Comparative experimental evidence from Peru, Chile & the U.S. shows substantial variation among social groups

Joe Henrich
University of Michigan Business School
701 Tappan Drive
Ann Arbor, MI 48109-1234

Natalie Smith
University of California, Los Angeles
Department of Anthropology
Los Angeles, 90095

This paper reports experimental results from ultimatum and public goods experiments performed among the Machiguenga of the Peruvian Amazon, the Mapuche and Huinca of southern Chile, and with U.S. control groups in Los Angeles and Ann Arbor (MI). We will emphasize three findings. First, results from both our ultimatum and public goods games indicate much greater between-group variation than previous work has suggested (see Chapter 1). Second, if individual economic decisions vary as a consequence of differences in individuals' circumstances, then variables such as wealth, household size, age and sex should provide some explanatory power. However, individual-level economic and demographic variables, including a measure of risk preference, do not account for much, if any, of the variation. Finally, despite the failure of individual-level variables to explain variation, our results do seem to reflect group-level differences in the economic life of these groups, as captured in numerous ethnographic accounts (including our own). To deal with these empirical patterns, new theories will need to provide processes that generate group-level effects while reducing the relevance of individual-level differences.

For organizational purposes, we will not address these three points sequentially. We'll begin with a brief ethno-historical sketch of the Machiguenga, Mapuche and Huinca. Then, we'll describe our ultimatum game methodologies, and present the results. Next, we'll describe the methodologies we used in our public goods games, and present those results—we do this first for the Machiguenga/American comparison and then for the Mapuche/Huinca experiment. As we present this data, we'll emphasize the results pertaining to our three major points. We will conclude with some theoretical and methodological points related to our findings.

Ethnographic Sketches

The Machiguenga

Traditionally, the Machiguenga lived in mobile single-family units and small extended-family hamlets scattered throughout the tropical forests of the southeastern Peruvian Amazon. They subsisted, and still subsist, on a combination of hunting, fishing, gathering and manioc-based, swidden horticulture

(Johnson, 1983). Economically-independent at the family-level, this Arawakan-speaking people possess little social hierarchy or political complexity. Most sharing and exchange occurs within extended kin circles. Cooperation above the family level is almost unknown, except in a limited form during occassional communal fish poisonings (Baksh, 1984; Johnson & Earle, 1987).

During the last 30 years, missionaries, markets and government-administered schools have sedentized and centralized most of the Machiguenga into a number of villages in a continual process of increasing market integration. As these demographic changes have strained local game and wild food resources, the Machiguenga have gradually intensified their reliance on horticultural products, especially manioc (a starchy root crop). Until recently the Machiguenga faced few shortages, owing to their low population densities and their periodic resettlement in new areas (moving every four years; Johnson, 1989). In larger, settled communities, many Machiguenga face increasing shortages of good soil, fish, game and palm roofing materials (Smith, 1999). Furthermore, in an effort to buy increasingly available western goods, many Machiguenga farmers have begun to produce cash crops (primarily coffee and cocoa), raise domesticated animals (e.g. chicken, ducks and guinea pigs) and participate in limited wage labor (usually for logging or oil companies; Henrich, 1997).

Although most Machiguenga now live in communities of about 300 people, they remain primarily a family-level society. This means that families can fully produce for their own needs (food, clothing, etc.) and don't rely on institutions or other families for their social or economic welfare—although there is a constant demand for market items such as machetes, salt, sugar and steel axes. With the exception of recent trips to nearby (minimum 8-hour trip) towns, anonymous transactions are almost unknown. When local bilingual schools (Machiguenga-Spanish) are not in session, and incessant rains of the wet season make travel difficult, many families move away from the community to live in their distant gardens—often located 2 to 3 hours away from the village.

The Mapuche

Until the arrival of the Spanish in the mid 16th century, the Mapuche lived much like the traditional Machiguenga. These semi-nomadic slash and burn horticulturalists organized themselves in economically independent single family units or extended family groupings, and subsisted on a mix of game, gathered foods and horticultural products (primarily potatoes, quinoa, and corn). Unlike the Machiguenga, however, the Mapuche "Lonkos" (hereditary lineage leaders) were able to muster substantial numbers of fierce, stalwart warriors who thwarted Incan, Spanish and Chilean efforts at conquest and pacification for more than 400 years.

Despite their struggle against European political conquest, the Mapuche gradually adopted cereal agriculture (primarily wheat and oats), oxen-driven steel plows, 3-field agriculture and numerous Old

World domesticates (horses, cows, chickens, pigs, and sheep). Since their permanent settlement in *reducciones* in the 1860's, the Mapuche have also been compelled to adopt sedentary living, private ownership of land, and higher levels of community integration (or at least the appearance of such). Only more recently have they begun to speak Spanish, construct European-style housing, and gained access to formal education. Expanding rural Mapuche populations are now experiencing intense land pressure and massive rural-urban migration. At the same time, Mapuche farmers have avoided agricultural innovation, intensification and large-scale economic cooperation.

Today families are highly independent, sedentary, subsistence-oriented agriculturalists. Families grow one or two hectares of wheat (the primary source of calories), a few sacks of oats for the animals, and a small amount of vegetables and legumes for household consumption. The average family manages 6-8 hectares, and owns 2 oxen, 2 cows, 1 horse and 2 pigs. The sale of animals, lumber (fast growing species of pine and eucalyptus) and occasional/seasonal wage-labor generate some cash income. Individual families continue to engage in one-on-one reciprocal exchanges of labor, but larger-scale *mingacos*, in which many men perform cooperative work for a single family, have become increasingly rare—except in female headed households. Exchanges of goods (meat, animals, vegetables, etc.) between families and neighbors proceeds on a cash basis, although credit is extended to friends and relatives.

The Huinca

Inhabiting the small, rural towns around which Mapuche farmers live are non-Mapuche Chileans, or *Huinca* (the Mapuche term for non-Mapuches), who are of mixed European (primarily Spanish) descent, and of comparable economic status to the Mapuche. Most Huinca live in single or extended family households, are almost entirely dependent on the market, and work in their town as temporary wage laborers—although some have more permanent jobs in local businesses. Huinca households participate in larger, interdependent, social networks of exchange. Social ties and loyalty often hold sway over prices in deciding where to shop, or from whom to obtain services. We'll use the *Huinca* as a control group in the Mapuche public goods game.

The Ultimatum Bargaining Game

Although typical ultimatum game (UG) results consistently and substantially deviate from the predictions of game theory (under typical assumptions and standard preferences), the results are very robust. Experimental economists have systematically studied the influence of various factors on the game's results, including stake size[1] (Cameron, 1998; Fehr & Tougareva, 1996; Tompkinson & Bethwaite, 1995; Hoffman et. al., 1996), degree of anonymity (Forsythe et. al., 1994; Bolton & Zwick, 1995), context (Hoffman et. al., 1994; Konow, 1996) and "culture" (Roth et. al., 1991; Slonim & Roth,

1998; Cameron, 1998), but have found that these produce little or no effect on players' behavior. Readers unfamiliar with the UG should refer to Chapter 1 for summaries both of the relevant game theory and of previous experimental results. Most important for our purposes: the robusticity of cross-national research led researchers to believe that people from all over the world behave quite similarly in the ultimatum game, and therefore possess similar notions of fairness and punishment. In studies from places as varied as Ljubljana, Pittsburgh, Tokyo (Roth et. al., 1991), Yogyakarta (Cameron, 1998), Tucson (Hoffman et. al., 1994) and Los Angeles proposers make similar mean offers (40 to 50% of the total), and responders frequently reject low, "inequitable" offers.

Ultimatum Game Methodology

To deal with the particular challenges of performing experiments in the ethnographic settings of both the Mapuche and the Machiguenga, we had to modify the typical experimental procedures used in the ultimatum game. Among the Machiguenga, Henrich first gathered twelve men together between the ages of 18 and 30 under the auspices of "playing a fun game for money." He explained the game to the group in Spanish using a set script written with simple terminology like "first person," to refer to the proposer, and "second person," for the responder. After this, a bilingual schoolteacher (a *mestizo* who teaches the Machiguenga) re-explained the game in the Machiguenga language (translating from the set script), and displayed the money that would be used to make payments. After this, each participant entered Henrich's house (the guesthouse) individually, where the teacher and Henrich explained the game a third time. A number of hypothetical, practice questions were administered to test the participant's comprehension of the game. Parts of the game were re-explained as necessary and often numerous examples were needed to make the game fully understood. After the individual confidently answered at least two hypothetical questions correctly, Henrich would submit the actual question with a pile of *soles* (Peruvian money) in view. The following day, after having successfully gotten 12 responses and paid out some money, randomly selected individuals were sought to play the game. Most people had already heard of the game and were eager to play. Henrich privately explained the game to each individual (usually in the participant's house) and ran through the same testing procedure as in the previous day. During this process several people were rejected because they, after 30+ minutes of explanation, could not understand the game—at least they could not answer the hypothetical questions. More details on this process and the sample can be found in Henrich (2000).

As a control experiment, Henrich repeated a nearly identical version of the Machiguenga UG with graduate students at the University of California, Los Angeles. This experiment sought to minimize differences in (1) stake size, (2) 'community closeness', (3) experimental procedures, (4) instructional details, and (5) the age of players, as well as controlling some aspects of the experimenter himself. First,

the Machiguenga's 20-*soles* stake equals about 2.3 day's pay from the logging or oil companies that occasionally hire local labor. In order to match this amount, Henrich set the UCLA stake at $160, which is about 2.3 days pay for a graduate student working as a "reader" ($9-$10 per hour after taxes). Second, because the Machiguenga were told that they were playing with an anonymous person *from their community*, which contains about 70 adults, the UCLA experiment was restricted to graduate students in the Department of Anthropology (also a community of about 70 adults), and the subjects were informed accordingly. Third, as with the Machiguenga, all UCLA players received instructions from the same script, and then further explanation was given informally using a serious of examples. Each subject then had to answer hypothetical test questions before actually playing the game. Fourth, in both cases the same written instructions were used (translated into English at UCLA), as well as the same pattern of examples and test questions. Fifth, the average age of Machiguenga and UCLA subjects was about the same (26.3 and 25.7 respectively). Finally, Henrich was the experimenter in both cases, and was personally known (to varying degrees) by most of the UCLA and Machiguenga subjects. Unlike the Machiguenga, UCLA students had to sign a consent form before playing.

Among the Mapuche, Henrich again repeated the procedure used among the Machiguenga as closely as possible. However, four differences deserve note. First, unlike with the Machiguenga, Henrich manipulated thirty 100-*peso* coins (the stakes were 3000 Chilean *pesos*) to demonstrate the game and to pose the test questions—Machiguenga examples were only verbal or occasionally sketched on paper. This was done with the hope of facilitating instruction. Second, Mapuche players were told that they would be paired with another Mapuche in the region, but not with a neighbor. Third, the stakes were somewhat lower in this game: 3000 *pesos* equals about one day's pay in local wage labor (remember, stake size has little or no effect in previous work). Fourth, the average age of Mapuche players was 38, a decade or so older than the Machiguenga and UCLA participants (we show in the next section that age does not affect the offers).

Ultimatum Game Results

Our UG results show much greater cross-group variation than previous experimental work, and the size of this effect is substantially larger than that created by existing manipulations of context, stake size, within-population subject selection (e. g., whether the players majored in Economics or not), and anonymity. Table 1 summarizes ultimatum game data for seven different groups: UCLA graduate students, University of Pittsburgh undergraduates, Hebrew University students (Jerusalem), University of Arizona students (Tucson), Gadjah Mada University students (Yogyakarta, Java, Indonesia), the Mapuche and the Machiguenga. In comparing industrial, market contexts, like Los Angeles, Tucson, Pittsburgh and even Yogykarta,[2] we observe little or no difference. However, as we hop from Los

Angeles to Jerusalem, to the Mapuche and to the Machiguenga (see Table 1), we see the mean offer plummet from 48% to 36% to 34% and finally to 26%, respectively. In terms of modal proposer offers, all these groups have a single dominant mode at 50%, except for Yogyakarta, the Machiguenga and the Mapuche. Yogyakarta has a mode at 40% with a strong secondary mode at 50%, while the Mapuche have a weak mode at 50% and a strong secondary mode at 33% (with the two modes differing by only a single individual). The Machiguenga have a strong mode at 15%, and a secondary mode at 25%. The variances in proposer offers within groups also suggest an interesting difference between groups. In Los Angeles, Pittsburgh and Tucson, the variance in offers is quite small compared to what happens outside the U.S., where the variance in offers doubles and triples.[3] Americans (and Europeans) seem to share more agreement about what the "proper" behavior is in the ultimatum game context than the other groups.

(Table 1 about here)

Figure 1, which compares the UG offer distributions for Machiguenga, Mapuche and Pittsburgh, shows that the multi-modal offer distributions of the two small-scale societies are quite different from those found in industrial societies like Pittsburgh (which is a typical U.S. result). While the Machiguenga distribution is dominated by modes at 15% and 25%, the Mapuche are widely scattered from 5% to 65% with peaks at 15%, 33% and 50%. In contrast, Pittsburgh shows a single dominant mode at 50%, and no offers below 20%. The figure also highlights the fact that means and modes do not tell us much about ultimatum game distributions.

(Figure 1 about here)

On the receiving end, responders from industrial societies often reject offers below 20% (see "Rej<20%" in Table 1), although these offers are quite rare. For example, proposers in both Los Angeles and Pittsburgh made 0 and 1 offers below 20%, respectively, while Mapuches, Machiguengas and Israelis made numerous low offers: 10 of 21 Machiguenga offers, 10 of 31 Mapuche offers, and 7 of 30 Israeli offers were below 20%. Unlike Israelis, however, Machiguenga and Mapuche responders almost always accept offers less than 20%. The Machiguenga and Mapuche rejection rates for offers less than 20% are significantly lower (all $p < 0.012$) than the rates found in Jerusalem and Yogyakarta, which are the only places with enough offers below 20% to make this analysis possible. Presumably, if we had larger samples in Los Angeles and Pittsburgh, the rejection rates for low offers would be even higher than those in Jerusalem and Yogyakarta, and thus even more different from the Machiguenga and Mapuche. The

overall rejection rates (rather than the rate for offers less than 20%) for the Machiguenga (0.048) and the Mapuche (0.065) were also quite low (0.048 and 0.065, respectively), especially when compared with Pittsburgh (0.22), Jerusalem (0.33) and Yogyakarta (0.22, 0.33 and 0.19, respectively). See Table 2. This difference is especially provocative because responders in Pittsburgh, Jerusalem and Yogyakarta faced higher average offers, so we might expect lower, not higher, rejection rates.

(Table 2 about here)

It's worth noting that our UCLA control data does look slightly different from the typical U.S. results. UCLA subjects have a slightly higher mean offer and a smaller variance (the mode of 50% entirely dominates the UCLA offers) than typically occurs in U.S. UG experiments. However, both of these differences (the mean and variance) tend in directions opposite to those demonstrated by the Machiguenga and Mapuche (relative to the typical results). Therefore, the particular methodology/stakes used in the UCLA experiment may explain the variation from other U.S. results, but cannot be used to account for the differences found among the Machiguenga and Mapuche. Note, the pattern of differences between the UCLA data and typical U.S. data is consistent with the effect created by increasing the stakes shown in previous experimental studies—more "fair" offers and less variance in offers.

It is also possible, however, that anthropology graduate students represent a self-selected and biased portion of the U.S. population, which tends to exhibit a greater sense of social responsibility and concern for economic equality than the average American. Consequently, proposers make more "fair" offers, and responders seem quite willingly reject "unfair" offers (at least according to post-game interviews). So then, in the same way that economics students tend to make somewhat lower than average offers (Carter and Irons, 1991), perhaps anthropology graduate students tend to make higher than average offers.

Does 'strategic understanding' and 'mathematical ability' matter?

To get some handle on how individual differences in 'strategic understanding' and 'mathematical ability' affect people's decisions, Henrich ranked Mapuche players with 1s, 2s, and 3s according to both how well they understood the strategic nature of the game (with 3 being the highest and 1 being the lowest ranks), and how well they were able to do the mathematical calculations.[4] Very few of the individuals receiving a 1 for mathematical ability occur in the dataset because they were often unable to complete the game. For both mathematical ability and strategic understanding, the game behavior of players receiving '3s' cannot be distinguished from those receiving '2's (using Epps-Singleton, $p = 0.78$

and 0.81, respectively). There were too few '1's to analyze, and '1's were removed from our analyses. The regressions below further illustrate the lack of effect of these measures.

Can individual-level variables explain UG offers?

A substantial amount of theoretical work on human behavior predicts that, in making decisions that carry non-trivial economic consequences, much of the variation should be explained by individual-level differences in economic and demographic circumstances. Our games among the Machiguenga and Mapuche were high stakes games relative to people's earning abilities, their cash-on-hand, and previous experimental work. Consequently, one might expect variables such as age, wealth, sex, household size, and risk preference to account for a significant portion of the variation. However, our analyses indicate that such individual-level variables do **not** account for any substantial portions of the variation. Similar analyses of experimental data among European subjects yield the same conclusion (Gächter, personal communication).

Table 3 analyzes the predictive capability of 10 different variables on Mapuche UG offers using a series of linear regression models. These independent variables are Animal Wealth (AW), Land Wealth (LW), Household Size (HS), Head-of-Household (HH), Age, Sex, Risk Preference (RP), Wage Labor (WL), Strategic Understanding and Mathematical Ability. AW is the total market value of an individual's livestock—sheep, pigs, horses, cows and oxen—based on the most recent price reports from local farmers. LW is the number of hectares owned by the player's household. Animal Wealth can fairly easily be converted to cash, but Land Wealth cannot, as Mapuche can only sell their land to other Mapuches, and Mapuche buyers are extremely hard to find.[5] HS is the total number of individuals living in the player's household. HH is a dummy variable in which '1' indicates the player is the primary economic decision-maker in his or her household. RP was measured several months prior to the UG using a series of binary lottery choices to titrate out each person's indifference point. These lotteries involved substantial financial incentives of the same magnitude as the UG stakes (Henrich & McElreath 2000). Wage Labor (WL) is also a dummy variable in which '1' indicates that the individual has (at some point) participated in wage labor, while '0' indicates he has not. 'Strategic Understanding' and 'Mathematical Ability' were explained in the preceding section. We hope Sex and Age are self-explanatory.

The single message from Table 3 is that none of these variables matter very much. Looking at the 'bivariate' column, we see that nothing is significant. Models 1 through 3 indicate that the variables LW, AW, HS and HH do not provide any substantial predictive power. Adding for Age and Sex in Models 4 does not improve matters. Model 5 controls for Age, Sex and RP, but still the wealth variables remain inert. Adding WL (and removing RP), also fails to exhume anything in Model 6. Model 7, which adds controls for Strategic Understanding and Mathematical Ability to Model 2, lacks any predictive

significance. In analyses not summarized in this table, we also looked at how HOH might interact with LW, AW and HS, thinking that perhaps only heads of household consider their household's wealth and size in making decisions. However, these efforts revealed nothing of significance. Similarly, models examining wealth per household member (i.e. AW/HS and LW/HS), instead of absolute wealth, also came up empty. Using adjusted R^2 values, none of our bivariate or multivariate models explain any of the variation in UG offers.[6]

(Table 3 about here)

Interestingly, analyses of our experimentally-derived Risk Preference measure revealed no relationship with UG offers. In addition to the bivariate analysis, Models 8 and 9 attempted to control first for Age and Sex, and alternatively for Strategic Understanding and Mathematical Ability. None of these efforts unearthed any connection between RP and UG offers. Multivariate analyses examining RP as the dependent variable (with a much larger sample) also fail to show significant predctive powers for LW, AW, WL, Age, Sex, and HOH (Henrich & McElreath 2000).

For the Machiguenga, Table 4 summarizes our regression analyses using the variables Cash Cropping Land (CCL), Wage Labor (WL), Age and Sex. CCL is the amount of land an individual's household devotes to producing cash crops. It provides an indirect measure of an individual's market participation and his experience in the local cash economy. As with the Mapuche, Wage Labor indicates participation (WL = 1) vs. non-participation (WL = 0) in occasional wage labor. Bivariate analyses of these four variables suggest that only CCL has any significant predictive value. CCL remains significant in Model 1, after controlling for WL. Models 2 and 3, which further control for Age and Sex, show nothing significant. Because only men do the cash cropping, we thought the interactional variable Sex*CCL might strengthen and clarify the effect. A bivariate analysis and Model 4, which controls for age and wage work, show that males whose households do a lot of cash cropping make significantly higher UG offers.

(Table 4 about here)

The importance of CCL may reflect a tendency for individuals with more cash to offer more in the UG. However, we believe it captures an individual's greater exposure to the larger Peruvian society. Cash croppers also tend to speak better Spanish, participate more in exchange with non-Machiguenga, have more experience with Protestant missionaries and have spent more time in local Peruvian towns. Consequently, we hypothesize that this greater degree of contact outside the Machiguenga social sphere makes these individuals more likely to have acquired different norms of fairness. Post-game interviews

further suggest that these Machiguenga have acquired some ideas about 'what's fair' from non-Machiguenga.

The lack of predictive capability from our independent variables probably does not result from noise introduced during our data collection. We believe our measures are generally better than the self-report data found in many social science datasets, outside of anthropology. Our measures of both animal wealth and household size involved both interviews and direct observation. For example, in most cases the number of cows a person reported owning was verified by actually counting his cows, and further inquiries were made into any discrepancies between interviews and observation. Other data, like wage labor participation, was cross-checked in three ways: 1) we repeated the same questions several months apart, 2) a local informant re-asked many of the same questions in our absence, and 3) we often cross-checked data with other family members—that is, we asked wives and adult children (living at home) about their husbands and fathers, or vice versa. Any discrepancies provoked further inquiry. Finally, unlike census takers or annoying phone callers, we were familiar visitors and friends to many of these households.[7]

Acquiring data of this quality has an important cost. Both the Mapuche and Machiguenga samples are rather small for regression analyses, so the lack of significant results merely means that these variables probably are not *powerful* predictors. Larger samples may reveal that they are weak predictors. However, in the final chapter of this volume we'll show that such variables are rarely powerful predictors of game behavior, even using larger samples and many different groups.

Comparison of post-game interviews for the Machiguenga, Mapuche and UCLA students

Discussions, post-game interviews, and observations of body language gleaned from the Machiguenga, Mapuche and Americans during these experiments provide some further explanatory insights into the differences between them. Machiguenga had difficulty articulating why they were willing to accept low offers, but several individuals made it clear that they would always accept any money regardless of how much the proposer was getting. Rather than viewing themselves as being taken advantage of by the proposer, Machiguengas seemed to feel it was just bad luck that they were responders, and not proposers. In contrast, Mapuche responders expressed some frustration at low offers, but despite long, pensive reflection and clearly ambivalent feelings (they wanted to reject), most Mapuche finally accepted even very low offers—except for the two rejecters. Mapuche farmers felt that low offers were unfair and the proposer should have offered more, but they were not willing to take nothing in order to punish proposers.

In comparison to these two groups, American students claimed they would reject "unfair" offers (usually below 25%), and a few claimed they would reject any offer below 50%. Correspondingly, some

UCLA proposers, when asked why they offered 50%, said they were thinking of offering less, and thought that most people would accept less, but figured there were some people out there who might reject an offer below 50%. Proposers said that they wanted to be sure that they'd get at least $80 (half of the $160 stake), rather than proposing less and risk getting nothing.

These three groups also differ in their views of fairness. The few Machiguenga who offered 50%, when asked why, said that 50/50 was "fair." When asked if they thought their fellow Machiguengas would accept less, they said "yes, for sure." Many UCLA proposers, particularly those who seemed to know exactly what they were going to offer immediately (rather than pondering over it for 5 minutes like many other UCLA proposers) said they offered 50% "to be fair." When asked how much they thought their fellow responders would have accepted (had they offered less), they seemed uncertain, and said things like, "it depends on the person" or "I don't know."

Contrastingly, Mapuche proposers seem to be entirely driven by fear of punishment, and not at all by notions of fairness or equity, when compared to Machiguenga and American students. Mapuche proposers, especially those offering 50% and above, expressed concern that someone out there might spitefully reject anything but a generous offer. Those Mapuche offering lower amounts felt that some few might reject, but that most people would not, and they were willing to risk it. Like the Machiguenga, the Mapuche are unaccustomed to verbally justifying their actions, so getting detailed responses was difficult and sometimes impossible. However, of the 11 proposers who successfully responded to the postgame questions about why they offered what they offered, 10 indicated that a fear of rejection guided their offer and only one indicated that fairness guided his decision. This differs from UCLA where 60% suggested that fairness considerations influenced their decision and about 53% suggested that a fear of rejection played a part (one-third said both were important). Even among the Machiguenga, four proposers (19%) indicated the importance of fairness, compared to only one Mapuche. Further, unlike UCLA and Machiguenga proposers, who never offered greater than 50% of the total, four Mapuches (16%) made offers greater than 50% of the total. These Mapuche expressed a sense of fear that someone out there might reject an offer of 50% or less, but if they offered more than 50%, acceptance would be assured. Contrastingly, during post-game discussions, two UCLA students mentioned that they wouldn't consider making an offer greater than 50%, as that would be unfair to themselves. Compared to the Mapuche and Machiguenga, Americans seem obsessed with fairness—which includes punishing people who act unfairly.

Public Goods Game

Public goods experiments are designed to investigate how people behave when facing a conflict between individual and group benefits. These games have numerous formats, but in a typical game

individuals are allotted an initial endowment (usually tokens that represent real money), which they allocate between public and private "markets." Both markets offer a known and fixed rate of return. However, the return earned by an investor in the private market depends only on her own investment, whereas the return from the public market depends on the total amount invested byall players. Consequently, the larger the total investments in the public market, the higher the returns to *all* the investors (independent of their contribution to the public market). The conflict between individual and group interests arises from the structure of the payoffs. The individual receives the highest payment when she invests all of her endowment in the private market while all other players invest their entire endowment in the public market. The group, as a whole, receives the highest total payoff when everyone invests publicly (for some examples, see Marwell & Ames, 1979, 1980, 1981; Isaac, Walker & Thomas, 1984; Isaac & Walker, 1988a, 1988b, 1991).

Public goods games have been run with a wide range of structural variations. Researchers have explored variables such as group size, initial endowments, rates of return, basis for dividing money among players, etc. With the exception of modifications involving communication between players and punishment, behavior in the first round of experiments is fairly consistent (even when players know future rounds are coming): average contributions to the public market consistently falls between 40% and 60% of the maximum possible contribution (Chapter 1, this volume; Davis & Holt, 1993; Ledyard, 1995). This behavior, derived from research in western, industrial, urban settings with university students, clearly conflicts with the game theoretical prediction (under standard preferences) of zero contribution to the public market (i.e. to the group). Consequently, because of the robustness of round 1 behavior, and its substantial deviation from game theoretic predictions, we sought to explore the cross-cultural replicability of these results.[8]

Public Goods Game Methodology: the Machiguenga

For a number of reasons, we modified the more typical public goods game-structures for use with the Machiguenga and Mapuche. We will first describe the design of the games and then justify the modifications.

Among the Machiguenga, each experimental round was played with four individuals above the age of sixteen (average age = 20.3), in groups of either all males or all females. Participants and administrators sat in a circle around a communal pot of 20 *soles* ($1 equals 2.4 *soles*). The participants were read the game instructions in Spanish. Each participant had an opportunity to withdraw any quantity of *soles* from zero to five. Whatever money remained in the pot after all players had taken their turn was then increased by 50% and distributed equally among all players, regardless of how much each player initially took from the pot. In order for the game to be played anonymously and simultaneously, money

was not literally taken from the pot. Rather, each player wrote down on a piece of paper how many *soles* he (or she) wanted. Smith performed all subsequent calculations and then paid the players.

After reading the rules to the players, Smith performed an extensive series of examples to both teach the rules of the game, and to test players' comprehension of those rules—as well as to evaluate their ability to perform the mathematical calculations. We do not believe that the examples and testing led to a learning effect on the way the game was played. While the payoff outcomes of various scenarios were made evident, there was no strategic learning because players could not obtain information about how other people would play. In addition, the concept of the game was so foreign to the players that they needed this training to achieve the level of comprehension necessary to participate in the game.

The game was played in two rounds, 1) private/anonymous and 2) public/non-anonymous, but players were not initially told there would be a second round. In the private round, each player wrote on a slip of paper her name, age, and the amount of money that she wanted to withdraw from the pot. The paper was then handed to the game administrator. Payoffs were distributed in envelopes so that the players would not know how much the others received. In the public round, players again wrote down their name, age and the amount to withdraw, after which they handed these papers to the experimenter. However, this time, before calculating and distributing the payoffs, each player had to announce to the group the amount that he/she withdrew. The players were told before the round began that they would be making this announcement to the group. Payoffs were distributed without envelopes so that all the players could see how much each person received. The reason for the public round was to determine if public approval and fear of punishment/social repercussions motivated players' decisions, or if the rules governing the players' decisions were internalized and independent of the social awareness of one's behavior.

Justification of Game Modifications

We restructured the more typical 'voluntary contributions' (VC) public goods game in three ways. First, money was placed in a communal pot rather than distributed as an endowment to each player in order to better simulate the communal resources situation under investigation. We made cash an existing public resource from which people made personal withdrawals, just as natural resources are harvested——making it a common-pool resources (CPR) game. Assuming people are money maximizers and everyone knows this, the allocation of money to individuals or a central pool should not affect outcomes since the payoff structure remains unchanged. If this is true, then the communal pot modification is irrelevant. However, psychological experiments indicate that people place a higher value on goods in their "possession" than on the same goods lacking a contextually assigned sense of ownership—an empirical phenomena called the "endowment effect." If this game structure elicits the

endowment effect at all, it should cause people to be less selfish (withdraw less) than the more typical contribution format (the findings of Brewer and Kramer, 1986 are consistent with this logic). Since the money was not in the possession of the players, it may have less value to them, thus leading to lower rates of withdrawal and greater cooperation.[9]

Second, the payoff structure was designed to be as simple as possible in order to increase game comprehension. Rather than making the rate of return dependent on the amount of money left in the pot, the rate of increase was fixed at 50% and all players received an equal return from the pot. Structuring the payoffs in this manner polarizes the optimal strategies for maximizing group vs. individual benefits—a group maximizer should withdraw nothing from the pot and the individual maximizer should withdraw the full amount (5 *soles*). This setup is much simpler than games in which determining the optimal level involves withdrawing a portion of the total amount (for examples of experiments with complex maximizing strategies, see Ostrom et. al. 1994).

Third, we used higher stakes than have been used in other experiments. Each player earns approximately half a day's wage in each round (there were two rounds). We chose to use high stakes so that the players would take the experiment seriously. With a significant amount of money on the line, players should be more concerned with actual monetary outcomes, and less concerned with what they perceive the experimenters to expect or desire as an outcome.

U.S. Public Goods Control Experiment

In order to control for the effects of our modifications (and ourselves) on the experimental results, we replicated our experiment with undergraduates at the University of Michigan (UM) and the University of California, Los Angeles (UCLA). Although the modifications made to the standard experimental format may have had a slight impact on our results, the UCLA and UM results still fell within the usual cooperation range of 40% to 60%, and were indistinguishable from each other.

To perform this control experiment at UM, Smith recruited subjects from two large, introductory economics classes.[10] Students were told that they would earn an average of $20 to $30 for approximately 45 minutes of their time. We expected this monetary incentive to create sufficient interest in the experiment that we would be able to gather all the necessary subjects (40) from these two classes (each of which had approximately 200 students). However, this was not the case and Smith recruited the remainder of the subjects by randomly approaching students on campus. To maintain methodological uniformity between the Machiguenga and the university students, the following steps were taken.

1. As with the Machiguenga, both Smith and Henrich were present during all of the experimental rounds with Smith leading the experiment and Henrich interjecting to emphasize and clarify certain points.
2. The communal pot consisted of $80, with each subject able to withdraw a maximum of $20. This amount means that subjects would earn approximately one-half a day's wages, based on an hourly rate

of $7 per hour (a standard after-tax undergraduate wage). This is roughly equivalent to the stake size for the Machiguenga.

3. Since the Machiguenga could withdraw between 0 and 5 soles, which gave six possible withdrawal amounts (and the inability to withdraw exactly half), the university students were restricted to withdrawals in $4 increments. This created a withdrawal structure that paralleled that confronted by the Machiguenga.
4. Prior to making withdrawal decisions, Smith demonstrated several examples to illustrate the rules of the game and the results of different strategies. As with the Machiguenga, each subject was tested for comprehension before the game was played.
5. As with the Machiguenga, the university students were not allowed to discuss their withdrawal decisions or strategies with the group, Withdrawals were marked on a slip of paper, folded, and handed back to Smith. Payoffs were given out in envelopes.

The following variations from the Machiguenga methodology were unavoidable: 1) subjects read and signed consent forms prior to commencing the experiment; 2) written instructions were read by each subject prior to Smith's explanation and examples.

Overall, the control experiment was performed with 40 subjects at the University of Michigan and 24 subjects at UCLA. The UCLA methodology varied slightly from the Michigan format described above in that Henrich was not present during the experiment, subjects were not restricted to $4 increments ($1 increments were allowed), and a surprise public round was conducted in addition to the private round (as with the Machiguenga). A comparison of the Michigan and UCLA experiments shows that they are nearly identical, and are statistically indistinguishable ($p = 0.99$). Consequently, we combined the two samples for our analysis (hereafter termed the 'American control'); however, comparing only the Michigan sample to the Machiguenga does not significantly change the analyses or our conclusions.

Public Goods Results

Unlike results from typical one-shot public goods games and our control experiments, in which people tend to exhibit weak free-riding and contribute an average of 40% to 60%, the Machiguenga were strong free-riders and 'contributed' (meaning, didn't withdraw) a mean of only 23%. The basic results are summarized in Figure 2, which shows the distributions for both the anonymous Machiguenga experiment and the American control experiment. The results of our control experiment closely resemble the typical results found in other similar experiments (Chapter 1, this volume; Ledyard, 1995; Fehr & Gächter, 1997, Marwell & Ames, 1979, 1980, 1981; Isaac & Walker, 1988a, 1988b, 1991; Isaac, McCue & Plott, 1985, Kim & Walker, 1984), although complete information about these distributions is typically missing from published sources. While the distribution of withdrawals for American university students is bimodal, with peaks at full cooperation and no-cooperation, the modal withdrawal for the Machiguenga was 100% (or 5 *soles*)—i.e. pure free-riding, no cooperation. Remember, in the more standard VC public goods game, withdrawing 5 *soles* would be comparable to contributing nothing to the

public market. The mean Machiguenga withdrawal was 3.9 *soles* or 77% of the maximum possible withdrawal (equivalent to a contribution of 23% in a VC game). Our control subjects withdrew an average of 57% of the total possible, although, as Figure 2 shows, the mean withdrawal fails to capture much of the information in the distribution. The key difference between the American distribution and the Machiguenga is the frequency of players who fully cooperate (withdraw zero). It is these players who produce the greater variance in the American sample—otherwise the distributions are quite similar.[11]

(Figure 2 about here)

To explore the effect of public knowledge on individuals' decisions in our CPR game, we played a surprise second round in which individuals had to announce their withdrawal (instead of passing it secretly to the game administrator). The results were very similar. In both the anonymous and public rounds, the Machiguenga modal withdrawal is 100% (full free-riding), and the means are 77% and 80% for the private and public versions, respectively. Figure 3 compares Machiguenga behavior in public and private rounds. Clearly, public knowledge (and, thus opportunities for social sanctions and punishment) has no strong effect on Machiguenga behavior.

(Figure 3 about here)

In a similar, multi-round version of this game, Gächter & Fehr (1998) found that a combination of social familiarity and an opportunity for social approval (i.e., public knowledge) significantly increased cooperation, but that neither social familiarity nor opportunities for social approval (public knowledge) *alone* had significant effects. Our UCLA result is consistent with their conclusions—social approval of strangers had no effect.[12] However, our Machiguenga, who have both strong social familiarity and were provided an opportunity for social approval, did not reveal the expected increase in cooperation based on Gächter & Fehr's conclusions. The combination of familiarity and social approval opportunities did *not increase* cooperation. As well, field research with an ethnic community in Michigan (the Chaldeans) also reveals the lack of effect of strong social familiarity and non-costly punishment on cooperation levels, or on the likelihood of keeping commitments (Smith, in progress).

Comparison post-game interviews for the Machiguenga and American students

As mentioned earlier, Machiguenga say little during debriefing because they lack the cultural training to produce post-hoc rationalizations of their behavioral choices. The most frequent response to the question of why a subject withdrew the amount that he did was that it was the amount he wanted to withdraw. The three men with the most contact with outsiders explained that they each had withdrawn

the maximum amount of money because they had hoped that the other members of the group would withdraw little, thus increasing their own returns. The clarity of their answers indicated two important things. First, the men were motivated by self-interest. And second, that they understood the strategic component of the game.

In contrast to the Machiguenga, the American university subjects had plenty to say after the experiment, and are excellent at generating post-hoc justifications for their behavior. Smith interviewed each subject privately about the reasons for his decisions, what he had expected the other members of the group to do, and his reactions to what the other members actually did. Although the variation in behavior was high among the subjects, their reactions to the experiment were quite similar. They expressed a general concern with greed and selfishness. Thirty-eight percent of subjects made reference to greed and/or selfishness, although the majority of people who raised this issue had withdrawn more than half the possible withdrawal. In some cases, the fear of appearing or feeling greedy led people to withdraw low amounts, while others said that they were willing to deal with acquiring a negative reputation given the amount of money they could earn by being greedy. One subject, with respect to her withdrawal of $20, said that she felt "bad, greedy...but I got over it really quick." Another subject commented that he felt so guilty about withdrawing $20 in the private round that he kept his head down and avoided making eye contact with the other members of the group. However, some subjects were sufficiently motivated by a fear of appearing bad/greedy that they did withdraw zero, or near zero, in both rounds. One such subject succinctly stated, "I just didn't feel good about taking a whole $20." It is interesting that *regardless* of what people did in the game, most players shared a belief that withdrawing a large amount reflected a negative personality trait. This seems to reflect a shared, probably cultural, belief that cooperative, group beneficial behavior is valued.

Of the subjects who withdrew less than 50% of the maximum possible withdrawal, 39% explicitly expressed negative feelings, such as anger, towards the other members of the group. This anger was directed towards those who withdrew large amounts, but since the withdrawals were anonymous, the subjects were left with a non-directed feeling of anger or disappointment. In some cases, the subjects told Smith who they thought withdrew the large amounts, although in all but one of six cases their guesses were incorrect. More than the 39% appeared to be angry that some people took large amounts, but since they denied having negative feelings when Smith asked them, we did not count them. Despite the anger and disappointment of low withdrawers, 42% said that they would continue to take the same low amount again if there was another round with a different group, in hopes that the present group was an aberration from the norm, and that most people would take low withdrawals.

According to the interviews, the primary indicator of what a subject will do is what the subject thinks the rest of the group will do. In other words, people expected their behavior to match others (Dawes et. al. 1977; Dawes et. al. 1986; Orbell and Dawes 1991; Yamagishi 1994).[13] This expectation was highest among people who withdrew more than 50%: 88% of these subjects expected others to withdraw high amounts. In contrast, only 12% of the people who expected others to withdraw high amounts had withdrawn less than half for themselves. Similarly, 64% of the people who expected others to withdraw low amounts had withdrawn less than half for themselves.

Of the subjects who changed the amount of their withdrawal from the private round to the public round (44% of subjects changed their withdrawal in the second round), everyone who *decreased* her withdrawal had taken between 75% and 100% of the maximum in the private round and everyone who *increased* her withdrawal had taken between 0% and 25% of the maximum in the private round—people appear to be adjusting their behavior towards the mean (this has been observed in repeated PG games; Fehr & Gächter 2000).

According to the players' statements, a decline in the amount withdrawn was strongly affected by a concern for one's reputation. In the post-game interviews, subjects made statements such as: "I didn't care how much money I made, I was just concerned with what others thought" (from $20 to $5); "I didn't want to seem so wrong in front of other people" (from $15 to $10); and "(I thought that) everyone would go lower because it was public and that people would be embarrassed to take more and thought of as money hungry" (from $15 to $10). It seems that many subjects had an idea of what amount was "right" or "fair," and that by taking this amount they would appear to be a good person. While this amount was always less than $20, indicating that a positive value is placed on benefiting the group, most people did not think that it was necessary to withdraw $0 in order to protect their reputation. Of the four subjects who increased their withdrawals in the public round, three had taken $0 in the private round. These participants explained that the reason for their increased withdrawal was that they felt they had been taken advantage of in the first round (now it was their turn to make som e money), and because they wanted to *punish* the group for having withdrawn high amounts in the first round. It appears that the motivation to get even with defectors outweighed either their concern for their reputation, or their ideals of working for the good of the group.

Mapuche Public Goods Game Results

Among a mixed group of Mapuche farmers and Huincan townspeople (non-Mapuche Chileans) we used a 'contributions' version of a public goods game to examine how cooperation and defection varied between these groups. The game was quite similar to the Machiguenga game except in four aspects: 1) initial endowments were given directly to players (as in more typical VC games), rather than

being initially placed in a communal pool, 2) the communal pot was doubled after all contributions were made (increased by 100% instead of 50%); 3) all rounds were private (player-player anonymity); and 4) games were played with five players instead of four. To generate 5-person groups, we sampled from an intermixed group of Huinca and Mapuche students, ages 17 to 22, at a small agricultural secondary school in the rural town of Chol-Chol. The initial endowment of 1000 *pesos* was about 40% of a day's pay.[14]

Figure 4 shows the distribution of contribution levels for the Huinca and Mapuche. Unfortunately, due to the vagaries of field experiments, the sample sizes for the two groups are quite small (n = 12). However, despite this, the distribution and statistical tests suggest some differences may exist. The Huinca contributed an average of 58%, while the Mapuche contributed an average of only 33%. The modal contribution for the Mapuche is 10%, while the Huinca peak at 50%. Twenty-five percent of the Huinca sample contributed 90-100% of their endowment, while only 8% of the Mapuche contributed in this range—in fact, only 8% of Mapuche contribute anything above 60%. Similarly, over 40% of Mapuche contributed 10%, while no Huinca contributed less than 30%. The distributions are different at $p = 0.09$ (Epps-Singleton non-parametric test).

(Figure 4 about here)

In both the Machiguenga and the Mapuche/Huinca games the participants all knew each other well and expected to interact again in the future, unlike most western experiments (the exception being our UCLA UG control). This suggests that Machiguenga, Mapuche and Huinca should be more willing to contribute to the group (in anticipation of future interactions) than students at a large university who have, at most, only ephemeral associations with their classmates. However, despite this, we found that university students and Huinca contribute more to the group than do their respective control experiments, the Machiguenga and Mapuche. The differences between Huincan and American contributions (59% vs. 43%) may result from the familiarity of subjects and their expectation of future interaction (outside the game), or from the different marginal per capita rates of increase (0.38 vs. 0.40) in the two versions of the game. The CPR vs. VC game structure cannot account for the difference, as the endowment effect created by the CPR version would bias the results in a direction opposite to that observed. High contributions, around 60%, have been found in similar public goods games, especially when future interaction is anticipated (Fehr & Gächter 1996). So, it seems the importance of familiarity and the potential for future interactions may depend significantly on beliefs or norms about when to cooperate, and in what kinds of situations.

We selected our sample in the Mapuche/Huinca public goods game so as to squeeze out most of the economic and demographic variation in order to focus more precisely on the ethnic distinction. All the players in this sample are males, ranging in age from 17 to 20. All attended the same high school and come from the lower socioeconomic strata of rural Chilean society. Thus, as expected, analyses of age, household size, and father's occupation (as a proxy for wealth) revealed no significant predictors of individual contributions.

In a subsequent experiment reported in detail elsewhere, Henrich (manuscript) administered a simplified, 4-person PGG, using the VC format, to a subject pool drawn from the general Mapuche population around Chol-Chol. This sample of 28 individuals was 64% male, with a mean age of 35 (std. dev. 13.5). To make the game more tractable for uneducated Mapuche farmers, players faced only two options, 'contribute' or 'don't contribute.' Games were described within the context of contributing to a community project, and all the players at any particular session were from the same community. Each player received 1000 *pesos*, and was given an opportunity to secretly contribute this 1000 *pesos* to the group project or to keep the full 1000 *pesos* for himself. Contributions were doubled and distributed equally among all players.

Exactly half of the 28 subjects contributed to the public good, yielding a mean contribution of 0.50. Logistic regression analyses using Age, Sex, Community (where they live), Fluency in Mapudungun (the Mapuche language), Ethnic Ancestry (*mestizo vs. mapuche*), Animal Wealth, Animal Wealth per Household Member, Land Wealth, Land Wealth per Household Member, Household Size and Average Monthly Income show no predictive power. Education was marginally significant in bivariate analyses, with a standardized logistic regression coefficient of $\beta = -1.69$ ($p = 0.08$), but was not significant in multivariate analyses. The only robust predictor, and the best overall model (plus a constant), was an individual's Stated Beliefs about how many of the other people in his 4-person group he thought would contribute, $\beta = 2.46$ ($p = 0.03$). Interestingly, these guesses generally over estimated the number who would contribute. On-average, Mapuche guessed that 70% of players would cooperate, but only 50% did.

Ethnographic Data Supports Game Results

The Machiguenga's behavior in both the public goods and ultimatum games is not surprising to those familiar with the Machiguenga. The Machiguenga are individualistic, independent and not given to taking orders. Although they have recently begun to live in villages, they remain largely a family-level society. Social sanctions and punishment are rare in Machiguenga life (Baksh, 1984; Johnson, 2000; Henrich, 1999; Smith, 1999). Machiguenga are usually unaware of what others in their own community are doing (Smith, 1999), because they make little effort to monitor one another—which illustrates their

lack of interest in punishing, since punishing requires monitoring in order to detect norm-breakers/cheaters. Disagreements and disputes cause families to disperse into the forest. Consequently, Machiguenga players probably did not feel a threat of punishment in the games, nor would they be expected to act for the benefit of the group, since there is little social pressure to cooperate or make equitable distributions (i.e. withdraw less from the pot in the public goods game, or offer more in the ultimatum game).

Ethnographic work provides numerous example of the lack of community-oriented interests. Community work projects and cooperative gardening ventures typically flop, as many people refuse to contribute at all, or help for a while and leave on a whim (Baksh 1984). Democratically-elected community leaders, after three decades of striving to "build community," remain largely powerless and ineffective. During our time in one community, we frequently witnessed the village community president blowing a horn to call people to a meeting, but usually no one responded to the call. And when it came time to build a new schoolhouse, the men largely avoided the task, even when the community president and construction leaders pleaded for assistance.

One situation in which the community members cooperate to some degree is in *barbasco* fishing. In this type of fishing, a section of the stream is dammed and *barbasco* roots are squeezed into the water to release a poison, which stuns the fish. The stunned fish float to the surface, as people frantically scramble to collect as many fish as possible. This endeavor requires the coordinated efforts of many people to properly dam the river and release the poison at the correct time. However, even in this group project, we observe no concept of fairness or equity as each family tries to acquire as many fish as possible. There is no redistribution of fish between families so that all participants receive similar quantities of fish; instead, families compete in fish collection, and the amount of fish that a family acquires can be highly disproportionate to the family's effort in the damming and poisoning. Even when the Machiguenga are working together, they lack any sense of unity and families tend to behave individualistically. Johnson observed a disastrous *barbasco* effort in which the people releasing the poison did not wait for the signal from the dammers, and consequently the poison entered the water before the damming was completed. Interestingly, even when the fish are unevenly distributed between families, or when the rashness of a few causes failure for the group, people do not yell or punish, nor appear to feel great resentment. These situations are merely part of their way of life (Johnson 2000).

Together with the experimental data, this ethnographic description supports the idea that the Machiguenga have little or no expectations of favorable treatment from anonymous persons, no sense of group fairness and thus no reason to punish. That is, there's no expectation of "fairness" to violate or get

punished for violating. This suggests that the presence of some kind of norm is critical for cooperation, punishment and equity in bargaining.

The Mapuche results in both the ultimatum and public goods games are also consistent with field observations and ethnographic data. Like many small-scale sedentary agriculturalists, the Mapuche often view bad luck, negative events, discomfort and suffering as resulting from witchcraft enacted by unknown malevolent neighbors. A bad harvest, the deaths of several cows, or an illness will probably be attributed to witchcraft coming from another Mapuche who suffered an accidental injury or social embarrassment several months (or even years) in the past. Envy is considered dangerous and can produce bad luck for the envied. To deal with illness attributed to malevolent magic and envy, these impoverished farmers will travel several hours by oxcart, and wait several more hours for treatment by shamanistic healers, or *Machis*, who supposedly possess the power to identify the transgressor, and defeat the malevolent magic. These healers are paid substantial sums of money for their services (relative to the finances of farmers), and continue to prosper despite more conveniently-located, biomedical health services that are provided free by the Chilean government and local Christian organizations.[15] Out of the hundreds of Mapuche Henrich spoke with, not one could identify a particular witch, although most were quite certain that witches are out there. Further, nobody admitted to practicing malevolent magic, and all said it was a bad idea—not because it was morally wrong, but because bad magic generates a cycle of dreadful retributions. Being punished for norms violations and interpersonal transgression seems to be a strong part of Mapuche heritage.

Relations between neighboring households are frequently distrustful, jealous and contentious. Gossip abounds. Individual households do interact in small, local socioeconomic exchange networks, based on kinship and friendships, which operate with great trust and reciprocity. Households in these networks frequently extend credit, share and cooperate. However, nearest neighbors and many other households within the same community may not be part of the same network. Consequently, families keep secrets from one another because they fear that jealously will provoke supernatural attacks. During Henrich's time with the Mapuche, he was often asked by his various hosts to keep the amount he paid for assistance, lodging, etc. secret, in order to avoid the envy of others. He was also frequently asked by neighbors how much he paid his benefactors. In accordance with the ultimatum game data, Mapuche have a clear *belief* that there are people out there willing to punish inequities (out of jealous, spite or revenge), even at a cost to themselves.

Actual Mapuche transactions suggest ultimatum game-like patterns. For example, the piglets of one farmer, Pedro, escaped and entered the vegetable garden (for lunch) of an out-of-network, non-relative, neighbor, named José. After the piglets were caught and identified, the regulating customs

dictated that the injured party, José, set the price of compensation. In this case, José demanded an outrageous recompense of 20,000 *pesos*. Everyone with whom Henrich discussed this situation agreed that the amount of lettuce eaten/damaged by the piglets could not even approach this amount, yet Pedro paid the exorbitant amount. During a discussion with Pedro, he seemed furious, but explained that he had to pay because he might be the injured party at some time in the future (implying that if he rejected the offer, he would lose the ability to claim compensation from anyone). He also said if the recompense had been any more, or if he'd had less money at the time, he would not have paid. Several similar, though less extreme, cases make the same point. As in the ultimatum game, Mapuche proposers are not regulated by notions of fairness, but only make equitable offers out of a fear of future punishment. Like ultimatum game responders, Mapuche in the position of José must typically accept an "unfair" offer because they fear the costs of rejecting.

Observations of Mapuche life also fit the public goods game results. Mapuche households are largely independent, and almost all cooperative activities (except for occasional harvest festivals, or *Ngillatuns*) occur repeatedly among two or three friends, or kinsmen. Even the once prominent agricultural work-parties (*Mingacos*, Faron 1968) that households hosted during planting and harvesting have all but vanished, except in female-headed households. Mapuche communities elect "presidents" who are encouraged by development organizations and agricultural extensions agents to organize public work projects to build irrigation systems, community storage facilities, stables, public buildings, and agricultural terraces, as well as to buy community owned farming equipment. However, despite the general recognition by most farmers that such projects are often good ideas, neither these elected leaders, nor visiting Chilean government agents, can get people to participate.

The big exception to the typical lack of cooperation and group-level organization is the Mapuche's religious harvest festivals (*Ngillatuns*). In these rituals, communities host hundreds of visitors from surrounding communities in three days of dancing, meat eating and drinking. These festivals are led by the community's *Lonko*, who acquires his power and position through his bloodline, the endowment of custom, and the general support of his fellows. Households from the host community supply all the labor (erecting altars and temporary housing), materials, meat and wine. Substantial proportions of livestock are expended for food and sold for ready cash. Failure to participate sufficiently in the *Ngillatun* certainly results in social sanctions and gossip. Folks believe that failure to fulfill the requirements of the *Ngillatun* will result bad luck—involving bad harvests and the deaths of animals. If asked, most people can provide cases in which they themselves or others experienced the negative consequences of such failures. The only community members who won't participate are usually the devout Christians whose social network ties them closely to local churches. Interestingly, in contrast to

the *Ngillatun,* failure to participate in public works projects will not generate supernatural retribution or social sanctions, even though people believe these projects to be important. In comparison to *Lonkos*, elected Mapuche leaders lack the sanction of tradition or the strength of supernatural forces.

Conclusion

In this paper, we've made three observations. First, our experiments reveal substantial differences in how people from different places behave in simple bargaining and public good games. This variation was previously missed because experimenters focused on industrial, urban, market societies rather than tapping into the broader spectrum of human cultural diversity. The magnitude of the between-group effect we've revealed is substantially larger than variables typically manipulated by experimenters, such as stakes size, anonymity, number of players (in public goods games), marginal return rates (in public goods games), etc.

Second, individual-level differences in economic and demographic variables account for little of the variation within these groups. Such findings suggest to us that average differences between groups (in something like wealth) probably do not explain the large differences between groups. The Huinca and Mapuche PG samples, for example, are quite similar both demographically and economically, yet they contribute significantly different amounts in the PG. Similarly, although the Mapuche behave more like westerners in their experimental behavior, it's not possible to argue that the Mapuche behave more like westerners because they are substantially richer or more educated than the Machiguenga. The Machiguenga learned the games more quickly than the Mapuche, and have more education on-average. Mapuche proposers actually behave most like Israeli proposers—although responders from these two groups behave quite differently.

Third, the behavioral patterns observed in both the PGG and UG experiments reflect the pattern of daily life for the Mapuche, Huinca and Machiguenga—that is, the results are not some strange experimental artifact. As we illustrated, despite pressure from elected leaders and a general recognition that group-level activities would be beneficial, Machiguenga and Mapuche rarely sustain cooperation or punish non-cooperators, except in very specific and culturally prescribed circumstances—such as the Mapuche's harvest festival.

In order to exist, modern, industrial, urban centers must have developed norms (behaviors and expectations) to deal effectively with anonymous transactions, and allow people to cooperate in a wide variety of contexts. Market societies are filled with opportunities to "cheat," such that, if most people took advantage of these loopholes, our systems would rapidly crumble. We think these systems persist because people share sets of re-enforcing norms about how to behave in different contexts, what is "fair" in different contexts, and what to punish. Tipping in highway diners persists in the U.S. because waiters

and customers share a belief that tipping is the right thing to do, and that non-tippers should be socially sanctioned. In other places, such as the Kingdom of Tonga, waiters believe that tipping is an insult, and will forcefully admonish presumptuous foreigners who leave a tip at the end of the meal. People do lots of things because they've acquired the belief that it's the right thing to do, or because they fear social sanctions, divine sanctions and ostracism. The point is, large-scale, market-based societies could not function without well-coordinated norms for dealing with anonymous, one-shot, monetary interactions. However, there's no reason to expect other societies, where anonymous monetary transactions are recent and rare, to share such norms.

Both ethnographic and experimental evidence suggest that whether an action is considered "right", "fair" or "proper", or whether it deserves punishment, depends entirely on context-specific rules that vary among human groups. For example, in the late 1970's the oil crisis led to long lines at the gasoline pump in the United States. Line-jumpers, who attempted to cut the line, were quickly punished by those waiting—shouting matches and fistfights were not uncommon. Frank (1994) and Fehr & Gachter (1998) use this example to illustrate that people are not willing to passively accept free-riders in public goods situations.[16] Now move to Peru. In airports and many other places, Peruvians do not form well-ordered waiting lines; instead, they form chaotic balls of humanity in which each person tries to get served next. During one instance, after patiently waiting while others went ahead, Henrich's Chilean traveling companion had had enough, and began yelling and scolding the Peruvians for their 'rude' behavior. People looked at her for a second, but quickly turned away and promptly returned to their efforts at being the next one served. Henrich and his companion were finally compelled, much to their dismay and displeasure, to adopt the common strategy.

This example demonstrates that orderly lines first require that most people have the idea that forming such a line is the proper mode of conduct, *and* that some minimum number of people have the idea that they should punish deviant line-jumpers. Whether people cooperate and punish depends on the existence of context specific rules, which vary substantially among groups. Our devotion to waiting quietly in line—one kind of public goods problem—doesn't help us solve other kinds of public goods problems, like driving small, fuel-efficient automobiles to reduce air pollution. If people acquire their rules for how to behave in different social circumstance through experience and/or cultural transmission in specific social groups, then the behavior we observe in experimental games depends on how particular game structures or experimental presentation connects to the diverse sets of rules in people's heads. If a game strongly cues one particular set of rules in the minds of people from one particular group, we will observe monomodal distributions with little variation (as we do in the UG in the U.S.). If the game structure weakly connects to two or more sets of rules, then we will observe multi-modal distributions

with large variances (as we do in Mapuche UG and the American PGG). If we are correct about this, then re-structuring the contextual set-up of the ultimatum game and public goods game to cue the rules of behavior for *Ngillatuns* (for Mapuche) or waiting in line (for Americans) should increase cooperation and punishment among these group. Using fairly weak contextual cues, it has already been shown that Americans and Japanese will vary their contributions depending on the context of a situation. Pillutla and Chen (1999) used two versions of a public goods game—one dressed up as a joint investment and the other as a contribution to a social event. As you might guess, players contributed significantly more to the social event (an average contribution of 39%) than to the investment (32%) despite the fact that the two versions have the same payoff structure. Similarly, Hayashi et. al. (1999) show that simple framing differences strongly affect rates of cooperation in a 2-person prisoner's dilemma, and that the emergence of these effects depends entirely on whether one is from Japan or the United States.

From our perspective, the central questions of future research should be: 1) Why do the rules or cues for fairness, cooperation and punishment vary among groups? 2) What processes can produce behavioral variation among groups, while diminishing the relevance of individual differences within groups? 3) Are the rules for cooperation and punishment actually structurally different for different groups and in different contexts, or do *only* the contextual cues vary? That is, do all human brains contain one general model or set of rules for cooperating and punishing, and this general model is cued by specific contexts? Or, do brains contain a multiplicity of different sets of culturally-transmitted rules/models about how to behave, with different contexts cueing different models/rules? And 3) why are some rules or cues for cooperation and punishment (like those found in the U.S.) are distributed so widely, across many so groups, while other cooperative norms (like those of the Machiguenga) remain isolated in rare groups?

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Table 2

Binomial *p*-values for Rejection Rates

Group	Jerusalem	Indonesia	Pittsburgh
Machiguenga	0.0023	0.071	0.0375
Mapuche	0.00052	0.049	0.044

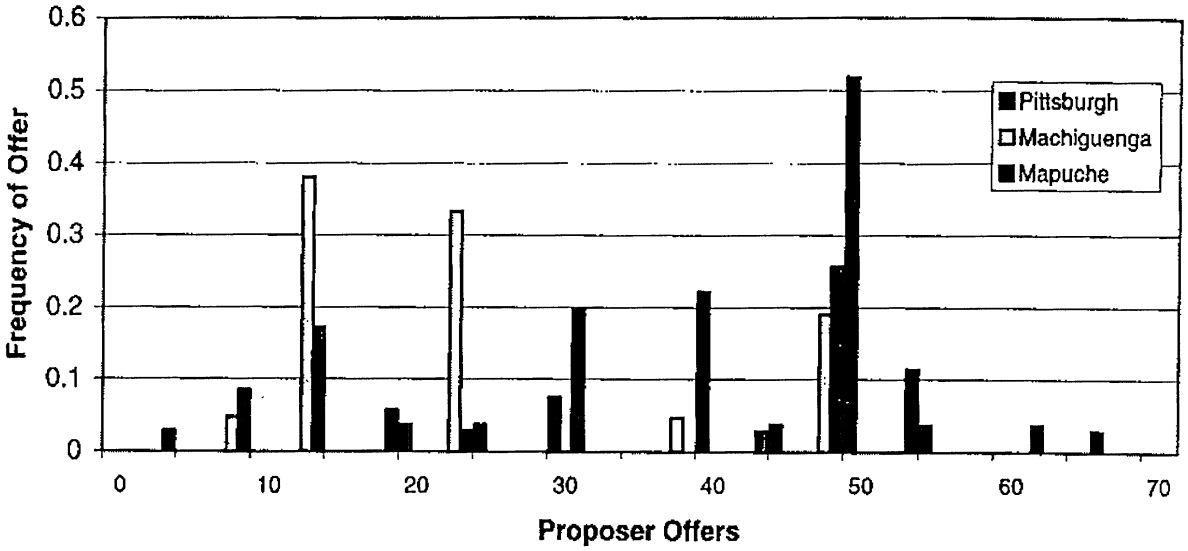

Figure 1. Distribution of proposer offers for the Machiguenga, the Mapuche and students from the University of Pittsburgh.

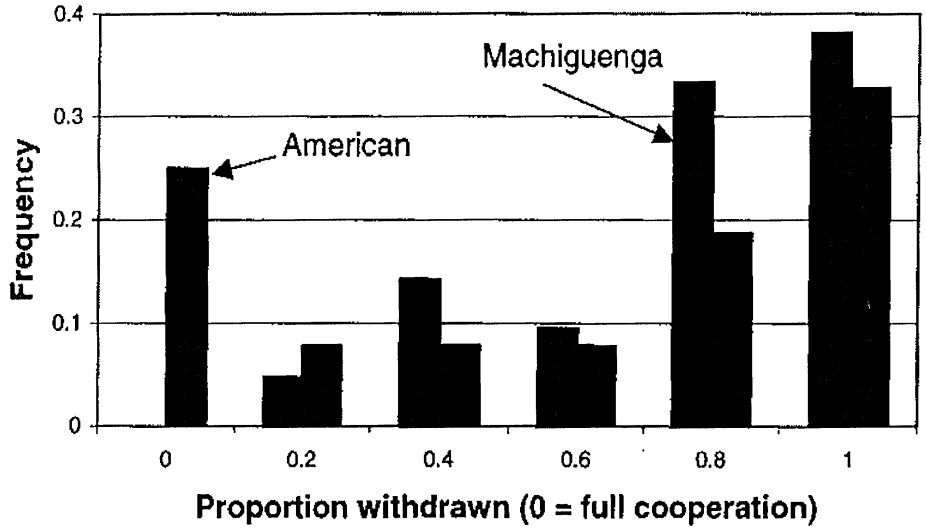

Figure 2. Common Pool Resource Game Results for Machiguenga and American university students: n = 64 for students and n = 21 for Machiguenga. Samples are not drawn from the same distribution at p = 0.05.

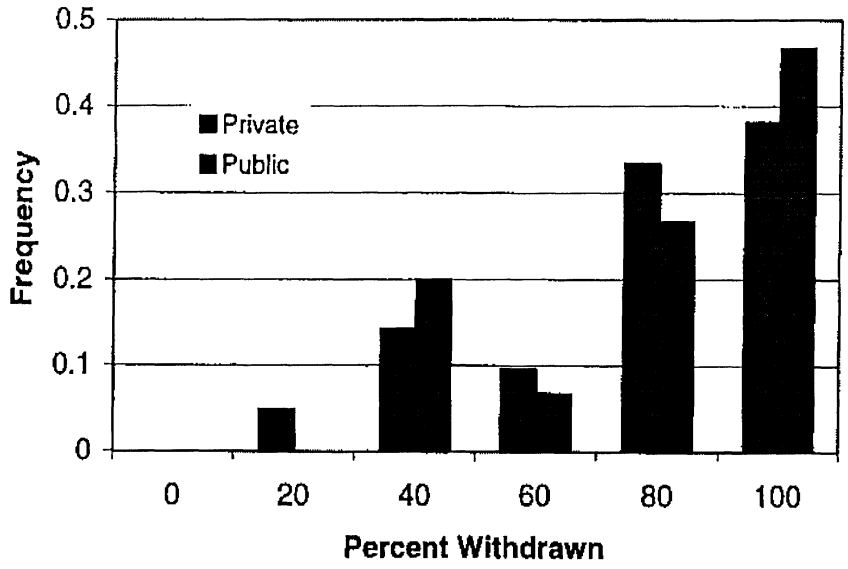

Figure 3. The distributions of Machiguenga withdrawals for Public and Private versions of our CPR game.

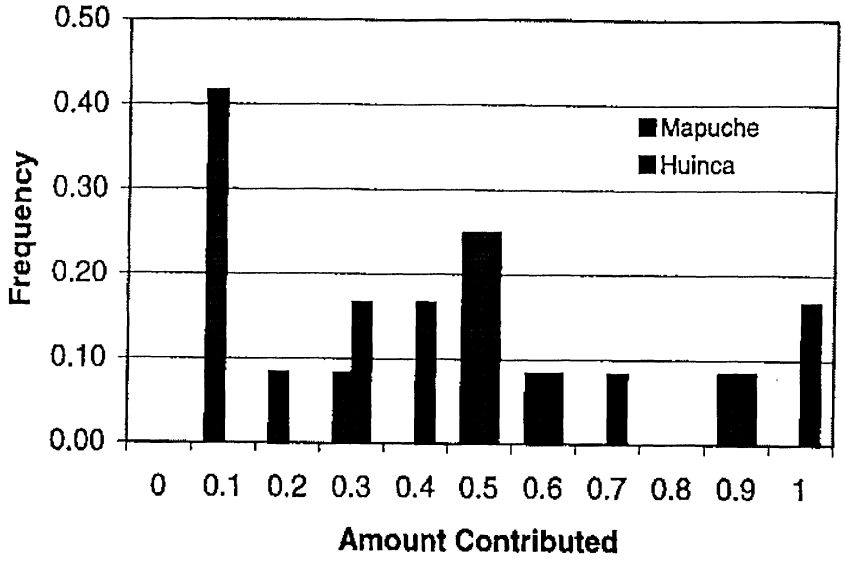

Figure 4. Distributions of Mapuche and Huinca contributions to the public goods game. (n = 12 for both samples, and p = 0.09).

Endnotes

[1] For example, Lisa Cameron's (1999) analysis of game data from Indonesia, where she was able to provide sums equivalent to approximately three months salary for test subjects, strongly rejects the hypothesis that higher stakes move individuals closer to game-theoretic behavior. In fact, her data suggests that proposers generally move away from game-theoretical predictions and toward a 50-50 split; responders, consequently, accept these proportionately higher offers more frequently. Similarly, in Russia, Fehr & Tougareva (1996) used stakes involving two to three months salary and found no differences in subjects behavior compared to low stakes games (also see Hoffman, McCabe and Smith 1996; Tompkinson & Bethwaite 1995).

[2] Note that Table 1 shows that when overall distributional characteristics are taken into account (using the Epps-Singleton test), Yogyakarta is actually significantly different from Pittsburgh. Cameron (1998) uses only the Mann-Whitney test and shows that the means cannot be distinguished statistically.

[3] This increase in the variance also applies to Roth et. al.'s (1991) Tokyo data.

[4] For strategic understanding, a rank of '3' meant a player's post-game interview indicated that they fully understood the strategic nature of the game, and could express it. Players received a '2' if their answers to post-game questions about the strategic nature of the game were somewhat fuzzy, but still captured the essential conflict. '1's were assigned when players failed to reveal any understanding of the game's strategic conflict. For mathematical ability, '3's were assigned to players who could do the subtraction easily. Players received a rank of '2' if they had problems doing the math and answered the test questions by manipulating stacks of coins and counting them. Players receiving '1s' had serious difficulties with both subtraction and counting.

[5] It's difficult to even assign a *peso*-value to Mapuche-owned land, and no Mapuche has any idea of what the 'going price' is for a hectare of land.

[6] $R_{adj} = R^2 - \frac{p(1-R^2)}{N-p-1}$, where p is the number of independent variables and N is the sample size.

[7] As explained above, we attempted to deal with the potential problem of 'familiarity' between the subjects and the experimenter in the UCLA control experiment.

[8] We focus on results from the first round of experiments because learning processes influence behavior in the subsequent rounds, with contributions to the public market decreasing substantially in later rounds. However, we are concerned with the norms that govern people's economic decisions, not the strategies that they can learn by playing repeated rounds of the game. We want to know what people bring to the game.

[9] Like many results in experimental economics and cognitive psychology the endowment effect, to our knowledge, has not been tested cross-culturally (with non-industrial societies). However, research with non-human animals suggests that it maybe present in baboons (Sigg & Falett,1985).

[10] We chose these classes because the students tend to be from a variety of majors, and have very little economic training, as these classes were introductory level and the experiment was conducted within the first month of the semester. This avoided students with any knowledge of game theory, increase the diversity of different majors, and thus minimized the non-randomness created by self-selection into particular disciplines (as was found by Marwell & Ames 1980, and Carter & Irons 1991 with economics students).

[11] Ledyard (1995) suggests that the 40-60 contribution in round 1 could be a result of people being uncertain about what to do and consequently picking near the middle. Our control distribution indicates this is clearly not the case, as most people withdrew either 0% or 100%—which seems to be the case with most PG games. Although the mean ends up in the middle, few people actual withdrew amounts near the middle.

[12] Our preliminary analysis suggests that the public manipulation may have opposing effects on males and females that cancel out any overall effect. We intend to investigate further.

[13] Our finding that people are most likely to cooperate when they think others will also (and vice versa) is not restricted to the domain of experimental games. Weiner & Doescher (1994) found that utility customers are more likely to install regulating devices on air conditioners when they think that others will also install the devices.

[14] Although an experiment identical to the Machiguenga would have facilitated further comparisons with the Machiguenga and the American control, we altered the game for several reasons. The *contributions* format, unlike the common pool resource format, allowed us to test for experimenter anonymity bias. That is, we tested for any effect that may arise from the experimenters' knowledge of players' behavior. To do this, we ran several rounds of the experiment with a double-blind in which players were left alone to contribute anonymously to the communal pot.

Second, our experience with administering the ultimatum game with the Mapuche made us suspect that explaining the Public Goods game to the Mapuche would probably be more difficult than explaining it to the Machiguenga (meaning it would be extremely difficult to get them to understand). Consequently, we decided to change from an increase of 50% to an increase of 100% (increasing by 50% turns out to be much more difficult to communicate than simply doubling something). Third, time and money prevented us from further testing public vs. private contributions.

[15] This prominence of these healers is not isolated to Mapuche. Non-Mapuche Chileans from all levels of the social strata, as well as foreigners, travel great distances to consult with famous Machis.

[16] Waiting in line is a public good because it minimizes the waiting time for the group, but the best individual strategy if everyone is waiting in line is to cut the line and get served first. If no one waits in line, the place is chaos.

Table 1

Summary of Cross-Cultural Ultimatum Game Data and Statistical Tests

Place	Los Angeles	Machiguenga	Mapuche	Yogyakarta[1] (high stakes)	Yogyakarta[2]	Tucson[3]	Pittsburgh[4]	Jerusalem[5]
No. Pairs	15	21	31	37	94	24	27	30
Stake Size	$160	$160	$60	$80-120	$10-15	$10	$10	$10
Mean	0.48	0.26	0.34	0.44	0.44	0.44	0.45	0.36
Mode	0.50	0.15	0.50/0.33	0.50	0.40	0.50	0.50	0.50
Std Dev	0.065	0.14	0.18	0.11	0.17	0.072	0.096	0.16
Rejection Freq.	0	0.048	0.065	0.081	0.19	0.083	0.22	0.33
Rej<20 percent	0/0	1/10=0.1	2/10=.2	0/0	9/15=0.6	----	0/1	5/7=0.71
EST *p* (LA)[d]	---	0.0000	0.0037	0.081	0.0000	---	0.089	0.010
MW *p* (LA)	---	2.64E-5	0.02	0.053	0.032	---	0.11	0.001
EST *p* (Mach)[d]	0.0000	---	0.130	0.0000	0.0000	---	0.0000	0.001
MW *p* (Mach)[e]	2.64E-5	---	0.087	1.22E-5	3.64E-5	---	3.06E-5	0.049
EST *p* (Mapuche)[d]	0.0037	0.130	---	0.003	0.0067	---	0.014	0.192
MW *p* (Mapuche)[e]	0.02	0.087	---	0.029	0.023	---	0.041	0.913

[1]Pittsburgh and Jerusalem data are from round 1 games in Roth et. al. (1991). Roth et. al. used the Round 10 data (the last round) for inter-study comparison. Using either Round 1 or Round 10 to compare to a single-shot game generates analytical ambiguities. In round 10 players may have modified their strategy through learning, while in round 1 players know it's a repeated game (but not repeated with the same person), so they may also make strategic adjustments compared to a single-shot game.

[2]The Yogyakarta data comes from Cameron (1999)—the data was extracted from bar charts and the "errors" were omitted in the re-analysis. The 'high stakes' data is from a second round game, after having played the low stakes ($10-15) game. This may explain the decrease in the standard deviation from the low stakes game.

[3]The 'Tucson' data is from Hoffman et. al. (1994).

[4] 'EST *p*' gives the *p*-value from the Epps-Singleton non-parametric test for Los Angeles ('LA'), the Machiguenga ('Mach') and Pittsburgh ('Pitt') compared against each of the other populations.

[5] 'MW *p*' gives the *p*-value for the Mann-Whitney non-parametric test (corrected for ties and continuity) for the Machiguenga compared to each of the other populations.

Table 3. Multivariate linear regression models for Mapuche UG data.

Variable	Bivariate[1]	Model 1[2]	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Constants	---	(0.003)	(0.18)	(0.17)	(0.27)	(0.27)	(0.12)	(0.72)	(0.017)	(0.60)
Animal Wealth (n = 30)[3]	0.051 (0.80)	0.056 (0.80)	0.055 (0.81)	0.026 (0.91)	0.54 (0.88)	0.019 (0.96)	0.09 (0.73)	0.12 (0.62)	---	---
Land Wealth[4] (n = 33)	0.011 (0.96)	-0.24 (0.92)	-0.028 (0.90)	-0.019 (0.93)	0.013 (0.97)	0.024 (0.94)	0.01 (0.97)	-0.009 (0.97)	---	---
Household Size (n = 31)	-0.051 (0.78)	---	-0.050 (0.82)	-0.050 (0.86)	0.009 (0.98)	---	-0.025 (0.93)	-0.022 (0.092)	---	---
Head of Household[5] (n = 35)	0.14 (0.42)		---	0.17 (0.56)	---	---	---	---	---	---
Age (n = 36)	0.19 (0.28)	---	---	---	0.17 (0.66)	0.21 (0.57)	0.18 (051)	---	0.22 (0.44)	---
Sex (n = 36)[6]	-0.25 (0.15)	---	---	---	-0.26 (0.45)	-0.26 (0.45)	-0.29 (0.25)	---	-0.25 (0.36)	---
Risk Preference (n = 17)[7]	0.043 (0.88)	---	---	---	---	-0.10 (0.77)		---	0.11 (0.69)	0.012 (0.97)
Wage Labor[8] (n =30)	-0.045 (0.82)	---	---	---	---	---	0.11 (0.69)	---	---	---
Strategic Understanding[9] (n =36)	-0.17 (0.66)	---	---	---	---	---		0.031 (0.94)	---	-0.003 (0.99)
Math Ability[10] (n = 36)	0.22 (0.22)	---	---	---	---	---		0.27 (0.50)	---	0.21 (0.62)
R^2 (adjusted)	---	-0.09	-0.14	-0.17	-0.401	-0.40	-0.19	-0.19	-0.099	-0.17

[1] These are simple linear regression coefficients with constants (constants and their significance are not shown). Beneath these, in parentheses, is the p-value.
[2] Except in the row labeled 'constants', each box contains the standardized regression coefficient and its p-value (based on the t-statistic) in parentheses. The row 'constants' give the p-value for the constant included in each regression model.
[3] Animal wealth was calculated using the average market value of each kind of livestock—oxen, cows, sheep, horse, and pigs—at the time of the game.
[4] Land Wealth is the number of hectares of land owned by a subject's household. By law, Mapuche cannot sell land to non-Mapuche, so no active market exists for land. For this reason, we've not combined land and animal wealth into a single aggregate measure.
[5] Head of household is a dummy variable code 1 = head, 0 = not the head. A Head of household is the primary economic decision-maker for the household.
[6] Sex is a dummy variable: 1= male, 0 = female.
[7] Risk preference was measured using an indifference point calculated using a series of binary lottery choices involving substantial sums, see text.
[8] Wage labor was incorporated as a dummy variable: 1 = experience in wage labor, 0 = no experience.
[9] Strategic Understanding was assessed through post-game questions about the interaction. Henrich assigned subjects scores on a 3-point scale, see text.
[10] Mathematical Ability was assessed through the pre-game testing and examples with values of 1-3 assigned to each subject based on his ability (see text). For the regression, ability rankings were converted into 0's and 1's. Subjects capable of doing all the mathematics received a '1'. Subjects who needed to move the coins around and count them in order to answer test questions received '0's. Subjects who could not count were removed from the analysis.

Variable	Bivariate[1]	Model 1[2]	Model 2	Model 3	Model 4
Constant	---	(0.014)	(0.63)	(0.76)	
Cash Crop Land[3] (n = 18)	**0.48** (0.021)	**0.52** (0.034)	0.43 (0.19)	---	---
Wage Labor[4] (n = 21)	0.11 (0.31)	0.21 (0.37)	0.11 (0.72)	---	0.10 (0.65)
Age (n = 21)	0.25 (0.14)	---	0.18 (0.60)	0.39 (0.14)	0.20 (0.37)
Sex[5] (n = 21)	0.22 (0.35)	---	0.13 (0.71)	0.36 (0.17)	---
Sex*CCL (n = 18)	0.51 (0.027)	---	---	---	**0.50** (0.034)
R^2 (adjusted)	---	0.18	0.072	0.068	

Table 4. Multivariate Regression Analyses for the Machiguenga UG data. The dependent variable is always UG offer.

[1] These are correlation coefficients. The value in parentheses is one-tailed p-value.
[2] Except in row 'constants', each box contains the standardized regression coefficient and its p-value (based on the t-statistic) in parentheses. The row 'constants' give the p-value for the constant included in each regression model.
[3] This is the amount of land the player's household has allocated to cash cropping (as opposed to subsistence cropping).
[4] Wage labor was incorporated as a dummy variable: 1 = experience in wage labor, 0 = no experience.
[5] Sex is a dummy variable: 1= male, 0 = female.