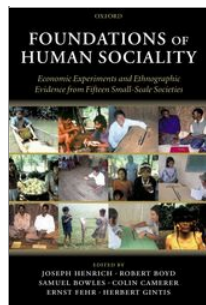


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Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies

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Comparative Experimental Evidence from Machiguenga, Mapuche, Huinca, and American Populations

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[–] Abstract and Keywords

Experimental results are reported from Ultimatum and Public Goods Games performed among the Machiguenga of the Peruvian Amazon, the Mapuche and Huinca of southern Chile, and US control groups in Los Angeles and Ann Arbor (Michigan). The chapter begins with a brief ethno-historical sketch of the Machiguenga, Mapuche, and Huinca, then the Ultimatum Game methodologies used are sketched and the results presented. Next, the Public Goods Game methodologies used are described, and those results presented – first for the Machiguenga/American comparison and then for the Mapuche/Huinca experiment. Three findings are emphasized: first, results from both the Ultimatum (bargaining) and Public Goods Games indicate much greater between-group variation than previous work has suggested; 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, but in fact individual-level economic and demographic variables do not account for much, if any, of the variation found; and finally, despite the failure of individual-level variables to explain variation, the results seem to reflect group-level differences in the economic life of these groups, as captured in numerous ethnographic accounts. Some theoretical and methodological points related to the findings conclude the chapter.

Keywords: chile, demographic differences, economic decisions, economic differences, ethnography, group variation, group-level differences, huinca, individual-level differences, machiguenga, mapuche, peru, public Goods Game, ultimatum Game, united States

This chapter reports experimental results from bargaining and public goods experiments performed among the Machiguenga of the Peruvian Amazon, the Mapuche and Huinca of southern Chile, and with US control groups in Los Angeles and Ann Arbor (MI). We will emphasize three findings. First, results from both our

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ultimatum bargaining and Public Goods Games indicate much greater between-group variation than previous work has suggested (see the Introductory Chapter). 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 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).

In this chapter, we begin with a brief ethno-historical sketch of the Machiguenga, Mapuche, and Huinca. Then, we sketch our Ultimatum Game methodologies, and present the results. Next, we describe the Public Goods Game methodologies, and present those results—we do this first for the Machiguenga/American comparison and then for the Mapuche/Huinca experiment. In presenting these results, we emphasize the results pertaining to our three major points. We will conclude with some theoretical and methodological points related to our findings.

(p.126) 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 continue to 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 occasional communal fish poisonings (Baksh 1984; Johnson and 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 sparsely populated areas (moving every 4 years; Johnson 1989). In larger, settled communities, many Machiguenga face increasing shortages of good soil, fish, game, and palm roofing materials (Smith 2001*a*). 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. chickens, 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 do not 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 towns (minimum 8-hour trip), (p.127) anonymous transactions are almost unknown. When local bilingual schools (Machiguenga-Spanish) are not in session, and the incessant rains of the wet season make travel difficult, many families move away from the community to live in their distant gardens—often located two to three hours away from the village.

The Mapuche

Until the arrival of the Spanish in the mid-sixteenth 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.

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Despite their struggle against European political conquest, the Mapuche gradually adopted cereal agriculture (primarily wheat and oats), ox-driven steel plows, three-field agriculture, and numerous Old World domesticates (horses, cows, chickens, pigs, and sheep). Since their permanent settlement in *reducciones* in the 1860s, 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. Households grow 1 or 2 ha 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 ha, and owns two oxen, two cows, one horse, and two 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 **(p. 128)** 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 use the *Huinca* as a control group in the Mapuche Public Goods Game.

The Ultimatum Bargaining Game

Although typical Ultimatum Game 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 size¹ (Tompkinson and Bethwaite 1995; Fehr and Tougareva 1996; Hoffman, McCabe, and Smith 1996; Slonim and Roth 1998; Cameron 1999), degree of Anonymity (Forsythe *et al.* 1994; **(p. 129)** Bolton and Zwick 1995), context (Hoffman *et al.* 1994; Konow 1996), and 'culture' (Roth *et al.* 1991; Cameron 1999), but have found little or no effect on players' behavior. Readers unfamiliar with the Ultimatum Game should refer to Chapter 1 for summaries both of the relevant game theory and of previous experimental results. Most important for our purposes: the robustness 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 1999), Tucson (Hoffman *et al.* 1994), and Los Angeles proposers make similar mean offers (40–50 percent 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, although the Machiguenga speak Spanish fairly well, 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 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

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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* (the Peruvian currency) in view. The following day, after having successfully obtained twelve responses and paid out some money, randomly selected individuals were sought to **(p.130)** 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 Ultimatum Game 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 for some aspects of the experimenter himself. First, the Machiguenga's twenty-*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 University of California, Los Angeles 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 seventy adults, the University of California, Los Angeles experiment was restricted to graduate students in the Department of Anthropology (also a community of about seventy adults), and the subjects were informed accordingly. Third, as with the Machiguenga, all University of California, Los Angeles players received instructions from the same script, and then further explanation was given informally using a series 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 University of California, Los Angeles), as well as the same pattern of examples and test questions. Fifth, the average age of Machiguenga and University of California, Los Angeles 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 University of California, Los Angeles and Machiguenga subjects.

Among the Mapuche, Henrich again repeated the procedure used among the Machiguenga as closely as possible. However, four **(p.131)** 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 1 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 University of California, Los Angeles participants (we show in the next section that age does not affect the offers).

Ultimatum Game Results

Our Ultimatum Game 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 5.1 summarizes ultimatum game data for seven different groups: University of California, Los Angeles 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 Yogyakarta,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 5.1), we see the mean offer plummet from 48 to 36 to 34 percent and finally to 26 percent, respectively. In terms of modal proposer offers, these groups all have a single dominant mode at 50 percent, except for Yogyakarta, the Machiguenga, and the Mapuche. Yogyakarta has a mode at 40 percent with a strong **(p.132)**

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Table 5.1. Summary of cross-cultural Ultimatum Game data and statistical tests

Place	Los Angeles	Machiguenga	Mapuche	Yogyakarta ^a (high stakes)	Yogyakarta ^b	Tucson ^c	Pittsburgh ^d	Jerusalem ^e
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
SD	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 %	0/0	1/10=0.1	2/12=0.17	0/0	9/15=0.6	—	0/1	5/7=0.71
EST <i>p</i> (LA) ^d	—	0.0000	0.0037	0.081	0.0000	—	0.089	0.010
MW <i>p</i> (LA)	—	2.64E-5	0.02	0.053	0.032	—	0.11	0.001
EST <i>p</i> (Mach) ^d	0.0000	—	0.130	0.0000	0.0000	—	0.0000	0.001
MW <i>p</i> (Mach) ^e	2.64E-5	—	0.087	1.22E-5	3.64E-5	—	3.06E-5	0.049
EST <i>p</i> (Mapuche) ^d	0.0037	0.130	—	0.003	0.0067	—	0.014	0.192
MW <i>p</i> (Mapuche) ^e	0.02	0.087	—	0.029	0.023	—	0.041	0.913

(a.) 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 with 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 with a single-shot game.

(b.) 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.

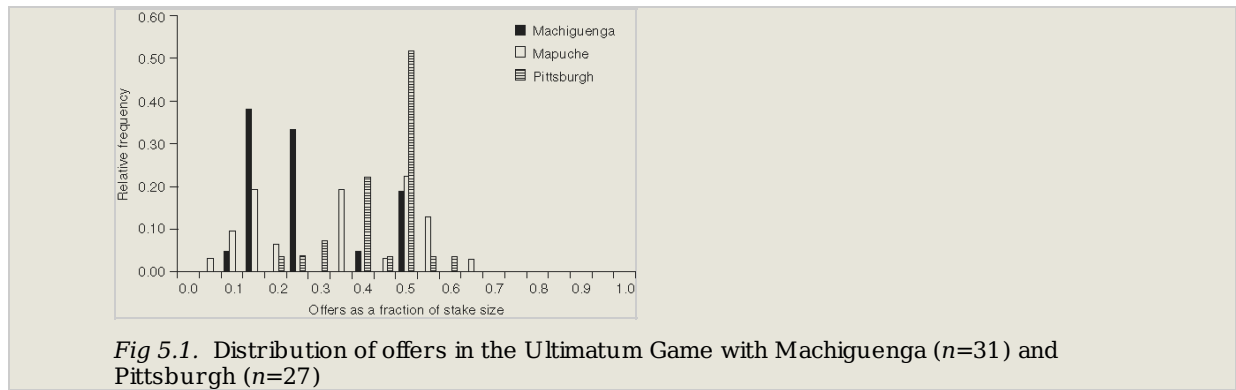
(c.) The 'Tucson' data is from Hoffman *et al.* (1994).

(d.) '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.

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

(p.133)

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secondary mode at 50 percent, while the Mapuche have a weak mode at 50 percent and a strong secondary mode at 33 percent (with the two modes differing by only a single individual). The Machiguenga have a primary mode at 15 percent, and a secondary mode at 25 percent. 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 with what happens outside the United States, 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.

Figure 5.1, which compares the Ultimatum Game 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 places like Pittsburgh (which is a typical US result). While the Machiguenga distribution is dominated by modes at 15 and 25 percent, the Mapuche are widely scattered from 5 to 65 percent with peaks at 15, 33, and 50 percent. In contrast, Pittsburgh shows a single dominant mode at 50 percent, and no offers below 20 percent. The figure also highlights the fact **(p.134)** that means and modes do not tell us much about Ultimatum Game distributions.

On the receiving end, responders from industrial societies often reject offers below 20 percent (see ‘Rej < 20 percent’ in Table 5.1), although these offers are quite rare. For example, proposers in both Los Angeles and Pittsburgh made zero and one offers below 20 percent, respectively, while Mapuches, Machiguengas, and Israelis made numerous low offers: ten of twenty-one Machiguenga offers, ten of thirty-one Mapuche offers, and seven of thirty Israeli offers were below 20 percent. Unlike Israelis, however, Machiguenga and Mapuche responders almost always accept offers less than 20 percent. The Machiguenga and Mapuche rejection rates for offers less than 20 percent 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 percent to make this analysis possible. If we had larger samples in Los Angeles and Pittsburgh, the rejection rates for low offers might 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 percent) for the Machiguenga (0.048) and the Mapuche (0.065) were also significantly smaller than Pittsburgh (0.22), Jerusalem (0.33), and Yogyakarta (0.19). See Table 5.2. 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.

It's worth noting that our University of California, Los Angeles control data does look slightly different from the typical US results. University of California, Los Angeles subjects have a slightly higher mean offer and a smaller variance (the mode of 50 percent entirely dominates the University of California, Los Angeles offers) than typically occurs in US Ultimatum Game experiments. However, both of these differences (the mean and variance) tend in directions

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

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(p.135) opposite to those demonstrated by the Machiguenga and Mapuche data relative to the typical results. Therefore, the particular methodology/stakes used in the University of California, Los Angeles experiment may explain the variation from other US results, but cannot be used to account for the differences found between University of California, Los Angeles and the Machiguenga, and Mapuche. Also note, the pattern of differences between the University of California, Los Angeles data and typical US data is consistent with the effect created by increasing the stakes shown in previous experimental studies—more ‘fair’ offers and less variance in offers. For example, Burks *et al.* (under review) performed high stakes (\$100) Ultimatum Game among employees at a large publishing company (mean age=38) in Kansas City and got results (Ultimatum Game offer mean=46.5 percent, standard deviation= 0.098) indistinguishable from our Anthropology graduate students.

It is also possible that Anthropology graduate students represent a self-selected and biased portion of the US student population, which tends to exhibit a greater sense of social responsibility and concern for economic equality than the average American student. Consequently, proposers make more ‘fair’ offers, and responders 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), and how well they were able to do the mathematical calculations.⁴ Very few of the **(p.136)** 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 Ultimatum Game 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 portion of the variation.

Table 5.3 analyzes the predictive capability of ten different variables on Mapuche Ultimatum Game offers using a series of linear regression models. These independent variables are Animal Wealth, Land Wealth, Household Size, Head-of-Household, Age, Sex, Risk Preference, Wage Labor, Strategic Understanding, and Mathematical Ability. Animal Wealth 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. Land Wealth 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 Household Size is the total number of individuals living in the player’s household. Head-of-Household is a dummy variable in **(p.137)**

Table 5.3. Multivariate linear regression models for Mapuche Ultimatum Game data

Variable	Bivariate ^a	Model 1 ^b	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 ($n = 30$) ^c	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)	—	—

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Land wealth ^d (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 ^e (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 (0.51)	—	0.22 (0.44)	—
Sex (n=36) ^f	-0.25 (0.15)	—	—	—	-0.26 (0.45)	-0.26 (0.45)	-0.29 (0.25)	—	-0.25 (0.36)	—
Risk preference (n=17) ^g	0.043 (0.88)	—	—	—	—	-0.10 (0.77)	—	—	0.11 (0.69)	0.012 (0.97)
Wage labor ^h (n = 30)	-0.045 (0.82)	—	—	—	—	—	0.11 (0.69)	—	—	—
Strategic understanding ⁱ (n = 36)	-0.17 (0.66)	—	—	—	—	—	—	0.031 (0.94)	—	-0.003 (0.99)
Math ability ^j (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

(a.) These are simple linear regression coefficients with constants (constants and their significance are not shown). Beneath these, in parentheses, is the *p*-value.

(b.) 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.

(c.) 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.

(d.) 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.

(e.) 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.

(f.) Sex is a dummy variable: 1, male; 0, female.

(g.) Risk preference was measured using an indifference point calculated using a series of binary lottery choices involving substantial sums, see text.

(h.) Wage labor was incorporated as a dummy variable: 1, experience in wage labor; 0, no experience.

(i.) Strategic understanding was assessed through postgame questions about the interaction. Henrich assigned subjects scores on a 3-point scale, see text.

(j.) Mathematical ability was assessed through the pregame 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.

(p.138) (p.139) which 'one' indicates the player is the primary economic decision-maker in his or her household. Risk Preference was measured several months prior to the Ultimatum Game using a series of

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binary lottery choices to titrate out each person's indifference point. These lotteries involved substantial financial incentives of the same magnitude as the Ultimatum Game stakes (Henrich and McElreath 2002). Wage Labor is also a dummy variable in which 'one' indicates that the individual has (at some point) participated in Wage Labor, while 'zero' 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 5.3 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 Land Wealth, Animal Wealth, Household Size, and Head-of-Household 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 Risk Preference, but still the wealth variables remain inert. Adding Wage Labor (and removing Risk Preference), 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 Head-of-Household might interact with Land Wealth, Animal Wealth, and Household Size, thinking that perhaps only Heads-of-Households might 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. Animal Wealth/Household Size and Land Wealth/Household Size), 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 Ultimatum Game offers.⁶

Interestingly, analyses of our experimentally derived Risk Preference measure revealed no relationship with Ultimatum Game 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 Risk Preference and (p.140)

Table 5.4. Multivariate regression analyses for the Machiguenga Ultimatum Game data. The dependent variable is Ultimatum Game offer

Variable	Bivariate ^a	Model 1 ^b	Model 2	Model 3
Constant	—	(0.014)	(0.63)	(0.76)
Cash crop land ^c (n=19)	0.48 (0.021)	0.52 (0.034)	0.43 (0.19)	—
Wage labor ^d (n=21)	0.11 (0.31)	0.21 (0.37)	0.11 (0.72)	—
Age (n=21)	0.25 (0.14)	—	0.18 (0.60)	0.39 (0.14)
Sex ^e (n=21)	0.22 (0.35)	—	0.13 (0.71)	0.36 (0.17)
Sex*Crash Cropping Land (n=19)	0.51 (0.027)	—	—	—
R^2 (adjusted)	—	0.18	0.072	0.068

(a.) These are correlation coefficients. The value in parentheses is one-tailed p -value.

(b.) 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.

(c.) This is the amount of land the player's household has allocated to cash cropping (as opposed to subsistence cropping).

(d.) Wage labor was incorporated as a dummy variable: 1, experience in wage labor; 0, no experience.

Ultimatum Game offers. Multivariate analyses examining Risk Preference as the dependent variable (with a much larger sample) also fail to show significant predictive powers for Land Wealth, Animal Wealth, Wage Labor, Age, Sex, and Head-of-Household (Henrich and McElreath 2002).

For the Machiguenga, Table 5.4 summarizes our regression analyses using the variables Cash Cropping Land, Wage Labor, age, and sex. Cash Cropping Land 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 (Wage Labor =

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1) versus non-participation (Wage Labor = 0) in occasional wage labor. Bivariate analyses of these four variables suggest that only Cash Cropping (**p.141**) Land has any significant predictive value. Cash Cropping Land remains significant in Model 1, after controlling for Wage Labor. Models 2 and 3, which further control for Age and Sex, show nothing significant. Because only men do the cash cropping, we also analyzed a simple linear regression model with Cash Cropping Land and a constant. The standardized β for Cash Cropping Land equals 0.46 ($p = 0.08$; $n = 15$).

The importance of Cash Cropping Land may reflect a tendency for individuals with more cash to offer more in the Ultimatum Game. 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. Postgame 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

(p.142) 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 postgame interviews for the Machiguenga, Mapuche, and University of California, Los Angeles students

Discussions, postgame 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 percent), and a few claimed they would reject any offer below 50 percent. Correspondingly, some University of California, Los Angeles proposers, when asked why they offered 50 percent, 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 percent. Proposers said that they wanted to be sure that they would 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 percent, when asked why, said that 50/50 was 'fair'. When asked if they thought their fellow Machiguengas (**p.143**) would accept less, they said 'yes, for sure'. Many University of California, Los Angeles proposers, particularly those

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who seemed to know exactly what they were going to offer immediately (rather than pondering over it for 5 minutes like many other University of California, Los Angeles proposers), said they offered 50 percent '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 a fear of punishment, and not at all by notions of fairness or equity, when compared with Machiguenga and American students. Mapuche proposers, especially those offering 50 percent 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 eleven proposers who successfully responded to the postgame questions about why they offered what they offered, ten indicated that a fear of rejection guided their offer and only one indicated that fairness guided his decision. This differs from University of California, Los Angeles where 60 percent suggested that fairness considerations influenced their decision and about 53 percent suggested that a fear of rejection played a part (one-third said both were important). Even among the Machiguenga, four proposers (19 percent) indicated the importance of fairness, compared with only one Mapuche. Further, unlike University of California, Los Angeles and Machiguenga proposers, who never offered greater than 50 percent of the total, four Mapuches (16 percent) made offers greater than 50 percent of the total. These Mapuche expressed a sense of fear that someone out there might reject an offer of 50 percent or less, but if they offered more than 50 percent, acceptance would be assured. Contrastingly, during postgame discussions, two University of California, Los Angeles students mentioned that they would not consider making an offer greater than 50 percent, as that would be unfair to themselves. Compared with the Mapuche and Machiguenga, Americans seem obsessed with fairness—which includes punishing people who act unfairly.

(p.144) Public Goods Game

Public goods experiments are designed to investigate how people behave when facing a conflict between individual and group benefits (see Camerer and Fehr, Chapter 3, this volume). They have been run with a wide range of structural variations with researchers exploring 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 group consistently fall between 40 and 60 percent of the maximum possible contribution (Camerer and Fehr, Chapter 3, this volume; Davis and Holt 1993; Ledyard 1995). This behavior, derived from research in industrial, urban settings with university students, clearly conflicts with the game theoretical prediction (under standard preferences) of zero contribution to the group investment. Consequently, because of the robustness of round one behavior, and its substantial deviation from game theoretic predictions, we sought to explore the cross-cultural replicability of these results.⁸ In order to do this, we conducted a Common-Pool Resource games with Machiguengas and American university students, and a Voluntary Contributions game with the Mapuche and Huinca.⁹ We first explore the methods and results of the Common-Pool Resources games and then discuss the Voluntary Contributions game.

Common-Pool Resource game methodology: the Machiguenga

Among the Machiguenga, each experimental round was played with four individuals above the age of 16 (average age = 20.3), in groups of either all males or all females. Participants and administrators sat **(p.145)** in a circle around a pile of twenty *soles* (\$1 equals 2.4 *soles*). The participants were read the game instructions in Spanish, in which they were told that they could withdraw any amount between zero and five *soles* from the pile. Any money they withdrew was theirs to keep, and whatever money was left in the pile after all players had made their withdrawals would be increased by 50 percent and distributed equally among all the players. In order for the game to be played anonymously and simultaneously, money was not literally taken from the pile. Instead, each player wrote down on a piece of paper how many *soles* he 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—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' because the examples made evident the payoff outcomes of various scenarios,

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but there was no strategic learning since 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, although 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 pile. The paper was then handed to the game administrator and payoffs were calculated. Payoffs were distributed in envelopes so that the players would not know how much the other members of the group 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. This time, however, 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 and that payoffs would be 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.

(p.146) Justification of game structure

We designed our Common-Pool Resources game in this way for three reasons. First, money was placed in a communal pile 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. 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 (as is done in some Common-Pool Resources games), the rate of increase was fixed at 50 percent and all players received an equal return from the pot. Structuring the payoffs in this manner polarizes the optimal strategies for maximizing group versus individual benefits—a group maximizer should withdraw nothing from the pot and the individual maximizer should withdraw the full amount (five *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, Gardner, and Walker 1994). Third, we used higher stakes than have been used in other experiments. Each player earned 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.

Common-Pool Resource game: control experiment in US

In order to control for the effects of our game structure, and any experimenter effect, on the results, we replicated our experiment with undergraduates at the University of Michigan and the University of California, Los Angeles. Our results from the University of California, Los Angeles and University of Michigan experiments fell within the usual cooperation range of 40–60 percent typically found in public goods experiments conducted with students in developed countries, and that our two student populations were indistinguishable from each other.

(p.147) To perform this control experiment at University of Michigan, Smith recruited subjects from two large, introductory Economics classes.¹⁰ Students were told that they would earn an average of \$20–\$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 (forty) 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. All University of California, Los Angeles subjects were recruited by an e-mail that was sent out to students randomly selected from a class list of a large, lower division, undergraduate course in biological Anthropology. 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. With

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these stakes, subjects earned approximately one-half a day's wages, based on an hourly rate of \$7/h (a standard after-tax undergraduate wage). This is roughly equivalent to the stake size for the Machiguenga.

3. Since the Machiguenga could withdraw between zero and five 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.

(p.148)

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.

Overall, the control experiment was performed with forty subjects at the University of Michigan and twenty-four subjects at University of California, Los Angeles. The University of California, Los Angeles 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 University of California, Los Angeles experiments shows that they are nearly identical, and are statistically indistinguishable ($p = 0.99$, Epps-Singleton non-parametric test). 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.

Common-Pool Resource game results

Unlike results from typical one-shot Public Goods Game and our control experiments, in which people tend to exhibit weak free riding, the Machiguenga are strong free riders, withdrawing an average of 77 percent from the communal money. In comparison, subjects in the American control experiment withdrew an average of 57 percent. Figure 5.2 shows the distribution of withdrawals in the anonymous rounds of the Machiguenga and American control experiments. The results of our control experiment closely resemble the typical results found in other public goods experiments (Ledyard 1995, Chapter 1, this volume; Fehr and Gächter 1998). It is important to note the bi-modal distribution from the American control, which has peaks at full free riding (withdraw 100 percent) and full cooperation (withdraw 0 percent). This may indicate the presence of two possible strategies or ways of interpreting the game in the population. Although complete information about distributions is typically missing from published sources, Fischbacher, Gächter, and Fehr (1999) and Croson (1999) also found bi-modal **(p.149)**

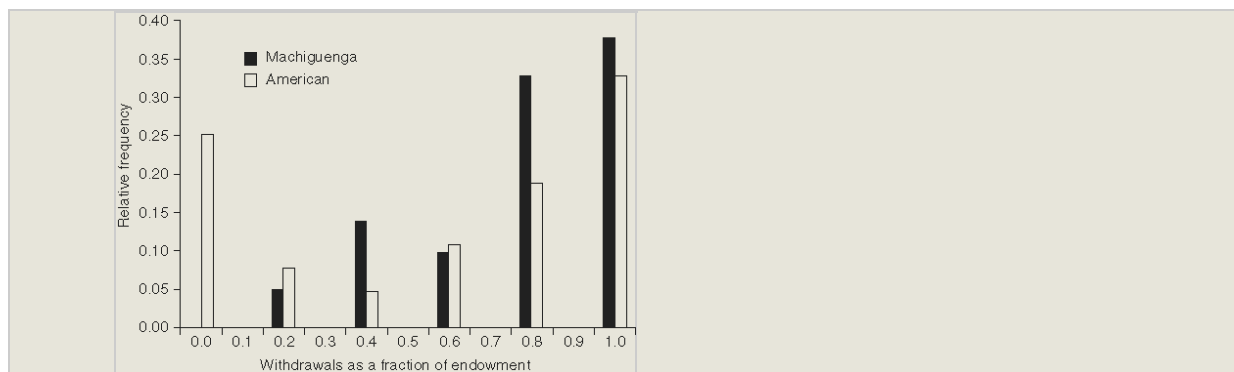


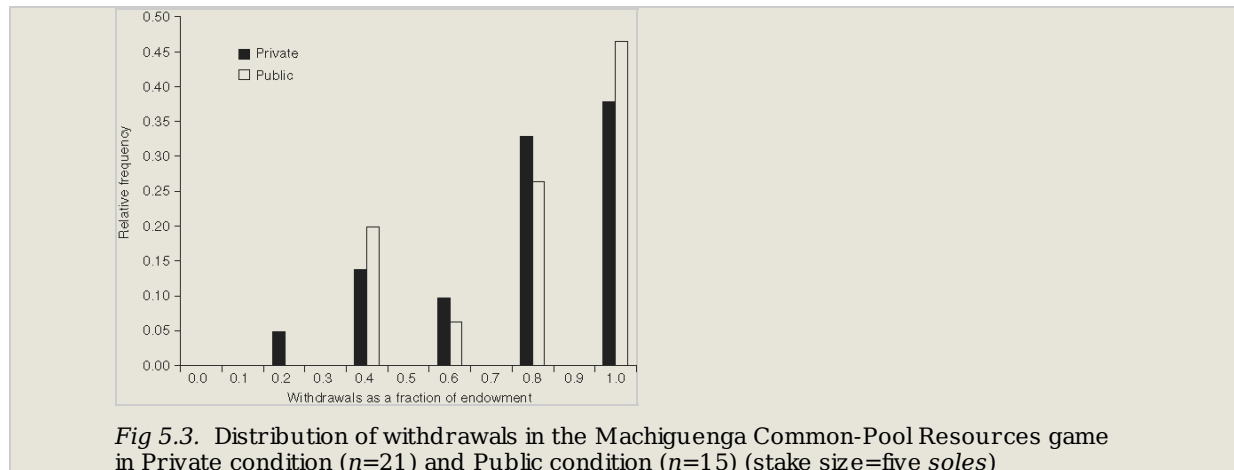
Fig 5.2. Distribution of withdrawals in the Common-Pool Resources game with Machiguenga ($n=21$) and Americans ($n=64$) (stake size=five soles)

distributions with peaks at the two extremes. This leads us to believe that our bi-modal distribution may be a common characteristic of university student populations. In contrast, the uni-modal distribution of the Machiguenga (with the mode at 100 percent) is consistent with a relatively homogenous strategy of self-

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interest. The key difference between the American and Machiguenga results is the frequency of players who fully cooperate (withdraw zero). While both populations have many free riders, the Americans also have a contingency that fully cooperates and it is these players who produce the greater variance in the American sample, otherwise the distributions are quite similar.¹¹

To explore the effect of public knowledge on individuals' decisions in our Common-Pool Resources game, we played a surprise, non-anonymous, second round in which players had to announce their withdrawal to the group and payoffs were distributed publicly. The results from the anonymous and the public rounds are nearly identical, with mean withdrawals of 77 and 80 percent for the **(p.150)**



private and public rounds, respectively, and a mode of 100 percent in both rounds. Figure 5.3 compares Machiguenga behavior in the public and private rounds. While an opportunity to punish was not built into the game itself, the public knowledge of game conduct could lead to punishment outside of the context of the game (such as gossip and social ostracism). However, the invariant behavior between the two rounds suggests that public knowledge about one's actions does not lead to an increase in group-oriented behavior. This finding supports two interpretations. First, the Machiguenga lack any shared rules about equity among group members, so acting selfishly evokes no punishment because no behavioral rules were violated. Second, the Machiguenga seem to lack any general taste for third-party punishment, so even if shared rules about equity were broken, violators need not fear repercussions, and thus have no reason to act less selfishly. Ethnographic evidence suggests that both explanations contribute to the observed results in the experiment (Baksh 1984; Johnson 2000; Smith 2001a).

(p.151) We played the public round of the Common-Pool Resources game with the University of California, Los Angeles control and found a similar result—public knowledge of conduct in the experiment did not lead to increased levels of cooperation.¹² However, unlike in the Machiguenga experiment, the subjects were strangers so the possibility of punishment outside of the context of the game was negligible. Our results show that public knowledge without social familiarity does not affect people's behavior, but we don't know if cooperation would in fact have increased had the players known each other. We do know that for the Machiguenga public knowledge and social familiarity did not affect game conduct.

Evidence from Gächter and Fehr (1999) suggests that in some groups, individuals act less selfishly when there is social familiarity and an opportunity for social approval (i.e. public knowledge of behavior). In a multi-round version of our Common-Pool Resources game, Gächter and Fehr found that a combination of these two conditions significantly increased cooperation, but that neither social familiarity nor opportunities for social approval (public knowledge) *alone* had significant effects. Our University of California, Los Angeles result is consistent with their conclusions—social approval of strangers had no effect on cooperation, although we do not know what would have happened if the subjects knew each other. Interestingly, Gächter and Fehr's effect appears to be culturally variable, as the Machiguenga, who have both strong social familiarity and were provided an opportunity for social approval, did not increase cooperation, and field research with an ethnic community in Michigan (the Chaldeans) also reveals a lack of effect from strong social familiarity and punishment on cooperation levels¹³ (Smith 2001b). Furthermore, other experiments suggest that in some

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cultures, public knowledge can induce cooperation even in the absence of social familiarity. In a Public Goods experiment comparing Canadian, mainland Chinese and Hong Kong students, low anonymity conditions led Asian students, especially the Chinese, (p.152) to behave very cooperatively while having no effect on Canadians (Kachelmeier and Shehata 1997). The effects of public knowledge and familiarity appear to be highly variable and very culturally sensitive.

Comparison of postgame 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 concern with greed and selfishness, with 38 percent of subjects using at least one of these words during their debriefing. The nature of their concern varied—low withdrawers said they didn't want to appear or feel greedy/selfish, and high withdrawers recognized their behavior as being greedy/selfish but were willing to live with this negative image because of the financial gains. Interestingly, concepts of greed and selfishness came up more frequently with subjects who had withdrawn more than 50 percent, which may reflect underlying guilt about acting self-interestedly. One subject, with respect to her withdrawal of \$20 (maximum withdrawal allowed), 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 (p.153) private round that he kept his head down and avoided making eye contact with the other members of the group. In contrast to the subjects who felt greedy but took large amounts, other subjects were sufficiently motivated to avoid feeling bad/greedy about themselves 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 negatively on one's personality. This seems to reflect a shared belief that cooperative, group beneficial behavior is valued.

Of the subjects who withdrew less than 50 percent of the maximum possible withdrawal, 39 percent explicitly expressed negative feelings, such as anger, toward the other members of the group. A male who withdrew \$0 in both rounds said that he was 'a little ticked' at the players who took more than \$0, while another subject scornfully said that by the end of the experiment he realized that 'it was an issue of doing things for yourself... you can note the subtle resentment in my voice'. Anger was directed toward players 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 percent 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 percent 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 (Orbell and Dawes 1991; Yamagishi and Yamagishi 1994; Dawes, McTavish, and Shaklee 1977).¹⁴ This expectation was highest (p.154) among people who withdrew more than 50 percent: 88 percent of these subjects expected others to withdraw high amounts. In contrast, only 12 percent of the people who expected others to withdraw high amounts had withdrawn less than half for themselves. Similarly, 64 percent of the people who expected others to withdraw low amounts had withdrawn less than half for themselves. This is consistent with findings of conditional

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cooperation in other public goods experiments (Croson 1999; Fischbacher, Gächter, and Fehr 1999).

Of the subjects who changed the amount of their withdrawal from the private round to the public round (44 percent changed their withdrawal), everyone who *decreased* her withdrawal had taken between 75 and 100 percent of the maximum in the private round and everyone who *increased* her withdrawal had taken between 0 and 25 percent of the maximum in the private round—people appear to be adjusting their behavior toward the mean (this has been observed in repeated Public Goods Games; Fehr and 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 postgame 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 some 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.

(p.155) Voluntary Contributions game: the Mapuche and Huinca

Among a mixed group of Mapuche farmers and Huinca 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 had the following structure: (1) initial endowments were given directly to players; (2) the communal money was doubled after all contributions were made (increased by 100 percent); (3) all rounds were private (player–player anonymity); and (4) games were played with five players. To generate five-person groups, we sampled from an intermixed group of male Huinca and Mapuche students, ages 17–22, at a small agricultural secondary school in the rural town of Chol-Chol. The initial endowment of 1000 pesos was about 40 percent of a day's pay.¹⁵

Figure 5.4 shows the distribution of contribution levels for the Huinca and Mapuche. Despite the small samples, the distribution and statistical tests suggest some differences may exist between the cultural groups. The Huinca contributed an average of 58 percent, with a modal contribution of 50 percent, while the Mapuche contributed an average of only 33 percent with a mode of 10 percent. A dramatic difference between the groups occurs at the ends of the contribution spectrum. A substantial contingency of Huinca cooperated strongly, with 25 percent of the subjects contributing 90–100 percent of their endowment. In contrast, only 8 percent of the Mapuche contributed in this range—in fact, this 8 percent of Mapuche were the only ones to contribute anything above 60 percent. At the other end of the spectrum, non-cooperation, more than 40 percent of Mapuche contributed 10 percent, while (p.156)

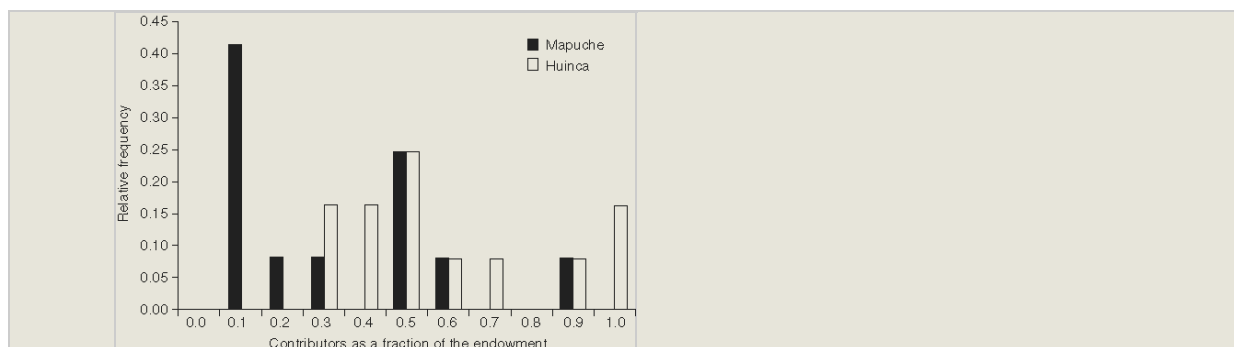


Fig 5.4. Distribution of contributions in the Voluntary Contributions game with the Mapuche (n=12) and Huinca (n=12) player (stake size=1000 pesos)

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no Huinca contributed less than 30 percent. The distributions are different at $p = 0.09$ (Epps-Singleton non-parametric test).

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 public goods experiments. 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. Despite this, we found that university students behaved more cooperatively in their experiment than the Machiguenga or the Mapuche. However, the Huinca were high cooperators, as would be expected from their social familiarity and on-going interactions. The puzzle, then, is why do the American subjects cooperate when they lack close relationships with the other players, and why do the Mapuche and the Machiguenga cooperate so little given the nature of their relationships with their co-subjects? Other experiments have demonstrated that expectation of future interactions can increase cooperation. In Fehr and Gächter (2000), subjects contributed approximately 60 percent when future interaction was anticipated (the Huinca contributed 58 percent), but since we have found that this is not always the case, we propose that **(p.157)** this expectation only effects cooperation when it is coupled with beliefs and norms about when to cooperate, and in what kinds of situations.

In a subsequent experiment, Henrich administered a simplified, four-person Voluntary Contributions game, to a subject pool drawn from the general Mapuche population around Chol-Chol. This sample of twenty-eight individuals was 64 percent male, with a mean age of 35 (SD 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 these 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 twenty-eight 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* versus *Mapuche*), animal wealth, and animal wealth per household member, land wealth, land wealth per household member, household size, and average monthly income show no predictive power. 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 four-person group he believed would contribute, $\beta = 2.46$ ($p = 0.03$). This means that believing one additional person will contribute increases in Mapuche's probability of cooperating 11.7 times. Interestingly, these guesses generally over estimated the number who would contribute. On-average, Mapuche guessed that 70 percent of players would cooperate, but only 50 percent did.

Ethnographic Data Supports Game Results

The Machiguenga's behavior in both the public goods and Ultimatum Game is not surprising to those familiar with the Machiguenga culture and lifeways. The Machiguenga are individualistic, independent, and not given to taking orders. Although they have begun to live in villages, they remain largely a family-level **(p.158)** society. Social sanctions and punishment are rare in Machiguenga life (Baksh 1984; Henrich 2000; Johnson 2000; Smith 2001a). Machiguenga are usually unaware of what others in their own community are doing (Smith 2001a), 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

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usually no one responded to the call. And when it came 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 **(p.159)** 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 Game and Public Goods Game 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 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.¹⁶ 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 **(p.160)** said it was a bad idea—not because it was morally wrong, but because bad magic generates a cycle of dreadful retributions. A belief that people will be punished for norm violations and interpersonal transgressions seems to be a strong part of Mapuche heritage, even though the punishments they fear come through magic and supernatural agency.

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 jealousy will provoke supernatural attacks or bad luck. 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, many 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, which explains the high offers. Responders, on the other hand, did not feel any obligation to actively punish inequities, and seemed motivated to 'accept' by pecuniary payoffs.

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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.

(p.161) 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 3 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 in 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 with *Lonkos*, elected Mapuche leaders lack the sanction of tradition or the strength of supernatural forces. From this perspective, experimental games—at least in their standard format—are extremely unlikely to cue the *Ngillatun*-related cooperative behavior because the games are administered by outsiders (who is associated with community projects) not *Lonkos*, there is no ritualized context (singing, symbols, etc.) and cash is the contribution rather than labor, certain food, and livestock.

Conclusion

In this paper, we have made three observations. First, our experiments reveal substantial differences in how people from different places behave in simple bargaining and Public Goods Game. 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 have revealed is substantially larger than variables typically manipulated by experimenters, such as **(p.162)** 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 Public Goods samples, for example, are quite similar both demographically and economically, yet they contribute significantly different amounts in the Public Goods Game. Similarly, although the Mapuche behave more like university students in their experimental behavior, it is not possible to argue that the Mapuche behave more like university students 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 Public Goods Game and Ultimatum Game 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 explained, 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.

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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 United States 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. **(p.163)** People do lots of things because they have acquired the belief that it is the right thing to do, or because they fear social sanctions, supernatural retribution, 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.¹⁷ 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, may depend on context-specific rules that vary among human groups. For example, in the late 1970s 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 and Gächter (2000) use this example to illustrate that people are not willing to passively accept free riders in public goods situations.¹⁸ 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 seems to depend on the existence of context-specific rules, which vary substantially among groups. **(p.164)** 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 circumstances 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 should observe uni-modal distributions with little variation (as we do in the Ultimatum Game in the United States). If the game structure weakly cues two or more sets of rules, then we will observe multi-modal distributions with large variances (as we do in Mapuche Ultimatum Game and the American Public Goods Game). 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 percent) than to the investment (32 percent) 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 two-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: why do fairness, cooperation, and punishment vary among groups? What processes can produce behavioral variation among groups, while diminishing the relevance of individual differences within groups? How context-specific are fairness, cooperation, and punishment? That is, do brains contain a multiplicity of different sets of culturally transmitted

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rules/models about how to behave, with different contexts cueing different models/rules? Are there innate social grammars (e.g. Fiske 1991) for acquiring (p.165) contextually specific rules and cues about fairness, cooperation, and punishment? And, why are some rules or cues for cooperation and punishment homogeneous across large geographical areas with many sub-populations (in the United States and Europe), while other cooperative norms vary between populations living close together and in similar environments (as seems to be the case in many small-scale societies; e.g. Gurven, Chapter 7, this volume; Marlow, Chapter 6, this volume; Patton, Chapter 4, this volume)?

References

Bibliography references:

Baksh, M. G. (1984). *Cultural Ecology and Change of the Machiguenga Indians of the Peruvian Amazon*. Unpublished doctoral dissertation, University of California at Los Angeles.

Bolton, G. E. and Zwick, R. (1995). 'Anonymity versus punishment in ultimatum bargaining', *Games and Economic Behavior*, 10(1), 95–121.

Brewer, M. B. and Kramer, R. M. (1986). 'Choice behavior in social dilemmas: Effects of social identity, group size, and decision framing', *Journal of Personality and Social Psychology*, 3, 543–9.

Burks, S., Carpenter, G., Carpenter, J., and Verhoogen, E. (2001). 'High Stakes Bargaining with Non-Students', Working paper, Middlebury College, Middlebury UT.

Cameron, L. (1999). 'Raising the stakes in the ultimatum game: Experimental evidence from Indonesia', *Economic Inquiry*, 37(1), 47–59.

Carter, J. and Irons, M. (1991). 'Are economists different, and if so, why?', *Journal of Economic Perspectives*, 5 (Spring), 171–7.

Croson, R. (1999). 'The disjunction effect and reason-based choice in games', *Organizational Behavior and Human Decision Processes*, 80(2), 118–33.

Davis, D. D. and Holt, C. A. (1993). *Experimental Economics*. Princeton, NJ: Princeton University Press.

Dawes, R., McTavish, J., and Shaklee, H. (1977). 'Behavior, communication, and assumptions about other people's behavior in a commons dilemma situation', *Journal of Personality and Social Psychology*, 35, 1–11.

Faron, L. C. (1968). *The Mapuche Indians of Chile*. Prospect Heights, IL: Waveland Press.

Fehr, E. and Gächter, S. (1998). 'Reciprocity and economic: The economic implications of *Homo reciprocans*', *European Economic Review*, 42(3–5), 845–59.

— and Gächter, S. (2000). 'Cooperation and punishment in public goods experiments', *American Economic Review*, 90(4), 980–95.

Fehr, E. and Tougareva, E. (1996). 'Do high monetary stakes remove reciprocal fairness: evidence from Russia'.

Fischbacher, U., Gächter, S., and Fehr, E. (1999). *Anomalous behavior in public goods experiments: how much and why? A comment*. Zurich: University of Zurich, Institute for Empirical Research in Economics.

Fiske, A. (1991). *Structures of Social Life*. New York: Free Press.

Forsythe, R., Horowitz, J., Savin, N., and Sefton, M. (1994). 'Fairness in simple bargaining experiments', *Games and Economic Behavior*, 6, 347–69.

Frank, R. (1994). *Microeconomics and Behavior*. New York: McGraw Hill.

Comparative Experimental Evidence from Machiguenga, Mapuche, Huinca, and American Populations

- Gächter, S. and Fehr, E. (1999). 'Collective action as a social exchange', *Journal of Economic Behavior and Organization*, 39(4), 341–69.
- Hayashi, N., Ostrom, E., Walker, J., and Yamagishi, T. (1999). 'Reciprocity, trust, and the sense of control', *Rationality and Society*, 11(1), 27–46.
- Henrich, J. (1997). 'Market incorporation, agricultural change and sustainability among the Machiguenga Indians of the Peruvian Amazon', *Human Ecology*, 25(2), 319–51.
- (2000). 'Does culture matter in economic behavior: Ultimatum game bargaining among the Machiguenga', *American Economic Review*, 90(4), 973–80.
- and Boyd, R. (2001). 'Why people punish defectors: Conformist transmission stabilizes costly enforcement of norms in cooperative dilemmas', *Journal of Theoretical Biology*, 208, 79–89.
- and McElreath, R. (2002). 'Are peasants risk averse decision-makers?', *Current Anthropology*, 43(1), 172–181.
- . 'Cultural Group Selection, coevolutionary processes and large-scale cooperation', *Journal of Economic Behavior and Organization* (forthcoming).
- Hoffman, E., McCabe, K. A., and Smith, V. L. (1996). 'On expectations and the monetary stakes in ultimatum games', *International Journal of Game Theory*, 25(3), 289–301.
- Shachat, K., and Smith, V. (1994). 'Preferences, property rights, and anonymity in bargaining games', *Game and Economic Behavior*, 7, 346–80.
- Johnson, A. (1983). 'Machiguenga Gardens', in R. Hames and W. Vickers (eds), *Adaptive Responses of Native Amazonians* (pp. 29–63). New York: Academic Press.
- (1989). 'How the Machiguenga manage resources: Conservation or Exploitation of Nature?', in D. A. Posey and W. Balée (eds), *Resource Management in Amazonia: Indigenous and Folk Strategies* (Vol. 7), Bronx, New York: The New York Botanical Garden.
- (2000). *The Matsigenka of the Peruvian Amazon: A Psychoecological Study*. Stanford, CA: Stanford University Press.
- and Earle, T. (1987). *The Evolution of Human Societies: From Foraging Group to Agrarian State*. Stanford, CA: Stanford University Press.
- Kachelmeier, S. and Shehata, M. (1997). 'Internal auditing and voluntary cooperation in firms: a cross-cultural experiment', *The Accounting Review*, 72(3), 407–31.
- Konow, J. (1996). 'A positive theory of economic fairness', *Journal of Economic Behavior & Organization*, 31, 13–35.
- Ledyard, J. O. (1995). 'Public goods: A survey of experimental research', *The Handbook of Experimental Economics* (pp. 111–94). Princeton, NJ: Princeton University Press.
- Marwall, G. and Ames, R. E. (1981) 'Economists free ride, does anyone else?', *Journal of Public Economics*, 15, 295–310.
- Orbell, J. and Dawes, R. (1991). 'A cognitive "miser" theory of cooperator's advantage', *American Political Science Review*, 85(2), 515–28.
- Ostrom, E., Gardner, R., and Walker, J. (1994). *Rules, Games and Common-Pool Resource Problems*. Ann Arbor, MI: University of Michigan Press.
- Pillutla, M. M. and Chen, X.-P. (1999). 'Social norms and cooperation in social dilemmas: The effects of context

Comparative Experimental Evidence from Machiguenga, Mapuche, Huinca, and American Populations

and feedback', *Organizational Behavior and Human Decision Processes*, 78(2), 81–103.

Roth, A. E., Prasnikar, V., Okuno-Fujiwara, M., and Zamir, S. (1991). 'Bargaining and market behavior in Jerusalem, Ljubljana, Pittsburgh and Tokyo: An experimental study', *American Economic Review*, 81(5), 1068–95.

Slonim, R. and Roth, A. E. (1998). 'Learning in high stakes ultimatum games: An experiment in the Slovak Republic', *Econometrica*, 66(3), 569–96.

Smith, N. (2001a). 'Are indigenous people conservationists? Preliminary results from the Machiguenga of the Peruvian Amazon', *Rationality and Society*, 13, 429–61.

— (2001b). Ethnicity, Reciprocity, Reputation and Punishment: An ethnoexperimental study of cooperation among the Chaldeans and Hmong of Detroit, Michigan. Unpublished doctoral dissertation, University of California, Los Angeles.

Tompkinson, P. and Bethwaite, J. (1995). 'The ultimatum game—raising the stakes', *Journal of Economic Behavior and Organization*, 27(3), 439–51.

Wiener, J. L. and Doescher, T. A. (1991). 'A framework for promoting cooperation', *Journal of Marketing*, 55, 38–47.

Yamagishi, T. and Yamagishi, M. (1994). 'Trust and commitment in the United States and Japan', *Motivation Emotion*, 18(2), 129–166.

Notes:

(1) For example, Lisa Cameron's (1999) analysis of game data from Indonesia, where she was able to provide sums equivalent to approximately 3 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 and Tougareva (1996) used stakes involving 2–3 months' salary and found no differences in subjects behavior compared with low stakes games (also see Tompkinson and Bethwaite 1995; Hoffman, McCabe, and Smith 1996).

(2) Note that Table 5.1 shows that when overall distributional characteristics are taken into account (using the Epps-Singleton test), Yogyakarta is actually significantly different from Pittsburgh. Cameron (1999) 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 postgame interview indicated that they fully understood the strategic nature of the game, and could express it. Players received a '2' if their answers to postgame questions about the strategic nature of the game were somewhat fuzzy, but still captured the essential conflict. Players were assigned '1's 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 '1's 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) $R_{adj} = R^2 - (p(1 - R^2)/n - p - 1)$ 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 University of California, Los Angeles control experiment.

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(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) In a Common-Pool Resources game, the endowment goes to the group investment and players decide how much to withdraw. In a Voluntary Contributions game, the endowment goes to the individual players and each person decides how much to contribute to the group. The payoffs for the two games are symmetrical, although there may be an endowment effect (Brewer and Kramer 1986).

(10) As these classes were introductory level and the experiment was conducted within the first month of the semester, students were from a variety of majors, and had very little economic training. This avoided students with any knowledge of game theory and increased the diversity of different majors—and thus minimized the non-randomness created by and self-selection into particular disciplines (as was found by Marwell and Ames 1981; Carter and Irons 1991).

(11) Ledyard (1995) suggests that the 40–60 average contribution in round one of Voluntary Contributions public goods experiments 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 may be the case with most Public Goods games. Although the mean ends up in the middle, few people actually 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) Members of a volunteer organization, all of whom come from the same community and have extensive relationships outside of the context of the organization, make commitments to participate in group projects but frequently fail to follow through even though the rest of the group knows they broke their promise and they are scolded in front of the group by the heads of the organization.

(14) 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 and Doescher (1991) found that utility customers are more likely to install regulating devices on air conditioners when they think that others will also install the devices.

(15) 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 versus private contributions.

(16) 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.

(17) The evolution of such norms due to competition among culturally variable groups may be an important part of the explanation of the gradual evolution of social and economic complexity over the last 10,000 years or so (Henrich and Boyd 2001; Henrich, forthcoming).

(18) 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.

