

Grid/Group Cultural Theory and Behavior in Voluntary Contributions Public Goods Experiments

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Abstract: We measure subjects along the grid and group cultural dimensions using survey questionnaires to predict variations in behavior in public goods experiments. Grid was hypothesized to induce enforcement of social norms of reciprocity, and group to induce altruism towards other individuals. Subjects were then placed in voluntary contribution mechanism with and without punishment. Overall, it was shown that the group attribute was positively and significantly correlated with the level of individual contribution. The grid attribute was positively correlated with willingness to punish, and significantly so for treatments where team membership was shuffled from round to round. Hence cultural type was shown to have a significant effect on performance in games, contrary to predictions of conventional models.

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The role of culture in collective human performance is a natural object of study in this age of globalization, with multinational workforces increasingly becoming the rule in both the private sector and government. Within the military, the necessity for individual soldiers to work with multinational coalitions is becoming more and more prevalent.

Moreover, there is a burgeoning literature within the social sciences that studies the effects of culture on collective action. Theories of this sort can be found throughout the social sciences. In economics, it can be found within the rising fields of behavioral economics (Camerer, Loewenstein, and Rabin 2004; Thaler 2007; Diamond 2007; Wilkinson 2007) and experimental economics (Friedman and Sunder 1994; Friedman 2004; Kagel and Roth 1997), where increasing notice is made of individuals who do not behave as uniform, homogenous rational maximizers. In other areas of economics, examination is made of the role of morality in market behavior (Zak 2008; Shermers 2008), social exchange and status (Gintis et al 2006), choice over time (Loewenstein 2003), and of social learning (Chamley 2004). Behavioral game theory is taking increasing notice of reputations (Mailath and Samuelson 2006) and learning (Cesa-Bianchi 2006). Finally, notice is being made increasingly of the cultural variations across countries and societies in the way that individuals behave under the same sets of circumstances (Henrich et al 2004). Computational economics (Holland 1998) and artificial life studies (Epstein and Axtell 1996; Epstein 2007) have always claimed to incorporate cultural factors into their analysis, but their rule-based models do not always make clear from where cultural determinants of rules arise.

One indication of the increased role of culture in social and behavioral theorizing is the tendency for various fields of study to blend together, such as recent collaborations between economists and psychologists (Frey and Stutzer 2007; Cremer 2006; Brocas and Carillo 2003). In sociology, the field of cultural sociology (Smith 1998; 2001; Alexander 2003) is undergoing a renaissance by being brought together with psychological theories into the new field of cognitive sociology (Zerubavel 1997; Cerulo 2002), as well as the more long-lasting field of sociological social psychology (Burke 2006), which is influenced by economic choice models as well as psychological ones. Finally, the study of acculturation psychology brings sociological analysis of norm formation into the field of cross-cultural psychology (Sam and Berry 2006).

Given all this intellectual activity revolving around questions of culture and collective action, one would think that considerable attention would have been paid to the role of culture in collective performance. However, this does not appear to be the case. In a recent survey of theories of collective performance (Stock 2004), it is evident that cultural factors are examined only very marginally in analysis of performance, and the interaction of cultures virtually ignored. There may be a number of reasons for this, but the most obviously pressing is the lack of an appropriate framework on which to base such an analysis.

The paper addresses this shortcoming by focusing at its core on the original objective put forward by the authors of this grant research topic, which was to “determine which cultural factors are most statistically relevant as performance moderators”. We do so by incorporating the role of two cultural factors in particular, grid and group, the basis for perhaps the most prominent general framework for cultural classification in the social sciences. We show how grid and group interact with the organizationally-induced structure of collective action to determine individual and collective performance.

This study empirically demonstrates how grid and group affect performance in, systematic, predictable ways, in a range of settings, making use of computer-mediated experiments, the most

rigorous way of validating general behavioral predictions. This is the first study of any kind to ever show that cultural characteristics, measured in quantitative form, can account for predictable differences in behaviors under controlled experimental conditions. More specifically, we show that grid and group characteristics of individuals can predict the level of contribution that such individuals make to a collective undertaking, hence affecting the overall benefits from that action. We demonstrate how under certain institutional structures and conditions, groupness influences contributions, while under others, gridness does.

Grid-group theory and the study of culture

Grid-group is perhaps the best-known general cultural framework in the fields of sociology and social anthropology. It is based on the work of preeminent cultural anthropologist Mary Douglas (1980, 1989) and pioneering political scientist, Aaron Wildavsky (1987), as well, on their joint work (Douglas and Wildavsky, 1982). Grid-group has been adapted to a formal, choice-theoretic decision-making framework (Chai and Wildavsky 1994, 1998). Grid and group are quite different from most cultural typologies such as those of Hofstede (1991, 2003 [1980]), House et al. (2004), Chhokar et al (2007), or Hampden-Turner and Trompenaars (1993). One distinction is that it has only two major factors, as opposed to the several found in comparable typologies. Moreover, these factors tend to be more abstract. This abstractness can be seen, indeed, as one of the framework's great advantages, as its concepts can be seen as being relevant to literally all choice situations that an individual will face in a group setting. It has been compared at times to the pioneering concepts of integration and regulation by 19th century sociologist Emile Durkheim (1997 [1897]), for their ability to capture within a small number of dimensions much of what makes cultures different from one another.

Within the grid-group model, group represents the extent to which a culture emphasizes positive or negative altruism towards other individuals, as opposed to pursuit of self-interest. Grid, on the other hand represents the extent to which a culture embodies a reliance on standardized role-based rules for achieving goals, as opposed to general approaches to problem-solving. We chose the grid-group framework because of its parsimony, the fact that it is probably the best-known formalized classification of cultures within the contemporary social science literature, and because its two abstract dimensions have been shown to be accurate predictors of numerous concrete cultural predispositions. While its two dimensions are deceptively simple, they also provide a systematic framework for organizing large numbers of more specific cultural attributes (Douglas 1970; 1989; Douglas and Wildavsky 1982; Chai and Wildavsky 1994; Chai and Swedlow 1998).

The grid-group framework has gained popularity as a conceptualization of culture in a number of branches of social science, including anthropology, sociology, and political science. Grid-group surmounts many of the limitations associated with previous theories of cultural dimensions. This framework proposes that an individual's behavior, perception, attitudes, beliefs, and values are shaped, regulated, and controlled by constraints that can be classified within two broader domains labeled as group commitment and grid control. Beliefs about humans and their world locate persons with respect to the grid and group dimensions and spawn preferences for specific patterns of social relations. It has been argued that this theory illuminates tighter, more specific relations between disparate constrained sets of practical objectives and interests than other theories of culture. This characteristic enables theorists to capture key features of persons' political worlds more effectively. Thus, grid-group theory helps generate clearer, more easily measurable concepts than alternative frameworks for representing culture.

The theory allows for the representation of distinctive, constrained, and predictable objectives and interests of each culture (Lockhart 1999).

The grid-group model is more than simply a taxonomy. Both grid and group have implications for a wide range of actions across diverse environments. Stated in basic fashion, low-group cultures will tend to have self-interested preferences based upon a individualized identity, while high-group cultures will be characterized by altruistic preferences towards others within their own collectivity, based upon a “fused”, collective identity. High-grid cultures will tend to prefer to adherence to rules of conduct based on social norms, articularly those of equity and reciprocity within the collectivity, even under conditions where this does not directly benefit them. Low-grid cultures, on the other hand, will tend to ignore such norms and decide to do things “their way”. These are general tendencies, and hence are not tied to any particular set of conditions or interactions.

The paper proceeds as follows. In section 1 we propose a formal model that presents culture in the grid group framework. Section 2 reviews the voluntary contribution mechanisms with and without punishment, ultimatum game and provides the hypothesis tested. In section 4 we describe experimental design followed by section 5 where we report main results from laboratory. We discuss results and conclude in section 6.

I. Model

The current approach has a number of different conceptual parts. The following are input parameters: a team T comprising a given number of individuals. Each individual $i \in T$ has the characteristics of grid (m_i) and group (n_i),

$$\forall i \in T : m_i, n_i \in [0,1] \quad (1)$$

Broadly speaking, grid has been defined as an attachment to rule-following determined by institutionalized social norms and group has been defined as incorporation of identity into a larger collective unit (Douglas 1970; 1982). In the process of being formalized for the purposes of incorporation into quantitative predictive models (Chai and Wildavsky 1994; Chai and Swedlow 1998), the grid has been further defined more concretely and in choice-theoretic terms as expressive utility placed on following social norms defined within a collectivity, and group as altruistic utility towards members of the collectivity. This leads us to the following transformation of individual utility functions based on grid-group cultural traits:

With x_i is defined as individual’s one-period untransformed utility (payoff function). A individual’s group-transformed utility y_i is specified as linear altruism

$$y_i = \left(\sum_{t < i} n_t x_t \right) + x_i \quad (2)$$

Let us define a_i^* as the socially prescribed action for the role into which individual i has been placed. An individual’s grid and group-transformed utility is then represented as:

$$z_i = y_i \left(ord(a_i = a_i^*) + (1 - m_i) ord(a_i \neq a_i^*) \right) \quad (3)$$

It should be noted that simplifications have been made here from a full translation of grid-group theory, primarily in light of practical data limitations, and to a lesser extent tractability. Among other things, the “groupness” and “gridness” variables n_s and m_s may apply differentially to members of a collective, depending on the extent to which certain individuals are judged to be part of an individual’s in-group. However, generating this information with a degree of subtlety and validity in experimental setting is problematic. A related issue is that groupness and gridness can both conceivably be negative, i. e. an individual may have negative altruism (misanthropy)

towards others or may gain expressive utility from violating norms. However, the originally grid-group theory posits that such values cannot proliferate in any society that is capable of surviving (Douglas 1970; 1982).

The goal of this project is to examine the role of culture, as characterized by the grid-group framework, in determining of individual behavior in collective action setting We employ a voluntary contribution mechanism with and without punishment and ultimatum game.

A. Voluntary contribution mechanism with and without punishment

Voluntary contribution mechanism (VCM hereafter) are a class of public good games in which a group of subjects are each given the opportunity to contribute their endowment to a group exchange that will benefit all members of the group or to invest to alternative private exchange that will benefit only the contributor. Typically, such public goods games have payoff similar to those of a prisoners dilemma, in which rational individual's dominant strategy is to contribute nothing to the group exchange despite the Pareto optimality of each person contributing his or her entire endowment. For the non-repeated version of this game, the rational strategy for a purely self-interested, norm-indifferent individual (i.e. zero grid and group), is to never contribute anything to the group account. Ample experimental analysis has shown that actual behavior does not correspond to this idealized economist's version of reality, but a thorough explanation of why this divergence exists is still in the works. It is our contention that grid-group theory provides us the means of demonstrating the role of culture in explaining this incongruity as well as allowing us to explain variation in the actions of different players in a game. Multi-person VCM have been used as the experimental abstractions for a number of real-world problems, such as the tragedy of the commons, where individuals share unlimited access to a limited common resource (Hardin 1968; Ostrom 1988), as well as collective action problems in the provision of public good (Olson 1971). A number of authors have looked at the possibility of designing institutions to resolve difficulties in obtaining optimal cooperation under such conditions (Ostrom 2007); but, to date, these models have not explored how the cultural characteristics of the individuals involved might influence institutional design.

Experiments demonstrate a wide range of actions that may occur in public good environments, varying from zero contribution to the contribution of one's entire endowment of resources. In general, about 40-60 percent of the group optimum can be achieved (Ledyard 1995). It has been established that in initial stages, subjects contribute approximately half of their endowment, but contributions decline with repetition (Isaac, Walker and Thomas 1984). This might be due to learning, or to strategic attempts to signal or punish others. Part of the decline in cooperation may be due to social preferences, i.e. concerns that go beyond mere self-interest (Andreoni 1988, Kurzban and Houser 2002). On the other hand, Andreoni (1995) suggests the decline is due to frustrated attempts at kindness. He speculates that there may be individuals who contribute conditional on others' contributing at the same level and that he or she will decrease contributions in the next period if his or her contribution was above the average of others. Fear that others will not contribute as much as the individual himself/herself is another possible explanation (Chen 1996, Yamagishi and Sato 1086). Similarly, Croson (2000), Fischbacher et al. (2001) observe conditional cooperation, e.g. some behavioral types contribute more when others' contributions are high. Gächter and Fehr (1999) and Rege and Telle (2001) show increase in contributions with social approval, i.e. individual contributions are observable by others. Fischbacher and Gächter (2006) explain the decay in the contribution by heterogeneity of

preferences and interaction between types. They find consistency between expressed preference for cooperation and actual contributions observed among contributing individuals, while those who fail to contribute (free riders) had systematic deviation from their expressed preferences in the first half of experiments due to strategic effort to induce others to cooperate more. However, none of these researchers describe differing cultural characteristics of individuals that might contribute to the varying levels of contributions under particular circumstances.

More recently new experiment designs have allowed researchers to devise institutional rules that maintain high levels of contributions throughout the course of the experiment. One of these allows subjects to selectively impose financial penalties on other subjects within the group in response to his or her level of contribution to the public good (Fehr and Gächter, 2000). Recall that when VCM has no regularities and no penalties can be imposed on non-cooperators, reciprocators condition their behavior upon others and reduce contribution. A different outcome is expected under conditions where punishment is possible. Fehr and Gächter (2000) find that allowing a second stage in which subjects can punish other subjects after observing their contribution levels raises the level of contribution to the group account and stems the speed of contribution decay. Indeed, Carpenter, Bowles, and Gintis (2007) find strong reciprocity could be one factor increase performance in team if punishment opportunities exist. Again our grid measure obtained through the survey identifies strong reciprocal behavior in the VCM with punishment.

According Yamagishi and Yamagishi (1988) institutions affect the behavior. While they do not attempt to directly measure the cultural characteristics of US and Japanese citizens, they make predictions based upon conventional stereotypes about the differences between the two cultures. According one view, Japanese prefer collective values and trust more while American should be individualists and therefore trust less. However, lab experiments provide opposite evidence. In a no-punishment condition, Japanese individuals contribute less (44 percent of their endowment) and Americans individuals more (56.2 percent of their endowment) to a collective enterprise. However, when sanctions were available, cooperation was high across both subject pools (74.6 and 75.5 percent respectively). This suggests that Japanese individuals cooperate often within the group not because of an intrinsic desire to do so, but instead because of the presence of social norms that encourage sanctions against those who fail to do so. Note, however, that imposition of such sanctions itself is costly, and therefore cannot be explained by merely self-interested behavior.

In many ways, our research seeks to improve on this approach by Yamagishi and Yamagishi (1988) by integrating use of the grid-group framework to better characterize cultural variables. Grid-group theory can not only help explain these differences between Japanese and Americans, but can show how they can be generalized to other countries and other types of interactions. Moreover, it shows how it is possible to go beyond stereotypes of national character and examine cultural differences at an individual and sub-national level. We test the importance of cultural factors in sustaining high levels of contribution to the group account. Specifically, we hypothesize that high-grid (strong reciprocity) and high-group (altruism) characteristics are among the explanations for a shift in contributions over repeated interactions.

Predicted behavior in VCM and ECM

The aim of study is to capture effect of cultural factors such as grid and group on individual as well as group performance. According our model the formalization of groupness allows an individual to appropriate some of the team payoff as part of his or her own utility, thus increasing

the incentives for contribution. Therefore, we would expect that high groupness individuals would contribute more than the low groupness individuals.

Punishment of failure to contribute is a form of strong reciprocity, a social norm that is accepted in by most experimental social scientists to be one (and perhaps the only one) that is universally shared in by all societies. If an individual can commit to punishing failures to contribute in the partner treatment, and the other individuals in the team are aware of this, these individuals may choose to contribute because the cost of receiving punishment exceeds any individual benefits from failing to contribute. For the VCM games with punishment opportunity, we posit the existence of a norm of reciprocity that occurs to some extent across all cultures, but is stronger in some cultures than others. Stated formally, reciprocity is an individual-level norm that calls for rewarding those who act cooperatively and punishing those who do not, even when following such a pattern of reward and punishment is costly to oneself. Strong reciprocity is the willingness to follow the norm of reciprocity, even when doing so is costly to oneself (Fehr, Fischbacher, and Gächter 2002). The focus on reciprocity is justified by ample experimental evidence which suggests that this norm can account for much of the deviation of individual behavior from that predicted by conventional economic theory (Fehr and Gächter 1998; Andreoni 1995; Falk and Fischbacher 1998 (2006); Bolton and Ockenfels 2000). Given the existence of reciprocity as a social norm, our formalization of grid implies that cultures that are higher in gridness will be more willing to give up their own benefits and engage in costly monitoring activity in order to restore social norms. Thus the existence of gridness makes reciprocity stronger than its absence, and hence leads to more enforcement. Within the context of this experiment, where assigning penalty points to non-cooperators is helpful in enforcing cooperation, and thus beneficial to the group, it follows that high-grid individuals will be more likely to assign penalty points than low-grid individuals. Hence, we would expect individuals with high gridness characteristic to have higher punishment abilities in the VCM with punishment opportunity (ECM hereafter).

We test the following propositions:

Hypothesis 1: High-group individuals contribute more than the low-group individuals in the VCM.

Hypothesis 2: High-grid individual will punish more than the low-grid individuals in the ECM.

Hypothesis 3: High-grid individuals will react more radically to initial contributions by others, rewarding high contributions and punishing low contributions.

Hypothesis 4: High-group individuals will anticipate higher cooperation among others than low-group individuals.

Hypothesis 5: High-grid individuals will anticipate greater adherence among others to strong reciprocity than low-grid individuals.

B. Ultimatum Game

We also examined the nature of human cooperation in a bargaining game where some total amount of money has to be divided among two persons. The proposer first specifies the proportion of the money that he/she offers to the responder and proportion he/she keeps for himself. The responder has option either to accept or reject proposed offer. If the receiver rejects the offer, both players get zero (Guth, Schmittberger, and Schwarzze 1982). By backward induction techniques, standard economic theory predicts that proposers will demand all of money except a small positive number. Such theory also assumes that a receiver will accept any small number greater than zero; therefore a selfish proposer would offer this small increment. However, laboratory experiments report that most of subjects offer almost half of the pie and reject even reasonably high offers. A number of different explanations have been put forward for this seemingly anomalous behavior. Some attribute this to concerns about kindness (Rabin 1993) or fairness (Bolton 1991). Note that kindness and fairness are clearly different concepts. Within the context of the ultimatum game, kindness refers to the willingness to offer a bigger share to ones partner, even when there is not an obvious benefit to oneself for doing so. Fairness relates to ones willingness to accept or reject an offer based upon what seems appropriate for the partnership, rather than what is personally beneficial to oneself. In the convex ultimatum game Andreoni et al. (2003) have shown that money maximization is a concern of about the half of subjects and another half of population are concerned about fairness.

It is plausible to define aggregate performance in an ultimatum game to there being an equal split of the money available, since subjects are chosen from the same pool and thus are on the average not different in skills or the amount of time devoted to the game. Individual performance can be defined for the role of the proposer as the willingness to offer such a split. From the role of the responder it can be defined as the willingness to reject any split that falls substantially short of this, even at short term cost to oneself, since awareness that the responder will behave in this fashion will lead even unkind proposers to offer more than they would otherwise.

As mentioned, it has been shown that proposers generally offer more, and responders generally are more willing to reject than conventional economic theory would suggest. However, cross-cultural experimental studies from fifteen small scale societies provide evidence there was a great deal of variability in behavior across societies in their behaviors both as proposers and responders (Henrich et al. 2004). Grid-group theory can help to explain both these findings. The cultural characteristics assumed by conventional economic theory are not universal in real life, but are limited to those who are of low-grid, low-group culture. Moreover, if we know the grid and group characteristics of different individuals, we may be able to predict how their behavior will differ in the proposer and responder roles. The role of a proposer identifies the groupness characteristic, since offering a greater amount is only rational if an individual incorporates the responding partner's payoff into his or her utility function. Therefore, we would expect that high-groupness proposers will offer more than low-groupness proposers. The role of a responder isolates the gridness characteristic of the individual, since rejecting an offer is harmful to the payoffs of both proposer and responder, hence is rational only if it allows the responder to follow a social norm, in this case the norm of reciprocity. Thus, we would expect that high-gridness individuals will be more likely to reject offers than low-gridness individuals.

Hypothesis 6: High groupness individuals, when placed in the offerer role, will be more likely to make high offers than others.

Hypothesis 7: High gridness individuals, when placed in the receiver role, will be more likely to reciprocate others (accept high offers, reject low offers).

III. Experiment Design

A. General lines

To test our hypothesis we conducted VCM, ECM and ultimatum game conditions depicted in Table 1. To capture cultural attributes of participants, in all sessions subjects proceed first with the survey completion explained in the subsection D below. Total of 132 undergraduate and graduate students from the University of Hawaii at Manoa campus participated in a single experimental session during February 2008. First they were prompted to HCXC lab computer¹ terminals to take the questionnaire. Then subjects in groups of four or two have experienced (i) a voluntary contribution mechanism with no punishment (VCM) in ten periods followed by, (ii) the voluntary contribution mechanism with punishment (ECM) in ten periods followed by (iii) one period of ultimatum game.

Based on three basic conditions we built four designs where subject's matching and framing conditions vary. In designs 1 and 3 (Table 1) subjects are placed in the same group for the duration of the treatment (partner matching). Design 2 and 4 simulate one-shot games with and without punishment such that subjects are re-matched randomly after each period (shuffled groups). In each treatment, subjects are made aware of these rules for group composition and are aware that this knowledge is common across all subjects. All VCM, ECM and ultimatum game conditions were tested in the different contexts of partner matching (iterated) and random matching (one-shot game) to separate fully the strong reciprocity motive from selfish motive to punish. A strong reciprocal individual (high-grid) acts contingent on the contribution of other members and is willing to discipline non-cooperative members at her/his own cost. However, a low-grid individual also has a motive to punish others in the current period as a means of inducing increased contributions from others in the next period. To isolate the effects of strong reciprocity, treatments with random re-matching (design 2 and 4) eliminate the selfish motive to punish. In addition, there is no reputation effect when subject is placed in a group with different team members after each period.

In designs 3 and 4 we study framing effect on top of this. Designs 3 and 4 include a preliminary stage to elicit from subjects their expectation of fair contribution levels. In order to enhance the presence of social norms within the group we report average group opinion about fair contribution. The average answer is reported back to the subjects before the treatments commence. This is meant to create a "frame" for subjects, a collectively shared norm against which the actual contributions can be compared. Designs 1 and 2 do not include this framing stage.

¹ The experiment was programmed and conducted with the software z-Tree (Fischbacher 2007).

B. Payoffs

VCM: Each period in groups of four ($N=4$) each subject was endowed with $e=50$ tokens to invest in two exchanges. The group exchange generated half of the amount invested in that exchange and benefited everyone in that group, i.e. efficiency factor was set to two. The individual exchange returned exactly the same amount of what was invested in it.

We can characterize individual-level payoffs in each period of VCM as follows:

$$x_i = (50 - c_i) + 0.5 \sum_{j=1}^N c_j, \quad (3)$$

where $0 \leq c_i \leq 50$ represents the contribution of individual i , and $\sum_{j=1}^N c_j$ total contributions of all individuals in a group.

ECM:

A public good experiments with punishment (Fehr and Gächter 2000) is similar to a VCM, except for the fact that, after contribution, there is an additional stage in which individuals may punish others whom they do not think contributed sufficiently to the public good. This punishment incurs a cost to both the punisher and punishee, so there is no benefit to doing so except to promote a "just" outcome and, in a repeated game, to deter further failure to contribute. After the investment decisions, subjects are allowed to assign points to any other subject within the group whom they think violated the norms. The points assigned to individuals reduce the payoff of the receiver by 10 percent per each point assigned, with the constraint that an individual's payoff cannot be reduced by more than 100 percent. Our ECM differs from punishment games in Fehr and Gächter (2000) in that each point assigned to others costs the punisher 5 cents, i.e. non-increasing in the punishment level. Also in our setting endowment and marginal per capita return for the group exchange are higher, i.e. $e=50$, $MPCR=0.5$. From this, it follows that

$$x_i = [(50 - c_i) + 0.5 \sum_i c_i] \cdot (10 - P_i) / 10 - \sum_j 5 \cdot p_i^j \quad (4)$$

where $P^i = \min(\sum_{j \neq i} p_j^i, 10)$ is the deciles reduction in payoff to penalty recipients due to assigned penalty points, p_i^j is the number of penalty points given out by individual i to each other individual j .

Ultimatum game:

In the ultimatum game, each proposer is given an endowment of 10 dollars to divide between himself/herself and a responder. After the proposer makes an offer, the responder can either accept or decline. If the responder declines, neither party receives anything. For the self-interested norm-neutral rational actor, the optimal strategy in an ultimatum game is to offer nothing if they are the proposer, and to accept any offer above zero if they are the responder. Therefore, the payoff for the proposer, x_i , and the payoff for the responder, x_j are given by:

$$\text{if } \text{accept} = \begin{cases} 1, & \text{then } x_i = 10 - g_i, \quad x_j = g_i \\ 0, & \text{then } x_i = x_j = 0 \end{cases} \quad (5)$$

where g_i is the offer made by a proposer.

C. Procedural

After the completion of the questionnaire subjects were aware of only ten periods of the no punishment VCM condition. Then as a surprise they were placed in a ten periods of punishment condition (ECM) and were told that there would be exact ten periods. After the contribution stage subjects received information on the total group investment and own payoff for this stage. Also they receive information on contribution levels in their group. In every condition, individual's contribution was listed in the first place and contributions of other members were followed in the random order so that there was no possibility of identifying other contributions. This way we remove reputation building effect in the partner matched groups and rule out possibility of revenge type punishment that could be carried over from the previous period to the current period. In the punishment condition subjects did receive information only on their own punishment expenditure, total punishment points assigned to them by others and the following reduction in their own payment. Subjects are neither received information on the individual punishment activities of other members nor overall punishment level in the group. Subjects did not know about the ultimatum game prior to ten periods of ECM. However, all subjects were informed about the partner or stranger pairing before the simultaneous ultimatum game where each subject was placed in the role of a proposer first without knowledge of the payoff; then all subjects were placed in the role of a responder.

Every effort was made to employ neutral language. For instance, the word "investment" is used instead of "contribution". To ensure that subjects understand the nature of the institution and payoffs, subjects complete a quiz and two practice periods before treatment starts. After the experiment, a questionnaire is administered to ascertain the participants' strategies and opinions about the experience. Each subject was paid on average \$30 including a flat show-up fee of \$5.00 in cash at the end of experiment. Each session lasted less than three hours including the payment time. Instructions were provided in verbal and written format before subjects began the experiment. See Appendix A for the instructions.

D. Survey method

We conducted a survey before each experiment to determine the cultural characteristics of each subject and then quantified these cultural characteristics of each individual based on answers they pursue during a survey that consists of 29 questions, which transmits information on personal values with respect to following key elements: (i) social values, (ii) opinion on employment, (iii) national goals, (iv) social distance, (v) workplace, (vi) religion and (vii) social norms. See survey attached for details.

All subjects were ranked according to grid/group characteristics. We calculate grid² and group³ indexes in line with the formula in the footnote. This method for calculating grid and group is determined by taking selected items from the World Values Survey (Inglehart et al. 1998, 2004). It has an advantage of allowing the survey results to be verified on a national basis against the

² Grid= $((4-\text{Answer}[10])/3+(3-\text{Answer}[13])/2+(3-\text{Answer}[14])/2+(3-\text{Answer}[17])/2+n(2-\text{Answer}[18])/1+(3-\text{Answer}[22])/2+(\text{Answer}[25]-1)/9+(10-\text{Answer}[26])/9+(10-\text{Answer}[27])/9+(10-\text{Answer}[28])/9+(10-\text{Answer}[29])/9)/11$;

³ Group= $((4-\text{Answer}[8])/3+(4-\text{Answer}[9])/3+(2-\text{Answer}[11])/1+(2-\text{Answer}[12])/1+(\text{Answer}[15]-1)/1+(\text{Answer}[16]-1)/3+(3-\text{Answer}[19])/2+(3-\text{Answer}[20])/2+(\text{Answer}[21]-1)/2+(\text{Answer}[23]-1)/9+(10-\text{Answer}[24])/9)/11$; The Answer[1], Answer[2] are the numbers that quantify and identify the exact answers provided by subjects in the survey.

much larger sample than the WVS provides. Moreover, the survey that determines cultural attributes of subjects serves as a predictive measure of behavior induced in the laboratory. For reasons of robustness, two additional questions were placed on the survey, each being original items that seek to encapsulate in a single indicator the qualities that make up grid (Answer[7]) and group (Answer[6]). These single-question indicators are named Alt Grid and Alt Group as compared to Grid and Group indexes calculated using several questions.

Previous attempts to incorporate survey instrument linked trusting attitudes with actual contributions in experiments (Glaeser et al. 2000, Ahn et al. 2003, Ashraf et al. 2003, Danielson and Holm 2003, Gächter et al. 2004). Out of several measures of trust attitudes it has been found that "General Social Survey (GSS) *trust* question least accurately reflects actual trusting and cooperative behavior. The *Trust strangers* and the *GSS fair* and *GSS help* questions seem to reliably reflect trusting and cooperative behavior" (Gächter et al. 2004). Also Capra et al. (2007) used World Value Survey (WVS) and GSS questions to explain trust in a series of games. None of these studies that use survey have looked at grid/group cultural measures.

IV Result

We analyze data first on an aggregate level by looking at the average contribution, mean punishment expenditure by group across ten periods of VCM or ECM. Then we report results on individual level behavior followed by ultimatum game results.

A. Voluntary Contribution Mechanism Results

We compare data with Nash predictions and cultural model predictions.

Result 1: *In line with cultural model predictions, high-group scores were positively correlated with the average contributions in VCM (hypothesis 1). This result was most pronounced in the shuffled groups.* Support: Table 2, 3 and 5

Groupness and contributions: Examination of initial results show confirmation for our hypotheses, indicating that, according to the institution under which individuals are functioning, either grid and group can be an important and systematic determinant of individual and team performance. As seen in table 2, the correlation between individual groupness (Group) and the average amount (Contrib) contributed across all periods in the VCM, in both shuffled and partner matched groups, was positive and statistically significant. Hence, it was shown that high-group individuals tend to lead to higher team performance for the team in the VCM. Note that these findings hold for both the indexed and alt versions of the group indicator, and are significant for both, a strong verification of the importance of group for contribution behavior in the shuffled groups VCM. Shuffled groups helped to isolate groupness effect from gridness effect because one-shot game structure eliminates any reciprocity and reputation building effects. We report pooled data results for only shuffled treatments since as we will show below framing had no effect at all in those treatments.

Contribution: (Figure 1). Table 3 displays both the average group account contribution levels and the corresponding standard deviations for the various treatments within the VCM institution. Within each, the results are presented for each of the following treatments: the sessions where framing took place, the sessions where framing did not, the sessions where the group

composition was maintained through every round (partner), the sessions where group composition was scrambled every round (shuffled). The VCM institution shows an average contribution over all ten periods of 21.5 and 30 for the shuffled and partner conditions. But it is important to note that contributions are clearly highest in the early periods and decay throughout the treatment. The Wilcoxon matched pairs signed-ranks test across time periods shows significant difference among periods (p -value=0.0000). This type of group contribution decay is common in VCMs. However, the decline in contributions toward the end of ten rounds was not sharp, with individual contribution levels at 29-45 percent of endowment.

Result 2: *In the VCM cooperation was higher with partner groups rather with shuffled groups. Framing was silent.* Support: Table 2, 3 and 5

Matching: There is very clear distinction in the behavior of *shuffled* groups comprised of unique combinations of subjects each round, and *partner* groups whose composition remains unchanged. As demonstrated in prior VCM experiments of this type, randomly re-matched subjects contribute less to the group account than subjects who are told they will remain matched with the same people through out the treatment. This is demonstrated by the difference in the averages across all periods (shuffled groups contribute 21.5, partner groups contribute 30) and in per period differences as well. Wilcoxon rank-sum test indicates that contributions to the public good are maintained at a higher level longer in the partner groups (p -value=0.0009 and p =0.0015 in the frame and no frame conditions, two sided). See Table 3. Average contributions in shuffled groups amount to 43 percent of endowment vs. 60 percent in partner groups.

Framing: Average contributions were 25.5 in both No Frame and Frame shuffled treatments. Similarly, in the partner treatments mean contributions were higher (30) but similar for both No Frame and Frame treatments suggesting that framing induced little or no distinction between subjects with differing grid and group scores (Wilcoxon-Mann-Whitney rank-sum test p -value=0.9698 and 0.8798 in partner and shuffled matching conditions correspondingly, two-sided). High-group individuals anticipate higher cooperation among others in the sense that the group scores are positively and significantly correlate with one's expectations of others cooperation ("Norm") for both Group index and Alt group indicator in the shuffled condition (Pearson p -value=0.000 and 0.001, respectively). This result is significant in the partner groups as well (hypothesis 4). In line with predictions, grid scores are significantly and negatively correlate with the expectations on others adherence to norm ("Pnorm") in the shuffled condition while the sign reverses in the partner condition. Therefore, high-grid individuals condition their decisions on their expectations of the norm and others behavior (hypothesis 5). As we will show below, high-grid individuals cooperate more in the ECM than in VCM.

B. Enforced Contribution Mechanism Results

Now we analyze the data for the contribution mechanisms with punishment opportunities (ECM) where subjects were allowed to assign points to those who fail to contribute sufficiently.

Result 3' *In line with theoretical predictions, high-grid scores were positively correlated with the punishing expenditures in the shuffled groups (hypothesis 2). The voluntary contribution mechanism with punishment (ECM) opportunity produces higher level of output than the standard VCM. Partner groups perform better than the shuffled groups.* Support: Table 2, 4 and 5.

Gridness and Punishment: Results largely in accordance with expectations were also found in the ECM. Here we would expect that the correlation between individual gridness and the average penalty expenditures (Punish) incurred across all periods be positive. We find the correlation is in the expected direction for both the indexed and alt grid indicators, although the level of significance is not as high as needed to be decisive across the various treatments. However, when one focuses in on the shuffled groups with and without frame, the correlation is both high and significant (Pearson coefficient=0.230, $p=0.000$ and coefficient=0.111, $p=0.036$). This is in line with our expectations as, partner groups provide an incentive for even low-grid individuals to punish those who fail to contribute, since this may lead to higher future contributions from which they themselves can benefit. For the shuffled groups, the only reason to do so would be strong reciprocity.

Contribution with punishment: (Figure 1). Table 4 shows similar data as Table 3 but with the addition of the average expenditure on punishment disbursed in the second stage of each period. As demonstrated by Fehr and Gächter (2000), the potential for punishment, even at a substantial cost to the punisher, serves to encourage increased contributions to the group account. This higher level of contributions is seen in the average across all periods (41.01 versus 35.69 in shuffled, 45.39 versus 36.96 in partner conditions) and in the comparisons across each period. Average contribution across all periods and across ECM is higher than that in the VCM and, what's more, the contributions display none of the tendency to decay across periods. Wilcoxon matched pairs test reveals that two samples with and without punishment differ from each other at 1 percent level of significance. See Table 5, pre-last column. This result again manifests the importance of institutions, existence of norms that supports full cooperation in social dilemma situations.

Matching effect: Not as surprising, the means of group composition, random or invariable, is also a significant determinant of contributions in this institution. The partner treatment results in higher levels of group account contribution across all periods (45.4 versus 36.96 in partner and 41.01 vs. 35.69 in shuffled conditions) just as in the VCM without punishment. Mean contributions were higher in the partner groups with framing than in the random groups with framing (Wilcoxon-Mann-Whitney test $p=0.0015$). Presumably, the potential for punishment in this institution mitigates the inability to reciprocate in the randomly determined groups and thus eliminates the distinct incentive to cheat in those treatments that accounted for the difference in the non-punishment VCM.

Result 4: *Framing strengthens the punishment effect in both partner and shuffled groups.*

Partner groups exhibit higher contributions than shuffled groups. In the partner groups without framing punishment level was higher than in the partner groups with framing. Support: Table 2, 4 and 5.

Framing effect: Interestingly, in the ECM, framing has a substantial positive effect on the level of contribution whereas, in the absence of punishment (VCM), it has no effect at all. Wilcoxon rank-sum test in Table 4 shows higher average contributions with framing than without frame (p -value=0.0002, two-tailed). The mean contribution was different from Nash level and reached 91 and 82 percent of endowment in the partner frame vs. shuffled frame punishment conditions respectively. For no frame conditions corresponding contributions remain lower, i.e. 78 and 71 percent. Individual's group scores and contributions remained strong, positive and significantly

correlated for both groups of subjects in the partner conditions (0.164 for those asked and 0.165 for those who were not).

Punishment behavior: The punishment statistics are also included in Table 4. The average per-person expenditure on punishment were 3.93 in the partner frame, 11.7 in partner no frame, 5.37 in shuffled frame, and 5.29 in shuffled no frame treatments. Interestingly, there was no decay in the level of punishment contributions across all periods despite the value of punishment as an inducement for future contributions would decrease each period. There are also obvious treatment effects. For starters, framing actually decreases the average expenditure on punishment (3.93 versus 11.7 in the partner groups). But this is less surprising in light of the observed higher levels of contribution in the partner condition where reported average opinion about the fair contribution served as group norm to follow. More intuitive is the difference in the punishment levels between the random and the partner group composition treatments with no frame, 5.29 versus 11.7 (Wilcoxon-Mann-Whitney test, $p=0.0002$). Presumably, subjects have an increased incentive to punish other subjects with whom they are going to be matched again. However, this explanation is belied by the lack of decay in punishment expenditures over the course of the treatment. Note that in the partner groups low-grid-low-group (selfish) individuals have the incentives to punish others because they benefit from increased contributions in the next period. While in the shuffled treatments, only high-grid individuals would be expected to punish others at some cost to themselves. Therefore, in the partner matching with no frame we have higher punishing expenditures because low-grid-low-groupness individuals also punish whereas in the shuffled groups only high-grid subjects attempt to enforce norms. This is why grid scores and punishment correlations become stronger and statistically significant (0.111 for shuffled subjects compared to 0.012 for those whose groups were not shuffled with no frame and 0.230 for shuffled groups compared to 0.081 for partner groups with frame).

C. Individual behavior in VCM and ECM

We identify cultural types and classify them based on answers provided during the pre-treatment survey. Grid/ group cultural attributes are considered high/low if the grid/group scores are higher/lower than the average score of the experimental subject pool.

Result 5 Heterogeneity observed among subject pool. Different behavior emerged across cultural types, i. e. high-group subjects contribute more than low-group subjects and high-grid subjects punish more than other types. Support: Figure 2 and 3.

Heterogeneity: Individual actions were diverse and vary from zero to full endowment contribution. In our shuffled groups 24 percent of population were low-grid and high-group, 26 percent were low-grid and low-group, 50 percent had high-grid characteristics. Latter classification based on the cut-point equal to the average grid and group scores for the shuffled sessions that were 0.37 and 0.47 respectively. Composition of cultural types was 21, 32, and 47 percent respectively in the partner groups. The cutting point to classify types in the partner groups was 0.4 for the grid and 0.5 for the group attributes. Recall that individuals with low-grid and high-group attributes resemble the cooperators, low-grid-low-group individuals are the self-regarding types and high-grid individuals are the conditional cooperators.

Average contributions were greater for high-group individuals than for low-group individuals in the VCM shuffled groups (Wilcoxon-Mann-Whitney test $p=0.0167$). Also high-grid individuals' average contributions were below the mean contributions of high-groupness

individuals (Wilcoxon-Mann-Whitney test $p=0.0340$) while there was no difference recorded among high-grid and low-group individuals' contributions (Wilcoxon-Mann-Whitney test $p=0.1615$). See Figure 2. This verifies our hypothesis 1. Contribution levels were no different across cultural types in the VCM partner groups ($p=0.2623$, 0.1342 , and 0.6043).

In the shuffled groups average punishing expenditures incurred by high-grid subjects were significantly higher than punishing expenditures for low-grid- high-groupness and low-grid-high-groupness subjects (Wilcoxon-Mann-Whitney test p -value= 0.0001 and 0.0037 respectively). There was no difference in the punishing behavior for low-group-low-gridness and high-group-low-gridness individuals (Wilcoxon-Mann-Whitney test p -value= 0.5016). This confirms our prediction that high-grid individuals could serve useful purposes within a group charged with collective action (hypothesis 2). See Figure 3.

Result 5: *Cooperation changes with institutions: in regular VCM contributions decline toward the end of rounds while in VCM with punishment subjects sustain cooperation until the end of game. This is explained by the majority that consists of high-grid individuals who act conditional on the institution (hypothesis 3).*

Support: Figure 1 and 2.

Contribution: With punishment opportunity 75 percent of all actions were contributions above 35 tokens compared to 37 percent in no punishment treatment. Also, the percentage of full free riding actions ($c_i = 0$) dropped from 22 percent in no punishment VCM to 3.3 percent in the ECM. Conditional cooperators are the primary cause of this reduction since full free riding actions of high-grid subjects regardless of group score fall from 8.9 percent to 1.3 percent with punishment.

Result 6: *Punishment was targeted toward low contributors and subjects were punished if their contributions fall below the other's average. Yet, efficiencies with and without punishment were no different.* Support: Table 6; Figure 4

Punishment: Simple regression analysis shows negative relationship between punishment points that subjects received from others and negative deviation from other's average contribution. See Table 6, Figure 4. We run ordinary least square (OLS) regression of punishment points on constant, other's average contribution, absolute negative deviation, positive deviation and dummies for rounds and sessions in shuffled treatments, dummies for rounds and matched groups in partner treatments. In both shuffled and partner treatments the coefficient of the absolute negative deviation was highly significant and positive indicating that subjects were punished more the more their contribution fall below the other's average. The coefficient on positive deviation was insignificant and low which confirms absence of systematic antisocial, spiteful or revenge-type punishment. After-treatment response on motives to punish others was to punish those who were selfish, not investing in the group exchange and contributing way less than the average.

Efficiency: We compute the efficiency as a percentage of actual surplus reached during the experiments from the maximum surplus available with no punishment (in our case 400), where surplus is the sum of individual payoffs within the group. As we discussed above, with punishment opportunity contributions increased significantly as well as the payoffs compared to the no punishment VCM. At the same time, recall that punishment is a costly activity that

reduces the payoffs for both the punisher and receiver. Wilcoxon matched-pairs signed-rank test suggests that in both partner conditions with frame and shuffled conditions with and without frame average efficiency was no different between VCM with no punishment and VCM with punishment ($p=0.7353$, $p=0.2029$, $p=0.8590$). Only in the partner condition with no frame we had efficiency drop from no punishment to punishment condition ($p=0.0425$). This was due the fact that punishment was way too high in this treatment due to no framing plus selfish motive to punish others. This suggests that punishment institutions are efficiency improving if the cost of administering monitoring is low and the deadweight losses due to fines are low. In our ECM games efficiency maintains at the VCM level due to multiple fine structure up to the level where subject may lose all earnings.

D. Ultimatum Game Results

Now we report the results of two-person ultimatum game where subjects were paired once as a proposer and as a responder. Some of sessions had stranger and some had partner pairing.

Result 7: *Predictive capability of grid/group variables are verified in regular version of ultimatum games. Namely, group scores were positively correlated with the average offers. Proposer's offers had a single dominant mode at fifty percent. The grid indicator was silent due to low number of rejections.* Support: Table 2 and Figure 5.

Groupness and offers: Examination of initial bivariate correlations reveals a number of interesting and important findings. In Table 2, respondents' group scores and initial offers (Offer) correlated in a strong and statistically significant manner in the direction expected by the theory in all four treatments. This direction and significance hold up for both the indexed and alt indicators of groupness, showing the strength of this finding in the partner conditions. Respondents indexed group scores in the partner conditions were positively correlated with the average amount they offered other subjects in the experiment (.272) and statistically significant at the 0.01 level; the alternative group question was also associated with respondent contributions in a positive (.327) and similarly statistically significant manner.

Gridness and acceptance: Respondent indexed and alt grid scores and acceptance of offers (Acceptance) were also correlated in the expected negative direction, although not statistically significant. One factor in particular may have led to the lack of statistical significance in the result; the first being the relatively generous average initial offers (itself a function of relatively high mean groupness in the population) meant that there were relatively few cases in which the norm of reciprocity called for rejection of an offer, leading to a small sample size.

Partner vs. stranger matching: If the grid and group attributes were more pronounced in the VCM shuffled games, in the ultimatum games correlations between group scores and offers were stronger for those subjects whose groups were not shuffled (.272) compared to those whose groups were shuffled (.223 and no longer significant). Mean offers in partner frame were higher than the mean offers in the shuffled frame condition (Wilcoxon rank-sum test, $p=0.0383$). There was no significant framing effect in the ultimatum treatment.

V. Discussion

This project has been the most comprehensive study in the social sciences examining the relationship between individual-level cultural characteristics (grid and group as measured by survey) and behavior in controlled computer-mediated experiments. Evidence from lab experiments provides a strong and systematic confirmation of a predictable role of grid and group in determining performance across different institutional settings. In particular, high-group individuals contribute more than low-grid individuals in VCM game. Moreover, with punishment opportunity high-grid individuals inclined to social norms and punish others more than low-grid individuals. The shuffled groups VCM allow to capture this heterogeneity in population. Punishment opportunity and availability of high-grid subjects (strong reciprocators) willing to establish norms by incurring monitoring cost lead to higher cooperation in ECM than the VCM. The threat of punishment substantially increases average contributions, yet efficiency in both institutions (with and without punishment) were the same. This was due to monitoring costs to maintain institution and reduction in payoffs related to punishment. Furthermore, there was no evidence of antisocial punishment; punishment was more targeted to low-contributors than high-contributors. As a result, punishing expenditures were lower. Moreover, predictive power of grid/group attributes also verified in the ultimatum game. In particular, group attribute was positively correlated with offers in the regular ultimatum game. With low number of rejections the grid attribute was silent. Overall, the study shows that cultural factors can be used to predict individual and team performance in a an environment of collective action and that this can be demonstrated using the contemporary tools of experimental social science. That being said, this should just be the beginning of the journey.

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Table 1: Summary of Experimental Sessions

	Number of periods	Number of groups in four persons	Date	Session code
Design1 :	NP, P, UG			
(NP *), (P *), (UG *)	10, 10, 2	3	2/5/08	1
	10, 10, 2	4	2/7/08	7
Design2 :				
(NP), (P), (UG)	10, 10, 2	4	2/5/08	2
	10, 10, 2	5	2/6/08	5
Design3 :				
(NP – F *), (P – F *), (UG – F *)	10, 10, 2	4	2/6/08	3
	10, 10, 2	3	2/7/08	6
Design4 :				
(NP – F), (P – F), (UG-F)	10, 10, 2	5	2/6/08	4
	10, 10, 2	5	2/7/08	8

NP-no punishment, P-punishment, *-partner (iterated) condition, F-framing, UG-ultimatum game

Table 2. Shuffle/Framing- Pearson Correlations

		Shuffled Frame						Shuffled No Frame					Shuffle pool		
		Contrib	P Contrib	Punish	Norm	Pnorm	Offer	Accept	Contrib	P Contrib	Punish	Offer	Accept	Contrib	Offer
Grid	Pearson's r	-0.036	-0.102*	0.230**	-0.137**	-0.309**	0.1924	-0.0523	-0.107*	0.093	0.111*	0.0505	0.0556	-0.0743*	0.0987
	Sig. (2-tailed)	0.477	0.041	0	0.006	0	0.2344	0.7487	0.043	0.079	0.036	0.7698	0.7476	0.0407	0.3961
	N	400	400	400	400	400	40	40	360	360	360	36	36	760	76
Group	Pearson's r	0.293**	0.026	-0.172**	0.308**	-0.005	0.5147**	-0.0012	0.207**	0.096	0.048	-0.008	0.196	0.2531*	0.2234
	Sig. (2-tailed)	0	0.584	0.001	0	0.922	0.0007	0.9942	0	0.068	0.369	0.9632	0.252	0	0.0524
	N	400	400	400	400	400	40	40	360	360	360	36	36	760	76
Alt Grid	Pearson's r	-0.019	-0.175**	-0.062	-0.045	-0.421**	0.1589	0.0052	-0.176**	-0.248**	0.027	-0.228	-0.0744	-0.0917*	-0.0531
	Sig. (2-tailed)	0.708	0	0.216	0.365	0	0.3274	0.9746	0.001	0	0.612	0.1811	0.6661	0.0114	0.6489
	N	400	400	400	400	400	40	40	360	360	360	36	36	760	76
Alt Group	Pearson's r	0.032	-0.089	0.004	0.171*	-0.241**	0.2495	0.015	0.198**	0.269**	0.047	0.1425	0.255	0.1002*	0.1803
	Sig. (2-tailed)	0.525	0.075	0.939	0.001	0	0.1205	0.9267	0.001	0	0.374	0.407	0.1334	0.0057	0.119
	N	400	400	400	400	400	40	40	360	360	360	36	36	760	76
		Partner Frame						Partner No Frame					Partner pool		
		Contrib	P Contrib	Punish	Norm	Pnorm	Offer	Accept	Contrib	P Contrib	Punish	Offer	Accept		Offer
Grid	Pearson's r	0.198**	0.008	0.081	0.103	0.0928	-0.0036	0.0377	0.191**	-0.113	0.012	-0.0168	-0.263		-0.0122
	Sig. (2-tailed)	0.001	0.889	0.179	0.085	0.1214	0.9853	0.8488	0.001	0.06	0.839	0.9323	0.1763		0.9288
	N	280	280	280	280	280	28	28	280	280	280	28	28		56
Group	Pearson's r	0.227**	0.1639**	-0.006	0.170**	-0.0113	0.1857	0.125	0.156**	0.1646*	-0.236**	0.3521	-0.1104		0.2715*
	Sig. (2-tailed)	0.0001	0.006	0.925	0.004	0.8503	0.3442	0.5263	0.009	0.006	0	0.0662	0.576		0.043
	N	280	280	280	280	280	28	28	280	280	280	28	28		56
Alt Grid	Pearson's r	0.182**	0.168**	0.074	0.185**	0.2184**	-0.1379	0.5471*	0.253*	0.07	-0.06	-0.1206	-0.1082		-0.1487
	Sig. (2-tailed)	0.0022	0.0048	0.2168	0.002	0.0002	0.4842	0.0026	0	0.247	0.32	0.5411	0.5836		0.2741
	N	280	280	280	280	280	28	28	280	280	280	28	28		56
Alt Group	Pearson's r	0.476**	0.2547**	-0.072	0.1219*	0.2751**	0.1867	0.0804	-0.091	0.0486	-0.0557	0.4481*	-0.1843		0.3274*
	Sig. (2-tailed)	0	0	0.2294	0.042	0	0.3414	0.6844	0.1304	0.4179	0.3534	0.0168	0.3477		0.0138
	N	280	280	280	280	280	28	28	280	280	280	28	28		56

Contrib-contribution in the no punishment VCM, Punish-punishing expenditure, Norm- fair contribution in the no punishment VCM, Pnorm- fair contribution in the punishment VCM (ECM), P Contrib- contribution in the punishment VCM (ECM).

Table 3. VCM without Punishment

period	Partner				Shuffled			
	Frame	sd	No Frame	sd	Frame	sd	No Frame	sd
1	32.07	(18.24)	33.32	(16.49)	28.83	(15.62)	27.56	(17.27)
2	33.36	(17.70)	30.82	(17.60)	25.4	(17.07)	23.89	(18.34)
3	32.79	(19.93)	32.11	(15.92)	24.67	(16.16)	24.47	(17.32)
4	33.11	(19.85)	33.11	(16.98)	22.52	(17.32)	24.11	(16.78)
5	31.25	(21.33)	30.04	(18.30)	22.08	(17.77)	19.08	(18.87)
6	31.54	(21.11)	30.82	(17.53)	19.9	(17.54)	21.03	(17.06)
7	29.79	(22.52)	37	(14.25)	21.02	(17.07)	19.64	(17.56)
8	29.29	(22.96)	28.75	(19.20)	19.63	(17.06)	21.89	(17.79)
9	25.64	(23.11)	23.46	(20.51)	16.88	(17.91)	16.22	(16.63)
10	21.04	(21.74)	22.29	(18.88)	14.6	(18.15)	17.42	(17.53)
mean	29.99		30.17		21.55		21.53	
			partner		shuffled			
Ho:			var1=var2	var1>var2	var1=var2	var1>var2		
p-value*: Frame=No Frame			0.9698	0.495	0.8798	0.52		
p-value*: time1=time5			0.6623	0.548	0.0153	0.73		
p-value*: time1=time10			0.0179	0.763	0.0003	0.841		
p-value*: time5=time10			0.0805	0.694	0.1609	0.633		
				var1=var2	var1>var2			
p-value*: PartnerFrame=ShuffleFrame				0.0009	0.94			
p-value*: PartnerNoFrame=ShuffleNoFrame				0.0015	0.92			

* Wilcoxon Mann Whitney (rank-sum test)

time1 means group average contributions in period 1

sd-standard deviation

Table 4. Mean contributions and punishment in VCM with Punishment (ECM)

Round	Partner				Shuffled			
	Frame		No Frame		Frame		No Frame	
1	45.89	(9.74)	35.36	(14.19)	38.35	(11.75)	33.69	(14.31)
punish	3.04	(3.93)	8.93	(16.80)	6.13	(8.66)	5.97	(8.44)
2	46.71	(9.59)	35.07	(14.76)	38.05	(12.82)	34.17	(15.43)
punish	6.07	(14.80)	12.68	(19.08)	6	(10.87)	5.97	(9.77)
3	45.89	(9.82)	41.07	(11.17)	39.53	(11.66)	36.19	(14.54)
punish	3.93	(9.27)	10	(26.53)	6.5	(12.15)	4.17	(5.92)
4	47.21	(4.83)	36.61	(15.45)	39.53	(12.49)	34.78	(14.89)
punish	5.89	(22.69)	9.46	(15.17)	8.63	(14.50)	6.25	(12.09)
5	47.11	(5.95)	37	(15.49)	40.72	(10.76)	35.5	(16.03)
punish	2.32	(5.69)	12.86	(21.83)	7.63	(11.38)	5.14	(7.70)
6	47.71	(3.51)	35.96	(16.05)	42.38	(10.67)	34.94	(15.96)
punish	2.68	(8.11)	10	(20.00)	4.38	(8.71)	5.56	(10.40)
7	45.21	(12.15)	35.11	(16.17)	42.5	(9.49)	37.89	(14.74)
punish	2.68	(6.16)	12.32	(27.16)	3.25	(4.88)	4.17	(7.97)
8	43.04	(15.31)	36.21	(14.37)	43.58	(6.86)	36.08	(15.76)
punish	5	(11.86)	10.36	(26.77)	3.88	(6.65)	4.31	(7.19)
9	43.39	(13.90)	38.11	(14.14)	43.28	(7.37)	36.75	(15.90)
punish	3.57	(8.37)	10.89	(30.06)	3.25	(6.05)	5.56	(10.27)
10	41.75	(15.55)	39.14	(13.83)	42.17	(11.76)	36.86	(15.36)
punish	4.11	(9.63)	19.46	(36.42)	4	(7.27)	5.83	(17.79)
Mean Contribution	45.39		36.96		41.01		35.69	
Mean Punish	3.93		11.7		5.37		5.29	
Ho:	Contribution							
p-value*: t1=t5	var1=var2	var1>var2	var1=var2	var1>var2	var1=var2	var1>var2	var1=var2	var1>var2
p-value*: t1=t10	1	0.5	0.6533	0.429	0.4722	0.405	0.5951	0.426
p-value*: t10=t5	0.4005	0.633	0.2748	0.327	0.1288	0.3	0.3309	0.364
	0.2716	0.673	0.7483	0.449	0.4485	0.4	0.8595	0.475
	Punish							
p-value*: t1=t5	0.5986	0.582	0.797	0.459	0.4935	0.41	0.6897	0.556
p-value*: t1=t10	0.6964	0.439	0.2217	0.306	0.2367	0.655	0.4229	0.611
p-value*: t10=t5	0.3946	0.367	0.4408	0.378	0.1687	0.68	0.5605	0.58
			contribute		punish			
			var1=var2		var1>var2		var1=var2	
p-value*: PartnerFrame=PartnerNo Frame			0.0002		1		0.0002	
p-value*: ShuffleFrame=ShuffleNoFrame			0.0002		1		0.9397	
p-value*: PartnerFrame=ShuffleFrame			0.0015		0.92		0.0586	
p-value*: PartnerNoFrame=ShuffleNoFrame			0.1306		0.7		0.0002	

* Wilcoxon Mann Whitney (rank-sum test)

time1 means group average contributions in period 1

sd-standard deviation

Contributions and punishment are no different across periods in the punishment condition

Contributions are higher with frame in both partner and shuffled condition

Punishment is higher with No Frame in partner condition, but no different in shuffled condition

Contributions are higher in partner condition with frame rather in shuffled with frame

Punishment is higher in partner conditions

Table 5. Mean contributions and punishment in VCM by treatment

Treatment	Number of groups.		Actual Mean Contributions		Actual Mean Punishment		contribute	efficiency
	Partner	Shuffle	Partner	Shuffle	Partner	Shuffle	p-value**: NPu=Pu	p-value*: NPu=Pu
NPuNF	7	9	30.17 (17.87)	21.53 (17.63)	~	~	0.0011	0.057
PuNF	7	9	36.97 (14.51)	35.69 (15.16)	11.7 (24.55)	5.29 (10.16)		
NPuF	7	10	29.99 (20.92)	21.55 (17.44)	~	~	0.0003	0.2214
PuF	7	10	45.4 (10.82)	41.01 (10.80)	3.93 (11.18)	5.37 (9.62)		
NPu all	14	19	30.08 (19.44)	21.54 (17.52)	~	~	0.0000	0.617
Pu all	14	19	41.18 (13.46)	38.49 (13.31)	7.82 (19.45)	5.33 (9.87)		

	Ho:	var1=var2	var1>var2	var1=var2	var1>var2	
p-value*:	NPuNFPa=NPuNFS	0.0003	0.825	~	~	NPuNFPa=PuNFPa
p-value*:	PuNFPa=PuNFS	0.9578	0.492	0.2232	0.683	0.0425
p-value*:	NPuFPa=NPuFS	0.2413	0.671	~	~	NPuNFS=PuNFS
p-value*:	PuFPa=PuFS	0.0404	0.8	0.5243	0.407	0.859
p-value*:	NPuPa=NPuS	0.0146	0.752	~	~	NPuFPa=PuFPa
p-value*:	PuPa=PuS	0.2155	0.628	0.6356	0.451	0.7353
p-value*:	PuNFPa=PuFPa	0.0476	0.184	0.0636	0.796	NPuFS=PuFS
p-value*:	PuNFS=PuFS	0.0037	0.106	0.5946	0.428	0.2029
p-value*:	NPuNF=NPuF	0.7322	0.535			
p-value*:	PuNF=PuF	0.0014	0.175	0.2795	0.61	

* Wilcoxon-Mann-Whitney rank-sum test, two-tailed and one-tailed

** Wilcoxon matched-pairs signed-ranks test, two-tailed

N-no, Pu-punishmentnet, F-frame, Pa-partner, S-shuffle

Here punishment cost used as measure of punishing behavior

Table 6 Regression: determinants of getting punished

Independent variables	Dependent variable: received punishment points		
	Shuffled	Partner Frame	Partner No Frame
Constant	0.349 (0.43)	-0.7484 (2.27)	-1.88 (1.77)
Other's average contribution	-0.0102 (0.01)	0.01665 (0.04)	0.0483 (0.03)
Absolute negative deviation	0.1111 *** (0.01)	0.09167 *** (0.01)	0.1188 *** (0.02)
Positive deviation	-0.0133 (0.01)	0.02602 (0.04)	0.04839 (0.04)
	N= 760	N= 280	N= 280
	F(15, 744) =34.99***	F(18, 261) =7.47***	F(18, 261) =11.82***
	Adj R-squared=0.40	Adjusted R ² = 0.30	Adjusted R ² = 0.41
	DW=1.99	DW=1.75	DW=1.67

Note: Standard errors are in parenthesis. *-significant at 10-percent,

** -significant at 5-percent, ***-significant at 1-percent level

Regression includes dummies for rounds and sessions in shuffle treatments and dummies for periods and groups in partner treatments

Since punishment level in the shuffled frame and shuffled no frame conditions were no different, we may pool shuffled data for the only punishing behavior purpose

Figure 1. Mean Individual Contributions in VCM (1st ten periods) vs. ECM (last ten periods)

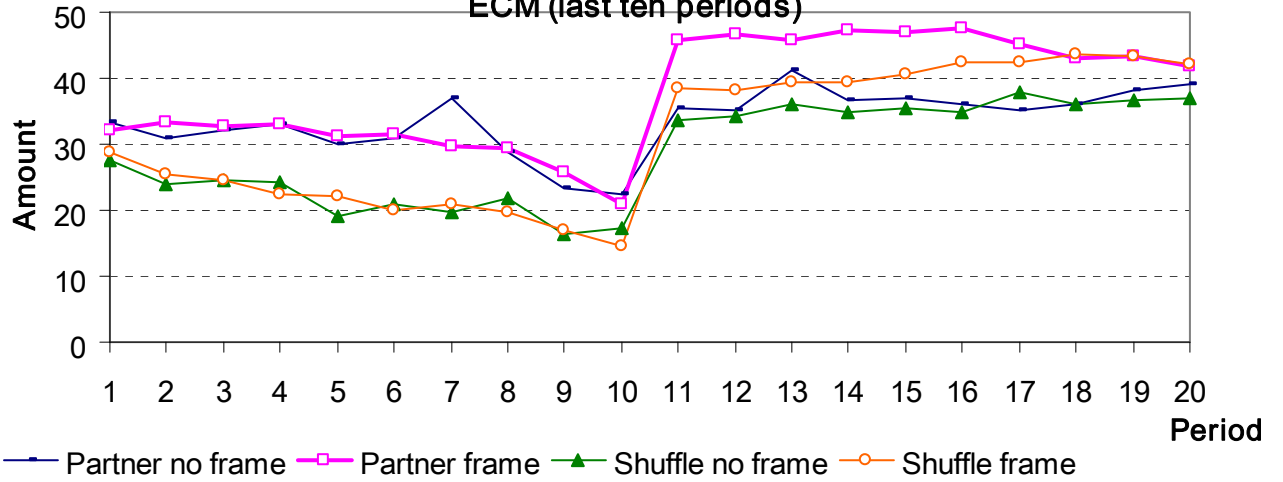
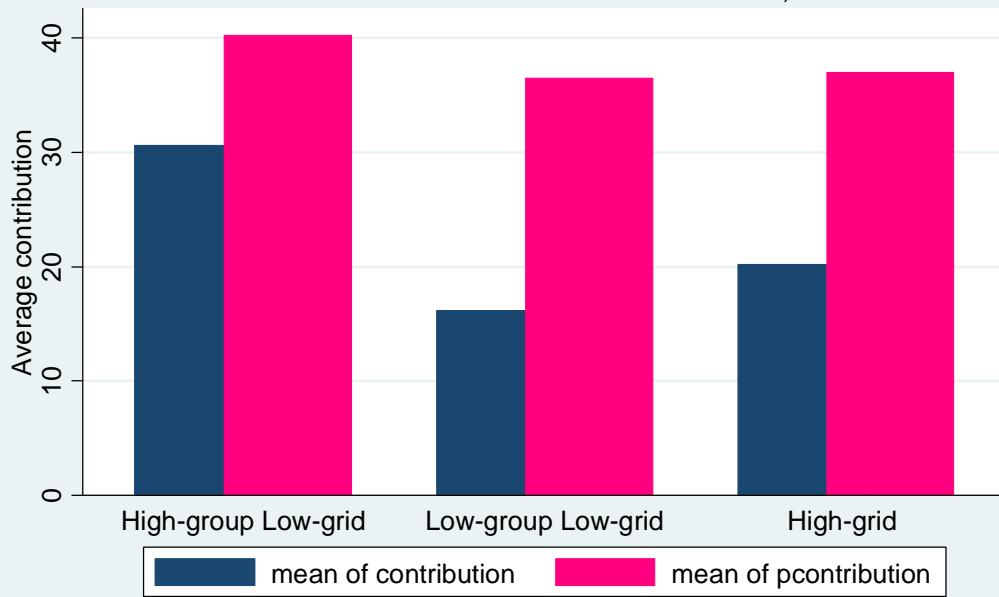


Figure 2. Mean Contributions by Cultural Types
in No Punishment and Punishment treatments, Shuffled



Cut-point for grid=0.37,group=0.47

Figure 3. Mean Punishment Expenditure
Punishment VCM, Shuffled

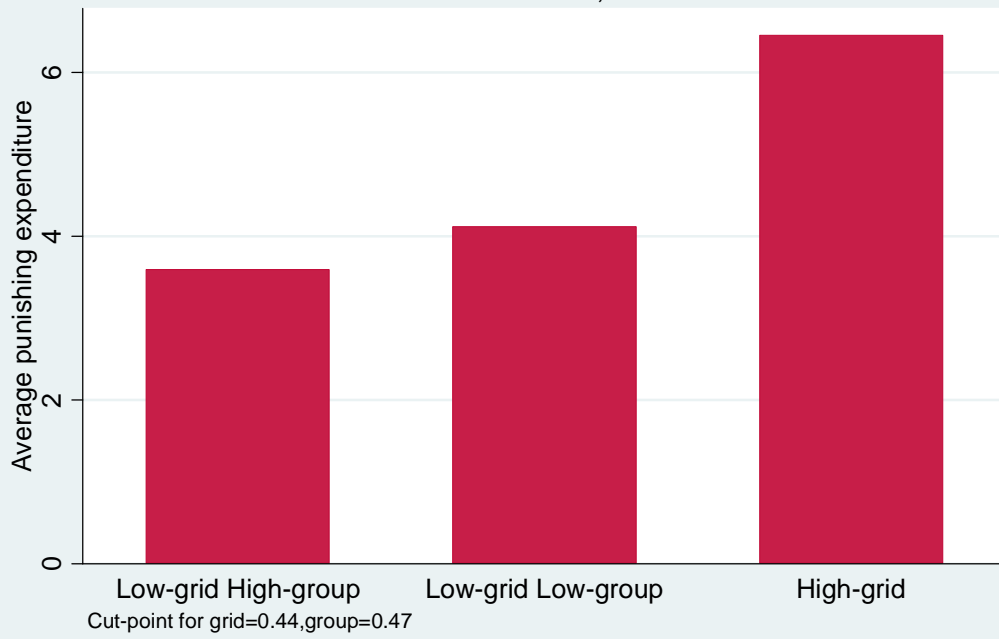


Figure 4. Received Punishment Points

by deviation from the average contribution of the other group members

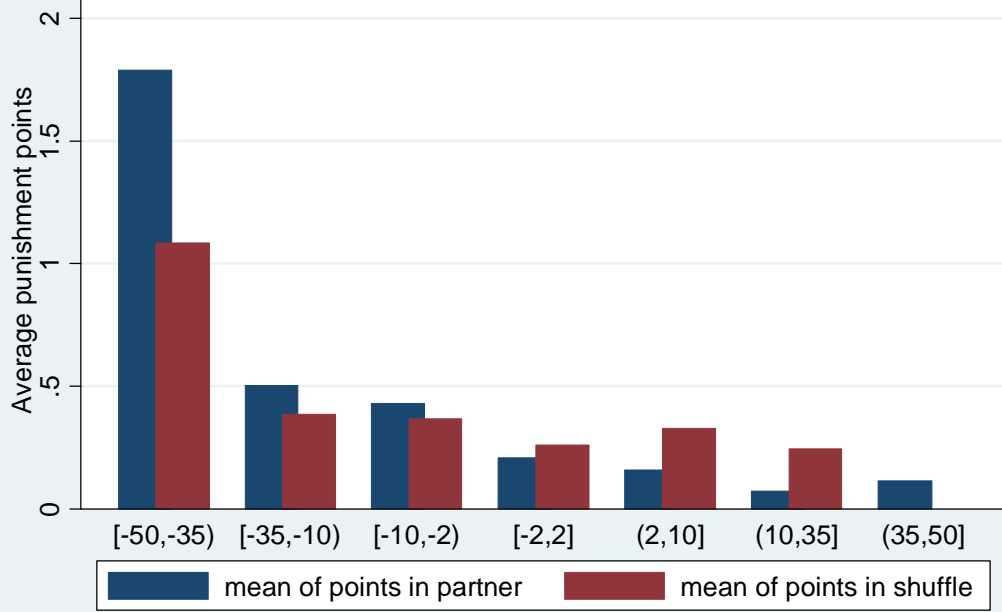


Figure 5a. Ultimatum game offers, \$: Partner no frame

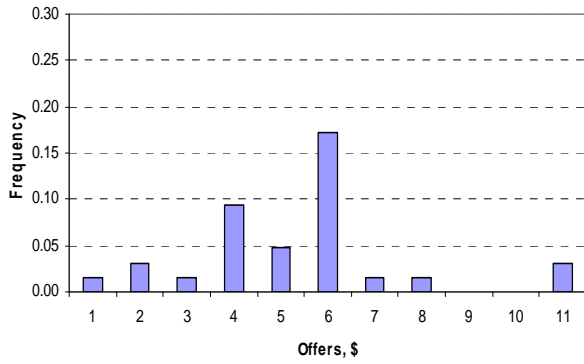


Figure 5b. Ultimatum game offers, \$: Partner frame

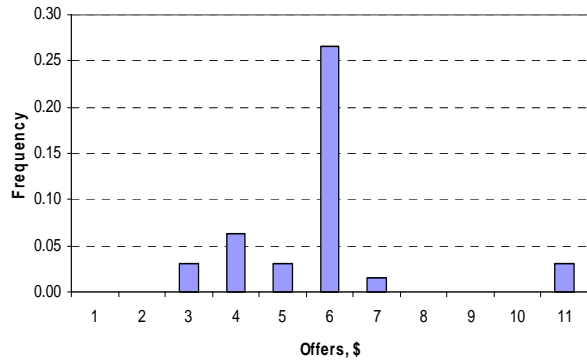


Figure 5c. Ultimatum game offers, \$: Shuffle No Frame

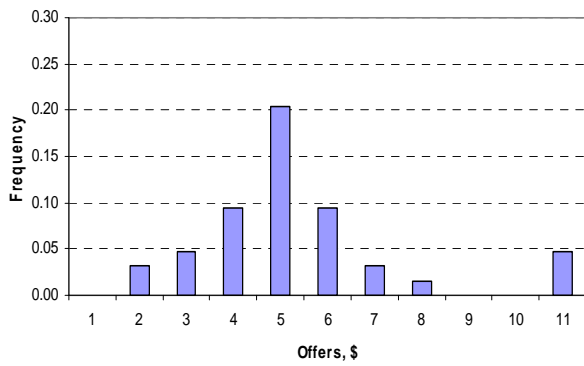


Figure 5d. Ultimatum game offers, \$: Shuffle Frame

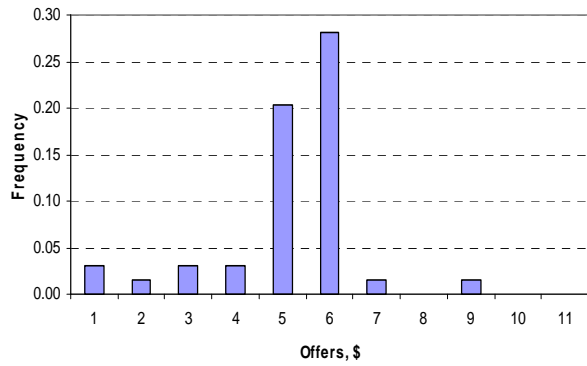


Figure 6. Mean Offer by Cultural Types
Ultimatum game, Partner

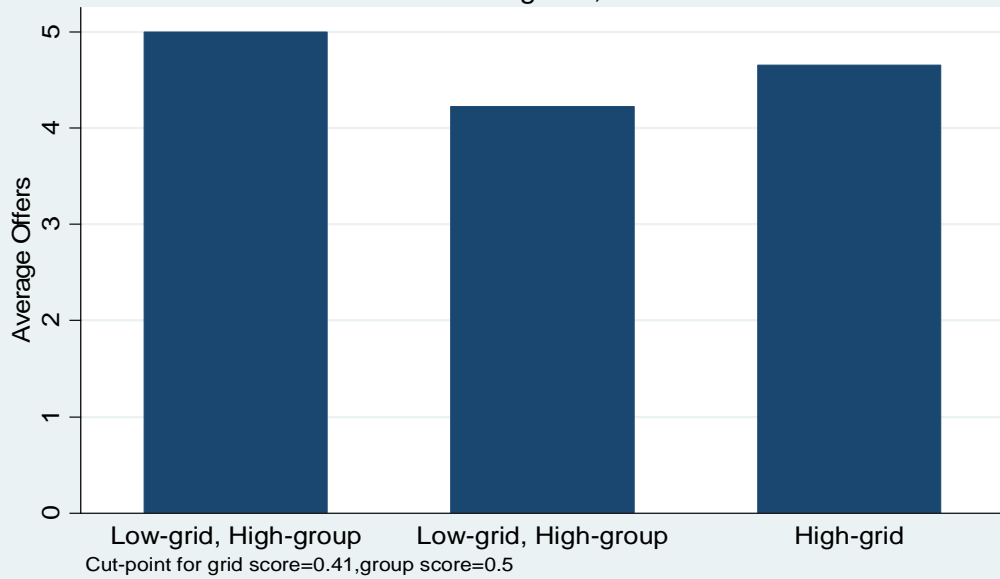
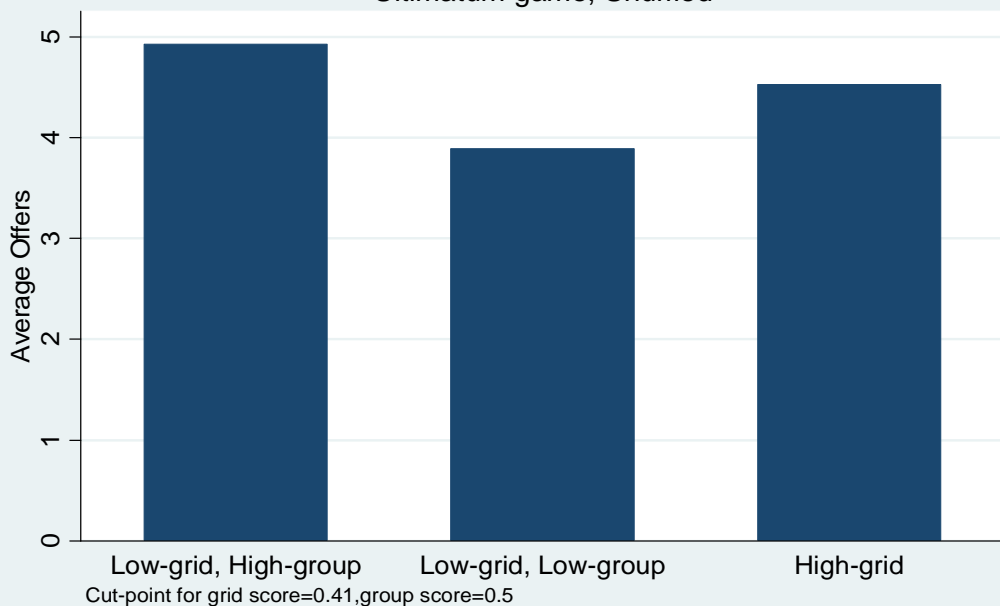


Figure 6. Mean Offer by Cultural Types
Ultimatum game, Shuffled



Above is the pooled data for 132 subjects

Figure 6. Proposals below \$4 received by Cultural Types

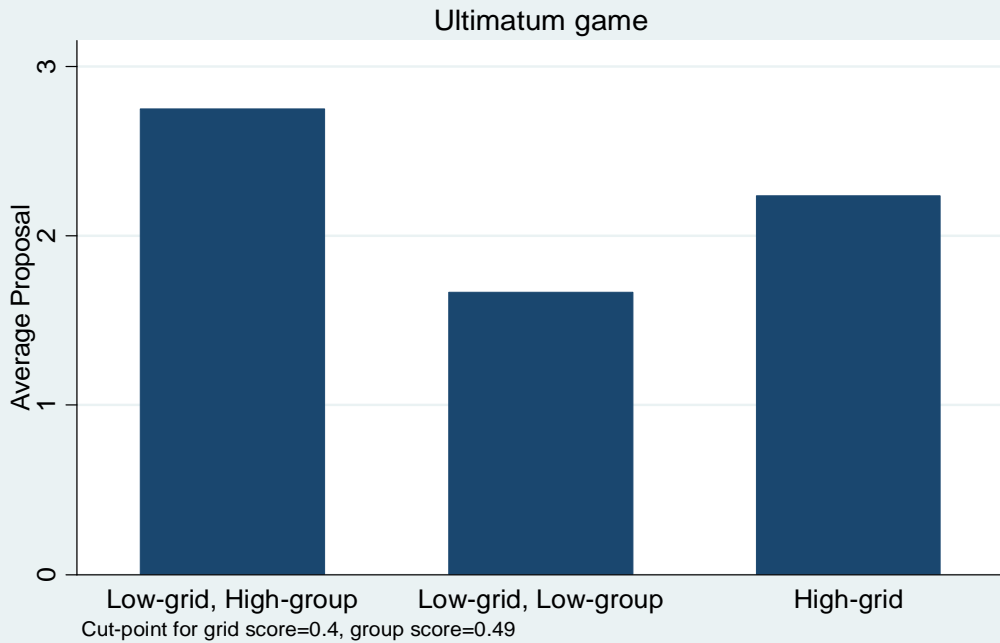


Figure 6. Acceptance of proposals below \$4 by Cultural Types

