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Abstract: While most of the previous literature interprets trust as an action, we adopt a view that trust is represented by a belief that the other party will return a fair share. The agent's action is then a commitment device that signals this belief. In this paper we propose and test a conjecture that economic agents use trust strategically. That is, the agents have incentives to inflate the perceived level of trust (the signal) in order to induce a more favorable outcome for themselves. In the experiment we study the behavior of subjects in a modified investment game which is played sequentially and simultaneously. While the sequential treatment allows for strategic use of trust, in the simultaneous treatment the first mover's action is not observed and hence does not signal her belief. In line with our prediction we find that first movers send significantly more in the sequential treatment than in simultaneous. Moreover, second movers reward trusting action, but only if it is maximal. We also find that signaling with trust enhances welfare.

Keywords: Experimental economics; Trust; Beliefs

JEL Classifications: C70; C91

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1. Introduction

In many institutions people transact sequentially and the success of the one-shot interaction often relies on the first mover having trust in the second mover to share the created surplus. An important feature of these trust situations is that the first mover can choose a level of credible (costly) commitment which can possibly reveal information about her degree of trust in the favorable response of the second mover. For example, in an Internet auction, the final price may signal the level of trust that the winning buyer has in the seller's credibility; in labor relations, the size of the salary signals the firm's trust in the ability and the diligence of the worker**;** and last but not least a co-payment requirement signals the bank's trust (or lack of) in the entrepreneur's ability to pay back the loan. If the second mover can ascertain the level of trust from the first mover's action and responds to it positively, then the first mover may want to manipulate her level of commitment in order to induce the most favorable response. In other words, the first mover strategically enhances trust.

An example illustrating the consequences of signaling trust could be the extensive use of teaser rates in the credit card markets. In recent years the teaser or 0% introductory rates on consumer credit have realized a boom (Ausubel (1999) and Bertrand et al. (2005)). In the eye of the consumer the 0% rate could represent a trust by the credit company – in fact, one could say that this is the strongest sign of trust that can be signaled through an interest rate. But is it really true that all the consumers that get these offers (even when they are just solicited by getting an "approved" letter) are trustworthy? Unlikely. The credit firms facing a tougher competition probably rely on these signals of trust in order to attract customers to actually start using their card and accumulate balances. The interest rate is a commitment device through which the firm can "appear" exposed and hence can signal trust. The target consumer may of course like the rate itself, but in addition, she could also value the communicated trust which causes her then to choose that card over others. Thus, as in most other examples, the behavioral effects such as trust signaling can be just what it takes to give a firm the competitive edge or sway a consumer's decision one way or another.[1]

While most of the previous literature interprets the action taken by the first mover in these types of scenarios as trust, we adopt a view that trust is represented by the first mover's belief in the second mover returning a fair share. The first mover's action is then a commitment device that could signal this belief. Whether the first mover's action indeed signals trust and how the second mover responds to it is an empirical question. In this paper, we report the results of an experiment that addresses this question by comparing decisions of the first mover in two modified trust games. The only difference between the two games is that in one case the first mover's decision is observable and in the other it is not. In our trust game, the first mover initially chooses an amount t to be sent to the second mover. This amount is tripled and the second mover must decide whether to send half of it back (fair split) or to keep everything for herself (selfish split).[2] When the game is played sequentially, the amount sent is observable and it could be used as a signaling device because the second mover can condition her decision on t.

[1] Depending on the circumstances, the signal can also represent means to get business away from a rival in the above scenario. The strategic use of trust is often intertwined with market forces in other real life examples as well. Therefore, they are only meant to illustrate a situation where at least one of the transacting parties has incentives to appear more trusting than otherwise. However, our experiment eliminates the possible confounds and studies the strategic use of trust in its pure form.

[2] Fair division in our understanding would correspond to any division which allocates positive amount of surplus to both parties and makes them reasonably happy. At this point we do not want to go into any deeper discussion into the meaning of fairness.

Conditioning the response on *t* is not possible if the game is played simultaneously because *t* is not observed.

Our conjecture is that the amount sent by the first mover is a signal of her trust vested in the second mover who then responds to this favorably.[3] If there is this positive relationship between t and the response by the second mover in the sequential version of the game, then the first mover has an additional incentive to inflate the amount sent and appear more trusting. It seems natural that the second mover would like to reward only the genuine trust which reflects the first mover's opinion about how pro-social, fair, or generous the second mover is. However, she would not want to reward the portion of trust that is strategic, i.e., driven by the monetary interests due to the expected response of the second mover.[4] Nevertheless, if the amount sent is observed, then the incentives to appear more trusting could be present (this depends on the anticipated response of the second mover) and hence, the first mover would send more. This reasoning implies hypotheses which we test in our experiment: When *t* is observable, the ability to signal trust creates a stronger positive relationship (i.e., larger slope coefficient) between the first mover's trust as represented by her belief, denoted as μ, of the second mover's response and the amount sent by the first mover, *t*, than when *t* is not observable. This is reinforced by a positive and monotone response to *t* by the second mover.

Our results provide strong support for the strategic use of trust. There is a significantly stronger positive relationship between the belief μ of the first mover and *t* in the game where *t* is observable than when it is not observed. Given this, one would

[3] An illustrative example of such a signaling argument is presented in Appendix A.
[4] A reader familiar with the theory of sequential reciprocity (Dufwenberg and Kirchsteiger (2004)) may see parallel here. In a gift-exchange game with reciprocal agents, a very high wage offered by the first mover could be perceived as unkind by the second mover because it could indicate that the first mover is counting on a generous response by the second mover.

expect that the second mover would reward higher *t* with higher chances of a fair split. Surprisingly, this monotone relationship is rejected by the data. In particular, the second mover responds in a very strict manner. If she is fully trusted, i.e., if *t* is maximal, then she almost always responds with the fair split. However, if she senses any doubt, no matter how small, i.e., *t* is less than maximal, then she almost always keeps the whole surplus. This brings us to an unexpected observation that the incentives to signal trust in our design are quite extreme: either signal trust all the way or don't signal at all.

The possibility that trust is used strategically gives rise to another interesting question: Is it efficiency enhancing or reducing? Observability of *t* is an important aspect of many institutions. Knowing its marginal contribution to social surplus may have important implications for understanding and designing institutions. Our design allows us to measure this marginal effect by comparing the average level of *t* in our two environments, where in one trust signaling is possible and in the other it is not. It may seem natural that signaling trust enhances efficiency because the first mover can increase her chances of a fair split by increasing *t*. However, this is only one side of the story. First of all, it is a common feature of any signaling equilibrium that no one is fooled by the inflated signals.[5] Secondly, increasing the chances of receiving a fair share (half) comes at a cost of having to commit more resources. Because of this, it may be that no level of *t* signals sufficiently high trust for the first mover to take the chance and send a positive amount. Therefore, the ability to signal trust can be a double-edged sword. Nonetheless, we have good news; the results of our experiment indicate that the efficiency is higher when signaling is possible.

[5] Within the example presented in Appendix A, such equilibrium is derived.

A modified version of the Berg et al. (1995) trust game is a centerpiece of our design. Berg et al. were the first to study trust in laboratory conditions. Their experiment identifies trusting behavior by observing that subjects playing the role of the first mover often send money to their counterpart second movers who in turn often reciprocate by returning positive amounts.[6] Whether the fist mover's decision reflects a degree of trust or rather a variation of risk preferences has been recently looked at by several studies (Eckel and Wilson (2004), Kosfeld et al. (2005), and Houser et al. (2006)). Houser et al. find that variations in risk-preferences are not an important determinant of the first mover's decision in the trust game. More specifically, they argue that trust games measure trust, which is important for us because it implies that there is a close relationship between first mover's trust and the amount sent. Therefore, it is plausible that the first mover could be signaling trust by manipulating *t*.

There is a large body of literature exploring behavioral foundations of trust. Recent papers, Ellingsen and Johanesson (forthcoming) and Sliwka (2007), have proposed explanations for trust that are closely related to our argument. In both papers, agents have individual preferences for the opinions of others. In Ellingsen and Johanesson, the agent cares about whether her opponent thinks she is fair or not. If she is fair then recognition of others becomes a point of pride for her. She takes a good opinion of her as a compliment and rewards it accordingly. In Sliwka, on the other hand, agents care about opinions that others have about the population in general. Some agents are "conformists," which means that they like to be fair only if the majority of other people

[6] There are other possible motivations why players would send and return positive amounts, such as other-regarding preferences (Cox (2004)) or preferences for increasing social welfare (Charness and Rabin (2002)). Nevertheless, the behavior of the first and second mover can be seen as 'proxies' for trusting and trustworthy behavior (Charness et al. (forthcoming)).

are also fair. They care about opinions of others to the extent that it this gives them extra information about the population characteristics.

There are a few other renowned models that interpret trust as a product of rational behavior. For example, Dufwenberg (2002), Dufwenberg and Gneezy (2000), Charness and Dufwenberg (2006), Battigalli and Dufwenberg (2007), and Dufwenberg et al. (2008) rely on the theory of guilt aversion. The main idea is that if the second mover is sufficiently guilt-averse, then she will experience a disutility from feeling guilty whenever she "lets her counterpart down," i.e., returns less than what was expected. To avoid guilt, she optimally splits the surplus in a way that matches her belief about what is expected by the first mover. Thus, the first mover can trust the second mover and sends positive amounts if she is sufficiently confident that her counterpart knows about her expectations of a fair division.

Other prominent theories explaining trust are based on the concept of reciprocity (Dufwenberg and Kirchsteiger (2004), Falk and Fischbacher (2006), and Cox et al. (2007)). The basic idea is that because the amount sent creates a large surplus on the side of the second mover, she perceives it as a “kind action” and reciprocates by returning a fair share. It is not hard to imagine that if this perception of kindness is increasing in the level of t (as would follow from any of the three above models), then the first mover may have stronger incentives to invest when the t is observed than when it is not.

While the present paper focuses on signaling trust, Falk and Kosfeld (2006) and Schnedler and Vadovič (2007) find that a signal of distrust, represented by restricting the agent’s action space in a dictator game, negatively affects the performance of the agent. In their experimental designs, a principal can choose either to trust the agent or to "control" her by eliminating her most opportunistic actions. Their experiments confirm that subjects interpret the control as a signal of distrust and lower their (voluntary) performance. In contrast to Falk and Kosfeld study, where controlling could harm the agent and signal distrust, the *t* in our case signals trust by benefiting the second mover.

Comparing the behavior of subjects playing the trust game sequentially and simultaneously is somewhat similar to the hot versus cold effect of elicitation procedure in economic experiments. According to the standard game-theoretic view, the outcome of the sequential play in our setting should be equivalent to the simultaneous play, just like the outcome of sequential play is equivalent to the strategy method. Indeed, in reality sequential play and strategy method often yield similar results, e.g., Cason and Mui (1998), Brandts and Charness (2000), Sonnemans (2000), Oxoby and McLeish (2004), Bosch-Domènech and Silvestre (2005), and Falk and Kosfeld (2006). However, in certain environments the qualitative results can be reversed just by changing the response elicitation method (e.g., Güth et al. (2001), Brosig et al. (2003), and Cooper and Van Huyck (2003)) or by changing the method in combination with changing other factors such as context in which the game is played (e.g., Falk et al. (2003) and Cox and Deck (2005)). However, our treatments are different from the hot versus cold comparison as in the simultaneous treatment we do not allow for conditional responses which the strategy method would. Nevertheless, if the strategic use of trust is behaviorally important, we can expect higher amounts to be both sent and returned in the treatment when the trust game is played sequentially.

The rest of the paper is organized in the following manner. Section 2 provides the experimental design. Section 3 describes the procedures, Section 4 presents the experimental results, and Section 5 concludes with a discussion.

2. The Experiment

Our experiment consists of two treatments in which players A and B play a modified trust game. The first mover, player A, decides how much of her initial endowment to send to her counterpart, i.e., she chooses a whole dollar amount t from the interval between 0 and 10. The amount sent is tripled by the experimenter. The second mover, player B, then decides whether to return a fair split, 3t/2, or a selfish split, 0, back to the player A.[7] Before player A chooses t, we elicit her beliefs about the chances of a fair split in a salient way (see Dufwenberg and Gneezy (2000)). The treatments vary in the timing of play and thus, in the availability of information that player B has at the time of making her decision. In one treatment, SEQ, players A and B play the game sequentially. Player B chooses the split of the tripled amount only after she observes how much player A has sent. In the other treatment, SIM, both players make their decisions simultaneously. Therefore, player B chooses a split without knowing how much player A has sent.

Let us discuss several features of our design in more detail. First, notice that player's A action space is rich while player's B action space is binary. The reason for this design feature is that we focus on the behavior of player A and want to observe the relationship between her level of trust and a costly message t that she sends to player B.

[7] Notice that we are now assuming a particular concept of fairness. A fair split is equal to exactly a half of the generated surplus. This concept of fairness also corresponds to the notion of Shapley value which has been shown to bear empirical validity in experiments, e.g., see Eckel and Gilles (1997).

Observe that if player A faced just a binary decision to either send money or not, then her action could not signal various degrees of trust. Player's B action space is also important because it determines the belief of player A which we take as a measure of trust. If player B also faced a rich action space, as in the original trust game (Berg et al. (1995)), she would have to decide what whole dollar amount to return. In that case, player A would have to form her expectations over the whole distribution of possible player's B choices. Because player's B decision is simple player's A decision is also simple, which in turn makes our measurement more precise. Moreover, the decision of player B is stated as a fraction in order to make the behavior of subjects comparable between the two treatments.

In our view player's A belief in a fair response from player B and her level of trust are innately related. Therefore, we elicit player's A belief and use it as a measure of trust. The amount t will likely correlate with this belief, but we do not assume that ex ante. We simply consider t to be a costly message. It is the relationship between player's A belief and t that is of interests to us.

The experiment was designed to test three hypotheses. First, we test whether player A signals her trust to player B. In the SEQ treatment where trust signaling is possible, we expect that the rate of increase in t for a given μ is higher in SEQ than in SIM.

H1: The mean t conditional on player's A belief μ is greater in SEQ than in SIM.

Trust signaling is a response to the expected behavior of player B. Therefore, it only pays off if player's A beliefs μ are correct, and indeed player B rewards higher t with higher propensity of a fair split.

H2: In the SEQ treatment, there is an increasing monotonic relationship between t and frequency of fair split decisions made by player B.

Finally, we want to compare the efficiency levels between the two treatments. In SEQ if μ is high it is optimal for player A to send high t (possibly maximal), but if μ is low, it is optimal to send $t = 0$. Thus, in SEQ trust signaling can have positive as well as negative effect on t. For this reason it is not clear that efficiency as measured by t is higher in SEQ or in SIM.

H3: There is no difference in efficiency between the two treatments.

3. Procedures

The experiment consisted of eight sessions conducted in March of 2007 at the University of Canterbury, Christchurch, New Zealand. A total of 156 subjects were recruited from economics and mathematics undergraduate courses. Some of the students had previously participated in economics experiments, but none had experience with trust games. Each subject only participated in a single session of the study. On average, a session lasted 50 minutes including initial instructional period and payment of subjects. Subjects earned on average 18.85 NZD.[8] All sessions were hand run in a classroom.

Each session included between 18 and 22 subjects who were randomly matched into two person groups that consisted of a player A and player B participants. The assignment of these groups was done according to the following process. The classroom was segmented in half such that all subjects of a given type would be located in the same half of the room. The desks for each type were arranged in two rows facing the wall, and thus neither type would be able to see the other when making decisions. The subjects were free to choose any seat upon entering the classroom. Once everyone was seated, a coin was publicly flipped to determine which side of the room was to be which type. The allocation of a player A and player B to a particular group was done by experimenter randomly pairing one subject from each type together.

At no time during the experiment was there direct interaction. Each subject was provided a set of decision sheets that were identical across subjects. Subjects recorded any decisions during the experiment on these sheets. In order to transfer information between matched pairs, the experimenters collected all decision sheets, copied the decisions from one sheet to another, and then redistributed the sheets to the subjects. This prevented the exchange of superfluous information and aided in maintaining the anonymity of individual decisions.

The general structure of the trust game is similar to Berg et al. (1995). In the first stage of each trust game, players A were endowed with $10NZ. They had to decide how much of this endowment they wanted to keep for themselves and how much to transfer to

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[8] The adult minimum wage in New Zealand at the time of the experiment was 10.25 NZD per hour (1 NZD = 0.6943 USD).

their anonymous player B counterpart. This was done by circling one of the whole numbers ranging from zero to ten on their decision sheet. It was common knowledge that any amount transferred by player A would be tripled by the experimenter. That is, players B would receive three times the amount that their player A counterpart transferred to them. In the second stage, players B must decide how much of the tripled amount they want to keep for themselves and how much to transfer back to their player A counterpart. This decision is restricted to a binary choice of either half or zero. Just as for players A, this decision was done by circling one of the two choices on their decision sheet.

In both treatments we elicited player A's beliefs about their counterpart's behavior prior to playing the game.[9] The protocol used follows closely Dufwenberg and Gneezy (2000). Players A were asked to predict the percentage of all players B who will transfer half in the second stage by completing the following statement, *"I believe that …% of players B in the room will return HALF of the tripled amount."* The subjects' earnings depended upon the accuracy of their prediction. For this task, all subjects were endowed with $5. For every one percentage point deviation from the actual outcome, ten cents was deducted from the $5. Therefore, a deviation of 50% or more resulted in zero earnings.[10]

We have two treatments in the experiment, i.e., sequential (SEQ) and simultaneous (SIM) play of the trust game. Four sessions in total were conducted for each treatment. The sequence of events in a session was the following. (1) A coin was flipped

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[9] To prevent the asymmetry in payoffs, players B had a chance to predict the average answer of players A and were paid for their accuracy in the same manner.

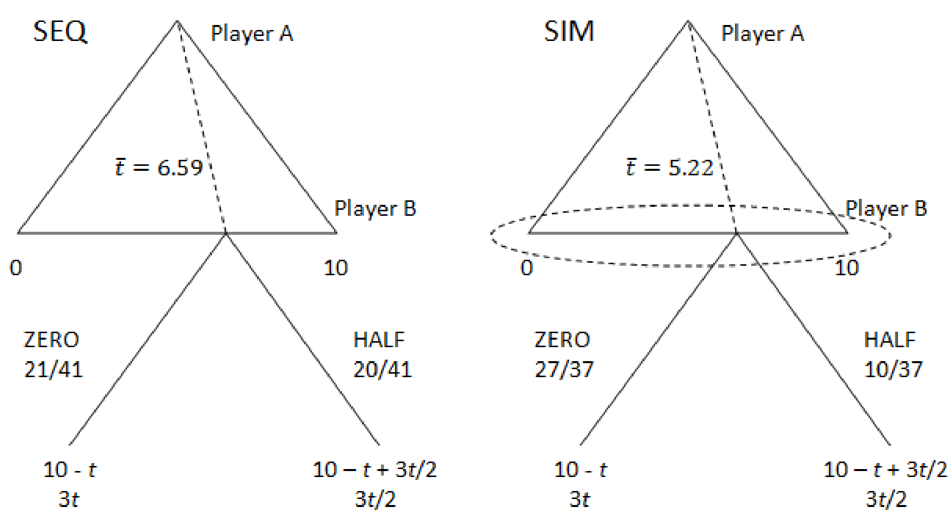
[10] It is important to note that in SEQ, player A's belief depends also on an estimate of how much other players A will send as these amounts will affect the responses of players B by the very nature of sequential interaction. An alternative belief elicitation procedure would be to ask about the player A's subjective probability that her paired player B will return *HALF*. However, this is not verifiable given our design and thus we would not be able to make such procedure monetarily salient.

to determine player types. (2) The instructions were read aloud for the subjects, who followed along with their own copy. To assist in their understanding, a copy of the instructions was also placed on an overhead and any decisions sheets, tables, etc. were illustrated specifically. The subjects were encouraged to ask questions relating to the rules of the game at any time. (3) Players A completed the belief elicitation task. (4) The experimenter collected the belief decision sheets and distributed the trust game decision sheets. (5) The sequence of events differed slightly between sessions implementing the sequential and simultaneous trust games. In the sequential trust game sessions, players A first made their transfer decision to players B. All decision sheets were collected and the amount transferred from players A were copied to their counterpart players' B decision sheets, which were then returned to players B. Presented with the decision of their player A counterpart, players B made their decision on whether to return half or zero. The experimenter collected all decision sheets, transferred the decision information of players B to their player A counterparts' decision sheet, and returned the decision sheets to all players to reveal their earnings. In the simultaneous trust game sessions, both player types of participants made their transfer decisions simultaneously. The experimenter collected all decision sheets, transferred the decision information each decision sheet to their counterparts', and returned the decision sheets to all players to reveal their earnings. (6) Subjects completed a short survey on the experiment and general demographic information for which they were paid $5 instead of a show up fee. This was not announced to the subjects at the start of the experiment. (7) Subjects were privately paid their earnings for the session.

4. Results

Given our modification to the Berg et al. trust game, we want to verify the robustness of our results to previous studies. Figure 1 provides a summary of players' decisions across treatments.[11] SEQ (n=41) is displayed on the left and SIM (n=37) is displayed on the right. The average t sent by players A in SEQ and SIM was 6.59 and 5.22 respectively. The subgame perfect equilibrium for both SEQ and SIM is for all players A to send $t = 0$ and all players B to return *ZERO*. Players A sent $t = 0$ only 5 out of 41 (12%) instances in SEQ and 4 out of 37 (11%) instances in SIM. Irrespective of the particular subgame in SEQ for a chosen t, players B returned *ZERO* 21 out of 41 (51%) instances. In SIM, players B returned *ZERO* 27 out of 37 (73%) instances.[12] Much like most of the previous literature on trust, we also find very little support for the subgame perfect equilibrium predictions for self-regarding players in our data.

Figure 1: Summary Statistics of Decisions across Treatments



[11] Although player's A action space is pictured as continuous, the subjects could invest only whole dollar amounts in the experiment.

[12] The difference in the frequency of returning *HALF* in SIM and SEQ is statistically significant (p = 0.000) using 2-sided Fisher's exact test.

The average beliefs of players A in SEQ and SIM were 51% and 46%, respectively. We expect there to be a positive relationship between player's A belief and the amount t that she invests. To verify this relationship, we run a tobit regression of players' A beliefs μ onto t. The bounds for the tobit estimation were imposed by the experimental design: $t \in [0,10]$. We find that the estimated coefficient of μ is positive for SEQ (0.27) and SIM (0.12), and both are highly statistically significant (p=0.000).

Next we turn our attention to *Hypothesis 1,* which states that the mean t conditional on player's A belief μ is greater in SEQ than in SIM.

Result 1: Players A signal trust in SEQ treatment.

Support for result 1: We compare the slopes of regressions of t on beliefs in SEQ and SIM treatments. The tobit analysis of pooled players' A decisions based on the treatment he participated in has the form:

$$t_i = \alpha + \beta_1 \mu_i + \beta_2 T_{SEQ} \cdot \mu_i + \gamma\, T_{SEQ} + \varepsilon_i \,,$$

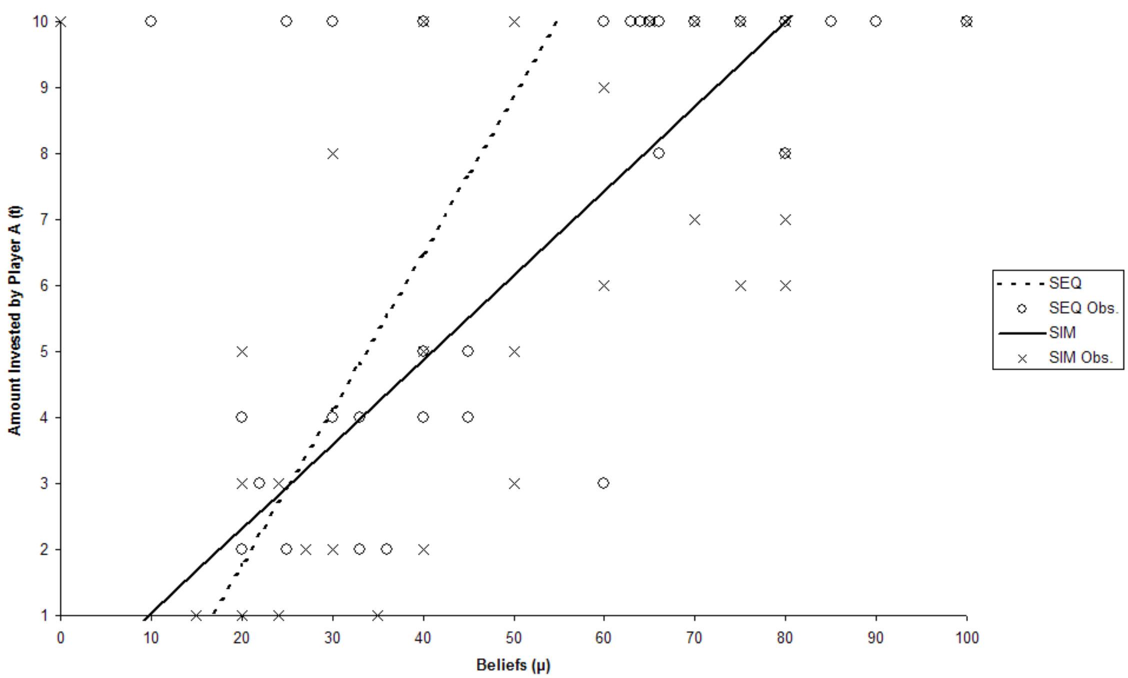
where T_{SEQ} represents a dummy variable that equals 1 for SEQ treatment and 0 otherwise. Once again, the bounds for the tobit estimation were imposed by the experimental design: $t \in [0,10]$. If the trust signaling hypothesis is true, we will expect that the slope of the regression in SEQ to be higher than in SIM, i.e. $\beta_2 > 0$. The estimated coefficients are provided in Table 1 and scatter plot of the data and regression lines (plotted as an estimated latent variable $t_i^* = \hat{\alpha} + \hat{\beta}\mu_i$ using the elicited beliefs in the respective treatments) are illustrated in Figure 2. The estimated slope of the regression in SEQ is significantly higher than in SIM, thus confirming our expectations.[13] □

Table 1: Tobit Regression Estimates for SEQ vs. SIM

	Coef.	Std. Err.	T	P >| t |
A's Beliefs (β_1)	0.128	0.036	3.55	0.001
Product (β_2)	0.109	0.058	1.89	0.063
Dummy (γ)	-2.748	2.813	-0.98	0.332
Cons. (α)	-0.248	1.829	-0.14	0.893
Sigma	4.883	0.623		

Product = A's Beliefs x Dummy

Figure 2: Data Scatter Plot and Tobit Regression Lines

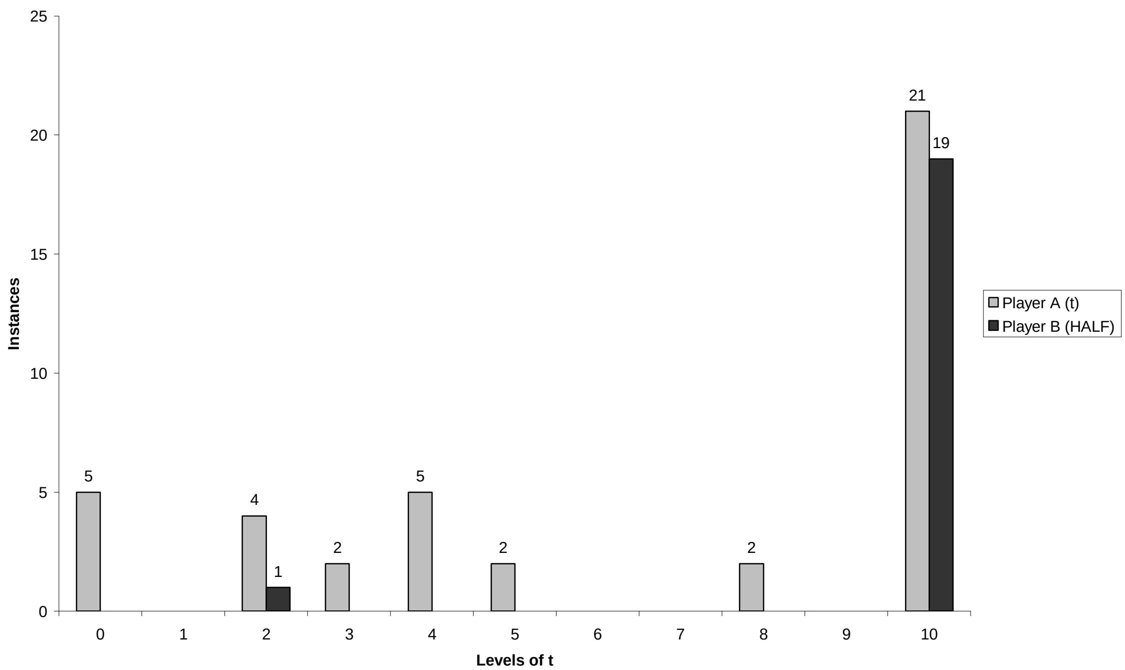


We now analyze the behavior of players B. Do players B react to the level of *t* sent to them by players A in SEQ? More precisely, do players B respond to trust

[13] Table 1 reports p-values for 2-sided tests estimated in STATA. However, our alternative hypothesis is 1-sided, and therefore, the appropriate p-value for slope is 0.032.

signaling by returning HALF with a higher frequency when they observe a higher *t* as conjectured in *Hypothesis 2*?

Figure 3: Instances of Decisions in SEQ.



Result 2: Players B only reward highest signals of trust.

Support for result 2: Figure 3 provides the distribution of decisions SEQ. The columns labeled Player A(t) present the instances that Players A sent *t*. The Player B (HALF) columns present the instances that Player B returned HALF for a given *t* received. It is clear from the figure that there is not an increasing monotonic relationship between *t* sent by players A and the frequency of HALF returned by players B. Notice that among the 41 pairs, 21 (51%) of the players A sent *t*=10 and 19 (91%) of players B who received *t*=10 returned HALF. On the other hand, only 1 out of the 20 players B (5%) who received $t < 10$, returned HALF. Thus, we reject the hypothesis that an increase in *t* induces a higher frequency of returning HALF by players B. □

Obviously in SEQ, the decision of players B of whether to return *HALF* or *ZERO* depended heavily upon the observed decision of player A. This clear pattern is not present in the SIM data where *t* is not observable to players B before they make their decisions. When player A sent *t*=10 in SIM, only 1 out of 9 (11%) players B returned *HALF* compared to 9 out of 28 (32%) when player A sent $t < 10$.[14]

We now compare the efficiency levels between SEQ and SIM.[15] Although we suspect that trust signaling is efficiency enhancing, our intuition about this is not clear-cut. In order to subject our conjecture to a stronger test, Hypothesis 3 posits that there is no difference in efficiency between the two treatments.

Result 3: SEQ treatment has a higher efficiency level than SIM treatment.

Support for result 3: The mean *t* sent by players A in SEQ and SIM was 6.59 and 5.22 respectively. A two-sided Mann-Whitney test indicates that they are significantly different at the 10% level (*p*=0.092). It is worthwhile to highlight the source of higher *t* in SEQ. A closer look at the data reveals that the number of players A who *signal trust* by sending *t*=10 (maximal) is significantly higher in SEQ than in SIM (*p*=0.013, 1-sided

[14] From the perspective of this evidence, it is possible that some of our subjects interpreted t <10 as a signal of distrust, rather than t >0 as a signal of trust. However, our experiment was not designed to distinguish between these explanations. Hence, we do not offer a conclusive answer here.

[15] We define efficiency as the percentage of maximum potential earnings realized by the subject's decisions. The level of efficiency in our trust game is solely dependent upon the amount *t* sent by player A because it is only their decision that determines any increase in the size of the pie. The decision by players B determines the distribution of the pie increase.

Fisher's exact test), but the number of those who sent nothing does not differ between treatments (p=0.566). □

The previous result indicates that social welfare as measured by t is higher in SEQ than in SIM. However, are players A actually better off in SEQ than in SIM. This is not obvious because, as shown in result 2, players' A trust signaling efforts are rewarded only if they send the full amount. We compare the income levels of players A across treatments, which is 10.44 in SEQ and 6.89 in SEQ. And thus, players A are indeed better off in the SEQ treatment.

5. Discussion

We set out to study trust in two environments that allow different degrees of strategic behavior. In the first environment players A and B make decisions in a trust game sequentially and in the second they make decisions simultaneously. In the sequential game player A can signal trust. The structure of the game also implies that player B observes whether she was trusted or not before she makes her decision. Hence, her response will likely depend on player's A action. Therefore, player A has the ability to behave strategically.

In the simultaneous game, the behavior of both players A and B is solely driven by their personal beliefs. More specifically, the trust of player A in receiving a fair response derives purely from her subjective belief about the proportion of fair players B in the population. And thus, player's A beliefs are dependent upon own experiences and biases. Because of the fact that player A's decision is not observable, she has no opportunity to signal trust and thus cannot affect the decision of player B. Hence, we expect that in a sequentially played trust game player A sends more money in order to induce player B to behave fairly than if the game is played simultaneously.

The results of our experiments for the most part confirm our conjectures. We find that players A signal trust to their counterpart players B who in turn reward them by sharing the surplus. However, in the laboratory environment that we created, it is necessary for player A to signal complete trust in order to receive this reward. Therefore, we reject the monotone relationship between the amount sent by players A and the frequency of returning a fair share by players B. This result seems quite intuitive – players B reward only what they consider absolute trust and appear to interpret any *t* smaller than 10 as a sign of distrust (Falk and Kosfeld (2006) and Schnedler and Vadovič (2007)). As argued earlier, it is not obvious a priori whether trust signaling is welfare improving or not. The experimental evidence suggests that welfare is higher when the display of trust is explicit as in our SEQ treatment.

Our results are relevant from theoretical standpoint and also from the point of view of designing institutions. We found that when interaction is sequential (i.e., agents have the ability to signal trust), more transactions are initiated (increasing overall welfare) and more transactions are completed (thus making it profitable for the trusting party). Hence, our experiment advocates designing institutions that allow for a display of trusting behavior. Nevertheless, the laboratory results are to be interpreted with caution as they may vary in different strategic and contextual environments in which the interaction between transacting parties is embedded. Moreover, the nature and extent of scrutiny by others as well as self-selection of individuals making the decisions might influence the observed behavior in other settings (Levitt and List (2007)).

The game subjects play in our experiment can be viewed, under certain assumptions (e.g., of guilt-averse or reciprocal preferences of player B), as an example of a dynamic psychological game (Duwfenberg and Battigalli (forthcoming)). By signaling trust player A may be signaling her beliefs about receiving a fair share of the pie. The greater the amount sent, the greater the loss to player A if player B decides to keep everything. Because of such credible exposure, it should be unambiguous that player A has high expectations. Hence, player B should revise her initial belief upwards about what player A expects her to do. This reasoning is also known as psychological forward induction (Duwfenberg and Battigalli (forthcoming)). It seems reasonable to conjecture that changes in behavior between our two treatments are driven by the heterogeneity in players' initial and updated beliefs, i.e., subjects induct forward. However, to further verify this claim a different design that will include a simpler game (for example, with binary choices) and will elicit beliefs of both players at appropriate moments of the game is necessary.

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Appendix A: An Illustrative Example

In this part we want to illustrate the incentives for the strategic use of trust. Consider our version of the trust game between player A and player B. Player A sends $t \in [0,1]$ which is tripled and player B may then return *HALF* of the surplus back to player A. Player A only sends positive t in case she expects a *HALF* to be returned with some positive probability μ. This type of behavior is of course inconsistent with the classical prediction under the usual self-regarding preferences. But, it can be justified by numerous explanations that have been proposed over the years, such as: reciprocity (Falk and Fischbacher (2006)), guilt aversion (Battigalli and Duwfenberg (2007)), inequity aversion (Fehr and Schmidt (1999)), pride (Ellingsen and Johannesson (2008)) and/or conformism (Sliwka (2007)) among others. We will not specifically pick any of these theories. After all, choosing one of them is not important for our argument. What is important is their common prediction, which is also backed up by the wealth of empirical and experimental evidence, that there is a monotone increasing relationship between the amount sent and the amount received. This is also known as the gift-exchange. In other words, if player A sends more (i.e., trusts more, as interpreted by the previous literature), then player B also returns more. Our argument is based on the idea that player B intensifies his gift-exchange behavior when she thinks that she is trusted by player A to do that. In other words, she cares about the opinion of player A regarding her reciprocal or pro-social predisposition. Because the amount sent, *t*, reflects the level of trust, player A may want to strategically increase *t* in order to induce more generous response from player B. The following example illustrates this reasoning.

To keep matters as simple as possible we assume that there are two kinds of players B in the world. The first are those who care about being trusted, i.e., care about what others think of them, and reward higher perceived trust with more generous response. The second kind are those who do not care about being trusted and always maximize their monetary gain. Further suppose that player A has a type $\theta \sim \mathrm{F}[0,1]$ which is her subjective belief that player B is the caring type. Then, with probability $1-\theta$

player A thinks player B is purely self-regarding, *homo economicus*, who will always keep everything regardless of the *t*. This means that the caring player B's strategy $\sigma(\alpha_B)$, which is the probability of returning *HALF*, depends on her (first-order) belief α_B about θ in a monotone way. The idea is intuitive: if player B believes that player A thinks that she is kind, or fair, or altruistic person, then player B wants to live up to this expectation. This formulation is reminiscent of Ellingsen and Johannesson (2008) who also consider preferences for opinions of others and argue that individuals use positive opinions to derive pride in themselves. Our idea is similar. Individuals like to be trusted because that reflects well upon them in their own eyes.[16] Unlike Ellingsen and Johannesson, however, we do not model preferences explicitly. Rather, we directly assume the behavior which is consistent with preferences that we have in mind. For the sake of simplicity we assume that $\sigma(\alpha_B) = \alpha_B$.

In this example we suppose that $F(x) = x^2$ is a (triangular) distribution with the mean 2/3 and that this is common knowledge.[17] We also assume that player A is risk-neutral.[18] Let us begin with the simpler simultaneous moves game which corresponds to our SIM treatment. In equilibrium, due to the lack of extra information about player A's type, player B acts purely on her prior belief about θ and returns *HALF* with probability $\sigma(\alpha_B) = E[\theta] = 2/3$. Player A optimizes given her belief θ. Because she is risk-neutral,

[16] And possibly in the eyes of others. But this is not a part of our model.
[17] Even simpler would be to use uniform distribution but that would give us only a trivial outcome because of a low mean. This will become clearer later in the example.
[18] This assumption is important because it will produce dichotomous optimal behavior by player A -- she optimally sends either 1 or 0. Obviously this is irreconcilable with the empirical data from trust games where we observe much richer behavior. The virtue of assuming risk-neutrality is that it allows us to make our argument in a simple and clear way.

her optimal strategy is to either send all or nothing, i.e., $t^* \in \{0,1\}$. Denote by α_s player A's (first order) belief about σ. Her expected payoff from sending any *t* is

$$\theta\left(\alpha_A(1-t+\frac{3t}{2})+(1-\alpha_A)(1-t)\right)+(1-\theta)(1-t).$$

She optimally sends $t^*=1$ rather than 0 only when it is profitable,

$$\frac{3\theta\alpha_A}{2}\geq 1. \qquad (1)$$

Notice that player A's expectations of receiving *HALF* are $\mu=\theta\alpha_A=(2/3)\theta$. Hence, she sends $t^*=1$ whenever $\theta\geq 1$. This may at first seem a bit extreme since at most one type $\theta=1$ would ever send a positive amount, i.e., 1. However, we particularly like this feature because it illustrates nicely our argument. Namely, below we will see that in the sequential game there is a whole interval of types who would send a positive amount due to signaling incentives.

To see that player A may have incentives to signal her type in the sequential environment suppose now that player A moves first and then player B observes *t* and responds. The behavior just described for the simultaneous game is not optimal anymore. Some players A will deviate and send positive amounts. To see this suppose that both player A and player B act the same as in the simultaneous game, i.e., send $t=1$ only if $\theta\geq 1$ and send $t=0$ otherwise and $\sigma(\alpha_B;t)=E[\theta]=2/3$. Then, upon observing $t=1$, player B revises her belief about player A's type to $\alpha_B=1$ and returns *HALF* with certainty $\sigma(\alpha_B)=\alpha_B=1$. Because of this, it becomes profitable for all types $\theta\geq 2/3$ to deviate as well (by (1)) and send 1 instead of 0. Thus, types in this interval $[2/3,1]$ would want to send 1 instead of 0 in the sequential game because they have incentives to signal with trust.

We have just illustrated that signaling with trust can be profitable against a myopic player B. But can this happen in equilibrium? Notice that in the above example the player B's updated belief is incorrect. In equilibrium there are no surprises and player B adjusts her belief accordingly. In other words, she is aware of the signaling behavior.

Set

$$\bar{\theta} = \frac{2}{3\alpha_A} \tag{2}$$

which denotes the threshold for player A below which she optimally sends 0 and above which she optimally sends 1. In equilibrium player B updates her belief accordingly,

$$\begin{aligned} \alpha_A &= \int_{\bar{\theta}}^{1} x f(x \mid x > \bar{\theta}) dx \qquad (3) \\ &= \int_{\bar{\theta}}^{1} x \frac{2x}{1-\bar{\theta}^2} dx \,. \end{aligned}$$

The signaling equilibrium is characterized by $\bar{\theta}$ which satisfies both (2) and (3). That is, $\bar{\theta} = 0.76$. Notice that even in equilibrium where the beliefs are correct and players B are not fooled by the signals sent by players A, there are incentives to strategically increase *t*. In the interval $[2/3,1)$ all types would have sent 0 in the simultaneous move game but send 1 in the sequential move game.

The example above implies that one could identify signaling behavior in our experiment by comparing the relationship between individual types (θ) of subjects and their amounts sent (*t*) for our two treatments and find that the relationship is steeper in the sequential game. Indeed this is something we would like to do, but we cannot do it directly. The reason is that we cannot directly measure individual types (θ), the private beliefs of subjects about the proportion of self-regarding individuals in the population. Rather, what we can and do measure are "average trust levels" or, in other words, the overall beliefs that players A have regarding the average response of players B in the room. It is apparent from the example that these are not the same. But they are closely related. In fact what we measure is $E[\mu]$, which depends on θ, i.e., $\mu = \theta E[\alpha_A]$. Now the comparison between treatments may be slightly problematic if $E[\alpha_A]$ differs between treatments. Notice that in our example this does not happen, because we have assumed linear response of player B, $\sigma(\alpha_r) = \alpha_B$. Then,

$$
\begin{aligned}
E[\alpha_A^{SEQ}] &= E[E[\sigma(\alpha_B) \mid \theta < \bar{\theta}] \mid \theta < \bar{\theta}] + E[E[\sigma(\alpha_B) \mid \theta > \bar{\theta}] \mid \theta > \bar{\theta}] \\
&= E[E[\theta \mid \theta < \bar{\theta}] \mid \theta < \bar{\theta}] + E[E[\theta \mid \theta > \bar{\theta}] \mid \theta > \bar{\theta}] \\
&= E[\theta] \\
&= \sigma(E[\theta]) \\
&= E[\sigma(E[\theta])] = E[\alpha_A^{SIM}],
\end{aligned}
$$

where all expectations are taken with respect to θ. However, also notice that the equalities in steps 2 and 4 will break if σ is either a convex or a concave function (because of Jensen's inequality). Thus, the beliefs of the players A may be biased in the upper (if σ is concave) or the lower (if σ is convex) direction. In our data we test for the difference in the distributions of beliefs for our two treatments and cannot reject the hypothesis that they are the same using Mann-Whitney test ($p = 0.528$) which gives us a certain level of comfort and confidence in our results.

Appendix B: Instructions

You are a Player ____ ID#:____

GENERAL INSTRUCTIONS

March, 2007

This is an experiment studying decision-making. The instructions are simple and if you follow them carefully and make good decisions, you might earn a considerable amount of money which will be paid to you in cash at the end of the experiment. It is therefore very important that you read these instructions with care.

No Talking Allowed

It is prohibited to communicate with other participants during the experiment. Should you have any questions please ask us. If you violate this rule, we shall have to exclude you from the experiment and from all payments.

Anonymity

Each person will be randomly matched with another person in the experiment. No one will learn the identity of the person she/he is matched with. You will be matched with the same person for the entire experiment.

Types

Each two person group will consist of two types of participants (Player A and Player B) that are assigned randomly. Your assigned type will be listed at the top of each task instruction sheet.

The Game

You are randomly paired with another individual. One member of your pair will be a player A and the other one will be player B. Find your type in the upper right corner of this sheet. You will never be able to find out the identity of the player you are paired with.

Each player's earnings will be determined according to the process below.

(a) Player A begins the process with $10, and player B begins with $0.

(b) Player A then has the opportunity to transfer all, any portion, or none of his/her $10 to player B. Player A circles his or her decision on line (1) of the attached *Decision Sheet*. The amount that is not transferred is player A's to keep. The amount that player A transfers triples when it reaches player B. For example, if A transfers $10 to B, B receives $30. If A transfers $5 to B, B receives $15. If A transfers $0 to B, B receives $0.

(c) Player B then has the opportunity to transfer half or none of the money he/she has received to player A. Player B indicates his/her decision in line (3) of the *Decision Sheet* by circling either **HALF** or **ZERO**. The amount that is not transferred is player B's to keep, and the amount transferred is added to player A's earnings.

You are a Player A ID#:____

Task 1 Instructions for Player A

In task 2, the initially described two stage game is played **sequentially**. That is, player A makes their transfer decision and then player B makes their transfer decision after being able to see how much player A transferred to them. Therefore, player B is going to make their decision **knowing** how much player A has transferred to them.

For task 1, you must answer the following question:

After seeing how much is transferred to them from player A, what is the percentage of players B in the room that will return HALF of the amount that they receive, i.e. HALF of the tripled amount that is transferred to them from player A counterpart?

Your payout will depend on your accuracy. The payout is calculated as follows:

You will start with $5. For every percentage point (1 % point) of mistake, 10 cents will be deducted from this $5. The mistake is the absolute value of (your answer – the actual percentage). For example, if you answer accurately, you will get $5. If you miss by 20% points (i.e., your answer is either twenty percentage points too high or twenty percentage points too low), you will be paid $3 (500 - 20 x 10 = 300). If your mistake will be larger than or equal to 50% points, then your earnings from this task will be zero.

I believe that ……… % of players B in the room will return HALF of the tripled amount.

You are a Player A ID#:____

Task 2 DECISION SHEET

Player A begins with $10. Player B begins with $0.

Each dollar that Player A gives to Player B is multiplied by 3 by the experimenter.

The decisions of both players will be made sequentially. Therefore, player B will know how much player A has transferred to player B before player B makes their decision of whether to return HALF or ZERO.

(1) **Player A's decision**:

Circle the amount that you want to transfer to player B

0 1 2 3 4 5 6 7 8 9 10

(3) **Player B's decision:**

Circle the amount you want to transfer to player A:

HALF or ZERO

(4) Experimenter calculates total earnings:

Final payoff to player A: ____________________
Final payoff to player B: ____________________

You are a Player B   ID#:____

DECISION SHEET

Player A begins with $10. Player B begins with $0.

Each dollar that Player A gives to Player B is multiplied by 3 by the experimenter.

The decisions of both players will be made sequentially. Therefore, player B will know how much player A has transferred to player B before player B makes their decision of whether to return HALF or ZERO.

(1) **Player A's decision**:

Circle the amount that you want to transfer to player B

0   1   2   3   4   5   6   7   8   9   10

(3) **Player B's decision:**

Circle the amount you want to transfer to player A:

HALF   or   ZERO

(4) Experimenter calculates total earnings:

Final payoff to player A: ____________________
Final payoff to player B: ____________________

You are a Player A   ID#:____

Task 1 Instructions for Player A

In task 2, the initially described two stage game is played **simultaneously**. That is, player A makes their transfer decision at the same time that player B makes their transfer decision back to player A. Therefore, player B is going to make their decision **without knowing** how much player A has transferred to them.

For task 1, you must answer the following question:

Without knowing how much player A has transferred to them, what is the percentage of players B in the room that will return HALF of the amount that they receive, i.e. HALF of the tripled amount that is transferred to them from player A counterpart?

Your payout will depend on your accuracy. The payout is calculated as follows:

You will start with $5. For every percentage point (1 % point) of mistake, 10 cents will be deducted from this $5. The mistake is the absolute value of (your answer – the actual percentage). For example, if you answer accurately, you will get $5. If you miss by 20% points (i.e., your answer is either twenty percentage points too high or twenty percentage points too low), you will be paid $3 (500 - 20 x 10 = 300). If your mistake will be larger than or equal to 50% points, then your earnings from this task will be zero.

I believe that ……… % of players B in the room will return HALF of the tripled amount.

You are a Player A ID#:____

Task 2 DECISION SHEET

Player A begins with $10. Player B begins with $0.

Each dollar that Player A gives to Player B is multiplied by 3 by the experimenter.

The decisions of both players will be made simultaneously. Therefore, player B will **not know** how much player A has transferred to player B before player B makes their decision of whether to return HALF or ZERO.

(1) **Player A's decision**:

Circle the amount that you want to transfer to player B

0 1 2 3 4 5 6 7 8 9 10

(3) **Player B's decision:**

Circle the amount you want to transfer to player A:

HALF or ZERO

(4) Experimenter calculates total earnings:

Final payoff to player A: ____________________
Final payoff to player B: ____________________

You are a Player B ID#:____

DECISION SHEET

Player A begins with $10. Player B begins with $0.

Each dollar that Player A gives to Player B is multiplied by 3 by the experimenter.

The decisions of both players will be made simultaneously. Therefore, player B will **not know** how much player A has transferred to player B before player B makes their decision of whether to return HALF or ZERO.

(1) **Player A's decision**:

Circle the amount that you want to transfer to player B

0 1 2 3 4 5 6 7 8 9 10

(3) **Player B's decision:**

Circle the amount you want to transfer to player A:

HALF or ZERO

(4) Experimenter calculates total earnings:

Final payoff to player A: ____________________
Final payoff to player B: ____________________

QUESTIONNAIRE

Thank you for participating in the experiment. While we calculate your final payout, please complete the following survey. All of your responses will remain anonymous and only linked to the decisions within the experiment via your ID#. Therefore, please answer as truthfully and completely as possible. You will be paid $5 for the completion of this questionnaire.

1. Were you a player A or player B?

2. Did you find the instructions clear and self-explanatory? If not, please specify.

3. What was your decision rule when making your choice?

General Demographic Information

1. What is your age? ___________

2. What is your sex? (Circle one number.)

   01 Male 02 Female

3. Which ethnic group(s) do you belong to? (Circle as many as you need, then write the country you are from if applicable.)

01	NZ European/Pakeha	_	04	Asian
02	NZ Maori	_		Country: ________________
03	Pacific Islander	_	05	Other
	Country: ________________			Country: ________________

4. What is your major? (Circle one.)

   01 Accounting
   02 Economics
   03 Finance or Information Systems
   04 Education
   05 Engineering
   06 Law
   07 Biological Sciences
   08 Math, Computer Sciences, or Physical Sciences
   09 Social Sciences or History
   10 Humanities
   11 Psychology
   12 Other Fields

5. What is your class standing? (Circle one.)

01	Undergraduate – first year	04	Honours
02	Undergraduate – second year	05	Masters
03	Undergraduate – third year	06	Doctoral

6. What is the **highest** level of education you expect to **complete**? (Circle one.)

01 Bachelor's degree
02 Honour's degree
03 Master's degree
04 Doctoral degree

7. What was the highest level of education that your **father** (or male guardian) **completed**? (Circle one.)

01 Less than high school (Fifth Form Certificate or Sixth Form Certificate)
02 High school (Bursary or UE)
03 Vocational or trade school
04 College or university

8. What was the highest level of education that your **mother** (or female guardian) **completed**? (Circle one.)

01 Less than high school (Fifth Form Certificate or Sixth Form Certificate)
02 High school (Bursary or UE)
03 Vocational or trade school
04 College or university

9. What is your citizenship status in New Zealand?

01 NZ citizen
02 Permanent Resident
03 Refuge
04 Other

10. Are you a foreign student on a Student Visa?

01 Yes
02 No

11. Are you currently …

01 Single and never married?
02 Married?
03 Separated, divorced or widowed?

12. On a 9-point scale, what is your current GPA if you are doing a Bachelor's degree, or what was it when you did a Bachelor's degree? This GPA should refer to all of your coursework, not just the current year. Please pick one:

01 Between 7.01 and 9.0 GPA (A- to A+ average)
02 Between 5.01 and 7.0 GPA (B to A- average)
03 Between 3.01 and 5.0 GPA (C+ to B average)
04 Between 1.01 and 3.0 GPA (C- to C+ average)
05 Between 0 and 1.0 GPA (D- to C- average)
06 Have not taken courses for which grades are given

13. How many people live in your household? Include yourself, your spouse and any dependents. Do not include your parents or flatmates unless you claim them as dependents. ____________

14. Please circle the category below that describes the total amount of INCOME earned last year by the people in your household (as "household" is defined in question 13). [Consider all forms of income, including salaries, tips, interest and dividend payments, scholarship support, student loans, parental support, social security, alimony, and child support, and others.]

01 $15,000 or under
02 $15,001 - $25,000
03 $25,001 - $35,000
04 $35,001 - $50,000
05 $50,001 - $65,000
06 $65,001 - $80,000
07 $80,001 - $100,000
08 Over $100,000

15. Please circle the category below that describes the total amount of INCOME earned last year by your parents. [Consider all forms of income, including salaries, tips, interest and dividend payments, social security, alimony, and child support, and others.]

01 $15,000 or under
02 $15,001 - $25,000
03 $25,001 - $35,000
04 $35,001 - $50,000
05 $50,001 - $65,000
06 $65,001 - $80,000
07 $80,001 - $100,000
08 $100,001 - $120,000
09 $120,001 - $140,000
10 Over $140,000
11 Don’t know
12 Known only in foreign currency
Write currency and amount here: __________________

16. Do you work part-time, full-time, or neither? (Circle one.)

01 Part-time
02 Full-time
03 Neither

17. Before taxes, what do you get paid? (Fill in only one.)

01 ___________ per hour before taxes
02 ___________ per week before taxes
03 ___________ per month before taxes
04 ___________ per year before taxes

18. Do you currently smoke cigarettes? (Circle one.)

01 No
02 Yes
If yes, approximately how much do you smoke in one day?