Cultural Diversity, Discrimination and Economic Outcomes: an experimental analysis

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Working Paper 2003-002, revised January 2005

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Abstract

Economists have paid increasing attention to the role of cultural diversity in explaining the variability of economic outcomes across societies. We develop an experimental framework that complements existing research in this area. We implement the framework with two cultures that co-exist in an industrialized society: the Hispanic and Navajo cultures in the southwestern United States. We vary the ethnic mix of our experimental sessions in order to infer the effect of inter-cultural interactions on economic behavior and outcomes. We control for demographic differences in our subject pools and elicit beliefs directly in order to differentiate between statistical discrimination and preference-based discrimination. We present clear evidence that Hispanic and Navajo subjects behave differently and that their behavior is affected by the ethnic composition of the experimental session. Our experimental framework has the potential to shed much needed light on economic behavior and outcomes in societies of mixed ethnicity, race and religion.

Keywords: culture, diversity, discrimination, bargaining, economic experiments
JEL classification: C78, C90, Z10

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I. Introduction

Economic disparities have long existed across nations and between racial and ethnic groups within nations. Not surprisingly, economists are beginning to take a closer look at the role of "culture" in explaining global variability in economic behavior and outcomes. One path of inquiry focuses on cross-cultural differences in behavior (e.g., Brandts *et al.*, 2004; Henrich, 2000; Croson and Buchan, 1999; Burlando and Hey, 1997; Roth *et al.* 1991). In particular, an initiative to explore the effect of culture in 15 small-scale societies across the globe has found striking variability in the outcomes of economic experiments (Henrich *et al.*, 2001, 2003).

Others have taken the "cultural effects" inquiry in a different direction: if cultural differences affect economic behavior and outcomes (or indeed even if they do not), do *inter*-cultural relationships affect behavior and outcomes? A controversial empirical literature has developed over the role that cultural diversity may play in explaining cross-national or cross-regional differences in economic outcomes. Some authors (e.g., Easterly and Levine 1997; Alesina *et al.* 2003) find that there is an inverse relationship between economic growth and cultural diversity, while others (e.g., Collier 2001; Fearon 2003) contest this conclusion. In the United States, Alesina *et al.* (1997) find that cultural diversity is an important determinant of local public finances. In particular, they find an inverse relationship between diversity and spending on education, roads and sewers, which they attribute to majority white citizens reacting to the size of minority groups. Miguel (1999) finds similar results in Kenyan primary schools: high levels of ethnic diversity are linked to lower school funding, lower student to teacher ratio, and lower parental involvement in school functions.

One possible mechanism through which cultural diversity can affect economic behavior and

outcomes is discrimination (Barr and Oduro 2002). Economists have performed many empirical analyses to identify discrimination in the marketplace and to determine the nature of the discrimination (for recent reviews, see Yinger 1998; Altonji and Blank 1999; Riach and Rich 2002). To test for discrimination, economists depend on regression-based methods and field experiments. The former technique tests for a statistical relationship between an outcome measure, such as wage or price, and a group membership indicator (e.g., Goldberg 1996). The latter includes audit studies (e.g., Neumark *et al.* 1996) and correspondence tests (e.g., Bertrand and Mullainathan 2004). As noted by List (2004), empirical studies have provided evidence that discrimination exists in various markets, but they rarely allow the analyst to draw conclusions concerning the nature of discrimination (i.e., is it preference-based or statistical?).

Our paper provides an experimental framework that can tie together these disparate literatures and help economists move toward a synthesis of the effects that "culture" has on economic behavior and outcomes. In particular, our analysis complements existing research in three important ways.

First, empirical analyses of the economic effects of cultural diversity at the level of communities and nations suffer from the inability to control many of the factors that affect the observed outcomes and the classic problem of having only one observation of the world at time *t*. By virtue of the experimenter's ability to control and manipulate the cultural diversity within laboratory sessions, our experimental framework provides a path of inquiry that can yield insights into the recent debate about the role of cultural diversity and economic outcomes in societies. In the laboratory, one can reproduce existing cultural diversity patterns or create counterfactual societies. Observations of these laboratory societies offer insights about behavior and outcomes in the

naturally-occurring societies outside the laboratory. We know of no other experiment designed to determine if the cultural diversity of the experimental session affects how subjects make decisions.

Second, as mentioned above, economists have been successful in developing techniques to identify discrimination, but less successful at explaining observed discrimination. If rational agents have no information about the behavior of the person with whom they are interacting, but have information about the *average* behavior of the group to which the person belongs (e.g., an ethnic group), they may condition their decision on this average behavior. Such discrimination is called "statistical discrimination," or "rational stereotyping" (Arrow, 1973; Phelps, 1972). If, in contrast, rational agents simply prefer to behave differently when interacting with an individual from a given group, such behavior is called "preference-based discrimination," or "a taste for discrimination" (Becker, 1971). From a theoretical and policy perspective, the difference between these two types of discrimination is important, but the relative importance of each type empirically is controversial (Ladd, 1998).

Like the recent paper by List (2004), we demonstrate how our experimental framework can provide insights into the economics of discrimination. The paper complements List by demonstrating an alternative method for distinguishing between statistical discrimination and preference-based discrimination *in situ*, without requiring inferences to be drawn from behavior in other experiments.

Third, cross-cultural experiments often emphasize cross-*national* differences in behavior. We wish to determine if cross-cultural differences in economic decision-making can be detected within two cultures that co-exist in the *same* industrialized society. Furthermore, through the control afforded by the laboratory, we ensure that we do not attribute to "culture" any differences in behavior that stem from variability in the socio-demographic attributes of our subjects.

To address these issues, we organized experimental sessions of a simple bargaining game with members of two cultural groups from New Mexico: Navajo Indians and Hispanic Americans. We varied the cultural mix of our experimental sessions in order to infer the effect of inter-cultural interactions on economic behavior. In the next section, we define what we mean by "culture" and describe the way in which our study builds on previous experimental research. In Section III, we describe the design of our experiments. Results are reported in sections IV and V and, in Section VI, we present a simulation based on these results. Concluding remarks are offered in section VII.

II. Culture, Ethnicity and Race

Our experiments were conducted in Albuquerque, New Mexico. New Mexico is arguably the most unique state in the U.S. in terms of ethnic diversity, with three major ethnic groups each accounting for a sizable proportion of the population. In 2001, New Mexico's population was 42.1% Hispanic, 45% Anglo, and 10% Native American, with Blacks and Asians accounting for the remaining 2.9%.[1] New Mexico has a higher Hispanic population, in terms of percentage of total population, than any other state in the U.S. Other states have a higher proportion of Native Americans, but no other state has a mix of Anglos, Hispanics, and Native Americans comparable to New Mexico. Native American and Hispanic cultures are distinct and dominant in the state, and in the City of Albuquerque.

Economists who work with concepts like culture, ethnicity and race often avoid defining such words. Their definitions, however, are subject to much debate in other disciplines (McElreath

[1] Department of Commerce website: Statistical Abstract of the U.S., 2001, Washington, DC, Tables 23 and 24.

et al., 2003).[2] We use the word "culture" to refer to the statistical distribution of beliefs, values and modes of thinking that shape behavior among a group of people (e.g., notions of fairness). "Ethnicity" is related to symbolically marked groups (e.g., marked by language, dialect or clothing). Cultural differences may be present in a population when ethnicity is not marked (e.g., southern-born and northern-born whites in the United States; Nisbett and Cohen, 1996). Similarly, ethnic differences may exist when no cultural differences exist (except for the ethnic marking). "Race" is like ethnicity, except the "markers" are genetically transmitted (e.g., physical characteristics; Gil-White, 2001).

Navajo and Hispanic individuals in our experiments are distinct culturally, ethnically and racially. We are testing whether such distinctions make any difference in the bargaining behavior of our subjects. In our experiment, we cannot differentiate the separate effects of culture, ethnicity and race; empirically, they are identical for our purposes. Thus we will use the term "cultural differences" to describe any differences that result from differences in culture, ethnicity or race. As in previous papers that find relationships between an individual's culture, ethnicity or race and his or her behavior or economic status, we can never be certain that what we describe as cultural determinants are not actually non-cultural determinants (for which we have no data) that are correlated with our cultural categories. In this sense, what economists call "culture" in analyses of economic behavior is best viewed as a residual category. By controlling for differences in behavior that stem from variability in the socio-economic attributes of our subjects, we attribute to "cultural differences" any remaining variability in behavior across cultural groups.

Although experimental economists have explored cross-cultural differences in behaviors (see references in Introduction), they have generally ignored the question, "Do individuals interacting

[2] The authors thank anthropologist Joseph Henrich (Emory University) for directing us to the relevant literature.

with others sharing the same culture behave differently than when interacting with others from a *different* culture?" We find only two published studies that address this question: Fershtman and Gneezy (2001; hereafter FG) and List (2004).[3]

In experiments with two major Israeli ethnic groups, the Ashkenazic Jews (European and American immigrants and their Israeli-born offspring) and the Eastern Jews (Asian and African immigrants and their Israeli-born offspring), FG address the effects of ethnic stereotyping on trust and bargaining. In their bargaining game, FG find larger offers of a fixed pie are proposed to Eastern players.[4] However, they find no significant difference between the percent of Eastern and Ashkenazic players that reject a (low) proposed split of 25% of the pie.

FG write (p. 370) that the observed discrimination "is probably an outcome of a common ethnic stereotype in Israeli society, according to which men of Eastern origin are believed to react more harshly if treated unfairly." Absent information about players' expectations of partner responses, however, FG are unable to determine if the observed discrimination derived from preference-based discrimination or erroneous statistical discrimination ("stereotyping").[5]

List (2004) offers the first experimental attempt to differentiate these two types of discrimination by examining the bargaining behaviors of participants in a sportscard field experiment. He observed starting and final offers for a specific card and collected information on

[3] We note, however, Gil-White's (2003) interesting study of the Ultimatum Game. Similar to FG, it paired members from two cultural groups (two Mongolian tribes). We do not explore this study at length because it used deception.
[4] FG do not make clear whether this discrimination was observed only with Ashkenazic Proposers or both Eastern (n=33) and Ashkenazic (n=24) Proposers.
[5] In the Trust Game, FG attempted to discriminate between stereotyping and a taste for discrimination by changing the rules of the Trust Game to make it a Dictator Game in which the recipient of the offer plays no strategic role. FG found no differences in amounts sent to Eastern and Ashkenazic subjects in the Dictator Game. From this observation, they concluded that there was no evidence of a "taste for discrimination" in the Trust Game. However, using the Dictator Game to infer the source of discrimination in a Trust Game may be problematic if the framing of the games generates different norms or behavioral strategies among subjects. As noted by Goeree and Holt (2001, p. 1418), an alternative approach would be to elicit beliefs directly as the game is played.

basic attributes of the bargainers (age, experience, gender, education, income, height and weight) and the length of the bargaining session. Subjects came from four categories: white males aged 20-30, white females aged 20-30, white males aged 60+, and "nonwhite" males aged 20-30. Given that race was not asked on the questionnaire, it is unclear as to how the author determined race and what race, or races, the term "nonwhite" includes for his sample.

List found that average initial and final offers from dealers to "minority" buyers (females, older males, and nonwhite males) were lower than those received by young white males. After controlling for experience, the differences were small for experienced buyers (but minority buyers did have to spend more time to obtain a similar outcome) and were only significantly different among inexperienced older male and young female buyers.[6] List used complementary experiments (Dictator Game, Decentralized Chamberlain Market, and a Vickery second-price auction for a real card) to elucidate the underlying reasons for the observed discrimination in the field experiment. Behavior in the complementary experiments suggests that the discrimination in the field experiment was a result of statistical discrimination by dealers rather than preference-based discrimination. We develop an alternative method for distinguishing between statistical discrimination and preference-based discrimination that does not require inferences to be drawn from other experiments: we elicit beliefs in the experiment itself.

Note that the ways in which inter-cultural effects are induced in FG and List are different from our experimental framework. FG's inquiry into the existence of inter-cultural discrimination is based on a design wherein players attempt to infer the ethnicity of their partners, who are in a different location, from the partners' surnames. In List, subjects can observe the race, gender or

[6] Similar results are presented for the offers made by dealers to minority sellers, but the differences are not statistically as meaningful.

approximate age of their partner or are told these attributes by the experimenter. While these may be important contexts, we wish to explore behavioral variability in response to changes in the *proportional representation* of two ethnic groups in an experimental session. In other words, we wish to determine if subjects behave differently in the following three contexts: (1) all players share the subject's ethnicity, (2) the player's ethnic group makes up a large majority of the players, and (3) the player's ethnic group is a small minority of the players.

Finally as mentioned in the Introduction, we wish to reduce the chance that we mistakenly attribute to "culture" differences in behavior that stem from variability in the socio-demographic attributes of our subjects. For example, FG analyzed only the behavior of the male Proposers in their bargaining game and did not analyze rejections controlling for the gender (or ethnicity) of the subject making the offer. Other studies, however, have found gender effects in same game (Eckel and Grossman, 2001; Solnick, 2001; Botelho *et al.*, 2002). FG also did not control for socio-economic differences across subjects (e.g., Ashkenazic Jews tend to be wealthier). List, in contrast, controls for gender, length of bargaining session, average frequency of buyer transactions per month, years of market experience, income, and education. Likewise, we control for socio-demographic attributes that may affect bargaining behavior.

III. Experiment Design

Throughout the world, ethnic, racial and religious conflicts persist in the face of potential settlements that plainly serve the interests of all sides. We thus conduct our analysis in the simplest of bargaining environments: the Ultimatum Bargaining Game. Two players, a Proposer and a Responder, bargain over $10. The Proposer offers $*x* to the Responder, leaving himself

$10-*x*. The Responder can either take the offer, in which case each obtains the proposed split of the $10 pie, or reject it and both get nothing. The Ultimatum Game is too simple to be a good model of the complicated processes of most real-world bargaining. Yet, as noted by Camerer (2003: 8), its simplicity offers a useful environment for testing hypotheses about the factors that influence how people feel about the allocations of money between themselves and others. It is thus unsurprising that previous cross-cultural studies and the Fershtman-Gneezy study have used the Ultimatum Game as a vehicle for understanding the ways in which culture affects economic behavior.

The experimental sessions were held in a large room rented at the Menaul School, centrally located in Albuquerque. A portable experimental laboratory was used that consists of 32 networked notebook computers with wireless connection to a laptop computer that acts as a server. Subject computers are situated in folding partitions to ensure private decisions. The instructions for the experiments were conveyed orally and in writing. A portable projector demonstrated the subject interface (see appendix for instructions). Prior to each session, subjects were placed in a room in which some food and refreshments were offered. We grouped subjects prior to entering the experimental room for two reasons: (1) such grouping allowed subjects to observe the ethnic makeup of their session (Navajo and Hispanic subjects are visually very different) and (2) it allowed us to conduct back-to-back sessions without risking cross-session observation or communication.

Sixty Hispanic subjects were recruited by distributing flyers in Hispanic neighborhoods. All of our Hispanic subjects were raised in the United States. Sixty Navajo subjects were recruited primarily by distributing flyers at three Navajo organizations: the Southwest Indian Polytechnic Institute (SIPI), the PHS Indian Hospital, and the Albuquerque Indian Center. "Navajo

neighborhoods" do not exist and these organizations serve as the closest equivalent. Overall, 45% of the subject pool was male, 59% reported an annual income of less than $15,000, 47% of the sample were full- or part-time students, 15% was married and the mean age was 29 years.

We scheduled four experimental sessions. The ethnic composition of each session was as follows:[7]

Session 1 (All-Hispanic)	30 Hispanic subjects
Session 2 (Majority-Hispanic)	21 Hispanics subjects and 6 Navajo subjects
Session 3 (All-Navajo)	29 Navajo subjects and 1 Hispanic subject[8]
Session 4 (Majority-Navajo)	23 Navajo subjects and 7 Hispanic subjects.

Session 1 followed immediately by Session 2 took place on one night, and Session 3 followed immediately by Session 4 took place the next night.

Standard rules of the Ultimatum Game were explained to subjects and subjects were required to complete a practice question to ensure they understood how their earnings would be calculated (see Davis and Holt (1993) or Roth (1995) for more information on Ultimatum Games). Subjects played the role of *both* Responder and Proposer (as was done in the original application of the

[7] Only 117 of 120 observations were usable. Given our concern with offending subjects or the organizations from which we recruited them, we chose to allow subjects to complete the experiment even if they were unable to successfully complete practice questions or were demonstrably unable to comprehend questions. As a result, we exclude data from three subjects: one Navajo subject from the All-Navajo session who could not respond to the practice question (even after repeated explanations by the experimenter), had trouble using the mouse, and rejected every possible offer; and one Navajo subject from the All-Navajo session and one Hispanic subject from the Majority-Hispanic session, both of whom had obvious difficulty completing the practice question and who then clicked reject and accept in alternating fashion for every potential offer that could be sent to them. For these three subjects, the idea of a minimum acceptable offer makes no sense and it is unlikely that these subjects understood the main components of the experiment. We note, however, that including these subjects in the analysis by treating their first accepted offers as their Responder reservation prices does not affect our results. When estimating the percentage of Navajo and Hispanic in a session, we include these subjects because they were observable to every subject in the room (removing them from the percentage calculation does not affect our results).

[8] Native American ethnicity is a requirement for entry into these organizations. Thus, presumably all subjects in the All-Navajo session were Navajo. However, one subject selected "Hispanic" on the post-experiment questionnaire. We are unsure if the subject was indeed Hispanic, was of mixed heritage and did not see the option for mixed ethnicity, or made a mistake filling out the questionnaire, which was completed on a computer. We treat the subject as Hispanic, but note that deleting this subject or re-coding her as "Navajo" does not affect our results.

Ultimatum Game by Güth *et al.* (1982) and in later studies like Andreoni *et al.* (2003), Carter and Irons (1991), and Kahneman *et al.* (1986)). Subjects were told that they would make decisions as a Responder and as a Proposer. At the end of the experiment, the computer randomly assigned each subject to the role of Responder or Proposer, and randomly paired the subject with another subject in the room (not known to him or her) who played the opposite role. Subjects were cautioned to take each role seriously given the equal chance that each person had of being assigned the role of Responder or Proposer. With the exception of the All-Navajo and All-Hispanic sessions, the ethnicity of a subject's partner was uncertain but the ethnic composition of the session was obvious: the subject's ethnic group constituted either a large majority or a small minority of the subjects.

As an aside, we note that our design differs from FG's in that subjects from one culture interact *directly* with subjects from the other culture. The only contact that an Ashkenazic subject in FG's experiment had with an Eastern subject was a visual inspection of the Eastern subject's name on a form.

The amount of money given to the Proposer, known by all subjects, was $10.00. Subjects first saw a screen (Figure 1) that asked them to make the decisions of a Responder. They were asked to indicate, for each dollar amount between $0 and $10, *if* they were assigned the role of Responder and *if* that dollar amount were sent to them, whether they would accept it or reject it; i.e., we used the strategy method. Eliciting the behavior of Responders through the strategy method allowed us to collect data on all information sets of the game, not just those that were actually reached in the course of the game. Subjects were cautioned that, if assigned the role of Responder, they would be bound by the decisions that they recorded on this screen.

[Figure 1 about here]

Subjects were then asked to play the role of a Proposer. To allow us to make inferences about discriminatory behavior that may be observed in the laboratory, subjects were first asked *to predict* how they believed Responders would respond to each possible amount that they might send to a Responder, from $0 to $10 (Figure 2 below). Subjects predicted the *percent* of Responders in the session that would accept each amount. To create incentives for subjects to think about their estimates, subjects were informed that the individual whose estimates were the closest to the actual percent of Responders accepting each amount would win $10.00.[9]

[Figure 2 about here]

Subjects were then asked to decide how much they would send to a Responder *if* they were assigned the role of a Proposer (Figure 3). Subjects were advised that if assigned the role of Proposer, the amount they chose on this screen would be sent to the Responder.

[Figure 3 about here]

Finally, subjects responded to a questionnaire (Figure 4) that inquired about the motivations for the decisions made by the subject as a Responder (Figure 1) and as a Proposer (Figure 3). At the end of the session, demographic information was obtained from each subject. The same person conducted all the sessions.

[Figure 4 about here]

[9] More specifically, they were told that the absolute values of the differences between their predicted percentages and the actual percentages for each potential offer would be summed. The subject with the *lowest sum* wins the $10.00. We do not claim that this method is incentive-compatible (we gratefully acknowledge related comments offered by Uri Gneezy). However, our payment rule is highly transparent and can include truth telling as one best response, while a best response that deviates from true beliefs under this rule requires sophisticated strategizing about the beliefs of others in the session and mathematical acumen to solve for a best-response conditional on those beliefs. Moreover, a recent study by two economists who have published numerous experiments using incentive-compatible quadratic scoring rules (Sonnemans and Offerman, 2001) found no significant difference between the beliefs elicited from a sophisticated quadratic scoring rule that corrects for undesired effects of risk attitudes and probability weighting and beliefs elicited from a method that simply pays subjects a fixed (unconditional) payment: the offer of some compensation for effort was enough to induce subjects to think carefully about their beliefs.

IV. Results – Summary Statistics

A summary of the results from the four experimental sessions is given in Table 1. This summary shows rough trends in the data. In the next section (V), we control for demographic and other subject characteristics in the analysis.

Responders

We begin by examining the behavior of Responders. Hispanic Responders have higher minimum acceptable offers, on average, than Navajo Responders in all sessions (significant at 2%-11% level, depending on the session, under Mann-Whitney and t-tests). In the All-Navajo and All-Hispanic sessions, 60% of both ethnicities were willing to accept an offer of 10% of the pie ($1). These acceptance rates are substantially higher than those observed in previous Ultimatum Game experiments in industrialized nations. Güth *et al.* (2003) report that anything over 33% is much higher than the rates typically observed in Ultimatum Game experiments that use the strategy method (including experiments in which subjects played both roles).[10]

Furthermore, both Hispanics and Navajos appear to discriminate against the other group -- there is an increase in the minimum offer that they would accept as the relative proportion of their ethnic group in the session decreases. This increase is particularly notable for the Hispanics.[11] The

[10] Our anomalous results are not likely to be a result of having players play both roles. Conducting the same experiment at Georgia State University, we find only one-third willing to accept $1 *or* $2 (mean reservation price was $2.77). The mean offer in this session was $4.17. This session of 30 subjects had no culture in a majority or substantial minority: 14 foreign subjects from 10 different nations, 5 Hispanic, 3 African-American, and 8 White. Although we limit our comparisons to other Ultimatum Game experiments that use the strategy method, a recent working paper by Oxoby and McLeish (2004) finds no difference in behavior between Proposer and Responder behavior when strategies are elicited through the strategy method or simply observed sequentially in the game.

[11] Results from a Jonckheere-Terpstra test (with exact p-values) indicate a significant difference in Hispanic Responder behavior across sessions (p=0.0015). No such significant difference is found among Navajo Responders (p=0.2837). The JT test is a nonparametric test for ordered differences (trend) among classes and is preferable in this context to tests of more general class differences (e.g., Kruskal-Wallis H test; Hollander and Wolfe, 1998).

same pattern appears in the percent of subjects willing to accept an offer of one dollar. Both Hispanics and Navajo become more willing to accept the one-dollar offer as the proportion of their ethnic group in the session increases. Again, the behavior on the part of Hispanics is more striking. Thus Navajo are willing to accept low offers at much higher rates than most other subjects in previous Ultimatum Game experiments, whereas Hispanic acceptance rates are only unusually high when playing in an All-Hispanic group.

Table 1
General Summary of Experiment Results

	..... **Responder**.....				.....**Proposer**.....	
	Average reservation price:		% responders accepting $1.00		Average offer:	
Session	Navajo	Hispanic	Navajo	Hispanic	Navajo	Hispanic
All subjects same ethnicity	$1.31	$1.83	62%	60%	$3.83	$4.90
Subject's ethnicity is a majority	$1.78	$2.73	61%	33%	$5.13	$4.77
Subject's ethnicity is a minority	$2.00	$3.38	50%	13%	$4.17[12]	$4.50

Proposers

Offers by both Hispanic and Navajo Proposers are in the range observed in earlier studies regardless of their proportion of the session: between 38% and about 50% of the $10.00 to be divided. When playing with members of one's own ethnic group, however, Navajos make significantly lower offers than Hispanics (significant at 1% level under both a Mann-Whitney and t-test). In addition, Hispanics appear to persistently discriminate against the Navajo -- Hispanic offers appear to decline as their majority status diminishes – while Navajos appear to make higher offers

[12] The mean offer increases from $4.17 to $5 if one influential subject is removed. We will discuss this influential observation (subject #33) in the next section.

when Hispanics are in the session.[13]

Statistical versus Preference-based Discrimination

Any observed changes in Responder behavior as a result of changes in the ethnic mix of the session must necessarily reflect preference-based discrimination. There is no role for statistical discrimination on the part of Responders – they simply must accept or reject a given offer.

As Proposers, however, subjects may make offers that are rational responses to the average behavior of subjects from the two ethnic groups (i.e., statistical discrimination). Navajo Responders are, on average, more likely to accept low offers and thus a rational agent without complete information may choose an offer based on the likely ethnicity of the Responder. To examine this conjecture, data on subject beliefs are presented in Table 2. The table, broken down by the ethnic mix, presents subjects' mean predictions of the percentage of individuals in the session that would accept low offers ($0-$3). For example, Hispanic subjects in the All-Hispanic session believed, on average, that 35% of the subjects in the session would accept $1; when Hispanic subjects were a minority, however, they believed that only 5% of the subjects in the session would accept $1.

An examination of Hispanic beliefs does not support the statistical discrimination conjecture: as the proportion of Navajos in the session increases, Hispanic subjects believe the likelihood of a low offer being accepted *decreases*, yet they send lower offers.[14] The data on Navajo beliefs are roughly consistent with the data in Table 1: there appears to be a decrease in expected acceptance rates when Hispanics are present, which would lead to higher offers, but this decrease in average

[13] Results from a Jonckheere-Terpstra test (with exact p-values) indicate significant differences in Proposer behavior across sessions for both the Navajos (p=0.0237) and Hispanics (p=0.0590).

[14] Results from a Jonckheere-Terpstra test indicate a significant difference in Hispanic beliefs across sessions at the 1% level for offers of $0 - $3, as well as for the sum of predicted acceptance rates from $0 to $3.

expectations is only weakly statistically significant ($p<0.10$).[15] In summary, there is no evidence of statistical discrimination playing a role in the behavior of Hispanic Proposers, and there is weak evidence that such discrimination may play a role in the behavior of Navajo Proposers.

Table 2
Summary of Subject Expectations

Mean Expected Percentage of Subjects Who Would Accept an Offer of $X

	..... **Hispanic**…….....				..... ……**Navajo**….....			
Session	$0	$1	$2	$3	$0	$1	$2	$3
All subjects same ethnicity	20%	35%	40%	53%	13%	32%	43%	52%
Subject's ethnicity is a majority	7%	27%	33%	41%	19%	25%	30%	37%
Subject's ethnicity is a minority	1%	5%	9%	20%	12%	27%	29%	37%

V. Results – Regression Analyses

The summary statistics in the previous section do not, of course, control for demographic variability among subjects or the differences in ethnic proportions across sessions. There was a high degree of variability in our subject pool with, for example, ages ranging from 16 to 50 years old and annual incomes ranging from less than $5,000 to more than $50,000. Such variability affected the demographic composition across sessions. For example, among Hispanic subjects in the All-Hispanic session, the mean age was 32.3 years, 40% of the subjects were male and 40% reported incomes less than $5000 per year. For Hispanic subjects in the Majority-Navajo session, the mean age was 22.1 years, 25% of the subjects were male and 12.5% reported incomes less than $5000 per year. Similar variability existed among Navajos across sessions. Some studies have found that socio-demographic attributes are important determinants of behavior in the Ultimatum Game

[15] Results from a Jonckheere-Terpstra test indicate weakly significant differences in Navajo beliefs across sessions ($0: p=0.1383; $1: p=0.2242; $2: p=0.0480; $3: p=0.0311; sum of predictions $0 to $3: p=0.0917).

(Harbaugh *et al.*, 2002; Botelho *et al.*, 2002; Eckel and Grossman, 2001; Solnick, 2001; Stanley and Tran, 1998; Carter and Irons, 1991; Kahneman *et al.* 1986).[16] To control for their effects, and to allow us to focus on cross-cultural and inter-cultural aspects of behavior, we conduct regression analyses of Proposers' offers and Responders' minimum acceptable offers (reservation prices) against the variables listed in Table 3.

Hispanic ethnicity is the omitted ethnicity variable in the models. Inter-ethnic effects are measured by the variables (2) and (3). The squared interaction term (3.a) between Navajo and percent of subjects in a session from a different ethnic group is included as a result of our finding a non-linear relationship between Navajo Proposer behavior and the ethnic composition of the session.[17] As we will note, however, this non-linearity is largely a result of the behavior of two subjects. Such non-linearity was not observed among Hispanics.

We estimate two models for each role in the Ultimatum Game: Model 1, which includes demographic variables, and Model 2, which includes demographic and behavioral variables (i.e., responses from questions in Figures 2 and 4).[18] Our impression is that some experimental economists question the usefulness of asking subjects what they believe and why they made a particular decision. By presenting two models, we demonstrate that our conclusions are not affected

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[16] Although previous Ultimatum Game studies have not included marital status (probably because most of the subjects were young college students), 15% of our subject pool was married and we hypothesized that married subjects may behave differently in a bargaining situation

[17] We detected this non-linearity using Mallows (1986) augmented component-plus-residuals plot, a sensitive test of non-linearity.

[18] We recognize that the responses to some of the behavioral questions may be ambiguous (e.g., a subject may consider a 50:50 split "fair" as a Responder but a 70:30 split "fair" as a Proposer), but we believe they are reasonable proxies for the behavioral variables that previous studies have suggested are important in the Ultimatum Game (Thaler, 1988; Güth and Tietz, 1990; Güth *et al.*, 1996; Güth and van Damme, 1998). We attempt to control for beliefs directly in the regression and thus assume that the variable Reject captures a subject's *concern* about rejection (e.g., two subjects may both believe a $1 offer has a 50:50 chance of being rejected, but one subject may not be concerned about rejection, while the other subject may be).

by the inclusion of self-reported behavioral variables.

Table 3. Variables Used In Regression Analyses

Variable	Description
Dependent variables:	
RESERV	Responder's reservation price
OFFER	Proposer's offer
Independent variables:	
1. Navajo	Dummy variable = 1 if subject is Navajo
2. PercentOther	Percent of subjects in session from an ethnic group *different* that of the subject's [0, 96.9]
3. NavPercentOther	Interaction between (1) and (2)
3.a $(NavPercentOther)^2$	(3) squared, used only in Offer equation
4. Age	Subject's age
5. Male	Dummy variable = 1 if subject is male
6. Econ	Number of economics courses taken by subject
7. Less$15000	Dummy variable = 1 if subject's income is less than $15,000
8. $15_$45000	Dummy variable = 1 if subject's income is between $15,000 and $45,000
9. NavLess$15000	Interaction term between (1) and (7)
10. Nav$15-$45	Interaction term between (1) and (8)
11. Married	Dummy variable = 1 if subject is married
12. Fair { * }	Dummy variable = 1 if subject ranks concern for fairness (Figure 4) at 4 or 5 as a {*} = {Responder} or {Proposer}
13. Payoff { * }	Dummy variable = 1 if subject ranks concern for earning money at 4 or 5 as a {*} = {Responder} or {Proposer}
14. Reject	Dummy variable = 1 if Proposer ranks concern about Responder's rejection at 4 or 5
15. Known	Dummy variable = 1 if Proposer ranks concern about knowing the Responder at 4 or 5
16. Prob$0-3	The sum of subject's estimates of the percent of subjects who would accept $0, $1, $2, and $3
17. Nonmonotonic	Dummy variable = 1 if Responder had non-monotonic behavior (see text).

In the model of Proposer behavior, variable 16 (Prob$0-3) captures a subject's beliefs about

the likelihood that low offers would be accepted: this variable sums a subject's estimates of acceptance rates [0-100%] for each dollar amount from \$0 through \$3. Finally, about 10% of the sample had what we term "non-monotonic" Responder preferences: after choosing to accept an offer, the subject chose to reject one or more offers that were higher. This pattern, which has also been found in other studies (e.g., Andreoni *et al.* 2003), could be due to error, an aversion to unequal outcomes (regardless of who benefits) or some other unknown reason. We include a dummy variable (17) for these subjects, but note our results do not change by dropping these subjects or pooling them without the dummy variable.

Given evidence of heteroskedasticity, we use the Huber/White/sandwich estimator of variance (White, 1980), which produces robust estimates of the standard errors.[19] In order to address the potential correlation between subject beliefs and the error term, we perform an instrumental variables regression. We instrument for Prob\$0-3 using the sum of absolute values of the differences between a player's estimated percent of subjects that would accept each potential offer and the actual percent of subjects that accepted each offer (i.e., a measure of the overall accuracy of a subject's beliefs). This sum is highly correlated with Prob\$0-3, but uncorrelated with OFFER.[20]

Results from the regressions of Responder behavior (RESERV) and Proposer behavior (OFFER) are presented in Tables 4 and 5. These results will serve as a basis for responses to three questions: are findings of substantial cross-cultural differences in bargaining behavior limited to cultures in small, non-industrialized societies; can changes in the proportional representation of an

[19] We also used Davidson and MacKinnon's (1993) more conservative HC3 estimator without a substantial change in the standard errors. All regressions were run in Stata v.7.

[20] Pearson correlation coefficients are –0.45 ($p<0.0001$) and 0.05 ($p=0.606$), respectively. Running the regressions with the OLS estimator does not change our inferences about the ethnicity variables, but does change the estimate and standard error of the coefficient on Prob\$0-\$3.

ethnic group substantially affect behavior in the Ultimatum Game; and if discrimination is observed, what are the likely causes? We answer these questions by first examining the behavior of Responders, and then focusing on the behavior of Proposers.

Responders

With respect to *cross*-cultural effects, Navajos have significantly lower reservation prices, on average, than Hispanics in both models (Table 4). For example, the ethnicity coefficients in Model 2 suggest that, depending on income, a Navajo subject will accept, on average, between $0.50 and $3.00 *less* than a Hispanic subject ($0.35 - $2.80 less in Model 1).

With respect to our second question concerning *inter*-cultural effects, the behaviors of both Hispanic and Navajo Proposers are significantly affected by the ethnic composition of the session in both models. Both Hispanics and Navajo discriminate against the other ethnic group in the sense that their mean reservation prices increase with an increase in the proportion of subjects from the other ethnic group; this effect is most pronounced with Hispanic subjects. If, for example, the subject pool were 25% Hispanic and 75% Navajo, Model 2 predicts that the average minimum acceptable offer of Hispanics would be about $1.34 more than if the pool were 100% Hispanic ($1.44 more in Model 1).

The coefficient estimates on the ethnicity variables are largely unaffected by including subjects' self-revealed concerns about fairness (Fair) and self-interest (Payoff).[21] The coefficient on "Fair" is positive and significant at the 1% level (on average, subjects very concerned about fairness had higher minimum acceptable offers). This result provides support to previous claims that concerns about fairness are important factors in explaining the behavior of the average

[21] We acknowledge that what a subject considers "fair" may be related to the ethnic mix of the session as well as the

Responder in the Ultimatum Game: a subject who self-reported being concerned about a fair division of the pie demanded almost $1 more, on average, than a subject who was not equally as concerned.

Table 4. Responder's Reservation Price As Dependent Variable

Model 1: F(11,105) = 10.27 (Prob>F=0.000)[22]; R-squared = 0.24; Root MSE = 1.50
Model 2: F(14,102) = 7.48 (Prob>F=0.000); R-squared = 0.32; Root MSE = 1.44

	Model 1		**Model 2**	
Independent Variable	Coefficient (Standard Error)	t-statistic (p-value)	Coefficient (Standard Error)	t-statistic (p-value)
Constant	4.165	5.20	3.39	3.87
	(0.801)	(0.000)	(0.875)	(0.000)
Navajo	-2.793	-4.35	-3.04	-4.17
	(0.642)	(0.000)	(0.730)	(0.000)
PercentOther	0.019	2.88	0.018	2.61
	(0.007)	(0.005)	(0.007)	(0.010)
NavPercentOther	-0.010	-0.77	-0.009	-0.66
	(0.013)	(0.443)	(0.014)	(0.510)
Age	0.011	0.64	0.014	0.82
	(0.017)	(0.527)	(0.017)	(0.415)
Male	-0.446	-1.53	-0.421	-1.48
	(0.292)	(0.130)	(0.283)	(0.141)
Econ	-0.079	-2.31	-0.060	-1.94
	(0.032)	(0.023)	(0.031)	(0.056)
Married	-0.969	-2.52	-0.970	-2.46
	(0.385)	(0.013)	(0.394)	(0.016)
Less$15,000	-2.355	-4.63	-2.057	-3.39
	(0.509)	(0.000)	(0.607)	(0.001)
$15-$45,000	-1.793	-3.94	-1.568	-2.86
	(0.456)	(0.000)	(0.548)	(0.005)
NavLess$15,000	2.445	3.20	2.564	3.08
	(1.027)	(0.002)	(0.831)	(0.003)
Nav$15-$45,000	1.970	2.35	2.092	2.22
	(0.838)	(0.021)	(0.942)	(0.029)
Nonmonotonic			-0.525	-1.30
			(0.403)	(0.196)
Fair {reserv}			0.928	3.25
			(0.403)	(0.002)
Payoff {reserv}			-0.021	-0.06
			(0.316)	(0.948)

subject's personality, but we do not control for this potential endogeneity.
[22] Values of "0.000" imply a value less than 0.001.

Table 5. Proposer's Offer As Dependent Variable

Model 1: F(12,104) = 1.97 (Prob>F=0.034); R-squared = 0.15; Root MSE = 1.56
Model 2: F(18,98) = 2.53 (Prob>F=0.002); R-squared = 0.20; Root MSE = 1.57

	Model 1		**Model 2**	
	Coefficient	t-statistic	Coefficient	t-statistic
Independent Variable	(Standard Error)	(p-value)	(Standard Error)	(p-value)
Constant	6.642	7.27	6.596	5.67
	(0.914)	(0.000)	(1.163)	(0.000)
Navajo	-2.502	-2.17	-2.671	-2.66
	(1.151)	(0.032)	(1.005)	(0.009)
PercentOther	-0.013	-1.98	-0.017	-3.28
	(0.007)	(0.050)	(0.005)	(0.001)
NavPercentOther	0.107	3.18	0.087	2.74
	(0.034)	(0.002)	(0.031)	(0.007)
NavPercentOther^2	-0.001	-2.75	-0.0008	-1.99
	(0.000)	(0.007)	(0.0004)	(0.049)
Age	-0.029	-1.54	-0.019	-1.06
	(0.019)	(0.126)	(0.018)	(0.292)
Male	0.092	0.29	0.548	1.44
	(0.314)	(0.771)	(0.380)	(0.153)
Econ	0.052	1.62	0.039	1.40
	(0.032)	(0.109)	(0.027)	(0.164)
Married	-0.245	-0.55	0.104	0.24
	(0.442)	(0.580)	(0.435)	(0.812)
Less$15,000	-1.060	-2.26	-0.472	-0.70
	(0.470)	(0.026)	(0.675)	(0.486)
$15-$45,000	-0.689	-1.46	-0.427	-0.68
	(0.472)	(0.147)	(0.675)	(0.495)
NavLess$15,000	1.232	1.20	1.318	1.46
	(1.027)	(0.233)	(0.904)	(0.148)
Nav$15-$45,000	1.050	0.90	1.440	1.35
	(1.170)	(0.372)	(1.068)	(0.181)
Nonmonotonic			-0.340	-0.76
			(0.446)	(0.448)
Fair {offer}			-0.350	-1.05
			(0.334)	(0.297)
Payoff {offer}			-0.791	-2.00
			(0.371)	(0.048)
Reject			0.631	1.70
			(0.371)	(0.092)
Known			-0.302	-0.52
			(0.576)	(0.602)
Prob$0-3			-0.006	-2.24
			(0.003)	(0.027)

With regard to the demographic variables, we observe that Hispanic reservation prices are significantly and positively related to income, whereas such a relationship was not observed for the

Navajo (if anything, poorer Navajos demand a little more of the pie). Married subjects, both Hispanic and Navajo, have significantly lower reservation prices than single subjects by almost $1 on average. Evidence of gender effects on a Responder's reservation price is weak, at best, with males requiring about $0.45 less than females on average. A negative, but weakly significant, effect also derives from exposure to economics courses.[23]

Proposers

In terms of *cross*-cultural effects among Proposers, we find a significant difference in the behavior of our two cultural groups in both models (Table 5). On average, Navajos offer less than Hispanics. For example, the ethnicity coefficients in Model 2 suggest that, depending on income levels, a Navajo subject offers, on average, between $1.35 and $2.67 *less* than a Hispanic subject ($1.27 - $2.50 less in Model 1). Thus our observations of Proposer and Responder behavior imply that even among cultures that co-exist in a Western, industrialized society, there may be much greater cross-cultural behavioral variability than previous research suggests.

In terms of our *inter*-cultural question -- does the ethnic mix of the session "matter" -- we find the ethnic composition of the session has significant effects on offers. Hispanics make the highest offers to a Responder *when all subjects are Hispanic*, and persistently lower offers as the percent of Hispanics in the group decreases. For example, a Hispanic subject offers, on average, $1.27 less if Hispanics make up only 25% of the session rather than 100% ($1 less in Model 1).

Turning to Navajo Proposers, the non-linear response to ethnic composition that was

[23] Removing the subject who reported taking 26 courses decreases the coefficient (0.02) and p-value (0.79).

evident in Table 1 is also reflected in our regression results: mean Navajo offers rise and then fall their proportional representation of the session decreases (reflected in the significantly positive sum of "PercentOther" and "NavPercentOther" and the significantly negative sign on "NavPercentOther^2"). However, much of this non-linearity is driven by two influential observations. Using Cook's (1997) distance to identify influential observations, we identified two Navajo subjects who offered $0 as the two most influential observations in Model 2 (#29 in the All-Navajo session; #33 in the Majority-Hispanic session). Removing these observations from the data set removes the observed nonlinearity in the data: the coefficient on NavPercentOther^2 is statistically no different from zero ($p=0.220$). Removing the two influential observations and the squared variable from the regression yields the following coefficients: PercentOther = -0.019 ($p<0.001$) and NavPercentOther = 0.036 ($p=0.001$). This result implies that Hispanic offers decrease linearly in the proportion of Navajo subjects in the session (almost 2 cents for every 1% increase in the proportion of Navajos), while Navajo offers *increase* linearly in the proportion of Hispanic subjects in the session (almost 2 cents for every 1% increase in the proportion of Hispanics).

Predicted Proposer and Responder Behavior

In an effort to make clear the nature of these cross-cultural and inter-cultural effects, an example is given below in Table 6 where we consider two hypothetical subjects: a Navajo and a Hispanic subject, both 25 year-old single females with incomes in the $15,000-$45,000 range (Fair{reserve}= 0, Fair{offer}= 0, Reject = 0, Known = 0, Payoff{reserve} =1, Payoff{offer}= 1). Both subjects have monotonic Responder preferences and have average expectations of low offers being accepted. For various ethnic mixes, Table 6 gives the Responder reservation prices and

Proposer offers that are predicted by the regressions reported in Tables 3 and 4 (Model 2). Because the non-linearity observed in Model 2 for Proposer Offers was driven by two influential observations, we drop these two observations and use a re-estimated Offer model without the squared term "NavPercentOther^2."

Table 6. Comparison of Hypothetical Navajo and Hispanic Subjects with Identical Attributes

	Navajo		**Hispanic**	
Percent of "other" ethnic group in session	**Minimum Acceptable Offer**	**Offer**	**Minimum Acceptable Offer**	**Offer**
0%	$1.19	$3.13	$2.14	$4.33
20%	$1.37	$3.46	$2.50	$3.95
50%	$1.63	$3.96	$3.03	$3.38
80%	$1.89	$4.45	$3.57	$2.81

In the ethnically homogeneous sessions, reservation prices and offers are substantially different between the Navajo and Hispanic "subjects." Most importantly for our purpose, as the percent of Navajo subjects in a session increases, reservation prices increase and offers decrease for the Hispanic subject. For the Navajo subject, increases in the percent of Hispanics in the session also results in increasing reservation prices; her offer, however, also increases as the percent of Hispanic subjects in a session increases.

Statistical versus Preference-based Discrimination

The behavior of Hispanic and Navajo Proposers could be explained as statistical discrimination because Navajos are generally more likely to accept low offers in mixed sessions. The negative and significant coefficient Prob$0-$3 (beliefs that low offers will be accepted) is, in

fact, consistent with statistical discrimination. For example, a Proposer who believes low offers are unlikely to be accepted – only 5% of Responders will accept $0, 10% will accept $1, 20% will accept $2 and 30% will accept $3 - will offer $0.39 less than a person who believes the acceptance rate is double that.

If preference-based discrimination were absent among Hispanics, however, controlling for beliefs in Model 2 should render the coefficient on PercentOther statistically indistinguishable from zero (i.e., once beliefs are accounted for, varying the ethnic mix of the session should not affect the offer level). The coefficient on PercentOther, however, does not move toward zero when we control for beliefs and other behavioral variables in Model 2; in fact, it becomes more negative. This change implies that the observed discrimination against Navajos by Hispanics becomes stronger when beliefs are incorporated into the model. This result is consistent with a Hispanic taste for discrimination against Navajos.[24] Note that although the term "taste for discrimination" has negative connotations, it does not necessarily denote "dislike"; preference-based discrimination could arise, for example, from an agent's belief that a partner with given characteristics does not "need" or "deserve" the money as much as another agent with different characteristics (e.g., some Hispanics may believe that Navajos receive a substantial amount of state and federal funds and thus do not "deserve" a large offer).[25]

Turning to the behavior of Navajo Proposers, the combined sum of PercentOther and NavPercentOther (which reflects the mean response of Navajo Proposers to changes in the

[24] An alternative, but less plausible, explanation is that Hispanic subjects in the sessions with Navajos were less risk-averse than Hispanic subjects in the All-Hispanic session and that our demographic and behavioral variables (e.g., Reject) do not fully control for these differences in risk aversion.

[25] If Hispanics were to behave in the same manner towards an anonymous partner of unknown ethnicity, one might say that Hispanics do not discriminate against Navajos, but rather in favor of Hispanics (Fershtman *et al.*, 2002). Exploring this distinction is beyond the scope of this paper.

proportion of Hispanics) does move closer to zero but is still positive and substantial. This result provides evidence *against* the hypothesis that Navajo discrimination against Navajos is entirely a result of statistical discrimination. Removing the two influential Navajo observations (see above) and the squared interaction term does not change this conclusion (PercentOther = -0.019 ($p<0.001$) and NavPercentOther = 0.036 ($p=0.001$)).[26]

A reader may find strange the conclusion that Navajos discriminate against Hispanics when they are Responders but against Navajos when they are Proposers. Previous Ultimatum Game analyses, however, suggest that the framing of the Responder's decision is different from the framing of the Proposer's decision, and thus the operative decision variables are different. In the former decision, issues associated with justice, fairness and equity are operative, but in the latter decision, strategic concerns and other-regarding preferences are operative. We do not pretend to understand *why* these observed patterns of preference-based discrimination take place, but we note that the results are consistent across alternative model specifications.

Demographic and Behavioral Variables in Proposer Models

With regard to the demographic and behavioral variables, there is no strong evidence that a subject's age, marital status, gender, income or experience with economics has a significant effect on Proposers' offers. Likewise, the fact that a subject had non-monotonic preferences as a Responder, was concerned about potentially knowing the Responder with whom he or she would be paired, or was concerned about a fair division of the pie has no significant effect on the offer.

Subjects who reported being concerned about potential rejection of their offer sent, on

[26] As with the Hispanic Proposer result, an alternative explanation is that Navajo subjects in the sessions with Hispanics were more risk-averse than Navajo subjects in the All-Navajo session and the variables in the regression

average, $0.63 more to the Responder (holding constant their beliefs). Subjects who were concerned with keeping as much money as possible sent, on average, $0.79 less. The signs and statistical significance of the coefficients of the behavioral variables thus provide support to previous claims that strategic concerns are important in explaining the behavior of the average Proposer in the Ultimatum Game, but concerns about fairness are not.

Although subjects responded strategically to their beliefs, their beliefs were, on average, inaccurate; subjects were overly pessimistic about the likelihood of Responders rejecting low offers. To explore the determinants of the accuracy of subject beliefs, we select as the dependent variable the sum of absolute values of the differences between a subject's estimated percent of subjects that would accept each potential offer and the actual percent of subjects that accepted each offer. We regress this measure of accuracy on demographic variables (1-11 & 17). We find some evidence that Hispanic beliefs, on average, become *less* accurate as the percentage of Navajo subjects increases in the session and that Navajo beliefs, on average, become *more* accurate as the percentage of Hispanic subjects increases (PercentOther = 1.46, p= 0.069; NavPercent Other = -2.39, p=0.029). Thus Hispanics are most accurate when surrounded by other Hispanics, and Navajos are least accurate when surrounded by other Navajos. We also observe that subjects who are older or had non-monotonic preferences as Responders were, on average, less accurate in their beliefs ($p<0.05$).

VI. Simulated Societies

Subjects in the experiment described above were only matched once at random. What if these subjects in each session were matched repeatedly, as they would be in a larger society? How

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do not fully capture these differences in risk aversion.

would members of the Navajo and Hispanic cultures fare in such simulated societies? To explore this question, we take the subjects in each session and create thirty thousand random matches (we are implicitly assuming no learning or updating of prior beliefs among our subjects). We are able to randomly re-match subjects because we have each Responder's decision for every dollar offer a Proposer can make in this game.

We present the results from this simulation in Table 7. For each simulated society, we present the average payoff broken down by culture. For example, the average payoff to Navajos in the All-Navajo simulated society was $3.72, while the average Hispanic payoff in the All-Hispanic society was $4.95. We also present the "agreement rate" for the society, which is the percentage of interactions that resulted in positive payoffs for the bargainers.

Table 7
Summary of Simulation Results

	Average Payoff			
Society	All Subjects	Navajo	Hispanic	Agreement Rate
All-Navajo	$3.72	$3.72	-----	74%
All-Hispanic	$4.79	-----	$4.95	96%
Majority-Navajo	$4.69	$4.64	$4.81	94%
Majority-Hispanic	$4.14	$4.07	$4.79	83%

Hispanic bargainers in a culturally homogenous society are better able to extract the available surplus than the Navajo bargainers in a culturally homogenous society. The differences stem largely from the higher agreement rate among Hispanic bargainers – Hispanic Proposers in the All-Hispanic society tend to make higher offers and Responders are willing to accept low offers. As indicated in the last two rows of the table, Navajo bargainers do better in a mixed society with Hispanic members, but Hispanic members do best in a culturally homogenous society. Note that in

the mixed societies, however, Navajo bargainers earn lower payoffs than their Hispanic compatriots.

Do such simulations offer insights into current day behaviors and outcomes? Without further experimentation to expand the sample and include other cultural groups from New Mexico, we cannot say. Our purpose here is to simply illustrate the way in which our experimental framework allows for simulations that can yield additional insights. We do, however, note intriguing anecdotes from the real world that are consistent with the data in Table 7 and imply further study might be warranted. For example, the well-known trend of Hispanic self-segregation is generally thought of as largely an issue of language preferences. Our results suggest that Hispanics may also prefer self-segregation because it yields greater surplus gains in everyday negotiations. Indeed, among Hispanic communities in Chicago, Aaronson (2004) found that Hispanic-owned firms had access to more trade credit when working with Hispanic suppliers.

On the Navajo side, we note two observations from the field. First, Navajo reservations continue to lose members to off-reservation towns and cities in which Navajos find themselves in the minority. Second, establishing businesses on Navajo reservations is notoriously difficult because of intense negotiations that often fail to achieve a mutually agreeable outcome. A Navajo businessman who opened the first national brand restaurant and hotel near a Navajo reservation chose to build them just over the reservation's borders. He is quoted as saying, ""The number of businesses that are formed on Navajo lands is very small compared to other areas. The same project that would take three to four months to complete in Show Low, Ariz., for instance, could take three to four years on Navajo land."[27] The President of the Navajo nation acknowledged such difficulties and stated that the nation was "working on making it a little bit easier for businesses to get established."[28]

[27] http://www.hirediversity.com/news/newsbyid.asp?id=11971
[28] http://www.indiancountry.com/?1061221789

VII. Concluding Remarks

In this study, we depart from traditional empirical investigations to provide a framework to advance our understanding of the way in which culture affects economic outcomes. Our results clearly demonstrate that culture can matter in explaining variability in economic outcomes, and in more ways than previous research has suggested. Hispanic and Navajo subjects not only behave differently in the Ultimatum Game, but they also respond differently to the ethnic composition of the session. Twenty-six years ago, Thomas Schelling (1978: 108) observed that "undoubtedly for some behaviors…it is proportions that influence people, not absolute numbers." Our results provide empirical support for Professor Schelling's observation.

For example, assume that an economist was interested in testing for differences in Navajo and Hispanic bargaining behavior in the Ultimatum Game and set up sessions that were 50% Hispanic and 50% Navajo. The economist would likely find that Navajos, on average, have lower minimum acceptable offers and make higher offers. In contrast, the economist who used sessions of homogenous ethnic groups would find that Hispanic and Navajo subjects have similar minimum acceptable offers but Hispanics make higher offers. The economist who used sessions of various ethnic compositions, but did not control for the ethnic mix, might find no difference between Navajo and Hispanic subjects. In our analysis, were we to remove the variables that control for the ethnic composition of the sessions in our models of Proposer behavior (Table 4), the coefficient on the dummy variable for Navajo subjects would be small and not significantly different from zero, suggesting no cross-cultural differences. If individual behavior can be affected by cultural diversity, as well as by the subject's own culture, economists may need to reconsider the way in which they control for cultural differences in

empirical analyses.[29]

In addition to demonstrating how one can use experiments to explore the effects of cultural diversity on economic outcomes, we also demonstrate how one can use data on behavior, beliefs and motivations to provide insights into the *cause* of the observed behavioral variability that is conditional on the cultural mix of the experimental session. Our data are strongly consistent with the hypothesis that Navajo and Hispanic Responders exhibit preference-based discrimination by demanding less of the pie from members of their own ethnicities. The data are also strongly consistent with the hypothesis that Navajo and Hispanic Proposers exhibit both statistical and preference-based discrimination against Navajo Responders by offering them less.

Our novel experimental approach to studying cross-cultural and inter-cultural effects on economic outcomes should be of general interest to economists. Throughout the world, policies are formulated in societies characterized by mixed ethnicity, race and religion, in which there are clear majority and minority groups. Allocating the costs and benefits of public decisions across citizens (e.g., setting tax policy, providing public goods) is a crucial policy issue. The way in which citizens value the potential policy outcomes, however, may not only be affected by the cultural group to which they belong, but also by the group's relative size in the society. Our experimental approach complements ongoing empirical and theoretical work on this subject by offering more control over confounding effects and clearer insights into causal relationships.

[29] In mixed-race Ultimatum Game sessions, Carpenter, Burks and Verhoogen (2002) find that Black warehouse workers offer more as Proposers than Black students. The authors infer that Black students and Black workers behave differently, but a closer inspection of the racial composition of the sessions shows dramatic differences. In the warehouse session, Black subjects are 25% of the session, while Whites are 25%, Hispanics 9% and the rest are classified as "Non-white" (Asians, Native Americans, Other). In the community college session, Blacks are only 12% of the session, while Whites are 51%, Hispanics 9% and the rest are Non-whites.

As with any research endeavor, this study undoubtedly raises more issues than it settles and suggests questions that parallel those posed in Henrich's (2000: 973) conclusions. From where do people get their social norms and expectations? Why do these norms and expectations seem to vary among groups of people and by the extent of inter-group interactions? Do the effects of diversity observed in our experiment extend to other mixes of cultures, e.g., White, Black, intra-White cultures, North and South, Catholic and Protestant? Our hope is that our experimental design and results will stimulate research designed to address these questions.

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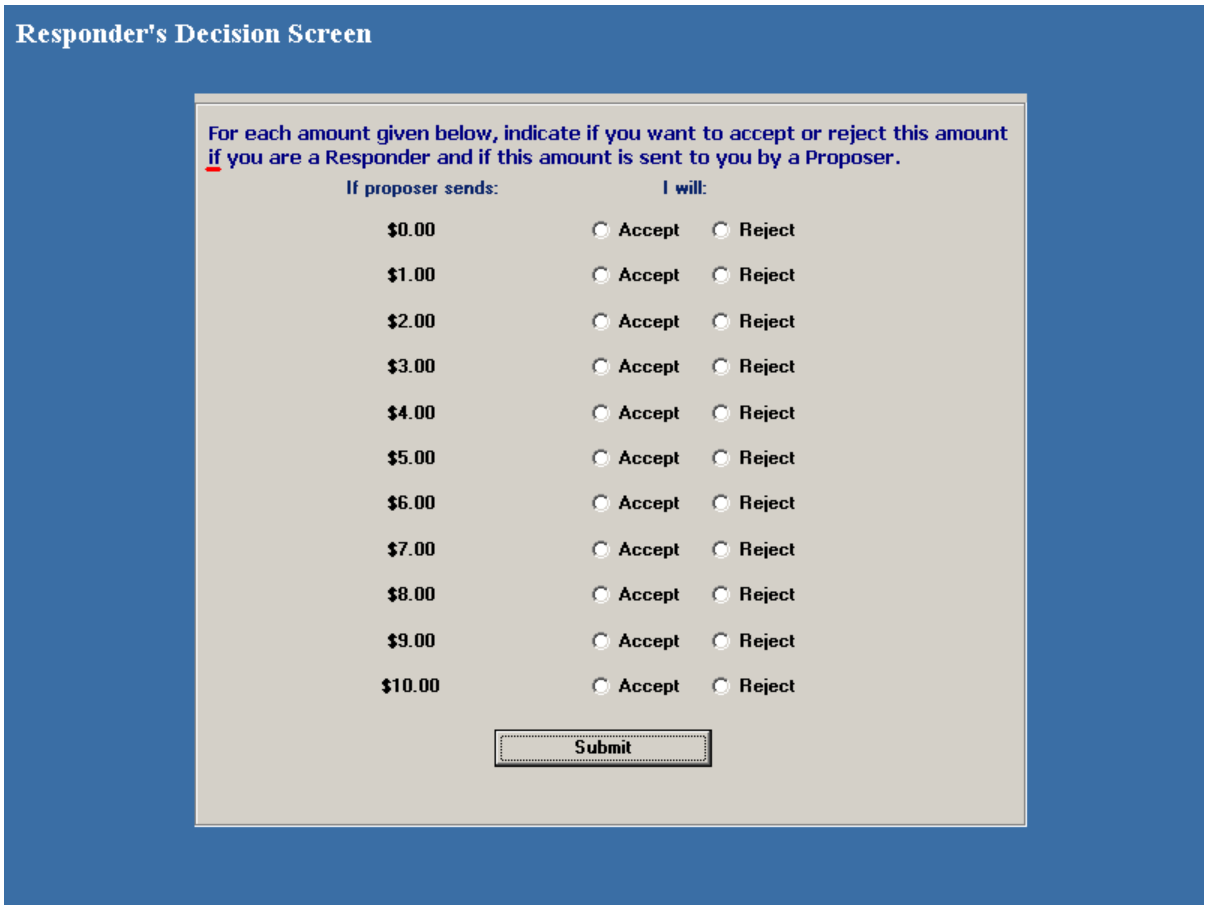

Figure 1 – Responder Screen

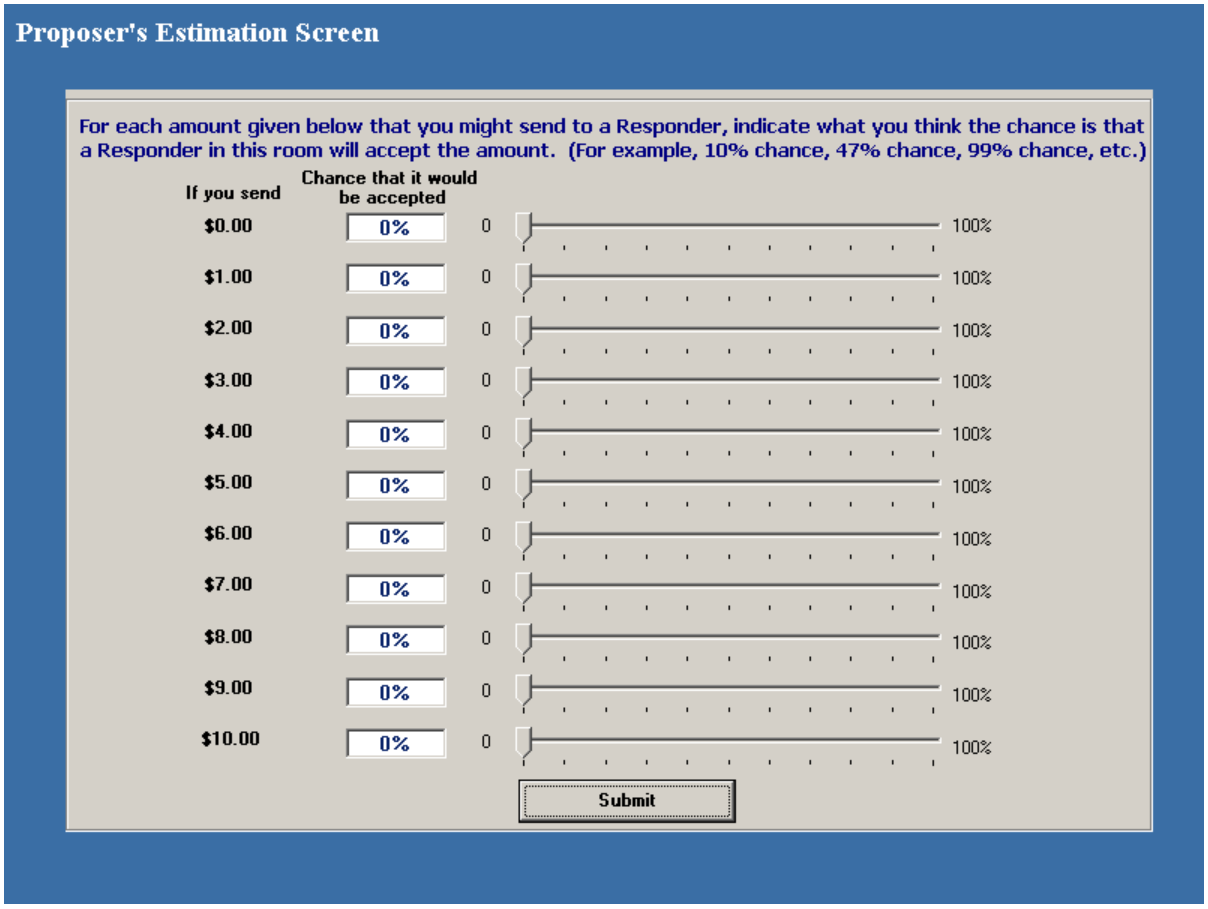

Figure 2 – Proposer's Expectations of the Likelihood of Offer Rejection

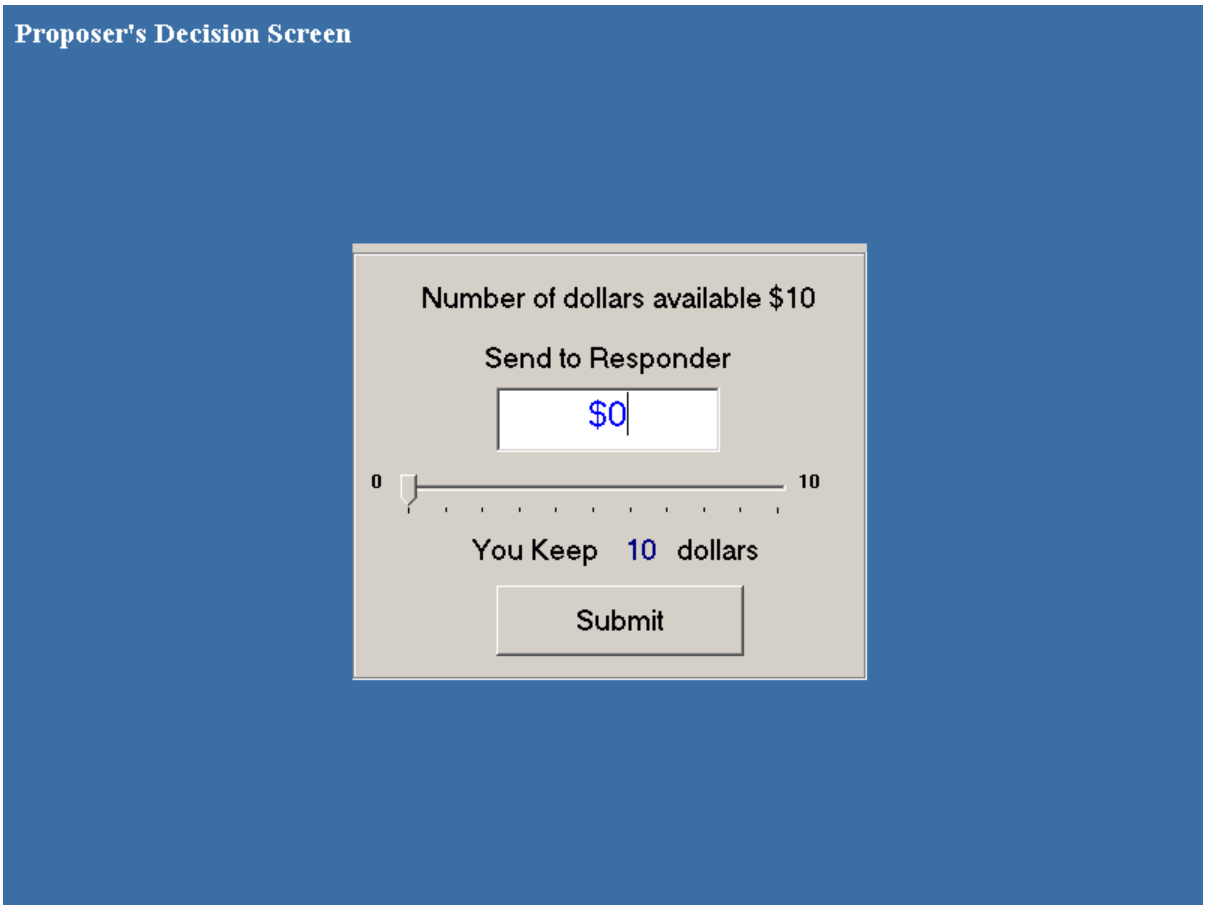

Figure 3 – Proposer's Screen

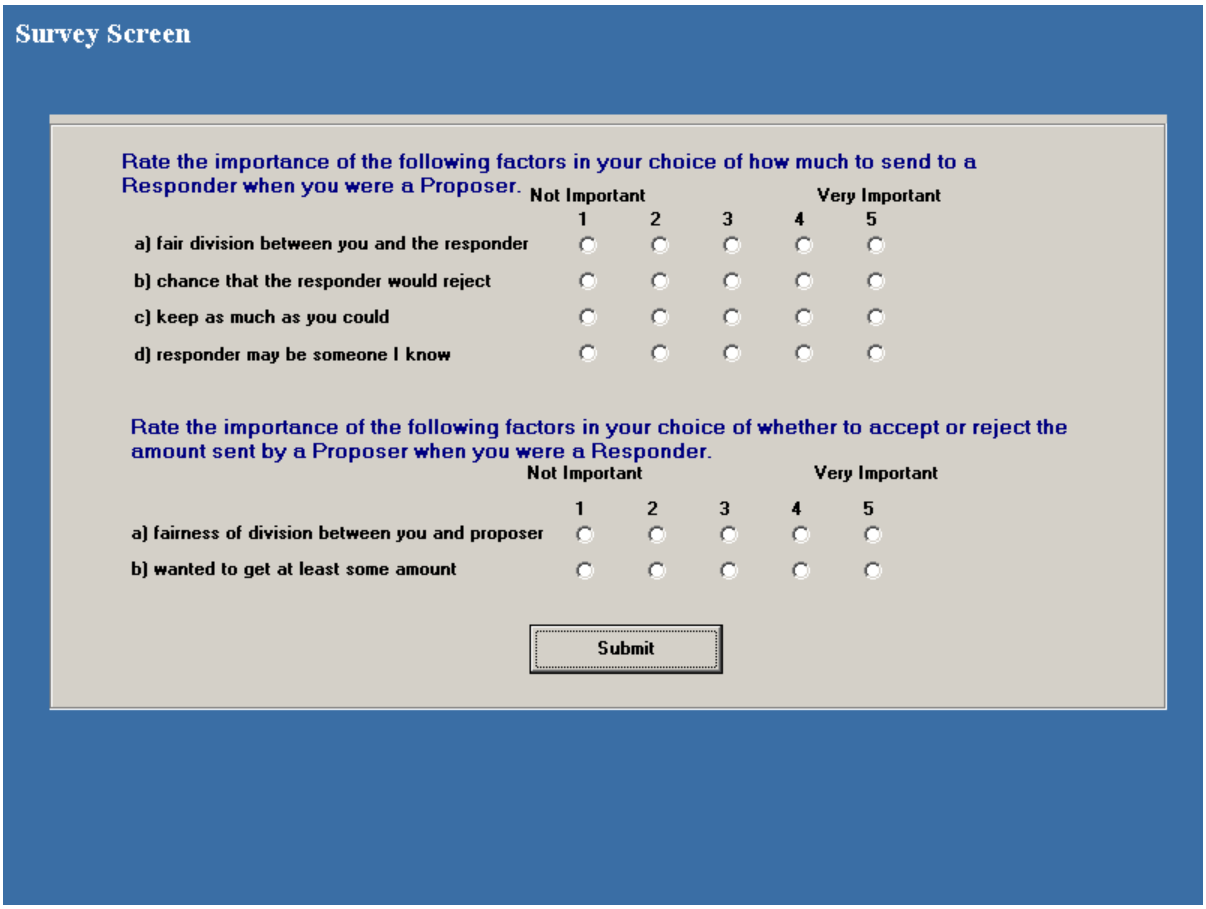

Figure 4 – Post-Experiment Questionnaire of Subject Motivations

Appendix

Instructions to Experiment

This is an experiment about decision-making. You will never be asked to reveal your identity to anyone during the course of the experiment. Your name will never be associated with any of your choices. In order to keep your decisions private, please do not reveal your choices to any other participant.

These instructions will first explain to you the choices that you will be making, and how you will earn money in this experiment. The second part of the instructions will explain how you will enter your choices on the computer. If you have any questions about the procedures at any point during these instructions or during the experiment itself, raise your hand and someone will come to your seat to answer it.

You can write on these instructions if you wish. Feel free to refer back to them at any time during today's experiment.

During the experiment you are not permitted to speak or communicate with the other participants.

In the experiment the currency is U.S. Dollars, which you will be paid at the end of the experiment.

The Task

In this experiment you will be randomly and anonymously paired with another person in the room. No one will know the identity of the other person in his or her pair. Your earnings depend on the decisions you make and on the decisions of the person with whom you are paired. You and the person with whom you are paired will play different roles. One of you will be the "Proposer" and one of you will be the "Responder." Your role (whether you'll be a Proposer or a Responder) will be determined at the very end of today's experiments – in other words, you won't know the results of this experiment until all experiments have been completed. Therefore, it is important that you understand both roles (the Proposer and the Responder) to make good choices.

Let's suppose you are the **Proposer.** You will be given some number of dollars. You may send any amount of these dollars to the Responder. If you send dollars to the Responder and if the Responder **accepts** the number that you send, you will keep the remaining dollars for yourself. If you send dollars to the Responder and if the Responder **rejects** the number you send, both you and the Responder receive ZERO dollars.

Consider an example. You are the **Proposer** and you are given $100.00 (of course, this is a fictitious number used just for the example; sorry, we aren't going to give you $100.00). Your task as the Proposer is to decide on a division of the $100 between the Proposer and the Responder by sending some amount of money to the Responder and keeping the rest. The

Proposer can only send whole dollars: $0, $1, $2, $3, $4, $5, $6, $7, $8, $9, up to $100, but **not** a value like $33.63.

With this $100 available, if you send $3 to the Responder and the Responder **accepts** this number, you would keep $97. If the Responder **rejects** this number, you and the Responder will receive **ZERO** dollars.

If you sent $97 to the Responder and the Responder **accepts** this number, you would keep $3. If the Responder **rejects** this number, you and the Responder will receive **ZERO** dollars.

If you are the **Responder,** your task is to choose whether to accept or reject the dollars sent by the Proposer. If you **accept**, you will receive the number of dollars the Proposer has sent to you. If you **reject** the number of dollars sent to you by the Proposer, both you and the Proposer receive ZERO dollars.

With $100 available, if the Proposer sends you $97 and you accept this number, you receive $97 and the Proposer keeps $3. If you reject this number, both you and the Proposer receive ZERO dollars. If the Proposer sends you $3 and you accept this number, you receive $3 and the Proposer keeps $97. If you reject this number, both you and the Proposer receive ZERO dollars.

Are there any questions concerning your task if you are a Proposer or a Responder?

Before being paired with anyone, each of you in the room today will be asked to make decisions in the role of a Proposer and in the role of a Responder. Your actual role – whether you'll be a Proposer or a Responder – will be determined randomly later in the experiment; therefore, there's a 50-50 chance that you'll be a Proposer or a Responder. You won't know your role – whether you'll be a Proposer or Responder – until after your decisions have been made.

After you have been assigned a role as a Proposer or a Responder, you will then be randomly paired with another person in the room, and your decision for only the role assigned to you will be carried out. The money you earn depends on the decisions made by you and the other person with whom you are paired.

Warm-up Exercises

It is important that everyone understand how to calculate earnings of both the Proposer and the Responder. Below we ask you to calculate the earnings for both of these roles using specific examples. After you finish, raise your hand and one of us will come by your desk and check your answers. For the purpose of this exercise, assume that the Proposer has $25 to divide.

(1) If you are the **Proposer** and you send $8 to the Responder and the Responder **accepts** this number, then you get $_____ and the Responder gets $_____.
(2) If you are the **Proposer** and you send $8 to the Responder and the Responder **rejects** this number, then you get $_____ and the Responder gets $_____.
(3) If you are the **Responder** and the Proposer sends $18 to you and **you accept** this number, then you get $_____ and the Proposer gets $_____.
(4) If you are the **Responder** and the Proposer sends $18 to you and **you reject** this number, then you get $_____ and the Proposer gets $_____.

The Computer Screen

Everyone now look at the picture on the overhead screen here at the front of the room. As you see here, on your computer screen you will see an icon that says DIVIDE. When we are ready to begin this experiment, you will double click on that icon. DO NOT DOUBLE CLICK ON YOUR MACHINE UNTIL WE HAVE FINISHED YOUR INSTRUCTIONS – just watch the overhead at this time.

THE RESPONDER'S DECISION SCREEN. After you double click on the DIVIDE icon, a screen will come up with the title RESPONDER'S DECISION SCREEN. You (all of you) are now being asked to make decisions that will affect how much money you earn in the experiment ***if you are assigned the role of the Responder*** (half of you will be randomly selected to assume this role).

For this experiment, the Proposer will be given $10 to divide between the Proposer and Responder. The screen lists every dollar amount between $0 and $10 that a Proposer could send to you. For each of these dollar amounts, you must decide whether you will **Accept** or **Reject** the amount if it is sent to you by the Proposer. You choose Accept or Reject by clicking the appropriate button (as you can see here on the overhead screen). If you click on the Accept button, you are indicating that **if** you are a Responder and **if** a Proposer sends you this amount of money, you will accept this amount from the Proposer. You will then receive the amount you accepted and the Proposer will receive the difference between $10 and the amount you have accepted.

If you click on the Reject button, you are indicating that **if** you are a Responder and **if** a Proposer sends you this amount of money, you will reject this amount from the Proposer. If you reject the amount sent by the Proposer, both you and the Proposer receive ZERO dollars.

After you have made your decision for all of the amounts of money that the Proposer could send you – you have clicked on either the Accept or Reject button for each amount -- click on the **SUBMIT** button. **DO NOT CLICK THE "SUBMIT" BUTTON UNTIL YOU ARE SURE OF ALL OF YOUR DECISIONS.** Once you click the SUBMIT button you can no longer change your mind. *Remember*: if you are assigned to play the role of Responder, your choices on this screen will determine how much money you earn.

THE PROPOSER'S ESTIMATION SCREEN. After you have completed the Responder's Decision Screen and clicked on the Submit button, a screen will then come up with the title PROPOSER'S ESTIMATION SCREEN. You are now playing the role of a PROPOSER. As a Proposer, you will first estimate how you think Responders in this room will respond to amounts of the $10 that you might send them. You will then make your decision as to the actual amount of this $10 you want to send to the Responder.

The Proposer's Estimation Screen lists every dollar amount that a Proposer could send to the Responder. As a Proposer, you are now being asked to estimate, for each dollar amount, what you think is the chance that this dollar amount would be accepted by a Responder who is in this room. For example, look at $0 that a Proposer could send to a Responder. If you think that

there's a 90% chance of a Responder accepting this amount, you would use your mouse (put the arrow on the slider and hold down on the left-hand click button) to move the slider to the right until it reads 90% (as I am demonstrating up here on the overhead screen). If you think the chance that a Responder would accept this amount is 70%, move the slider until it reads 70%. You must estimate the chance of a Responder accepting each of the numbers given on this screen.

Remember that, on the Responder's Decision Screen, all of you indicated whether you would accept or reject each dollar amount that a Proposer could send you. At the end of the experiment we will compare your estimates for the chance of a Responder accepting each possible amount with the **actual** percentage of people that in fact clicked Accept for each amount. For each dollar amount we will calculate the difference (in percentage points) between your estimate and the actual percentage for that dollar amount, and then add up these differences across all 11 numbers ($0 to $10). The person whose estimates are closest to the actual percentages (i.e., the person with the lowest total difference between estimated and actual percentages) will receive a prize of $10 (in addition to whatever they earn in the experiment).

After you have made your estimations for all of the amounts given on this screen, click on the SUBMIT button. DO NOT CLICK THE "SUBMIT" BUTTON UNTIL YOU ARE SURE OF YOUR DECISION. Once you click on the Submit button, you can no longer change your mind.

PROPOSER'S DECISION SCREEN. After you have completed the Proposer's Estimation Screen and clicked on the Submit button, a screen will then come up with the title PROPOSER'S DECISION SCREEN. On this screen you will see, at the top of the screen, the $10 that is available to the Proposer to be divided between the Proposer and the Responder. Below that you see a box with the title: "Send to Responder." You are now being asked to make a decision that will affect how much money you earn in the experiment **if** you are randomly chosen to play the role of Proposer (half of you will be assigned to this role). You enter the amount you want to send to the Responder using the slide bar. Using your mouse, put the arrow on the slide bar and hold down the left-hand click button. You can then slide the arrow to the amount that you want to send to a Responder. The amount gets larger the more you slide the arrow to the right as I am demonstrating here on the overhead screen. You will see the amount you are sending in the "Send to Responder" box. The number of dollars that you would keep, if the Responder accepts what you have sent, is shown directly below the box: "You keep XX dollars." This number, the number of dollars that you keep, changes automatically when you change the number of dollars that you are considering sending to the Responder. Remember; the number of dollars that you keep is the difference between the $10 and the number you are sending to the Responder. When you are **certain** of the number of dollars that you have entered in the "Send to Responder" box is really the number that you want to send to the Responder, click on the SUBMIT button located at the bottom of your screen. DO NOT CLICK THE "SUBMIT" BUTTON UNTIL YOU ARE SURE OF YOUR DECISION. Once you click this button you can no longer change your mind. *Remember*: if you are assigned to play the role of Proposer, your choice on this screen will determine how much money you earn.

After you click on the Submit button you will see a screen that asks two questions about the decisions you made in your role as a Responder and as a Proposer. You cannot see these questions here on the overhead. You will see them on your screen during the experiment. When you have answered the questions, click on the Submit button. The computer will then randomly assign you to either the role of Proposer or Responder and it will randomly pair you with another person in this room. The decisions you made on the screen for the role assigned to you will be carried out, as will the decisions of the person with whom you are paired. The results, and your earnings from this experiment, will be shown to you after all experiments have been completed.

After you have clicked on the Submit button, you will see a screen that says: "Please wait for others to make their decisions." Please wait quietly until everyone has made their decisions.