

Does Analytical Thinking Reduce Prosocial Behavior?¹

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Abstract

We investigate whether analytical thinking reduces prosocial behavior of humans using a subject pool of Chinese Muslims. We find a 10% negative effect on prosocial behavior, which is related to group identity: a 13% negative effect on behavior towards outgroup members (Han Chinese), but a small and generally insignificant effect towards ingroup members (fellow Muslims). Our results suggest that the former is mainly driven by fast thinking or norm-based, unconscious behavior, whereas the latter survives slow thinking, analytical thought. Our results are consistent with group competition affecting the benefits and costs of prosocial behavior, and these costs and benefits become more salient when engaging in analytical thinking. Our results have implications for the use of students from analytical fields such as economics in experiments and for our understanding of the effects of economics and other analytical training on human behavior.

Keywords: Analytical Thinking, Prosocial Behavior, Chinese Muslim, Ethnic Identity, Lab-in-the-field Experiment

JEL: A11; C91; C92; C99; D64; H00

1 Introduction

Does analytical thinking cause humans to be less prosocial? The answer to this question is crucial to our understanding of the motivation behind prosocial behavior (e.g., Gee and Schreck, 2018; Pan and Xiao, 2016; Cason, Friesen and Gangadharan, 2016; Dal Bó and Dal Bó, 2014; De Oliveira, Croson and Eckel, 2011; Chen and Li, 2009; Croson and Gneezy, 2009; Bénabou and Tirole, 2006). Examining the effects of studying economics on prosocial behavior may provide a partial answer to this question, since a hallmark of economic education is economic reasoning and the analysis of costs and benefits. In particular, a number of scholars have focused on the extent that students of economic theory or economists behave less prosocially than those who are in other disciplines. From the early days of experimental economics, researchers have been aware that economics students can be less prosocial than non-economics students (e.g., Marwell and Ames, 1981; Cadsby and Maynes, 1998; Selten and Ockenfels, 1998; Gandal, Roccas, Sagiv and Wrzesniewski, 2005; Rubinstein, 2006; Faravelli, 2007; Haucap and Just, 2010; Cappelen, Nygaard, Sørensen and Tungodden, 2015). At a research level, since many experiments use economics students, such results raise questions about the generalizability of studies from university laboratories. However, the results also raise questions about the value of spreading capitalism and economic thinking beyond western borders and into nonwestern societies. Will the spread of economics and economic reasoning affect the moral and prosocial attitudes of humans generally?

The current research on the issue does not provide clear answers but raises more questions than it answers. First, the empirical evidence is more mixed than is typically recognized. That is, not all studies find evidence of more selfish behavior by economists in the field or economics students and some even find support for more prosocial behavior by economic students or economists, raising issues with the basic premise that economic teaching reduces prosocial behavior.¹ Second, when an effect has been found,

¹See Seguino, Stevens and Lutz (1996); Frey and Meier (2003); Ahlert, Funke and Schwettmann (2013) for studies that fail to find significant evidence of less prosocial behavior by economists or economic students. Yezer, Goldfarb and Poppen (1996) find greater prosocial behavior by economics students and Laband and Beil (1999) find that economists cheat less on due paying than other social scientists.

it is unclear whether the effect observed is due to teaching economics or less prosocial individuals choosing to study economics, that is, a selection effect. A number of studies attempt to address this question but again do not provide clear answers. These studies focus on differences in behavior of students who are new to economics with those who have taken more classes (or examine individual economics students over time); some find little difference between new and advanced students, while others find some support for indoctrination.²

Importantly, by examining simply whether subjects have economic training or not does not address how such training works to possibly undermine prosocial behavior. Economics training has a number of dimensions. Is it an emphasis on maximizing self-interest as economics is often criticized for doing or is it the use of analytical thinking independent of the maximization of self-interest paradigm? Most seem to argue that it is the emphasis on thinking through situations in terms of what is best from a self-interested perspective that might lead individuals to make choices that are more self-centered rather than just the process of analytical thinking. Students are believed to become self-interested economic agents through studying how individuals are assumed to behave in the standard models. For example, Etzioni (2015) summarizes the argument against economics' training as the view "... that neoclassical economics' focus on self-interest, pleasure, and hence, consumer goods — what critics refer to as its hedonism and materialism — renders those influenced by its teaching less moral and more antisocial." Although some studies attempt to discover what it is about economics that leads to less prosocial behavior by comparing different types of economics classes (e.g., Frank, Gilovich and Regan, 1993; Frey and Meier, 2003), the comparisons do not cleanly investigate this issue since both aspects of economics training are generally contained in the types of classes compared (although arguably the emphasis may vary).

However, economics is also well known to be an analytical theory-driven field in which students are typically required to learn how to solve complex situations or games where

²See, for example, Carter and Irons (1991); Frey and Meier (2003); Frank and Schulze (2000); Gandal et al. (2005) find evidence suggesting selection while Frank, Gilovich and Regan (1993); Faravelli (2007); Bauman and Rose (2011) find support for indoctrination.

the solution is not always the intuitive or obvious choice. Another possible mechanism for less prosocial behavior might be that economics teaches one to rely less on fast, automatic, or unconscious processes in other behaviors and to place a greater reliance on those that are slow, effortful, and conscious in making decisions. If prosocial behavior is primarily an unconscious or automatic response, then becoming more analytical may lead to less prosocial behavior. Recent evidence on religiosity suggests such a relationship. That is, much empirical research has found a relationship between religious priming and prosocial behavior (see Shariff, Willard, Andersen and Norenzayan (2016) for a meta-analysis). Researchers argue that religious beliefs are related to more intuitive, fast, automatic, or unconscious processes of thought, *system 1 process*, whereas disbelief requires more slow, effortful, and conscious thought, *system 2 process*, (see Evans (2008) on the myriad of research on the two types of processes). Supportive of this argument, previous studies have found that analytical thinking can reduce individuals' reported religiosity and celebrity worship (e.g., Gervais and Norenzayan, 2012; Shenhav, Rand and Greene, 2012; McCutcheon, Lowinger, Wong and Jenkins, 2014). Hence, it may be that analytical thinking affects prosocial behavior directly, independent of the teaching the paradigm of self-interest, if it is the case that prosocial behavior, like religiosity, is characterized by more intuitive or unconscious processes and analytical thinking reduces reliance on these processes.

In this study, we develop a novel experimental design to explore whether and how analytical thinking influence prosocial behavior. In the experiment, some subjects are randomly assigned to engage in analytical reasoning before being confronted with the choice to be prosocial while other subjects are not. To address the endogeneity problem discussed above and to examine whether thinking through complex, nonintuitive situations leads to less prosocial behavior independent of messages that focus on self-interest, we focus on analytical thinking without reference to maximizing personal payoffs or the promotion of socially desirable behavior. To isolate the driving mechanism, the system 1 and/or system 2 processes of thought, and investigate the motivation behind prosocial behavior, we conduct our experiment with nonwestern religious subjects (Muslims in China)

in contrast to most previous studies that examined mainly western students.³ This design allows us to make causal claims about which process of thought dominates individuals' behavior under what situations.

We find a significant negative relationship. Overall, prosocial behavior is approximately 7-10% (depending on the specification) less after engaging in analytical thinking. Our results then suggest that independent of teaching about the self-interest paradigm, analytical thinking can reduce prosocial behavior. Furthermore, we find evidence that the effect appears strongly related to identity; engaging in analytical thinking leads to significantly less prosocial behavior to others in a different ethnic group by approximately 12-13%, but has a small and generally insignificant effect on ingroup members. Our results imply that there are important differences in the mental processes involved in prosocial behavior depending on whether the recipient is viewed as an in- or outgroup member. That is, our findings indicate that prosocial behavior towards outgroup members is primarily driven by fast, unconscious, norm driven thinking, whereas prosocial behavior towards ingroup members survives analytical thought about the costs and benefits of such behavior. Our results imply further that teaching analytical thinking is a mechanism through which economics' training may lead to less prosocial behavior. Economics training in itself is not necessarily more problematic than training in other fields which emphasize analytical thinking.

In the next section, we describe our experimental procedures and the design of treatments. In Section 3 we analyze the experimental results and discuss the implications of the results for the effects of analytical thinking and understanding prosocial behavior towards others (in-and outgroup members). Section 4 concludes.

³Xin, Dou and Chen (2013) is an exception; they compare economics and noneconomics students in China. The closest study to ours is provided in Xin and Liu (2013) who investigate the effects of a type of analytical thinking (profit calculation) on interpersonal trust as measured through survey responses in China. They find evidence of a mild negative effect.

2 Experimental Design

2.1 Location and Subjects

Our experiment was conducted in Yinchuan, the capital city of China’s Ningxia Hui (Muslim) Autonomous Region using a total of 288 Muslim and Han Chinese students from a local public university.⁴ The experiment was conducted using an improvised “lab-in-the-field” methodology with laptop computers connected via a wireless network in a standard classroom. The experiment was programmed in z-tree (Fischbacher, 2007)).

We chose the Muslim population in this region for two principal reasons. First, the population is relatively homogeneous in terms of their social norms and moral standards, living in an autonomous region in a relatively closed community. However, they still clearly face competition from Han Chinese who also live in the region and are the dominant ethnic group in the region (exact figures of the Hui population are not easily obtained, but most estimates are that they are a third of the population).⁵ Thus, we can clearly identify between in- and out-group individuals. Second, as a religious group, they are less likely to have been indoctrinated by government propaganda concerning the socialist code of conduct but at the same less likely to have been subject to westernized economics training. As a consequence, they are more likely to be affected by our analytical thinking treatments, allowing us to better measure the potential effects of these treatments.

We measured prosocial behavior using a voting game that is similar to the team dictator game in Cason and Mui (1997) and the voting mechanism in List, Berrens, Bohara and Kerkvliet (2004).⁶ A group votes to decide on the distribution of a given stake between themselves and a single second party, the receiver. The second party has no other option than to take whatever the group allocates to him or her. 288 undergraduate student subjects participated in our study. 216 of them participated as decisionmakers and the

⁴43% of the subjects were male and 57% female. We attempted to balance gender across sessions, although subjects were randomly assigned to sessions.

⁵See Encyclopedia Britannica, <http://www.britannica.com/place/Ningxia>.

⁶The voting game has a number of advantages for our study. First, it reduced the number of recipients required for the study and thus increased the number of observations for a given expenditure. Second, there is some evidence from Cason and Mui (1997) that there is greater prosocial behavior in the game, providing us a better opportunity to measure the possible negative effects of analytical thinking.

other 72 were recruited to serve as receivers. All decisionmakers were Muslim. Half of the 72 receivers were Hui Chinese (Muslim) and half were Han Chinese (non-Muslim).

It is important to stress that the receivers were chosen from a database of the “most needy students” at the local university. The family background of these students has been investigated by the university. The “most needy students” have received tuition waivers and living allowances. Moreover, almost every student at the local university understands the program of aiding the “most needy students,” so we could easily gain the students’ trust when we explained the role of the receiver and who they were during the experimental sessions. Students in the “most needy students” database were not allowed to participate in the experiment as voters. Only the decisionmakers came to the experimental sessions; the receivers were not present.⁷ Decisionmakers were allowed to participate in only one session.

2.2 Procedures

Upon arrival, each decisionmaker was seated at a desk; no form of communication was allowed during the experiment and subjects were placed such that their decisions were private. Decisionmakers were assigned experiment specific ID numbers, and they were randomly assigned to a 3-person Group in each period. Voters were provided with a printed sheet with basic demographic information about the 6 receivers assigned to their session. The printed sheet described the 6 receivers’ gender, ethnic identity, and birthplace, but it did not reveal the receivers’ names. In each session, there was always 3 male and 3 female receivers on the list and all 6 were in the same ethnic group. The possible influence of gender of the recipient (Dufwenberg and Muren, 2006; Croson and Gneezy, 2009) was therefore controlled through our design. Subjects knew that each receiver could only participate in one session. In addition, we required that the recipients agree to keep their identities confidential. Given that most receivers preferred to be anonymous to the

⁷The potential recipients were asked first as to their willingness to participate in our experimental study. Once a recipient agreed to participate the study, his or her information was recorded and (s)he was matched up with a 3-person team in one session as what will be described below. After the experiment was concluded, the experimenters as well as the local coordinator gave the money that had been transferred by the corresponding team to the person.

decisionmakers and that the receivers did not know which group they were assigned, it is unlikely that decisionmakers could tell the receivers' identities. Each three voter group was randomly matched up with a specific receiver prior to the beginning of a session but decisionmakers did not know which of the 6 receivers was assigned to their group.

The voting game in each period proceeded as follows: First, each decisionmaker was endowed with 20 RMB for the period. Then each voted as to whether to transfer an amount $T \in \{3, 5, 7\}$ of his or her endowment to the recipient assigned to their group. Decisionmakers chose between two options: A or B. Option A meant not transferring the money, while Option B meant transferring the money to the recipient. Abstention was not allowed. As explained in later, the sequence in which T changed was varied across sessions, but constant across treatments. The result of the voting was determined by simple majority rule. That is, if two out of three decisionmakers chose Option A, Option A was imposed on the group and vice-versa. Each decisionmaker kept his or her 20 RMB and the recipient received nothing. If Option B was chosen, then T was deducted from each of the decisionmakers' endowment and the recipient received $3T$.

Table 1 below presents the payoffs from the two options for the decisionmakers and recipients as a function of T . As abstention was not allowed in the voting game, it is straightforward that voting nonsincerely is weakly dominated and, based on previous voting experiments, we expected that subject did not require the repeated feedback and learning that may be necessary for equilibrium behavior to emerge in more complicated games. To deal with static and dynamic session effects (Fréchette, 2012), decisionmakers did not receive any feedback during the session. In each session, there were 18 decisionmakers and 6 receivers. The decisionmakers were randomly divided into three Sets of 6. Within each Set of 6, the subjects were randomly assigned to two Groups of 3 voters each. The 6 decisionmakers in each Set were fixed during a session, but in each period, the two groups were randomly re-drawn from the group of 6 within the Set.

Each session consisted of 60 periods. We varied T by period according to a fixed sequence by session (as will be explained below) such that each value of T was applied for 20 periods in 10-period parts. The giving behavior may decay over time (Chuan, Kessler

Table 1: Payoffs in the Voting Game

	A	B wins		
	wins	$T = 3$	$T = 5$	$T = 7$
Each Voter	20	17	15	13
The Receiver	0	9	15	21

and Milkman, 2018), which reflects a connection between prosocial behavior and system 1(2) thinking processes. That is, giving is often a spontaneous act of generosity, but as time passes, an individual may rely less on unconscious and fast-thinking and rely more on sophisticated and analytical thinking. A dynamic process of the evolution of giving over time can help us to explore this question, which is crucial for us to identify the underlying reason of prosocial behavior in our study. Varying T allowed us to investigate voters' concerns about the cost of acting prosocially and to use a within-subject design to measure these concerns by subject. Furthermore, it enables us to isolate the driving mechanisms of how analytical thinking affects prosocial behavior towards different group members differently.

To prevent possible wealth effects, one period for every 20 periods for each value of T was ex-ante selected as a paid period, such that subjects were paid for 3 periods. The paid periods were ex-ante selected, written on a blackboard, and covered by opaque papers. When the entire experiment was concluded, the experimenters uncovered the papers to show subjects which periods were ex-ante selected. We did this for three reasons: First, given the prohibition against gambling in Islam, we did not want to use traditional techniques of randomly selecting periods to be paid. Second, we wanted to show subjects that everything in the experiment was transparent and the ex-ante selected periods were not modified by the experimenters based on the results of the experiment. Third, we wanted to make sure that subjects were incentivized for each value of T .

Instructions were read aloud by the same experimenter in all sessions. The subjects were allowed to ask questions privately and to make sure that everyone had common knowledge of the decision tasks. On average, one session lasted for 90 minutes, and average earnings were about 49 RMB (1 US \$ = 6.2 RMB) at the time of the experiment. Subjects also received an extra 10 RMB for showing up on time.

We conducted three sessions for each treatment for a total of 54 decisionmakers and 18 recipients for each treatment (total of 288). We used three sequences (one session each): Sequence 1 {7, 5, 3, 7, 5, 3}; Sequence 2 {3, 5, 7, 3, 5, 7}; and Sequence 3 {7, 5, 3, 3, 5, 7}.

2.3 Treatment

Our principal research question is the effect of analytical thinking on prosocial behavior independent of references to self-interest as a paradigm. We consider two settings: (1) subjects are given an analytical thinking exercise prior to making voting decisions, which we refer to as the Baseline, and (2) subjects are not given the analytical thinking exercise, which we refer to as the Analytic Treatment. Specifically, we developed a unique analytical question set that is similar to the work by Gervais and Norenzayan (2012); Frederick (2005) and asked subjects (in the Analytic Treatment) to answer 15 questions as an analytical thinking exercise. The complete list of questions is contained in the Supplemental Online Appendix. Subjects had 20 minutes to answer the questions.

None of the analytical questions used in the experiment concerned moral behavior or self-interest as a motivation for behavior. It is essential to note that our analytical questions have two characteristics: First, the questions should make sense in the local language and they should be sufficiently easy for our subjects to understand; second, a correct answer should require some analytical thinking. In order to use the appropriate analytical questions in the study, before conducting the experiment, we assembled a focus group with local Muslim students who were randomly drawn from the same subject pool. They were invited to join a discussion on the choices of analytical questions. The focus group participants were given 50 analytical questions that were developed by our research team.⁸ They were asked to do all of the 50 questions and they were paid the same incentives for each correct answer. After finishing these questions, they were asked to select 25 questions that they believed are not difficult but require some analytical thinking. Then the experimenters gave them the right answers, and asked them to vote to select

⁸We developed 100 analytical thinking questions based on free examples posted on Baidu Knows. We asked our research assistants to filter out 50 of them based on the two criteria discussed earlier, and deliberated the other 50 questions with our focus group participants.

Table 2: Summary of Treatments

	Baseline		Analytic	
	Baseline-Han	Baseline-Muslim	Analytic-Han	Analytic-Muslim
Analytical Thinking	None	None	Yes	Yes
Recipient Identity	Han Chinese	Muslim	Han Chinese	Muslim
Number of Sessions	3	3	3	3
Number of Groups	18	18	18	18
Number of Voters	54	54	54	54
Number of Recipients	18	18	18	18

15 questions among the chosen questions. An example of an analytical question is given below.

“There is a snail that fell in the bottom of a well. The height of the well is 7 meters. The snail can climb up for 3 meters during the day, but fall down for 2 meters during the night. How long will it take the snail to climb up and come out of the well?” An intuitive answer is 7 days, given the average speed is 1 meter per day. The analytical and correct answer is 5 days, because in the fifth day, the snail can come out of the well.

We conducted two types of analytical treatments. In the Analytic-Han Treatment, subjects were given the analytical questions and paired with Han Chinese (non-Muslim) recipients. In the Analytic-Muslim Treatment, subjects were also given the analytical questions but paired with Muslim recipients. For comparison, we conducted two treatments in the Baseline where voters were not given the analytical questions. As with the analytical treatment, these vary depending on whether the recipient was Han Chinese (*Baseline-Han*) or Muslim (*Baseline-Muslim*). Table 2 summarizes the treatments and parameters.

2.4 Discussion of the Experimental Design

Before moving on to the empirical analysis of experimental results, it is important to highlight three aspects of our experimental design. First, one of the most important reasons that we used voting in this study is that we faced significant logistic constraints when we recruited subjects. Although our subjects were recruited from a public university in which there were significantly more Muslim students than most other Chinese universities,

only a small minority are needy students and thus eligible to be recipients and we were only able to recruit and manage a somewhat small subject pool when we conducted the experiment. We acknowledge that an individual may make giving decisions differently in a voting game than the canonical 2-person dictator game (Dana, Weber and Kuang, 2007). For example, Cason and Mui (1997) find that there is greater prosocial behavior in the team-dictator game, while there is some evidence from Luhan, Kocher and Sutter (2009) that the group setting may decrease generous decisions. Yet, our analysis focuses on the treatment effect caused by analytical thinking and we have left such investigation in the context of the canonical 2-person dictator game in future studies.

Second, the behavior towards in-group and out-group members is an important naturally occurring scenario that requires analytical thinking in one's daily life. Given our main research question is on the effect of analytical thinking on prosocial behavior, we wanted to study a relatively homogenous religious group in which people normally use fast and unconscious thinking to make prosocial decisions, so we conducted our study with nonwestern Chinese Muslims. We wanted to study decision-making on a natural question that individuals may have to deal with in their daily life, so we focus on Chinese Muslim subjects' behavior towards Muslim fellows and non-Muslim Chinese, especially when they face clear competition and potential conflict with Han Chinese. Hence, exploring Chinese Muslims' prosocial behavior towards ingroup and outgroup receivers becomes an ideal study that is relevant to the behavioral theory that we rely on and it enables us to address our research question.

Third, the analytical thinking exercise used in our treatment should be understood as a nudge rather than a heavy-handed education process. It is important to stress that we do not intend to assume that individuals only use one of the thinking processes in making decisions. Instead, our behavioral theory is based on the assumption that at the group level one thinking process generally dominates the other in decision-making. We do not expect that the introduced analytical thinking exercise may fundamentally change subjects' level of sophistication or make them smarter since we do not educate them. The Muslim subjects were undergraduate students who were recruited from the

same university and they were randomly assigned to treatments and sessions, so in terms of subjects' sophistication, there should not be any difference between subjects in the Baseline and subjects in the Analytic Treatment.

3 Experimental Results

In this section, we present the main results from our experiment regarding the prosocial behavior of the Muslim decisionmakers. We first analyze the average treatment effects of the analytical thinking exercises on individuals' prosocial behavior followed by our analysis of the effects of repeated play on preference change. Unless otherwise specified, we use nonparametric statistical tests to examine the significance of treatments effects. We use individual level averages to control for repeated play in a session. Because the individual level averages are numbers between 0 and 1 rather than dichotomous results, we conduct Wilcoxon-Mann-Whitney tests to investigate the difference of the individual level means of voting for option B towards Hui and Han receivers.

3.1 Religion, Identity, and Analytical Thinking

We expect that working on the analytical exercise will make voters less prosocial towards the recipients. If prosocial behavior is primarily a system 1 process that is related to intuitive, fast, automatic, or unconscious processes of thought rather than a system 2 process that is slow and analytical, then by thinking through complex and nonintuitive situations in our analytical exercise, Muslim decisionmakers will be less likely to behave prosocially. Thus, we expect subjects in the Analytic Treatment are less likely to vote for Option B as compared to the subjects in the Baseline, as stated in Hypothesis 1:

Hypothesis 1 *The share of voters who vote for Option B is smaller in the Analytic Treatment than in the Baseline.*

Result 1 We find a significantly lower share of voting for Option B (prosocial behavior) in the Baseline than in the Analytic Treatment. Specifically, we find that subjects engaged in prosocial behavior about 70% of the time in the Baseline, but 61% of the time in the

Analytic Treatment ($Z = 2.453$, $P = 0.014$). This result provides strong evidence of the significant effects of the analytical thinking on prosocial behavior.

Previous studies of the relationship between identity and prosocial choices suggest that social distance and ethnic identity may play a crucial role in the decision-making process of acting prosocially (e.g., Akerlof and Kranton, 2000; Chen and Li, 2009; Bassi, Morton and Williams, 2011). On the one hand, previous studies have demonstrated clear evidence of in-group favoritism (e.g., Efferson, Lalive and Fehr, 2008). On the other hand, as in a number of religions, Islam teaches that Muslims should treat non-Muslims with respect and that all humans are created from the same dirt.⁹ If the religiosity of Muslims treats Muslim and non-Muslims equally and because the Hui Chinese is a highly religious population, we would expect to find that participants are equally likely to vote for Option B regardless the recipients are Muslims or non-Muslims. Since prosocial behavior in general and the decision task in our study in particular is often a spontaneous act of generosity, we expect that the system 1 process should dominate participants' decision making in the Baseline and lead to the following hypothesis:

Hypothesis 2 *In the Baseline, voters are equally likely to make prosocial choices when the recipients are Muslim compared to when the recipients are Han Chinese (non-Muslim).*

Result 2 When we examine the aggregate percentage votes for Option B in the Baseline we find that, although the percentage of votes for Option B is slightly higher if the recipient is a Muslim (72%), there is no significant difference between this percentage and the percentage who vote to give to Han recipients (69%).¹⁰

Thus, we find strong support for Hypothesis 2, which provides new evidence showing that in the context of our experiment Muslims treat Muslim and non-Muslim recipients with little discrimination. On the other hand, analytical thinking can reduce individuals' reported religiosity and celebrity worship (Gervais and Norenzayan, 2012; Shenhav, Rand and Greene, 2012; McCutcheon et al., 2014). If it is the case that prosocial behavior that

⁹See, for example, the numerous examples from the Prophet's life in Tariq Ramadhani's *Footsteps of the Prophet*.

¹⁰The Mann-Whitney test yields a Z statistic = 1.143, P=0.253.

is driven by religiosity is characterized by more intuitive or unconscious processes and analytical thinking reduces reliance on these processes, we may expect that our analytical thinking exercise will have more of an effect on prosocial behavior when the recipients are outgroup members. Thus, we may expect that voters in the Analytic Treatment are more likely to engage in prosocial behavior when the recipients are fellow Muslims than when they are Han Chinese (non-Muslim). The system 2 process should dominate participants' decisionmaking in the Analytic Treatment and lead to the following hypothesis:

Hypothesis 3 *The influence of analytical thinking on prosocial behavior is different when the identity of the recipient varies.*

Result 3 When examining the aggregate percentage votes for Option B in the Analytic Treatment, we find that the effect of analytical thinking is significant only when the recipient is Han Chinese where voting for Option B is approximately 13% less.

Figure 1 presents aggregate percentage votes for Option B by whether subjects engaged in analytical thinking, recipient identity, and value of the transfer amount (T). The associated confidence intervals are estimated at the Set level. Within the Analytic Treatment, we find that the percentage of votes for Option B is higher if the recipient is a Muslim (66%) than if the recipient is a Han (56%), although it is not significant ($Z = 1.738$, $P = 0.082$) at conventional levels of significance. More importantly, when the recipient is Han Chinese, subjects voted for Option B about 69% of the time in the Baseline and 56% in the Analytic Treatment, which is significantly less ($Z = 2.327$, $P = 0.020$); but when the recipient is Muslim, subjects voted for Option B about 72% of the time in the Baseline and 66% in the Analytic Treatment, which is not statistically distinguishable ($Z = 1.195$, $P = 0.232$). Taken together, we find clear support for Hypothesis 3. Analytical thinking appears to have a stronger negative effect on behaving prosocially towards a recipient in the outgroup and leads to discrimination between ingroup and outgroup recipients.

Hypothesis 4 *The cost of transfer amount plays a crucial role in making prosocial decisions. The proportion of voting for Option B is higher when the cost is relatively lower.*

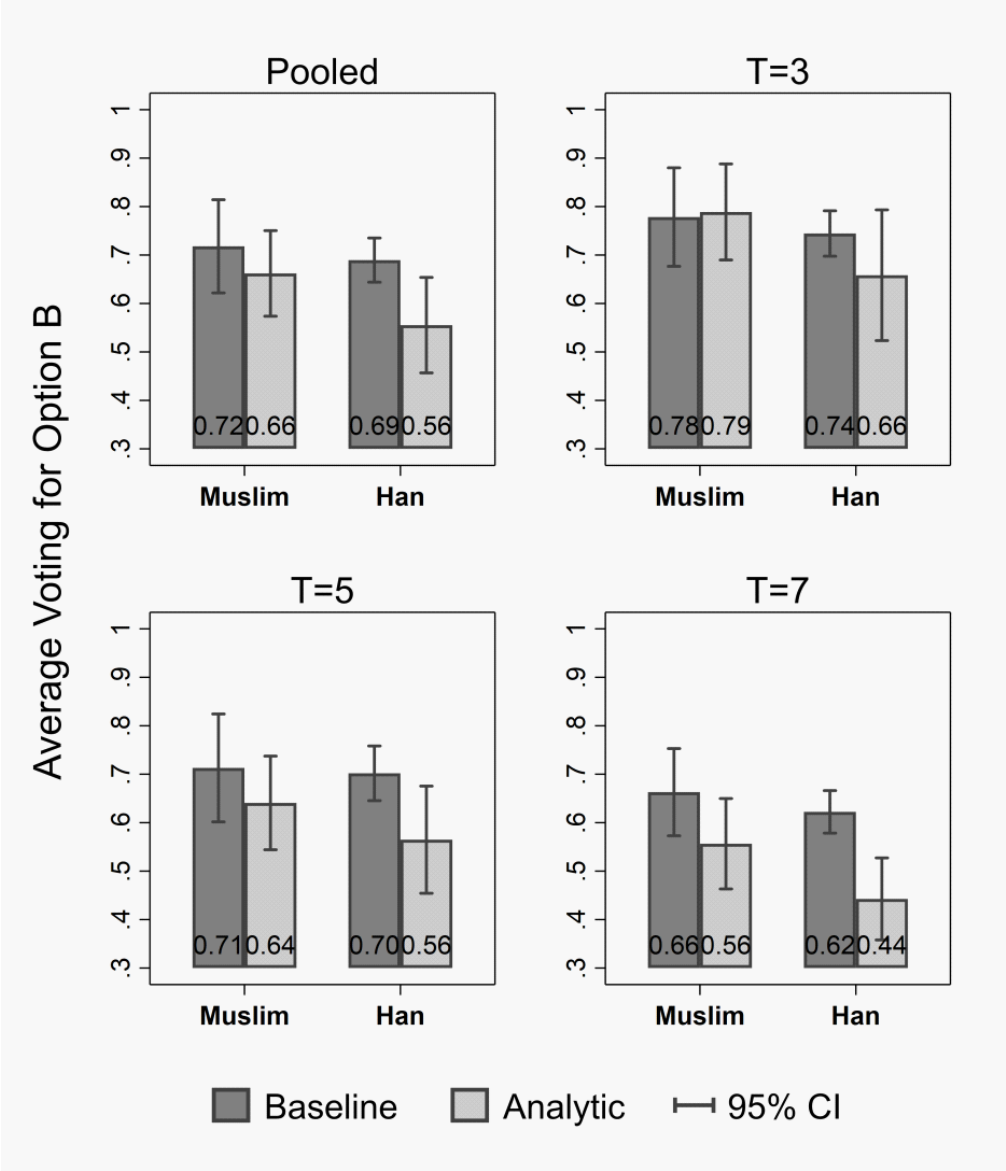


Figure 1: Average Voting for Prosocial Option at Individual Level by Treatment

Result 4 As the transfer amount increases, less Muslim subjects vote for Option B.

When we further disaggregate by identity and transfer amount, we find that subjects with Han Chinese recipients who engage in analytical thinking vote for option B increasingly less as transfer amount increases. The difference is 8% for $T = 3$, 14% for $T = 5$, and 18% for $T = 7$. However, the difference is only significant at the Set level for $T = 5$ and $T = 7$.¹¹ We also find that as transfer amount increases, subjects with Muslim recipients who engage in analytical thinking vote for option B increasingly less. But the differences are not statistically distinguishable at conventional levels of significance.¹² Hence we find evidence that the effect of analytical thinking is related to the transfer size. The effect is stronger when the recipient is a member of the outgroup and the amount to be transferred is large, but also appears when the recipient is a member of the ingroup.

In summary, we find that the analytical thinking exercise has a significant negative effect on prosocial behavior. But the effect is largely due to decreased prosocial behavior towards outgroup recipients and occurs primarily when prosocial behavior is more costly to decision makers. In the absence of the analytical thinking exercise, we find no evidence of discrimination between ingroup and outgroup recipients.

In Table 3 we report the results of a Probit analysis of individual voting for Option B as a function of the various treatments separated by recipient overall and by the three transfer amounts ($T=3,5$, and 7).¹³ Standard errors are clustered at the individual level.

First observe that the results reported in Table 3 are the same as those that we presented above. In the absence of the analytical thinking exercise, we find little discrimination between recipients by identity, since the coefficient of the Baseline-Han variable is not significant. This result holds for any of the transfer amounts.

As for ingroup members, on average analytical thinking has no significant overall effect. Relative to the Baseline-Muslim treatment, we do not find that voters in the Analytic-

¹¹For $T = 3$, 74% vs 66%, $Z = 1.268$, $P = 0.205$. For $T = 5$, 70% vs 56%, $Z = 2.199$, $P = 0.028$. For $T = 7$, 62% vs 44%, $Z = 3.182$, $P = 0.002$.

¹²For $T = 3$, 78% vs 79%, $Z = 0.073$, $P = 0.942$. For $T = 5$, 71% vs 64%, $Z = 1.314$, $P = 0.189$. For $T = 7$, $Z = 1.663$, $P = 0.096$.

¹³In one session of the Baseline there was a power outage in the last period and the data for that period were lost.

Table 3: Marginal Effects of Analytical Thinking on Voting for Option B

Probits, null=Baseline/Muslim				
Treatments	Total	$T = 3$	$T = 5$	$T = 7$
Baseline-Han	-0.030 (0.054)	-0.036 (0.054)	-0.012 (0.060)	-0.043 (0.057)
Analytic-Muslim	-0.058 (0.057)	0.111 (0.056)	-0.074 (0.064)	-0.109 (0.063)
Analytic-Han	-0.161** (0.057)	-0.116* (0.057)	-0.147* (0.062)	-0.222*** (0.063)
Number of Observations	12942	4302	4320	4320
Pseudo R^2	0.013	0.012	0.012	0.021
Log Pseudolikelihood	-8222.6	-2425.3	-2750.2	-2889.3

Standard errors clustering at the individual level are reported in parentheses.

Significance: * sig. at 0.05 level, ** sig. at 0.01 level, *** sig. at 0.001 level.

Muslim treatment are significantly less likely to vote for Option B. However, as for outgroup members, analytical thinking has significant overall effects. When we compare the estimated coefficient of the treatment variable Baseline-Han with Analytic-Han, we find that there is a significant difference between these two variables ($\chi^2 = 6.88, P = 0.009$) such that when the recipient is a Han, voters who engaged in the analytical thinking exercise prior to the voting decisions are about 13% less likely to vote for the prosocial choice.

Finally, as what we reported earlier, we find that a prosocial decision is correlated with the associated cost of the prosocial behavior. When we break down the effects by the transfer amount and when the recipients are ingroup members, we find that the size of the transfer does not reduce voters' probability of voting for Option B significantly. On the opposite, when the recipients are outgroup members, the cost of prosocial behavior seems to play a crucial role in decision-making. That is, when the receivers are outgroup members and the cost of prosocial behavior is small, the Analytic Treatment does not significantly affect voters' prosocial behavior ($\chi^2 = 2.38, P = 0.123$). But when the costs are larger ($T = 5, 7$), the analytical thinking exercise is observed to significantly reduce their willingness to vote for Option B ($T = 5, \chi^2 = 6.04, P = 0.014; T = 7, \chi^2 = 10.49, P = 0.001$). In summary, we find that the effects of analytical thinking are mainly reflected in the lower share of prosocial voting towards outgroup members,

particularly when the amount the recipient receives is large.

These results suggest that the analytical thinking exercise causes subjects to think about the cost and benefit of acting prosocially, especially when the prosocial behavior is towards outgroup members whose group is in competition with their own group. Our results imply, as what we argued earlier, that prosocial behavior towards others outside one's social or ethnic group is more a system 1 process that is related to intuitive, fast, automatic, or unconscious processes of thought; while behaving prosocially towards others inside one's social or ethnic group is more a system 2 process that is related to more slow and conscious thought.

This implication may seem counter-intuitive, but makes sense in a world of intergroup competition. That is, acting prosocially towards members within a group may be an analytical response to competition with outgroup members, reflecting analytically derived benefits of cooperative and prosocial behavior within a given group. In contrast, acting prosocially towards outgroup members may be a more automatic or norm driven response, rather than analytical. When groups are seen as in competition, the benefits from acting prosocially towards one's own group may be more likely to survive analytical calculation, while the benefits from acting prosocially towards those outside one's group may not. Although our study was not designed to investigate the evolution of in-group favoritism, our experimental results provide suggestive evidence that supports the theoretical framework for the evolution of in-group favoritism reported in recent studies (see, for example, Efferson, Lalive and Fehr, 2008; Fu, Tarnita, Christakis, Wang, Rand and Nowak, 2012).

3.2 Sophistication and Preference Change over Time

What is the relationship between voting for the prosocial choice and the number of correctly answered analytical thinking questions? In our experiment, the number of analytical questions answered correctly is within the range of 1 and 11. The mean number of questions answered correctly was 4.58 with a standard deviation of 2.03. In Table 4 we report the results of a Probit analysis of individual voting for Option B as a function of the identity of the recipient and the number of correctly answered analytical questions.

We focus on the results of the Analytic Treatment.

The results in Table 4 show that in the Analytic Treatment, individuals who answered more questions correctly do not behave significantly differently from who answered less questions correctly regardless the transfer size. The identity of the recipients seems to play a more crucial role since voters are significantly more likely to vote for Option B when the recipient is Muslim. Importantly, as what we reported earlier, there is no significant difference in the proportion of voting for Option B between the Baseline and Analytic Treatment when the recipients are Muslim, and there is no significant difference in the share of voting for Option B when we compare the effects of the identity of the recipients in the Baseline. Thus, the decline in the share of voting for Option B that we observed in the Analytic Treatment should mainly result from declined willingness to act prosocially towards outgroup members.

These results suggest that the effects of analytical thinking on prosocial behavior towards outgroup members are robust to the check of individuals' performance in the analytical thinking exercise. It is important to stress that though the analytical thinking task is incentivized, we could not control whether subjects seriously worked on the exercise. Again, as we emphasized previously, our analytical thinking exercise serves as a nudge rather than a heavy-handed education process. Subjects' performance in solving the analytical thinking exercise may only somewhat reflect their level of concentration or cognition, but it is not necessarily a reliable index of one's analytical skills.

It is essential to note that the subjects of this study were randomly recruited from the same university; these undergraduate students had similar performance on their China's National College Entrance Examination, also known as *gaokao* that should serve as a more reliable measurement of students' sophistication skills. The format of China's National College Entrance Examination is similar to the Scholastic Aptitude Test (SAT) exams of the United States. A crucial function of China's National College Entrance Examination is examining students' analytical skills. In the Ningxia Hui/Muslim Autonomous Area where we conducted our study, the universities use the "parallel enrolment mechanism" to recruit students. Generally speaking, under this recruitment mechanism, students with

Table 4: Marginal Effects of Performance and Identity on Voting for Option B in Analytic Treatment

Variables	Pooled			
		T=3	T=5	T=7
No. Correct Answers	0.006 (0.015)	0.015 (0.015)	0.020 (0.016)	0.015 (0.017)
Muslim=1	0.107* (0.054)	0.125* (0.055)	0.143* (0.062)	0.132* (0.064)
Period		-0.000 (0.000)	0.000 (0.001)	-0.001* (0.001)
Number of Observations	6480	6480	2160	2160
Pseudo R	0.000	0.000	0.012	0.009
Log Pseudolikelihood	-4335.5	-4298.5	-4287.0	-1438.1
				-1475.9

Note: Standard errors clustering at the individual level are reported in parentheses.

Significance: * sig. at 0.05 level, ** sig. at 0.01 level, *** sig. at 0.001 level.

better performance will be recruited by better a university, which in turn means that students recruited by one university have similar analytical skills. More theoretical and empirical discussions of this argument can be found in, for example, Chen and Kesten (2017); Wei (2009).

In our study subjects were randomly assigned to treatments and sessions, so it is safe to assume that there should not be any difference between subjects in the Baseline and subjects in the Analytic Treatment. We, therefore, conclude that the observed treatment effects of analytical thinking are largely driven by the analytical thinking process that we introduced in the experiment.

Last but most importantly, we find that on average subjects do not change their behavior as time goes within one session. The variable *Period* as an index of time may be associated with two factors: First, subjects might be tired in the later phase of the experiment, given each session is repeated for 60 periods. Second, subjects might be more or less analytical as time goes; the effects of analytical thinking may decay over time. The results reported in Table 4 show that in most cases the variable *Period* does not affect the probability of voting for Option B significantly. Meanwhile, when we break down the analysis by the value of transferred amount, we find that when $T = 7$, the time variable imposes a significant negative influence on the probability of voting for the prosocial choice. It may suggest, because the influence of Analytic Treatment lies in thinking about the cost of benefit of acting prosocially, the repeated play makes subject think more about their decisions and they rely more and more on sophisticated and analytical thinking as time goes. Hence, in a laboratory setting our study provides new evidence that prosocial preferences may decay over time, which is consistent with the field study by Chuan, Kessler and Milkman (2018).

What is the relationship between the estimated probability that Option B wins and the time? To determine if the group level behavior changes as time goes, we examine how the percentage of times Option B wins changes over time in our experiment. We consider an OLS model for the estimated probability of implementing Option B as a function of the *Period* variable in a session. The results of the regressions are summarized in Figure

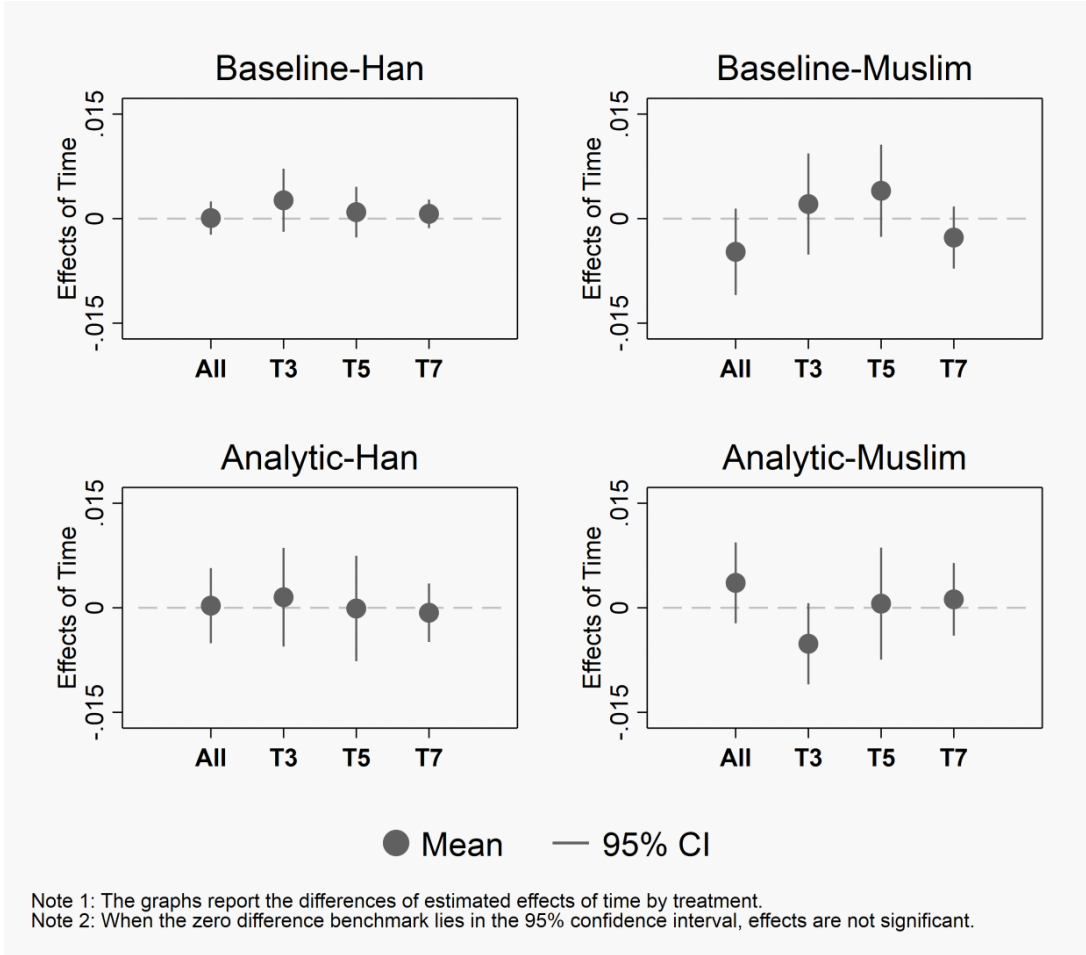


Figure 2: Estimated Probability of Implementing Option B as a Function of Period

2. It is straightforward to see that the coefficient of the Period variable is statistically indistinguishable. We do not observe that the group decision changes significantly over time, whether we pool the results together or break them down by transfer size. Taken together, although the individual prosocial behavior is somewhat influenced by time in some situations, little to no differences in the terms of group behavior are related to these effects.

4 Implications

In this study, by using a novel experiment and a unique sample of Muslim subjects, we find that analytical thinking significantly reduces prosocial behavior towards outgroup

members. The effect is related to transfer size, being larger when greater amounts are given to recipients. Our results with respect to analytical thinking suggest that prosocial behavior towards others outside one's social or ethnic group is more a system 1 process, while behaving prosocially towards others inside one's social or ethnic group is more a system 2 process.

Our results illustrate that acting prosocially towards ingroup members may be an analytical response to competition with outgroup members, which provides empirical evidence supporting the evolution of in-group favoritism. This suggests that in an ethnic-minority-inhabited area in which there are conflicts between ethnic groups, the education on rational behavior and the analysis of costs and benefits may be detrimental when it is analytical in nature, which may have special policy implications for (Chinese) policy makers of public administration in ethnic minority areas.

Since 1990s, the Chinese government has tried to moderate religious/worship activities and promote the education of sciences to reduce conflicts between ethnic minorities and the majority (Han Chinese). On the one hand, the better-educated minority citizens may have a better understanding of favorable policies (including tax exemption and subsidies in business and agriculture) to ethnic minorities and be grateful to the goodwill and effort of the government that is arguably regulated by the majority. It is believed that the analytical thinking may make people think about costs and benefit of engaging in violent ethnic conflict and move people from flights with authorities dominated by Han Chinese. However, on the other hand, the education that promotes analytical thinking may emphasize the ethnic identity and cause selfish or even spiteful behavior towards outgroup members, which then may ultimately undermine the benefits that the promotion of education was meant to bring about. Our study suggests that the Chinese policymakers need to think more about the tradeoff of regulating religious/worship activities, and they should consider using the positive and effective messages from religion to moderate the conflicts between ethnic groups.

Aside from the important policy implications, our experimental design allows us to make causal claims on the effects of economics' training on prosocial behavior. Our

results demonstrate that independent of teaching about “self-interested” behavior, the analytical nature of economic thinking can have an effect on prosocial behavior. Hence, our results suggest that previous research which finds that economics students may be less prosocial than other students may not be the teaching of maximization of self-interest, as is commonly believed, but the process of analytical thought. Economics is not the only field of study, which emphasizes analytical thinking. Frey and Meier (2003) compare economics students to various disciplines and find that students in some of the other disciplines which arguably value analytical thinking also demonstrate less prosocial behavior. They find that relative to Arts majors, students in law, veterinary medicine, natural science, and computer science are also significantly less prosocial, particularly those who are at the Ph.D. level. They conclude “that to isolate an indoctrination effect, it is crucial who the economists are compared with” (page 459).

What then do our results imply about the concerns about 1) the use of economics students in experiments as measures of human behavior and 2) the spread of economics training broadly on prosocial behavior? With respect to the use of economics students in experiments, our results suggest that if the goal of an experiment is to measure prosocial behavior or other system 1 process behavior for a broad population, using students in fields that prize analytical thinking (not just economics’ students) exclusively may be problematic. But such samples might be reasonable for studies of other types of behavior or research questions. With respect to the spread of economics training, our results suggest that economics training in itself is not necessarily more problematic than training in other fields, which emphasize analytical thinking. Encouraging students to study computer science or other analytical thinking fields may have similar effects on prosocial behavior and the view that economics is particularly a problematic field is not necessarily warranted.

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Supplemental Online Appendix

A. Analytical Questions

Translations of the analytical questions can be found below. The original version in native alphabet is available upon request from the authors.

1. The depth of a well is 7 meters. A snail is at the bottom of the well. The snail can climb up 3 meters per day, but it will fall down 2 meters per day too. How much time does the snail need to come out of the well?
2. There is a pan which can fry two cakes at a time. It takes five minutes to cook each side of a cake. How much time do we need to cook three cakes?
3. You are walking from west to east. Then you turn left for a degree of 270 and keep walking. Then you turn around and keep walking. Then you turn left for a degree of 90 and keep walking. Finally, you turn around and walk away. Which direction are you heading now?
4. In the 21st century, there is a year that looks exactly the same whether you see from left to right or rotate it 180 degrees, and then see it from left to right.
5. If you have three matchsticks, and you are not allowed to break them, what is the smallest number you can use them to compose?
6. There is a steel wire. When you use pliers to cut it, you can get a steel wire of the same length. What is the shape of the steel wire?
7. Three empty beer bottles can be exchanged for one bottle of beer. If someone has bought 10 bottles of beer, what is the maximum number of beer that he can have?
8. You have 20 dollars. A bottle of coke costs 1 dollar. You can have a new coke with two empty coke bottles. What is the maximum number of coke you can have?
9. There are two circles. The radiuses of the two circles are 2 and 1 respectively. If the smaller circle runs against the inside of the big, how many rounds does the smaller

circle run? If the smaller circle runs against the outside of the big circle, how many rounds does the smaller circle run?

10. You have a couple of jellies of yellow, green and red. When you close your eyes and randomly pick up some jellies, how many jellies do you need to pick to make sure that you can have at least two jellies of the same color?
11. Twelve people want to cross a river. But there is only one boat that can only carry three people at each time. How many times does the boat need to go back and forth to take all of the 12 people to the other side of the river?
12. Your sister was half of your age when you were 6 years old. Now you are 30 years old, what is your sister's age?
13. From the moment you are born till now, what is the difference between the times you fall asleep and the times you wake up? Which number is bigger?
14. Three people go to a hotel. The price is 30 Yuan per day/night. Each of the three gives 10 Yuan to the hotel manager. Later, the manager says that there is a promotion going on, and the three people only need to pay 25 Yuan for one day/night. The manager asks the waiter to give back 5 Yuan to the three people. The waiter ferrets away 2 Yuan secretly, and gives them only 3 Yuan. So each of them gets 1 Yuan back. How much have the three people spent on one night of hotel stay?
15. A person bought a chicken for 8 Yuan, and then sold it for 9 Yuan. Later, the same person bought back the chicken for 10 Yuan, and then sold it for 11 Yuan. How much money did the person make by buying and selling the chicken?

B. Translated Experimental Instructions for the Baseline/Muslim Treatment

Welcome to our experiment. During the following experiment, we require your complete and undivided attention and ask that you follow the instructions carefully. Please turn

off your cell phones. For the duration of the experiment, do not take actions that could distract you or other participants. Peeking at other participants' decisions are not allowed during the session. And do not let others observe your decisions. If you have any questions during the experiment, please raise your hand. The experimenter will come to you privately and answer your question. If we think the question is of a general nature, we will announce the question and the answer to everyone. Please restrict your questions to clarifications about the directions only. If you break silence while the experiment is in progress, you will be asked to leave the experiment with no pay.

Procedure

You will be independently and randomly assigned to a committee with the other 2 participants. Each committee has 3 participants all of whom are Muslims. Your committee will be asked to collectively decide whether to give an amount of money to a needy Muslim undergraduate student in your university. As you can see, on each of your desks, there is a sheet of which you can find the needy person's basic information. We have 18 participants, so we will have 6 committees. Each committee is matched with one needy person. That is the reason why you can find 6 needy persons' information. As you can see, we do not show their names, but they are real and they are selected from the database of the "needy-person" of your university. The basic information includes gender, ethnic identity, birthplace, etc.

Your committee will collectively decide whether to help a needy person. Your committee's decision is based on a simple majority rule. For example, please see a payoff matrix below

	Option A	Option B
Your Income	10	8
Needy Person's Income	0	6

At each time, you can vote for Option A or Option B. If you vote for Option A, it means you do not want to help the needy person at that level. If you vote for Option B, it means you want to help the needy person at that level. In your committee, if there are two or more votes for Option A, then Option A is your committee's decision. If there are two or more votes for Option B, then Option B is your committee's decision.

If your committee's decision is Option A, then your income will be 10 RMB, the needy person's income will be 0 RMB. If your committee's decision is Option B, according to the example above, your income will be 8 RMB, which means that each of you will give $(10 - 8 =) 2$ RMB to the needy person, and the needy person will have $(2 \times 3 =) 6$ RMB. The payoff table above is an example. In the experiment, you will see different payoff tables in the different periods.

Your committee's decision will be implemented for every committee members, which means even if your vote is different from your committee's decision, you need to follow the group decision. In the example above, if you vote for Option A, for example, but Option B is your committee's decision, Option B will be implemented. Your income will be 8 RMB, the needy person's income will be 6 RMB. If you vote for Option B, but Option A is your committee's decision, Option A will be implemented. Your income will be 10 RMB and the needy person's income will be 0 RMB.

The voting will be repeated for 60 periods. The payoff tables and the amount of money that will be transferred to the needy person can be different from period to period. Please pay attention to the instructions and read the payoff table carefully in every period.

Earnings

In every 20 periods, 1 period will be randomly selected as the period to be paid. Because we have 60 periods, at the end of the session, 3 periods will be randomly selected to be paid. Your committees' decisions in the selected 3 periods will determine your income and the needy person's income. Please note that the experimenters have selected the 3 periods and write them on board. These 3 numbers have been hidden behind the opaque papers. At the end of the session, these numbers will be revealed to you publicly.

Your accumulated income of these pre-selected periods will be used to calculate your cash payment. You will be paid in cash. Besides, you will get an additional 10 RMB as showing up payment. Whatever your or your committee's decision is, you will get the 10 RMB showing up payment.

Anonymity

All your decisions and your earnings will remain anonymous.

If you have any questions, please raise your hand. Otherwise, please proceed to answer the questions on the screen. The purpose of the questions is to make sure that you understand the different elements of the experiment. Any unclear question will be explained by the experimenter. Once you have answered all the questions, please press the “Continue” button to proceed. The computer will check your answers.