .002$ , *ns*. Humanitarian agents are as effective against selfish agents as ethnocentric agents are.

Finally, even in isolation, ethnocentrics and humanitarians perform much better than selfish and traitorous agents, as shown in Figure 7. The overall 4x1 chi-square for the frequency of each strategy in isolation is highly significant,  $X^2(3) = 579$ ,  $p < .001$ . Ethnocentrics and humanitarians both do better than either selfish or traitorous agents,  $X^2(1) > 128$ ,  $p < .001$ . Traitorous agents also perform better than selfish

agents,  $X^2(1) = 78$ ,  $p < .001$ . However humanitarians and ethnocentrics do not differ from each other,  $X^2(1) = 2.39$ , *ns*.

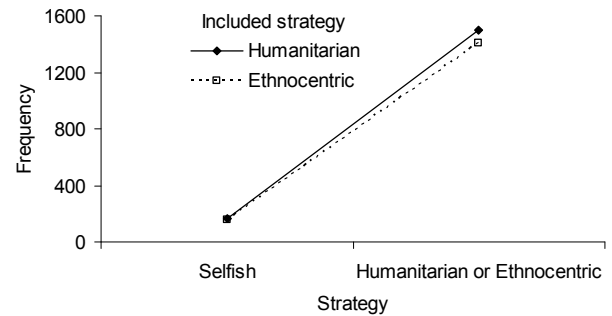


Figure 6: Mean strategy frequencies in the humanitarian-selfish and ethnocentric-selfish simulations.

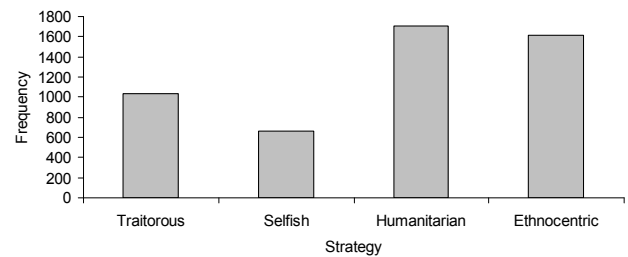


Figure 7: Mean frequencies of isolated strategies.

## Discussion

The results of these restricted strategy-set simulations contradict the predictions of the free-rider-suppression hypothesis. In contrast to the notion that humanitarians cannot effectively suppress free riders, humanitarians do just as well against selfish and traitorous agents as ethnocentrics do. This is consistent with the contrasting direct hypothesis in that the chief difficulty that humanitarians have is in competing with ethnocentrics. It seems that free riders do an effective job of suppressing their own gene pool, essentially by not cooperating with their own kind, including particularly their own offspring and parents.

## General Discussion

Both the direct and free-rider-suppression hypotheses correctly predict the temporal coincidence between population saturation and the beginnings of ethnocentric dominance over humanitarianism. Our correlation analysis and restricted strategy-set simulations support the direct hypothesis for explaining eventual ethnocentric dominance over humanitarianism. Because these two strategies are behaviorally identical when interacting within groups, ethnocentrism's advantage must result from between-group interactions. Along group borders, humanitarians cooperate while ethnocentrics do not. This provides a slight reproductive advantage for border-dwelling ethnocentrics,

who obtain the benefit of humanitarian cooperation while donating nothing across group lines. Ethnocentric agents are thus more likely to succeed in competition for remaining space along these borders.

Consistent with this direct hypothesis and against the free-rider-suppression hypothesis, strongly negative correlations between frequencies of ethnocentric and humanitarian strategies remain that way after partialling out correlations with free-rider strategies, either selfish or traitorous. The dominance of ethnocentrism over humanitarianism does not depend on the mediating effects of suppression of free riders.

The free-rider-suppression hypothesis is also contradicted by the finding that traitorous and selfish agents still perform poorly in the absence of ethnocentrism. Ethnocentrics are not any better than humanitarians at overcoming free riders. Although ethnocentrics have the ability to suppress free riders in neighboring groups, this potential may never be strongly realized due to the self-limiting characteristics of free riding.

In restricted-strategy-set simulations, when ethnocentric strategies are disallowed, the final concentration of humanitarians is similar to that of ethnocentrics in the full four-strategy simulation. Moreover, concentrations of selfish and traitorous agents remain more or less unchanged, whether interacting with ethnocentric or humanitarian strategies. Pointedly, in these restricted-strategy simulations, selfishness and traitorousness fare poorly against either humanitarian or ethnocentric strategies. Although it can be hazardous to be humanitarian, this is mainly due to exploitation by ethnocentrics rather than by free riders.

So what does limit free riders then? In this type of abundant and viscous environment, free riders do a fairly good job of limiting themselves. In our simulations run with only selfish or only traitorous agents, the final number of agents is about half that of simulations run with only ethnocentric or humanitarian agents. Selfish and traitorous groups reproduce at a lower rate because they most likely produce offspring who likewise fail to cooperate with their own kind. In addition, perhaps ethnocentric and humanitarian groups suppress selfishness and traitorousness indirectly by occupying space faster, thus leaving less room for those free riders.

It is noteworthy that the cognition employed by our simple digital agents is quite simple. The function in our computer code that implements an agent's decision to cooperate or defect is written as a nested conditional that takes account of whether the donor and recipient are members of the same group and the donor's strategies for in-group and out-group interactions. If the donor and recipient are in same group, then if the donor's strategy is to cooperate within its group, then the donor cooperates; otherwise it defects. But if the donor and recipient are in different groups, then if the donor cooperates outside of its group, then the donor cooperates; otherwise it defects. There is a separate function to compute whether the donor and

recipient agents are from the same group, in terms of whether they possess the same tags.

Although relatively simple, this sort of nested conditional action does not seem to be beyond the pale of what contemporary cognitive science regards as cognition. Furthermore, this research brings cognition into a social and evolutionary context that should be interesting to explore further.

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