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COMMON-VALUE PUBLIC GOODS AND INFORMATIONAL SOCIAL DILEMMAS

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ABSTRACT. We experimentally examine the role of private information and communication in a public goods environment with uncertain returns. We consider a public goods game in which the Marginal Per Capita Return (MPCR) is either high or low. Before contributing, three players observe private signals correlated with the true MPCR and then send cheap talk messages to one another. There are social gains from truthful communication, but a private incentive to exaggerate. We compare treatments with and without cheap talk, finding that messages are largely truthful and influence contribution decisions. In further treatments, we increase the incentive to exaggerate and find reduced truthfulness and smaller gains from communication.

Keywords: public goods, experiment, information, cheap talk, game theory, cooperation
JEL Classification: C72, D83, H41

I INTRODUCTION

Uncertainty is common in social dilemmas. Many important public goods yield stochastic returns that are not realized until after provision decisions are made. For example, in pollution abatement efforts there may be uncertainty about the effectiveness of abatement methods as well as uncertainty about the dangers of the pollution itself. Investment in preventing natural disasters through measures such as flood control also yield uncertain returns because of the unpredictability of such events. At the global level, the consequences of climate change and effectiveness of mitigation efforts are uncertain.

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Moreover, in many public goods environments there may also be decentralized private information related to the value of contribution (Cox, 2015; Butera and List, 2017). We refer to such public goods as common-value public goods. Such as setting may create a free-riding incentive for individuals not to share their private information truthfully. For example, consider a group of farmers choosing whether to adopt best management practices to reduce nutrient runoff and improve local water quality. The realized water quality depends both on the level of adoption and on the uncertain efficacy of best management practices. Individual farmers have heterogeneous and privately-known estimates of the efficacy of such practices (Wilson et al., 2014). If neighboring farmers truthfully communicate their private information to one another, uncertainty can be reduced. However, each individual can enjoy improved local water quality by encouraging others to adopt best management practices, creating an incentive to exaggerate. This incentive may render communication ineffective.

Analogous social dilemmas may occur in team production, such as joint business ventures with uncertain profitability or collaborative research projects with uncertain potential impact. On a larger scale, participation in climate change mitigation efforts such as the Paris Agreement and the Kyoto Protocol present a similar dilemma, with uncertainty about both the costs of climate change and the efficacy of proposed actions (Stern, 2008; Rogelj et al., 2016).

In such environments, there are potential social gains from information aggregation, but a private incentive to strategically report an overly optimistic assessment of the value of the public good through cheap talk (Crawford and Sobel, 1982; Farrell and Rabin, 1996). Thus, this common-value public goods setting is a social dilemma both in the contribution stage and in the communication stage. Furthermore, private information may also create the potential for free riders to hide behind the possibility that they observed unfavorable information, a type of "moral wiggle room" (Dana et al., 2007; Spiekermann, 2016).

We examine the role of private information and cheap talk in a common-value public goods game. We consider a voluntary contribution linear public goods game in which the marginal per capita return (MPCR) is either high or low, with equal probability ex ante. Before contributing, three players observe private signals correlated with the true MPCR and then send cheap talk messages to one another. There are potential social gains from truthful information sharing, but in equilibrium, cheap talk cannot improve contribution decisions because there is an incentive to misreport one's signal. If other players believe messages are informative, it is always privately optimal to send a "high" message because it encourages others to contribute without risking one's endowment. However, there is evidence from previous studies that some subjects are averse to lying (e.g. Gneezy, 2005; Hurkens and Kartik, 2009; Gneezy et al., 2013), suggesting that communication could be beneficial despite the incentive to lie.

In our first series of experimental treatments, we test whether cheap talk can improve contribution decisions in this environment using a laboratory experiment. The results show that messages are largely truthful, and contribution decisions are substantially influenced by messages. Many subjects appear to follow a majority heuristic, contributing when at least two of three bits of information (own signal and two others' messages) are favorable. In such cases, a large majority of subjects tend to contribute even when the single unfavorable bit of information is their own signal. Moreover, truthfulness and trust persist through multiple rounds of play, even in the commonly-known final round.

In a second series of treatments, we examine the robustness of cheap talk in this environment to increased incentives for misreporting one's private information. We increase this incentive in two ways: by decreasing the accuracy of private signals, and by decreasing the range of possible MPCR values. Our experimental results show that both manipulations significantly increase misreporting. Contribution choices are still influenced by messages, but the gains from communication are relatively small due to reduced truthfulness. Thus, overall our results show that cheap-talk communication can aggregate information and improve contribution decisions in common-value public goods games, but its effectiveness depends on the strength of incentives for exaggerating one's private information.

The paper is organized as follows. Section II reviews the related literature. Section III describes the theoretical model and equilibrium predictions. Section IV details the experimental design and procedures. Section V presents the hypotheses and experimental results. Section VI concludes. Additional analysis and complete experimental instructions are included in the Online Appendix.

II Related Literature

A number of experimental papers examine uncertainty in social dilemmas where the return from the public good contribution is probabilistic.[1] Some of these studies find that an uncertain public-good return lowers contributions (Dickinson, 1998; Gangadharan and Nemes, 2009; Levati et al., 2009). Other studies find that a negative response of uncertain public-good returns on cooperation may depend on the parameterization of the marginal benefits (Levati and Morone, 2013) and the order in which subjects experience uncertainty (Stoddard, 2015). Still

[1]Stoddard et al. (2014) and Fischbacher et al. (2014) also study uncertainty in public goods games where the aggregate group-account return is deterministic, but the allocation of the group fund within a group is probabilistic.

other studies find no evidence that uncertain public-good returns change contribution behavior (Stoddard, 2017; Boulu-Reshef et al., 2017; Theroude and Zylbersztejn, 2017).[2] Overall, these studies show somewhat mixed results about the effect of uncertainty per se on contribution, sensitive to experimental design and parameterization. The baseline setting in this study is a public goods game with an uncertain return from the public good.

Fewer studies have examined common-value public goods. Cox (2015) considers a common-value excludable threshold public good and finds that under-provision may occur due to improper conditioning of beliefs, similar to the winner's curse in common-value auctions (Thaler, 1988; Kagel, 1995; Kagel and Levin, 2002). Butera and List (2017) examine a linear public goods game with Knightian uncertainty and private information about the uncertain return to contribution, finding that greater uncertainty may actually increase contribution.

Related work on leading by example considers an informed first mover who conveys private information to uninformed second movers through a costly action, such as donating to a charity (e.g. Hermalin, 1998; Vesterlund, 2003; Potters et al., 2005; Andreoni, 2006; Potters et al., 2007; Serra-Garcia et al., 2011). In this setting, second movers tend to contribute in response to first-mover contribution. Unlike the current study, in this literature moves are sequential, only the first mover is informed, and information is conveyed through costly signaling. Serra-Garcia et al. (2011) also allow the perfectly-informed leader to send cheap talk messages to the follower about whether the return to contribution is high, low, or intermediate. In the intermediate state, the leader has an incentive to misreport the state as high, and frequently does so. In a treatment allowing vague messages, such as stating that the return is either high or intermediate, the leader often uses such vague messages when the return is intermediate. However, unlike our study, truthful communication in this setting reduces efficiency, and there is no information aggregation as only the leader is informed.

Other public goods experiments examine cheap talk about intended contribution (e.g. Isaac and Walker, 1988; Ostrom et al., 1992; Bochet et al., 2006). These studies find that allowing subjects to communicate face-to-face or in free-form chat increases contribution to the public good. Bochet and Putterman (2009) allow individuals to send limited numeric cheap talk messages and/or make non-binding promises announcing a contribution amount to the public good. They find that neither form of limited cheap talk increases contribution to the public good. However, the combination of promises, numeric cheap talk, and punishment lead to the higher contribution because of the possibility of punishment for broken promises. Palfrey and

[2]When the private-account return is uncertain, contribution is higher in public goods games, but not in common-pool resource games (Gangadharan and Nemes, 2009; Stoddard, 2017).

Rosenthal (1991) examine cheap talk about privately-known endowments, finding no improvement in efficiency. To the best of our knowledge, our study is the first to examine information aggregation by cheap talk with private information about returns to contribution.

The cheap talk messages examined in our study are related to other games of strategic information transmission. In a sender-receiver game where only the sender is informed, Crawford and Sobel (1982)'s classic theoretical result shows that more information is revealed in equilibrium as the preferences of the sender and the receiver become more aligned. Many experiments have examined cheap talk in a variety of related settings (summarized by Crawford, 1998). In particular, Cai and Wang (2006) find senders reveal more private information than predicted by the most informative equilibrium.

Recent work has examined individuals' willingness to lie in sender-receiver games. Gneezy (2005) examines a sender-receiver deception game where the sender sends a message stating which of two options will provide the receiver with the greatest payoff. The options are parameterized such that the sender's and receiver's largest payoffs are in different options. Treatments vary the benefits (to the sender) and costs (to the receiver) from lying. Similar treatments are also examined in dictator games where there is no opportunity to lie. Because the frequency of lying in the deception treatments is lower than the frequencies of choosing the selfish options in the respective dictator treatments, Gneezy finds that subjects have an aversion to lying.

Moreover, Gneezy finds that lying increases when either the sender's individual gains from lying increase or the receiver's costs from the lie decrease. Erat and Gneezy (2012) show further evidence for incentive-sensitive willingness to lie when the receiver is not harmed. Gneezy et al. (2013) classify individual subjects' degrees of lying aversion, finding that some subjects are always truthful, some always lie, and some lie only when the incentive to do so is high.[3] There are many important differences between our setting and the games examined in these papers. However, in our second series of treatments we examine the effect of stronger lying incentives, finding significant increases in lying rates.

III Theory

For simplicity, the endowment is normalized to 1. We denote by c_i the binary contribution to the group fund by player i. The MPCR is denoted by α. The number of players is denoted by n. The payoff of player i is denoted by π_i. We first consider one-shot games before extending the analysis to finitely-repeated games.

[3]Other studies examining lying in related sender-receiver games include Sanchez-Pages and Vorsatz (2007, 2009), Hurkens and Kartik (2009), Peeters et al. (2013), and (Lopez-Perez and Spiegelman, 2013).

In the usual case without uncertainty, player i's payoff function is $\pi_i = (1 - c_i) + \alpha \sum_{j=1}^{n} c_j$, where $\frac{1}{n} < \alpha < 1$. If all group members are self-interested, own-payoff-maximizers, then the dominant strategy equilibrium is for each player i to free ride, choosing $c_i = 0$.

III.A Uncertainty

Assume that the group-fund return is an exogenous random variable $\widehat{\alpha}$ drawn with equal probability from $\{L, H\}$, where $0 \leq L < H$ and $0 \leq L < 1$. Players do not know the realization of the group-fund return until after they make contribution decisions. The expected MPCR equals the MPCR in the case without uncertainty, $E[\widehat{\alpha}] = \alpha$, so that the game is a social dilemma in expectation. Thus, the expected payoff equals the payoff in the case without uncertainty, $E[\pi_i(\widehat{\alpha})] = (1 - c_i) + \alpha \sum_{j=1}^{n} c_j$. If all players are self-interested, non-risk-loving, own-payoff maximizers, then again the dominant strategy equilibrium is for each player to free ride.[4]

III.B Private Information

Now suppose that before making contribution decisions, each group member observes a private signal s_i. The signals are random variables, *iid* conditional on the the state $\widehat{\alpha}$, drawn from support $\{l, h\}$. Each signal s_i accurately predicts $\widehat{\alpha}$ with probability p, that is $Pr(h \mid H) = Pr(l \mid L) = p > 0.5$. Using Bayes' rule, it is straightforward to show that $Pr(L \mid l) = Pr(H \mid h) = p$ and $Pr(H \mid l) = Pr(L \mid h) = 1 - p$.

Thus, the conditional expectation of the MPCR given a signal h is $E[\widehat{\alpha} \mid h] = Pr(H \mid h)H + Pr(L \mid h)L = pH + (1 - p)L$. Likewise, the conditional expectation of the MPCR given a signal l is $E[\widehat{\alpha} \mid l] = Pr(H \mid l)H + Pr(L \mid l)L = (1 - p)H + pL$.

All players will free-ride in Bayesian Nash equilibrium if $E[\widehat{\alpha} \mid h] = pH + (1 - p)L < 1$. This condition guarantees that players observing a signal h will not contribute. Since $E[\widehat{\alpha} \mid l] < E[\widehat{\alpha}] < 1$, players observing a signal l will also free ride.

III.C Cheap Talk

Suppose that after observing signal s_i, player i sends a binary message m_i to all other players from the set $\{\tilde{l}, \tilde{h}\}$. All players observe all messages before making contribution decisions. Assume the parameter conditions from the previous subsection, so that all players will free-ride in a babbling equilibrium. We will refer to players observing signal h as high types, and players observing signal l as low types.

[4]Dickinson (1998) shows that uncertainty reduces the incentive to contribute for risk-averse subjects.

We will show by contradiction that there does not exist a perfect Bayesian equilibrium (PBE) in which communication generates positive contribution. Suppose that such an equilibrium does exist. By our previous assumptions, this PBE must not be a babbling equilibrium, so messages must be informative about signals. Assume without loss of generality that this correlation is in the natural direction, so that $Pr(\tilde{h} \mid h) > Pr(\tilde{h} \mid l)$ and thus $Pr(\tilde{l} \mid l) > Pr(\tilde{l} \mid h)$. Using the odds ratio form of Bayes' rule yields:

$$\frac{Pr(H \mid s_i, m_{-\{i,k\}}, m_k{=}\tilde{h})}{Pr(L \mid s_i, m_{-\{i,k\}}, m_k{=}\tilde{h})} = \frac{Pr(H \mid s_i, m_{-\{i,k\}})}{Pr(L \mid s_i, m_{-\{i,k\}})} \times \frac{Pr(m_k{=}\tilde{h},\ s_k{=}h \mid H)+Pr(m_k{=}\tilde{h},\ s_k{=}l \mid H)}{Pr(m_k{=}\tilde{h},\ s_k{=}h \mid L)+Pr(m_k{=}\tilde{h},\ s_k{=}l \mid L)}$$

$$= \frac{Pr(H \mid s_i, m_{-\{i,k\}})}{Pr(L \mid s_i, m_{-\{i,k\}})} \times \frac{Pr(m_k{=}\tilde{h} \mid s_k{=}h)p+Pr(m_k{=}\tilde{h} \mid s_k{=}l)(1-p)}{Pr(m_k{=}\tilde{h} \mid s_k{=}h)(1-p)+Pr(m_k{=}\tilde{h} \mid s_k{=}l)p} > \frac{Pr(H \mid s_i, m_{-\{i,k\}})}{Pr(L \mid s_i, m_{-\{i,k\}})}$$

Since $Pr(m_k = \tilde{h} \mid s_k = h) > Pr(m_k = \tilde{h} \mid s_k = l)$ and $p > 1 - p$. That is, i updates her belief that the MCPR is High upward when k sends a high message. By similar reasoning, i updates her belief that the MCPR is High downward when k sends a low message. Therefore, $E[\widehat{\alpha} \mid s_i, m_{-\{i,k\}}, m_k = \tilde{h}] > E[\widehat{\alpha} \mid s_i, m_{-\{i,k\}}, m_k = \tilde{l}]$. That is, the i's expectation of the MCPR is higher when k reports $\tilde{h}$ than when k reports $\tilde{l}$.

Since we assume that positive contribution occurs, it must be the case that if i is a high type, then i will contribute with positive probability if $m_j = \tilde{h}\ \forall j \neq i$, as this case is the most favorable information possible about the MCPR. It must also be the case that player i will not contribute if $m_j = \tilde{l}\ \forall j \neq i$, since $E[\widehat{\alpha} \mid h, m_j = \tilde{l}\ \forall j \neq i] \leq E[\widehat{\alpha} \mid h] < 1$.

Therefore, i is weakly more likely to contribute if $m_k = \tilde{h}$ than if $m_k = \tilde{l}$, and in some cases (for some values of $m_{-\{i,k\}}$), strictly more likely to contribute. Similar reasoning holds for low types, if low types ever contribute in the PBE.

Now suppose player i observes signal l. If i reports truthfully ($m_i = \tilde{l}$), the other players are less likely to contribute than if i lies, reporting $m_i = \tilde{h}$. This lie increases the probability that other players contribute, which increases i's expected payoff. Therefore, i can profitably deviate from the assumed PBE by lying, and thus i will always report $m_i = \tilde{h}$ regardless of s_i. However, for positive contribution to occur in equilibrium, messages must be informative about signals, yielding a contradiction.[5]

The standard backward induction argument extends this result to the case of a T-round finitely-repeated game (Kim, 1996). Since in round T there will be no contribution, and messages cannot influence contribution choices, there is no incentive for reputation building in

[5]In the game with cheap talk, there are many possible equilibria, but communication is ineffective in all of them. One intuitively appealing equilibrium is for all players to report $m_i = \tilde{h}$ and free ride regardless of the signal observed. If we rule out strategies such that received $\tilde{h}$ messages and contribution are negatively correlated, then reporting $m_i = \tilde{h}$ weakly dominates reporting $m_i = \tilde{l}$ in the stage game.

round $T-1$, and likewise for round $T-2$, and so forth. Similar reasoning also applies to the cases without communication and without private information, so that no contribution occurs in finitely-repeated versions of these games.

IV Experimental Design and Procedures

In the first series, we consider three treatments: Baseline uncertainty with no private information or communication, Signals with private information but no communication, and Cheap Talk with both private information and communication. In all treatments, subjects are randomly matched into groups of three at the beginning of each session, and groups remain fixed over 10 rounds of repeated play (Partners matching). Each player makes a binary contribution choice each round to allocate a single token to the group account or a private account. The MPCR of contribution to the group account is either High (1.1) or Low (0) with equal probability ex ante, so that the prior expected MPCR is 0.55.

In the Signals treatment, before making a contribution decision, each player observes a private signal correlated with the true MPCR. Signals are independent across players, conditional on the true state (MPCR). Conditional on a High (Low) state, the probability of observing a High (Low) signal is 0.8. Thus, the expected MPCR conditional on a High signal is $0.88 < 1$.

In the Cheap Talk Treatment, each player first observes a private signal with the same information structure as in the Signals treatment. After observing this signal, but before making a contribution decision, each player can send a binary message, "High" or "Low," to the other group members. Each player then observes the messages sent by their group members, and then makes a contribution choice. Given the parameters we use, the expected MPCR would only exceed 1 if all three signals are High, and all players report truthfully.

At the end of the round in all treatments, each player is given feedback about their payoffs and the contribution choices of the other players in their group. In the Cheap Talk treatment, each player is also shown again the messages sent by the other players in their group in that round. Importantly, in the the Signals and Cheap Talk treatments, individual signals are never revealed to other subjects.

As discussed in the next section, the results from the first series show that cheap talk is mostly truthful and strongly influences contribution choices. To examine the robustness of these results, we ran a second series of treatments in which the incentive to misreport one's private information is increased. We increase this incentive in two ways: by using a smaller range (SR) of possible MPCR values and by using a weaker signal (WS).

The Signals SR and Cheap Talk SR treatments are similar to the original Signals and Cheap Talk treatments, except that the uncertain MPCR takes values of 0.3 or 0.8, rather than 0 or 1.1.

Treatment	H	L	Private Signals	Communication	Signal Accuracy	Subjects	Groups
				First Series			
Baseline	1.1	0	No	No	0.8	42	14
Signals	1.1	0	Yes	No	0.8	45	15
Cheap Talk	1.1	0	Yes	Yes	0.8	96	32
				Second Series			
Signals SR	0.8	0.3	Yes	No	0.8	33	11
Cheap Talk SR	0.8	0.3	Yes	Yes	0.8	72	24
Signals WS	1.1	0	Yes	No	0.7	36	12
Cheap Talk WS	1.1	0	Yes	Yes	0.7	78	26

Table I. *Treatment Summary*

Note that this distribution is a mean-preserving contraction of the original MPCR distribution, so that the ex ante expected MPCR is 0.55 in both cases. As discussed in more detail in Subsection IV.C, this manipulation increases the incentive to misreport by creating a positive external benefit to contribution even in the Low state, so that each individual subject is strictly better off when other group members contribute, regardless of the state.

The Signals WS and Cheap Talk WS treatments are similar to the original Signals and Cheap Talk treatments, except that the signal accuracy is reduced to 0.7 rather than 0.8. As discussed in Subsection IV.C, this change increases the probability of the state actually being High given a Low signal, and increases the likelihood that a particular subject's message is pivotal in the contribution decisions of other group members.

Table I summarizes the treatments. At the end of each session in all treatments, subjects completed a brief demographic survey and were then paid in cash, using a conversion rate of \$0.70 for each token earned in the experiment. Subjects earned approximately \$18 each on average, including a \$5 show-up fee. Each session included 6-15 subjects (2-5 groups) and lasted less than one hour.

All experimental sessions were conducted at Virginia Commonwealth University between Spring 2016 and Summer 2017. Student subjects were recruited by email using ORSEE (Greiner, 2015). At the beginning of each session, subjects were given a set of printed instructions, which were then read aloud by the experimenter. After reading the instructions, subjects took a post-instruction comprehension quiz and were not allowed to continue with the experiment until all answers were correct. Subjects made all decisions on computers in private. The experiment was programmed and conducted in z-Tree (Fischbacher, 2007). Complete experimental instructions are included in the Online Appendix.

V Hypotheses and Results

V.A Hypotheses: First Series

The first series of treatments (Baseline, Signals, and Cheap Talk) are designed to examine the effect of private information and communication in a common-value public goods games. Hypotheses 1 and 2 are implications of the equilibrium prediction in the Cheap Talk game. In equilibrium, communication and contribution break down completely, despite an expected MPCR greater than one conditional on three High signals with truthful communication.

Hypothesis 1. Cheap talk messages will be uninformative about the sender's signal.

Hypothesis 2. Cheap talk messages will not influence the receivers' contribution choices.

Additionally, given that we do observe positive contribution and effective communication overall, we will examine whether such cooperative behavior decays across rounds. We also examine whether private information per se reduces contribution due to moral wiggle room, as subjects may hide behind the possibility of a Low signal as an excuse for free riding (Dana et al., 2007; Spiekermann, 2016).

V.B Contribution and Truthfulness: First Series

Figure I shows the average contribution rates by treatment, signal, and messages observed. Compared to the Baseline with no private information, contribution is significantly higher in the Signals treatment with a High signal (H), p-value=0.002, and lower with a Low signal (L), p-value<0.001.[6] Overall average contribution in the Signals treatment (47.8%) is not significantly different from overall average contribution in the Baseline (55.2%), p-value=0.210. Moreover, if private information reduces contribution due to moral wiggle room, we would expect to see contribution decisions following the signal when the signal is Low, but not when it is High, because the expected MPCR conditional on a High signal is $0.88 < 1$. In the Signals treatment, the rate of following a High signal (contributing) is 78.2%, slightly lower than the rate of following a Low signal (not contributing), 84.1%. However, the difference is not significant, p-value=0.396. Moreover, there are very few subjects who free ride in all 10 rounds in either the Signals treatment (4.4%), or the Baseline (4.7%).[7]

[6] To compare proportions, we use simple logistic regressions with standard errors clustered at the group level.

[7] While we find little evidence of a moral wiggle room effect in the Signals treatment, we find suggestive evidence for another form of moral wiggle room in treatments with communication, discussed in Appendix subsection AI.B. Some subjects send a Low message after observing a High signal, possibly as an "excuse" to free ride.

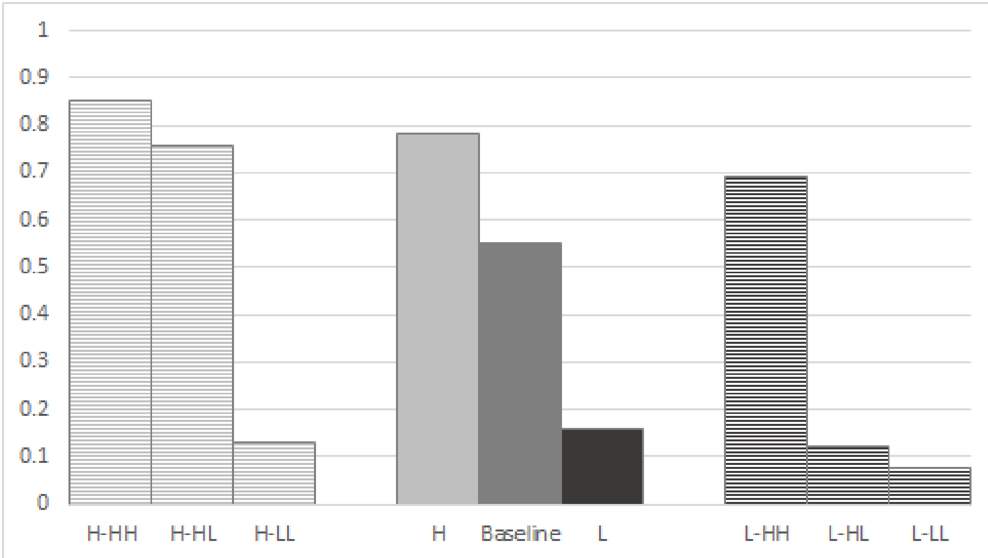

Figure I. *Contribution rates in Baseline, Signals (H, L), and Cheap Talk (H-HH, H-HL, H-LL, L-HH, L-HL, L-LL).*

Result 1. In the Signals treatment, overall average contribution does not differ significantly from the Baseline, and contribution decisions mostly follow private information. There is little evidence of a moral wiggle room effect in the Signals treatment.

With Cheap Talk, contribution rates when one or more others' messages agree with the observed signal (H-HH, H-HL, L-HL, L-LL) are similar to the rates in the Signals treatment (H, L). However, when both messages conflict with the signal (L-HH, H-LL), most decisions follow the messages rather than the signal. Conditional on observing a Low signal, the contribution rate in the Cheap Talk treatment when the other group members' messages are both High (L-HH) is significantly higher than the contribution rate in the Signals treatment (L), p-value$<$0.001. Similarly, conditional on observing a High signal, the contribution rate in the Cheap Talk treatment when others' messages are both Low (H-LL) is significantly lower than the contribution rate in the Signals treatment (H), p-value$<$0.001.

Overall, most decisions (83.5%) follow a majority rule, contributing whenever at least two of three bits of information (signal and others' messages) are favorable. In fact, when the observed signal is Low, but both others' messages are High (L-HH), the contribution rate is not significantly different from the case of observing a High signal and split messages (H-HL), p-value$=$0.201. Similarly, contribution rates in the cases where two of three bits of information are unfavorable (H-LL, L-HL) do not differ significantly from one another, p-value$=$0.844.

Result 2. In the Cheap Talk treatment, messages influence contribution choices when they conflict with the observed signal, contrary to Hypothesis 2. Most choices follow a majority rule.

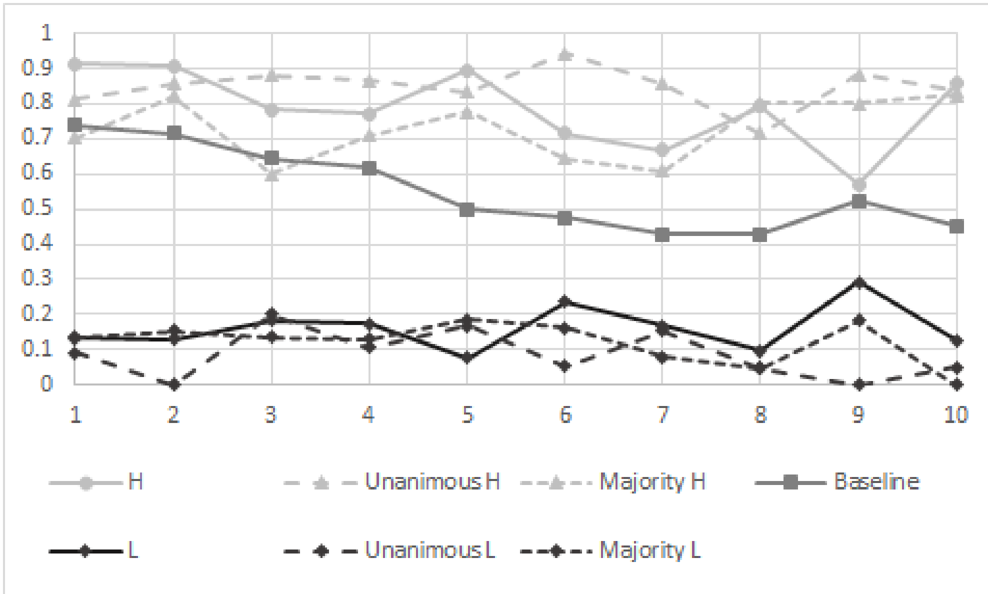

Figure II. *Contribution rates across rounds.*

Figure II shows contribution rates across the ten rounds of play. In the Baseline treatment, there is a clear downward trend in contribution, as commonly found in many public goods experiments (Ledyard, 1995; Chaudhuri, 2011). However, contribution rates appear more stable in the Signals treatment (H, L) and Cheap Talk treatment (Unanimous H, Majority H, Unanimous L, Majority L).[8]

Figure III shows the rates of truth-telling in Cheap Talk by signal across the 10 rounds. Messages were 98% truthful conditional on a High signal (when there is no incentive to misreport), and 89% truthful conditional on a Low signal (when there is an incentive to misreport). Moreover, truthfulness does not appear to decline in later rounds. Of the 96 subjects in the Cheap Talk treatment, 75 (78.1%) sent truthful messages in all ten rounds. However, there is some evidence of strategic misreporting, as the rate of truth-telling is significantly lower with a Low signal than with a High signal, p-value$<$0.001.

Result 3. While there is evidence of some strategic lying, the vast majority of communication is truthful throughout the ten rounds of play, contrary to Hypothesis 1.

The previous results have shown that communication is largely truthful, and messages strongly influence contribution choices. Next, we examine whether communication leads to improved

[8]Unanimous H and Unanimous L include cases in which subjects observed signal and received messages are all High or all Low. Majority H and Majority L include cases in which an exactly two of these three bits of information are High or Low, respectively. In Appendix subsection AI.C, the contribution rate paths of Majority H subcategories L-HH and H-HL are shown separately. These paths are similar, and are combined in Figure II for readability.

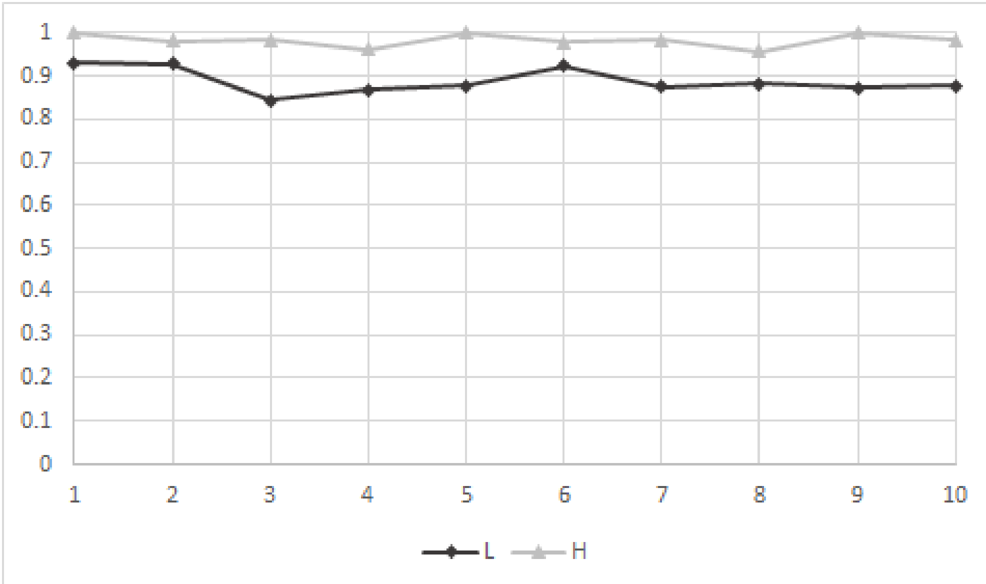

Figure III. *Truthfulness by signal and round.*

decisions. Figure IV shows the rates of contribution by state (true MPCR) and observed signal for the Signals and Cheap Talk treatments. When the signal matches the state, there is little difference in contribution rates in either the High state or the Low state. However, when the signal is incorrect, contribution decisions are substantially improved in the Cheap Talk treatment. In such cases, Cheap Talk significantly increases contribution in the High state (p-value=0.001), and decreases contribution in the Low state (p-value$<$0.001).

Result 4. Communication improves contribution decisions.

To further examine individual strategies, we also conducted a strategy method version of the Cheap Talk treatment, discussed in detail in Appendix subsection AI.A. In this additional treatment, in each round subjects chose contingent messages for each possible signal and contributions for each possible combination of signal and messages from others. While we find a similar overall pattern of contribution decisions in the strategy method treatment compared to the original Cheap Talk treatment, truthfulness is substantially lower using the strategy method. Therefore, we focus our main analysis on treatments that use direct response rather than the strategy method. However, it is an interesting methodological result that the strategy method affected the truthfulness of communication in this context. Examining whether this result extends to other cheap talk games is an interesting direction for future research.

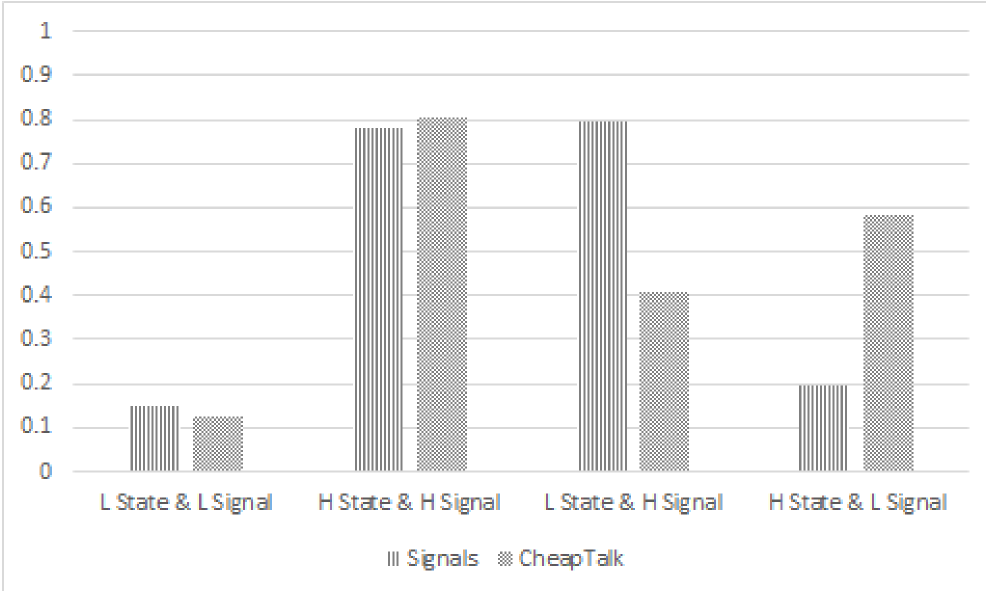

Figure IV. *Contribution rates by state and signal.*

V.C Hypotheses: Second Series

The results of the first series show that cheap talk can be effective in aggregating information and improving contribution decisions in this setting. In this section, we examine the robustness of these results when the incentive to misreport one's private information is increased. In the equilibrium prediction, this incentive is zero because others do not trust messages, so each individual is indifferent between truthful and untruthful messages. However, given the behavior observed in the Cheap Talk treatment, there is a positive expected benefit to misreporting when one's signal is Low.

Moreover, it is possible to quantify the incentive to misreport in the Cheap Talk treatment. First, based on the first series results, we make the simplifying assumption that other subjects are truthful and follow the majority in their contribution choices. Given that other subjects use this strategy, a particular subject benefits from misreporting a Low signal if the true state is High (i.e. the signal is incorrect) and the other two subjects' signals are split. In this case, the subject's message is pivotal in the contribution choices of the other subjects, and the others' contributions are valuable. Recall that the maximum total amount contributed by others is 2, and the MPCR in the High state is 1.1. Thus, conditional on observing a Low signal, the subject's expected benefit of misreporting is:

$$Pr(H \mid l) \times [2\,Pr(l \mid H)Pr(h \mid H)] \times 2 \times 1.1 = 0.2 \times [2 \times 0.2 \times 0.8] \times 2 \times 1.1 \approx 0.141$$

That is, misreporting a Low signal increases the subject's expected stage game payoff by approximately 14.1% of the endowment. We examine two ways of increasing this incentive, assuming the same strategy for the other subjects: using a smaller range of possible MPCR values, and weakening the accuracy of the private signals.

In the Smaller Range (SR) treatments, we change the Low and High MPCR values to 0.3 and 0.8, respectively. Thus, the distribution of MPCR values in the SR treatments is a mean-preserving contraction of the distribution in the original treatments, so that the ex ante expected MPCR is still 0.55. In the SR treatments, there is an external benefit to contribution even when the true state is Low. Thus, an individual subject always benefits from the contributions of others. In the Cheap Talk SR treatment, assuming other subjects are truthful and follow the majority, the expected benefit of misreporting a Low signal is:

$$
\begin{aligned}
&Pr(H \mid l) \times [2\, Pr(l \mid H) Pr(h \mid H)] \times 2 \times 0.8 + Pr(L \mid l) \times [2\, Pr(l \mid L) Pr(h \mid L)] \times 2 \times 0.3 \\
&= 0.2 \times [2 \times 0.2 \times 0.8] \times 2 \times 0.8 + 0.8 \times [2 \times 0.8 \times 0.2] \times 2 \times 0.3 \approx 0.256
\end{aligned}
$$

That is, misreporting a Low signal in the Cheap Talk SR treatment increases the subject's expected stage game payoff by approximately 25.6% of the endowment. This stronger incentive to misreport leads to the next hypothesis.

Hypothesis 3. Conditional on observing a Low signal, rates of truthfulness will be lower in Cheap Talk SR compared to the original Cheap Talk treatment.

In the Weaker Signal (WS) treatments, we decrease the accuracy of the private signals from 0.8 to 0.7. This manipulation increases the incentive to misreport in two ways. First, conditional on a Low signal, the probability that the true state is High increases. Second, reduced signal accuracy increases the probability that the other two subjects' signals are split, thus increasing that chance that an individual subject's message is pivotal. In the Cheap Talk WS treatment, again assuming other subjects are truthful and follow the majority, the expected benefit of misreporting a Low signal is:

$$
Pr(H \mid l) \times [2\, Pr(l \mid H) Pr(h \mid H)] \times 2 \times 1.1 = 0.3 \times [2 \times 0.3 \times 0.7] \times 2 \times 1.1 \approx 0.277
$$

That is, in the Cheap Talk WS treatment, misreporting a Low signal increases the subject's expected stage game payoff by approximately 27.7% of the endowment. The next hypothesis is based on this stronger incentive to misreport.

Hypothesis 4. Conditional on observing a Low signal, rates of truthfulness will be lower in Cheap Talk WS compared to the original Cheap Talk treatment.

In addition to the Cheap Talk SR and Cheap Talk WS treatments, we run Signals SR and Signals WS treatments to examine whether the gains from communication are diminished due to stronger incentives to misreport. We do not focus on Baseline treatments without private information in this section, as we are interested cheap talk rather than the affect of private information per se.

V.D Contribution and Truthfulness: Second Series

Figure V shows the rates of truthful communication in Cheap Talk SR and Cheap Talk WS compared to the original Cheap Talk treatment. Relative to Cheap Talk, subjects truthfully report a Low signal significantly less frequently in Cheap Talk SR (p-value=0.001) and in Cheap Talk WS (p-value=0.019). Thus, our results confirm that increasing the incentive to misreport reduces the rate of truthful communication.

Result 5. Consistent with Hypotheses 3 and 4, communication is less truthful in Cheap Talk SR and Cheap Talk WS compared to the original Cheap Talk treatment.

Figure VI shows the overall average rates of contribution in the SR and WS treatments by signal and messages observed. The pattern is similar to the observed in the first series treatments. In particular, conditional on a Low signal, the contribution rates in Cheap Talk SR and Cheap Talk WS when both observed messages are High (L-HH) is significantly greater than the respective contribution rates in Signals SR and Signals WS (L), p-values$\leq$0.001. Similarly, conditional on a High signal, we find smaller contribution rates in Cheap Talk SR and Cheap Talk WS when both observed messages are Low (H-LL) compared to the respective contribution

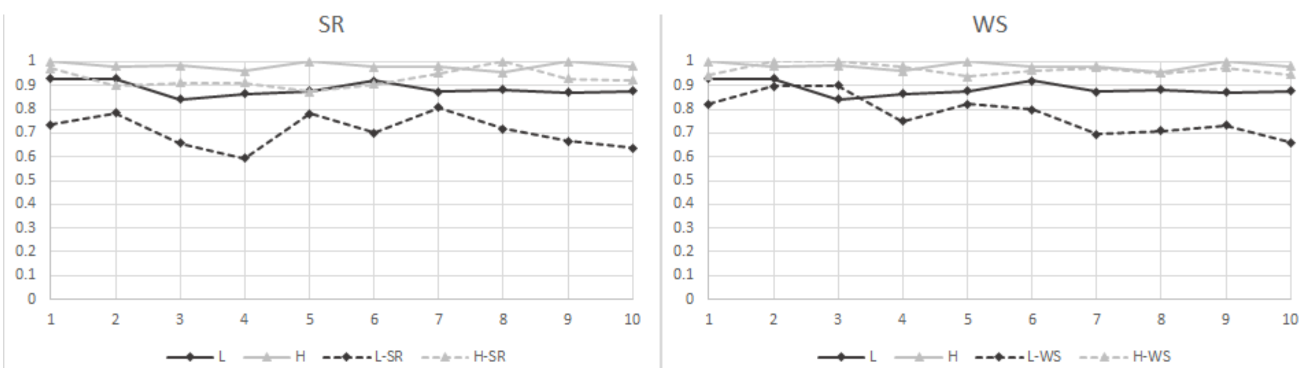

Figure V. *Truthfulness by signal and round Cheap Talk SR (H-SR, L-SR) and Cheap Talk WS (H-WS, L-WS) compared to Cheap Talk (H, L).*

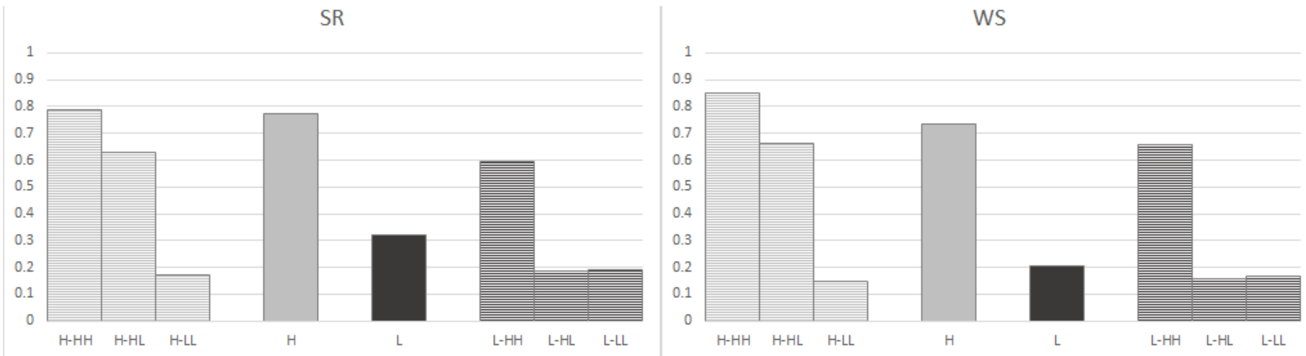

Figure VI. *Contribution rates in Signals SR and Signals WS (H, L) and in Cheap Talk SR and Cheap Talk WS (H-HH, H-HL, H-LL, L-HH, L-HL, L-LL).*

rates in Signals SR and Signals WS (H), p-values<0.001. Thus, despite decreased truthfulness relative to the original Cheap Talk treatment, we find that messages still influence contribution

Result 6. Messages influence contribution choices in Cheap Talk SR and Cheap Talk WS.

Figure VII shows the contribution rates in the SR and WS treatments across the 10 rounds. Unlike the original Cheap Talk treatment, contribution rates in the Majority H case of Cheap Talk SR and Cheap Talk WS appear to decay somewhat with repetition. This pattern is consistent with decreasing trust due to less truthful communication.

Figure VIII shows the average contribution rates in the SR and WS treatments by signal observed and state. In cases where the private signal is correct, we again find no significant differences in contribution rates with and without communication. In SR treatments, communication yeilds a marginally significant decrease in contribution when an incorrect High signal is observed, p-value$=0.087$. However, the communication does not yeild a significant increase in contribution when an incorrect Low signal is observed, p-value$=0.285$. In WS treatments,

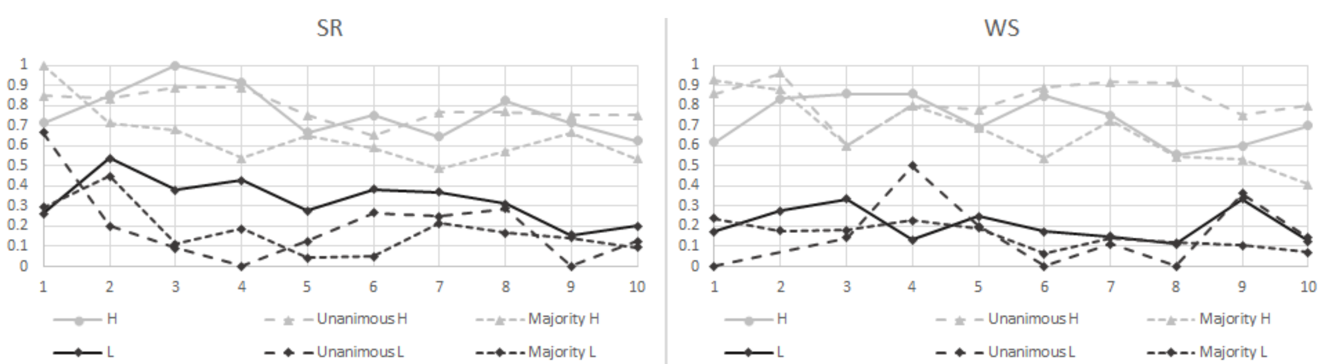

Figure VII. *Contribution rates across rounds in SR and WS treatments.*

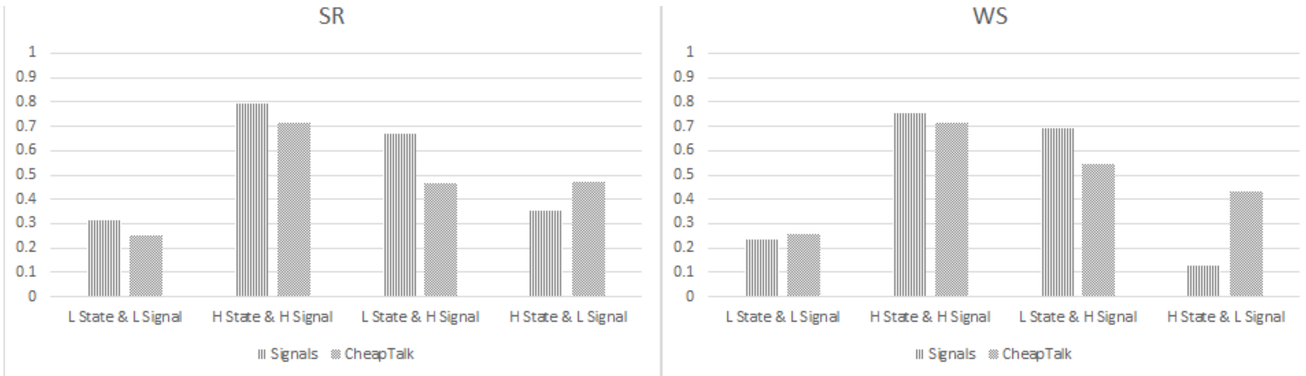

Figure VIII. *Contribution rates by state and signal in SR and WS treatments.*

communication improves contribution decisions when an incorrect Low signal is observed (p-value=0.001), but not when an incorrect High signal is observed (p-value=0.263). Where contribution decisions are improved, the effect is smaller than in the first series treatments.

Result 7. Cheap talk improves contribution decisions in the SR and WS treatments. However, the gain from communication is smaller compared to the first series treatments.

V.E Suspicion and Decay of Cooperation

The results shown in Figures II and VII suggest that cooperation decays with repeated play in Cheap Talk SR and Cheap Talk WS, but not in the original Cheap Talk treatment. This result may be related to the greater frequency of misreporting in the second series treatments.

While subjects can never be certain that others in their group have misreported in previous rounds, they may suspect misreporting under certain circumstances. To capture such circumstances, we define "suspicious behavior" as follows. A particular subject's behavior within a round is classified as suspicious if the subject sends a High message, observes fewer than two Low messages, and does not contribute. That is, the subject reported High and was not contradicted by both other group members, but still chose to free ride. In such circumstances, other group members may suspect that this subject's signal was actually Low.

Table II shows logistic regression models for contribution in Majority-H cases (H-HL and L-HH) of Cheap Talk, Cheap Talk SR, and Cheap Talk WS. Odds ratios are reported, so that estimates greater than one indicate positive correlations, while estimates less than one indicate negative correlations. The variable Suspicion is an indicator for suspicious behavior by any other member of a subject's group in any previous round. We find significantly reduced contribution after observing suspicious behavior in Cheap Talk (p-value=0.001) and Cheap Talk SR (p-value=0.004). We find a similar directional effect in Cheap Talk WS, but it is not statistically

	Cheap Talk		Cheap Talk SR		Cheap Talk WS	
Independent Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Round	1.06	1.16***	0.91**	0.97	0.79***	0.83***
	(0.05)	(0.06)	(0.04)	(0.05)	(0.03)	(0.04)
H-HL	1.42	1.44	1.17	1.10	0.88	0.81
	(0.39)	(0.41)	(0.26)	(0.27)	(0.25)	(0.24)
Suspicion	–	0.23***	–	0.32***	–	0.51
		(0.10)		(0.13)		(0.24)
Constant	1.64	1.94*	2.57***	3.37***	8.35***	9.25***
	(0.60)	(0.72)	(0.84)	(1.38)	(2.72)	(3.12)
N	285	285	207	207	282	282
Clusters	32	32	24	24	26	26

Table II. *Logistic regressions for contribution in Majority H cases. Odds ratios are reported, with robust standard errors in parentheses, clustered by group. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.*

significant (p-value=0.152). Consistent with the patterns in Figures II and VII, we find significant downward trends in contribution in Cheap Talk SR and Cheap Talk WS, but not in the original Cheap Talk treatment. However, after controlling for Suspicion, the downward trend in Cheap Talk SR is no longer significant, and we find a significant *upward* trend in the original Cheap Talk treatment. We still find a downward trend in Cheap Talk WS after controlling for Suspicion, though it becomes somewhat less pronounced.

Result 8. Contribution decays with repeated play in Cheap Talk SR and Cheap Talk WS, but not in the original Cheap Talk treatment. In Cheap Talk and Cheap Talk SR, contribution decreases following suspicious behavior by other group members.

VI Discussion

We find that cheap talk can improve contribution decisions in common-value public goods environments, despite incentives to lie. When unable to communicate, subjects mostly follow their private information. In the Cheap Talk treatment, communication is largely truthful and strongly influences contribution choices. Most decisions follow a majority rule, even when in conflict with the observed signal. While we find some evidence of strategic lying, the results of our first series of treatments suggest that cheap talk can be effective for aggregating decentralized information in this setting.

In our second series of treatments, we then examine the robustness of cheap talk in this setting by increasing the incentive to lie in two ways: reduced signal accuracy and smaller MPCR range. Reducing signal accuracy increases the chance of one's (low) signal being incorrect, and increases the chance of one's (high) message being pivotal in the contribution decisions of other players. Reduced MPCR variance increases the potential reward for misreporting in the case that the MPCR is actually low. We find that both manipulations significantly increase the frequency of misreporting relative to the original cheap talk treatment. Cheap talk messages still influence others' contribution choices. However, the benefit of cheap talk is smaller due to less truthful communication.

Overall, our results show that cheap talk can be an effective means of aggregating information in common-value public goods environments, despite incentives to exaggerate one's signal. However, truthfulness is sensitive to the strength of the incentive to misreport.

Future research might examine the effectiveness of cheap talk in other variations of this social dilemma, such as one-shot games, larger group sizes, and games with costly information acquisition or communication. Another interesting extension might be the case of interdependent values, where the public good has both common and private value components. For example, some public projects generate profits specific to the firms contracted to build them in addition to their broader social benefits. In such cases, individuals with large private values would have an additional incentive to exaggerate their signals about the common-value component.

Understanding the tension between social gains from information sharing and private incentives to lie may be important for policy makers. In environments with strong incentives for untruthful communication, failure of information aggregation may be an impediment to the voluntary provision of public goods, in addition to the classic free-rider problem. In such cases, alternative institutions for public goods provision may be necessary. Furthermore, we find more strategic lying when individuals have less accurate information. Educational efforts to provide information about the value of public goods may thus encourage truthful information sharing at the group level, in addition to decreasing uncertainty at the individual level.

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ONLINE APPENDIX TO ACCOMPANY: COMMON-VALUE PUBLIC GOODS AND INFORMATIONAL SOCIAL DILEMMAS

CALEB A. COX AND BROCK STODDARD

AI Additional Analyses

AI.A Cheap Talk Strategy Method Treatment

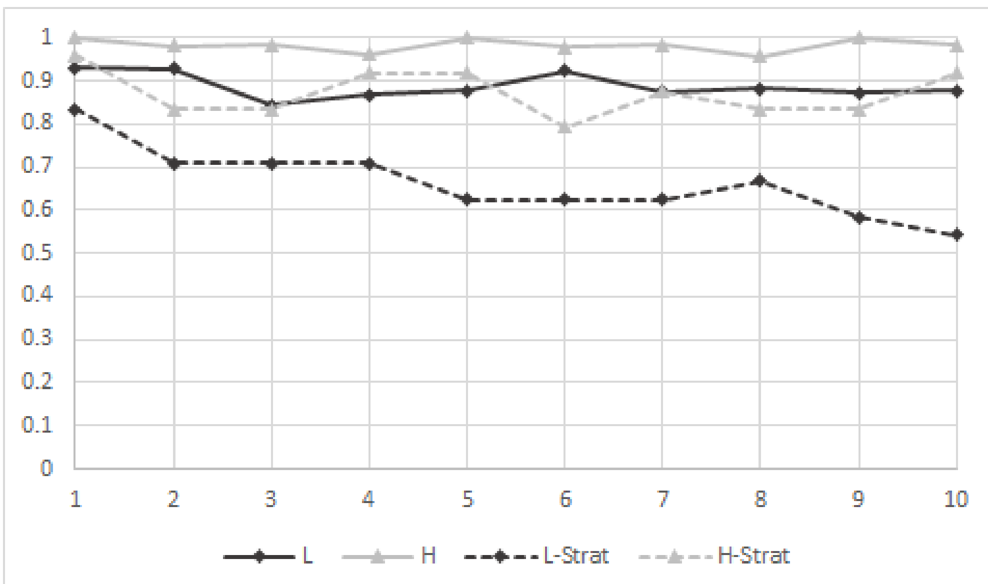

Figure AI. *Truthfulness by signal and round in Cheap Talk Strat (H-Strat, L-Strat) compared to Cheap Talk (H, L).*

In treatments with communication, there are many conditional contribution rates and truthfulness rates of interest, with few observations in some cells. To increase sample size for these various contingencies, we ran a strategy method version of the original Cheap Talk treatment. This treatment is referred to as Cheap Talk Strat. The game parameters were identical to Cheap Talk, but in each round, each subject reported conditional messages for each possible signal realization (High and Low) and conditional contribution decisions for each possible combination of own signal and others' messages. Thus, each subject made 10 conditional decisions in

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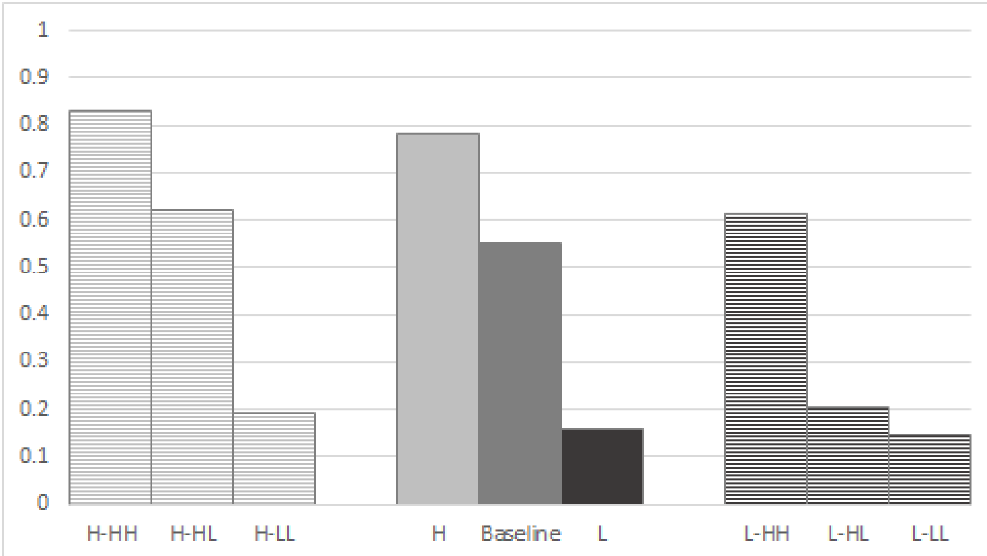

Figure AII. *Contribution rates in Baseline, Signals (H, L) and Cheap Talk Strat (H-HH, H-HL, H-LL, L-HH, L-HL, L-LL).*

each round. Full instructions are included in this Online Appendix. We ran 2 sessions of this treatment, with 12 subjects per session for a total of 24 subjects in 8 groups.

Figure AI shows rates of truthfulness across rounds in Cheap Talk Strat compared with the original Cheap Talk treatment. Conditional on a Low signal, truthfulness is substantially lower in Cheap Talk Strat (p-value$<$0.001). Interestingly, we also find reduced truthfulness conditional on a High signal in Cheap Talk Strat (p-value$<$0.001). Thus, it is clear that the strategy method affects behavior in this environment, so we chose to focus our main analysis on treatments that do not use the strategy method.

However, it is of some interest to examine contribution rates in Cheap Talk Strat. Figure AII shows overall contribution rates for various combinations of own signal and others' messages in comparison to contribution rates in the Baseline treatment and the Signals treatment conditional on High (H) and Low (L) signals.[1] The pattern is very similar to the original Cheap Talk treatment, with others' messages clearly influencing contribution choices when they conflict with the signal.

Figure AIII shows the path of contribution rates across rounds in Cheap Talk Strat. A notable difference compared to the original Cheap Talk treatment is that contribution in Majority H cases appears to decay across rounds. This result may be driven by the relatively high rate of misreporting eroding trust. In Table AI, we use a logistic regression model to examine the

[1]Since we decided to focus our main results on treatments that do not use the strategy method, we did not run a strategy method version of the Signals treatment.

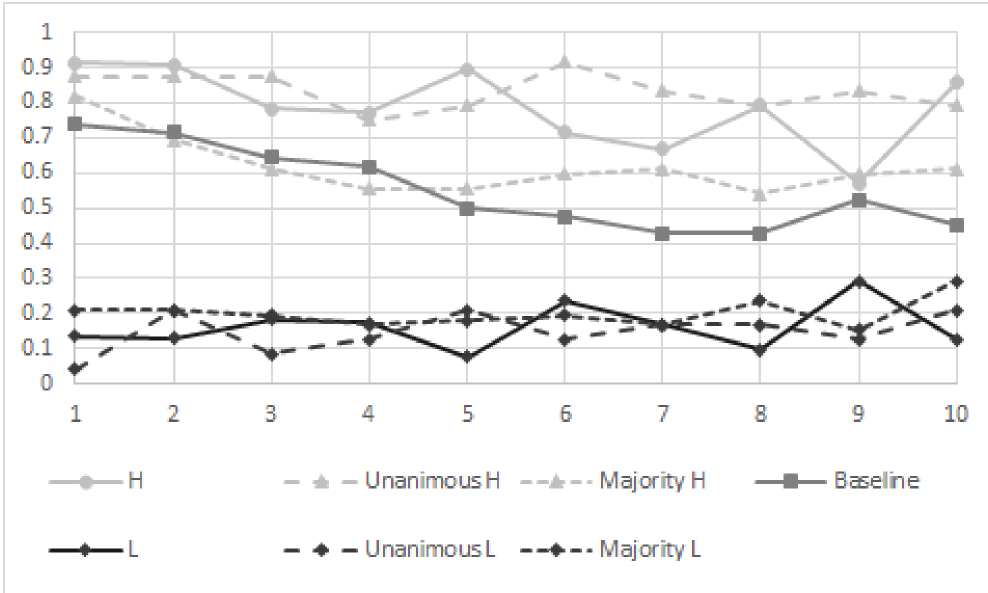

Figure AIII. *Contribution rates across rounds in Cheap Talk Strat.*

effect of "suspicious behavior" by other group members in previous rounds. Suspicious behavior is defined as in the main paper. Observing other group members behaving suspiciously in any previous round is negatively correlated with contribution, and the effect is marginally significant (p-value=0.082). Moreover, when the indicator for observing suspicous behavior is included, the downward trend in contribution becomes insignificant.

	Cheap Talk Strat	
Independent Variable	Model A1	Model A2
Round	0.93***	1.03
	(0.02)	(0.06)
H-HL	1.05	1.05
	(0.22)	(0.23)
Suspicion	–	0.34*
		(0.21)
Constant	2.33**	2.47**
	(0.84)	(1.05)
N	720	720
Clusters	8	8

Table AI. *Logistic regressions for contribution in Majority H cases in Cheap Talk Strat. Odds ratios are reported, with robust standard errors in parentheses, clustered by group. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.*

AI.B Downward Misreporting and Moral Wiggle Room

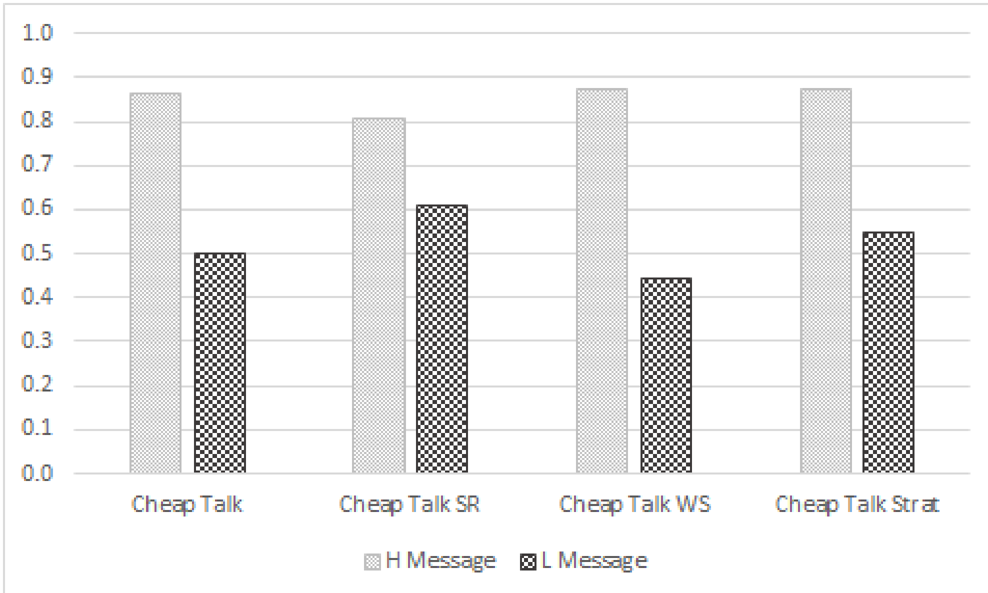

Figure AIV. *Contribution rates in Unanimous H cases by message sent.*

In the original Cheap Talk treatment, misreporting a High signal is very rare. We initially interpreted this form of misreporting as noise, perhaps due to confusion or boredom. However, such downward misreporting is significantly more frequent in Cheap Talk SR and Cheap Talk Strat. This result raises the question of why a subject might send a Low message conditional on a High signal. One possibility is a form of moral wiggle room: if a subject intends to free ride regardless of others' messages, sending a Low message might make such a decision appear justified, giving the subject an "excuse" for free riding. This motive might be particularly salient in Cheap Talk SR, where the MPCR is always less than one, even in the High state. However, even in the other Cheap Talk treatments, the expected MPCR is always less than one unless others' messages are believed to be (almost) perfectly truthful and all three bits of available information are High. Moreover, a risk averse subject may prefer to free ride even in this case.

To examine whether our data are consistent with this conjecture, we examine contribution rates in Unanimous H cases in which a subject sent a Low message. In other words, we are interested in cases where a subject observed a High signal, sent a Low message, and received two High messages from the other group members. Because of the low frequency of downward misreporting, there are few observations of such cases in Cheap Talk, Cheap Talk SR, and Cheap Talk WS (8, 18, and 9 observations, respectively), but somewhat more in Cheap Talk Strat (31 observations). However, we find a consistent pattern. Figure AIV shows these contribution rates in comparison to Unanimous H cases in which a High message was sent. In every treatment, contribution rates are lower when the subject sent a Low message rather than a High message. The difference is statistically significant in Cheap Talk (p-value=0.013), Cheap Talk WS (p-value<0.001), and Cheap Talk Strat (p-value<0.001), but not in Cheap Talk SR (p-value=0.112). These results are consistent with the moral wiggle room explanation of downward misreporting. However, moral wiggle room is an ex post explanation for this behavior, so we interpret this evidence as suggestive only.

AI.C Majority-H Across Rounds

Figure AV shows contribution rates across rounds in all cases with overall favorable information, splitting the Majority H category into L-HH and H-HL subcategories. In all treatments, the paths of L-HH and H-HL contribution rates across rounds are similar.

The Majority L category is of lesser interest. Moreover, there are few observations for subcategories L-HL and H-LL in some rounds due to the tendency for subjects to send High messages

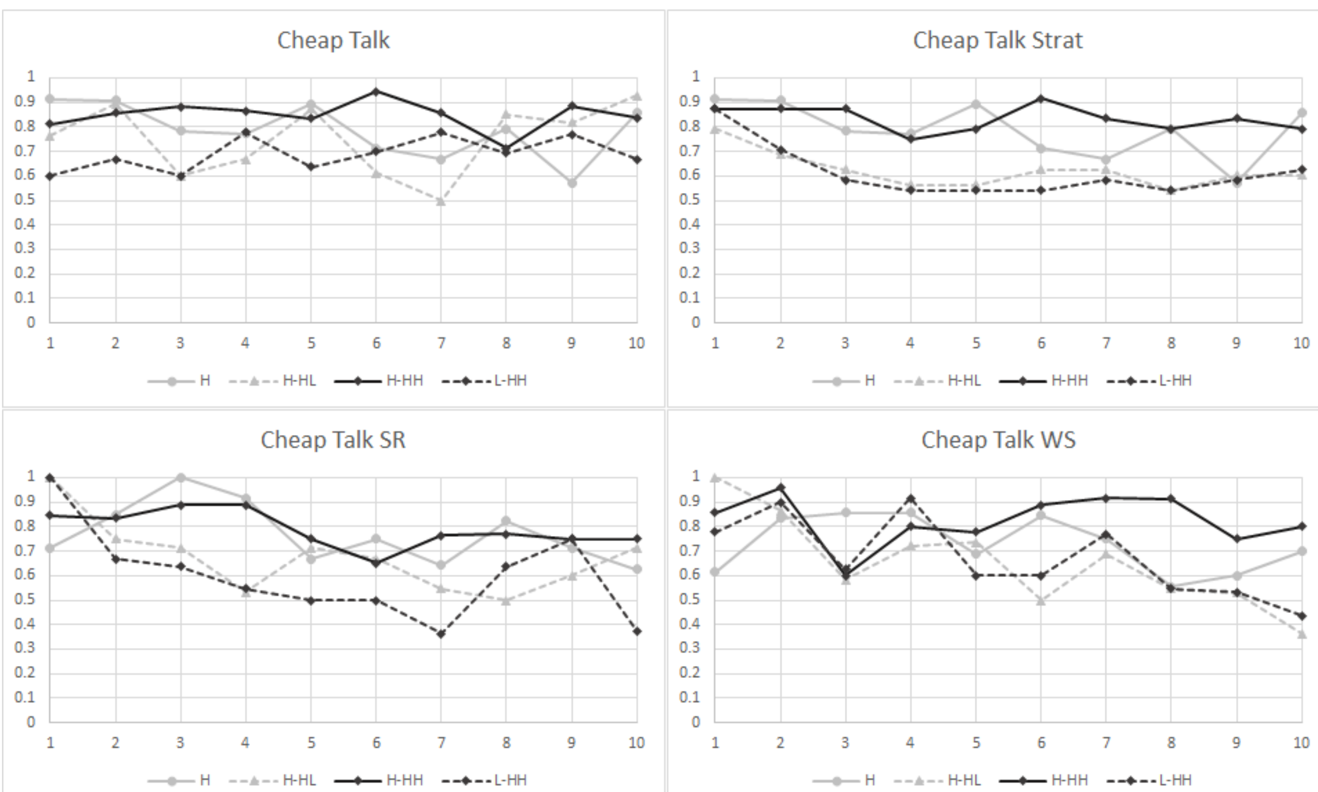

Figure AV. *Contribution rates in H, Majority-H (L-HH and H-HL), and Unanimous-H (H-HH) cases across rounds.*

more often than Low messages. Thus, we do not focus on such cases. However, overall the contribution rates in L-HL and H-LL categories are largely similar and low across rounds.

AII Experimental Instructions: First Series Treatments

Welcome

No Talking and Cell-Phone Usage Allowed

Now that the experiment has begun, we ask that you do not talk. Also, please turn off your cell phone. If you have a question after we finish reading the instructions, please raise your hand and the experimenter will approach you and answer your question in private.

Random Matching and Anonymity

Each person will be randomly and anonymously matched with 2 other people to form a group. Thus, each group will contain 3 individuals. YOU WILL REMAIN IN THIS GROUP FOR THE REST OF THIS EXPERIMENT. You and the other members in your group will be identified by ID numbers 1, 2, and 3. The ID numbers for each of the other group members will remain the same for the entire experiment. For example, the same group member will be identified as group member 2 for the entire experiment.

Cash Payment

Your earnings in this experiment are expressed in TOKENS. At the conclusion of the experiment you will be paid in U.S. dollars using a conversion rate of $0.70 for every token earned in the experiment.

Multiple Rounds

This experiment consists of 10 decision rounds. In each round, you will face the same decision task. The decision task in each round is described below.

Starting Balances

Each individual begins EACH ROUND with an endowment of 1 token. Each 3-person group begins EACH ROUND with a Group Fund containing 0 tokens.

Decision Tasks in Each Round

You will decide independently and privately whether to allocate your token to your own Individual Fund or to the Group Fund. The other players in your group will make similar decisions. Each token added to the Group Fund by a group member increases the value of the Group Fund by one of two Group Fund Returns, listed below. The computer will randomly choose the Group Fund Return. Each return has an equal probability of being chosen in each round, regardless of the result from previous rounds.

- Low Group Fund Return: Each token added to the Group Fund by a group member increases the value of the Group Fund by 0 tokens.
- High Group Fund Return: Each token added to the Group Fund by a group member increases the value of the Group Fund by 3.3 tokens.

You will not know whether the Group Fund Return is High or Low until after you make your decision for the round.

(SIGNALS & CHEAP TALK TREATMENTS ONLY) However, before making your decision, you will see a SIGNAL related to the Group Fund Return. This signal is informative about the Group Fund Return, but may be inaccurate. Specifically, if the Group Fund Return is in fact High, you will see the signal "High" with 80% probability, and you will see the signal "Low" with 20% probability. Similarly, if the Group Fund Return is in fact Low, you will see the signal "Low" with 80% probability, and you will see the signal "High" with 20% probability. Thus, in short, on average the signal will correspond to the actual Group Fund Return 80% of the time, but will be inaccurate 20% of the time.

(SIGNALS & CHEAP TALK TREATMENTS ONLY) The other members of your group will also see signals, which will on average correspond to the actual Group Fund Return 80% of the time, but will be inaccurate 20% of the time.

(SIGNALS & CHEAP TALK TREATMENTS ONLY) Note that the Group Fund Return in a particular round is the same for you as it is for the other 2 members of your group. However, the other members of your group may not see the same signal that you see.

(SIGNALS & CHEAP TALK TREATMENTS ONLY) For example, suppose Tom and Mary are in the same group. Further suppose that the computer randomly chooses the High Group Fund Return. With 80% probability, Tom will see a signal that says "High," and with 20% probability, he will see a signal that says "Low." The same is true for Mary. So with probability 16% (= 80% * 20%) Tom will see a signal that says "High" and Mary will see a signal that says "Low." Similarly, there is a 16% chance that Tom will see a signal that says "Low" and Mary will see a signal that says "High." Thus, overall, there is a 32% chance that Tom and Mary will see different signals.

(CHEAP TALK TREATMENT ONLY) In each round, after you and the other group members receive your signals related to the Group Fund Return, but before you and the other group members decide whether to allocate your tokens to the Group Fund, you will each be able to send a message to the other group members. The message you will send will be one of two options, "High" or "Low." You may choose either message option. After all group members send their messages, you will see the other group members' messages and then make your allocation decision. You will not see the other group members' signals.

Earnings

Earnings in EACH round: After all persons in the group make their decisions, the Group Fund will be divided equally among all individuals in the group. That is, all individuals in the group will receive one-third (33.33%) of the Group Fund. In other words, for each token added to the Group Fund each group member will receive 0 tokens if the Low Group Fund Return is randomly chosen or 1.1 tokens if the High Group Fund Return is randomly chosen.

Your earnings in a round will equal the ending value of tokens in your own Individual Fund plus one-third of the ending value of tokens in the Group Fund.

After all individuals make their decisions for the round, the computer will tabulate the results. At the end of each round, you will receive information on the allocation decisions of each of the other group members identified by their ID numbers, the total number of tokens allocated to the Group Fund, (SIGNALS & CHEAP TALK TREATMENTS ONLY) your signal related to the Group Fund Return, (CHEAP TALK TREATMENTS ONLY) your message and the messages of the other group members related to the Group Fund Return, the Group Fund Return randomly chosen for that round, your earnings related to the Group Fund, and your total earnings for that round.

The following examples illustrate how your earnings from the Group Fund in a round are related to value of the Group Fund.

- Suppose all 3 members of your group (including yourself) allocate their tokens to the Group Fund.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, each person would receive 0 tokens.

  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 9.9 tokens. In this case, each person would receive 33.33% of the Group Fund, worth 3.3 tokens each.
- Suppose all 3 members of your group (including yourself) allocate their tokens to their own Individual Funds.
  - Regardless of the Group Fund Return randomly chosen by the computer, this would result in a Group Fund with a total value of 0 tokens. In this case, each person would receive the value of their own Individual Funds, worth 1 token each.
- Suppose you allocate your token to the Group Fund, but the other 2 members of your group allocate their tokens to their own Individual Funds.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, you would receive 0 tokens, and the other 2 members of your group would receive the value of their Individual Funds, worth 1 token each.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 3.3 tokens. In this case, you would receive 33.33% of the value of the Group Fund, worth 1.1 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, plus the value of their Individual Funds, worth a total of 2.1 tokens each.
- Suppose you allocate your token to your own Individual Fund, but the other 2 members of your group allocate their tokens to the Group Fund.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, you would receive the value of your Individual Fund, worth 1 token, and the other 2 members of your group would receive 0 tokens each.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 6.6 tokens. In this case, you would receive 33.33% of the value of the Group Fund, plus the value of your own Individual Fund, worth a total of 3.2 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, worth a total of 2.2 tokens each.

TOTAL Earnings: Total Earnings for the experiment will be the sum of the earnings in all rounds of the experiment. Recall, at the conclusion of the experiment you will be paid in U.S. dollars using a conversion rate of $0.70 for every token of earnings from the experiment.

AIII Experimental Instructions: SR Treatments

Welcome

No Talking and Cell-Phone Usage Allowed

Now that the experiment has begun, we ask that you do not talk. Also, please turn off your cell phone. If you have a question after we finish reading the instructions, please raise your hand and the experimenter will approach you and answer your question in private.

Random Matching and Anonymity

Each person will be randomly and anonymously matched with 2 other people to form a group. Thus, each group will contain 3 individuals. YOU WILL REMAIN IN THIS GROUP FOR THE REST OF THIS EXPERIMENT. You and the other members in your group will be identified by ID numbers 1, 2, and 3. The ID numbers for each of the other group members will remain the same for the entire experiment. For example, the same group member will be identified as group member 2 for the entire experiment.

Cash Payment

Your earnings in this experiment are expressed in TOKENS. At the conclusion of the experiment you will be paid in U.S. dollars using a conversion rate of $0.70 for every token earned in the experiment.

Multiple Rounds

This experiment consists of 10 decision rounds. In each round, you will face the same decision task. The decision task in each round is described below.

Starting Balances

Each individual begins EACH ROUND with an endowment of 1 token. Each 3-person group begins EACH ROUND with a Group Fund containing 0 tokens.

Decision Task in Each Round

You will decide independently and privately whether to allocate your token to your own Individual Fund or to the Group Fund. The other players in your group will make similar decisions. Each token added to the Group Fund by a group member increases the value of the Group Fund by one of two Group Fund Returns, listed below. The computer will randomly choose the Group Fund Return. Each return has an equal probability of being chosen in each round, regardless of the result from previous rounds.

- Low Group Fund Return: Each token added to the Group Fund by a group member increases the value of the Group Fund by 0.9 tokens.
- High Group Fund Return: Each token added to the Group Fund by a group member increases the value of the Group Fund by 2.4 tokens.

You will not know whether the Group Fund Return is High or Low until after you make your decision for the round. However, before making your decision, you will see a SIGNAL related to the Group Fund Return. This signal is informative about the Group Fund Return, but may be inaccurate. Specifically, if the Group Fund Return is in fact High, you will see the signal "High" with 80% probability, and you will see the signal "Low" with 20% probability. Similarly, if the Group Fund Return is in fact Low, you will see the signal "Low" with 80% probability, and you will see the signal "High" with 20% probability. Thus, in short, on average the signal will correspond to the actual Group Fund Return 80% of the time, but will be inaccurate 20% of the time.

The other members of your group will also see signals, which will on average correspond to the actual Group Fund Return 80% of the time, but will be inaccurate 20% of the time.

Note that the Group Fund Return in a particular round is the same for you as it is for the other 2 members of your group. However, the other members of your group may not see the same signal that you see.

For example, suppose Tom and Mary are in the same group. Further suppose that the computer randomly chooses the High Group Fund Return. With 80% probability, Tom will see a signal that says "High," and with 20% probability, he will see a signal that says "Low." The same is true for Mary. So with probability 16% (= 80% * 20%) Tom will see a signal that says "High" and Mary will see a signal that says "Low." Similarly, there is a 16% chance that Tom will see a signal that says "Low" and Mary will see a signal that says "High." Thus, overall, there is a 32% chance that Tom and Mary will see different signals.

(CHEAP TALK SR TREATMENT ONLY) In each round, after you and the other group members receive your signals related to the Group Fund Return, but before you and the other group members decide whether to allocate your tokens to the Group Fund, you will each be able to send a message to the other group members. The message you will send will be one of two options, "High" or "Low." You may choose either message option. After all group members send their messages, you will see the other group members' messages and then make your allocation decision. You will not see the other group members' signals.

Earnings

Earnings in EACH round: After all persons in the group make their decisions, the Group Fund will be divided equally among all individuals in the group. That is, all individuals in the group will receive one-third (33.33%) of the Group Fund. In other words, for each token added to the Group Fund each group member will receive 0.3 tokens if the Low Group Fund Return is randomly chosen or 0.8 tokens if the High Group Fund Return is randomly chosen.

Your earnings in a round will equal the ending value of tokens in your own Individual Fund plus one-third of the ending value of tokens in the Group Fund.

After all individuals make their decisions for the round, the computer will tabulate the results. At the end of each round, you will receive information on the allocation decisions of each of the other group members identified by their ID numbers, the total number of tokens allocated to the Group Fund, your signal related to the Group Fund Return, (CHEAP TALK SR TREATMENT ONLY) your message and the messages of the other group members related to the Group Fund Return, the Group Fund Return randomly chosen for that round, your earnings related to the Group Fund, and your total earnings for that round.

The following examples illustrate how your earnings from the Group Fund in a round are related to the value of the Group Fund.

- Suppose all 3 members of your group (including yourself) allocate their tokens to the Group Fund.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 2.7 tokens. In this case, each person would receive 0.9 tokens.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 7.2 tokens. In this case, each person would receive 33.33% of the Group Fund, worth 2.4 tokens each.
- Suppose all 3 members of your group (including yourself) allocate their tokens to their own Individual Funds.

  - Regardless of the Group Fund Return randomly chosen by the computer, this would result in a Group Fund with a total value of 0 tokens. In this case, each person would receive the value of their own Individual Funds, worth 1 token each.
- Suppose you allocate your token to the Group Fund, but the other 2 members of your group allocate their tokens to their own Individual Funds.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0.9 tokens. In this case, you would receive 33.33% of the value of the Group Fund, worth 0.3 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, plus the value of their Individual Funds, worth a total of 1.3 tokens each.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 2.4 tokens. In this case, you would receive 33.33% of the value of the Group Fund, worth 0.8 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, plus the value of their Individual Funds, worth a total of 1.8 tokens each.
- Suppose you allocate your token to your own Individual Fund, but the other 2 members of your group allocate their tokens to the Group Fund.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 1.8 tokens. In this case, you would receive 33.33% of the value of the Group Fund, plus the value of your own Individual Fund, worth a total of 1.6 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, worth a total of 0.6 tokens each.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 4.8 tokens. In this case, you would receive 33.33% of the value of the Group Fund, plus the value of your own Individual Fund, worth a total of 2.6 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, worth a total of 1.6 tokens each.

Total Earnings

Total Earnings for the experiment will be the sum of the earnings in all rounds of the experiment. Recall, at the conclusion of the experiment you will be paid in U.S. dollars using a conversion rate of $0.70 for every token of earnings from the experiment.

AIV Experimental Instructions: WS Treatments

Welcome

No Talking and Cell-Phone Usage Allowed

Now that the experiment has begun, we ask that you do not talk. Also, please turn off your cell phone. If you have a question after we finish reading the instructions, please raise your hand and the experimenter will approach you and answer your question in private.

Random Matching and Anonymity

Each person will be randomly and anonymously matched with 2 other people to form a group. Thus, each group will contain 3 individuals. YOU WILL REMAIN IN THIS GROUP FOR THE REST OF THIS EXPERIMENT. You and the other members in your group will be identified by ID numbers 1, 2, and 3. The ID numbers for each of the other group members will remain the same for the entire experiment. For example, the same group member will be identified as group member 2 for the entire experiment.

Cash Payment

Your earnings in this experiment are expressed in TOKENS. At the conclusion of the experiment you will be paid in U.S. dollars using a conversion rate of $0.70 for every token earned in the experiment.

Multiple Rounds

This experiment consists of 10 decision rounds. In each round, you will face the same decision task. The decision task in each round is described below.

Starting Balances

Each individual begins EACH ROUND with an endowment of 1 token. Each 3-person group begins EACH ROUND with a Group Fund containing 0 tokens.

Decision Tasks in Each Round

You will decide independently and privately whether to allocate your token to your own Individual Fund or to the Group Fund. The other players in your group will make similar decisions. Each token added to the Group Fund by a group member increases the value of the Group Fund by one of two Group Fund Returns, listed below. The computer will randomly choose the Group Fund Return. Each return has an equal probability of being chosen in each round, regardless of the result from previous rounds.

- Low Group Fund Return: Each token added to the Group Fund by a group member increases the value of the Group Fund by 0 tokens.
- High Group Fund Return: Each token added to the Group Fund by a group member increases the value of the Group Fund by 3.3 tokens.

You will not know whether the Group Fund Return is High or Low until after you make your decision for the round. However, before making your decision, you will see a SIGNAL related to the Group Fund Return. This signal is informative about the Group Fund Return, but may be inaccurate. Specifically, if the Group Fund Return is in fact High, you will see the signal "High" with 70% probability, and you will see the signal "Low" with 30% probability. Similarly, if the Group Fund Return is in fact Low, you will see the signal "Low" with 70% probability, and you will see the signal "High" with 30% probability. Thus, in short, on average the signal will correspond to the actual Group Fund Return 70% of the time, but will be inaccurate 30% of the time.

The other members of your group will also see signals, which will on average correspond to the actual Group Fund Return 70% of the time, but will be inaccurate 30% of the time.

Note that the Group Fund Return in a particular round is the same for you as it is for the other 2 members of your group. However, the other members of your group may not see the same signal that you see.

For example, suppose Tom and Mary are in the same group. Further suppose that the computer randomly chooses the High Group Fund Return. With 70% probability, Tom will see a signal that says "High," and with 30% probability, he will see a signal that says "Low." The same is true for Mary. So with probability 21% (= 70% * 30%) Tom will see a signal that says "High" and Mary will see a signal that says "Low." Similarly, there is a 21% chance that Tom will see a signal that says "Low" and Mary will see a signal that says "High." Thus, overall, there is a 42% chance that Tom and Mary will see different signals.

(CHEAP TALK WS TREATMENT ONLY) In each round, after you and the other group members receive your signals related to the Group Fund Return, but before you and the other group members decide whether to allocate your tokens to the Group Fund, you will each be able to send a message to the other group members. The message you will send will be one of two options, "High" or "Low." You may choose either message option. After all group members send their messages, you will see the other group members' messages and then make your allocation decision. You will not see the other group members' signals.

Earnings

Earnings in EACH round: After all persons in the group make their decisions, the Group Fund will be divided equally among all individuals in the group. That is, all individuals in the group will receive one-third (33.33%) of the Group Fund. In other words, for each token added to the Group Fund each group member will receive 0 tokens if the Low Group Fund Return is randomly chosen or 1.1 tokens if the High Group Fund Return is randomly chosen.

Your earnings in a round will equal the ending value of tokens in your own Individual Fund plus one-third of the ending value of tokens in the Group Fund.

After all individuals make their decisions for the round, the computer will tabulate the results. At the end of each round, you will receive information on the allocation decisions of each of the other group members identified by their ID numbers, the total number of tokens allocated to the Group Fund, your signal related to the Group Fund Return, (CHEAP TALK WS TREATMENT ONLY) your message and the messages of the other group members related to the Group Fund Return, the Group Fund Return randomly chosen for that round, your earnings related to the Group Fund, and your total earnings for that round.

The following examples illustrate how your earnings from the Group Fund in a round are related to value of the Group Fund.

- Suppose all 3 members of your group (including yourself) allocate their tokens to the Group Fund.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, each person would receive 0 tokens.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 9.9 tokens. In this case, each person would receive 33.33% of the Group Fund, worth 3.3 tokens each.
- Suppose all 3 members of your group (including yourself) allocate their tokens to their own Individual Funds.

  - Regardless of the Group Fund Return randomly chosen by the computer, this would result in a Group Fund with a total value of 0 tokens. In this case, each person would receive the value of their own Individual Funds, worth 1 token each.
- Suppose you allocate your token to the Group Fund, but the other 2 members of your group allocate their tokens to their own Individual Funds.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, you would receive 0 tokens, and the other 2 members of your group would receive the value of their Individual Funds, worth 1 token each.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 3.3 tokens. In this case, you would receive 33.33% of the value of the Group Fund, worth 1.1 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, plus the value of their Individual Funds, worth a total of 2.1 tokens each.
- Suppose you allocate your token to your own Individual Fund, but the other 2 members of your group allocate their tokens to the Group Fund.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, you would receive the value of your Individual Fund, worth 1 token, and the other 2 members of your group would receive 0 tokens each.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 6.6 tokens. In this case, you would receive 33.33% of the value of the Group Fund, plus the value of your own Individual Fund, worth a total of 3.2 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, worth a total of 2.2 tokens each.

TOTAL Earnings: Total Earnings for the experiment will be the sum of the earnings in all rounds of the experiment. Recall, at the conclusion of the experiment you will be paid in U.S. dollars using a conversion rate of $0.70 for every token of earnings from the experiment.

AV EXPERIMENTAL INSTRUCTIONS: STRATEGY METHOD TREATMENT

Welcome

No Talking and Cell-Phone Usage Allowed

Now that the experiment has begun, we ask that you do not talk. Also, please turn off your cell phone. If you have a question after we finish reading the instructions, please raise your hand and the experimenter will approach you and answer your question in private.

Random Matching and Anonymity

Each person will be randomly and anonymously matched with 2 other people to form a group. Thus, each group will contain 3 individuals. YOU WILL REMAIN IN THIS GROUP FOR THE REST OF THIS EXPERIMENT. You and the other members in your group will be identified by ID numbers 1, 2, and 3. The ID numbers for each of the other group members will remain the same for the entire experiment. For example, the same group member will be identified as group member 2 for the entire experiment.

Cash Payment

Your earnings in this experiment are expressed in TOKENS. At the conclusion of the experiment you will be paid in U.S. dollars using a conversion rate of $0.70 for every token earned in the experiment.

Multiple Rounds

This experiment consists of 10 decision rounds. In each round, you will face the same decision task. The decision task in each round is described below.

Starting Balances

Each individual begins EACH ROUND with an endowment of 1 token. Each 3-person group begins EACH ROUND with a Group Fund containing 0 tokens.

Decision Tasks in Each Round

You will decide independently and privately whether to allocate your token to your own Individual Fund or to the Group Fund. The other players in your group will make similar decisions. Each token added to the Group Fund by a group member increases the value of the Group Fund by one of two Group Fund Returns, listed below. The computer will randomly choose the Group Fund Return. Each return has an equal probability of being chosen in each round, regardless of the result from previous rounds.

- Low Group Fund Return: Each token added to the Group Fund by a group member increases the value of the Group Fund by 0 tokens.
- High Group Fund Return: Each token added to the Group Fund by a group member increases the value of the Group Fund by 3.3 tokens.

You will not know whether the Group Fund Return is High or Low until after you make your decision for the round. However, before making your decision, you will receive a SIGNAL related to the Group Fund Return. This signal is informative about the Group Fund Return, but may be inaccurate. Specifically, if the Group Fund Return is in fact High, you will receive the signal "High" with 80% probability, and you will receive the signal "Low" with 20% probability. Similarly, if the Group Fund Return is in fact Low, you will receive the signal "Low" with 80% probability, and you will receive the signal "High" with 20% probability. Thus, in short, on average the signal will correspond to the actual Group Fund Return 80% of the time, but will be inaccurate 20% of the time.

The other members of your group will also receive signals, which will on average correspond to the actual Group Fund Return 80% of the time, but will be inaccurate 20% of the time.

Note that the Group Fund Return in a particular round is the same for you as it is for the other 2 members of your group. However, the other members of your group may not receive the same signal that you receive.

For example, suppose Tom and Mary are in the same group. Further suppose that the computer randomly chooses the High Group Fund Return. With 80% probability, Tom will receive a signal that says "High," and with 20% probability, he will receive a signal that says "Low." The same is true for Mary. So with probability 16% (= 80% * 20%) Tom will receive a signal that says "High" and Mary will receive a signal that says "Low." Similarly, there is a 16% chance that Tom will receive a signal that says "Low" and Mary will receive a signal that says "High." Thus, overall, there is a 32% chance that Tom and Mary will receive different signals.

In each round, before you and the other group members decide whether to allocate your tokens to the Group Fund, you will each be able to send a message to the other group members.

Figure 1. *Message selection interface*

The message you will send will be one of two options, "High" or "Low." You may choose either message option. After all group members send their messages, you will receive the other group members' messages and then make your allocation decision. You will not see the other group members' signals.

In each round, before actually observing your signal, you will select a message for both possible values of the signal, "High" and "Low." In the screenshot of the interface in Figure 1, on the left you are asked to choose a message in the case that your signal is "High," and on the right you are asked to choose a message in the case that your signal is "Low."

The message you actually send will be the message you chose for the actual value of your signal.

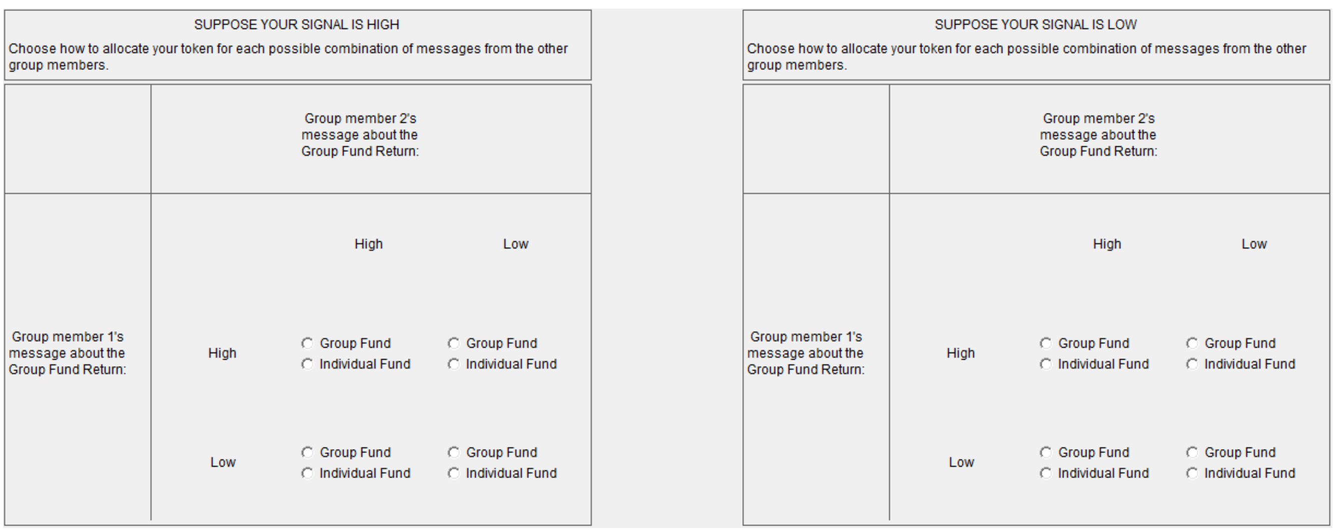

Figure 2. *Allocation decision interface*

After choosing your message for each possible value of your signal, you will similarly make an allocation decision for each possible value of your signal and each possible message from the other two members of your group. In the screenshot of the interface in Figure 2, on the left side you are asked to choose how to allocate your token if your signal is "High," and on the right side you are asked to choose how to allocate your token if your signal is "Low," each for the four possible combinations of messages from group members 1 and 2. For example, in the upper left part of the table on the left, you are asked to allocate your token to either the Group

Fund or your Individual Fund in the case that your signal is "High" and both group members 1 and 2 send "High" messages. As another example, in the lower left part of the table on the right, you are asked to allocate your token in the case that your signal is "Low," group member 1's message is "Low," and group member 2's message is "High."

The allocation you actually choose will be your decision corresponding to the actual value of your signal and the actual messages sent by the other members of your group.

Earnings

Earnings in EACH round: After all persons in the group make their decisions, the Group Fund will be divided equally among all individuals in the group. That is, all individuals in the group will receive one-third (33.33%) of the Group Fund. In other words, for each token added to the Group Fund each group member will receive 0 tokens if the Low Group Fund Return is randomly chosen or 1.1 tokens if the High Group Fund Return is randomly chosen.

Your earnings in a round will equal the ending value of tokens in your own Individual Fund plus one-third of the ending value of tokens in the Group Fund.

After all individuals make their decisions for the round, the computer will tabulate the results. At the end of each round, you will receive information on the allocation decisions of each of the other group members identified by their ID numbers, the total number of tokens allocated to the Group Fund, your signal related to the Group Fund Return, your message and the messages of the other group members related to the Group Fund Return, the Group Fund Return randomly chosen for that round, your earnings related to the Group Fund, and your total earnings for that round.

The following examples illustrate how your earnings from the Group Fund in a round are related to value of the Group Fund.

- Suppose all 3 members of your group (including yourself) allocate their tokens to the Group Fund.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, each person would receive 0 tokens.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 9.9 tokens. In this case, each person would receive 33.33% of the Group Fund, worth 3.3 tokens each.
- Suppose all 3 members of your group (including yourself) allocate their tokens to their own Individual Funds.

  - Regardless of the Group Fund Return randomly chosen by the computer, this would result in a Group Fund with a total value of 0 tokens. In this case, each person would receive the value of their own Individual Funds, worth 1 token each.
- Suppose you allocate your token to the Group Fund, but the other 2 members of your group allocate their tokens to their own Individual Funds.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, you would receive 0 tokens, and the other 2 members of your group would receive the value of their Individual Funds, worth 1 token each.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 3.3 tokens. In this case, you would receive 33.33% of the value of the Group Fund, worth 1.1 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, plus the value of their Individual Funds, worth a total of 2.1 tokens each.
- Suppose you allocate your token to your own Individual Fund, but the other 2 members of your group allocate their tokens to the Group Fund.
  - If the computer randomly chooses the Low Group Fund Return, this would result in a Group Fund with a total value of 0 tokens. In this case, you would receive the value of your Individual Fund, worth 1 token, and the other 2 members of your group would receive 0 tokens each.
  - If the computer randomly chooses the High Group Fund Return, this would result in a Group Fund with a total value of 6.6 tokens. In this case, you would receive 33.33% of the value of the Group Fund, plus the value of your own Individual Fund, worth a total of 3.2 tokens. The other 2 members of your group would also receive 33.33% of the value of the Group Fund, worth a total of 2.2 tokens each.

TOTAL Earnings: Total Earnings for the experiment will be the sum of the earnings in all rounds of the experiment. Recall, at the conclusion of the experiment you will be paid in U.S. dollars using a conversion rate of $0.70 for every token of earnings from the experiment.