CHILDREN'S BARGAINING BEHAVIOR

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7/5/2002

JEL classifications: C70 D10 D63
Keywords: children, culture, fairness, dictator game, ultimatum game.

Abstract: We study the development of bargaining behavior in children age seven through 18, using ultimatum and dictator games. We find bargaining behavior changes substantially with age and that most of this change appears to be related to changes in preferences for fairness, rather than bargaining ability. Younger children make smaller dictator proposals than older children do, and they also make and accept smaller ultimatum proposals. Even young children seem to be quite strategic in their behavior. Boys claim to be more aggressive bargainers than girls do, but they are not. We also find a relative height effect: within each experimental group, shorter girls make much larger dictator offers. Since sex and height are correlated, height alone explains part of the sex effects. We argue that the existence of systematic differences in bargaining behavior across age supports the argument that culture is a determinant of economic behavior, and suggests that people acquire this culture during childhood. We argue that the height differences indicate that forces other than culture, in the usual sense of the word, are also important.

Acknowledgments: We thank the children, teachers and administrators of the Coquille and Myrtle Point, Oregon public school districts for their assistance, without which this research would have been impossible. This research was supported by a grant from the NSF.

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I. Introduction

While Adam Smith believed that the propensity to "truck, barter, and exchange" was a part of human nature, we think it is unlikely that these behaviors are completely determined at birth.[1] Instead it seems probable that they are at least in part learned, and in this paper we report on the results of a study that uses economic experiments to examine the development of bargaining behavior during childhood. There are several reasons to study bargaining in children. In most bargaining situations optimal decisions depend heavily on an understanding of how others will respond. Beliefs about fairness, and about what others believe to be acceptable, are important considerations. Very little work has been done on when or how these beliefs and knowledge are acquired. Second, we know that adults exhibit wide variations in bargaining behavior, both within and across cultures. It seems likely that these variations lead to different outcomes in such matters as wages, job searches, and housing and auto purchases. Studying the development of bargaining behavior will lead to more knowledge about the sources of this heterogeneity in both behavior and in economic outcomes. Third, modern explanations of economic behavior model important family decisions as outcomes of a bargaining process. For many decisions children are an important part of that process, and an understanding of how children bargain will lead to better models of family decisions.

We use the ultimatum game to study bargaining behavior. For this game two children are paired anonymously and each is assigned the role of either proposer or responder. The proposer suggests how to split some money. If the responder accepts, each gets the amount proposed by the proposer. If the responder rejects, neither gets anything. If both players only care about their own payoffs, then the proposer should offer the smallest possible amount, and the responder should accept. On the other hand, there are two reasons to make larger proposals: the proposer might care about the responder's payoff, or she might fear that responder cares about fairness and will reject a small proposal. To distinguish between these two motives we also conducted dictator game experiments. The dictator game is the same as the ultimatum game, except the

[1] Smith (1776/1937)

responder has no ability to reject: he just gets whatever the proposer offers. In combination these two games allow us to separate proposals into a fairness component and a strategic component, where the second component is due to a calculation of the chance that a small proposal will be rejected.

We did both experiments on a total of 310 children aged seven to 18, in second through twelfth grade classrooms. Almost all the children acted strategically, making larger ultimatum than dictator proposals. We found large differences in behavior in both games across age, sex, and height. Young children made considerably smaller dictator and ultimatum proposals than older children and adults, and they were correspondingly more likely to accept small proposals. When acting as proposers in the ultimatum games, the youngest children actually earned more than the older ones. Girls made larger proposals than boys, and shorter girls made larger proposals than tall ones, particularly in the dictator games. Last, we found that children's self-reported propensity to reject "unfair" ultimatum offers was substantially exaggerated, particularly by boys.

We conclude that children are good bargainers by age 7. Like adults they have preferences about their own payoff and the payoffs of others. Their choices show that they understand that the optimal bargaining strategy depends on the situation and on the preferences of those with whom they are bargaining, and that they have a working knowledge of what those preferences are. However, we do not find that these preferences are fixed, homogenous, or unexplainable: they vary substantially across age, sex, and relative height. We believe that these results not only support existing work on the existence of cultural differences in economic behavior, they also suggest two new directions for further research in that area: one into how cultural influences affect behavior, and another into the sources of differences in behavior within a culture.

This paper begins with a brief review of the literature from economics, anthropology, and developmental psychology. This is followed by a description of our protocol. We begin the analysis of our experimental results with a descriptive section comparing proposals in the ultimatum and dictator games. We then trace the development of concerns for fairness by looking at how dictator proposals and ultimatum rejections vary with age and height. Next we look at strategic considerations: how good are children at making optimal ultimatum proposals,

given the probabilities that small offers will be rejected? We then compare actual and stated behavior, and conclude.

II: Literature Review

The economic literature on bargaining is extensive and we restrict our attention to the most relevant articles. Since devised by Guth, Schmittberger and Schwarze (1982), the ultimatum experiment has been done many times. Proposals typically have a mode at 50% of the endowment, average about 40%, and proposals smaller than this are often rejected. This is true even when the sums involved are very large, as in Cameron (1999), who conducts the experiments on Indonesians with amounts equivalent to several months' wages. While these results are very different from the Nash predictions for selfish preferences, they are not necessarily irrational. Rabin (1993), Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) have created models of preferences for fairness that explain this behavior.

There is evidence that ultimatum behavior varies across cultures. Roth, et al. (1991) study students from four different countries. For their first round ultimatum experiments, average proposals range from 36% in Israel to 47% in the United States. Correspondingly, Israelis are more likely to accept a given proposal than Americans. Henrich (2000) compares ultimatum bargaining behavior (over amounts equivalent to several day's wages) between members of the Machiguenga tribe in Peru with that of graduate students in the UCLA anthropology department. He finds that the mean offer among the Machiguenga is only 26% of the endowment, and even lower offers are almost always accepted, while at UCLA the mean offer was 48%, and many people at least claimed that they would reject lower amounts. He argues that this provides evidence for cultural differences in economic behavior, and he attributes the Machiguenga's behavior to their culture, which involves few economic relationships outside of the family. Henrich, et al. (2001) report further results from 15 small-scale societies, and argue that differences in the general level of social interactions within a culture can explain differences in behaviors across societies.

In addition to this evidence that culture matters in bargaining there is some evidence of systematic behavioral differences within a culture. Eckel and Grossman (2001) report that in their experiments female college students make statistically significantly larger ultimatum offers than males. While the proposal differences were small, they also found that females were much

less likely to reject a given offer. Solnick (2000) also looks at ultimatum games and finds no sex differences in ultimatum proposals, but that female students were much less likely to reject proposals. Croson and Buchan (1999) look for differences in behavior in the "trust game" for different sexes in different countries. They find no differences across countries, but in general women return a larger proportion of the money sent them by an anonymous partner than men do. There is also work on sex differences in dictator games. Eckel and Grossman (1998) report that men give 8% of their endowment, women 16%. Andreoni and Vesterlund (2001) do a version of the dictator game with different endowments and costs of giving. They find that men's proposals are more sensitive to price than women's. Ayres and Siegelman (1995) find that even when using identical bargaining strategies car dealers quote higher prices to (American) women and blacks than to white men. This could be a consequence of the dealers reacting to systematic differences in bargaining behaviors among regular customers, but it could also result from discrimination or differences in average reservation prices among these groups.

Several papers report on across subjects comparisons of behavior in ultimatum and dictator games. In their treatments with real payoffs, Forsythe, et al. (1994) find that proposals in the ultimatum games are significantly larger than those in the dictator games: 46% versus 22% of the pie. They conclude that the ultimatum offers are due in part to fear of rejection, and in part to concern for the other person's payoff. Anderson, Rodgers and Rodriguez (2000) do a within subjects comparison of ultimatum and dictator behavior, with university students in the U.S. and Honduras. They find that while in the U.S. people make smaller dictator proposals if they do ultimatum bargaining first, order has no effect with the Honduran participants.

There is one previous study of children and ultimatum games. Murnighan and Saxon (1998) report on a study of bargaining attitudes in children from kindergarten through ninth grade. In face to face interviews they asked individual children, recruited from public school classes, what offers they would make and accept in hypothetical ultimatum bargaining situations involving first money and then candy. In general, subjects seemed much more interested in candy than money, and they often said very different things across the money and candy treatments. They found that the proposals kindergartners gave were quite unstrategic: sometimes they told the experimenter they would give away everything. Third graders said they would make smaller proposals than sixth graders did. Third grade boys seemed the most strategic, and boys in general were more likely to say they would take advantage of others in treatments where

they had better information. For responses, the only significant age difference was that the youngest children said they were more likely to accept very small proposals.

In addition to this economic literature, there is a large literature from developmental psychology that relates, sometimes indirectly, to the development of bargaining behavior. Most of this literature is concerned with how "prosocial" reasoning and behavior develop with age and differ across sexes, and what factors encourage such behavior. Eisenberg and Fabes (1998) provide a comprehensive survey. The word prosocial includes things such as cooperative behavior, distinctions between what is right and what is wrong, compliance with social norms, and absence of criminality. This literature is at least as concerned with how children reason about these issues as about their behavior, and the methodology is often very different from that used in economic experiments. Many studies use surveys or interviews, often asking mothers to describe their children's behavior. Some involve observations in classrooms and playgrounds, and a few involve laboratory simulations of real life situations, using puppets or similar devices. The experiments often involve some sort of deception and generally do not have salient payoffs.

Kohlberg (1976) is perhaps the most widely cited work in this field. Kohlberg used survey data on how children reason about a series of hypothetical moral dilemmas to argue that children pass through a series of stages of moral development. He found that the biggest shift occurs around age 12, when children begin to move away from seeing moral behavior as a matter of obeying rigid rules and towards seeing it as being a matter of fulfilling obligations to others. As with earlier theories that have proposed discreet stages of development, e.g. Piaget (1965), attempts to link these stages of reasoning with actual behavior have met with very mixed success. However, a meta-analysis of 125 studies, Fabes and Eisenberg (1996), does find that prosocial behaviors generally increase with age. Studies in which simulated or actual donating took place found larger age affects than did surveys. Eisenberg (1986) has shown a positive correlation between prosocial reasoning and cognitive ability within ages, and argues that the age trend is in part due to an increasing capacity for the sort of cognitive reasoning that is needed to keep score and figure out what is fair and what is not.

One experiment that is more related to this paper than most of this literature is Keil (1986). Keil showed second and sixth grade children a videotape of another child, telling them that this was live video and that the two of them would be simultaneously sorting letters by zip-code for a nickel per letter. Treatments had the videotaped child performing their part of the task

either quickly or slowly. At the end of each round, the subject and the co-worker (actually, the experimenter) allocated the pair's earnings between themselves, taking turns as to who decided the split. Older children were less vengeful after the "co-worker" had divided the nickels unfairly, and were more likely to reciprocate fair and generous distributions. (In the end, every participant was give the same $2.50 payoff.)

The development of sex differences has also received attention from psychologists. The meta-analysis by Fabes and Eisenberg (1996) documents sex differences in prosocial reasoning, (girls are better) but reports that differences in actual behavior are not so strong. They also show that there is a general increase in sex differences with age, with some research finding that the differences arise during adolescence. They caution that much of this research suffers from using non gender-neutral definitions of pro-social behavior. Girls might report yes when asked if they would give up milk to feed a stray kitten, but boys might say yes if asked if they would rescue it from a tree, particularly if a ladder or a fire-truck was involved.

Last, there is a substantial literature on the effect of physical characteristics on wages. Perhaps the paper with the closest connection to this work is Persico, Postlewaite and Silverman (2001). The authors find that while taller men earn more than short ones, all this correlation can be explained using height at age 16. Height as an adult does not add any additional explanatory power. They attribute this to the fact that taller adolescents report having larger social networks which in turn lead to the development of skills that are valuable in the labor market. This paper provides evidence that early developmental factors have important consequences for adults.

III. Participants and protocol

We modified the usual dictator and ultimatum protocols so as to make them understandable to children. The instructions are in the appendix. We obtained permission from the Coquille and Myrtle Point, Oregon public school districts to run experiments in their schools and then asked individual teachers for permission to conduct the experiments in their classrooms. Coquille and Myrtle Point are logging and farming towns with populations of about 4,000, and our samples range from about 50% to 90% of the local population in each age group. Since school attendance is mandatory, and few children in these towns go to private schools or are home schooled we avoid the usual problems of over-sampling children from richer and more

educated families present in self-selected samples. On the other hand, while our sample is representative of children in these towns, it is not representative of the national population of children. It is also not comparable to the samples of college students on which most experiments are conducted.

We did the experiments on 310 children in second, fourth, fifth, ninth, and twelfth grades. We did not collect individual age data, but the average ages of these groups are 7, 9, 10, 14, and 18 respectively, and variations of more than a year are rare. Since the experiments were conducted in their regular classrooms, children always played against others of the same age. They also knew the other players, though their specific partners were anonymous. Each participant played two ultimatum games, once as proposer and once as responder, and two dictator games, again as both proposer and responder. They were told that multiple games would be played, but not how many of each or of what type. We paid them after each round, and told them they would be matched with a different player each time.

Each game was played with an endowment of ten tokens. The ninth and twelfth graders could exchange tokens for cash at the end of the experiment, at preannounced rates of $0.25 and $0.50 per token. The younger children could use the tokens to buy toys and school supplies from us at the end of the experiment. We told them that each token was worth about $0.25, and that our prices were about the same as in a regular store. These payoffs were sufficient to engage the interest of all the age groups.

We conducted two versions of the experiment, one starting with the dictator game and another with the ultimatum game. Within each version there were two groups of subjects, those whose initial role was as a proposer, and those who started as a responder. Subjects kept the same initial role for both games, so that while everyone played each role in each game, they did so in one of four different treatments, with their roles ordered as follows:

Version A:
Treatment 1: dictator proposer, dictator responder, ultimatum proposer, ultimatum responder.
Treatment 2: dictator responder, dictator proposer, ultimatum responder, ultimatum proposer.
Version B:
Treatment 3: ultimatum proposer, ultimatum responder, dictator proposer, dictator responder.
Treatment 4: ultimatum responder, ultimatum proposer, dictator responder, dictator proposer.

The number of participants by grade and experiment version are shown in the appendix. In the analysis, we pool the fourth and fifth grade classes.

IV. Results

The primary objective of this paper is to examine how bargaining behavior develops with age. We start with summary data by age and by game, and then look at behavior across games within subjects. We show that there are significant differences in proposals across age groups. We then show that even the youngest children make very different proposals in the dictator and the ultimatum games, indicating that they understand the protocol and that they play strategically. We then look at behavior across rounds, first descriptively and then using regressions. We find that proposals change across rounds in different ways for different ages. Last, we look at differences in proposals by sex and by height.

A. Summary results across experiments

Table I shows average proposals and standard deviations in the dictator and ultimatum games, and the proportion of proposals rejected, by grade.[2] There are several interesting results. Even the youngest children make smaller dictator proposals than ultimatum proposals. Dictator proposals increase substantially with age, while ultimatum proposals increase by a smaller amount and most of the increase occurs from second to fourth/fifth grade. Rejection is rare for all ages. The variance of the dictator proposals increases and then decreases with age, while that of ultimatum proposals decreases steadily.

Figure I shows the possible combinations of proposals in the dictator game and in the ultimatum game, with the percentage of children making each combination on the vertical axis. Over all, the modal proposal combination is five tokens in the ultimatum game and 0 in the dictator game. Combinations in the northeast quadrants of these figures are "strategic" in that they involve a larger proposal in the ultimatum game, where there is a possibility of rejection,

[2] Table A.II in the appendix shows the results of Mann-Whitney (MW) and Epps-Singleton (ES) tests of differences in these proposals across grades. Dictator and ultimatum proposals by second graders differ from those of every other age, with either test. Dictator and ultimatum proposals for any age are significantly different at better than the 1% level, with either test.

than in the dictator game. Overall, 78% of the participants make strictly larger ultimatum proposals, while 92% of the second graders do. Only 7% of kids make a dictator proposal that is larger than their ultimatum proposal, and only one of the 74 second graders does this. We conclude that children, even the youngest ones, have a good understanding of the protocols used in these games, and that their behavior shows clear evidence of strategic behavior.

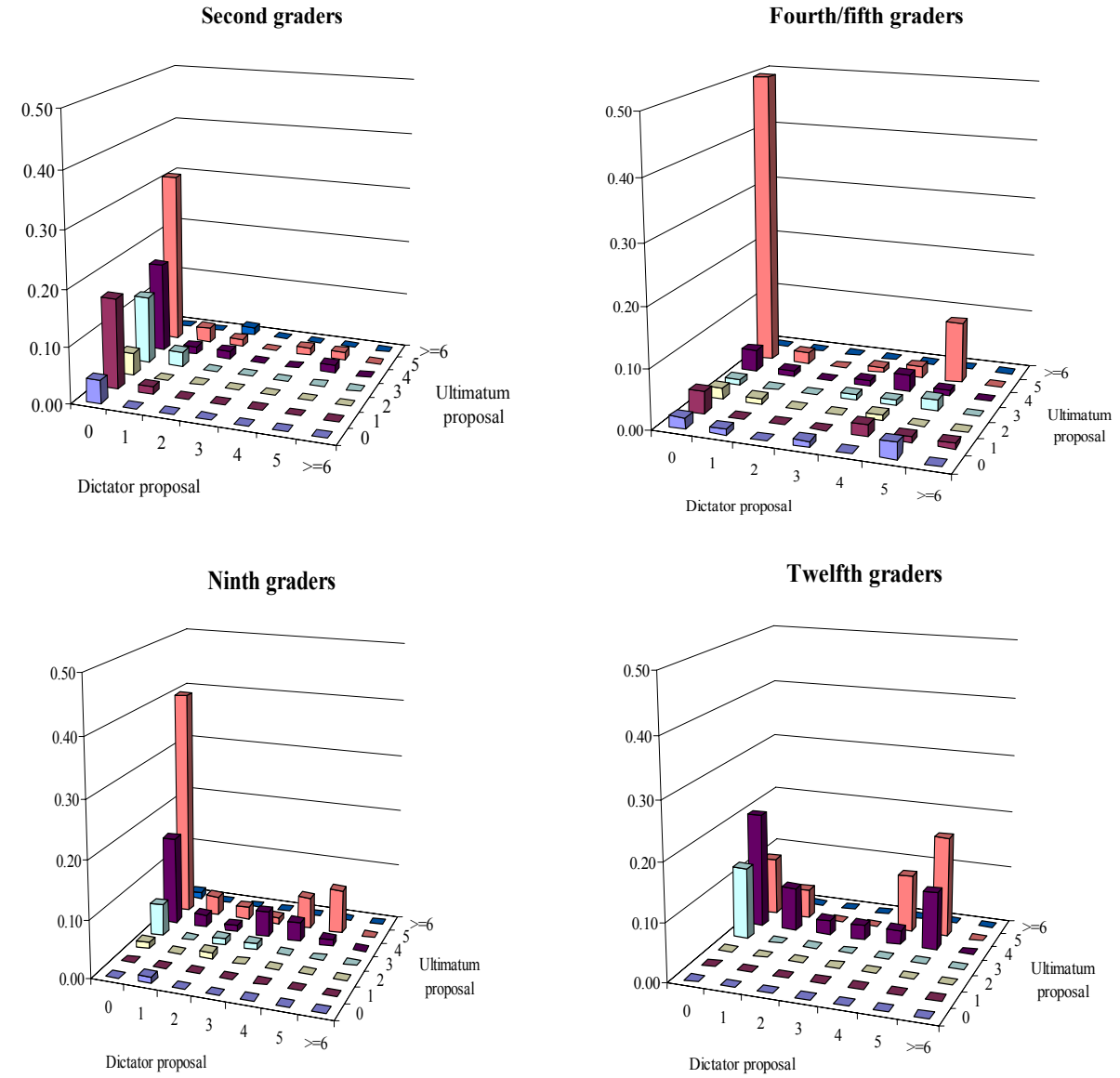
Figure one also reveals some interesting differences across ages. Among second graders, most of the heterogeneity is in ultimatum proposals, while almost everyone gives 0 tokens away in the dictator game. The opposite holds among the twelfth graders - dictator proposals cover the range from 0 to 5, while ultimatum proposals are almost all either four or 5. Only a few second graders offer anything close to an even division in both games, while a substantial proportion of the older participants, particularly twelfth graders, do so. For all grades except twelfth, the modal combination of proposals is 0 in the dictator game and five in the ultimatum.

Table I: Dictator and ultimatum proposals and rejection rates, by grade.

Grade	n	Dictator proposal		Ultimatum proposal		Rejection rate	
2	74	0.35	(1.0)	3.5	(1.7)	0.11	(0.31)
4	106	1.4	(2.1)	4.1	(1.6)	0.14	(0.35)
9	90	1.2	(1.8)	4.5	(0.89)	0.033	(0.18)
12	40	2.1	(1.2)	4.3	(0.69)	0.10	(0.30)
all	310	1.2	(1.2)	4.1	(1.4)	0.10	(0.30)

Note: Means, with standard deviations in parentheses.

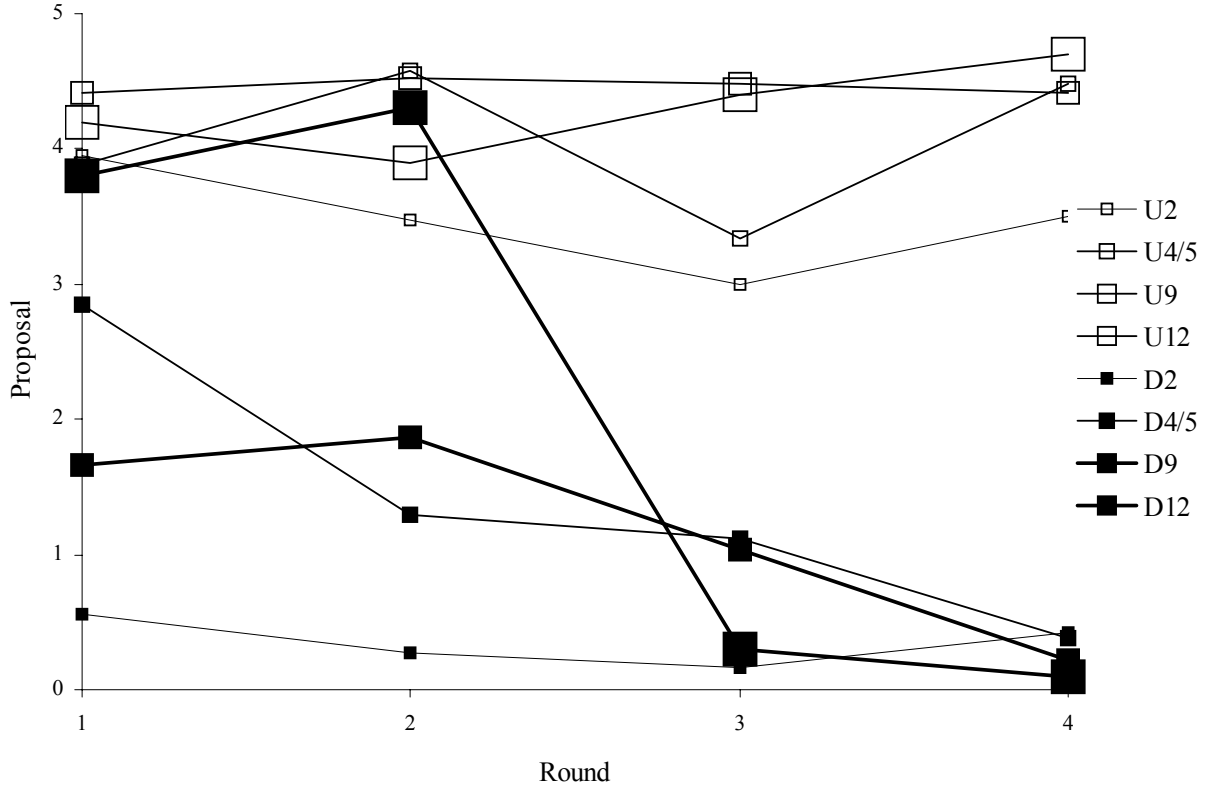
Figure I: Dictator / ultimatum proposal cross tabs, by grade.



B. Proposals by game, age, and order.

Figure II shows average dictator and ultimatum proposals by grade and by round. There are large differences across games, for all age groups. For both games and for most rounds, proposals by second graders are smaller than those of the older children. In the dictator game, things are more complicated, particularly for the older participants. If the dictator game is played first, proposals by twelfth graders are larger than those of any other age group – and as large as twelfth graders' first round ultimatum proposals. If the ultimatum game is played first, the subsequent dictator proposals by twelfth graders are much smaller, as small as those by second graders. Dictator proposals by the fourth and ninth graders show similar patterns, though not to the same extent. It is interesting to compare these results with those from Anderson et al. (2000). For U.S. college students, they find the same patterns we find for twelfth graders, while the Honduran students show no decline in dictator proposals if the ultimatum game is played first. They attribute this difference to a distaste for bargaining in the U.S. students, though obviously there are other differences between the groups. Whatever the cause, it is interesting that we find that the drop gets more severe as people get older. Note also that the drop does not come from older children making small late round dictator proposals: these are almost identical across ages. Rather it comes from the older children making relatively high proposals in the early rounds. This wide variation in dictator proposals across rounds for older children explains part of the standard deviations in Table I. Within a given round, dictator proposals for the older children are very homogenous.

Figure II: Proposals by game, grade, and round.



With our protocol there are two reasons why order might matter. First, behavior in one game may be affected by history. For example, if someone rejects what you feel was a perfectly reasonable ultimatum proposal, you might feel justified in subsequently making a smaller dictator proposal than you otherwise would have, even to a different partner. Second, decisions in one game may be affected by the simple fact that a person played another game first. For example, people may make smaller proposals in later dictator games because playing an ultimatum game first somehow makes them less generous, regardless of their particular experience in that game. (Similar effects might derive from playing the role of proposer before responder.)

We use regressions to examine both these issues, and to control for them in a parsimonious framework which will allow us to examine differences in behavior across age and other demographic variables. To see if individual specific history matters, we ran separate regressions on each decision in each treatment, with independent variables representing outcomes in previous play. Results are shown in the appendix. Out of 14 coefficient estimates only one was significant at the 5% level, not much more than would be expected by chance. Therefore, in the remainder of the analysis we will ignore individual history.

Next we look at differences in proposals and responses across order and demographic variables. Results are shown in Table II. We use OLS for the ultimatum proposals, and Tobit for the dictator regressions to account for the many proposals at zero. We use probit for the binary ultimatum response.[3] For the order effects, the proposal regressions basically mirror what is shown in Figure II. Dictator proposals decrease with order, at a rate that accelerates with age. We omitted the order grade interactions for the ultimatum game proposals, since there is no obvious pattern in Figure I. The age differences also mirror the Figure II results. The older children make significantly larger dictator and ultimatum proposals than the second graders do. These differences are not trivial: in the dictator game the average proposal is 1.2 tokens, and each year of age is associated with an increase in the proposal of about 0.23 tokens. For the ultimatum game the overall average proposal is 4.1 tokens, and each year of age is associated with an increase of about 0.1 tokens.

[3] The results are essentially same if we use ordered probit for the proposals to account for the fact that only integer responses are allowed, or if we just use OLS for all the regressions.

The first regression for every behavior includes an indicator variable for sex. Boys tend to make smaller dictator and ultimatum proposals, though only the dictator difference is statistically significant. Boys are perhaps slightly less likely to reject a given ultimatum proposal, though the coefficient is not significant. These differences in proposals for boys and girls are very similar to the differences cited in Eckel and Grossman [2001] for undergraduate men and women.

Along with sex, the second regression for every behavior includes a measure of relative height. This is the percentage deviation of the participant's height from the mean of all those in the experiment with them. We measured the second graders ourselves at the end of the experiment, while the other heights are from a survey the students filled out before being paid. Relative height has a significant effect on dictator proposals: children who are one standard deviation taller than the mean propose about half a token less than children who are one standard deviation shorter. As a percentage, this effect is very large.

Interestingly, height alone explains more of the variance in both dictator and ultimatum proposals than sex alone does. Adding it to the regression for dictator proposals decreases the sex coefficient and makes it insignificant at even the 10% level. Adding it to the ultimatum proposal regression actually changes the sign of the sex coefficient, though it is insignificant before and after the addition. For all three behaviors, adding relative height to a regression that includes sex improves the fit by more than adding sex to a regression that includes relative height does. We get similar results if we use a measure of height relative to others of the same gender in the experiment, rather than relative to everyone.

All the regression results on sex and height are essentially unchanged if we run the regressions with indicator variables for order and grade instead of the continuous measures. While there are some nonlinearities with age and order, the basic age and order patterns also hold.

Table II: Regressions.

Independent variable:	Dependent variable: Dictator proposal		Ultimatum proposal		Ultimatum rejection	
order	-0.2567	-0.2563	-0.0012	0.0038	-0.0014	-0.0018
	(0.176)	(0.173)	(0.0696)	(0.0695)	(0.0077)	(0.0071)
grade	0.2314***	0.2283***	0.0932***	0.0927***	0.0060**	0.0060**
	(0.0607)	(0.0594)	(0.0226)	(0.0225)	(0.0026)	(0.0025)
order x grade interaction	-0.0529**	-0.0524**				
	(0.0242)	(0.0237)				
boy	-0.4121**	-0.2671	-0.0226	0.0473	-0.0102	-0.0152
	(0.181)	(0.185)	(0.1569)	(0.1636)	(0.0170)	(0.0171)
height		-0.0354**		-0.0181		0.0016
		(0.0143)		(0.0123)		(0.0012)
ultimatum proposal					-0.0441***	-0.0411***
					(0.0135)	(0.0138)
Constant	-0.2752	-0.3405	3.5112***	3.4637***		
	(0.447)	(0.439)	(0.2517)	(0.2533)		

Notes: 310 observations. Marginal effects are shown (cumulative for the Tobit). Standard errors of the marginal effects are in parentheses. * means the underlying coefficient is significantly different from 0 at the 0.10 level, ** at the 0.05 level, *** at the 0.01 level. The dictator proposal regressions are done with Tobit, ultimatum proposals with OLS, and ultimatum rejections with probit.

While the regression results in Table II provide more controls, the age, sex and height story is easier to tell if we just sort the girls and the boys in each class by height, and then evenly divide them into three groups: short, medium, and tall. Figure III shows average dictator proposals for kids grouped by sex and by this measure of relative height, for the younger and older kids respectively.[4] If we look at the last pair of bars in the top panel of this figure, for the younger children, we see that, ignoring height, the proposals by young girls and boys are the same. But if we look across the first three pairs of bars we see that, for girls though not boys, there is a large decrease in proposals as height increases. The shortest girls give nearly four times more than the tall ones. The tall boys give three times as much as the tall girls.

For the older kids, shown in the bottom panel, the gender / height story is very different. The last pair of bars shows that, overall, the older girls give more than twice as much as older boys. The first three pairs of bars show that the height effect in girls has diminished , and that again that proposals by boys are similar across height. So, we find that for young children the heterogeneity in dictator proposals is driven more by height than gender, while in older children it's driven more by gender than by height.

Table A.III in the appendix shows the results of non-parametric tests for differences in dictator proposals according to sex and height. In addition to the ES and MW tests, we also report Fisher's exact test of independence for the proportions of people making zero versus greater than zero proposals. These tests give support for sex differences in proposals. For differences across the relative height groups the support is mixed: the ES test cannot reject the hypothesis that the distributions are the same, while the MW test and Fisher's test show a robust difference. The tests generally support the existence of differences by height in proposals by girls, though Fisher's test is significant only at the 10% level. For boys, the support is weak: the ES test does not support a difference, and the MW and Fisher's tests only support it at the 10% level. None of the tests can reject the hypothesis that the short boy/tall girl groups have the same contributions.

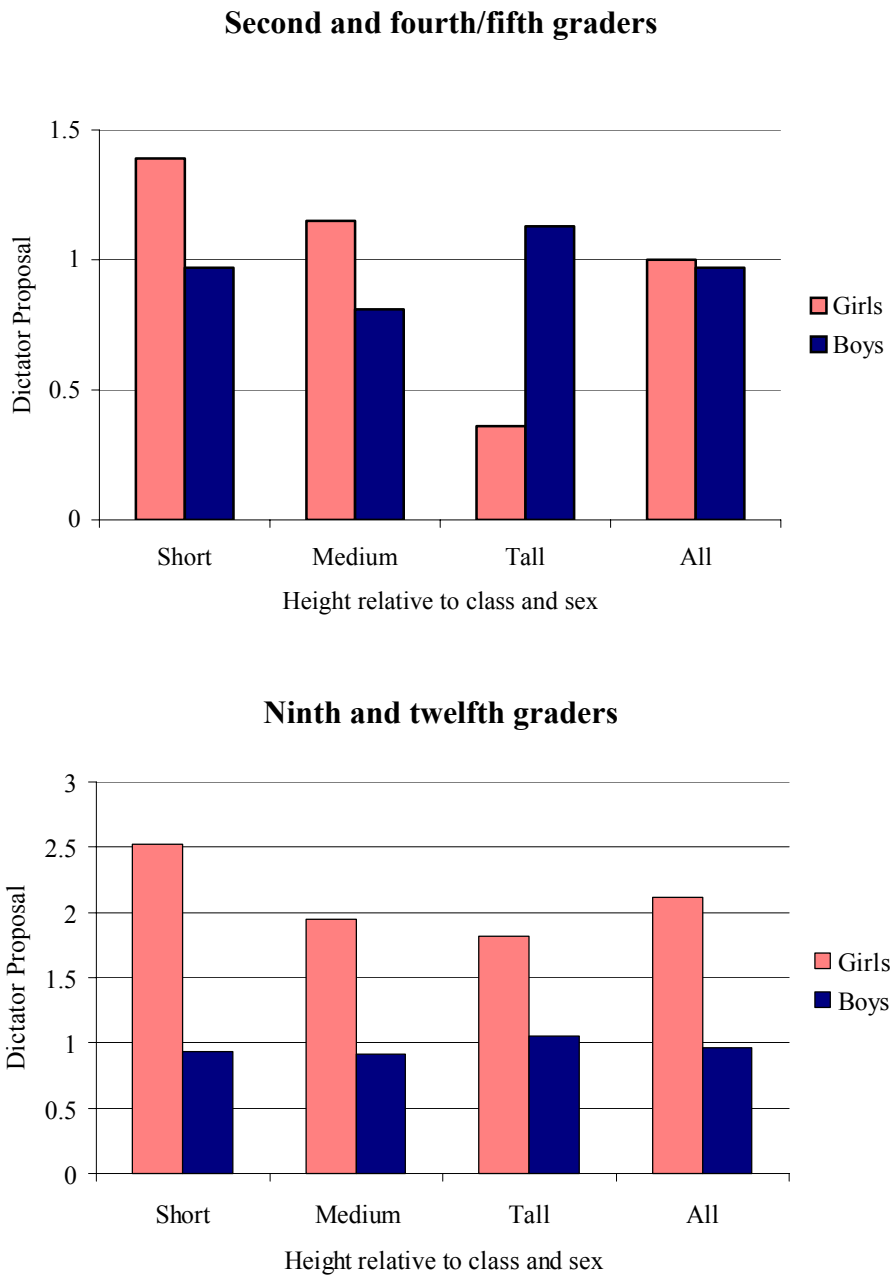
Statistical significance also holds if we test the hypothesis that height and the interactions discussed above matter, using regressions. Likelihood ratio tests show that saturated models with height and interactions of age and gender, age and height, and gender and height fit the dictator

[4] We also tried computing relative height by class only, rather than class and sex. The patterns are stronger, but this gives very unequal cell sizes, particularly for the older students.

proposal and the ultimatum response data better than the regressions in Table II without height. The p-values are 0.037 and 0.047 respectively. Individual coefficients in these regressions are generally insignificant, however.

When we include relative height, it is hard to generalize about sex and fairness in the dictator game. If we compare across sex while holding height constant, the sex difference actually switches sign in the tall kids, with tall boys giving more than tall girls. Across sex and height, short girls give the most, but tall girls give the least. For the ultimatum proposals, we don't find any substantial sex differences. There is a modest and barely significant height effect, as the Table II regressions indicate, but it's not monotonic in the boys. Interestingly, it seems to be relative rather than absolute height that matters. The twelfth graders are more than half again as tall as the second graders, but when playing against other twelfth graders, they actually make larger dictator and ultimatum proposals.

Figure III: Average dictator proposals by age, sex and size.



Rejections and optimal ultimatum proposals

The analysis of rejections is only based on few observations, since just 30 of the 310 proposals are rejected. Despite this, the relationship between the proposal amount and the probability of rejection is statistically significant in the regressions shown in the last two columns of Table II. Order does not appear to have any effect on the decision to reject a proposal. Older children are more likely to reject. A one token increase in the proposal decreases the probability of rejection by about 4%, and this effect is significant at the 1% level.

If we run probit regressions on rejections for each of the four grades, with the proposal as the independent variable, and then use the estimated probit function to predict rejection rates for different proposal amounts, rounding off to halves, we find that proposals of 2.0, 3.5, 3.5, and 4.0 maximize the predicted returns for grades 2, 4/5, 9, and 12 respectively.[5] These results are shown in Table IV. For every grade, average proposals are higher than the estimated optimal proposals. Risk aversion, altruism, and upward bias in children's estimation of the rejection probabilities are all possible explanations for this. The differences, both in terms of the deviation from the optimal proposal, and in terms of the loss in the expected return, are largest for the second graders, the age group least likely to be able to figure this out.

[5] We get similar results, in levels and changes across grades, if we estimate this using a linear probability model, or if we pool the data across grades and add a variable for the grade to the regression.

Table IV: Average returns by ultimatum proposal and grade.

	Grade			
Proposal	Second	Fourth / fifth	Ninth	Twelfth
0.0	1.85	1.99	0.08	0.00
1.0	5.28	3.61	0.83	0.00
1.5	6.65	4.40	1.86	0.00
2.0	**7.28**	5.07	3.28	0.14
2.5	7.28	5.53	4.69	0.88
3.0	6.95	5.77	5.65	2.79
3.5	6.49 *	**5.78**	**5.99**	4.87
4.0	6.00	5.62 *	5.85	**5.67**
4.5	5.50	5.31	5.47 *	5.47 *
5.0	5.00	4.91	4.99	5.00
6.0	4.00	3.99	4.00	4.00
Average proposal	3.5	4.1	4.5	4.3
Rejections / Obs.	8 / 74	15 / 106	3 / 90	4 / 40
Pseudo R-sq.	0.542	0.456	0.404	0.444

Notes: Rejection probabilities are estimated using probit, separately for each grade.
Bold face indicates the maximum return.
* indicates the average proposal for that grade.

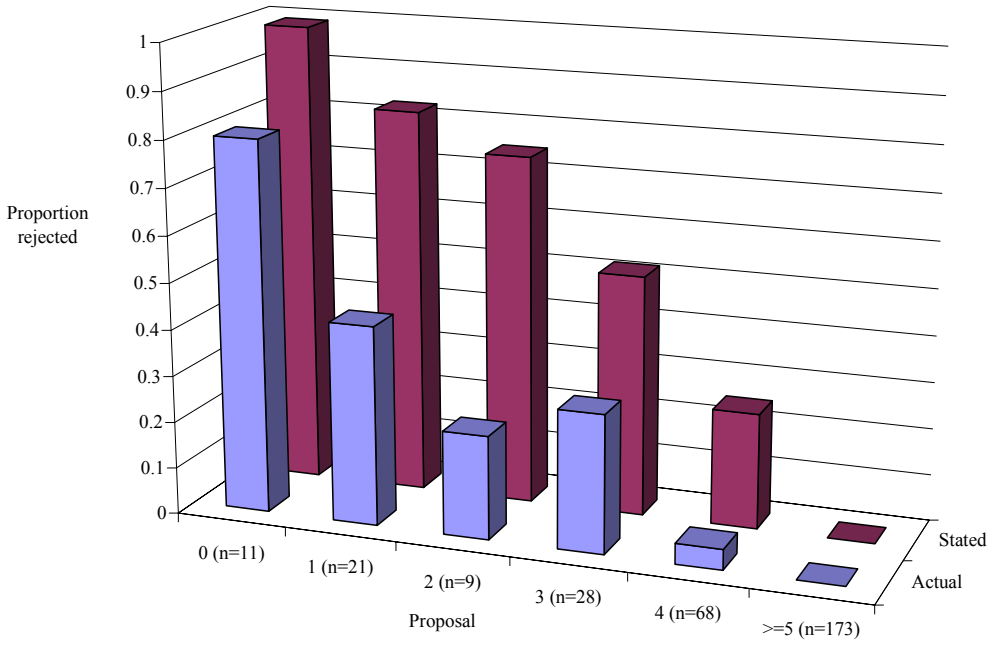
Stated versus actual accept/reject decisions

In addition to experimental data on ultimatum rejections, we have self-reported data from responses to the question "What is the smallest offer that you would accept?" collected in a survey immediately after the experiment. In Figure III we show a comparison of the actual and the hypothetical rejection rates, (derived from the lowest acceptable offer question) for different proposals. The number of actual proposals at given levels are in parentheses. Despite the small numbers of observations in some cells, the general pattern of decreasing actual rejection rates with larger proposals is very intuitive. The pattern in the stated rejection rates is even more intuitive, both in its trend and in the differences from the actual data. For example, 51% of the subjects report that they would reject an offer of three tokens, but when actually confronted with this situation and actually losing their tokens, only 23% reject.

Most of the discrepancy between actual and stated behavior comes from boys. Using the ES test, we can reject the hypothesis that the distributions of lowest acceptable offers are the same for girls and boys at the 0.0000 p-value. On average, boys say that the lowest offer they will accept is 3.50 tokens, while for girls it is 3.14. On the other hand, the regressions in Table II show that, if anything, boys are actually *less* likely to reject a given ultimatum proposal.[6] This gender difference in self-reports is highest among the younger children. One interpretation of children's tendency to exaggerate their toughness as bargainers is that it is further evidence of their strategic abilities. This result also shows that it can be very important to use real rather than hypothetical payments with young children – the conclusions about sex differences are exactly opposite, depending on which data we use.

[6] This difference is all due to sex. Relative height does not have any statistically significant correlation with stated behavior.

Figure III: Actual and stated rejection rates.



V: Conclusion

In this paper we have shown that children's bargaining behavior is similar, though not identical, to that reported by others for adults. In the dictator game, children, particularly young ones, make considerably smaller proposals than adults do. Children also make, and accept, smaller ultimatum proposals than adults do. In general, the youngest children make the smallest proposals.

Even young children are quite strategic, and very good at playing the ultimatum game. When making ultimatum proposals, we actually found that second graders earned more than any other age group, though this may have been as much due to their willingness to make small proposals as to their ability to predict rejection probabilities. When combined with the fact that the second graders give less in the dictator game, we interpret this to mean that the behavioral differences are related to different preferences for fairness, not to differences in the ability to play strategically.

This result gives a new twist to work by others on cross-cultural differences in economic behavior. Explanations of these cultural differences are either really about genetic differences, or they require that there be some way that different cultures persuade people with the same genes to behave differently. We suggest that this process happens in childhood, and we provide evidence of substantial behavioral changes in a sample of children from the same culture, over the ages seven to 18.

We have also identified a height effect: relatively taller girls make much smaller dictator and marginally smaller ultimatum proposals, and they are more likely to reject ultimatum proposals. These differences do not decrease as children get more experience with the experiment, however they do decrease with age. This suggests that even within a culture individual differences can be sensibly explained. We think the fact that these differences are larger for the dictator proposals than the ultimatum proposals fits with this, since dictator proposals are purely a matter of preferences.

To our knowledge no prior bargaining experiments have looked at variables such as height, though there is a large literature on sex differences, cited above. While the evidence is mixed, the general conclusion is that, when making proposals to respondents of unknown sex, women make noticeably larger dictator proposals than men do, make nearly equivalent

ultimatum proposals, and are considerably more likely to accept a given ultimatum proposal. Except for ultimatum responses, where we have very little data, these are exactly the results that we find for children. However, we find that relative height alone has a considerably larger effect than sex alone, and that part of the sex difference disappears when height is included.

While interesting in and of itself, we think these relative height results also have implications for more important issues. When people behave differently it is either because they have different preferences or because they face different constraints. On a playground with sporadic adult supervision, a sharing decision may involve very different constraints for a little kid than for a big one, and it would not be surprising to see smaller children "sharing" more than large ones. In our experiments, however, decisions are anonymous, and so the constraints are the same. So, the fact that different size kids make different decisions in the experiment means that different size kids have different preferences. In the dictator games with the younger children the differences in preferences implied by the proposal differences of the small and large kids seem very large. In addition, it is interesting that height matters most in the dictator game, where the proposal is purely a matter of preferences.

Appendix:

Table A.I: Participants by grade and treatment.

Grade	N	Version
2	16	A
2	20	A
2	20	B
2	18	B
	74	
4	28	A
5	26	A
4	28	B
5	24	B
	106	
9	25	A
9	18	A
9	22	B
9	25	B
	72	
12	20	A
12	20	B
	64	
Overall:	310	

Forsythe et al. [1994] show that with ultimatum game proposals, the Epps and Singleton [1986] (ES) test of the hypothesis that data from different populations is drawn from the same underlying discrete distribution has considerably more power to reject the hypothesis that the distributions are the same when they are different than do the common non-parametric alternatives. This power is derived from the fact that the alternatives either assume a continuous rather than a discrete distribution, or only compare a measure of central tendency, rather than the entire distributions. We show test statistics and p-values of the hypothesis that the distribution of proposals for each game differ across grades and rounds, and that proposals for the same game differ across grades, using this test as well as the more familiar Mann-Whitney.

Table A.II: Non-parametric tests of differences in proposals by grade and game.

Dictator

Grade	2	4/5	9
4/5	$1.07^{***,+++}$		
9	$0.83^{***,+++}$	-0.25	
12	$1.77^{***,+++}$	0.70^{**}	$0.95^{**,++}$

Ultimatum

Grade	2	4/5	9
4/5	$0.58^{***,+++}$		
9	$0.97^{***,+++}$	0.39^{+++}	
12	$0.81^{***,+++}$	0.23^{+++}	$-0.16^{*,+++}$

Notes: The tables show the row mean minus the column mean.
*, **, and *** indicate the difference is significant at the 0.1, 0.05, or 0.01 level respectively using the Mann-Whitney test.
+, ++, and ++ indicate the same using the Epps-Singleton test.

Table A.III: Significance tests of dictator proposal differences by age, sex and height.

	First group		Second group		P-value:		
Groups:	n	Mean	n	Mean	Epps-Singleton	Mann-Whitney	Fischer's Exact
All grades:							
Girls vs. boys	140	1.46	170	0.965	0.102	0.0121	0.012
Short vs. tall	115	1.36	94	1.03	0.136	0.0741	0.040
Short girls vs. tall girls	52	1.85	42	0.95	0.193	0.0331	0.056
Short boys vs. tall boys	52	0.95	42	1.10	0.256	0.618	0.413
2^{nd} and 4^{th} / 5^{th} grades:							
Girls vs. boys	83	1.00	97	0.97	0.467	0.4043	0.314
Short vs. tall	66	1.17	55	0.78	0.469	0.1248	0.151
Short girls vs. tall girls	31	1.39	25	0.360	0.230	0.0384	0.079
Short boys vs. tall boys	35	0.971	30	1.13	0.626	0.831	0.779
9^{th} and 12^{th} grades:							
Girls vs. boys	57	2.12	73	0.96	0.0158	0.0018	0.012
Short vs. tall	49	1.61	39	1.38	0.201	0.3863	0.197
Short girls vs. tall girls	21	2.52	17	1.82	0.381	0.3960	0.324
Short boys vs. tall boys	28	0.929	22	1.05	0.373	0.6429	0.548

History

We considered each of the 16 possible combinations of the four treatments and four roles. We can ignore the role of responder in the dictator game since there is no decision, and we can ignore the combinations where the role is played in the first period of the treatment, since the decision cannot be conditioned on history. For each of the remaining nine combinations of role and treatment we run a regression on the decision, using any outcomes that have preceded that decision. The coefficients and standard errors are shown in Table A.II.

The last three regressions in this table show that, as expected, larger proposals are more likely to be accepted. Rather surprisingly, the only other significant effect of history is a difference, in one regression, between the people whose ultimatum offers were accepted and those whose offers were rejected. However, only four people rejected proposals in this group, so while this rather counterintuitive tendency is statistically significant it does not seem important economically.

Based on this table we argue that the noticeable decrease in dictator proposals that occurs when the dictator games are done later in the experiment is derived from some general effect, rather than individual specific history. We note that the result that order matters has implications for models such as those cited above that are designed to explain behavior in these games.

Table A.II: Does history matter?

	Dictator proposal			Ultimatum proposal			Ultimatum rejection		
Round:	2	3	4	2	3	4	2	3	4
Model:	Tobit	Tobit	Tobit	OLS	OLS	OLS	Probit	Probit	OLS
Partner's dictator proposal	0.354 (0.219)		-0.056 (0.898)		0.153 (0.095)	0.090 (0.059)		0.097 (0.110)	0.078 (0.148)
Partner's ultimatum rejection		3.600* (1.827)	-31.577 (0.000)				-0.057 (0.084)		0.529 (0.639)
Partner's ultimatum proposal		-0.531 (0.530)	-0.802 (0.831)	0.138 (0.092)		0.085 (0.078)	-0.110*** (0.024)	-0.603*** (0.148)	-0.570*** (0.203)
Observations	77	79	78	78	76	77	79	77	76

Note: Coefficients shown. Standard errors in parentheses.
Dictator proposal regressions are done using Tobit, ultimatum proposals with OLS, reject ultimatum regressions with probit.
* means significantly different from 0 at the 0.10 level, ** at the 0.05 level, *** at the 0.01 level.
+ means unable to estimate Tobit or probit because some responses were perfectly predicted, so results shown are for OLS.

Protocol

Experiment Script

Note: The vocabulary given here was designed to make sense to the fourth graders. We used it as is on the ninth graders, except as noted. For the second graders, it was necessary to start by explaining the terms proposer and responder. In addition, the directions were given more slowly and with more examples. When giving the examples to the second graders we physically showed them the division and the allocation using the tokens. Whenever possible, we answered questions by repeating or rephrasing the words in the protocol. While these protocols were followed as closely as possible, we did find it necessary to ask the children to pay attention and not talk to each other. Their teachers were very helpful with this.

We did not tell them that the games would be repeated with different roles, or that two different games would be played. If asked, we just said "Sorry, we can't tell you that. You will have to wait and see what happens."

"We are going to play some games today. In these games you can get some tokens. When we are all done you can use the tokens to buy items from our store. Each token is worth about 25 cents or a quarter. The stuff you buy in the store is about the same price as in a regular store. Here are the things we have to sell."

We then showed the kids the items in the store. We had a selection of toys and school supplies that have proved popular in previous experiments, and the children were invariably quite attentive after this. To avoid threshold effects, we did not tell them prices if asked but just repeated that prices were about the same as in a regular store. The ninth graders were told that each token could be traded in for 25 cents cash at the end of the experiment, the twelfth graders that each could be traded for 50 cents. We then used playing cards to randomly divide the class evenly into two groups, A and B, and we separated the groups to different sides of the classroom.

"In each of these games half of you are going to be proposers and half responders. We are not going to tell you which you are until later, so pay attention to all the instructions about who does what. (*For the second graders, we then explained what these terms meant.)* Each of you will have a partner from the other group. We will decide who is a proposer and who is a responder by chance. We will also decide who is partner with who by chance, and we will keep it a secret. You will never know who your partner is, and they will never know who you are."

"I want you to know that no one else in the class will know what you choose to do in today's game. To be sure of this, on your game sheets you will not even put your name, instead we will give you a number. So do not worry about other people in the game knowing what you choose, because they won't."

"You will make all of your decisions by filling out forms that I give you. To help keep your choices secret, we will collect the forms in these envelopes. On your envelope is an ID number.

This is your personal ID number and you need to put it on all the papers that you fill out so that we make sure you get your tokens and so that everything you do is secret."

Depending on the treatment, we then either started with the ultimatum or the dictator game instructions below.

Ultimatum Bargaining Protocol.

"Here is the game. I am going to give you and your secret partner 10 tokens. Your job is to decide how to divide them. But we have a special way of doing this. We'll call the first partner the proposer. First, the proposer will pick how many of the 10 tokens they want to keep for themselves and how many they want to offer to the other person. They can choose any combination that adds up to ten tokens. After they have decided this, we will tell their responder partner how many tokens the proposer offered them. Then it is the responders turn. They decide if they want to accept or reject the offer. If they accept, the proposer and the responder each get the amount of tokens that the proposer picked. If they reject then both the responder and the proposer get nothing."

"We'll try it one time to make sure everyone understands. This is just an example, so it does not count for tokens. *(Pick a child from the front.)* Let's pretend we are partners. Right now I can see who my partner is, but remember in the real game you will not know who your partner is. I will be the proposer, the person who decides how the chips are split up. You are the responder, who chooses if you accept or not. Suppose I choose 6 tokens for me and 4 for my partner. If you accept, that's what we each get. If you reject, neither of us gets any tokens.

Now let's say that I said 7 for me and 3 for my partner. Suppose you said you will not accept this. Than we both get zero tokens. So does everybody understand? Are there any questions?"

To group A (Tell group B to listen too.):

"OK, you are the proposers who will make a proposal about how the tokens will be divided. You will be paired with another person in the other group. You will not know who they are and they will not know who you are. You will make a proposal about how to divide the tokens. If your partner accepts how you divided them, then that is how the 10 tokens will be divided. But if they reject your proposal you both get nothing. You can divide the tokens any way you want. Take the first form out of your envelope now. Be sure and write the number on your envelope on the top right side of the form. Make your choice by circling across the two numbers that you choose and then put your form back in your envelope. For example, you could circle 8 for you and 2 for your partner, or 3 for you and 7 for you partner. *(When describing how to fill out the form, hold up a form as an example.)* We have all the time you need, so think about what you want to do."

(Collect the envelopes from the proposers. Match proposers up with responders and fill out forms for the responders and put it in their envelopes. If there was an odd number of players, we matched one player with two partners when computing payoffs.)

To group B:

"You are the responders. You will decide whether to accept or reject the offer. If you accept the offer then you will get the tokens that proposer offered to you and they will get the tokens for they proposed for themselves. If you do not accept the offer then both you and your partner will get zero tokens. In your envelope is a form that tells you how many tokens you have been offered. First, be sure and put your ID number on the envelope on the top right part of your paper. Has everybody done this? OK, now, circle the box to accept or reject the offer. Don't rush, take your time and think about what you want to do."

(*Collect the envelopes from the responders. Fill out the forms for the proposers, which tell what the responders decided to do. Put the appropriate number of tokens in the envelopes.)*

"OK, now we are going to do this same game again. But this time everybody will switch roles. So, if you were a proposer, this time you are a responder. If you were a responder, this time you are a proposer."

(Repeat the protocol, starting with the specific instructions to the proposers.)

Dictator Bargaining Protocol:

"Here is the game. I am going to give you and your secret partner 10 tokens. The proposer's job is to decide how to split these tokens between the two people. Whatever the proposer says is final. The responder doesn't really decide anything, they just get the tokens the proposer offers them, if any. *(If this game followed the ultimatum game, we added "So, it's different than the other game. This time the responder doesn't get a chance to reject the split that the proposer makes. Whatever the proposer says goes.")*

"We'll try it one time to make sure everyone understands. This is just an example, so it does not count for tokens. *(Pick a child from the front.)* Let's pretend we are partners. Right now I can see who my partner is, but remember in the real game you will not know who your partner is. I will be the proposer, the person who decides how the chips are split up. You are the responder. Suppose I choose 6 tokens for me and 4 for my partner. So, that's what we each get.

Now let's say that I said 7 for me and 3 for my partner. So, that's what we each get.
So does everybody understand? Are there any questions?"

To group A (Tell group B to listen too.):

"OK, you are the proposers who will make a proposal about how the tokens will be divided. You will be paired with another person in the other group. You will not know who they are and they will not know who you are. You will make a proposal about how to divide the tokens. Whatever you decide goes. You can divide the tokens any way you want. Take the first form out of your envelope now. Be sure and write the number on your envelope on the top right side of the form. Make your choice by circling across the two numbers that you choose and then put your form back in your envelope. For example, you could circle 8 for you and 2 for your partner, or 3 for

you and 7 for you partner. *(When describing how to fill out the form, hold up a form as an example.)* We have all the time you need, so think about what you want to do."

(Collect the envelopes from the proposers. Match proposers up with responders and fill out forms for the responders and put it in their envelopes. If there was an odd number of players, we matched one player with two partners when computing payoffs.)

To group B:

"You are the responders. The form in your envelope tells you how many tokens your partner gets and how many you get."

(*Collect the envelopes from the responders. Fill out the forms for the proposers, which tell what the responders decided to do. Put the appropriate number of tokens in the envelopes.)*

"OK, now we are going to do this same game again. But this time everybody will switch roles. So, if you were a proposer, this time you are a responder. If you were a responder, this time you are a proposer."

(Repeat the protocol, starting with the specific instructions to the proposers.)

Payouts:

After all 4 rounds, we passed out sheets to the children, with the prices of the items in the store. We asked them to write down how many of each item they wanted, and to make sure they didn't spend more than they had. We then collected these sheets along with their envelopes with the tokens, put the items in bags, and returned them. For the ninth and twelfth graders we collected the envelopes, exchanged the tokens for cash, at rates of 25 and 50 cents respectively, and then returned them.

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