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More 'altruistic' punishment in larger societies

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If individuals will cooperate with cooperators, and punish non-cooperators even at a cost to themselves, then this strong reciprocity could minimize the cheating that undermines cooperation. Based upon numerous economic experiments, some have proposed that human cooperation is explained by strong reciprocity and norm enforcement. Second-party punishment is when you punish someone who defected on you; third-party punishment is when you punish someone who defected on someone else. Third-party punishment is an effective way to enforce the norms of strong reciprocity and promote cooperation. Here we present new results that expand on a previous report from a large cross-cultural project. This project has already shown that there is considerable cross-cultural variation in punishment and cooperation. Here we test the hypothesis that population size (and complexity) predicts the level of third-party punishment. Our results show that people in larger, more complex societies engage in significantly more third-party punishment than people in small-scale societies.

Keywords: cross-cultural economics games; evolution of cooperation; social complexity; strong reciprocity; third-party punishment

1. INTRODUCTION

Cheating or defection poses an obstacle for the evolution of cooperation. Punishing defectors can minimize cheating and promote cooperation. Such punishment is a public good that benefits everyone, and like other public goods is vulnerable to free riding (Boone 1992; Hawkes 1992). Those who take the benefit without paying the costs of punishing gain more than those who punish. Punishment, therefore, poses a second-order collective-action problem.

On the basis of experiments with college students, some propose that humans are good at solving this collective-action problem because we exhibit strong reciprocity (Fehr & Gachter 2002; Fehr *et al.* 2002; Bernhard *et al.* 2006). Strong reciprocity involves second-party punishment, punishing those who defect on you, and 'extends to the sanctioning behaviour of 'unaffected' third parties' (Fehr & Fischbacher 2004), i.e. third-party punishment. A high percentage of third-party punishers can limit the options of defectors and could lower the costs of punishment if everyone shares the cost. Reputation offers an alternative solution to the second-order collective-action problem of punishment because third parties could simply avoid interacting with those who have a bad reputation rather than paying a direct cost to punish (Gintis *et al.* 2001; Panchanathan & Boyd 2004, 2005; Smith 2005; Rockenbach & Milinski 2006). However, with greater anonymity in larger populations, there is a greater likelihood of interacting with a stranger whose reputation is unknown. Third-party punishment then poses a possible solution to this problem because any third party may punish even a stranger who defects on someone else.

High levels of cooperation in experimental economics games lead some to conclude that humans violate some basic assumptions of rational choice theory

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Table 1. Summary of study populations. (Study populations ordered by local group size. 1, Marlowe; 2, Barrett; 3, Henrich; 4, Bolyanatz; 5, Gurven; 6, Tracer; 7, McElreath; 8, Camillo Cardenas; 9, Lesorogol; 10, Ensminger & Gwako; 11, Gwako; 12, Barr.)

ethnic group	nation	local group population	ethnic population	MAO	local population	ethnic population	economic base
Hadza[1]	Tanzania	33	1000	5.65	1	1	foraging
Shuar[2]	Ecuador	100	47 000	19.33	2	7	horticulture
Yasawa[3]	Fiji	104	2500	5.00	3	2	horticulture
Sursurunga[4]	PNG	215	3000	10.31	4	3	horticulture
Tsimane[5]	Bolivia	230	6500	3.91	5	4	horticulture/foraging
Au[6]	PNG	242	8000	30.67	6	5	horticulture/foraging
Isanga[7]	Tanzania	1500	45 000	31.00	7	6	agriculture
Sanquianga[8]	Columbia	1900	n.a.	23.87	8	n.a.	fisheries
Samburu[9]	Kenya	2000	147 000	18.93	9	8	pastoralism
Maragoli[10]	Kenya	3067	197 000	33.04	10	9	agricultural
Gusii[11]	Kenya	3580	1 300 000	41.00	11	10	agricultural
Accra[12]	Ghana	2 000 000	5 000 000	26.15	12	11	wage work

(Henrich *et al.* 2001, 2005; Boyd *et al.* 2003; Gintis *et al.* 2003). In particular, people are willing to spitefully punish stingy players and tend to be more generous than is necessary to avoid being punished (Henrich *et al.* 2004), and even punish as third parties. But do we see such a willingness of third parties to punish norm violators among all, or even most societies where there is no government, law or police—societies more similar to those our ancestors lived in before agriculture? If strong reciprocity involving both second- and third-party punishment is responsible for much of human co-operation across societies, games that measure norms of sharing and punishment should reveal that people, even in foraging societies, tend to share stakes equally, punish those who do not share with them equally and even punish those who do not share equally with others.

In a cross-cultural project, three experimental economics games were played in societies ranging from foragers to city dwellers. Results from that project have already been reported, including levels of third-party punishment, which varied considerably (Henrich *et al.* 2006). Here we report new findings that explain the variation in those levels of third-party punishment. The third-party punishment game (TPPG) is a dictator game (DG) in which player 1 (P1) decides how to split a stake (one day's wage in the country played) with player 2 (P2). P1 can give as much or as little as he or she wants. Rational choice theory predicts that in a regular DG (with no one who can punish) P1 should give nothing to P2. In the TPPG, however, there is a player 3 (P3) who is endowed with a stake (worth half-a-day's wage). P3 can either keep all of his or her endowment or give back to the gamesman 20% of that endowment in order to subtract three times that amount from P1. P3 can therefore punish P1 for being stingy and giving P2 a small fraction of the stake (for complete details of games and methods, see Henrich *et al.* 2006).

Here we want to explain the cross-cultural variation in third-party punishment using the minimum acceptable offer (MAO), i.e. the lowest amount that P1 could give P2 without P3 choosing to punish P1. The TPPG reveals how strongly P3 feels that P1 should share with P2, and how willing P3 is to sacrifice to punish P1. Unlike spiteful second-party punishment, third-party punishment can rightly be considered altruistic (at least in the context of these anonymous, one-shot games). In real life, one might gain from having a good reputation (as a third-party punisher), hence the 'altruistic' in our title.

The cross-cultural games project revealed that higher levels of punishment were significantly associated with higher levels of cooperation. Table 1 shows that the level of third-party punishment varied greatly across the 12 societies in the cross-cultural project (table 1). Rather than this being simply random cultural variation, we hypothesized that people in larger, more complex societies would engage in more third-party punishment due to the fact that it is more difficult to maintain reciprocity in larger populations, given that free riding should increase in larger groups where monitoring everyone becomes more difficult as anonymity increases (Boyd & Richerson 1988). With increasing social complexity should come more challenging collective-action problems.

We used two separate measures of population size (local and ethnic). The local group population is the mean number of people who live together in a camp of mobile hunter-gatherers, a village of horticulturalists or a town in an agricultural society (Ensminger *et al.* submitted). We also used the ethnic population, which refers to the total number of people in the ethno-linguistic group. We found both measures of population size to be significant predictors of the level of punishment.

2. MATERIAL AND METHODS

In the cross-cultural project, three experimental economics games were played in societies including hunter-gatherers, horticulturalists, pastoralists and city dwellers (Henrich *et al.* 2006; Ensminger *et al.* submitted). Three games were played: the DG (with no punishment involved), the ultimatum game (involving the second-party punishment) and the TPPG. The TPPG was played using the strategy method, which means P3 decides to punish or not punish for all possible amounts that P1 might give to P2 before hearing the actual amount that P1 gave. The strategy method may influence the way people play compared with hearing only the one actual offer, but since this method was used in all 12 societies we have no reason to suspect that this should alter our results. The strategy method allowed us to calculate the MAO. We analysed the variation in MAO in relation to our two measures of population.

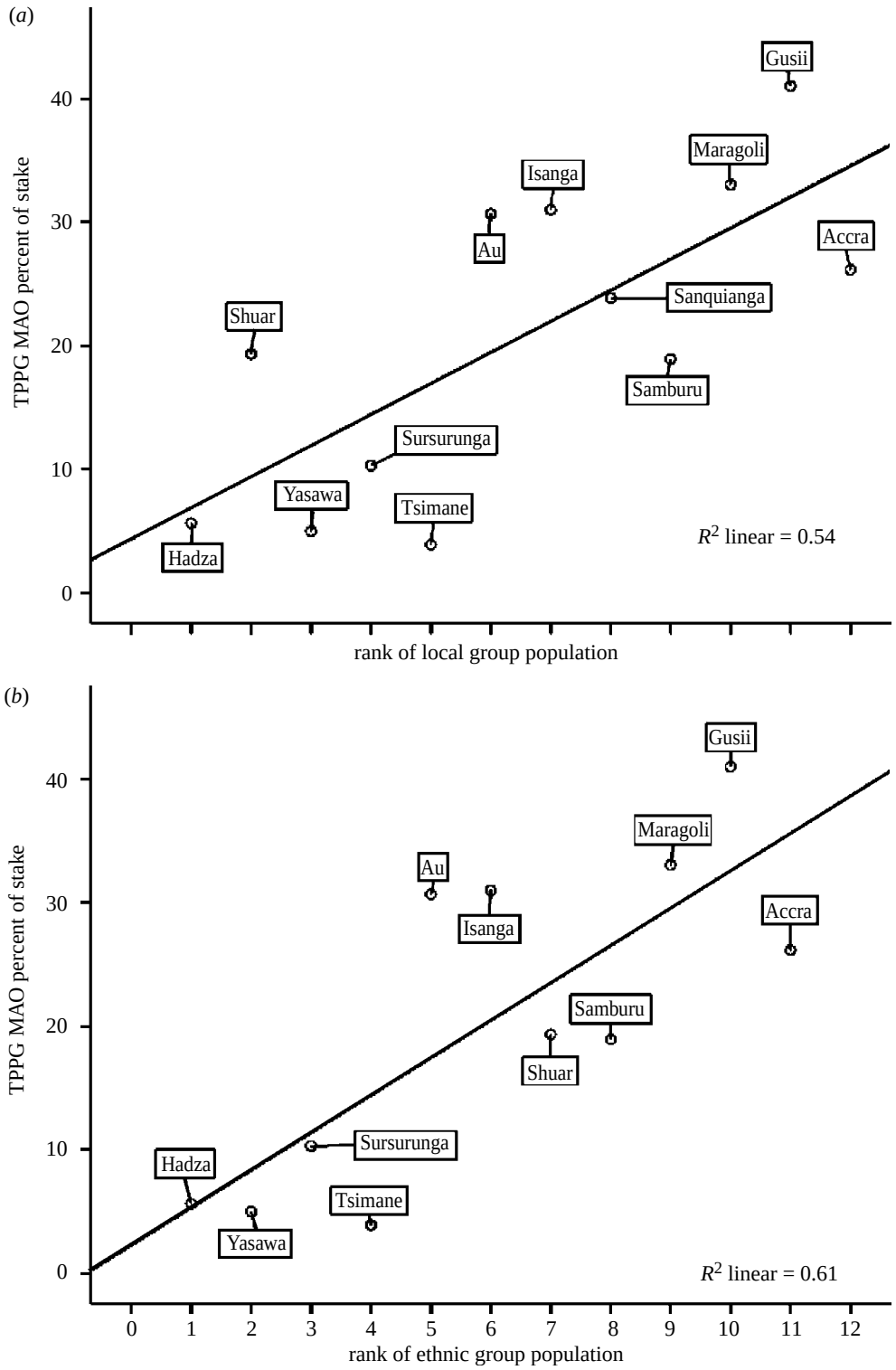

Figure 1. Minimum acceptable (non-punished) offers by (*a*) local group population ($\rho = 0.727$, $p = 0.007$, $n = 12$) and (*b*) ethnic group population ($\rho = 0.764$, $p = 0.006$, $n = 11$). (*b*) Has only 11 societies because ethnic group could not be calculated (or reliably identified) for Sanquianga. We used the Hadza MAO reported in the previous *Science* article (Henrich *et al*. 2006), excluding several players who probably did not understand the TPPG, the MAO drops from 5.65 to 0 (Marlowe in press), making all the associations reported here even stronger.

Local group population was calculated by taking the mean of the several camps, villages or towns that games were played in by each researcher within one ethnic group. In a few special cases, we used the judgement of individual researchers for more accurate reflections of the typical local group population (to better reflect the society's expected norms), rather than using a village that was well outside the normal range for that society. Ethnic populations were obtained from the Ethnologue database of world languages on-line (Grimes 2000), or from the previous researcher's own reports (Henrich *et al*. 2004).

3. RESULTS

By ranking the societies in terms of the mean size of local group population, we found that MAO was

Table 2. Multiple regression models controlling for region (Africa, Insular Pacific and South America). (Multivariate regression results for two models (local population and ethnic population ranks) on MAO controlling for the geographical regions.)

independent variables	R^2	β	p
model 1 local population			
local population rank	0.545	0.701	0.038
model adj R^2	0.375		0.084
model 2 ethnic population			
ethnic population rank	0.690	0.805	0.016
model adj R^2	0.557		0.034

significantly higher in larger societies with a larger mean local group population ($\rho=0.685$, $p=0.014$, $n=12$; figure 1*a*). Societies with a larger ethnic group population also had higher MAO's ($\rho=0.727$, $p=0.011$, $n=11$; figure 1*b*). Since people in small-scale societies tend to live in small camps or villages and people in complex societies tend to live in cities, it is not surprising that mean local group and ethnic populations are correlated ($r=0.968$, $p>0.0005$, $n=11$).

The 12 societies in which the TPPG was played fall within three general geographical regions (Africa, Insular Pacific and South America). Given the lack of either a genetic or linguistic phylogeny of these 12 societies, we used the three regions as a proxy for phylogenetic relatedness. In a multiple linear regression that controlled for the three geographical regions, no region had a significant effect on the level of punishment. Controlling geographical region only made the effect of population slightly stronger, implying that these results are not an artefact of cultural phylogenetic relationships (Galton's problem; table 2).

4. DISCUSSION

Our results suggest that cooperation in larger societies may depend on third-party punishment. The three societies with the lowest MAO, the Hadza, the Tsimane and the Yasawa, are all small. The Hadza are hunter–gatherers in Tanzania, the Tsimane are horticulturalist–foragers in Bolivia and the Yasawa are horticulturalists in Fiji. The other society that had an MAO less than 15%, the Sursurunga horticulturalists of New Ireland, Papua New Guinea, is also small. The Au of Papua New Guinea and the Shuar of Ecuador had relatively high mean MAO's, considering that they are also fairly small-scale societies. However, both the Shuar (C. Barrett 2005, personal communication) and the Au (D. Tracer 2007, personal communication) have a fairly recent (up until the past 30 years) history of endemic warfare. Warfare creates conditions that promote norm enforcement and strong reciprocity. If a group is not good at solving the collective-action problem of recruiting cooperative warriors, then it cannot attack others or defend itself very well (Patton 2000).

Because third-party punishment is a powerful way to promote cooperation, we may think it would always be a good thing to promote. However, consider that among the Taliban, those who punish a woman when she is not covering her head are third-party punishers of norm violators; presumably the woman's husband, father and brothers are the wronged second parties. These sorts of impositions on individual liberty are unimaginable in some small-scale societies where few norms are enforced by third parties. Individual liberty can coexist with a good deal of cooperation in such small-scale, 'egalitarian' human societies. We stress 'human' societies because small-scale, non-egalitarian chimpanzee societies are so different (*Pan troglodytes*, Jensen *et al.* 2007).

Second-party punishment may be sufficient to explain the cooperation observed in many small-scale human societies. It is only once a society becomes larger, more stratified, with more anonymity that cheating becomes more tempting and more difficult to monitor. These are the conditions that promote third-party punishment. As societies grow larger, they face more pressing collective-action problems such as defence of territory, distribution of communal food stores or prevention of theft. Political hierarchy emerges first with big men, then chiefs and then monarchs to solve collective-action problems (Boone 1992). This may first be dealt with by vigilantes but as societies grow even larger and more complex it is more likely that they will have an institutionalized system of third-party punishment involving police, judges and jailers. We might view them as paid, full-time third-party punishers.

We suggest that strong reciprocity based on third-party punishment is not a human universal, i.e. it is less common among egalitarian foragers than among stratified agricultural societies. Third-party punishment increases in agricultural societies because solving collective-action problems becomes more important as populations grow larger and more complex.

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NOTICE OF CORRECTION

The author and affiliations presented in the correct form.
Addition of the authors and affiliations has extended the article onto an un-numbered page.

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