USING CROSS-CULTURAL EXPERIMENTS TO UNDERSTAND THE DYNAMICS OF A GLOBAL COMMONS

1. INTRODUCTION[1]

The conservation of biodiversity for the global community and for local users can be modeled as a multi-level social dilemma. On the level typically studied, the success of such a project depends directly on the solution of local commons dilemmas among rural users whose livelihoods come from extracting natural resources in rich ecosystems. However, to achieve a socially desirable outcome at the global level, preserving biodiversity also requires cooperation between outsiders and local users who both benefit from the commons economically (e.g. extracting productive resources) and in non-market-oriented ways (e.g. oxygen production and species preservation).

Global-level cooperation is complicated by the fact that local users benefit mainly from extraction, while outsiders have begun to realize that they benefit, on aggregate, mainly from the non-market aspects of the rainforest. As a result, many of the difficulties arising in international negotiations are derived from different perceptions (North vs. South) about the rights and responsibilities of each side regarding the use of these ecosystems (Buck [1998]).

Keohane and Ostrom [1995] highlight shared concerns of the international relations and local common pool resource (CPR) literatures, one of which is the problem of heterogeneity among actors: "*While the assumption of homogeneity was made for theoretical simplicity, it has been regarded for too long as sufficiently close to reality to* *be able to be used as a basis for policy analysis, despite the fact that heterogeneity is a prominent aspect of both CPR and IR situations.*" (1995:6-7). They suggest that heterogeneities of capabilities, preferences, information and beliefs are important determinants of cooperation in commons dilemmas. In the same volume, Martin [1995] and Snidal [1995] draw attention to the problems of heterogeneous preferences and differing preference intensities, and Oye and Maxwell [1995] and Mitchell [1995] provide examples. Particularly relevant, Snidal illustrates the issue of differing interests by writing, "*But when distributional issues are important because states have different interests - for example, if they have differences over which public good should be provided ... - then heterogeneous preferences inhibit cooperation.*" (1995:64).

Many positions remain polarized by different views of who has the right to benefit from extracting biodiversity resources, who should pay for conservation, and who should bear the opportunity costs of either conserving or transforming forested land for agriculture. Colombia and the U.S. represent countries on opposing sides of the debate. The former is a host of much of the biodiversity of the world, as well as a primary beneficiary of extraction. The latter benefits mostly from conservation (non-extraction). Since Colombia and the U.S. have different interests with respect to the problem of preserving biodiversity in the global context, we are interested in examining, in a controlled setting, how constituents of these countries, when primed with a commons situation, behave given potentially differing preexisting attitudes towards conservation.

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[1] We thank the Workshop in Political Economy at Indiana University for funding this project and Dan Brayton for comments on an earlier draft. Additionally, Cardenas acknowledges the support of the MacArthur Foundation and Carpenter acknowledges the National Science Foundation (SES-CAREER 0092953).

Because naturally arising group affiliations are our only manipulation, we assign behavioral differences to participants' perceptions of themselves and of other actors in the global conservation dilemma. Specifically, we study how students from the U.S. and Colombia behave when facing a commons dilemma, to see whether group composition (all U.S., all Colombian, or mixed) matters. To supplement our group composition analysis we also allow participants to donate their earnings from the commons stage to three actual conservation funds. The donation stage is motivated by two rationales: actual donations may test and extend the external validity of the commons experiment and we can test the extent to which prior cooperation (or the lack there of) affects donations.

Related work on social dilemmas, group organization and group cohesiveness forms the basis for our experiment and informs our priors about behavior in our experiment. There are two classes of results one can read in this literature that are important for our purposes. First, group affiliation appears to be a robust determinant of cooperativeness in social dilemmas, but pre-existing affiliations affect behavior much more than artificial or manipulated affiliations. For example, Kollock [1998] demonstrates that fraternity brothers subjectively transform social dilemmas into games with multiple Pareto-ranked equilibria when playing with other brothers, but seek to exploit students from a rival school or the campus police. Further, Kramer and Brewer [1984] in a common pool resource setting find that location, another determinant of identity brought to the lab (and our main treatment variable), affects cooperativeness between groups. However, Eckel and Grossman [2001] show that simply assigning otherwise homogeneous participants to groups and using an innocuous method to identify groups is not enough to foster group identity. In another treatment, however, they show that a common history of cooperation in one task builds group cohesion and translates into more cooperation in a team production experiment.

When group affiliation matters, it tends to play one of two roles. As documented in Kollock [1998], group affiliation changes one's subjective characterization of the material payoffs to interactions depending on whether one plays with an ingroup member or someone from an outgroup (especially if the outgroup is perceived as hostile). Simply put, people play assurance games with ingroup members and prisoners dilemma games with outgroup members. This phenomenon is also discussed in Komorita and Lapworth [1982] who show that ingroups foster cooperation, while the presence of an outgroup triggers competition among subgroups in an N-person prisoners dilemma. Similarly, ingroups often use outgroups as scapegoats for the lack of internal cooperation. Recently, Schmitt, Swope et al. [2000] conducted a series of CPR experiments in which two out of the eight players were excluded from group communication before each round. Such restricted communication created difficulties for increasing cooperation and social efficiency because groups found it difficult to reach and adhere to agreements. The existence of outsiders benefiting from the cooperation of those agreeing created more suspicion about outsiders' intentions; further, this setting created strategic opportunities for some players to free-ride and expect the group to blame the outsiders.

Despite the variety of basic research done on the role of naturally occurring group affiliations in solving social dilemmas, the following paper is unique in that we test whether preexisting affiliations affect behavior in a particular situation of economic and political interest, conserving a common pool resource. Basing our prior expectations on the results of the above experiments, we anticipated that our naturally occurring group manipulation (i.e. one's actual relationship with a global commons) would affect cooperative behavior. But, the magnitudes of the effects, their directions, and whether the effects would persist outside of the hypothetical CPR experiment (i.e. do they also affect real donations) were interesting questions when trying to understand complex negotiations concerning a global commons. A summary of our findings is as follows. In the CPR environment, we find evidence that group affiliation affects behavior. American students maintain their extraction in the mixed treatment (both Colombian and American participants) compared to homogeneous groups (American only), while Colombian participants extract more in the mixed treatment. We also witness negative reciprocity by exploited subgroups. Here subgroups that extract less in one period (i.e. are exploited) tend to extract more in the future, and the magnitude of this adjustment is determined by participant nationality and our treatments. In the donation stage, we show that nationality affects how much participants are willing to donate their first-stage earnings to a conservation fund. We also examine the possibility that altruistic preferences to donate to a conservation fund are endogenous, in that they reflect the level of cooperation in the CPR game.

2. EXPERIMENTAL DESIGN

Using current internet technology, we were able to run real-time experiments in which half our participants were students from Javeriana University, Colombia, and half were Middlebury College students in the U.S. We also conducted sessions with homogeneous groups of Colombian and American students to control for base levels of cooperativeness between the two cultures. Each experimental session was split into three parts: a CPR game, a dictator game, and a survey. Further, players were not told there would be a dictator game when participating in the CPR game, so we can assume that any cooperativeness demonstrated in the CPR stage is independent of anticipated altruism in the second stage, but the reverse is not true. In fact, we counted on the possibility that players' experiences in the CPR game would partially determine their behavior in the dictator game.

2.1 Stage I - The CPR Game

Our CPR experiment is similar to the one used in Cardenas, Stranlund and Willis [2000], which was initially based on the experiments discussed in Ostrom, Gardner and Walker [1994]. Similar to Ostrom, Gardner and Walker [1994], the design maintains the incentive structure of a non-linear commons extraction problem with a symmetric Nash strategy that is not dominant. However, we preferred the Cardenas et al. payoff function because it includes an element that motivates this research. Specifically, non-use benefits of a common pool resource also accrue to players when there is no appropriation from the CPR. These benefits represent the indirect benefits, such as clean air and the prevention of erosion, discussed above.

The payoff function is based on a simple model of a fixed number of homogenous agents that benefit from both the extraction of a forest for which there is joint access and from the externalities that flow from the conservation of the forest. In each round of the game, each player is given an endowment of effort, e, that can be allocated between extracting resources - which increases individual benefits from extraction but decreases group benefits from conservation - and providing labor to an unrelated activity that yields private marginal benefits.

Let x_i denote the amount of time individual i spends collecting resources from the forest, and let w denote the marginal return on effort not allocated to extraction. Then, i's decision to provide $(e - x_i)$ units of labor to the private alternative yields a payoff of $w(e - x_i)$. Effort spent extracting from the forest yields a private benefit, which we assume takes the form $g(x_i) = \gamma\, x_i - \phi(x_i)^2 /2$, where γ and ϕ are strictly positive and are chosen in part to guarantee $g(x_i) > 0$, for $x_i \in [1, e]$. The strict concavity of $g(x_i)$ indicates diminishing marginal private returns to extraction.

In the case of the group externality from aggregate extraction, individual payoffs decrease with $\sum x_i$ because, for instance, biodiversity or water regulation benefits diminish. We can assume then that q is a quadratic function of the aggregate amount of time individuals in the group spend collecting resources; specifically, $q(\sum x_j) = q^0 - (\sum x_i)^2 / 2$, where q^0 is interpreted to be biodiversity or water quality in the absence of human extraction. Again these parameters are chosen to guarantee $q(\sum x_i) > 0$ for all feasible $\sum x_i$.

Define $u(x_i, \sum x_j)$ to be the sum of the sources of utility for an individual that exploits the forest. Parameters were chosen, in part, to guarantee that $u(x_i, \sum x_j) > 0$ for all possible x_i and $\sum x_i$. To facilitate scaling individual payoffs, we take an individual's payoff function to be a positive, monotonic transformation F of u. In particular, $F(u) = k(u)^\eta$, where k and η are all positive constants. An individual's payoff function is then

$$U_i(x_i, \sum x_j) = k[(q^o-(\sum x_j)^2/2) + (\gamma x_i - \phi(x_i)^2/2) + w_i\times(e-x_i)]^\eta \qquad [1]$$

Each group consisted of n = 8 subjects, and each subject was allocated e = 8 units of time in each round. As in Cardenas [1999] we choose parameter values: $k=0.0024$, $\eta=2$, $q^o=1372.8$, $\gamma=97.2$, $\phi=3.2$, $w_i=30$, and $e=8$. Individual payoffs were therefore calculated from the payoff function:

$$U_i(x_i, \sum x_j) = 0.00024[(1372.8 - (\sum x_j)^2/2) + (97.2\ x_i - 3.2(x_i)^2/2) + 30\times(8-x_i)]^2 \qquad [2]$$

All subjects were given the same table of payoffs (see the appendix), which listed how much they would earn as a function of their choices and the choices of the other group members. Because extracting resources generates a public bad (here lower biodiversity or water quality), standard theory predicts that purely self-interested individuals will spend more time harvesting resources than is socially optimal. Indeed, one common reference point for experiments of this type is the one-shot, complete-information Nash equilibrium, and another is the outcome at which group welfare is maximized. Since players' payoffs are identical, we only discuss symmetric individual choices. Let x denote the common amount of time each individual spends extracting in any symmetric outcome. Using [1], the joint welfare function is $W(x) = n(k)[(q^0 - (nx)^2/2) + (\gamma x - \phi(x)^2/2) + w(e - x)]^\eta$. The first-order condition for the maximization of $W(x)$ requires $-xn^2 + \gamma - \phi x - w = 0$. Solving for x and substituting the actual parameter values yields optimal individual amounts of time spent extracting, $x^* = (\gamma - w)/(\phi + n^2) = 1$. That is, if all eight players choose 1 month in the forest the Pareto optimal solution is achieved. The equivalent conditions for the symmetric Nash equilibrium require that $x^{nash} = (\gamma - w)/(\phi + n) = 6$.

To communicate player decisions back and forth during mixed sessions we used an internet messaging program, which allowed us to transfer data instantly between Bogota and Middlebury. As players entered the classroom in which the experiments were conducted, they saw the instant messaging software projected on a screen. Additionally, they were able to see the pre-experiment conversation between the two authors as it happened (e.g. we discussed how many participants had shown up). We projected the screen to assure participants that there were four additional participants in the other country. When a session was ready to begin, we turned off the projector to assure that individual choices were anonymous.

The CPR stage lasted fifteen rounds (this was common knowledge), and each round proceeded as follows. Players were given small pieces of paper on which they were told to write on the blackboard their player numbers, the round number, location, and the number of *months* they wanted to spend extracting from the commons. The experimenter in each location collected the decision sheets after each round and sent the individual decisions to his counterpart. Once the subtotals from each location had been recorded, they became common knowledge, as each experimenter wrote the round number, the months spent in the forest by players in Bogota, the months spent in the forest by Middlebury players, and the total months spent by the entire group. Although subtotals were spurious information in theory (i.e. players only needed the total to calculate payoffs), we recorded these figures to reinforce the fact that the commons was split into two subgroups. Each round was completed when the players calculated their earnings and recorded them on their earnings record sheet.

To make the protocol for the homogeneous sessions as close to the protocol for the mixed sessions as possible, players in the homogeneous sessions were split into two subgroups and one subgroup was brought into an adjoining room. In this case, after players made their decisions one experimenter would go to the other room to exchange subgroup totals.[2] When making aggregate extraction decisions public in the homogeneous sessions, each experimenter wrote on the board the round, subgroup one's months, subgroup two's months, and the total number of months spent extracting.

Group composition	No. of 8-person groups	No. of participants in the U.S.	No. of participants in Colombia	No. of rounds
US-Only	5	40	-	15
Col-Only	5	-	40	15
US-Col	5	20	20	15
Totals	**15**	**60**	**60**	**-**

Table 1 - Experimental Design

Table 1 summarizes our design. At the end of fifteen rounds, players were asked to total their payoffs and hand in their earnings record sheets. All participants faced the same payoff table, but they were paid differently per point earned. Colombians were paid 2.5 Colombian pesos per point earned, while U.S. participants were paid 0.02 cents per point earned. At an exchange rate of 2,200 pesos per dollar when we ran the experiments, this represents a 9/5 ratio for payments. This ratio was chosen because we estimated it would maintain differences in the purchasing power for these two particular populations

[2] We are indebted to Maria-Claudia Lopez, Landreth Freeman, Tom Kelly, Bob Prasch, and Will Pyle for their help in running the homogeneous sessions.

of students.[3] Including the show-up fee, participants in Middlebury received an average of $14.70, ranging from $11.00 to $19.00, and their Colombian counterparts received an average of $7.88, ranging from $5.45 to $11.82.

2.2 Stage II - The Donation Decision

In the second stage of each session we allowed participants to voluntarily donate any portion of their earnings from stage I to three actual biodiversity conservation projects (in a way similar to Eckel and Grossman [1996]). Each subject was presented with two projects, one benefiting the local community and the other benefiting the international community. In all sessions players could donate to the Nature Conservancy, which is involved in international conservation projects. Additionally, Middlebury players could donate to the Vermont Land Trust, which purchases rural land for preservation in Vermont, and Bogota players could donate to Fundacion Natura's "Adopt a Hectare" program, which accumulates donations to purchase and maintain forested areas in Colombia.

One reason we included the second stage was to examine whether a history of cooperativeness, and player attitudes towards the other subgroup, influence an actual donation decision. In particular, we were interested to see whether the level and distribution (local versus international) of contributions would be affected by play in stage I. Another reason to include the second stage was as a check on the external validity of our stage I results (particularly if one believes behavior in the two stages is

[3] We estimated the 9/5 ratio based on (1) a typical bundle of recreation expenditures college students purchase, and (2) typical wages for students on both campuses.

independent). In stage I, although money is at stake, players make conservation decisions in a hypothetical game environment and we were curious about whether group affiliations (i.e. being from Colombia or from the U.S.) are sufficient to cause behavioral differences. Therefore, in stage II we ask players to directly demonstrate their willingness to pay for conservation.

To mitigate the possible confounds of subjects feeling they must contribute and/or suspicions that contributions would not actually be sent (as conjectured in Frohlich, Oppenheimer and Moore [1997]), we ran stage II carefully. Subjects were given their final earnings in cash (small denomination bills) in a large envelope within which there were two smaller envelopes. They were asked, one by one, to go into the hall where they could privately open their packets and deposit any amount they wished in two boxes, one for the relevant local conservation project and one for the global conservation project. After making this decision, subjects returned to their seats to fill out a short exit survey.

While the surveys were being completed, each experimenter counted the donations for his or her subgroup. He or she then wrote out a check to each of the conservation funds for the total amount donated and placed the checks in pre-addressed, stamped envelopes. At the end of the session volunteers were asked to bring the envelopes, as a group, to mailboxes near by (no fewer than two participants volunteered to drop the envelopes). This procedure was emphasized in the instructions for stage II. Before the participants left, but after everyone had finished the survey, the experimenters exchanged donation information and wrote the total donations to the two funds for each subgroup on the blackboard.

2.3 Stage III - The Survey

As mentioned above, the third stage of the experiment asked participants to fill out a survey. Participants filled out the survey before knowing how much was donated, in total, to each conservation fund to control, as much as possible, for the possible confounding effects of this information. However, the survey did occur after the CPR segment of the experiment, which means that some responses may have been affected by differences in the evolution of play across sessions.

Players were asked about their perceptions of how the CPR game was played, including the final outcome in monetary terms (e.g. by the last rounds, were you satisfied with your earnings?). Additionally, we asked our players for their opinions concerning the conservation of commons resources locally and worldwide (e.g. should people who live near diverse ecosystems refrain from extraction?). Lastly, we asked for basic demographic data (e.g. age, gender) and whether players (in the mixed sessions only) believed there were people on the other end of the internet connection.[4]

3 OUR PRIORS

At the beginning of this project we designed the experiment with the following research

[4] On an integer scale from 1 to 5 where 5 meant one completely believed there were players in the other country, the average response was 4.80 for Vermonters and 4.25 for Colombians.

questions in mind:

(i) *The CPR Decision:* What are the effects of group affiliation on individual extraction choices and aggregate social efficiency? Are there cross-cultural differences in cooperation and social efficiency? Does being in a mixed group change a player's willingness to cooperate compared to being in a homogeneous group?

(ii) *The Donation Stage:* Are individuals willing to contribute to a conservation project that benefits others, locally and internationally? Does this willingness depend on group affiliation?

(iii) *Endogenous Social Preferences vs. Preference Validation:* Do players condition donations on the cooperativeness of their subgroup and the other subgroup during the CPR stage, or do donations correlate with, and therefore validate, initial levels of cooperation in the CPR stage?

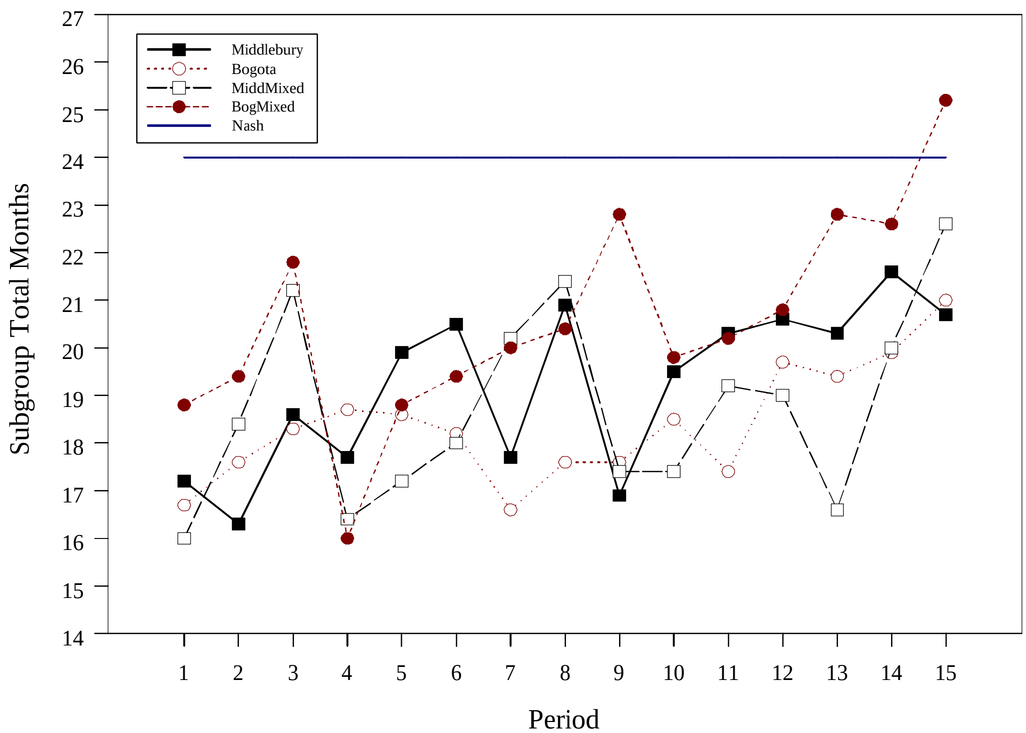
4 OUR RESULTS

On average, our Colombian participants were 22.6 years old, and 52 percent were female; our American players were 19.47 years old, with 53 percent female. As for perceived levels of cooperativeness in the populations and existing levels of social capital (see Putnam [1995]), Middlebury students come from families of 4.49 people, believe 52 percent of other Middlebury students will sacrifice for the common good, spent 69.46 hours last year volunteering in their community, and belonged to 1.80 voluntary organizations, on average. Our representative Javeriana student comes from a family with 4.80 members, believes 41 percent of his fellow students are cooperative, spent 188.45 hours volunteering last year, and belongs to 0.70 volunteer organizations. We present our choice data in three sections that are organized around our research questions.

4.1 Extraction Choices

Figure 1 compares the three treatments based on the average subgroup total months spent extracting from the commons. Using this figure we can graphically analyze differences in behavior between our two homogeneous treatments, between nationalities in the mixed treatment, and between our homogenous treatments and the corresponding subgroups of the mixed treatments. Overall, we see that players extract less than the Nash prediction in each treatment, but players in the mixed treatment approach the equilibrium extraction level by the end of the game. Further, without statistical tests, the biggest difference in behavior appears to be between homogeneous Colombian players and their counterparts in the mixed treatment, with the latter extracting noticeably more. We now highlight the major results from the CPR stage.

Figure 1 - Extraction Decisions by Treatment



Result 1 - Players Show Restraint: Splitting participants into subgroups should be an innocuous change in the design, and it is for homogeneous groups. Overall, participants show restraint with respect to the symmetric Nash prediction (months = 6), but there are differences in restraint by treatment.

To begin, splitting homogeneous groups into two subgroups does not affect behavior in either location. We compared levels of extraction between our homogeneous Middlebury treatment to a further control session we ran with Middlebury students in which the groups were not divided into subgroups and found no difference in the central tendency of behavior (z=1.35, p=0.18) nor in the distribution of extraction decisions (ks=0.18, p=0.25). The same was true for Colombian students (z=0.88, p=0.38; ks=0.09, p=0.31).[5]

According to game theory, we would also expect no differences in behavior by treatment. Table 2 below presents summary statistics for the subgroup total months chosen by the participants in our three treatments. Rather than being the same, the means can be ordered as follows: BogMixed > Middlebury > MiddMixed > Bogota. Further, means tests on the data pooled across rounds (line 6) show that mean behavior in each treatment is significantly below the theoretic prediction - subgroup months equal 24. However, this result must be tempered by tests limited to the last period only (last line of table 2). In period 15 only the MiddMixed data and the Bogota homogeneous data are significantly below the theoretic level, while the Middlebury homogeneous data and the BogMixed can not be differentiated from the prediction.

Subgroup Total Months Extracted
(data pooled across periods)

	Middlebury	MiddMixed	BogMixed	Bogota
min	6.00	8.00	13.00	5.00
mean	19.25	18.73	20.59	18.39

[5] Note, these comparisons were made based on individual level data, but for the statistical tests discussed in the remainder of the CPR section the level of analysis was the subgroup.

median	19.00	19.00	21.00	18.00
max	32.00	29.00	29.00	30.00
Std. Dev.	5.73	4.79	4.16	5.07
Wilcoxon test (pooled mean = 24)	p=0	p=0	p=0	p=0
Wilcoxon test (last period mean = 24)	p=0.15	p=0.06	p=0.48	p=0.07

Table 2 - Extraction Summary Statistics

Result 2 - Southern Resistance: Colombian players react to the mixed treatment by significantly increasing their levels of extraction.

If our framing of the CPR problem is salient and our participants bring preconceived notions of each other regarding conservation to the experiment, we expected Colombian players would resist Americans, who typically demand more restraint with respect to deforestation. Resistance and defiance in this case would be demonstrated by increasing extraction, despite the implications for social welfare. That is, if resistance motivates players, we expect Colombians to increase extraction compared to the control treatments and compared to Americans.

Table 3 presents evidence from Wilcoxon and Kolmogorov-Smirnov tests indicating southern resistance. First, the mixed treatment has a significant effect on Colombian participants, who increase their extraction compared to the homogeneous Colombian control. Second, we see that extraction is significantly higher in the Bogota mixed groups than in Middlebury mixed groups.[6]

Result 3 - Northern Restraint: Players from the United States do not react as strongly to the mixed treatment in that they do not reduce extraction compared to the baseline, but they do extract less than Colombian players in the mixed treatment.

As with result 2, one might expect American students to show more restraint in the mixed treatment if preconceived notions about rainforest conservation influence choices. However, returning to table 3 we see more limited support for this hypothesis. Although mean extraction falls between the homogeneous and mixed treatments for Americans (table 2), the difference is not significant. But we do see that American players extract significantly less than Colombian players in the mixed treatment.

Subgroup Total Months Extracted
(data pooled across periods)

	MiddMixed	BogMixed	Bogota
Middlebury	z=0.53, p=0.59 KS=0.14, p=0.12	z=-1.69, p=0.09 KS=0.20, p=0.01	z=1.24, p=0.21 KS=0.14, p=0.09
MiddMixed	-	z=-2.45, p=0.01 KS=0.21, p=0.06	z=0.74, p=0.46 KS=0.12, p=0.26
BogMixed	-	-	z=3.34, p=0.00 KS=0.27, p=0.00

Table 3 - Pairwise Mean and Distribution Tests for Extraction Differences

[6] These differences persist at the 1percent level if we look at the last five periods only.

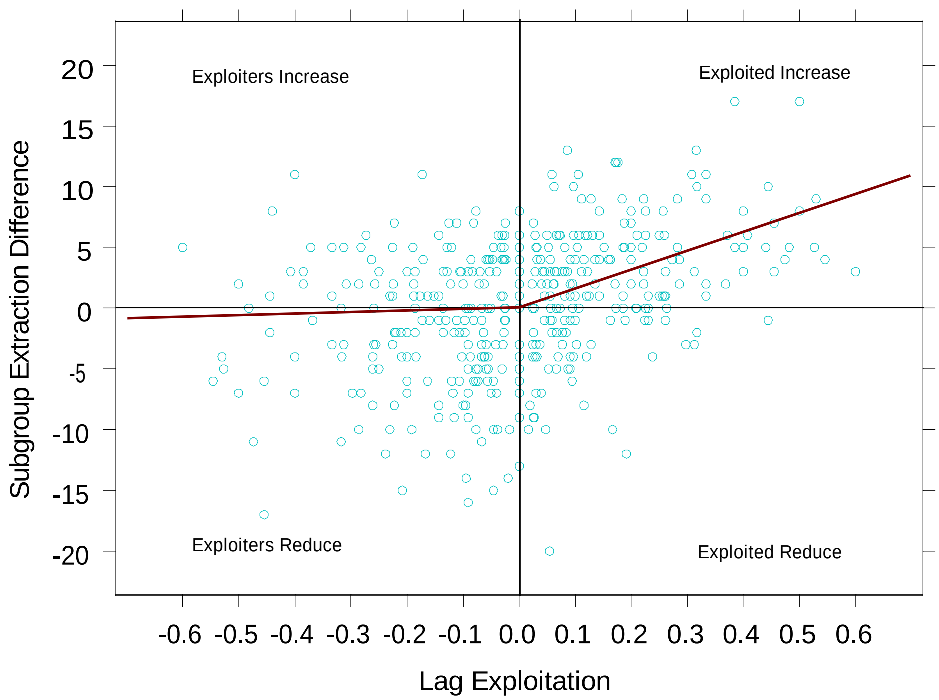
Results 2 and 3 suggest that group affiliation affects participant decisions. Therefore, we now examine the effect of splitting groups into two subgroups and how creating subgroups might interact with group affiliations to generate conflict in our experimental commons. We define subgroup exploitation in the following way. In each session, there are two subgroups extracting from the same commons. Calculate the level of extraction for each subgroup and then find the difference. We say that one subgroup exploits the other when it extracts more. To control for the overall level of extraction, we divide by the sum of the subgroup extraction levels. Hence, where *i* and *j* are the two subgroups in each session, we define $-1 = EXP = 1$ as our index of exploitation such that the exploitation experienced by group *i* is,

$$EXP_i = \frac{(X_j - X_i)}{(X_j + X_i)}$$

Result 4 - Subgroup Exploitation and Reciprocity: Being exploited causes subgroups to increase extraction, but exploiting others does not cause subgroups to reduce extraction.

To assess whether subgroups reacted to exploitation, we calculated our index for each treatment and for each period (note: positive *EXP* means your subgroup was exploited and negative means your group exploited the other subgroup) and then regressed the difference in subgroup extraction between period *t* and period *t-1* on the exploitation index in period *t-1*. Overall, we found great differences in the response, depending on whether a subgroup was exploited or was the exploiter. To give the reader a sense of the relationship between exploitation and extraction, figure 2 presents a scatter plot of all three treatments pooled annotated by the regression lines for the exploiters ($EXP \leq 0$) and the exploited ($EXP \geq 0$). Considering the reaction of the exploited first, the coefficient on the lagged exploitation regressor is 15.21 and, like all the separate treatment regressors, is significant at the one- percent level.[7] This indicates that moving from not being exploited to being fully exploited (e.g. from sharing the commons to extracting nothing) causes exploited subgroups to increase their collective extraction by an average of 15.21 months or 3.8 months per subgroup member, resulting in a level nearly double the average extraction.

Figure 2 - Exploitation and Negative Reciprocity



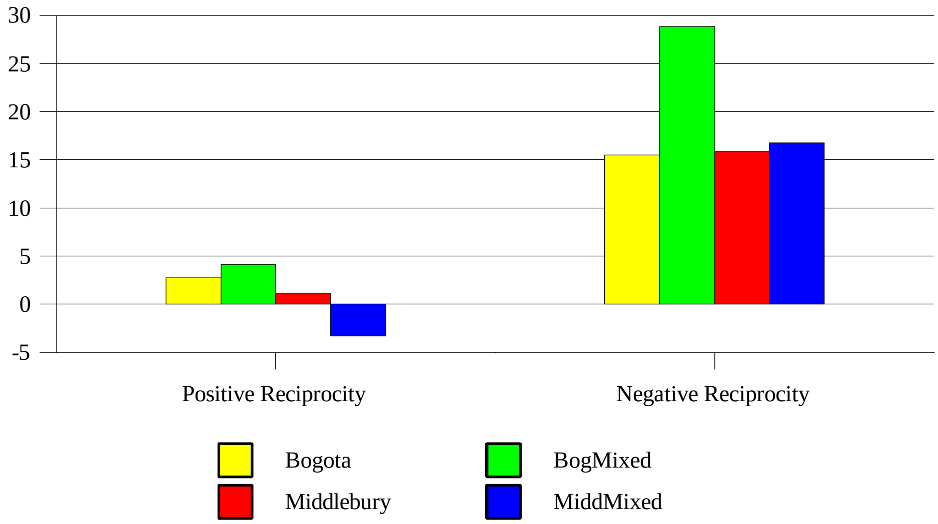
[7] le ... percent

However, as seen in figure 2, the relationship between exploitation and extraction is clearly kinked. The pooled coefficient for the exploiters is not significant (p=0.57), and small, (beta=1.6). This suggests that exploiting subgroups are just as likely to continue exploiting as they are to reduce extraction in the next period. In terms of reciprocity, pooling across treatments, our participants demonstrate strong negative reciprocity (i.e. they increase their extraction when exploited), but show no positive reciprocity (i.e. they don't reduce extraction when the other subgroup does). Further, this kink occurs at the origin, given that the intercepts are not significant on either side of *EXP*=0. This fact suggests that the only systematic response to exploitation occurs when a subgroup is exploited, in which case, it retaliates.

Result 5 - Group Affiliation Exacerbates the Relationship between Exploitation and Reciprocity: Exploitation in the mixed treatment elicits more negative reciprocity than in the homogeneous treatments. Colombians especially react more aggressively towards American exploitation than towards being exploited by other Colombians.

Figure 3 charts the coefficients of positive reciprocity (i.e. the coefficients on the lagged exploitation variable when *EXP*<=0) and negative reciprocity (i.e. *EXP*>=0) for our two homogeneous treatments and for the two components of our mixed treatment. We use a bar chart to facilitate comparisons. As with the pooled data, none of the coefficients of positive reciprocity is large or significantly different from zero. These coefficients suggest that in each treatment subgroups do not feel guilty about extracting more than the other subgroup, nor do they tend to reduce extraction in the future. By comparison, negative reciprocity is a strong motivator in each treatment (all coefficients are significant at the one percent level), and there is an interesting trend when comparing the size of the effect across treatments. First, comparing our homogeneous treatments, we see almost no difference between the size of the negatively reciprocal response in the two homogeneous groups (compare 15.47 to 15.86). Second, astonishingly, the response of Colombians to exploitation nearly doubles when the exploiters are American, while the American coefficient only increases mildly (from 15.86 to 16.77) when interacting with Colombians. We conclude that negative reciprocity within our two cultures is equally strong, but, in line with our hypothesis concerning north vs. south divides, Colombians show much more negative reciprocity towards Americans than Americans show towards Colombians.

Figure 3 - Coefficients on LagEXP (by treatment)



4.2 Donation Decisions

Because our protocol does not allow participants to identify each other's donations (i.e. they only learn the total given by their subgroup), we control for any "warm glow" reasons for giving (see Andreoni [1990]). Therefore, only a sense of responsibility for the environment can explain positive donations. Two broad questions organize our discussion of donations. First, do people actually donate part of their earnings? Second, if they do, does individual behavior (cash donated to the forest conservation funds) differ between treatments and nationalities? In general, both questions are answered affirmatively.

Result 6 - Donations are Positive: Overall, the 120 participants donated \$322, 24 percent of the total earnings from stage I. \$156 went to the local funds (Vermont Land Trust and Fundacion Natura), and \$166 to the international Adopt an Acre program by The Nature Conservancy.

Table 4 summarizes our donation data. Recall that we purposely controlled for differences in purchasing power, but this makes our donation analysis more complicated because players earn different amounts in the two countries. For this reason we note that, although players tend to earn less in the mixed treatment, the differences are not significant (for Middlebury z=0.25, p=0.80; for Bogota z=1.06, p=0.29) and discuss relative donations. Specifically, we find that average total donations are significantly greater than zero in each treatment (p<0.01 for each test). Further, American students, on average, contribute between 24 and 27 percent of their earnings, and Colombian students donate between 18 and 25 percent of their earnings, depending on the treatment. Lastly, we find no differences in mean total donation percentages between conditions (smallest p-value is 0.14 for the Bogota-BogMixed comparison), although the distribution of donations between local and international funds appear to differ by country and treatment.

Individual Earnings and Donations by Conservation Fund

	Middlebury n=40	MiddMixed n=20	BogMixed n=20	Bogota n=40

Mean Earnings including show-up fee (Min, Max)	$14.78 (11.00, 19.00)	$14.55 (11.00, 19.00)	$7.54 (5.45, 10.00)	$8.04 (6.36, 11.82)
Min Donation	$0.00	$0.00	$0.00	$0.00
Mean Donation (Local) (International) (Total)	$1.30 (8.8%) $2.55 (17.7%) $3.85 (26.6%)	$1.70 (12.2%) $1.70 (12.1%) $3.40 (24.3%)	$1.33 (17.2%) $0.64 (8.0%) $1.97 (25.2%)	$1.08 (13.3%) $0.43 (5.3%) $1.52 (18.6%)
Max Donation (Local) (International) (Total)	$11.00 $11.00 $16.00	$7.00 $6.00 $13.00	$3.64 $3.64 $7.27	$5.45 $2.73 $7.27

Table 4 - Individual Earnings and Donations Summary

Result 7 - Donation Allocations Vary by Nationality and Treatment: Colombian students donated proportionally more of their earnings to the local fund, while American students donated more to the international fund.

Figure 4 - Donation Composition by Fund
(Local vs. International)

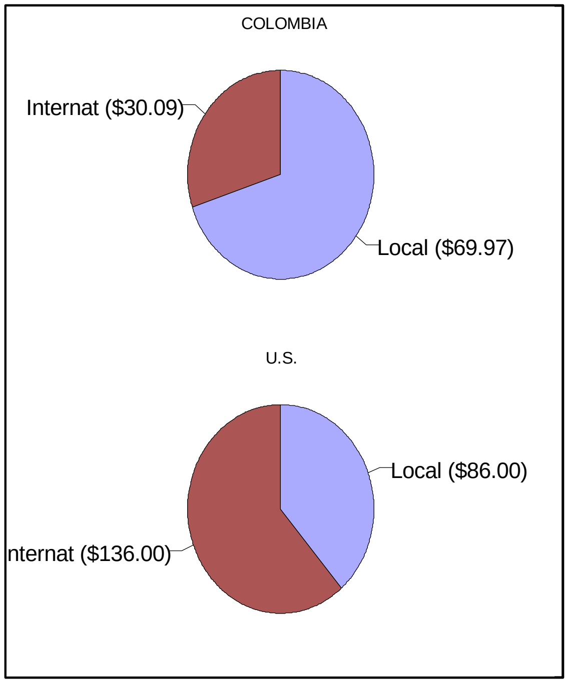


Figure 4 illustrates the group affiliation differences in our participants' donations. For Colombians, of the $100.06 donated, 70 percent is given to the local fund. This trend is reversed for Americans; of the $222 donated, sixty-one percent is given to the international fund. We proceed by examining behavior in the treatments to better understand this difference.

In table 5 we test for mean donation differences by treatment. There are three comparisons to notice. First, we find evidence of preexisting preference differences for local and global conservation. Comparing the homogeneous Middlebury and Bogota donations, we see that the fraction of earnings donated to the local fund is significantly higher in Bogota (p=0.05) and that the fraction donated to the international fund is significantly higher in Middlebury ($p=0.01$). Second, the mixed treatment does not seem to have a significant effect on Middlebury students (just like in the CPR stage), but Colombian behavior changes when nationalities are mixed. That is, notice that neither Middlebury-MiddMixed tests are significant, while Colombians give marginally more to the local fund in the mixed treatment. Third, comparing across nationalities in the mixed treatment, we find Colombians give significantly more to the local fund than Americans do ($p=0.04$). In sum, Colombian and American students start with differences in their giving patterns, and these differences are exacerbated in the mixed treatment because Colombians donate even more locally.

Individual Donations to Local and International Funds
(Donations as Percentage of Earnings)

	MiddMixed	BogMixed	Bogota
Middlebury	$z_{local}=-1.24$, $p_{local}=0.22$ $z_{intl}=0.09$, $p_{intl}=0.93$	$z_{local}=-2.87$, $p_{local}=0.004$ $z_{intl}=1.57$, $p_{intl}=0.12$	$z_{local}=-1.94$, $p_{local}=0.05$ $z_{intl}=2.69$, $p_{intl}=0.01$
MiddMixed	-	$z_{local}=-2.03$, $p_{local}=0.04$ $z_{intl}=1.40$, $p_{intl}=0.16$	$z_{local}=-0.80$, $p_{local}=0.42$ $z_{intl}=2.31$, $p_{intl}=0.02$
BogMixed	-	-	$z_{local}=1.78$, $p_{local}=0.07$ $z_{intl}=0.51$, $p_{intl}=0.61$

Table 5 - Pairwise Mean Tests for Donations Differences (p-values for local and international donations)

4.3 The Relationship Between Cooperation and Donations

Our final research question asks whether players' preferences for environmental conservation are endogenous to their experiences in the CPR game or whether they reflect cooperation at the beginning of the CPR game (i.e. can early CPR cooperation be taken as a proxy for an actual cooperative act?). These questions are important because, if previous cooperation in our experiment does affect attitudes towards the environment (i.e. if preferences are endogenous), then we can say something about the importance of cooperative outcomes for the future success or failure of global conservation agreements. Similarly, if donations correlate with early play, we can have more confidence in the external validity of the CPR game.

Result 8 - Donations are Correlated with Cooperation: Participants who extracted more at the beginning of the CPR stage donated less of their earnings (in three of the four treatments). However, the negative relationship between extraction and donations is stronger when considering extraction at the end of the CPR game.

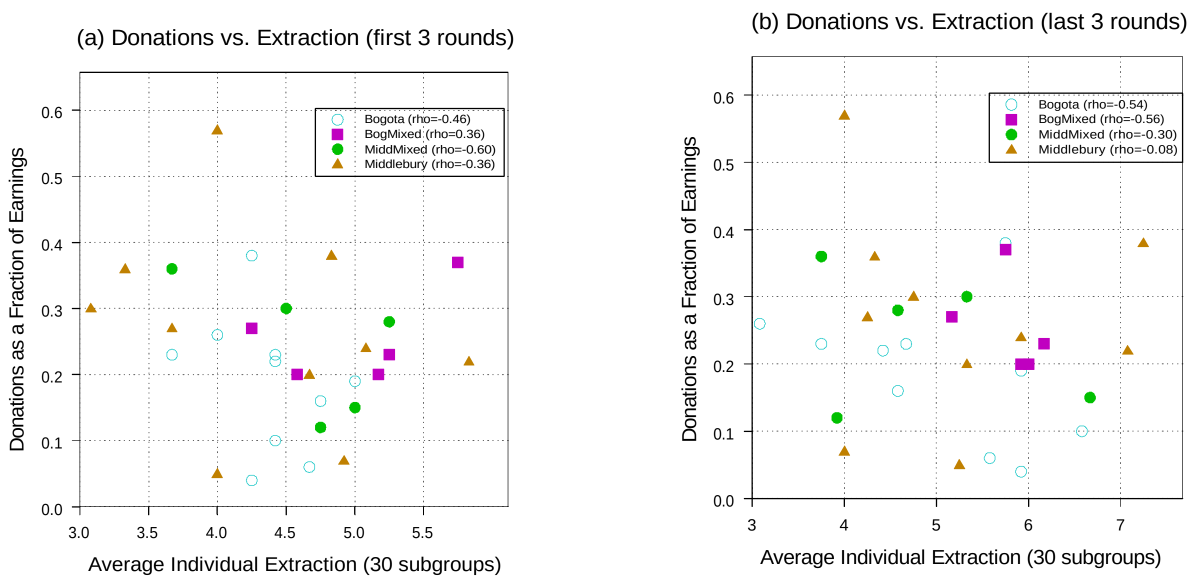


Figure 5 - The Correlation Between Cooperation in CPR and Donations

Figure 5 provides scatter plots of the relationship between extraction decisions and donations. In each case we use subgroups as the unit of analysis. The vertical axis measures the average fraction of subgroup earnings donated (to either fund), and the horizontal axis measures the average individual extraction of the subgroup's members for a three round period. Overall, we see a downward sloping relationship for most treatments indicating that participants who extracted more in the CPR stage gave less. In panel (a) extraction is the average of the first three periods, which we take as a proxy for base levels of cooperativeness, and in panel (b) we measure extraction with the last three rounds. This accounts for the effect of playing the entire CPR game. In the legend we report Spearman rank order correlations for each treatment. Interestingly, the correlation between donations and extraction is stronger in the first three periods for Middlebury students, but the reverse is true for students in Bogota (however the positive early CPR play-donation correlation is clearly driven by an outlier).[8] This suggests that our American participants returned to base levels of cooperativeness when making donations much more than Colombians, who conditioned donations on play in the CPR game.

While interesting because it shows the strong relationship between donations and extraction, the analysis based on figure 5 is unsatisfactory because we can not tell whether donations are endogenous to extraction decisions or whether they reflect players' base propensities to cooperate. To answer this question we conducted regressions.

Result 9 - Donations are Endogenous: Controlling for other indicators of cooperative propensities (e.g. social capital indicators) and personal characteristics (age and gender), behavior at the end of the CPR game predicts donations, but behavior at the beginning does not.

[8] At the individual level, the correlations are much more consistent and significant, but do not control for interdependencies in the data. The Pearson correlation coefficients and p-values for the Bogota, Middlebury and Mixed participants were: rho_{BOG}: = -0.365, p=0.0001; rho_{MIDD} = -0.184, p=0.044; rho_{MIXED} = -0.3084, p=0.0006.

Dependent Variable = Total Fraction of Earnings Donated			
	(1)	(2)	(3)
Mean Extraction First 3 Rounds	-0.015 (0.013)	-0.015 (0.013)	-0.007 (0.014)
Mean Extraction Last 3 Rounds	-0.030** (0.013)	-0.028** (0.014)	-0.029** (0.015)
Bogota	-0.118 (0.105)	-0.228*** (0.087)	-0.253** (0.126)
BogMixed	-0.056 (0.093)	-0.093 (0.093)	-0.185* (0.111)
MiddMixed	-0.075 (0.091)	-0.064 (0.089)	-0.134 (0.091)
Age	-	0.015** (0.007)	0.017** (0.008)
Gender	-	0.027 (0.037)	0.040 (0.037)
Number Siblings	-	-	0.013 (0.017)
Hours Volunteered Last Year	-	-	0.00002 (0.00005)
Number Organizations Belong To	-	-	-0.019 (0.019)
Understand Instructions	-	-	0.043 (0.032)
Exp. Proceeded According to Instructions	-	-	0.018 (0.014)
n	120	120	120
R^2	0.19	0.23	0.24
F-stat (p-value)	2.12 (0.01)	2.05 (0.01)	1.53 (0.07)

Notes: All results are OLS.
Robust standard errors in parentheses.
*** significant at the 0.01 level.
** significant at the 0.05 level.
* significant at the 0.10 level.

Table 6 - Preference Endogeneity or Validation?

In table 6 we present ordinary least squares regressions (with robust standard errors and session fixed effects) to assess whether donations are caused by play in the CPR game or reflect player social preferences exemplified at the beginning of the CPR game. In equation (1) we regress the total fraction of one's earnings donated on mean individual extraction in the first three rounds, the last three rounds and treatment dummies. As one can see, the first pass suggests that donations are endogenously determined and not simply transported from game to game. In addition, it appears that the different treatments only matter to the extent that they generate more or less cooperation (i.e. there seems to be no isolated role of nationality). In equation (2) we add individual characteristics (age and gender) and find similar results with two exceptions: older students give significantly more, and Colombians playing Colombians tend to give significantly less when compared to Americans playing with Americans.

We add two things in equation (3), social capital measures (see Putnam [1995], Glaeser et al. [1999], and Burks, Carpenter and Verhoogen [2001]) as further controls for cooperative propensities, and responses to questions about how the experiment was conducted to control for confusion and the credibility of the procedures (see Frohlich, Oppenheimer and Moore [1997]). First and foremost, we see that the effect of the last three rounds of play is robust to the other measures of cooperativeness, as are the effects of age and being a Colombian playing with other Colombians. Additionally, we see that standard social capital measures, such as the number of siblings one has, prior altruistic acts, and the number of social/volunteer organizations one belongs to, do not predict donations, but must correlate with extraction in the first three rounds because the coefficient falls by half when they are added.[9] In sum, our analysis suggests that donations are endogenous to the amount of cooperation that evolves in the CPR game and cannot be predicted by initial cooperative acts or other, more standard, measures of social capital.

5 DISCUSSION

Although local users do a surprisingly good job at creating decentralized institutions to regulate the use of common pool resources, global commons problems can be more complicated. Global commons are complicated by additional sources of heterogeneity among agents (including their preferences for conservation) which cause the formation of ingroups and outgroups that make agreements harder to implement. For example, the Amazonian rainforest not only generates extractive resources for local users, it is also the home of much of the world's biodiversity. Colombian users benefit from biodiversity conservation but may benefit from extraction more. At the same time, American users benefit primarily from biodiversity conservation. We hypothesized that this sort of difference in preferences, combined with any preconceived notions one group holds of the other, may confound the problem of conserving a commons such as the rainforest. Specifically, we expected that constituents of a southern country such as Colombia might

[9] In fact, regressing mean extraction in the first three periods on the social capital indices and other controls suggests the correlations are present but weak. Only the number of hours one volunteered last year significantly predicts initial cooperation at the five percent level. Additionally, none of the other game and conservation related questions mentioned in section 2.3 robustly predict behavior in either stage of the experiment.

react differently towards conservation when interacting with constituents of a northern country, such as the United States, because Colombians gain more from extraction, and because Colombians may resist perceived coercion by Americans.

In fact, we find evidence supporting both our general heterogeneity hypothesis and our specific hypotheses about the interaction of southern and northern countries. First, our common pool resource experiment yields data that suggest group affiliation matters to some of our participants. While our American participants do not react to changes in the composition of user groups, our Colombian participants extract significantly more when placed in a group with Americans. Upon analyzing our extraction data more rigorously, we see that a major determinant of the Colombian response to group affiliation is that Colombians react nearly twice as much to being exploited (extracting less than the other group) by Americans as to being exploited by other Colombians. Finally, when asked to actually donate to the conservation of a forest, we find that while overall contribution rates are the same across nationalities, the composition of contributions varies considerably. American participants donate much more to an international conservation program, while Colombians donate more to local conservation. We feel that these differences in the composition of contributions may reflect differences in the way our participants view conservation in general.

Given that our data demonstrate that group affiliation matters, it is important to differentiate between the role played by conservation preference differences and the role played by ingroup-outgroup mentality. Our data suggest that both components matter here. While extraction levels (table 3) and total donations (table 4) do not differ between our two homogeneous treatments, Colombian donations are skewed toward local conservation and American donations are skewed towards global conservation, which means that we can not rule out an explanation based on conservation preference differences. At the same time, because our Colombian participants react much more to American exploitation in the CPR game and generally increase extraction in the heterogeneous treatment, we suspect that our group affiliation manipulation also triggered ingroup-outgroup behavior.

We conclude by speculating about how these results may be informative for future negotiations over global commons. First, group affiliation is not innocuous. Negotiations may be affected in at least two ways. Preference differences with respect to a key issue may inhibit agreement rather than opening new dimensions for negotiation, as documented in the international relations literature. Further, preexisting group affiliation continues to be a strong source of ingroup behavior, which may inhibit agreements because cooperation is not tied to essential issues alone but becomes clouded by other rivalries one group feels towards another. Finally, because our data suggest that social preferences (e.g. for conservation) are endogenous to prior interactions, one possibly successful strategy would be to break negotiations into a series of steps because establishing a history of cooperation provides inertia for future agreements.

6 POSTSCRIPT

Thanks to student donations, three hectares of Andean forest were adopted through the Fundacion Natura program, almost five acres of tropical forest in Belize were adopted through the Nature Conservancy international program, and the students purchased a contributing membership at the Vermont Land Trust.

7 APPENDIX - PARTICIPANT INSTRUCTIONS

PAYMENT AND CONFIDENTIALITY

You have been asked to participate in an experiment. For your participation we have already paid you $5. You may receive an additional amount of money depending on your decisions in the experiment. This additional amount will be paid to you in cash at the end of the experiment. Your decisions in this experiment and your answers on a survey which we will pass out later will be confidential; none of the other participants nor anyone else will ever know the decisions you make or answers you give.

INTRODUCTION

This experiment attempts to recreate a situation in which a group of individuals must make decisions about how to use the resources of, for instance, a forest, a water source, a fishery, or any other situation where some group shares a natural resource. In this experiment, the resource will be referred to as the forest. You will play for 15 rounds, equivalent, for instance, to years or harvest seasons.

In this experiment the group will be composed of 8 people who are participating today. You will notice that there are only 4 participants in this room. Currently, there are another 4 participants (also college students) in Bogota, Columbia, who will also participate with you today. We will use the internet to transfer information from one location to the other. Continuing with the forest example, you should imagine that the community is made up of two villages, each populated by 4 residents. Further, suppose that the two villages are located on opposite sides of the forest. Now we will explain how the experiment will proceed in each round.

THE PAYOFF TABLE

At the end of the instructions is a PAYOFF TABLE. This table contains all the information that you need to make your decision in each round of the experiment. The numbers inside the table correspond to the experimental dollars (E$) that you would earn in each round for a given set of decisions. At the end of the experiment we will translate experimental dollars into real dollars at the following rate: $1 = 500 E$. Recall that there is a total of 8 members in the group (4 people in two subgroups). Each group member has to decide in each round the number of MONTHS that he/she wants to allocate to "*time extracting from the forest*" (in the columns from 0 to 8).

To play in each round, you must write your player ID, your location (in your case this will be Middlebury), the current round number, and your decision (a number between 0 and 8) on an EXPERIMENT CARD that will be given to you.

After everyone has made his or her decision, the monitors at each location will collect the EXPERIMENT CARDS from the 4 members of each subgroup. Each monitor will then calculate the total months that the subgroup decided to spend extracting from the forest. Next, the two monitors will share this information with each other using the internet and then write it on the black board for you to see. The monitors will write the time spent by each subgroup extracting from the forest and the total for both subgroups.

When the monitor announces the group total, each of you will be able to calculate the payoff that you earned in the round. Let us explain this with two examples.

In this experiment, we assume that each player has available a maximum of 8 MONTHS to work each year extracting a resource like firewood or logs. In the PAYOFF TABLE this corresponds to columns 0 to 8. Each member of the group will decide on a number of months from 0 to 8 in each round. To calculate your payoff for the round, you also need to know the decisions that the rest in the group made. Your payoff in each round will depend on the amount of time you spend in the forest and the amount of time all the other group members spend in the forest.

PAYOFF TABLE

		MY MONTHS IN THE COMMONS								
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
THEIR MONTHS IN THE COMMONS	**1**	619	669	717	764	809	851	890	926	959
	19	488	520	550	578	608	625	645	661	674
	20	475	506	535	581	585	606	625	640	653
	21	461	491	519	544	567	587	605	619	630
	22	447	476	502	527	548	567	584	597	608
	26	387	411	433	453	470	485	498	507	514
	50	31	34	36	37	33	37	36	34	32

Example 1: You decide that "MY MONTHS IN THE FOREST" will be 2.

The monitors collect all the experiment cards and announce that the Bogota subgroup spent 10 months in the forest and the Middlebury subgroup spent 12 months in the forest.

Therefore, the group spent a TOTAL of 22 months in the forest. Then you know…

- o "Their months in the forest" were __20__.
- o My E$ earnings for this round are _535_.

Example 1: You decide that "MY MONTHS IN THE FOREST" will be 5.

The monitors collect all the experiment cards and announce that the Bogota subgroup spent 14 months in the forest and the Middlebury subgroup spent 12 months in the forest. Therefore, the group spent a TOTAL of 26 months in the forest. Then you know…**(Please fill in answers)**

- o "Their months in the forest" were ____.
- o My E$ earnings for this round are ____.

THE DECISION FORM

Now we will discuss how the experiment will proceed in each round. Each participant has a DECISION FORM that is attached to the end of these instructions.

We can use Example 1 above to illustrate how to fill in the DECISION FORM. Recall that you decided to spend 2 months in the forest this round. On the EXPERIMENT CARD, you would write 2 next to "*My months in the forest*." You must also write this number in the first column (A) of the decision form. (You're writing your decision down in 2 places: the EXPERIMENT CARD you give to the monitor, and the DECISION FORM you keep).

The monitors will collect the 4 EXPERIMENT CARDS from each subgroup and will calculate the total time spent in the forest by the group. The monitor will announce this total to the group. Recall that in example 1 the total was 22 months. The Bogota subgroup spent 10 months in the forest and the Middlebury subgroup spent 12 months in the forest. Each of you will write 10 in column B of the decision form, 12 in column C, and 22 in column D.

To calculate column E, the months spent in the forest by everyone except for you, subtract column A from column D (E = D - A). Then look for the payoff in the PAYOFF TABLE that corresponds to "MY MONTHS…" = 2, and "THEIR MONTHS = 20." You will see a payoff of 535. So, in our example, you should have written down:

	Column	**Column**	**Column**	**Column**	**Column**	**Column F**
Round No.	**My Months**	**Bogota Subgroup Months**	**Middlebu ry Subgroup**	**Total Months (B+C)**	**Their Months (D-A)**	**My Payoff**
1	**2**	**10**	**12**	**22**	**20**	**535**
2						

It is very important to clarify that nobody, except for the monitor, will know your decisions in each round, or your earnings for the experiment. The only thing announced in public will be the **subgroup totals** and the **group total**. These examples are designed to help you understand how the experiment will proceed, and how to make your decisions to allocate your MONTHS in each round of the experiment.

Do you have any questions?

PAYOFF TABLE

	MY MONTHS IN THE COMMONS								
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0	619	670	719	767	813	856	896	933	967
1	619	669	717	764	809	851	890	926	959
2	617	667	714	760	804	845	883	918	950
3	615	664	711	756	798	838	875	909	940
4	613	660	706	750	792	831	867	900	929
5	609	656	701	744	784	822	857	889	917
6	605	651	695	737	776	813	847	877	905
7	600	645	688	729	767	808	836	865	891
8	595	638	680	720	757	792	824	852	877
9	588	631	672	711	747	780	811	838	862
10	581	623	663	700	735	768	797	823	846
11	573	614	653	689	723	755	783	808	830
12	565	605	642	678	711	741	768	792	813
13	556	594	631	665	697	726	752	775	795
14	546	583	619	652	683	711	736	758	776
15	536	572	606	638	668	695	719	739	757
16	525	560	598	624	653	678	701	721	737
17	513	547	579	609	636	661	683	701	717
18	501	534	565	594	620	643	664	681	696
19	488	520	550	578	608	625	645	661	674
20	475	506	535	581	585	606	625	640	653
21	461	491	519	544	567	587	605	619	630
22	447	476	502	527	548	567	584	597	608
23	433	460	485	509	529	547	563	575	585
24	418	444	468	490	510	527	541	563	561
25	402	428	451	472	490	506	520	530	538
26	387	411	433	453	470	485	498	507	514
27	371	394	415	434	450	464	476	484	490
28	355	377	396	414	430	443	453	461	466
29	338	359	378	395	409	421	431	438	442
30	322	341	359	375	389	400	409	415	418
31	305	324	341	355	368	378	386	392	394
32	288	306	322	336	347	357	364	368	371
33	272	288	308	316	327	335	341	345	347

	34	255	270	284	296	306	314	319	323	324
	35	238	253	266	277	286	298	297	300	300
	36	221	235	247	257	265	272	276	278	278
	37	205	218	229	233	245	251	254	256	255
	38	189	200	211	219	226	231	233	234	233
	39	173	184	198	201	206	211	213	213	212
	40	157	167	175	182	188	191	198	198	191
	41	142	151	159	165	169	172	174	173	171
	42	127	135	142	148	152	154	155	154	152
	43	113	120	126	131	134	136	137	136	133
	44	99	106	111	115	118	119	119	118	115
	45	86	92	96	100	102	108	108	101	99
	46	73	78	82	86	87	88	88	86	83
	47	61	66	69	72	73	74	73	71	68
	48	51	54	57	59	60	61	60	58	55
	49	40	44	46	48	49	48	47	45	43
	50	31	34	36	37	33	37	36	34	32
	51	23	25	27	28	28	28	27	25	23
	52	16	18	19	20	20	19	18	17	15
	53	10	12	12	13	13	12	11	10	8
	54	6	7	7	7	7	7	6	5	4
	55	2	3	3	3	3	3	2	2	1
	56	0	1	1	1	1	1	0	0	0

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