

The Tsimane rarely punish: an experimental investigation of dictators, ultimatums and punishment

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1. Introduction

With a revised, standardized set of protocols, the Cross-Cultural Games Project examines whether prior “anomalies”, which are not consistently predicted by any of the available social preference models, re-appear in this second round of games played in seventeen cultures. If so, we can be more confident that initial results were not artifacts of an inconsistent methodology. Furthermore, the non-industrialized environmental settings characteristic of the seventeen cultures, with varying degrees of market involvement, allow for a serious treatment of the role of culture, the development, maintenance, and evolution of social norms, and the effects of acculturation and market access on pro-social behavior. In this second round of games, with a systematic set of variables measuring different aspects of market access and acculturation, we can examine whether integration, acculturation, and experience with anonymous others in market settings leads to the more uniform and modal patterns of game behavior seen in industrialized societies. The addition of the Third Party Punishment game to the repertoire, and the strategy method applied to the Ultimatum Game should give us greater insight into responder behavior, and therefore on second-party and third-party punishment of perceived cooperative norm

violations. Results of these new games have important implications on our understanding of how reciprocal altruism, or other models of cooperation such as strong reciprocity may operate in natural populations, as well as the ways in which different social preferences lead to variable game behavior in different contexts (e.g. Bolton and Ockenfels 2000, Charness and Rabin 2002, Falk and Fischbacher 2000, Fehr and Schmidt 1999, Rabin 1993). Finally, the inclusion of follow-up interviews of select game players should help provide additional ethnographic insight into the ways people view the games, and people's expectations of others' game behavior. Only through ethnographic interviews can we understand the links between emotional response to specific situations, the internalized norms brought to bear on emotions and behavior, and the actual behavioral choices made by individuals.

This paper examines the Strategy Method Ultimatum Game (SMUG), Dictator Game (DG), and the Third Party Punishment Game (TPPG) played among the Tsimane of Bolivia. It addresses several questions which allow comparison with results obtained in the other volume chapters to assess cross-cultural validity. These are: 1) To what extent is within-cultural variation in game behavior explained by demographic and market-oriented variables? Are more educated, fluent, and market-oriented individuals more likely to uphold equality-based norms, or those which favor short-term self-interest? 2) How prevalent is second and third party punishment? 3) To what extent is proposer behavior in the SMUG and TPPG linked to the responders' taste for punishment? 4) How good are people at guessing how others will behave? 5) Is there consistency in offers made by the same individuals across the SMUG and DG? Additional questions addressed in this paper include: 6) Do the same people show similar game behavior in the DG after a two year gap? 7) To what extent does observed game behavior in the SMUG, DG, and TPPG match natural observations of collective action-oriented behavior? 8) Are those

individuals who are good at guessing others' decisions (as measured by a Matching Game), more likely to choose modal offers in the DG, and income-maximizing offers in the SMUG?

2. Study Population: Tsimane'

The Tsimane' are Amazonian forager-horticulturalists living in the Beni Department of Bolivia on the eastern foothills of the Andes. Tsimane live in small villages consisting of 50-100 individuals, and these are usually composed of a number of extended family clusters. Villages tend to be located along major rivers, although villages also exist in terra firme areas in the Isiboro-Secure region. The majority of Tsimane (over 4,000) live along the banks of the Maniqui River, occupying over 50 villages. Almost all of the food the Tsimane consume comes from horticulture, fishing, hunting, and gathering. They cultivate plantains, rice, corn, and sweet manioc in small swiddens and regularly fish and hunt for meat. Fish, game, and gathered foods comprise about a quarter of the diet, although this may vary depending on the season and local abundance. More detailed background information on the Tsimane is provided by (Chicchón 1992), Reyes-García (2001) and Godoy (2001). I focus here on the relevance of cooperation in daily economic and social life, and the relevance of markets and acculturation.

2.1 Cooperation

There is a strong sense of economic independence at the level of the nuclear family and extended Tsimane household. Each family has its own set of fields, and sometimes individuals within families have ownership of specific fields. Over 70% of the diet comes from fields and house gardens. Men within a household will perform the clearing and burning of unused primary or secondary forest to create new fields during the dry season, while both men and women

harvest and weed fields throughout the year. Occasionally male relatives or affines will collaborate in some of these activities. Single-day hunting and fishing activities are mostly solitary or with up to two male partners, usually siblings, sons, in-laws, or age-mates. The exception to this is group fishing events, where groups of families, and sometimes entire villages, use plant poisons to fish in closed-off sections of rivers, streams, and lagoons. In these events, several men perform all of the work (acquiring the plant poisons, closing off the body of water, pounding the poison), and many more individuals, including women and children, harvest the fish with bow and arrow, machete, or knife. In a cross-village sample, Godoy et al. (2004a) estimated that one-fourth of all fishing events were communal. Finally, entire families often go on extended fishing trips in riverine villages, and on extended hunting trips in the interior forest villages, which can last anywhere from two days to several months.

An estimated 10% of household consumption derives from gifts or transfers from relatives and friends, while 88% comes from labor efforts of household members (Godoy et al. 2004b). Some foods are shared more than others. The most widely shared food is manioc in the form of home-brewed beer (*shocdye*). Strong beer will always draw many visitors, and beer drinking often continues until none remains. Any Tsimane can visit another Tsimane household and expect to be served. As in other small-scale populations, large game may be shared with wide depth, but a restricted breadth of only several households (Gurven, Hill, and Kaplan 2002). Small game, such as birds and squirrel monkeys tend to be shared only within the household. Food preparation and cooking is usually done in the open (kitchens usually do not have walls), but food consumption can occur inside houses. Cooked meals are usually consumed by household members. Though people eat communally in smaller villages, they usually do not go out of their way to invite others to partake in their meals. Tsimane' often turn their backs to

others when they eat, and people in more modern villages often complain that neighbors do not share meat. There is some suggestive evidence that the lack of extensive sharing in daily life is mirrored during difficult times as well. In a study of risk management in two Tsimane villages, Godoy et al. (In press) report that only 5% interviewed said that kin or neighbors helped them cope with a misfortune such as illness or crop loss.

In villages with schools and chiefs, men usually engage in communal village labor, such as clearing soccer fields, and building schools. Both men and women also help organize festivities. In a panel study done during 2001-2002 in 37 villages, Godoy et al. (2004b) found that 92% of households had made some gift of food and 61% of households had engaged in some communal labor, in the week prior to the interview. Nonetheless, gifts are usually small, and made to close kin, while communal labor is of brief duration.

2.2. Market Affiliation and Acculturation

Although the Tsimane' were exposed to Jesuit missionaries in the late 17th century, they were never successfully settled in missions and remain relatively unacculturated. Some degree of their isolation is suggested by the fact that their language is an isolate, even within Bolivia, sharing a similar vocabulary and grammar only with the Mosetene, who inhabit the southern and northern stretches of Tsimane territory. New mission posts in several different villages only began in the 1950s (Chicchon 1992). The greatest influence of the 20-year-old New Tribes Mission was to create a system of bilingual schools with trained Tsimane' teachers and an elected village chief in each village downstream from the Catholic mission, Fátima. Chiefs act as representatives primarily for interaction with outsiders, and to help organize group labor. They do not receive salary or tribute, and are generally not awarded with prestige.

Tsimane villages vary in their degree of market access and interaction with outsiders. The domain of acculturation occurs in several ways: visits to the main market town, San Borja (pop'n ~14,000), wage labor with loggers, debt peonage with river merchants, and schools which exist in over 2/3rd of all Tsimane villages. Market items which are highly valued by the Tsimane include clothing, aluminum pots, salt, sugar, kerosene, utensils, and school supplies. Schools have existed anywhere from two to twenty years. Since the 1970s, Tsimane have come into greater contact with outsiders as new roads were built, inviting a burst of logging, trading, and encroachment by lowland and highland colonists (Ellis, 1996; Chicchón, 1992). Tsimane make occasional visits to San Borja during town festivals, and some sell agricultural produce or handicrafts. On average, however, only 2-6% of the diet derives from market purchases. Near San Borja, some Tsimane work as farm hands for local ranchers. Along the upper Maniqui River, Tsimane often collect jatata palm leaves and weave them into roofing panels. These panels are then traded with itinerant merchants who provide market goods and alcohol. The exchange rates vary among merchants, but most are unfavorably low. Goods are usually given in advance of payment, and Tsimane rarely refuse these 'gift' advances, which positions many households in a cycle of debt with the merchants.

A recent study by Godoy et al. (2004a) has shown that neither market access, nor economic development is consistently associated with economic inequality across a sample of 59 Tsimane villages, where inequality was measured in terms of monetary income, household wealth, or rice production. Gini coefficients estimating these inequalities vary from 0.3-0.8 (mean 0.539) for monetary income, 0.1-0.5 (mean 0.281) for household wealth, and 0.2-0.8 for rice (mean 0.471). Thus, there is little direct evidence that increased market exposure has led to substantial increases in inequality, beyond which already existed in traditional domains of

economic production.

2.3. Prior Results

An Ultimatum Game without strategy method was played in five villages along the Maniqui River in 1999 (Gurven 2004a). Mean and median for the combined sample was 37% with modal offers at 50% and 30%. In multivariate analyses, fluent Spanish speakers gave about 13% more than monolingual tsimane speakers, men gave about 10% more than women, and the least educated gave about 14% more than the most educated. However, the strongest predictor of offer level was the identity of one's resident village.

A Dictator Game was played in Cosincho in 2000 (Gurven 2004b). Mean, median, and modal offers were 32%, 30%, and 25%, respectively. As in the Ultimatum Game, men gave about 6% more than women, and the most frequent visitors to San Borja offered about 10% more than those who rarely left the village to go to market. Both games used increments of 5%, rather than the 10% increments used in the current games.

3. Dictators and ultimatum

3.1. Study Village: Cosincho

The DG and SMUG were played in the village of Cosincho (Gurven 2004b). Cosincho is located about 60 km, or up to several day's journey upstream, on the Maniqui River. Much of the village is located about a 15 minute walk from the Maniqui River to the interior, and is close to the smaller Cosincho River. There were 215 residents living in Cosincho during the time of the games, although 12 of these individuals had not lived there for at least several months. In the center of the village is a soccer field, a new school, and a scattered cluster of 11 families. Two

nearby clusters about five minutes walk away consist of 6 and 2 families, respectively. A cluster of 4 families lives another 10-15 minutes walk on the other side of the Cosincho River. The other two clusters are more distantly located. One of these distant clusters of 4 families lives near the Maniqui River about 30 minutes away, and the other lives across the Maniqui River, about 45 minutes away. This latter cluster moved across the river after political conflicts within the village several years ago.

3.2. Methods

The DG and SMUG protocols followed the standard versions translated into Spanish by Clark Barrett. These were translated into Tsimane with the help of a bilingual Tsimane assistant, Alfredo Zelada Supa. Zelada, a resident of a community outside this sample, also acted as a personal assistant during all games. The Tsimane protocols were then orally back-translated into Spanish to assess the accuracy and clarity of the Tsimane translation. Revisions were then made in the Tsimane language version. Games were played Nov. 30 and Dec. 1, 2002. All Tsimane eighteen years of age and older were invited to appear at the school in the early morning, upon the ringing of a bell. Roughly 90% of eligible people were present for the group meeting. People were told that they would be playing two games, that they would receive 5 Bolivianos (Bs) as a show-up payment for each game, and that they should only play the first game if they could play the second game. The DG was played first, and the SMUG second. The sample for the DG was 71 individuals (38 proposers), and for the SMUG was 67 (36 proposers). Four individuals did not return to play the SMUG after the DG. The endowment for each of the games was 20 Bs (\$2.75; 7.3 Bs=\$1 US), which represents about one day's wage labor with food, or about 0.8 day's wage labor without food. This was the same endowment used in Gurven (b, 2004a).

The DG was explained in both Spanish and Tsimane by myself and Zelada. Several examples were illustrated according to the script. Special emphasis was given to capture the attention of younger and older individuals, who experience has shown, have a more difficult time listening to spoken rules in group settings. All questions concerning procedure were answered, but these were minimal. Examples include “How long will this take?”, “When do I play?”, and “Can we watch the movie about the man and the coconuts [*Castaway*]?” We emphasized the confidentiality of responses, and the facts that Player 1 (the proposer) can choose to give whatever he or she wishes to give, and that the money derived from a U.S.-based foundation solely for this purpose, by repeating the appropriate portions of the protocol. Both Zelada and I felt that repetition was important, given the relative lack of experience with games, or with formal instructions read aloud to an audience. The initial group explanation was about 1.5 hours. Players then entered the school one-by-one in a random order chosen by an American assistant, Jeffrey Winking. Inside the school, windows were barred and children were dissuaded from peering or listening. The only people present inside the school were the player, myself, and Zelada. However, Zelada’s presence was minimized as his back was turned during actual play. Zelada is from a different community with no relationship with any of the study communities, and community members said they did not mind his presence in the room. Nonetheless, his assistance was requested only when test questions were answered incorrectly, and therefore the game rules needed to be explained again. Upon entry in the room, players received additional instruction, a series of test questions, and additional help from Gurven and Zelada, if necessary, until the test questions were answered correctly. Outside the school, individuals were seated on a concrete patio watching DVD movies. It was forbidden for anyone to discuss the games, and Winking confirms that no one did. After playing the game, individuals were urged to stay and

watch the films. A vat of refreshment was also prepared for players to encourage them to stay. However, several players who lived nearby needed to return to their homes to attend to their children or to eat a mid-day meal after playing the DG. The majority watched the films (which are otherwise non-existent). Those who had already played sat on the opposite side of the patio, separated from those waiting to play, to avoid any potential for contagion. It took 5 hours for 62 people to play the DG on Day 1. On Day 2, it took 1.5 hours for 11 more people who were not present on the previous day to play the DG.

The SMUG was explained in a similar fashion as the DG described above. Explaining the game in the group took about 1 hour. It took 2 hours for 13 people to play the SMUG, after which the sun had already set, players were bored and hungry, and the truck battery powering the movie-displaying laptop computer had died. The SMUG was then continued the next morning for 7.5 additional hours until 54 others had played the game. About half of the players were paid for both of the games in the late evening on Day 2, and the remainder of the players were paid the following morning. People were paid individually in a private house location. At this time, select individuals were asked several questions about their opinions of the game and of others' behavior in the games.

A matching game was also played in Cosincho in May 2003 with 59 individuals during household visits, to see whether the ability to converge on focal concepts with other community members would associate with game play. Individuals were asked to leave their house by themselves to talk privately for several minutes, whereupon they were asked to play a very short game where they could win 5 Bs. Upon agreement, they were asked to "name a plant (or animal) that others in Cosincho might also name if they were asked the same question. If you name the same plant (or animal) that most others in this village name, then you will win 5 Bs." They were

asked this for two categories of objects: forest game animals (*jebacdye'*) and plants (*cätidye*). It took only a few minutes to play this game with each person. Players were told not to discuss the game with anyone until after payment. Indeed, there was no effect of order of play on the popularity of responses given for animals ($r=0.11$, $p=0.43$) or plants ($r=0.07$, $p=0.63$), where popularity is measured as the percentage of others who gave the same answer. Individuals were paid after all participants had played. Total play covered two days.

3.2.1 Predictor variables

Market-oriented experiences tend to fluctuate by week or month. Thus, rather than use the standard interviews based on previous day's or week's experiences, in this paper, market-oriented variables in Cosincho were estimated using a combination of interviews and direct observations of household clusters from a concurrent study. Interviews of hunting and fishing returns, town visits, and market purchases were done two to three times per week for all households in Cosincho over a ten month span. From these data, estimates of the number of town visits, wage labor activities, and income, were estimated. Food production and consumption were examined during three-hour observation blocks of household clusters. From these data, estimates of market contributions to the diet were estimated. Household wealth and domestic animal-based wealth were estimated from wealth surveys conducted in each household, where wealth is defined as income-generating capital. Land-based wealth was estimated from a combination of interviews about household agricultural production, and GPS mapping of sample agricultural fields for different cultigens.

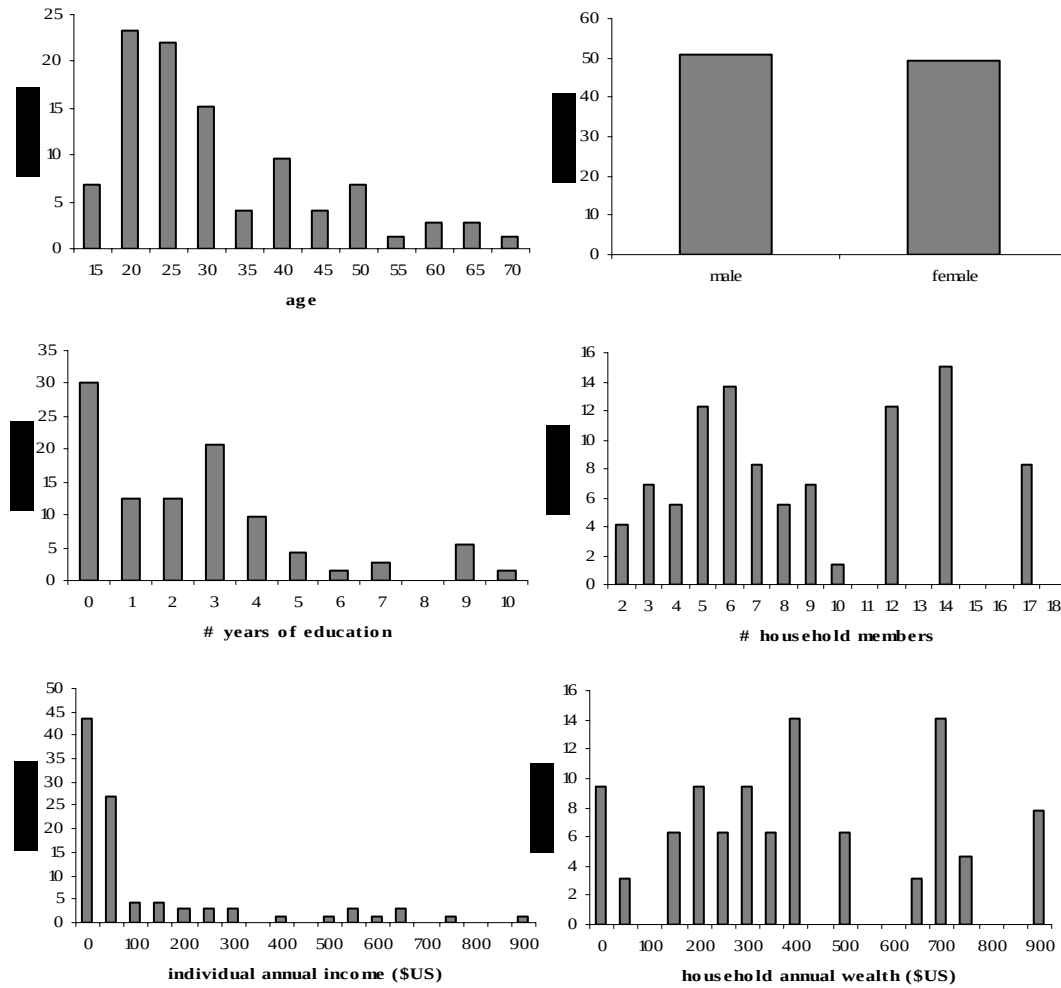
Age was estimated from demographic interviews, which incorporate known ages, and estimates based on interviews of reproductive histories, and a series of comparisons with

individuals of known ages. Years of education, linguistic competence in Spanish, marital status, number of offspring, household size, and length of residence in Cosincho were also garnered from demographic interviews. Spanish ability is categorized as 0=cannot speak, 1=speak some, 2=fluent. Length of residence tallies the total number of years the player has lived in the study village over their entire lives. An examination of cross-correlations (not shown) reveals that many of these variables are correlated with each other. For example, Spanish ability correlates positively with frequency of and income from wage labor, annual income, trips to market, and education. Figure 1 displays histograms for each of the independent variables for the DG and SMUG samples.

3.3. Results: Dictator Game (DG)

Figure 2 shows the distribution of offers made by proposers in the DG. The mean, median, and modal offers were 26%, 30%, and 10%, respectively. A secondary mode at 40% is also prominent. Only 13% offered half of the 20 Bs endowment. To examine significant differences across populations (and also across games), I employ three non-parametric statistical tests. A Mann-Whitney (M-W) test examines differences in means across samples, a Median test examines differences in medians across samples, and an Epps-Singleton (E-S) test examines distributional differences across samples. Table 1 compares the DG sample with DG results obtained in two other samples, including the Hadza (Marlowe 2004), and the Tsimane from Cosincho in 2000. The M-W and Median tests reveal no significant differences between the Cosincho DG and the other three DG samples in Table 1, at the 5% significance level. Focusing exclusively on means or medians can be deceiving, as revealed by the E-S test, which shows highly significant differences between the Tsimane DG (see below) and Cosincho 2000 samples, and no difference with the Hadza.

FIGURE 1. Histograms of predictor variables for DG and UG samples



There was no statistically significant difference between mean offers for first and second days of play (27.5% ($n=32$) vs. 20.0% ($n=6$), respectively; $p=0.33$, M-W). The order of play also had no significant effect on offers ($r=-0.14$, $p=0.39$). However, play day becomes significant after controlling for other predictors in a stepwise regression, using the predictors described in the next section. After controlling for household wealth and income, offers on the second day were 12% lower than those on the first day. This effect is mainly driven by the lack of 50-50 splits on the second day. The sample from the second day was of individuals who were away fishing, visiting another village, or too tired to appear on the first day of the games. It is possible

that this represents a slightly biased sample, rather than the decrease in offers due to contamination. Nonetheless, the effect is small and does not change the qualitative results described below.

FIGURE 1. Offer distributions for Dictator Game (DG), Ultimatum Game (UG), and Third Party Punishment Game (TPP)

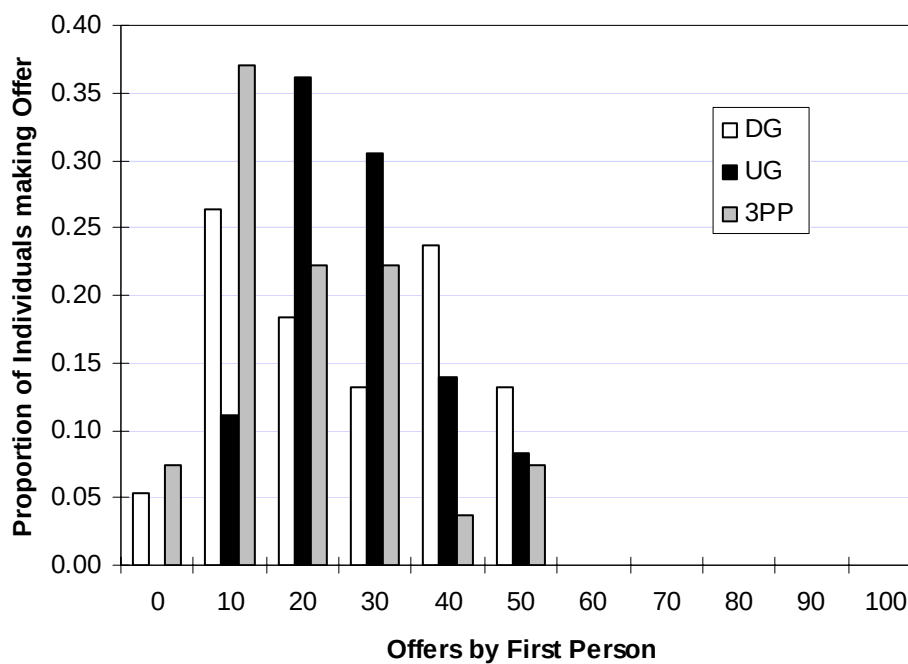


TABLE 1. Statistical Comparison of Game Samples

Pop'n 1	Pop'n 2	n2	Epps-Singleton		Mann-Whitney		Median 2-sample test		Wilcoxon signed rank	
			CF	p-value	Z	p-value	Z	p-value	Z	p-value
DG 2002	DG 2000 ¹	24	26.519	0.000	1.474	0.140	0.835	0.404	-0.140	0.236
	DG Hadza ²	43	6.520	0.164	1.822	0.069	1.716	0.086		
UG 2002	UG 1999 ³	70	14.675	0.005	3.679	0.000	3.037	0.002		
	UG 1999 PM ³	17	10.212	0.037	2.840	0.005	2.091	0.037		
	UG 1999 LP ³	16	4.066	0.397	0.757	0.449	1.081	0.280		
	UG 1999 OC ³	16	11.455	0.022	3.218	0.001	2.421	0.016		
	UG 1999	10	7.621	0.107	2.141	0.032	0.637	0.524		

CAT ³										
UG 1999										
	CACH ³	11	18.377	0.001	3.129	0.002	2.699	0.007		
UG MACH ⁴		21	5.248	0.263	1.039	0.299	0.764	0.445		
DG 2002	UG 2002	36	9.964	0.041	0.337	0.736	0.148	0.882	27.000	0.517
TPP 2003										
	DG 2002	38	4.569	0.335	1.623	0.105	1.342	0.180		
	DG 2000 ¹	24	24.718	0.000	3.616	0.000	2.440	0.015		
	TPP Berlin ⁵	22	2.863	0.581	0.752	0.452	0.617	0.539		

Data sources: ¹Gurven (2004b); ²Marlowe (2004); ³Gurven (2004a); ⁴Henrich (2000); ⁵Fehr and Fischbacher (2004)

3.3.1 Predictors of DG Offers

I perform regression analyses to examine whether demographic and market variables predict DG offers. Demographic variables include age, sex, number of years of formal education, and household size. Market-oriented variables such as percentage of diet derived from the market (whether purchased or traded), frequency of wage labor in the past month, the number of trips to market town in a typical week, and the amount of land devoted to cash crops are insignificant and therefore not included in the analysis of DG and UG offers.¹ Additional variables included are household wealth (in \$US), and individual income (in \$US). Figure 1 shows histograms of the predictor variables. The results of multivariate analyses are shown in Table 2. As for all regressions, all independent variables are normalized by dividing by the standard deviations of each variable. Model 1 includes all independent variables, and each reduced model subtracts each of the insignificant variables from Model 1.

The only variables found to be statistically significant were household wealth and individual income. Every 100 Bs of additional wealth is associated with a 2% decrease in offers. The wealthiest therefore gave 19% *less* than the poorest in the sample, controlling for other factors. A linear effect of income was not statistically significant. Instead, income has a quadratic effect such that those with the lowest and highest incomes gave less than those with intermediate

incomes.² In particular, those who earned more than 4,000 Bs (~\$533) a year gave 1.2% less for each additional 100 Bs they earned, while each additional 100 Bs earned up to 2,000 Bs was associated with a 0.3% increase in offers. Reduced models reveal robust patterns for household wealth, and reasonably robust patterns for individual income. Wealth and income account for 16% of the adjusted variation in DG offers.

TABLE 2. Linear Regression of Tsimane Dictator Game Offers

Variable (Divided by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5
Age	1.05 (2.61)				
Female	3.86 (3.21)	3.74 (3.15)			
Education	0.02 (2.98)	-0.29 (2.84)	-1.36 (2.71)		
Individual Income	17.51 * (9.91)	17.44 * (9.76)	12.48 (8.88)	11.67 (8.62)	14.35 * (8.36)
Household Wealth	-5.75 ** (2.76)	-5.52 ** (2.66)	-6.39 ** (2.58)	-6.40 ** (2.55)	-5.97 ** (2.54)
Household Size	2.30 (2.72)	2.16 (2.65)	2.93 (2.59)	3.00 (2.56)	
Individual Income-squared	-5.77 ** (2.64)	-3.80 ** (2.60)	-4.85 * (2.50)	-4.72 * (2.45)	-5.34 ** (2.41)
Constant	20.48 *	23.37 **	29.42 ***	28.42 ***	33.07 ***
Observations	34	34	34	34	34
Model Significance	0.137	0.086	0.082	0.046	0.038
Adjusted R-squared	0.14	0.16	0.15	0.17	0.16

Note: Standard errors in parentheses. All coefficients are normalized (divided by std. dev.)

*** Coefficient significant at < 0.01 level in two-tailed test.

** Coefficient significant at < 0.05 level in two-tailed test.

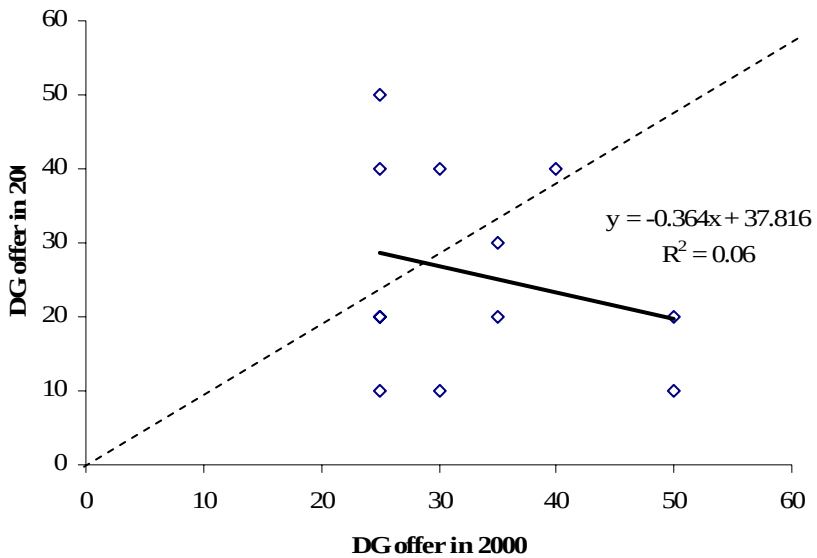
* Coefficient significant at < 0.10 level in two-tailed test.

3.3.2. Repeated DG

Of the 38 proposers, 12 of them were also proposers in the DG played in 2000. Does repeated play lead to a decrease, increase, or no change in offers? The same people offered an average of 7% less in 2002 than in 2000. A Wilcoxon signed rank test for matched pairs shows no significant difference in offers given across study years ($F=-14$, $p=0.236$). However, the

emphasis on mean differences may be misleading. Of the 12 players who participated in both study years, only 1 offered the same, while 8 lowered their offer, and 3 raised their offer (Figure 3). At the village level, however, significant distributional differences exist, despite the insignificant M-W and Median tests (Table 1, row 1). For example, in 2000, there were no offers of 20% or less, while in 2002, half of the sample gave 20% or less. Some 17% of the offers in 2000 were at 40% or higher, whereas 37% were at this level in 2002. If experience learning the game in 2000 helped players to better understand the rules, and how to earn the most money, we should expect less variance in offers in 2002. However, variance in offers actually increased from 2000 to 2002 (s.d.=8.2 in 2000 vs. 15.5 in 2002). Regression analysis of sex and age on the difference given between 2002 and 2000 shows that men gave 18% less in 2002 ($p=0.07$), and each additional year of age is associated with 0.82% ($p=0.03$) more given ($F=4.05$, $R^2=0.47$). Each year of education is associated with 3% less given, but this result was significant only at the 10% level. The strongest predictor is the household wealth of the player, where every 100 Bs of wealth is associated with an offer decrease of 9% ($p=0.002$, $R^2=0.62$) (7% controlling for sex and age). It is important to note that whether or not a person had played the DG in 2000 shows no significant effect on DG offers in 2002. The p-values for the dummy variables on previous play are insignificant in both univariate analysis ($p=0.90$), and when added to the reduced regression model 5 from Table 2 ($p=0.99$).

FIGURE 3. Dictator Game behavior for repeat players in 2000 and 2002 ($n=12$). Dashed line of equality shows where the same players made the same DG offer in both years.



3.4. Results: SMUG

Figure 2 shows the distribution of offers made by proposers in the SMUG. The mean, median, and modal offers were 26%, 30%, and 20%, respectively. Two-thirds of the offers were between 20-30%. Only 8% offered half of the 20 Bs endowment. Table 1 compares the means, medians, and distributions of SMUG offers with those from the UG played in 1999 in five separate Tsimane villages, and the pooled UG samples. The SMUG is significantly different from the pooled 1999 sample, and three of the five villages, using all three statistical tests. It is only similar to the UG offers in a village further upstream, Catumare, and a village near San Borja, La Pampita. The pattern of SMUG offers was also indistinguishable from the offers in a sample of Machiguenga, a group of Peruvian forager-horticulturalists similar to the Tsimane (Henrich 2000).

The mean offers given on the first play day was 30.0% (n=6). For the second day, mean offer was 28.3% (n=23) for session 1 and 21.4% (n=7) for session 2. The mean from this last session was only marginally significantly different from the means of the first two sessions

($p=0.14$, $p=0.10$, respectively; M-W). Order of play tracks these sessions and is significantly associated with a small decrease in offers ($r=0.35$, $p=0.04$). However, there is no order effect for first day or session 1 of the second day. The decrease in offers with order of play is due to the same group of people who gave less on the second day of the DG. Unlike in the DG, however, session or order is not significant in stepwise regressions including the other predictors described below. There are no significant differences between mean minimal accepted offers made across sessions (7.1% ($n=7$), 6.2% ($n=21$), 8.0% ($n=5$), $p=0.70$ from Kruskal-Wallis test).

3.4.1. Predictors of SMUG Offers

Table 3 shows the regression results examining the effects of the same set of variables from 3.3.1 on SMUG offers. Figure 1 displays histograms for the independent variables used in the regressions. The only significant predictors of offers were individual annual income and household size. As in the DG, the linear effect of income is statistically insignificant, yet income shows a significant quadratic effect on offers. Thus, intermediate annual income is associated with higher UG offers than low or high income. Those who earned more than 4,000 Bs (~\$533) a year gave 0.8% less for each additional 100 Bs they earned, while for each additional 100 Bs earned up to 2,000 Bs was associated with a 0.4% increase in offers. While not a market-oriented measure, household size acts as a proxy for household demand for resources because larger households have more mouths to feed. Yet each additional member in the household was associated with 1% *more* given away. Each standard deviation unit increase is associated with a 4-5% increase in offers. Income accounts for 13% and household size 20% of the variance, while the multivariate model accounts for 22% of the adjusted variance in offers.

TABLE 3. Linear Regression of Tsimane Ultimatum Game Offers

Variable (Divided by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5
Age	-2.13 (1.93)				
Female	2.70 (2.30)	2.92 (2.30)			
Education	-0.38 (2.20)	0.29 (2.12)	-0.55 (2.04)		
Individual Income	15.32 ** (7.54)	14.88 ** (7.56)	10.91 (6.96)	10.57 (6.73)	11.03 * (6.11)
Household Wealth	2.58 (2.10)	2.13 (2.06)	1.49 (2.02)	1.52 (1.99)	
Household Size	3.97 * (1.97)	4.16 ** (1.97)	4.73 ** (1.94)	4.74 ** (1.91)	4.61 ** (1.74)
Individual Income-squared	-4.09 ** (2.05)	-3.89 * (2.06)	-3.11 (1.98)	-3.05 (1.94)	-3.36 * (1.79)
Constant	13.86 **	8.20	12.88 **	12.47 **	15.57 **
Observations	32	32	32	32	34
Model Significance	0.060	0.052	0.051	0.025	0.013
Adjusted R-squared	0.22	0.21	0.20	0.22	0.22

Note: Standard errors in parentheses. All coefficients are normalized (divided by std. dev.)

*** Coefficient significant at < 0.01 level in two-tailed test.

** Coefficient significant at < 0.05 level in two-tailed test.

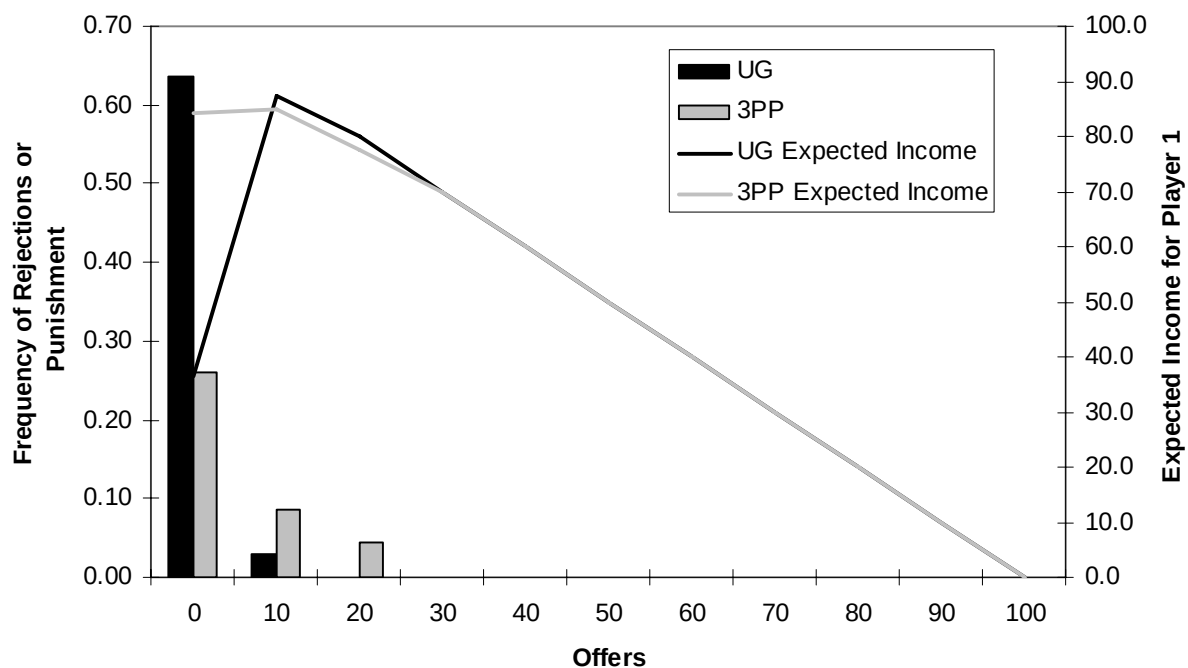
* Coefficient significant at < 0.10 level in two-tailed test.

3.4.2. Predictors of SMUG Minimum Acceptable Offer (MAO)

No actual offers were rejected in the SMUG, and the strategy method does not provide much evidence for punitive sentiment for low hypothetical offers. All hypothetical offers of 20% or higher were unanimously accepted, and only 1 of 33 responders rejected an offer of 10%. Interestingly, only 21 of 33 (or 64%) responders said they would reject offers of nothing! Thus, 36% of the responders would accept no money in the game. While a self-interested money-maximizer should accept any positive offer, there is no absolute gain from accepting a null offer, and a definite loss in terms of relative payoffs. Given the empirical pattern of acceptances and rejections for all offers, the income maximizing offer for Tsimane proposers is 10% (Figure 4). This offer yields an expected 17.5 Bs (87.3% of the endowment), with only a 2.7% loss. On

average, Tsimane proposers offer more than the income-maximizing offer. Only 11% of proposers offered 10% of the endowment. If offers were made in coordination with expected responder behavior, then there should be a positive correlation between the amount of expected income generated from a specific offer and the proportion of proposers making that specific offer. The Pearson correlation is 0.77 ($p=0.006$) when all possible offers (including those above 50%) are considered. If we restrict the analysis to the set of offers of 50% and below, the correlation drops to 0.65 and loses statistical significance ($p=0.16$).

FIGURE 4. Rejection, punishment, and expected income. Bars indicate frequency of rejections (black for UG) and punishment (gray for 3PP). Lines indicate income that Player 1 can expect to receive given the pattern of rejections by Player 2 in the UG and punishment by Player 3 in the 3PP.



Regression analyses examine the potential explanatory power of the set of predictors tested in the above analyses of DG and UG offers on the minimum acceptable offer (MAO) elicited from the strategy method (Table 4). The proportion of land devoted to cash-cropping,

and linguistic competence in Spanish showed significant effects in Model 1, and so are included in the analyses. Figure 4 displays histograms of the independent variables. Even though only offers of 0% and 10% saw rejections, there are still significant effects. Model 1 reveals that males, the least skilled Spanish speakers, people from less wealthy and larger families, and those with a greater percentage of their land devoted to cash crops, are each more likely to reject a lower offer. Household wealth shows a quadratic effect where those of intermediate wealth are predicted to accept offers as low as 4%, whereas members of the poorest and wealthiest families won't accept offers below 10%. Only household size and cash cropping land show robust results across all models in Table 4. Household wealth is nearly robust, but loses significance in Model 4. Each standard deviation unit increase in land percentage devoted to cash-cropping and household wealth is associated with a 3% and 2% higher MAO, respectively. A comparison of standardized estimates reveals that sex, household size, and the percentage of cash-cropping land have equal predictive power of the MAO. A maximum of 45% of the adjusted variance in MAOs is explained by these models.

TABLE 4. Linear Regression of Tsimane Ultimatum Game Maximum Acceptable Offers (MAO)

Variable (Divided by std. dev.)	Model 1	Model 2	Model 3	Model 4
Age	0.85 (1.11)			
Female	-1.85 (1.29)	-2.32 ** (1.12)		
Education	2.69 ** (1.24)	2.28 ** (1.11)	2.01 (1.19)	1.88 (1.28)
Individual Income	1.98 (1.22)	1.61 (1.11)	2.36 ** (1.13)	
Household Wealth	-9.21 ** (4.11)	-8.04 ** (3.77)	-7.81 * (4.08)	-6.53 (4.36)
Household Size	1.94 * (1.08)	1.79 * (1.05)	1.50 (1.12)	2.45 ** (1.11)
Household Wealth-squared	8.00 * (3.94)	6.72 * (3.53)	6.71 * (3.82)	5.44 (4.07)
Proportion of land devoted to cash cropping	3.01 ** (1.13)	2.97 ** (1.12)	2.54 ** (1.19)	2.67 ** (1.29)

Competency in Spanish language	-2.60 *	-2.69 *	-1.00	-0.85
	(1.43)	(1.41)	(1.24)	(1.34)
Constant	6.12	9.13 **	5.02	3.65
Observations	26	26	26	26
Model Significance	0.016	0.009	0.022	0.055
Adjusted R-squared	0.45	0.46	0.37	0.26

Note: Standard errors in parentheses. All coefficients are normalized (divided by std. dev.)

*** Coefficient significant at < 0.01 level in two-tailed test.

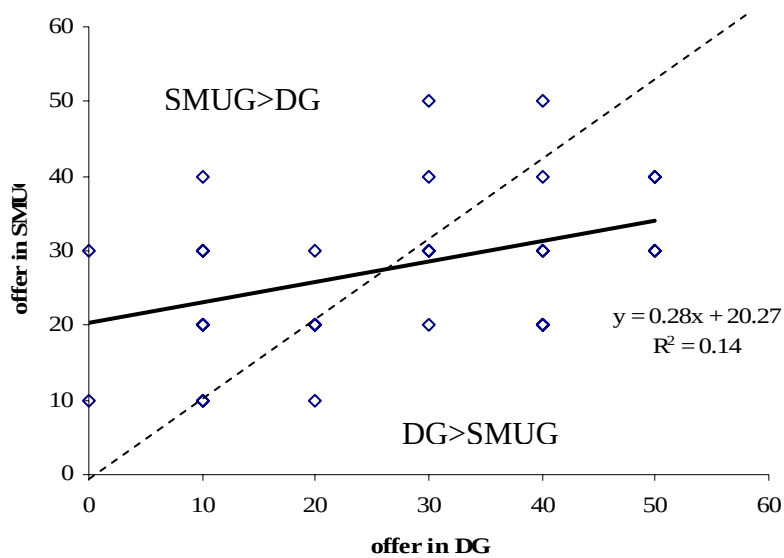
** Coefficient significant at < 0.05 level in two-tailed test.

* Coefficient significant at < 0.10 level in two-tailed test.

3.5. DG and SMUG correspondence

Because the same individuals acted as proposers in both the DG and SMUG, we can compare offers to examine whether offers are similar across games (Figure x). On average the same people ($n=36$) gave 1.9% more in the SMUG than in the DG. Of the 36 proposers who played both games, 9 gave the same amount, 15 gave more in the UG, and 12 gave more in the DG. A Wilcoxon signed-rank test on paired offers reveals no significant difference in mean offers across games ($p=0.52$; Table 1). Additionally, there is a significant positive correlation between offers in the DG and SMUG (Pearson's $r=0.38$; $p=0.02$). The more stringent Epps-Singleton test, which compares distributional shapes and does not account for the lack of independence between games, shows a significant difference across games ($p=0.04$; Table 1). Linear regression analysis on the difference between SMUG and DG offers reveals that proposers from larger, and more wealthy households gave more in the SMUG than in the DG, even though household wealth was shown above to be associated with lower offers in the DG.

FIGURE 4. Dictator Game and Ultimatum Game offers made by the same people ($n=36$). Dashed diagonal line of equality shows where individuals made the same offer in both games. Above this line, offers in SMUG are greater than those in DG, and vice versa below the line.



3.6. Matching Game (MG)

The Matching Game examines people's ability to converge on common focal points with other community members. In the MG on game animals, 32% of the sample converged on tapir (*shi'*), 25% on red brocket deer (*ñej*), and 15% on collared peccary (*quiti'varej*). Hunting is not so successful in Cosincho, where the majority of animals encountered are monkeys, birds, and coatis. Tapir is the rarest and largest animal in South America. For the MG on plants, 40% of the sample converged on mahogany (*tyura'* - *Swietenia macrophylla*), and 17% on almendrillo (*cojma* - *Dipteryx odorata*). The remainder of the responses each received less than 10%. In total, there were 9 animal and 17 plant responses. My catalog of forest resources includes 43 animals and 428 different plants or trees. Thus, Tsimane converge on 21% of the animals and 4% of the plants which others and I have documented.

If modal responses in the DG are construed as perhaps more representative of group norms, then we can examine whether those individuals who are best at guessing what most others will say in the MG are also more likely to give the modal response in the DG. If those

best at the MG are better able to predict behaviors or actions of other group members, then they should also be more likely to offer the income-maximizing offer in the SMUG. Neither of these predictions is borne out. There is no relationship between the percentage of others who offered the same amount in the DG and the percentage of others who also said the same plant ($r=0.08$, $p=0.70$, $n=24$) or animal ($r=0.11$, $p=0.60$, $n=24$) in the MG. There was also no relationship between the expected income from the offer (given the observed pattern of rejections – Figure 4) made in the SMUG and the percentage of others who also said the same plant ($r=0.07$, $p=0.77$, $n=23$) or animal ($r=0.17$, $p=0.43$, $n=23$) in the MG. Thus, those who performed the best in the MGs did not make offers closest to the mode in the DG or to the income-maximizing offer in the SMUG.

4. Third-party punishment Game (TPPG)

4.1. Study village: Fátima

The TPPG was played in Fátima, located about 70 km upstream on the Maniqui River, or up to a four-day river journey.³ A different village was used for TPPG because of the large sample of subjects required to play the game. At the time of the TPPG, there were 444 residents, making it one of the largest Tsimane villages.⁴ Fátima was chosen for the TPPG because of the large population and because economic games have never been played there before. Like Cosincho, much of the village is also located in the interior, along the smaller Chimanes River. Fátima is home to a well-organized Catholic Mission, which flourished under the stewardship of the Alsatian Father Martín in the 1950s. He attracted Tsimane from other parts of the Maniqui region to congregate and live near the Mission. In its current form, much of the village is highly dispersed along the Chimanes River. It is at least a half-day's journey from the mouth of the

Chimanes River to where it reaches the last household. At least half of the village congregates routinely at the weekly Sunday masses. After Martín's death in 1997, the only Tsimane "priest" was given charge of the Mission, with occasional assistance from Bolivian priests who arrive by airplane during bi-monthly visits via a small airstrip near the Mission. Father Martín had struggled against river merchants and loggers, and had strongly discouraged any village residents from interacting with them. The majority of agricultural production traded or sold was, and still is, purchased by the Mission at a reasonable price, rather than by the merchants. In recent years, river merchants and loggers have started to revisit the region.

4.2. Methods

The TPPG protocol followed the adapted standard version translated into Spanish by Clark Barrett. Village members were given initial notice about the game at the conclusion of Mass one week prior to the games, then reminded during frequent household visits and by word-of-mouth. The TPPG was played after a Sunday service in June 2003. Over 90 individuals had congregated to listen to the rules of the game. Explanation of the game followed the procedure outlined in section 3.2. Total time to explain the game was 1 hour. Players then entered one-by-one into a private area inside the Mission courtyard. Game rules were explained again, test questions given, and rules re-explained until the test questions were answered correctly. Total sample size for TPPG is 73 (27 proposers, 23 receivers, 23 punishers). It took 5.5 hours for 63 Tsimane to play the game on the first play day. On the second play day, it took 1.5 hours for an additional 11 people to play. All players were paid at the end of the second day, and the day after. There was no significant effect of day of play on offers made (19.6% (n=23) on the first day, 22.5% (n=4) on the second day, $p=0.76$, M-W) or on minimal accepted offer (4.2% (n=19)

vs. 2.5% (n=4), $p=0.60$, M-W). There was also no effect of order of play and offer ($r=0.03$, $p=0.88$).

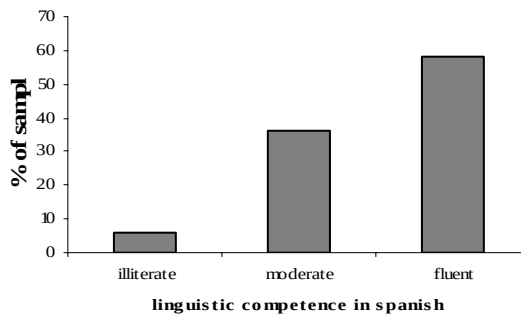
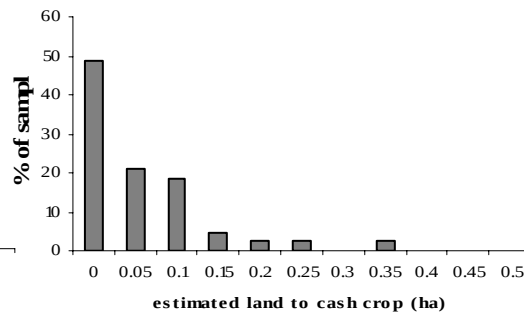
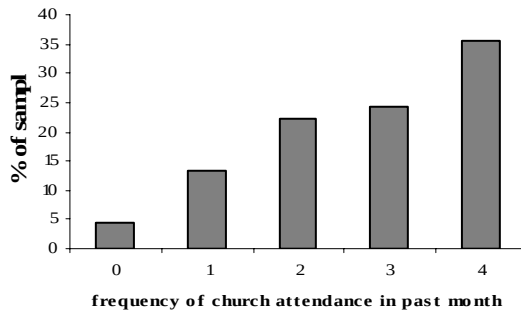
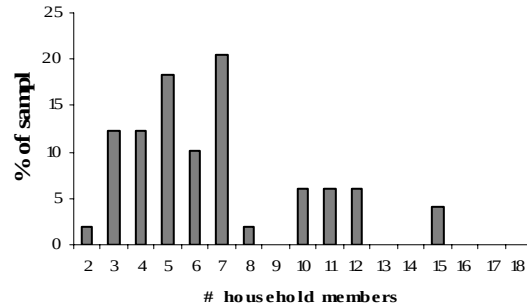
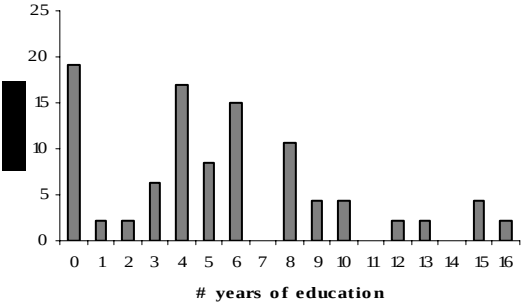
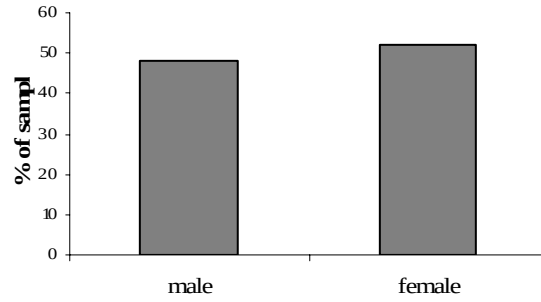
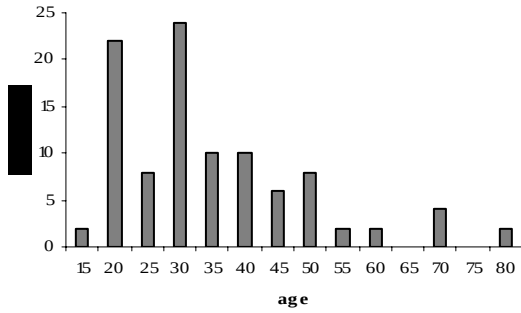
4.2.1. Predictor variables

Market-oriented variables were not collected in the same way as done in Cosincho due to time constraints and because there was no concurrent anthropological project in Fátima. However, during brief interviews of players after payment, I asked about prior visits to market towns over the previous two months, and total number of arrobas (~12 kg) of rice sold either to the Mission or in San Borja. Rice is a principal cash crop and so can be used to roughly estimate the amount of land devoted to cash cropping. Demographic variables were collected in the same manner as in Cosincho. Histograms of these predictor variables are shown in Figure 5.

4.3. Results: Third Party Punishment (TPPG)

Figure 2 shows the distribution of offers in the TPPG. Mean, median, and modal offers were 20%, 20%, and 10%, respectively. Neither the Mann-Whitney nor the Epps-Singleton test reveal significant differences between TPPG offers in Fátima and DG offers in Cosincho (Table 2). A comparison of the TPPG offers in Fátima with those from a sample in Berlin, Germany (from Fehr and Fischbacher 2004) also revealed no significant differences using both statistical tests (Table 1).

FIGURE 5. Histogram of predictor variables from TPPG sample



4.3.1. Predictors of Third Party Punishment offers

Table 5 shows the regression results examining the effects of predictor variables on TPPG offers. Figure 5 shows the histograms of the distribution of predictor variables from the

sample of players 1 and 3. None of the demographic or acculturation variables are significant predictors of TPPG offers in Models 1-3, which are probably due in part to the small sample size. In reduced models, Spanish ability and frequency of attendance at the weekly church services over the past month (range 0 to 4) are significant. When analyzed together, each additional church visit was associated with 5-7% more given away, while the most fluent gave 8% less than non-speakers. Fluency in Spanish is associated with increased church attendance ($r=0.30$, $p<0.05$). Using non-normalized parameter estimates, fluent Spanish speakers, who went to church 3.2 times in the previous month, gave an average of 15%, while non-speakers, who went to church 2.5 times in the previous month, gave an average of 22%. This model accounts for 13% of the adjusted variance in TPPG offers.

TABLE 5. Linear Regression of Tsimane Third Party Punishment (TPP) Offers

Variable (Divided by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	1.20 (4.85)					
Female	-2.06 (4.00)	-2.45 (3.55)				
Education	0.83 (4.28)	0.45 (3.82)	0.09 (3.71)			
Household Size	3.12 (5.25)	2.50 (4.40)	2.52 (4.31)	2.69 (3.59)		
Frequency of church attendance in past month	6.72 (4.81)	7.10 (4.36)	6.89 (4.25)	6.96 ** (3.37)	6.45 ** (3.00)	4.85 * (2.62)
Amount of land devoted to cash cropping (hectares)	2.05 (3.84)	2.28 (3.57)	2.13 (3.49)	2.08 (3.07)	1.25 (2.84)	
Competency in Spanish language	-4.71 (4.58)	-4.81 (4.36)	-4.06 (4.13)	-3.98 (3.19)	-4.04 (2.93)	-4.91 * (2.75)
Constant	0.33	3.98	1.43	0.84	8.77	15.04 **
Observations	17	17	17	17	17	17
Model Significance	0.760	0.638	0.564	0.268	0.162	0.094
Adjusted R-squared	-0.21	-0.11	-0.06	0.09	0.12	0.13

Note: Standard errors in parentheses. All coefficients are normalized (divided by std. dev.)

*** Coefficient significant at < 0.01 level in two-tailed test.

** Coefficient significant at < 0.05 level in two-tailed test.

* Coefficient significant at < 0.10 level in two-tailed test.

4.3.2. Predictors of Third Party Punishment Minimal Accepted Offer (MAO)

Out of 23 offers which could have been punished, 3 of these were met with punishment by third parties.⁵ Two of these were offers of 10% and one was an offer of 0. No third party players said they would punish any offer of 30% or greater. One player (4%) said he would punish someone who offers 20%. This individual was an educated person, the elected chief of the village, and had worked with the author previously as a translator for a physician. Two individuals (9%) said they would punish those who offer 10%, and six (26%) said they would punish those who offered nothing. Given the pattern of third-party punishment, the income-maximizing offer is 10% (Figure 4). 37% of TPPG proposers gave this amount. The Pearson correlation between expected income from an offer and the proportion of proposers making that offer is 0.58 ($p=0.06$). Restricting the set of possible offers from 0-50% increases the correlation to 0.69, but reduces the significance level ($p=0.13$).

Regression analysis on MAOs using the same variables as in 4.3.1 does not reveal any statistically significant effects in any of the regression analyses shown in Table 6.

TABLE 6. Linear Regression of Tsimane Third Party Punishment Minimum Acceptable Offer

Variable (Divided by std. dev.)	Model 1	Model 2	Model 3	Model 4	Model 5
Age	-0.15 (2.61)				
Female	-1.85 (3.30)	-1.87 (3.14)			
Education	-3.46 (3.92)	-3.35 (3.28)	-2.63 (2.96)		

Household Size	1.00 (3.07)	0.91 (3.26)	0.69 (3.15)	-1.27 (2.23)	
Frequency of church attendance in past month	-1.17 (3.07)	-1.18 (2.92)	-1.88 (2.60)	-1.60 (2.56)	-1.63 (2.50)
Amount of land devoted to cash cropping (hectares)	-1.13 (2.42)	-1.13 (2.30)	-1.33 (2.22)	-1.59 (2.18)	-1.87 (2.08)
Competency in Spanish language	1.02 (3.82)	0.93 (3.35)	2.14 (2.59)	1.23 (2.36)	1.38 (2.29)
Constant	8.67	8.63	2.92	5.52	2.76
Observations	17	17	17	17	17
Model Significance	0.938	0.874	0.830	0.856	0.795
Adjusted R-squared	-0.40	-0.28	-0.21	-0.19	-0.13

Note: Standard errors in parentheses. All coefficients are normalized (divided by std. dev.)

*** Coefficient significant at < 0.01 level in two-tailed test.

** Coefficient significant at < 0.05 level in two-tailed test.

* Coefficient significant at < 0.10 level in two-tailed test.

5. Collective action in action

5.1. Digging a well in Cosincho

There was a government initiative to install an underground well in several Tsimane villages several years ago. Plans to build a well never solidified in Cosincho, after residents dug an 8 m hole, and the government project ran out of money. The project was left unfinished until a pig fell into the hole and died two years ago. This event prompted villagers to fill the hole back up with dirt. During the wet season, the Cosincho River is muddy and dirty, and people often complain that this water has a bad taste, and believe this water to be a major cause of sickness. As a goodwill gesture, our research team bought concrete in November 2002, and a group of residents were quickly motivated to re-construct the well. In place of bricks for constructing the walls, stones were to be brought from the river. The well was to be built in the same location as the planned well several years ago. It took about 9 work days (over the span of 2.5 weeks) to dig a hole 8 m deep and 2 m wide, transport stones from the river, and apply the liquid concrete to the interior wall. Well construction is a classic public good because once built, everyone has

access to the water it provides, and no one is excluded from using the well. To recruit workers, the village chief visited each household and discussed the well project. There were 41 eligible males who could potentially work on the well. I recorded the identity and type of work done by each worker for each day of labor. Additionally, several women helped provide beverages on select days. While 19 (46%) of the males worked at least once, on average only 8 men contributed labor per work-day. In total, only 18% of the total possible labor-force (as measured in man-days) worked on the well project.

If proposer behavior in the DG or SMUG measures some aspect of altruistic or pro-social behavior that is independent of the potential reputational gains associated with display and reciprocity, then we might expect a positive correlation between work effort in the well project and game behavior. Even though the games are private and anonymous, and well construction is public and non-anonymous, it is nonetheless instructive to examine whether the pro-social tendencies measured in the games map onto one domain of communal behavior. However, there is no significant relationship between the number of days worked, and offers in the DG ($r=-0.21$, $p=0.40$, $n=18$) or in the SMUG ($r=0.14$, $p=0.59$, $n=18$). Even if helping behavior is dichotomized as either 'worked' or 'did not work', there are no significant relationships with game behavior ($p=0.18$ for DG, $p=0.79$ for SMUG). One important confound is the fact that even though water will be available to all in the community who want it, travel costs are significantly less for those who live near the well. Realistically, those living closer to the Maniqui River than to the well are unlikely to use the well as their water source. Indeed, none of the 14 men who live near the Maniqui worked on the well, and 64% of the non-workers live near the Maniqui. However, after controlling for location (defined as near Maniqui, central near well, central interior, near

Cosincho River), neither number of days nor presence or absence of help was significantly associated with proposer behavior in either DG or SMUG.

If participants in collective action are ‘suckers’ who pay the costs so that others (and themselves) may receive benefits, then participants might display low MAOs in the UG, whereas if these participants are more likely to rally and enforce coordination for collective action purposes, then these individuals should display higher MAOs. However, there was no relationship between MAO and the number of days worked on the well ($r=0.15$, $p=.70$, $n=9$). After controlling for residence location, there is a significant negative relationship, such that each additional day of work was associated with 2.3% lower MAO.

5.2. Planning a village feast

One week after the TPP game was played in Fátima, a visiting priest announced during a Saturday service that the following day would be a village-wide feast. He said that the Mission would provide some food such as rice, but that the responsibility for a satisfying feast rested with the generosity of community members. He urged village members to bring fish, meat, rice, manioc, or any other food items, which would be prepared, cooked, and eaten communally at the Mission. Type and quantity of food contributions from specific individuals (or families) were recorded by myself and Zelada, as were the identities of those who helped process or cook the food, and those who ate from the (literal) common pot. No one was excluded from eating, and consumption continued until the pot was empty. Out of 85 total households, members of only 10 households provided food or some type of assistance, but adults from 34 households were observed eating. Thus, only 11% of households helped contribute to the total pot, whereas 40% of households benefited from consumption. The percentage of consumers is probably higher

because identities of children (who were only consumers, not producers) were not recorded. In terms of individuals, out of a total 187 adults, only 5% helped provide food, but 27% received shares. Another way of stating the free-rider problem is that 75% of those who ate at the feast did not contribute food or services to the common goal. All who contributed food or labor ate during the feast.

As in the case of the well construction project in Cosincho, I examine whether voluntary participation in collective action associates with greater TPPG offers if both cue some aspect of pro-social sentiment. It is unclear whether greater participation should lead to a larger or smaller MAO. There is, however, no significant relationship between feast participation and the TPPG. Labor and food contributions to the feast were not associated with TPPG offers ($r=0.09$, $p=0.67$, $n=23$) nor with MAO ($r=0.02$, $p=0.92$, $n=23$).

6. Summary

The important findings are summarized below.

1. DG offers are higher, UG offers are lower, and TPPG offers are similar to those found in industrialized societies. The level of variation in these offers is higher than in samples from industrialized societies. These patterns in the DG and UG are similar to previous findings using a different protocol and methodology. Tsimane UG results are also similar to Machiguenga results reported by Henrich (2000), and Machiguenga show many ethnographic similarities to the Tsimane (Johnson 2003).
2. Both second-party and third-party punishment were rare. Consistent with this general lack of punishment, proposer offers were very similar across the three DG, UG, and TPPG. Despite the overall low rate of rejection, being male, educated, a cash cropper,

and resident in a larger, and less wealthy household were all associated with a greater tendency to reject the lowest offers in the SMUG.

3. Income had an inverted U-shaped effect on offers in the DG and SMUG. Those with greater household wealth gave less in the DG. Members of larger households gave more in the SMUG.
4. Sex, education, and Spanish ability had no effect on offers in the DG and SMUG games.
5. A repeat of the DG in Cosincho revealed lower offers in 2002 than in 2000. Being male, younger, educated, and more wealthy, were all associated with a greater tendency to give less in 2002. However, those who played in 2000 did not play significantly different from those who had never played the DG before.
6. The distribution of SMUG offers is different than that of several other Tsimane villages studied in 2000.
7. Offers made by the same people were similar across the DG and SMUG, but significant distributional differences remain.
8. A limited comparison revealed little correlation between two instances of actual collective action or matching game behavior and proposer or rejector behavior in the games.

7. Discussion

7.1. What have we learned about norm salience and market influence?

There are a variety of ways by which market integration and acculturation can affect social norms, and lead to cross-cultural discrepancies in game behavior. First, interaction with outsiders and anonymous others (“strangers”) in large societies, without a common history or

close kinship, may lead to less daily cooperation, but also a greater emphasis on courtesy and etiquette. For example, experimental evidence supports the notion that explicit score-keeping is more profound with casual friends and strangers than with kin and close friends (Silk 2003). Second, familiarity with a competitive, money-based market system, perhaps in combination with the former, may be associated with equality norms of fairness. If money is a novel currency, then more familiarity and appreciation of the value (and rarity) of money may produce more selfish behavior. If money is instead viewed as just another type of resource, then money may not lead to any differences in game behavior. Third, formalized education in a classroom often emphasizes rules and structure, as well as information and linguistic competence for interacting in national society. These may favor more pro-social norms. Fourth, the extent of individualistic entrepreneurship, coupled with market integration, may also produce ambiguous outcomes. They may either emulate western-style norms, or may diverge from them if those Tsimane who actively seek out the market tend also to be more “selfish”. Thus, each of these components of ‘industrialization’ need not produce western-style game behavior. Even in samples in industrialized societies, framing and anonymity matter in the DG (Hoffman, McCabe, and Smith 1996), and the few non-student samples have shown different behavior in the DG (Carpenter, Burks, and Verhoogen 2004, Henrich and Henrich n.d.) Ensminger this volume). Similarly, an increasing body of work is showing that market integration can have both positive and negative effects on other features of people’s lives, such as deforestation, health, and indigenous knowledge (Godoy 2001). For example, markets foster new kinds of wealth which can help improve nutrition, but as opportunities for wealth and spending increase, some individuals choose to spend much of their income on more status-oriented goods that do not positively

impact the health or general welfare of families, and this income usually comes at a cost to other investments in family and community.

The market and demographic variables analyzed in this paper are proxies which tie into several of the above domains of industrialization. For example, fluent Spanish speakers most likely received formal schooling, engage in wage labor, and make frequent town visits to purchase or trade items, or for occasional educational workshops. It is appropriate that Spanish ability is correlated with the greatest number of other acculturation-oriented variables. While Spanish competency and visits to San Borja were positive predictors of offers in prior UG and DG (Gurven 2004b), these relationships do not consistently re-appear in the multivariate analyses presented here. Spanish competency was negatively associated with offers in the TPPG and mostly absent in the SMUG and DG presented here. Income and per-capita wealth showed significant non-linear effects on offers in the UG and DG. Those with the highest incomes or wealth give less, perhaps attributable and indicative of the entrepreneurship of the wealthiest few.⁶ Indeed, the wealthiest were most likely to have reduced their DG offers over the two year gap, and to accept lower SMUG offers. As mentioned above, these effects may be indicative of self-selection on market behavior by Tsimane. Wage labor was measured in days spent in labor and not in total earnings in Gurven (2004a), which saw no effect on UG offers. The market contributions to the diet did not predict anything in the current analyses, although they positively predicted UG offers and negatively predicted DG offers in earlier games which used a cruder, more short-term measure of diet composition (ibid).

One problem with acculturation variables is the potential for high measurement error given the relatively short time frames over which they are measured. This paper tried to avoid some pitfalls of one-shot interviews about past week or past month by examining behavior over a

year's duration. Spanish literacy and years of education probably observe the most long-term effects, whereas market contributions to diet, visits to San Borja, cash cropping, income and wealth can all fluctuate seasonally and annually. It is not clear a priori whether short-term or long-term salience should be a better predictor of game behavior. Norm internalization may require long-term exposure, but the salience of a recent trip to San Borja, for example, may also carry weight in the minds of players.

7.2. Why do the Tsimane punish so little?

There was little evidence for second-party or third-party punishment in the UG and TPP games, in marked contrast to results in samples from industrialized societies, and in several other cross-cultural samples (e.g. Hadza). Although rates of punishment tend to be lower when a strategy method is employed (Brosig, Weimann, and Yang 2003, Oxoby and McLeish 2004), the absence of overt punishment may be more common than previously thought. The same result was found in all of the UGs played among the Tsimane in 1999, as well as among the Ache (Gowdy, Iorgulescu, and Onyeiwu 2003, Hill and Gurven 2004), Achuar (Patton 2004), Machiguenga (Henrich 2000), and Igbo (Gowdy, Iorgulescu, and Onyeiwu 2003). If moderate to high levels of second-party or third-party punishment are required to maintain pro-social norms, then why isn't punishment of low offers a more universal phenomenon in these groups?

Punishment of true norm violations does occur in these groups, so the absence of punishment in the games does not mean that punishment does not exist in the social world of these groups. Several examples from the Tsimane and Ache illustrate my point. After being ignored several times during meat distributions by a hunting partner, one Tsimane man refused to go hunting or share with that individual until the former changed his behavior. Upon

disclosure of infidelity with an outsider, another Tsimane man was beaten by male members of his wife's family. Accusations of stealing sometimes result in verbal or physical violence against perpetrators among Tsimane. An Ache woman who had lived in Paraguayan society, was trained as a schoolteacher and who received a steady income, saw her house and all of her possessions burned down by envious others. Another young Ache woman who worked as a prostitute in Paraguayan society had her head shaved to publicly display her transgression.

The above cases connote clear transgressions of local norms, whereas the economics games do not. Receiving little from another person is unpleasant, but is not necessarily viewed as particularly "unfair", and therefore does not elicit punishment (see Fehr and Fischbacher 2002 for a similar argument). Four of ten individuals interviewed after the DG and three of nine after the SMUG said the games did not remind them of anything in their daily lives. There is little precedent for 50/50 split-offers in many domains of Tsimane social life, beyond distribution rules for wild game among hunters. Only one person reported giving half in the SMUG so that "the other person wouldn't be sad". In informal interviews about distribution rules for a wide variety of resources, people commonly reported that "you can give what you want", emphasizing individual choice. Thus, the absence of punishment in the games is not so strange. Additionally, the setup of the games does not mimic any kind of traditional system where rules governing distribution are often tied to systems of production incorporating labor or capital inputs (Gurven 2004c, Güth 1994, Kaplan and Gurven 2004). Instead, the games provide arbitrary windfalls received as manna from heaven. In a series of clever experiments, differential inputs or costs incurred explained twice as many UG offers as the equality norm when endowments were produced through joint production decisions (Königstein 2000: Table 1.4). Those more likely to

punish may therefore not be representative of most people. The highest offer rejection (20%) was in the TPPG, and voiced by the village chief.

Despite the examples mentioned above, the Tsimane generally avoid confrontation, and are not overly eager to establish reputations as norm-enforcers. After severe incidents, such as murder, the perpetrator usually “escapes” and moves to a different community in a distant region of the Tsimane territory. If the murderer returns years later, they are not formally punished, but may be ignored and avoided by a majority of the community. If disgruntled with an individual, Tsimane will usually gossip about the transgression, and through word-of-mouth hope to induce a change in behavior. If this is unsuccessful, Tsimane will ignore or avoid interaction with transgressors (they may do this anyway), which is not difficult due to the often dispersed layout of villages. Grievances are often voiced during public drinking festivals, which can result in an alleviation of conflict, or an eruption of physical violence. Conflicted parties will often resolve their differences, but frequently one or both parties may leave the village temporarily or permanently. Thus, even if individuals were annoyed or upset with the prospect of receiving or having others receive low offers, they were not stirred enough to provoke a punishment that carried a monetary cost.

Two other possibilities were considered in Gurven (2004a) and Hill and Gurven (2004). Even though the identities of players were anonymous, some players may have believed that offer rejection would stir discontent in small communities where people need to live with each other long after the games are over. This seems unlikely among Tsimane, considering many did not care if others were present while they received their payment. There is also the possibility that the cost of rejecting offers is too high, given the scarcity of wage labor, and hence money. It

remains to be seen whether the SMUG or TPP played with a more locally abundant alternative currency might invoke a higher rate of rejections.

7.3. Why different results across villages, and even in the same village over time?

An interesting finding is that proposer behavior in the DG differed more from the pattern of proposer behavior in the same village two years prior, than from that among other similar, traditional populations such as the Hadza or Machiguenga. Similarly, SMUG proposals differed substantially from several of the UG samples from 1999. What can account for the relatively high degree of intra-cultural and even intra-village variation in game behavior?

One hypothesis is that differences in proposer behavior across villages are real and reflect variation in norms. No obvious differences in norms exist across all villages, although there are definitely obvious differences in communality, personalities, and recent histories of inter-personal conflicts. Some of these differences may be due to variation in group size, shared history, kinship, and extent of exploitation by loggers, merchants, and encroachers. The extent to which game behavior variation reflects differences in norms will be the subject of a study in progress using a series of games played in ten villages.

A second hypothesis is that learning or practice is required for game behavior to be ‘representative’ of an individual’s preferences because Tsimane have no experience playing economics games, and thus differences in first-run games played in different villages may reflect confusion, by at least some proportion of village members. Two related ideas are that different players conceptualize the games differently, and that the same individuals may change the way they view the same game via learning effects. For example, minimal observation of another pair showed a significant decrease in UG offers over repeated rounds in a U.S. sample (Duffy and

Feltovich 1999), although this and most studies only report mean offers over time. Repeat offers over multiple rounds in an UG in Germany decreased somewhat, then converged (Königstein 2000). Support for a learning effect comes from Cosincho, where mean DG offer decreased from 32% in 2000 to 26% in 2002. An altered dictator game played exclusively among women using plastic beads as the currency showed a further decrease in offers (Rucas et al. in prep). The game was played in four villages, and women in Cosincho gave an average of only 16% of the beads to another woman. This was less than women gave in the other three villages (combined average of 34%). This game was played in 2002 after the DG reported here, but with a different methodology and so is not directly comparable to the DG. Informal follow-up interviews did reveal a variety of ways to interpret the games. As mentioned in 7.2, several people said the DG and SMUG did not remind them of anything in their lives. Others remarked that these games reminded them of loggers' failed promises to pay for wood extraction, "river merchants who offer low because they can", gifting of fish, meat, or money to other Tsimane. One informant said the UG reminded him of the craps games he saw played on the street in San Borja. Regardless of these anecdotes, the learning hypothesis is unlikely to explain the inter- and intra-village game behavior variation because all players answered test questions correctly, the variance in DG offers increased in the repeat play, and game behavior was systematically associated with several predictors unrelated to learning.⁷

A third hypothesis is that the differences are real and reflect differences in unmeasured state variables which can lead to variable levels of pro-sociality (e.g. immediate need for money, impatience, changed social relations with group members). This would explain both the intra- and inter-village differences. For this to be true, it would have to be shown that Tsimane are more whimsical, or more easily influenced, than players in other cultures who show more similar

patterns, or that among the Tsimane, the absence of any obvious norms applied to the games means that individual-level factors therefore carry more psychological weight.

7.4. *What do the games tell us about pro-social behavior?*

Neither participation in well construction nor feast preparation showed a positive relationship with giving in the three games. Similarly, sharing behavior was uncorrelated with UG and in public goods contributions among the Ache (Hill and Gurven 2004). The UG results from the 15-culture sample were more similar to *Homo economicus* than are results from industrialized societies, despite the impression of more daily cooperation in small communities. Economics experiments also show that western subjects generally sort into groups of obligate cooperators, defectors, and conditional cooperators (Kurzban and Houser 2005), and so presumably this typology should carry over into daily behavior. Given that the goal of experiments is to understand aspects of real preferences and behaviors in a controlled environment, the failure of these games to correspond to several observed behaviors is problematic. However, blind comparison of “pro-social” behaviors may not be very revealing due to differences in the underlying costs and benefits associated with engaging in different behaviors. Games are controlled circumstances which attempt to eliminate the common factors which are already known to influence pro-social behavior. Behavior in real-life situations involves significant trade-offs, which can be situation-specific, and which can vary over time. For example, sharing behavior is usually public, and depends on the amount of production available to give, types of resources involved, number of hungry mouths, other people involved in production. Thus, the Ache and Hadza abundantly share food resources, yet play the UG very differently. Well construction is a public event, and people stand to differentially gain benefits

from use of the well depending on where they live. One possibility is that either a wider range of pro-social activities may be necessary, or a larger sample of game behavior from other types of games. Alternatively, the games may not accurately reflect pro-sociality, or reflect pro-social tendencies in only a very limited domain. This may be especially true if Tsimane social norms reflect anti-sociality, or are silent with regards to novel types of distributions. Future research might include a personality assessment to examine whether pro-social orientations correspond with pro-social game play and actual behavior in natural populations (see Ben-Ner, Kong, and Putterman 2004, Boone, de Brabander, and van Witteloostuijn 1999).

An anecdote demonstrates the fallibility of ethnographic interpretations of game behavior. Villagers in Cachuela made the lowest contributions in a public goods game in 1999 (Gurven 2004a). I thought this was strange at the time, because the community was small and tight-knit. Household visiting and sharing were more common than what I witnessed in other villages. I was aware of a history of conflict among several group members prone to drunken brawls, but at the same time, the village shared a common history as migrants from Fátima about fifteen years ago. However, in 2001, the village fissioned after a series of conflicts erupted in a violent altercation. In this case, the public goods game was more revealing than observations of sharing, household visitations, or communal work enterprises.

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¹ I do not report the frequency of trading goods for purchase or resale, because this level of integration is extremely rare, and therefore this variable is uninformative.

² This quadratic effect is not due to a single outlier. There are at least three low offers made by high income proposers. Without these three points, income is marginally statistically significant ($p=0.06$). However, this effect is driven by two other outliers, without which income shows no significant effect. For these reasons, I leave all data points in the analysis of DG and SMUG offers.

³ Cosincho and Fátima are connected by means of a poorly maintained, four hour trail. By river, Fátima is up to a day's journey upstream from Cosincho.

⁴ Technically, the village of Ijnanarej is part of Fátima, although members live on the opposite side of the Maniqui some distance from the rest of Fátima. Residents from Ijnanarej only sporadically visit the Mission for mass or social visitation. Inclusion of Ijnanarej puts the census of Fátima at 469.

⁵ Several players left the game scene before playing, and so several proposers were not paired with third parties.

⁶ Only four proposers in the SMUG and DG had annual incomes estimated at over 3,000 Bs.

⁷ In a study designed to estimate the rate of time-discounting among the Tsimane, Godoy and colleagues employed repeat trials of a task once every three months over the course of a year and a half (Kirby et al. 2002). The first several trials showed little intra-individual correlation, although subsequent trials proved to be more stable (Godoy, personal communication).