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Essays in Decision Making and Beliefs

A dissertation submitted in partial satisfaction of the

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in

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by

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The Dissertation of Alison Lee Sanchez is approved, and it is acceptable

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Chair

University of California, San Diego

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DEDICATION

In recognition for all of their support, this work is dedicated to

my parents Christine and Rudolph.

EPIGRAPH

If we shadows have offended,
Think but this, and all is mended,
That you have but slumbered here
While these visions did appear.

--*A Midsummer Night's Dream*
William Shakespeare

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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ABSTRACT OF THE DISSERTATION

Essays in Decision Making and Beliefs

by

Alison Lee Sanchez

Doctor of Philosophy in Economics

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This dissertation examines decisions and belief formation in a variety of experimental settings. Chapter 1 examines how individuals form self-serving beliefs to justify selfish actions against others. The second chapter investigates how social and self-image can affect an individual's decision to be charitable. The third chapter uses the mobile application Prometheus to conduct a field-style experiment to study how individuals search for information, process information and ultimately make a decision using various types of information.

Chapter 1

Beliefs of Convenience: Justifying Selfish Behavior through Perception Manipulation

1.1 Introduction

People are now inundated with numerous opportunities to be generous by donating their money, volunteering their time, as well as performing and returning favors for others. Solicitations come from multiple sources: at home (e.g. direct mail solicitations, door-to-door fundraising campaigns, petitioners in front of the grocery store; helping neighbors); at work (e.g. coworkers' and managers' appeals to participate in various charitable causes); on social media (e.g. charitable appeals that have gone viral, such as the Ice-Bucket Challenge); from friends (e.g. sponsoring charity marathons and their children's school fundraisers). Over 50% of adults report being asked to give to charity more than three times per year through at least one of these channels (Exely, 2015). These solicitations rely in part on individuals' need to maintain a positive social and self-image through social norm conformity. Individuals care about how others view them (social image) and how they view themselves (self-image). Several studies have shown that this concern for image can motivate cooperative behavior (Andreoni and Bernheim, 2009; Areiely, Bracha, Meier 2009; Bagwell and Bernheim, 1996; Glazer and Konrad, 1996; and Ireland, 1994). In addition, the material and psychological costs associated with deviating from group norms can be significant. For example, de Waal (1996) notes that group punishments of deviators can be extreme, ranging from social marginalization and ostracism to starvation, physical isolation and even violence. Psychological costs include experiencing feelings of guilt and shame from failing to conform to others' expectations (Battigalli and Dufwenberg, 2007; Battigalli et. al 2013; Battigalli and Dufwenberg, 2009; Tadelis, 2011). Thus, gaining

and maintaining social approval has become an important factor in human evolution and survival (Bowles and Gintis, 2002; Gintis, et. al, 2003; Fehr and Gachter, 2002; Fehr, et. al, 2002). However, individuals also need to consider the effect of donating time and money on their own personal resources. If one were to comply with all solicitations they would find themselves bankrupt of both material and psychological resources. Thus, there must be times at which an individual must decline to yield to group demands. Recent studies have demonstrated that individuals do avoid giving when offered a chance to do so without damaging their image (Dana et. al, 2006; Lazear et al., 2012; Broberg et al., 2007). The social pressure model (Akerlof and Kranton, 2005) confirms that demand-driven giving may be utility-reducing for the giver. It then becomes natural to ask how individuals balance these two opposing demands: the demand to maintain their own resources and the demand by their group to cooperate with social norms. We investigate the behavior of individuals who take a selfish action in defiance of established social norms and their subsequent attempt to maintain a positive social and self-image. We propose that image motivation through social approval can a double-edged sword: it can increase compliance with norms, but it can also decrease (or at the very least fail to increase) the incentive to comply in shirkers who can satisfy their need for social approval by attaining it through other means.

Our investigation centers on whether and how individuals manipulate others' perceptions of their selfish action in order to mitigate their selfish behavior. By manipulating others' perceptions about their selfish action, this eliminates the need for a person to take a cooperative action. Negative social consequences, such as punishment,

and negative personal consequences, such as guilt and shame, are avoidable if an appropriate explanation or excuse can be crafted that diminishes the selfishness of the action. To illustrate the point, consider the following scenario. An individual wanting to shirk on a project has received a favor from a coworker who contributes extra effort to the project on their behalf. Failure to repay that favor may result in guilt, retaliation from the coworker, ostracism from other coworkers, or a combination of all three. However, if one can justify the failure to repay the favor by changing the perception of their selfish action of shirking, then they can feel free to shirk without social consequences. If the individual says that they believed that they were being asked to put in more effort than what their coworkers had contributed, then this would perhaps be perceived differently than if the individual reported a belief that their coworker was contributing extra effort as a favor. The former is a more justifiable strategic defense, whereas the latter is viewed as taking advantage of a coworker and is thus viewed as being more selfish and worthy of punishment.

We first begin by demonstrating that image concerns dominate preferences for social norms, such as fairness or reciprocity. In other words, individuals have a preference for *appearing* to be reciprocal, instead of actually behaving reciprocally. Further, this concern over image will not motivate selfish individuals to change their selfish behavior and behave cooperatively. Instead, image-conscious selfish individuals will maintain their selfish behavior, but go out of their way to create the false impression that they are cooperative. We then establish one strategy by which image-conscious selfish individuals create the false impression that they are cooperative. We

propose that individuals, with the intention of maintaining a positive image, purposely manipulate information they know others might use to evaluate their actions. We consider whether certain individuals, in an effort to cover their selfish action, will subsequently lie about the beliefs they held when they took that action, knowing that others may possibly look to these stated beliefs when evaluating their selfish actions.

We are not the first to study image motivation or social norms, but we are one of the first to suggest that image concerns may not result in an increase in cooperative behavior as previously posited. The novelty of our paper is to compare two different belief elicitation methods to expose subjects' motivations and strategies. In our approach we look at the difference between *stated beliefs*, the beliefs subjects express when only their image is at stake, and *revealed beliefs*, the beliefs subjects express when only their monetary payoff is at stake. To our knowledge we are the first to introduce this method of comparing belief elicitation methods as well as introducing the revealed beliefs elicitation device itself. We conduct a modified trust game, after which we obtain the two measures of beliefs. First, we directly ask subjects to state the beliefs they held when they made certain decisions in the trust game. We term these "stated beliefs", as there are no monetary consequences for stating inaccurate beliefs. Second, we implement a belief elicitation device where subjects indirectly express their beliefs by placing bets on different game outcomes. We term these revealed beliefs, as subjects are unaware that their beliefs are being measured when they make a decision about their final payoff. We find that subjects who take a selfish action in the trust game subsequently exhibit large differences between their *stated* beliefs and their *revealed*

beliefs. Selfish subjects stated that they believed their opponent took a selfish action first. However, in contrast with what they stated when asked directly (the *stated* belief), selfish subjects staked their entire payoff on the chance that their opponent took a cooperative action (the *revealed* belief). Thus, these subjects were revealed to believe that their opponent was in fact cooperative. By comparison, subjects who took a cooperative action in the trust game do not display this difference between their stated and revealed beliefs. In order to rule out confusion as an explanation for the difference between stated and revealed beliefs we measure the decision-making sophistication of subjects. Sophisticated subjects are subjects who did not violate stochastic dominance in the revealed elicitation task[1]. Our key result is that we find that the subjects with the largest differences between their stated and revealed beliefs are the subjects who are both selfish and sophisticated. When even under a small amount of social pressure, subjects will go out of their way to "blame the victim" to relieve themselves of the social responsibility to be generous.

We suggest that the reason for the disparity between selfish subjects' stated and revealed beliefs is that these selfish individuals are precluded from using their action to signal a positive image. Instead, the selfish players must use their stated beliefs to signal their motivation in making a selfish decision and in doing so, mitigate their selfish actions and preserve a positive social image. On the other hand, subjects who have taken the cooperative action can signal a positive social image with their action alone and thus would have no need to alter their social image through their stated

[1] Please see Section 1.3 for a complete explanation of how subjects' sophistication was determined.

beliefs.

Our results have important implications for policy. Many charities and policy makers rely on solicitation methods meant to motivate charitable behavior through aversive stimuli. However, stimuli such as social pressure, guilt or shame may, in fact, drive people *away* from cooperative behavior. Our results suggest that solicitation methods relying on social pressure may in the short-run produce desired behavior, but may cause an avoidance of charitable giving in the long-run.

The paper proceeds as follows: Section 1.2 provides background and motivation for the main hypotheses; Section 1.3 describes the experimental design; Section 1.4 describes predictions; Section 1.5 presents the results; Section 1.6 provides discussion; and Section 1.7 concludes.

1.2 Background and Main Hypotheses

1.2.1 Social Pressure and Concerns for Image

Our main line of inquiry involves how individuals justify their selfish behavior in response to concerns about their image[2]. We investigate two hypotheses related to the desire to manipulate perceptions and the method by which this is accomplished.

Hypothesis 1 - Perception Manipulation*:* *Individuals who exhibit selfish behavior will subsequently attempt to justify this violation of social norms by manipulating the way*

[2] Rather than debating the type of image concern (social vs. self-image), we take the view that a combination of both drives behavior in our experiment. Given that social and self-image are inextricably linked, it would be beyond the scope of this current study to test for the individual effects of social image and self-image on self-serving beliefs.

others perceive that selfish action.

Hypothesis 1 states that individuals will attempt to change the context in which their selfish action is viewed. We define this as "perception manipulation": an attempt to alter others' appraisal of one's actions. That is, an attempt to make an apparent "selfish" action appear to be less selfish than it really is. In the context of our trust game, Hypothesis 1 predicts that subjects taking a selfish action will state that they believe that their opponent was selfish first. Perception manipulation allows an individual to take a selfish action even when social norms dictate they take a cooperative action. By manipulating the way others view that selfish action, one can mitigate any potential damage to their social or self-image (or both). Thus, without the threat to image, the motivation to comply with social norms dissipates.

1.2.2 Role of Beliefs in Perception Manipulation

Altering the way an action is perceived calls for a manipulation of beliefs about that action. The role beliefs play in judgments and decision-making is not a new topic of study. It has been postulated by many that in addition to preferences, beliefs have played an important role in explaining prosocial behavior[3]. Several previous studies have incorporated beliefs about subject intentions in models of reciprocity (Fehr and

[3] Many theories of social preferences have allowed for belief-dependent motivation based off of Geanakopolos, Pearce and Stacchetti (1989) and Gilboa and Schmeidler (1988) who found that traditional methods were inadequate in representing preferences that exhibit belief-dependent motivations. Rabin's (1993) reciprocity theory, in which a Player's preferences over material payoff distributions are influenced by the co-players intentions, is a well-known application of "psychological" game theory. Several extensions of Rabin's 1993 theory, including Dufwenberg and Kirsteiger (2004) and Battigalli and Dufwenberg (2009) have illustrated the importance of incorporating updated beliefs, others' beliefs, and players' plans of how they intend to play. For example, Battigalli and Dufwenberg (2007) suggest that individuals care about what other people give to others in order to avoid aversive feelings of guilt based on co-players beliefs and expectations.

Schmidt, 1999; Levine, 1998; Dufwenberg and Kirchsteiger, 2004; Falk and Fischbacher, 2006; Falk et. al, 2008; McCabe, et. al, 2003). These experiments have provided evidence that individuals take others' intentions and beliefs into account when evaluating when to punish or reward others' actions.

Hypothesis 2 - Deceitful Beliefs*:* *Selfish individuals will attempt to alter others' beliefs about their own beliefs when they think that others will be evaluating their selfish action. Specifically, selfish individuals will misstate their beliefs when asked, but will later reveal their true beliefs when they are unaware that their true beliefs are being measured.*

In the context of our experiment, Hypothesis 2 predicts that selfish players express two different sets of beliefs: those beliefs they express when they think that others are evaluating them (stated beliefs) and those beliefs they express when they feel they are free from evaluation (revealed beliefs). Misstating beliefs is one way to alter others' perceptions of a selfish action. Stating a belief that their opponent was selfish first relieves someone of the obligation to return kindness. If one never believed their opponent was going to be kind, there is no social obligation to return kindness. However, if one were to state that they believed their opponent to be kind and they took advantage of their opponent's kindness by acting selfishly toward their opponent, this would be judged as violating the social norm of reciprocity. Thus, stating one's opponent is selfish is self-serving as it alleviates both psychosocial costs of guilt/shame and minimizes the probability of group punishment from violating social norms of reciprocity.

1.2.3 Relation to Previous Work

This study builds on growing literature on image motivation, social pressure, social norms and strategic avoidance of other-regarding behavior. The pressure to comply with social norms has been well documented. For example, DellaVigna, List, and Malmendier (2012) present a field experiment exploring donor reactions to door-to-door fundraising drive. They find that social pressure is indeed a driving force in a large number of charitable donations. Importantly, the authors also find that utility losses are significant, as about half of the donors in their study would have preferred to not donate, or, to donate less. In a closely related study[4], DiTella et. al (2015) find that people avoid altruistic actions by distorting others' beliefs about altruism. They conduct a modified dictator game where recipients have the opportunity to take a side payment in exchange for reducing the overall size of the pie. Dictators in this setting reported that recipients were likely selfish and used this self-serving belief to convince themselves to take selfish action against the recipients.

It is already well known that social and self-image are associated with conforming to group norms. Dufwenberg et al. (2006) elicited beliefs in one-shot public goods games to explore the impact of framing and to assess theories of reciprocity and guilt-aversion. They found that when players know they are expected to be other-regarding, they give according to what they believe others expect of them. This suggests that individuals are very aware and sensitive to others' expectations. Complying with social norms results in a positive social and self-image, whereas violating norms results

[4] Conceived entirely independently.

in a negative social and self-image (Benabou and Tirole, 2005; Akerlof and Kranton, 2005). Consequences of violating group norms can loom large for individuals. A damaged social image may result in material punishment and can result in psychological costs to self-image. Study of social preferences, such as preferences for fairness, reciprocity and guilt aversion, has shown that social norms can induce cooperative behavior in some settings. For example, Fehr and Schmidt, 1999; Charness and Rabin, 2002; Charness and Levin, 2007; Charness and Haruvey, 2002; Blount, 1995 all present evidence suggesting that individuals readily comply with the social norms of fairness and reciprocity. These studies suggest that individuals comply with social norms because of an innate preference for the norm itself (i.e. reciprocity entering directly into one's utility).

However, other evidence demonstrates that, rather than a preference for fairness or reciprocity, it is a concern for *projecting an image* of being fair or reciprocal that motivates cooperative behavior. In other words, when confronted with an opportunity to give, an otherwise selfish person may give if they feel that their social or self-image is at stake. These individuals may truly prefer to be self-regarding, but refrain under social pressure. Andreoni and Bernheim (2009) found that individuals have a strong preference for being *perceived* as complying with fairness norms, rather than having a preference for fairness itself. This evidence suggests that there are a number of individuals who care so much about how they are perceived by others that they are willing to take actions that violate their own preferences and incur a utility loss in the process.

Much of the previous research on the effect social preferences on cooperation has taken for granted that individuals' only alternative in the face of social pressure is to behave cooperatively. However, a growing literature on avoidance of opportunities to be generous suggests that individuals actively avoid opportunities to be other-regarding. Andreoni, Rao, and Trachtman (2011) find that individuals physically avoid situations where they will be asked to give to charity. It has also been found that individuals will pay to avoid the opportunity to give (Dana et. al, 2006; Lazear, et.al, 2012; Broberg et. al, 2007). Rabin (1995) presents a model of self-deception that suggests that a selfish individual forms self-serving beliefs that their actions are not harmful to others and thus allows them to take a selfish action. Social psychology experiments have established that rather than comply with group demands, individuals suffering from guilt or shame as a result of violating social norms often make an effort to cover over their deviant behavior in order to alleviate aversive feelings or prevent group punishment (Gausel and Leach, 2011).

1.3 Experimental Design

Each session consisted of three decision stages. In the first stage, subjects play a modified Trust game with binary choices. We employ the strategy method: subjects were asked to make binding choices for different scenarios, and paid based on one randomly chosen scenario at the end of the session. All choices were made with paper and pencil. In the second and third stages we collect non-incentivized stated beliefs and incentivized revealed beliefs, respectively. Players were paid in the last stage, Stage 4. For ease of reference, a diagram of the game is provided in Figure 1.1.

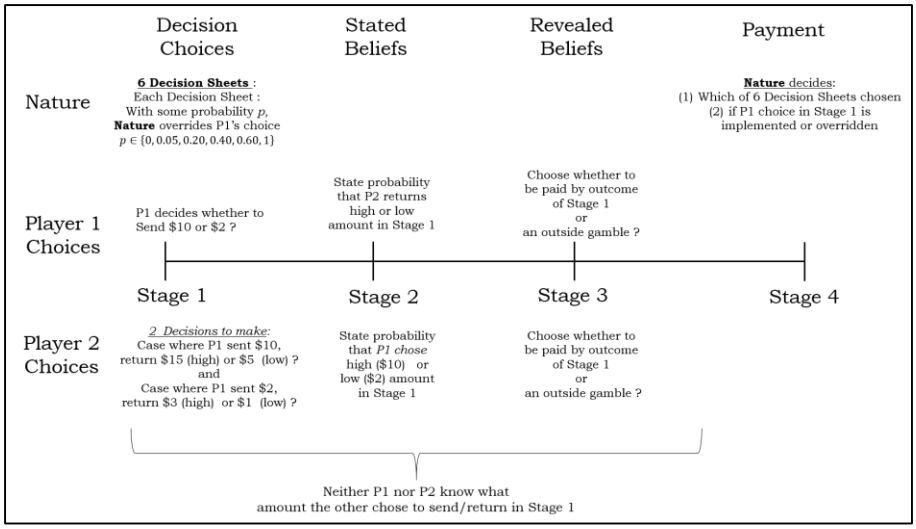

Figure 1.1: Timeline of Experiment

Note: All decisions/choices made simultaneously without knowledge of what the other player has chosen. Only after receiving payment in Stage 4 can players infer their opponents' moves.

1.3.1 Stage 1: Choices

We use a variation of the Berg, Dickhaut, & McCabe Trust (1995) game that restricts all players to binary choices. This was done to facilitate the belief elicitation in Stage 3. In Stage 1 subjects are randomly divided into pairs and randomly assigned to roles as Player 1 (P1) or Player 2 (P2). To begin, $10 is placed into player 1's "account". Player 1 now decides either to send the whole $10 to player 2 or to send $2 to player 2 and keep $8. The amount sent to player 2 is tripled. Player 2 decides how much of the tripled transfer they received, x, to return to player 1. Player 2 must decide between two options: (1) whether to return $x/2$ to player 1 and keep $x/2$, or, (2) return $x/6$ to player 1 and keep $5x/6$. Further, with probability $1-p$, player 1's choice determines the amount transferred to player 2 (either $10 or $2), and, with

probability p nature intervenes and the "Experimenter" forces player 1 to send the whole \$10 to player 2. We examine choices for six different values of p, $p \epsilon$ (0, 0.05, 0.20, 0.40, 0.60, and 1). The parameter p is common knowledge, but player 2 cannot observe whether nature intervened. We employ the strategy method to elicit choices for all six values of p: each player makes choices on six different "Decision Sheets". Player 1 subjects make a total of 6 choices: one choice on each of 6 sheets by marking whether they would choose to send \$10 or \$2 to player 2 for each sheet (even the treatment where $p = 1$). By comparison, player 2 subjects make 12 total choices: a conditional choice for the possibility that \$10 is sent, and, a conditional choice for the possibility that \$2 is sent for each value p.

1.3.2 Stage 2: Stated Beliefs

After all players made their choices, Decision Sheets were collected. Subjects were then told, "We would like to know what you think the other player sent you". The Belief Elicitation Stages (Stages 2 and 3) were not announced to the subjects until after each subject had made their choices in the first stage and the Decision Sheets were collected. Each subject wrote their predictions on their own form called the Prediction Sheet. It was made clear to subjects that there was no penalty or reward for accuracy and that this would not affect their final payoff.

Player 1 subjects were asked to predict the chances that player 2 would send back different amounts of money to player 1 under three different scenarios. It was publically stated that (a) if \$10 is sent to player 2, player 2 could send back either \$15 or \$5 to player 1, (b) if \$2 is sent to player 2, player 2 could send back either \$3 or \$1 to

player 1, and (c) player 2 makes a conditional choice for each possibility. It was also common knowledge that in each condition there existed a chance that nature could "override" player 1's choice and force player 1 to send $10 to player 2. Therefore, there were two beliefs player 2 could have held about who was responsible for sending the $10: first, player 1 was responsible themselves for sending the $10, or, second, player 1 was forced by the Experimenter to send the $10. This stage was designed to test if individuals operate on the assumption that their intentions will be taken into account when being judged by others. Therefore, player 1 was asked to predict the chances that player 2 sent back $15 or $5 for each of two possibilities: first, if player 2 believed player 1 was responsible for sending the $10 and second, if player 2 believed player 1 was not responsible for sending the $10 (i.e. player 1 was forced by the Experimenter). Player 1 was then asked to predict the chances that player 2 sent $3 or $1 back to player 1 under the $2 possibility. Player 1 made predictions for all six values of p. Again, it was made clear to subjects that there was no penalty or reward given for accuracy and that it would have no effect on their final payoff.

Player 2 subjects were asked to predict the chances that player 1 would send either $10 or $2. They were specifically instructed to predict the chances that player 1 chose $10 or $2 on their Decision Sheet (which depends solely on what player 1 chose) and not the probability that player 2 would receive $10 or $2 (which depends on the chances that player 1's decision is chosen). Player 2 made predictions for all six values of p. Again, it was made clear that there was no penalty or reward given for accuracy.

1.3.3 Stage 3: Revealed Belief Elicitation

We employ a unique method in order to measure first-order beliefs about what player 1 and player 2 thought the other player had done. We use a Multiple Price List style approach to measure player 1 and player 2's preference between two payment options. An advantage of our method over other elicitation methods is that our method is not affected by risk aversion (Andreoni and Sprenger, 2012). Subjects were informed that they would be making a series of decisions on "how they would like to be paid" on a Payment Option Form. Option 1 is the "Outcome of the Game". If players choose this option, they are paid based on the outcome of the game they played with their opponent. Subjects knew that the payment they would receive under this option, either $\$x/6$ (the "low" amount) or $\$5x/6$ (the "high" amount), depended in part on what the other player chose to send them. Option 2 was a q chance of receiving $\$x/6$ and a $1-q$ chance of receiving $\$5x/6$. Option 2 varied in incremental steps of 5 percent, which ranged from a 0 percent chance of receiving $\$x/6$ and a 100 percent chance of receiving $\$5x/6$, to a 100 percent chance of receiving $\$x/6$ and a 0 percent chance of receiving $\$5x/6$. The two amounts of money, $\$x/6$ and $\$5x/6$, are the same two amounts of money the player could earn if they were to choose the Outcome of the Game option (Option 1). Under Option 2 however, instead of their payment relying upon what the other player chose to send them (as under the Outcome of the Game Option), the payment under Option 2 depended solely upon the chances they saw listed under Option 2. Therefore, the row at which a subject decides to switch from Option 2 to Option 1 reveals the range of values of their belief about what the other player has

chosen to send them. Subjects fill out one Payment Option Form for each of their six Decision Sheets[5]. Since the first row under Option 2 gives the player a 100 percent chance of receiving the high amount, rational subjects who understand the game should initially prefer Option 2, if they believe that there is less than a 100 percent chance they will receive the high amount under Option 1.[6]

Whereas most previous studies infer beliefs from either subjects' choices or use a scoring rule to elicit beliefs, we elicit beliefs not once, but twice, and exploit the difference between the two measures to expose subjects' motives. Our study differs from previous studies of beliefs which have implemented a scoring rule technique (quadratic loss function, etc.) to elicit accurate beliefs. Subjects in the studies utilizing a scoring rule receive a "bonus" from accurately reporting beliefs in addition to the money earned from playing any game in which they had participated. Thus, only a small portion of each subject's payments come from accurately reporting beliefs. If any subject wished to conceal their true beliefs they would only need to sacrifice a small percentage of their entire payment to do so. So, while these scoring rules do offer

[5] Previous price list style experiments have documented that a portion of subjects tend to switch multiple times between the two options presented (Holt and Laury, 2002; Meier and Sprenger, 2010; and Jacobsen and Petrie, 2009). It is generally accepted that since multiple switch points can indicate subject confusion and are difficult to rationalize, a framing device may be necessary to avoid subject confusion and clarify the decision process (Andreoni and Sprenger, 2012). We used animated instructions in order to illustrate the directions for the subjects. Out of 82 subjects, two subjects had multiple switch points on one or more of their Payment Option forms and one subject who switched "backwards" (starting with Option 1 and later switching to Option 2).

[6] Under Option 2, the probability of receiving the high amount declines with each descending row, while the probability of receiving the low amount increases with each descending row. At the row where a subject believes that they would have a higher probability of receiving the high amount from the other Player than the probability they see under Option 2, the subject has the incentive to switch to Option 1. Thus the row where each subject switches allows us to infer their belief about the chances of the other Player sending the high amount. In addition, we verbally instructed subjects that "Most people begin by preferring Option 2 and then switch to Option 1. Thus one way to view this task is to determine the best row to stop checking the box under Option 2 and start checking the box for Option 1"

monetary incentives to accurately report beliefs, there is no way to tell if subjects who wish to lie about their beliefs would give up their "bonus" in order to signal a false belief to the experimenter. In contrast, our method of eliciting revealed beliefs has higher stakes for the subjects. Each subject's entire payout for the experiment is determined from their decision on the revealed belief elicitation task (the "Payment Option Form"). Furthermore, while it is obvious to subjects that researchers are collecting their beliefs when using a scoring rule, it is not obvious to subjects that we are measuring their beliefs on the revealed belief task. This is so for two reasons. First, subjects had just completed the stated belief task. Recall, the stated belief task was labeled as the "Prediction Sheet" on which the subjects were asked to tell us their beliefs about how the other player had behaved. On the Prediction Sheet, we asked subjects to tell us "What do you believe the other player sent to you?" Thus, the framing of the stated belief task made salient that we were inquiring about their own beliefs. In contrast, the aspect most salient for subjects in the revealed belief task was that their final payment for the entire experiment was "on the line". Recall that the revealed belief task was labeled as the "Payment Option Form" on which subjects were instructed that "Now tell us how you would like to be paid." On the Payment Option Form, the subjects had two "payment" options. Subjects could either choose to be paid from the "Outcome of the Game" they had just played with their opponent, or, they could choose the outside gamble. Thus, the framing of the revealed belief task nudged subjects toward focusing on their payment.

After Stage 3, player 1 rolled the dice in order to determine whether it would be

player 1's decision that would be chosen or if player 1's decision would be overridden (i.e., the Experimenter's decision would be used instead). In order to maintain anonymity, all subjects rolled the dice.

1.4 Predictions

We propose that selfish individuals[7] deem that their selfish action will be evaluated in a kinder light if they are perceived as reacting to a belief that their opponent was selfish rather than if they are perceived as truly believing that their opponent acted kindly toward them and subsequently taking advantage of this kindness. Since selfish individuals can no longer use their actions to signal their type to the experimenter, they must rely on the only means left available to maintain their social image: others' perceptions of their beliefs. Consequently, selfish individuals wishing to maintain their social image (while not risking any monetary payoff) will state on their "stated" beliefs that they believe that there is a low probability of their opponent voluntarily sending the high amount and a high probability that their opponent will send them the low amount. This serves as an excuse for a selfish individual's behavior. However, we predict that not all of these individuals truly believe that their opponents were selfish. When it comes to receiving their final payoff, we posit that selfish individuals will be willing to risk their entire payment for the experiment on their true belief that their opponent was kind to them by sending the high amount. Thus, this

[7] We classify individuals based on their actions taken in the experiment rather defining types independently. It is plausible that in real world settings individuals may perform a combination of selfish acts and altruistic acts. It is only when they perform a selfish act that they would need to cover their action. We leave it to future studies to formalize our work.

would reveal that they believe they have a better chance of receiving the high amount from their opponent rather than from the outside gamble[8].

Our design allows us to separate out individuals who are more sophisticated decision makers. We term subjects who switched to Option 1 immediately on the last Payment Option form as being "Sophisticated"[9]. We predict that since these subjects are capable of understanding complex situations they are the subjects who would best be able to navigate situations in which they need to cover over their bad deeds. Examining the behavior of these "sophisticated" subjects can also help to rule out confusion as a factor in any differences seen between stated and revealed beliefs.

1.5 Main Findings

Eighty-two subjects were recruited from the undergraduate population at University of California, San Diego. Each session was conducted at the Economics Laboratory at UC San Diego and ran between an hour and 30 minutes to two hours. Each subject maintained the same role (player 1 or player 2) throughout. Average earnings were $19, including a $7 participation fee, with a standard deviation of $8.16. Payoffs ranged from $10 to $32.

[8] Recall that the payment received under Option 1 is dependent on the action of their opponent. Therefore, the sooner a subject "switches" to Option 1 the higher is their belief about their opponent sending them the high amount.

[9] Recall that on the Stage 3 "Revealed" Belief elicitation form, players are faced with two payment options: Option 1, receiving a payment from the outcome of the game played with their opponent; and Option 2, receiving a payment from an outside gamble. Recall also that for the last Decision Sheet and corresponding Payment Option form the chance that the Experimenter will force player 1 to send the whole $10 to player 2 is 100 percent. Therefore, player 2 will receive $15 (the highest amount) with 100 percent probability. Therefore, it is in a player's best interest to switch to Option 1 (payment from the game) immediately since there is a 100 percent chance they will receive $15 from the game, while there is less than 100 percent chance they will receive $15 from the outside gamble.

1.5.1 Choice Behavior

Result 1a – Selfish Behavior: *As the chance that player 1 is forced by the Experimenter to send $10 increases, the fraction of player 2s returning $15 (an Equal split) declines steadily.*

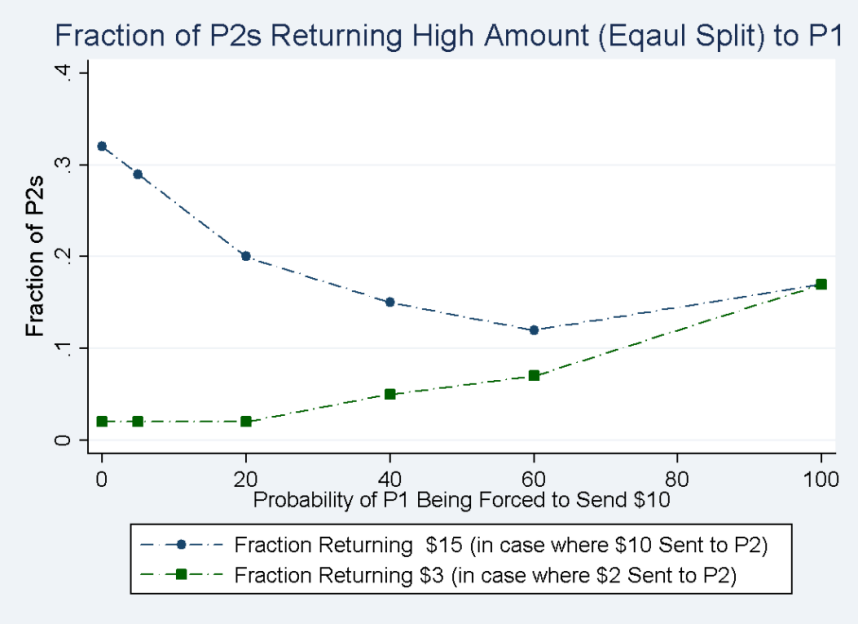

Figure 1.2: Fraction of Player 2s Returning an Equal Split

As can be seen in Figure 1.2 approximately 30 percent of player 2s return $15 to player 1 when (as was publically stated) there is zero chance that player 1 was forced to send $10. In this case ($p$ =0), player 2s know with certainty that if they receive $10 that it was player 1 who decided to send the $10 and it was of their own volition. Therefore, responsibility for sending the $10 is unambiguous to player 2s. However, as the chance that player 1 will be forced to send $10 increases, the fraction of player 2s reciprocating by returning an equal split of $15 declines. There is a small increase in the number of player 2s returning $15 on the last decision sheet, where the probability of player 1

being forced to send $10 reaches 100 percent.

The first column of Table 1.1 reports the estimates of a random-effects probit model of the probability of player 2 returning $15 in the case where $10 is sent to them. The second column reports the probability of player 2 returning $3 in the case where $2 is sent to them. The explanatory variables include indicators for $p \geq 0.05$, $p \geq 0.20$, $p \geq 0.40$, $p \geq 0.60$, and *p=1* (with $p = 0$ omitted). In all cases, we report marginal effects at mean values. As we are most interested in player 2 reaction to knowledge that player 1 could have been forced to send $10, we focus on the results in the first column. The coefficients in the first column imply that there is a statistically significant decrease in the probability of player 2 returning $15 when *p* rises from 0.05 to 0.20, from 0.20 to 0.40, from 0.40 to 0.60 and from p=0.60 to 1.

Table 1.1: Probability of Player 2 Choosing Equal Split, Conditional on Probability of Player 1 Being Forced Random Effects Probit : Marginal Effects

Probability of Player 1 Being Forced to Send $10	**(1)** **If $10 Sent to Player 2:** Probability of Player 2 Returning **$15**	**(2)** **If $2 Sent to Player 2:** Probability of Player 2 Returning **$3**
p ≥ 0	-0.948**	-3.109***
	(0.417)	(0.855)
p ≥ 0.05	-0.137	0.000
	(0.393)	(0.751)
p ≥ 0.20	-0.717*	-0.210
	(0.422)	(0.817)
p ≥ 0.40	-1.105**	0.332
	(0.454)	(0.708)
p ≥ 0.60	-1.246***	0.665
	(0.453)	(0.674)
p= 1	-0.903**	1.341**
	(0.428)	(0.660)
Observations	246	246

Standard Errors in parentheses. Significance*** $\alpha < 0.01$, ** $\alpha < 0.05$, * $\alpha < 0.10$

We now turn to player 1 choice behavior. Figure 1.3 shows the fraction of player 1s who voluntarily chose to send $10 to player 2. When the probability of being forced to send the whole $10 to player 2 is zero, around 30 percent of player 1s voluntarily choose to send $10. The fraction of player 1s voluntarily choosing to send $10 increases gradually as the probability that they will be forced to do so increases. When the probability of being forced to send $10 is 100 percent, half of player 1s voluntarily choose to send $10. Table 1.1 shows the marginal effects from a random effects regression. The specification describes the probability of selecting $10. The explanatory variables include indicators for $p \geq 0.05$, $p \geq 0.20$, $p \geq 0.40$, $p \geq 0.60$, and $p=1$ (with $p = 0$ omitted). We report marginal effects at mean values. The coefficients imply that the only statistically significant increase in the probability of voluntarily choosing to send $10 occurs when p rises from 0.60 to 1 ($\alpha < 0.10$, one tailed t-test).

1.5.2 Examining Beliefs

Figure 1.4 shows stated beliefs, revealed beliefs and the actual frequency of player 1 sending $10 to player 2 (notice that this is the probability of player 1 voluntarily choosing $10 and not the probability that player 2 will receive $10). What is apparent from cursory examination is that there is a constant difference of approximately 20 percentage points between what player 2s *state* they believe and what player 2s are revealed to believe. This difference is statistically significant for all six values of p.

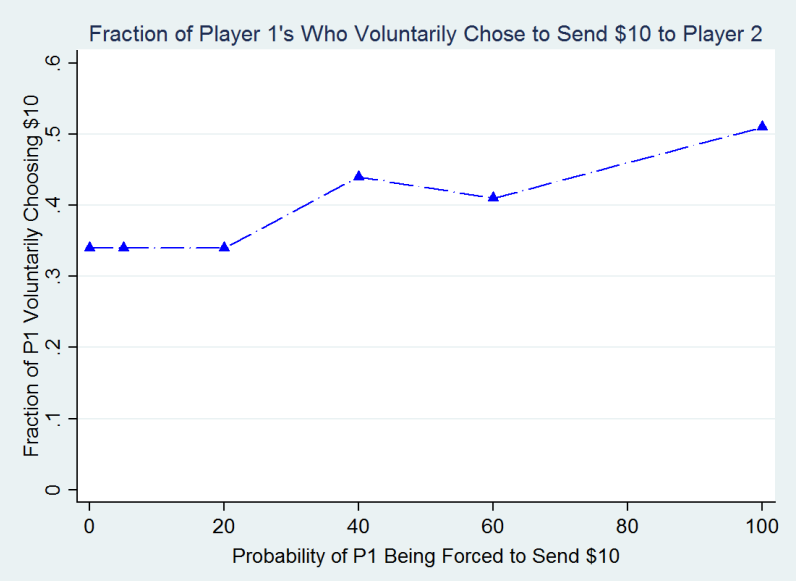

Figure 1.3: Fraction of Player 1s Who Sent $10 Voluntarily

Table 1.2: Probability of Player 1 Voluntarily Sending $10 Random Effects Probit Model

Probability of Player 1 Being **Forced** to Send $10	Probability of Player 1 **Voluntarily Choosing** to Send $10
$p \geq 0$	-0.368
	(0.273)
$p \geq 0.05$	-0.020
	(0.324)
$p \geq 0.20$	-0.113
	(0.327)
$p \geq 0.40$	-0.244
	(0.322)
$p \geq 0.60$	-0.154
	(0.322)
$p = 1$	0.538*
	(0.311)
Mean	0.167
Observations	246

Standard Errors given in parentheses.
Significance: *** $\alpha < 0.01$, ** $\alpha < 0.05$, * $\alpha < 0.10$

In order to further investigate the cause of this large difference between stated and revealed beliefs, we break the player 2s into four types based on 2 dimensions: Selfishness and Sophistication. We code a player 2 as being "Selfish" if they chose to send $5 (the lower amount) to player 1 for every value of *p*. Otherwise, the subject was coded as "Cooperative". We code a player 2 as being "Sophisticated" if on the Payment Option Form where $p = 1$, the subject switched from preferring the Outside Gamble (Option 2) to preferring the Outcome of the Game (Option 1) in Row 1 or Row 2[10].

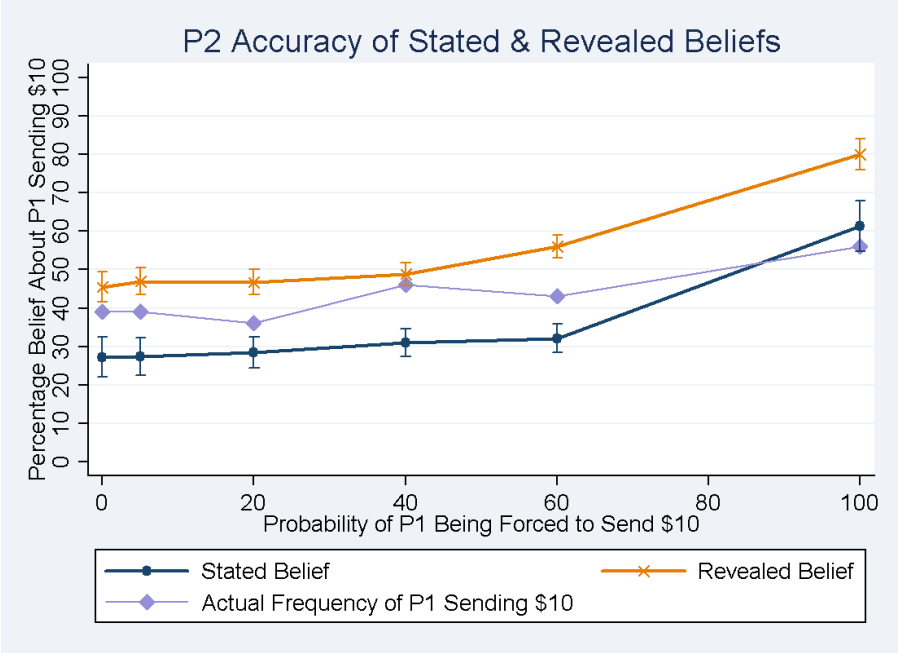

Figure 1.4: Player 2 Comparison of Stated vs. Revealed Beliefs

Result 1b – Sophisticated Image Manipulation*: Sophisticated-Selfish player 2s are* ***revealed*** *to believe that there is a much higher chance that player 1 voluntarily sent $10*

[10] Subjects switching in Row 1 or Row 2 of the Payment Option form would have to be aware that on the last decision sheet, they were guaranteed to receive $10 as the probability of player 1 being forced to send $10 was 100 percent on this sheet.

*than they **state** they believe. Furthermore, the sophisticated-selfish player 2s are capable of accurately predicting the actual frequency that player 1 voluntarily chose $10, but when asked, player 2s state a much lower probability than was true.*

Table 1.3: Number of Player 2 Types

	Unsophisticated	**Sophisticated**	**Total**
Cooperative	10 (24%)	8 (20%)	18 (44%)
Selfish	8 (20%)	15 (36%)	23 (56%)
Total	18 (44%)	23 (56%)	**41 (100%)**

Figure 1.5 shows the Stated Beliefs, Revealed Beliefs, and Actual Frequency of player 1 voluntarily choosing to send $10 for each type of player 2 (Unsophisticated - Cooperative, Unsophisticated -Selfish, Sophisticated-Cooperative, Sophisticated-Selfish). Comparing the Actual Frequency line with the Revealed Belief Line, one can see that sophisticated-selfish player 2s are fully capable of predicting player 1s' actions. In fact, there is no statistically significant difference between the Actual Frequency and the Revealed Belief for $p=0, p=0.05, p=0.20, p=0.40$. There is a significant difference for the last two values of p, $p=0.60$ and $p=1$. There is a substantial increase in the Revealed Beliefs for the last two values of p which causes the difference. The sophisticated-selfish subjects do not best respond to their stated beliefs, but to their revealed beliefs. This indicates that the sophisticated-selfish subjects lie about their beliefs when asked, but do not believe their own lies. That is, they know what the Actual Frequency of player 1 voluntarily choosing $10 is, but appear to purposely understate this probability.

Unsophisticated-Cooperative subjects do exhibit a statistically significant difference for *p=0, p=0.05, p=0.20, p=0.40, p=0.60* and *p=1*. However, there is no statistically significant difference between Unsophisticated-Cooperative subjects' stated beliefs and the Actual Frequency. This leads one to conclude that the unsophisticated-Cooperative subjects fail to best respond to their beliefs in a way that is overly optimistic. Sophisticated-Cooperative subjects exhibit only occasional differences between stated & revealed, revealed & actual frequency, and stated & actual frequency.

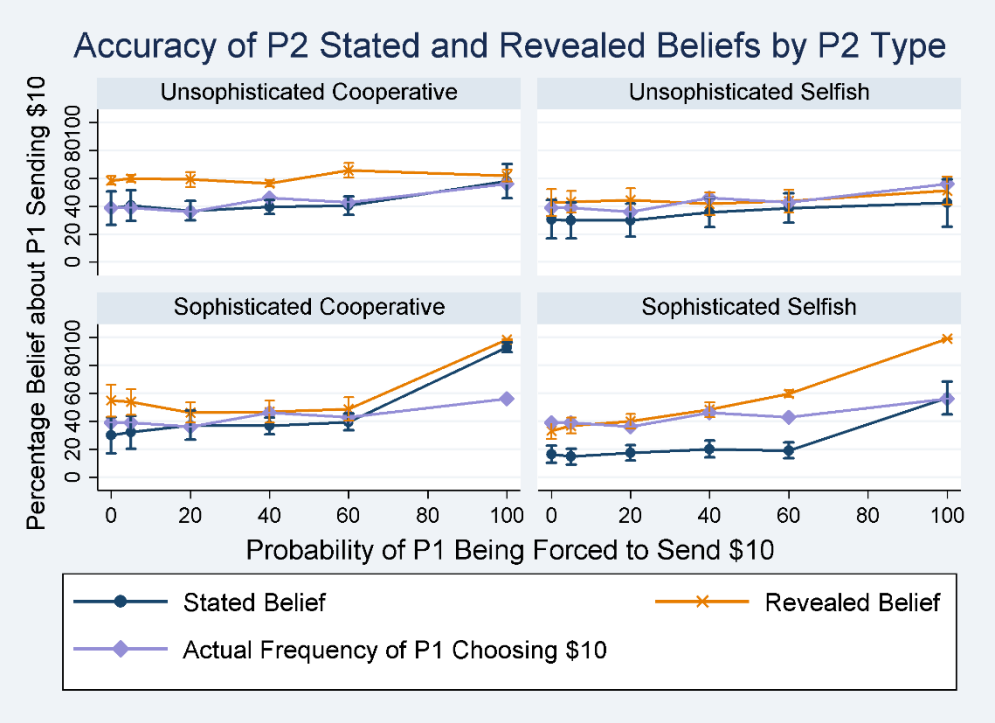

Figure 1.5: Comparison of Player 2 Stated vs. Revealed Beliefs by Player Type

On average, sophisticated-cooperative subjects best respond to their stated beliefs, but sometimes fail to best respond to their stated beliefs in favor of being optimistic. Unsophisticated-selfish subjects exhibit no statistically significant differences between stated & revealed beliefs, stated beliefs & actual frequency, and

occasional significant differences between revealed beliefs & actual frequency. This indicates that unsophisticated-selfish subjects are both honest and realistic in that they truthfully state their beliefs and best respond to these beliefs.

As a further test, we compare player 2s who have large differences between their revealed and stated beliefs with player 2s who have little or no difference between what they say they believe and what they are revealed to believe. Those player 2s who are "large deviators" are significantly more selfish than those player 2s with small or no deviations ($t = 4.06, \alpha < 0.00$ two-tailed *t*-test, Mann-Whitney $z = 3.42, \alpha < 0.00$).

Now to shed further light on player 2 behavior, we contrast player 2 belief data with player 1 behavior on the two belief elicitation tasks. Looking at Figure 1.6, it can be seen that player 1s state that they believe that if player 2 believes player 1 is responsible for sending the $10 then player 2 will positively reciprocate. In Figure 1.7, we break Pl subjects into two groups, Cooperative and selfish player 1s. Player 1s who chose to send $10 to player 2 at least three times are coded as "Cooperative," otherwise they are coded as "Selfish." Figure 1.7 displays player 1 Stated Beliefs, Revealed Beliefs and the Actual Frequency of player 2 returning an equal split.

Result 2- Sophisticated Deception*:* *Player 2s are able to accurately model player 1's expectations of player 2 behavior. Both types of player 1s both state and reveal that they believe that if player 2 believes that player 1 is responsible for voluntarily sending the $10, that player 2 will reciprocate this kindness by returning $15.*

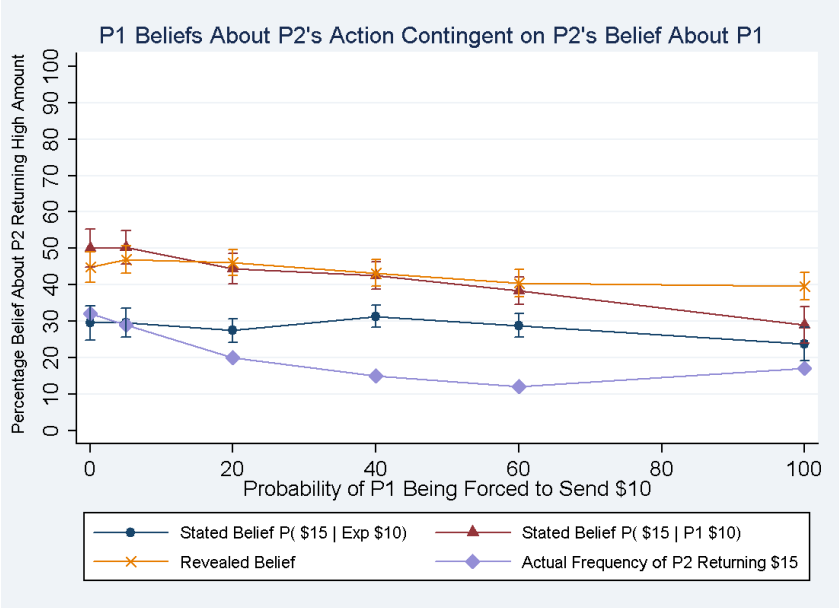

Figure 1.6: Player 1 Beliefs About Player 2's Actions

Both types of player 1s state that they believe that $P(\$15 \mid P1\ \$10) > P(\$15 \mid Exp\ \$10)$ (pooled: $t = 5.79, \alpha < 0.00$, Selfish: $t = 4.90, \alpha < 0.00$, Cooperative: $t = 3.57, \alpha < 0.00$ two tailed *t*-tests). Now comparing Revealed Beliefs with Stated Beliefs one can see that not only are both types of player 1s truthful, but both types are operating on the assumption that player 2 will positively reciprocate if player 1 is perceived as responsible for voluntarily sending $10. There is no statistically significant difference between the Revealed Beliefs and the Stated Belief of $P(\$15 \mid P1\ \$10)$ for both types of player 1s. This indicates that player 1s predict that player 2 will behave reciprocally, as is the social norm.

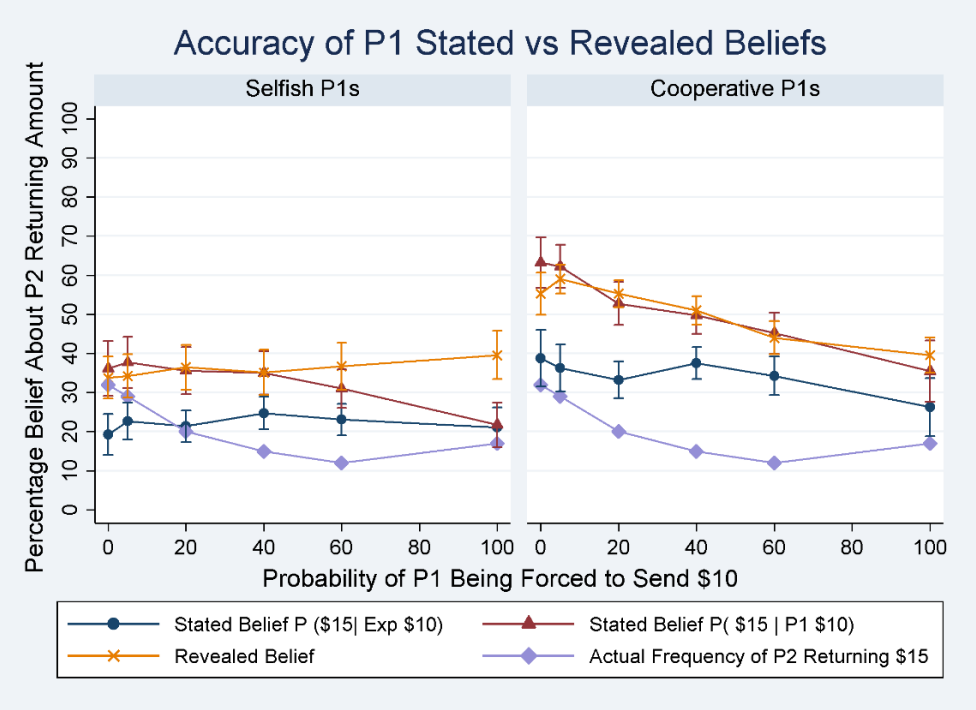

Figure 1.7: Accuracy of Player 1 Stated vs Revealed Beliefs

Result 3 : *Selfish player 1s understate their beliefs about* $P(\$15 \mid P1\ \$10)$.

The distribution of player 1s who had the largest difference between their revealed and stated beliefs are significantly more selfish than those player 1s who had little or no difference between their revealed and stated beliefs ($t = 1.96, \alpha < 0.025$ two tailed *t*-test). Looking at Figure 1.7, one can see that player 1s do not exhibit the same degree of deviation from their stated beliefs as exhibited by player 2s. Also evident from Figure 1.7 is that "Cooperative" player 1s believe there is a higher chance of receiving the high amount back from player 2 than do the selfish player 1s. Also, selfish player 1s were better at predicting the Actual Frequency that player 2 would return an equal split than are cooperative player 1s.

1.6 Discussion of Perception Manipulation

The discrepancy between the beliefs selfish-sophisticated players express on their stated beliefs and their revealed beliefs raises several questions. First, which belief represents players "true" beliefs? If sophisticated-selfish players' true beliefs are as they stated on their stated beliefs task, then these players are not best responding to these beliefs on their revealed beliefs task. If they truly believed that chances of player 1 sending the high amount ($10) were as low as they stated on their stated beliefs, then this should have been reflected by their choices on the Payment Option Form in the revealed beliefs task. Instead, their choices on their Payment Option Form indicate that their true underlying belief is that there was in fact a higher chance that player 1 had sent player 2 the high amount ($10). These sophisticated players are the players who were able to correctly calculate and assess that they were better off switching early from Option 2 to Option 1 on Decision Sheet 6, where the chance they would receive the high amount ($10) was 100 percent. Thus, it is difficult to comprehend how the sophisticated players can understand how to maneuver to make the most money for themselves in one part of the game and yet be confused or unable to best respond to their own beliefs on the very same task. In addition, selfish-sophisticated players demonstrated a keen ability to identify both the actual frequency of their opponents' kindness and their opponents' expectations. Those players who were selfish, but were unsophisticated, showed more consistency between their stated beliefs on the Prediction Sheet and their revealed beliefs on their Payment Option Form. Lack of concern over social image may be a possible explanation for the difference in behavior between the

sophisticated and unsophisticated -selfish players. It could be that unsophisticated players do not have enough knowledge to care about how others perceive them, or, they do care about how others perceive them but lack the prowess to manipulate others' perceptions.

The second question that arises is if their revealed beliefs are in fact more representative of their "true" beliefs, then what motivates sophisticated-selfish players to lie about their stated beliefs? We propose that sophisticated-selfish players intentionally misstate their stated beliefs in an effort to manipulate how others view their selfish actions. That is to say that sophisticated selfish subjects attempt to maintain a positive social image by manipulating how others perceive their selfish actions. Recall that on Figure 1.6 it was shown that player 1s stated that they believe that there was a higher chance of positive reciprocity from player 2 *if* player 2 believed that player 1, rather than the experimenter, was personally responsible for sending the high amount. Sophisticated-Selfish stated beliefs coincide directly with their opponents' expectations. When directly asked about what they believed when calculating their decision of what amount to return to player 1, sophisticated-selfish player 2s stated that they believed that there was a low chance that player 1 had personally sent the high amount. As we know, this statement is in direct contradiction with their revealed beliefs. However, this statement does provide player 2 with a ready-made excuse should anyone inquire about their selfish decision[11]. The fact that sophisticated-selfish player 2s are so well able to anticipate their opponents' expectations exposes their keen

[11] Concerns for social image maintenance may arise out of a desire to avoid social retaliation or revenge (see Andreoni and Gee (2012) for a review).

awareness of and desire to appear to be in compliance with societal norms. If one were to look solely at sophisticated-selfish players' actions or their stated beliefs, it might appear that sophisticated-selfish players had preferences for reciprocity and that these preferences were their driving decision making process. However, the revealed beliefs paint a different picture entirely. Behavior that would previously had been viewed as supporting hypotheses of reciprocity or guilt-aversion is now shown to support the hypothesis that individuals are indeed selfish and display a sharp level of sophistication in manipulating their image. This is not to say that prosocial behavior in the form of pure or impure altruism does not exist. However, what this does imply is that if individuals wish to be selfish, attempts to nudge them to cooperate through appeals to reciprocity or guilt will not alter their choice behavior. In the face of social pressure to comply with norms, sophisticated selfish individuals will not in fact cooperate but merely take measures to make others believe they are complying with social norms.

The third question pertains to whether sophisticated-selfish players believe their own lies. We suggest that sophisticated-selfish players do not believe their own lies and that these players knowingly misstate the beliefs when they think that others will be able to observe their beliefs, as in the stated beliefs task. If sophisticated-selfish players truly believed that their opponent was selfish, then in order to have the best chance to earn the most money in the game, they would have needed to make entirely different choices on the Payment Option form in the revealed belief elicitation task. Again, confusion seems unlikely as an explanation for their choices on this task since these players were the most sophisticated. In addition, their choices on the Payment Option

Form in the revealed belief task match up with the actual frequency of cooperation from their opponents. This implies that sophisticated-selfish players are very apt at predicting exactly how kind their opponents were in the game. Therefore, it seems unlikely that sophisticated-selfish players believed what they stated on their stated beliefs task. However, the question of whether the sophisticated players believe their own lies remains an open question and deserves more study.

A fourth and unanswered question is whether sophisticated-selfish subjects believe that their own lies are credible and whether their lies are believed by observers? This remains an open question that deserves more study and is not directly addressed within our paper.

1.7 Conclusion

In order to examine whether image concerns affect how individuals express their beliefs, we implement a new technique of contrasting two differing belief elicitation measures that identify both what people *say* they believe, and what they are revealed to believe. We find evidence that selfish, image-conscious individuals will lie about the beliefs they held about their opponent when carrying out this selfish action. Specifically, selfish players state that they believed their opponent would act selfishly toward them. However, in the revealed beliefs elicitation, selfish players stake their entire payoff on the opposite belief, that their opponent was in fact cooperative. In order to rule out confusion, we measure the "sophistication" of each subject. Evidence indicates that it is the individuals who are both sophisticated and selfish who are the most frequent users of the manipulation mechanism. While previous studies of

reciprocity concluded that players' beliefs about their opponents' intentions revealed that their subjects had a preference for reciprocity, our results contradict this finding. Our results suggest that individuals have a preference for being perceived as being cooperative instead of actually behaving cooperatively. Thus, if one wishes to take a selfish or uncooperative action, they can do so without fear of retaliation or punishment so long as they concoct a socially acceptable story justifying their selfish behavior. Given that beliefs seem to be playing a larger role in theory and are being increasingly relied upon as an explanation for behavior, it seems prudent to examine whether beliefs are influenced by social demand. This demand can take the form of experimenter demand, audience demand, or demand of societal expectation. Perhaps subjects write beliefs that they want to use as "socially acceptable excuses" to validate and explain why they behaved as they did. Further, people may know how to give the "right answers" to project their image of themselves to others (that is, manipulate others' perceptions). If this is indeed the case, careful attention must be paid to all of the incentives faced by individuals when measuring their beliefs.

Our results have important policy implications. Previous studies have advocated appeals to individuals' emotions in order to promote cooperative behavior. However, our results indicate that guilt may in fact cause selfish individuals to not only act selfishly, but to cover up their selfish actions with lies. In fact, recent evidence from the healthcare field indicates that when doctors make their patients feel "guilty" about being overweight or other unhealthy behaviors, a significant number of patients not only maintained their undesired behavior, but also lied and told their doctors that they had

changed their behavior to the desired behavior (Darby, et.al. 2014).

We believe our results also serve as a caution for studying data in situations where social image is especially heightened. For example, the use of "big data" analytics from social networking websites has become popular. Large consumer firms and political campaigns have begun to rely on data gleaned from social media sites. However, since social image is particularly salient to individuals frequenting these websites, the truthfulness of their actions and statements on these websites may be suspect. Our results suggest that using data from these sources may lead to faulty conclusions given our evidence that people will create false impressions about themselves[12].

Our results do not rule out cooperative behavior arising from altruism or warm-glow preferences. Since individuals can easily generate excuses to relieve themselves from social obligations to give, this supports evidence that giving is motivated by preferences for altruism and/or warm-glow. Further, people who want to behave selfishly will do so and that mechanisms designed to apply social pressure or guilt may do nothing to transform selfish behavior to cooperative behavior. Instead, selfish individuals may end up lying in order to maintain the *appearance* that they are cooperating with socially accepted group norms.

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[12] For example, an industry of firms has emerged that helps individuals create false beliefs by employing "click farms" to create false Facebook "likes", to create false Twitter followers, or to create false LinkedIn "links". For a small fee a firm or individual can purchase Facebook "likes" or Twitter followers in order to create a false image of popularity or sphere of influence (VerSteeg and Galstayan, 2011; Wilbur and Zhu, 2009). Since social image is a powerful motivator, previous research has focused on using social media to influence behavior (encourage people to quit smoking, lose weight, exercise more frequently, vote a certain way, etc.). However in light of our findings, will individuals maintain their current "undesired" behavior and merely lie in order to maintain their social image?

1.8 Acknowledgement

Chapter 1, in full, is currently being prepared for publication of the material. Sanchez, Alison; Andreoni, James. The dissertation author was the primary investigator and author of this material.

1.9 Appendix

1.9.1 Additional Tables

Below are tables showing additional statistical tests.

Table 1.4: Player 1 Beliefs

	(1) P1s Who Chose $10: Revealed Belief	(2) P1s Who Chose $2: Revealed Belief	(3) All P1s: Revealed Belief	(4) All P1s: Revealed Belief	(5) All P1s: Revealed Belief	(6) All P1s: Revealed Belief
Stated Belief About P($15| Exp Sent $10)	0.175***	0.141	0.110	0.112		0.138
	(0.064)	(0.137)	(0.117)	(0.114)		(0.090)
Stated Belief About P ($15 | P1 Sent $10)	0.330***	-0.170	0.125**	0.102*		0.419**
	(0.075)	(0.108)	(0.062)	(0.060)		(0.210)
Stated Belief About P($3| P1 Sent $2)				-0.143**		-0.695***
				(0.063)		(0.232)
Stated Belief About P($5| Exp Sent $10)					-0.064	0.043
					(0.112)	(0.066)
Stated Belief About P($5| P1 Sent $10)					-0.160***	0.302
					(0.059)	(0.209)
Stated Belief About P($1| P1 Sent $2)					0.074	-0.557***
					(0.072)	(0.207)
Constant	31.173***	38.362***	35.268***	38.227***	51.057***	59.068***
	(5.389)	(2.244)	(3.689)	(3.753)	(11.221)	(6.567)
Observations	97	135	232	232	232	232
Clusters	33	36	39	39	39	39
R-Squared	0.278	0.061	0.187	0.060	0.098	0.051

Robust Standard Errors in parentheses
Significance: *** $\alpha < 0.01$, ** $\alpha < 0.05$, * $\alpha < 0.10$

Table 1.5: Player 2 Revealed vs Stated Beliefs For Each Value of $P=p_0$
Player 1 Forced to Send $10

	Unsophisticated	**Unsophisticated**	**Sophisticated**	**Sophisticated**
p=0	**Nice**	**Selfish**	**Nice**	**Selfish**
Revealed Belief	58.5	42.8125	54.688	31.167
Stated Belief	38.5	30.625	30	16.333
Difference	20*	12.1875	24.688*	14.834**

	Unsophisticated	**Unsophisticated**	**Sophisticated**	**Sophisticated**
p=0.05	**Nice**	**Selfish**	**Nice**	**Selfish**
Revealed Belief	60	43.125	53.75	36.833
Stated Belief	40.5	30	32.125	14.6
Difference	19.5**	13.125	21.625*	22.233***

	Unsophisticated	**Unsophisticated**	**Sophisticated**	**Sophisticated**
p=0.20	**Nice**	**Selfish**	**Nice**	**Selfish**
Revealed Belief	59.25	44.375	46.25	40
Stated Belief	36.8	30	37.125	17.333
Difference	22.45***	14.375	9.125	22.667***

	Unsophisticated	**Unsophisticated**	**Sophisticated**	**Sophisticated**
p=0.40	**Nice**	**Selfish**	**Nice**	**Selfish**
Revealed Belief	56.5	41.875	46.875	48.214
Stated Belief	39.5	35.625	36.625	20
Difference	17***	6.25	10.25	28.214***

	Unsophisticated	**Unsophisticated**	**Sophisticated**	**Sophisticated**
p=0.60	**Nice**	**Selfish**	**Nice**	**Selfish**
Revealed Belief	65.75	43.75	48.75	59.833
Stated Belief	40.5	38.75	39.375	19
Difference	25.25***	5	9.375	40.833***

	Unsophisticated	**Unsophisticated**	**Sophisticated**	**Sophisticated**
p=1	**Nice**	**Selfish**	**Nice**	**Selfish**
Revealed Belief	62	51.25	98.438	99.107
Stated Belief	58	42.5	93	56.733
Difference	4	8.75	5.438*	42.374***

Significance: *** $\alpha < 0.01$, ** $\alpha < 0.05$, * $\alpha < 0.10$

Table 1.6: Player 2 Revealed vs True Prob Player 1 Voluntarily Chooses \$10 For Each Value of P=p_0 Player 1 Forced to Send \$10

p=0	**Unsophisticated Nice**	**Unsophisticated Selfish**	**Sophisticated Nice**	**Sophisticated Selfish**
Revealed Belief	58.5	42.8125	54.688	31.167
True Prob Player 1 Chooses \$10	39	39	39	39
Difference	19.5***	3.8125	15.688*	-7.833

p=0.05	**Unsophisticated Nice**	**Unsophisticated Selfish**	**Sophisticated Nice**	**Sophisticated Selfish**
Revealed Belief	60	43.125	53.75	36.833
True Prob Player 1 Chooses \$10	39	39	39	39
Difference	21***	4.125	14.75*	-2.167

p=0.20	**Unsophisticated Nice**	**Unsophisticated Selfish**	**Sophisticated Nice**	**Sophisticated Selfish**
Revealed Belief	59.25	44.375	46.25	40
True Prob Player 1 Chooses \$10	36	36	36	36
Difference	23.25***	8.375	10.25*	4

p=0.40	**Unsophisticated Nice**	**Unsophisticated Selfish**	**Sophisticated Nice**	**Sophisticated Selfish**
Revealed Belief	56.5	41.875	46.875	48.214
True Prob Player 1 Chooses \$10	46	46	46	46
Difference	10.5***	-4.125	0.875	2.214

p=0.60	**Unsophisticated Nice**	**Unsophisticated Selfish**	**Sophisticated Nice**	**Sophisticated Selfish**
Revealed Belief	65.75	43.75	48.75	59.833
True Prob Player 1 Chooses \$10	43	43	43	43
Difference	22.75***	0.75	5.75	16.833***

p=1	**Unsophisticated Nice**	**Unsophisticated Selfish**	**Sophisticated Nice**	**Sophisticated Selfish**
Revealed Belief	62	51.25	98.438	99.107
True Prob Player 1 Chooses \$10	56	56	56	56
Difference	6*	-4.75	42.438***	43.107***

Significance: *** $\alpha < 0.01$, ** $\alpha < 0.05$, * $\alpha < 0.10$

Table 1.7: Player 2 Stated Belief vs rue Probability Player 1 Voluntarily Chooses $10 For Each Value of $P=p_0$ Player 1 Forced to Send $10

p=0	Unsophisticated Nice	Unsophisticated Selfish	Sophisticated Nice	Sophisticated Selfish
Stated Belief	38.5	30.625	30	16.333
True Prob Player 1 Chooses $10	39	39	39	39
Difference	-0.5	-8.375	-9	-22.667***
p=0.05	Unsophisticated Nice	Unsophisticated Selfish	Sophisticated Nice	Sophisticated Selfish
Stated Belief	40.5	30	32.125	14.6
True Prob Player 1 Chooses $10	39	39	39	39
Difference	1.5	-9	-6.875	-24.4***
p=0.20	Unsophisticated Nice	Unsophisticated Selfish	Sophisticated Nice	Sophisticated Selfish
Stated Belief	36.8	30	37.125	17.333
True Prob Player 1 Chooses $10	39	39	39	39
Difference	-2.2	-9	-1.875	-21.667***
p=0.40	Unsophisticated Nice	Unsophisticated Selfish	Sophisticated Nice	Sophisticated Selfish
Stated Belief	39.5	35.625	36.625	20
True Prob Player 1 Chooses $10	39	39	39	39
Difference	0.5	-3.375	-2.375	-19***
p=0.60	Unsophisticated Nice	Unsophisticated Selfish	Sophisticated Nice	Sophisticated Selfish
Stated Belief	40.5	38.75	39.375	19
True Prob Player 1 Chooses $10	39	39	39	39
Difference	1.5	-0.25	0.375*	-20***
p=1	Unsophisticated Nice	Unsophisticated Selfish	Sophisticated Nice	Sophisticated Selfish
Stated Belief	58	42.5	93	56.733
True Prob Player 1 Chooses $10	39	39	39	39
Difference	19	3.5	54***	17.733

Significance: *** $\alpha<0.01$, ** $\alpha<0.05$, * $\alpha<0.10$

Table 1.8: Player 1 Stated Belief About P ($15 | Player 1 $10) vs Revealed Belief

	Player 1s Who Chose $2	Player 1s Who Chose $10
p= 0		
Stated Belief P ($15 | Player 1 $10)	33.5	65
Revealed	37.28	72.857
Difference	-3.78	-7.857
p= 0.05		
Stated Belief P ($15 | Player 1 $10)	37.8	63.214
Revealed	37.6	72.857
Difference	0.2	-9.643*
p= 0.20		
Stated Belief P ($15 | Player 1 $10)	39.3	58.214
Revealed	36.24	58.929
Difference	3.06	-0.715
p= 0.40		
Stated Belief P ($15 | Player 1 $10)	32.5	55.833
Revealed	33.33	53.333
Difference	-0.83	2.5
p= 0.60		
Stated Belief P ($15 | Player 1 $10)	35.227	47.2
Revealed	35.863	41.412
Difference	-0.636	5.788
p= 1		
Stated Belief P ($15 | Player 1 $10)	35.8	42.738
Revealed	25.94	31.429
Difference	9.86	11.309*

Significance: *** $\alpha < 0.01$, ** $\alpha < 0.05$, * $\alpha < 0.10$

Table 1.9: Player 1 Stated Belief About P ($15 | Player 1 $10) vs P($15 | Exp $10)

	Player 1s Who Chose $2	Player 1s Who Chose $10
p= 0		
Stated Belief P ($15 | Player 1 $10)	37.28	72.857
Stated Belief P ($15 | Exp $10)	25.84	36.538
Difference	11.44*	36.319***
p= 0.05		
Stated Belief P ($15 | Player 1 $10)	37.64	72.857
Stated Belief P ($15 | Exp $10)	30.24	28.571
Difference	7.4	44.286***
p= 0.20		
Stated Belief P ($15 | Player 1 $10)	36.24	58.929
Stated Belief P ($15 | Exp $10)	25.24	31.429
Difference	11**	27.5***
p= 0.40		
Stated Belief P ($15 | Player 1 $10)	33.333	53.333
Stated Belief P ($15 | Exp $10)	24.524	39.167
Difference	8.809*	14.166**
p= 0.60		
Stated Belief P ($15 | Player 1 $10)	35.863	41.412
Stated Belief P ($15 | Exp $10)	23.818	35.294
Difference	12.045**	6.118
p= 1		
Stated Belief P ($15 | Player 1 $10)	25.941	31.429
Stated Belief P ($15 | Exp $10)	21.389	25.714
Difference	4.552	5.715

Significance: *** $\alpha < 0.01$, ** $\alpha < 0.05$, * $\alpha < 0.10$

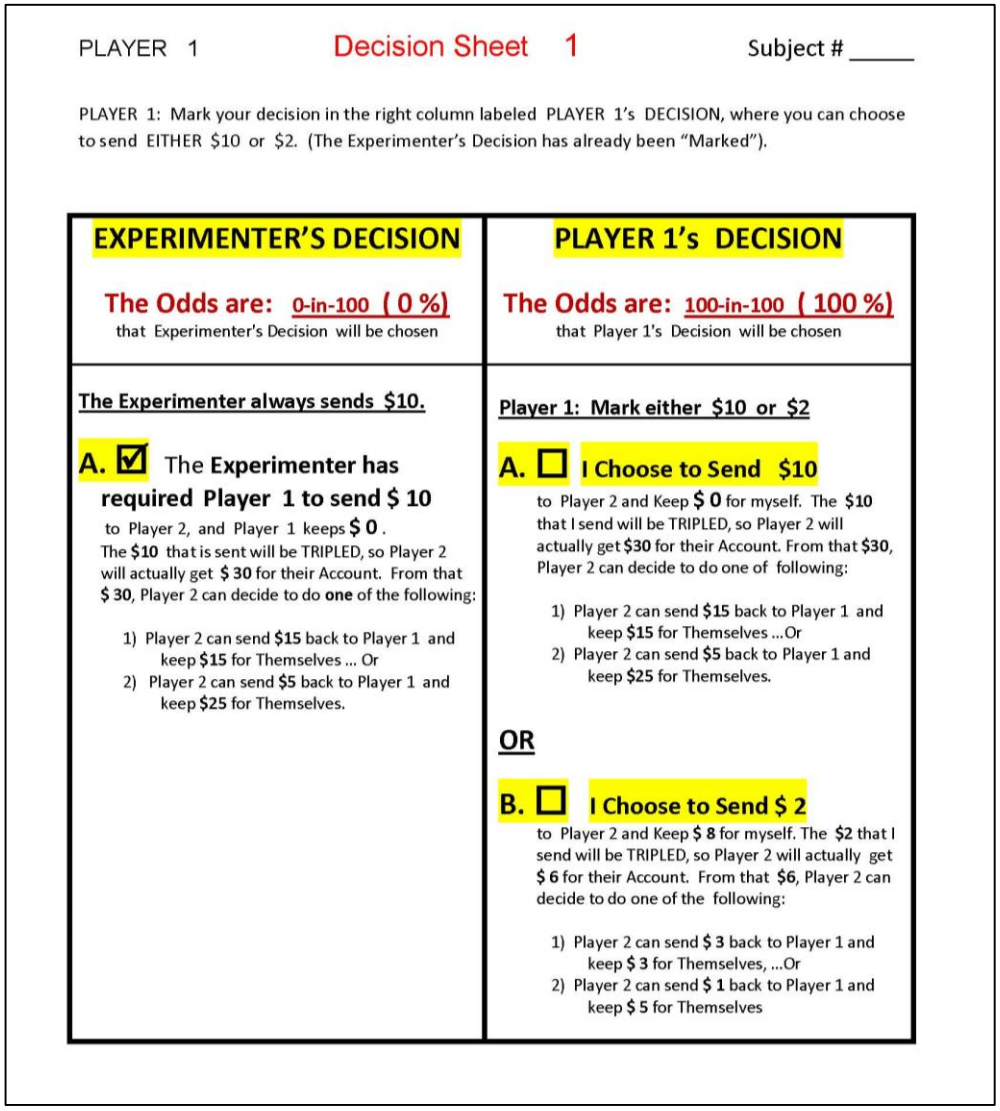
Table 1.10: Player 1 Stated Belief About P ($15 | Player 1 $10) vs. Actual Frequency of Player 2 Returning $15

	Player 1s Who Chose $2	**Player 1s Who Chose $10**
p= 0		
Actual Frequency of Player 2 Returning $15	32	32
Stated Belief P ($15 | Exp $10)	25.84	36.538
Difference	6.16*	-4.538
p= 0.05		
Actual Frequency of Player 2 Returning $15	29	29
Stated Belief P ($15 | Exp $10)	30.24	28.571
Difference	-1.24	0.429
p= 0.20		
Actual Frequency of Player 2 Returning $15	20	20
Stated Belief P ($15 | Exp $10)	25.24	31.429
Difference	-5.24*	-11.429**
p= 0.40		
Actual Frequency of Player 2 Returning $15	15	15
Stated Belief P ($15 | Exp $10)	24.524	39.167
Difference	-9.524***	-24.167***
p= 0.60		
Actual Frequency of Player 2 Returning $15	12	12
Stated Belief P ($15 | Exp $10)	23.818	35.294
Difference	-11.818***	-23.294***
p= 1		
Actual Frequency of Player 2 Returning $15	17	17
Stated Belief P ($15 | Exp $10)	21.389	25.714
Difference	-4.389	-8.714*

Significance: *** $\alpha < 0.01$, ** $\alpha < 0.05$, * $\alpha < 0.10$

1.9.2 Subject Form Examples

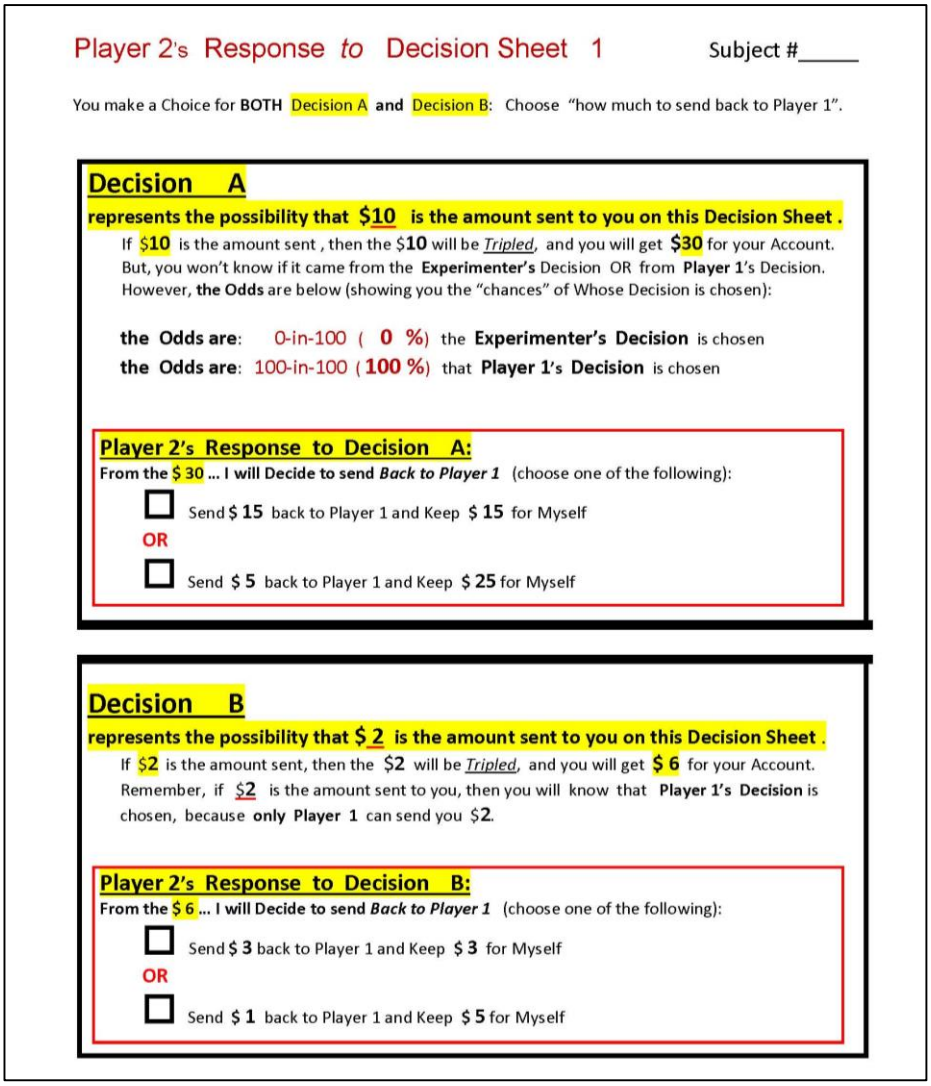
Below are samples of the forms subjects used.



PLAYER 1 Decision Sheet 1 Subject # _____

PLAYER 1: Mark your decision in the right column labeled PLAYER 1's DECISION, where you can choose to send EITHER $10 or $2. (The Experimenter's Decision has already been "Marked").

EXPERIMENTER'S DECISION	PLAYER 1's DECISION
The Odds are: 0-in-100 (0 %) that Experimenter's Decision will be chosen	The Odds are: 100-in-100 (100 %) that Player 1's Decision will be chosen
The Experimenter always sends $10. A. ☑ The Experimenter has required Player 1 to send $ 10 to Player 2, and Player 1 keeps $ 0 . The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30, Player 2 can decide to do one of the following: 1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or 2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.	Player 1: Mark either $10 or $2 A. ☐ I Choose to Send $10 to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30, Player 2 can decide to do one of following: 1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ...Or 2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves. OR B. ☐ I Choose to Send $ 2 to Player 2 and Keep $ 8 for myself. The $2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6, Player 2 can decide to do one of the following: 1) Player 2 can send $ 3 back to Player 1 and keep $ 3 for Themselves, ...Or 2) Player 2 can send $ 1 back to Player 1 and keep $ 5 for Themselves



Player 2's Response *to* Decision Sheet 1 Subject #_____

You make a Choice for **BOTH** Decision A **and** Decision B: Choose "how much to send back to Player 1".

Decision A

represents the possibility that $10 is the amount sent to you on this Decision Sheet .

If $10 is the amount sent , then the $10 will be *Tripled*, and you will get $30 for your Account. But, you won't know if it came from the **Experimenter's** Decision OR from **Player 1**'s Decision. However, **the Odds** are below (showing you the "chances" of Whose Decision is chosen):

the Odds are: 0-in-100 (0 %) the **Experimenter's Decision** is chosen
the Odds are: 100-in-100 (100 %) that **Player 1's Decision** is chosen

Player 2's Response to Decision A:

From the $ 30 ... I will Decide to send *Back to Player 1* (choose one of the following):

☐ Send $ 15 back to Player 1 and Keep $ 15 for Myself

OR

☐ Send $ 5 back to Player 1 and Keep $ 25 for Myself

Decision B

represents the possibility that $ 2 is the amount sent to you on this Decision Sheet .

If $2 is the amount sent, then the $2 will be *Tripled*, and you will get $ 6 for your Account. Remember, if $2 is the amount sent to you, then you will know that **Player 1's Decision** is chosen, because **only Player 1** can send you $2.

Player 2's Response to Decision B:

From the $ 6 ... I will Decide to send *Back to Player 1* (choose one of the following):

☐ Send $ 3 back to Player 1 and Keep $ 3 for Myself

OR

☐ Send $ 1 back to Player 1 and Keep $ 5 for Myself

PLAYER 1 **PREDICTION SHEET** **SUBJECT_____**

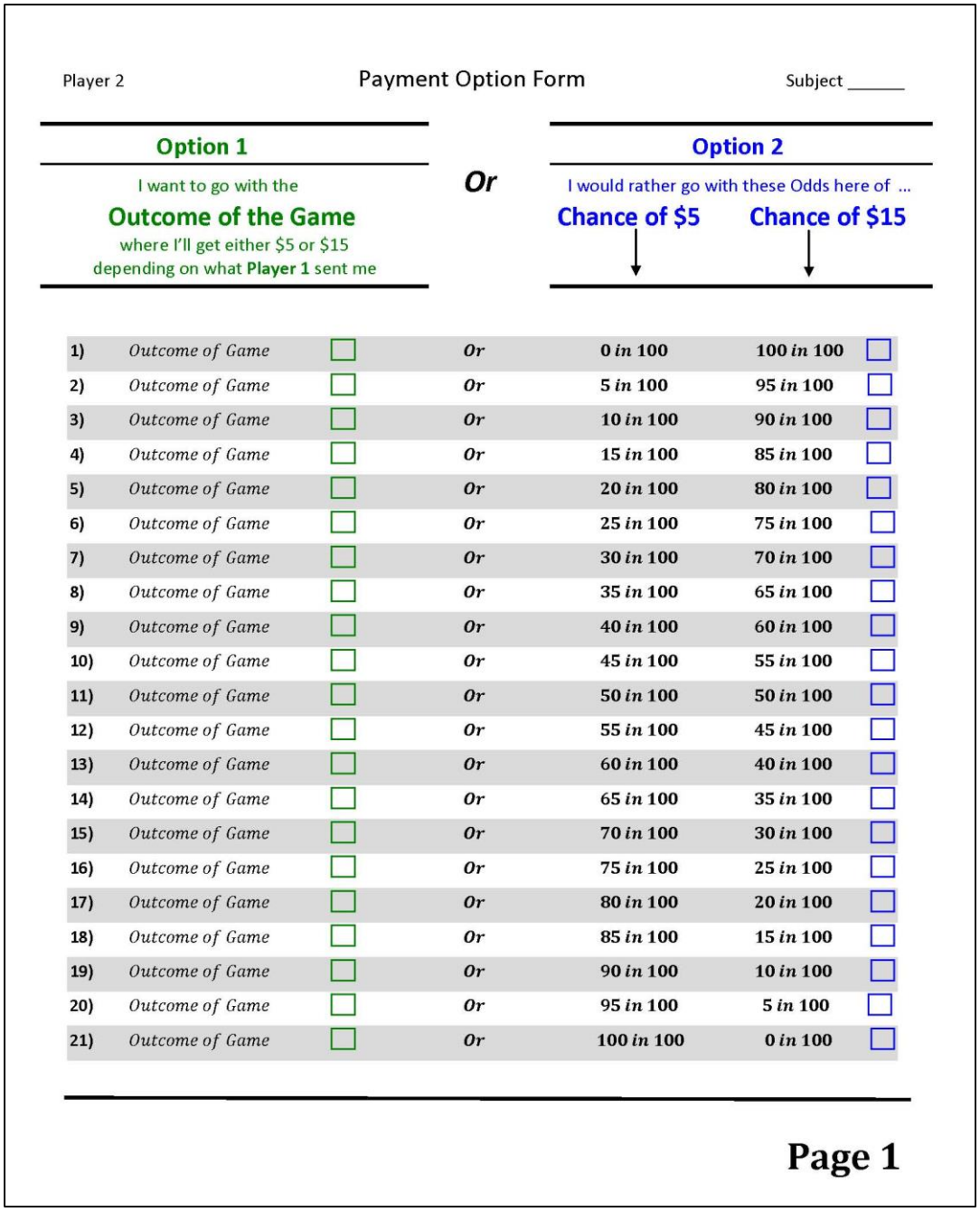
Here are the ODDS that Player 2 saw when deciding How Much to send back to you...	If $10 is sent to Player 2, *and* Player 2 believes that it came from...				If $2 is sent to Player 2	
	Experimenter's Decision — then I predict :		Player 1's Decision — then I predict :		then I predict :	
	the Chances that Player 2 Sent $15 Back to Me are....	the Chances that Player 2 Sent $5 Back to Me are....	the Chances that Player 2 Sent $15 Back to Me are....	the Chances that Player 2 Sent $5 Back to Me are....	the Chances that Player 2 Sent $ 3 Back to Me are....	the Chances that Player 2 Sent $ 1 Back to Me are....
Decision Sheet 1 — Odds for whose decision it is: 0 % Experimenter's Decision, 100 % Player 1's Decision	%	%	%	%	%	%
Decision Sheet 2 — Odds for whose decision it is: 5 % Experimenter's Decision, 95 % Player 1's Decision	%	%	%	%	%	%
Decision Sheet 3 — Odds for whose decision it is: 20 % Experimenter's Decision, 80 % Player 1's Decision	%	%	%	%	%	%
Decision Sheet 4 — Odds for whose decision it is: 40 % Experimenter's Decision, 60 % Player 1's Decision	%	%	%	%	%	%
Decision Sheet 5 — Odds for whose decision it is: 60 % Experimenter's Decision, 40 % Player 1's Decision	%	%	%	%	%	%
Decision Sheet 6 — Odds for whose decision it is: 100 % Experimenter's Decision, 0 % Player 1's Decision	%	%	%	%	%	%

Player 2 **PREDICTION SHEET** **SUBJECT _____**

IMPORTANT

On each decision sheet, the Experimenter made a decision and Player 1 made a decision. BUT HERE, we want you to think ONLY about PLAYER 1's decision. On each decision sheet, Player 1 could have decided to send either $10 or $2 to you. What do you think the chances are that PLAYER 1 decided to send to you $10 as compared to $2 ?

Here are the ODDS that Player 1 saw when deciding How Much to send you...	I Predict the chances that Player 1 chose to send $ 10 to me are...	I Predict the chances that Player 1 chose to send $ 2 to me are...
Decision Sheet 1 — Odds for whose decision it is: 0% Experimenter's Decision, 100 % Player 1's Decision	%	%
Decision Sheet 2 — Odds for whose decision it is: 5% Experimenter's Decision, 95 % Player 1's Decision	%	%
Decision Sheet 3 — Odds for whose decision it is: 20% Experimenter's Decision, 80% Player 1's Decision	%	%
Decision Sheet 4 — Odds for whose decision it is: 40% Experimenter's Decision, 60% Player 1's Decision	%	%
Decision Sheet 5 — Odds for whose decision it is: 60% Experimenter's Decision, 40% Player 1's Decision	%	%
Decision Sheet 6 — Odds for whose decision it is: 100% Experimenter's Decision, 0% Player 1's Decision	%	%



Player 2 Payment Option Form Subject _____

Option 1			Or	Option 2	
I want to go with the **Outcome of the Game** where I'll get either $5 or $15 depending on what **Player 1** sent me				I would rather go with these Odds here of ... **Chance of $5** ↓	**Chance of $15** ↓
1)	*Outcome of Game*	☐	*Or*	**0 *in* 100**	**100 *in* 100** ☐
2)	*Outcome of Game*	☐	*Or*	**5 *in* 100**	**95 *in* 100** ☐
3)	*Outcome of Game*	☐	*Or*	**10 *in* 100**	**90 *in* 100** ☐
4)	*Outcome of Game*	☐	*Or*	**15 *in* 100**	**85 *in* 100** ☐
5)	*Outcome of Game*	☐	*Or*	**20 *in* 100**	**80 *in* 100** ☐
6)	*Outcome of Game*	☐	*Or*	**25 *in* 100**	**75 *in* 100** ☐
7)	*Outcome of Game*	☐	*Or*	**30 *in* 100**	**70 *in* 100** ☐
8)	*Outcome of Game*	☐	*Or*	**35 *in* 100**	**65 *in* 100** ☐
9)	*Outcome of Game*	☐	*Or*	**40 *in* 100**	**60 *in* 100** ☐
10)	*Outcome of Game*	☐	*Or*	**45 *in* 100**	**55 *in* 100** ☐
11)	*Outcome of Game*	☐	*Or*	**50 *in* 100**	**50 *in* 100** ☐
12)	*Outcome of Game*	☐	*Or*	**55 *in* 100**	**45 *in* 100** ☐
13)	*Outcome of Game*	☐	*Or*	**60 *in* 100**	**40 *in* 100** ☐
14)	*Outcome of Game*	☐	*Or*	**65 *in* 100**	**35 *in* 100** ☐
15)	*Outcome of Game*	☐	*Or*	**70 *in* 100**	**30 *in* 100** ☐
16)	*Outcome of Game*	☐	*Or*	**75 *in* 100**	**25 *in* 100** ☐
17)	*Outcome of Game*	☐	*Or*	**80 *in* 100**	**20 *in* 100** ☐
18)	*Outcome of Game*	☐	*Or*	**85 *in* 100**	**15 *in* 100** ☐
19)	*Outcome of Game*	☐	*Or*	**90 *in* 100**	**10 *in* 100** ☐
20)	*Outcome of Game*	☐	*Or*	**95 *in* 100**	**5 *in* 100** ☐
21)	*Outcome of Game*	☐	*Or*	**100 *in* 100**	**0 *in* 100** ☐

Page 1

1.9.3 Subject Instructions

Below are screenshots of the animated PowerPoint instructions subjects viewed during the experiment.

Welcome

Please turn off all electronic devices

- **Guaranteed Money Earnings** from $10 - $ 32
  for completing entire experiment

- **Read and Sign Consent Form before beginning**
- **ALL Decisions will be ANONYMOUS**

Earnings	you make in the study
+ $ 7	we give you at the end
= Total Money you take home up to $ 32	

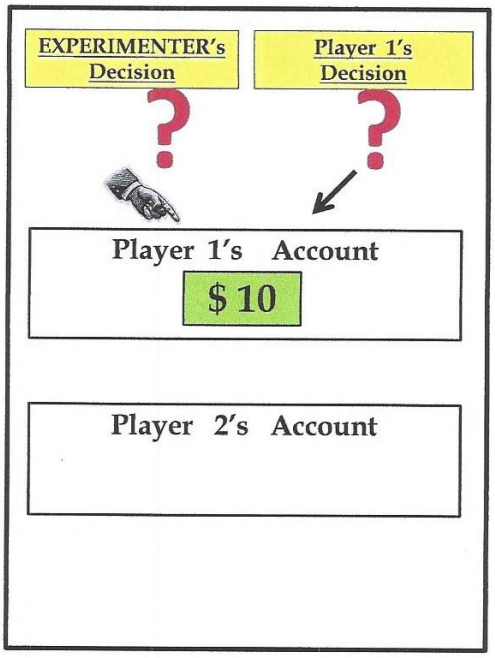
This is how you
Earn Money
in the study

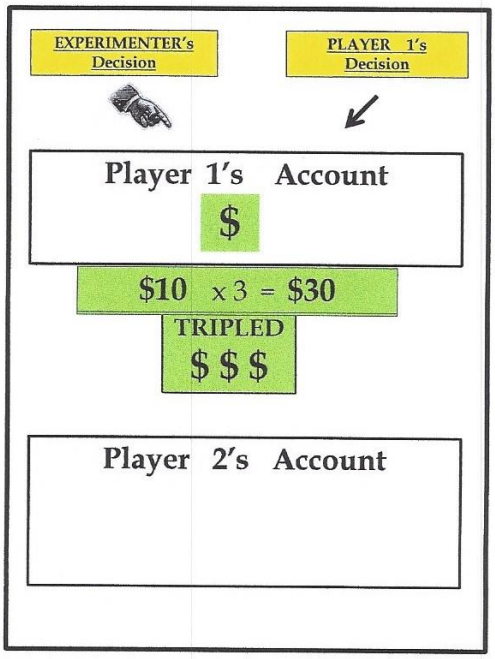
EXPERIMENTER's Decision	PLAYER 1's Decision
Experimenter always Forces Player 1 to send the whole $ 10	Player 1 can decide to send either $ 10 OR $ 2

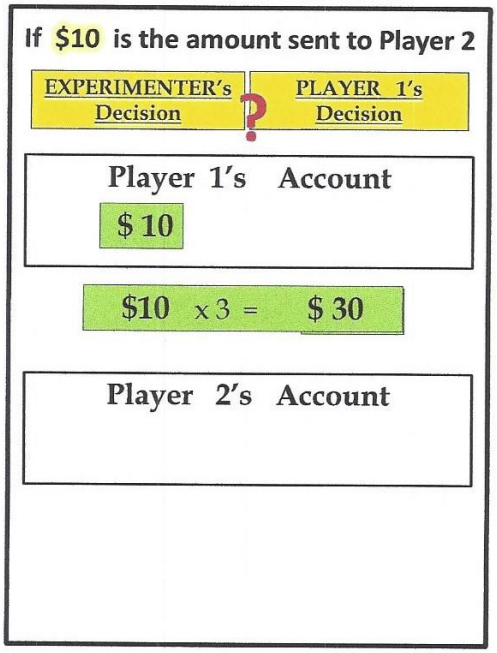
Player 1's Account

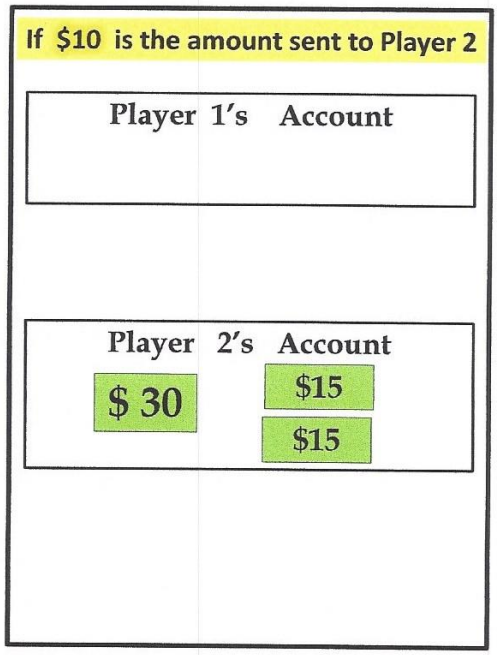
$ 10	$ 10	$ 2

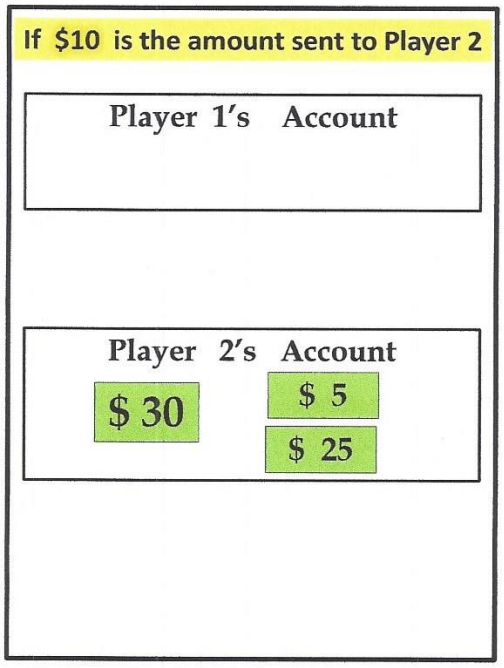
Player 2's Account

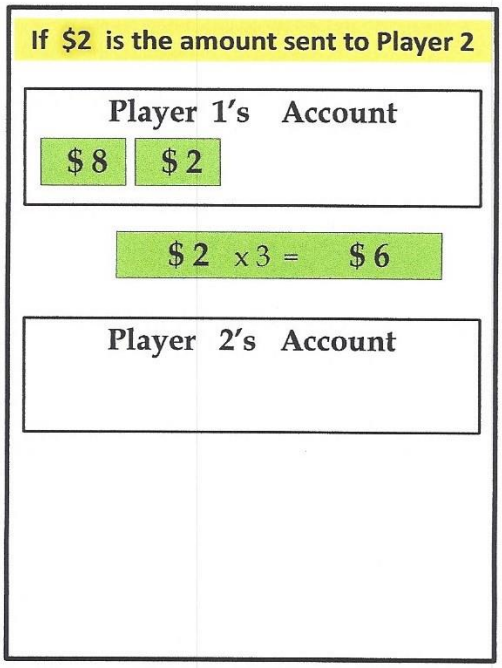

EXPERIMENTER's Decision
Player 1's Decision
Player 1's Account
$ 10
Player 2's Account

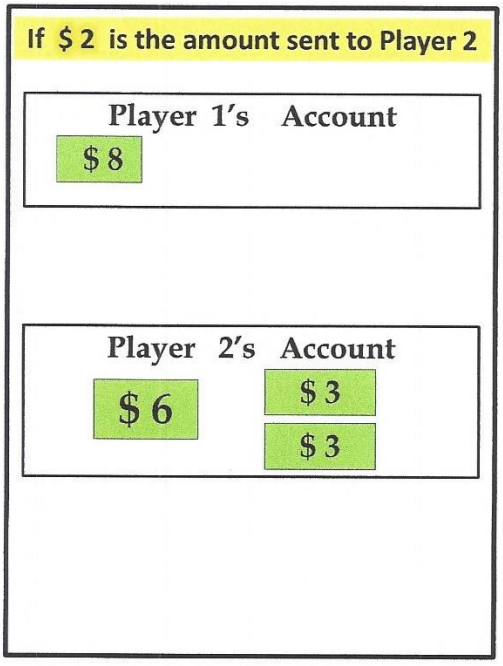

EXPERIMENTER's Decision
PLAYER 1's Decision
Player 1's Account
$
$10 x 3 = $30
TRIPLED
$ $ $
Player 2's Account

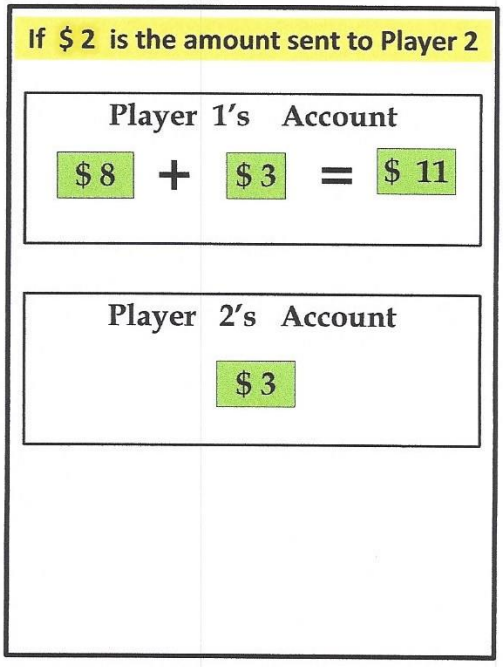

If $10 is the amount sent to Player 2
EXPERIMENTER's Decision
PLAYER 1's Decision
Player 1's Account
$ 10
$10 x 3 = $ 30
Player 2's Account


If $10 is the amount sent to Player 2
Player 1's Account
Player 2's Account
$ 30
$15
$15


If $10 is the amount sent to Player 2
Player 1's Account
Player 2's Account
$ 30
$ 5
$ 25


If $2 is the amount sent to Player 2
Player 1's Account
$ 8
$ 2
$ 2 x 3 = $ 6
Player 2's Account


If $ 2 is the amount sent to Player 2
Player 1's Account
$ 8
Player 2's Account
$ 6
$ 3
$ 3


If $ 2 is the amount sent to Player 2
Player 1's Account
$ 8 + $ 3 = $ 11
Player 2's Account
$ 3

If $ 2 is the amount sent to Player 2

Player 1's Account

$ 8

Player 2's Account

$ 6

$ 1

$ 5

If $ 2 is the amount sent to Player 2

Player 1's Account

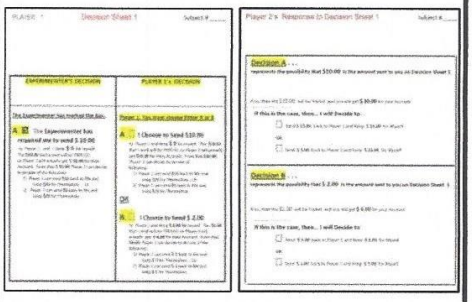
$ 8 + $ 1 = $ 9

Player 2's Account

$ 5

Players will never see each other's Decision Sheets

Player 1 Player 2

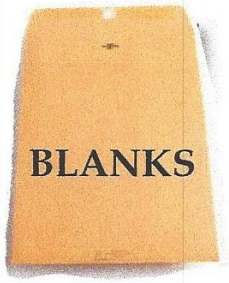


How to fill out your Decision Sheets

Player 1's Account

$ 10

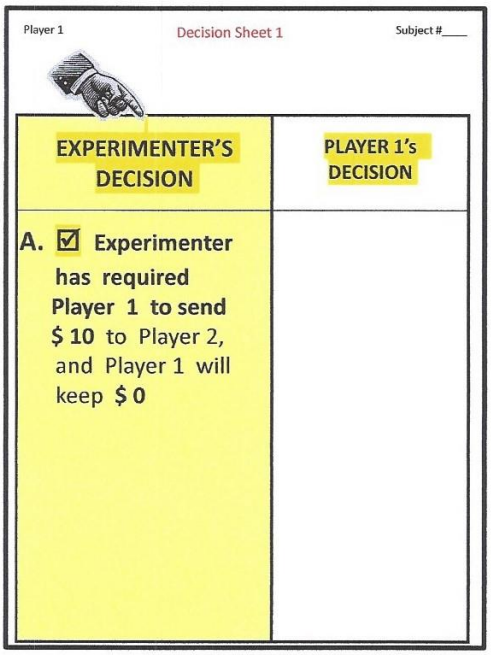
Player 2's Account

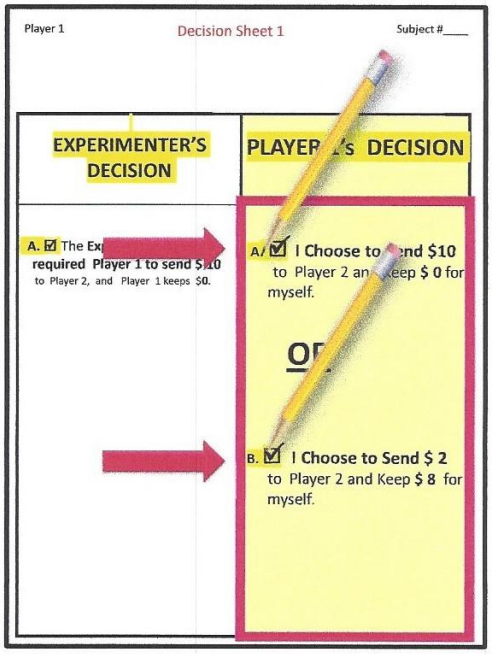


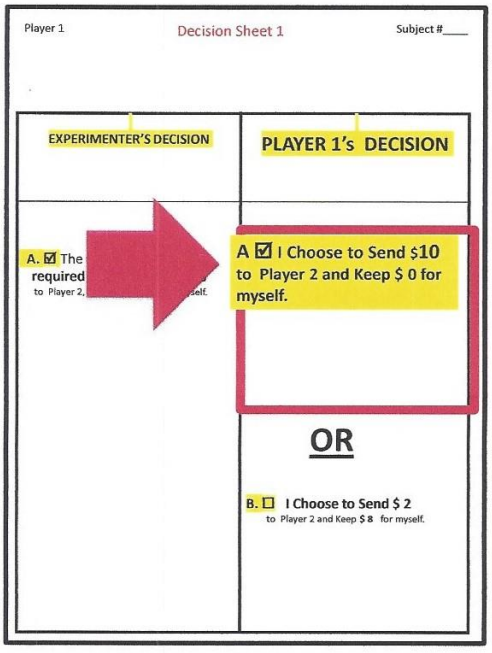
This is how Player 1 fills out their Decision Sheet

Player 1 — Decision Sheet 1 — Subject #____

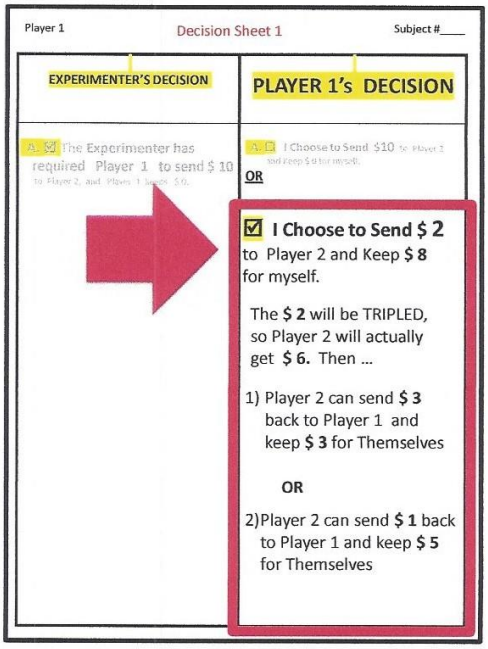
EXPERIMENTER'S DECISION	PLAYER 1's DECISION
A. ☑ **The Experimenter has required Player 1 to send $ 10** to Player 2, and Player 1 keeps **$ 0 .** The **$10** that is sent will be TRIPLED, So Player 2 will actually get **$ 30** for their Account. From that **$ 30**, Player 2 can decide to do **one** of the following: 1) Player 2 can send **$15** back to Player 1 and keep **$15** for themselves ... Or 2) Player 2 can send **$5** back to Player 1 and keep **$25** for Themselves.	A. ☐ **I Choose to send $10** to Player 2 and Keep **$ 0** for myself. The **$10.00** that I send will be TRIPLED, so Player 2 will actually get **$30** for their Account. From that **$30**, Player 2 can decide to do one of following: 1) Player 2 can send **$15** back to Me and keep **$15** for Themselves ...Or 2) Player 2 can send **$5** back to Me and keep **$25** for Themselves. **OR** B. ☐ **I Choose to Send $2** to Player 2 and Keep **$ 8.00** for myself. The **$ 2.00** that I send will be TRIPLED, so Player 2 will actually get **$ 6.00** for their Account. From that **$6.00**, Player 2 can decide to do one of the following: 1) Player 2 can send **$ 3** back to Me and keep **$ 3** for Themselves, ...Or 2) Player 2 can send **$ 1** back to Me and keep **$ 5** for Themselves

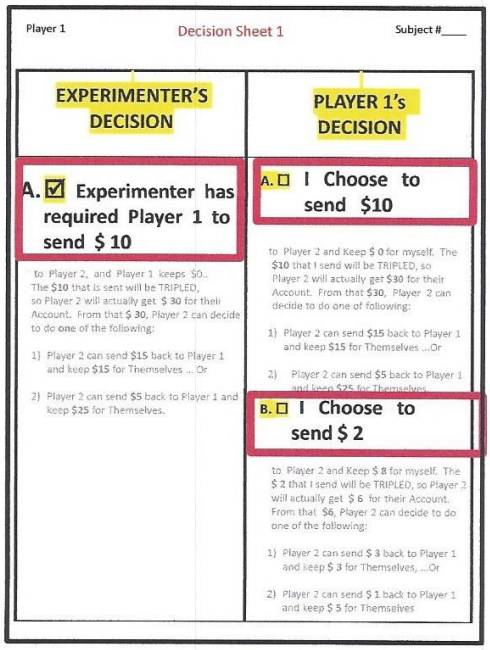

Player 1
Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
PLAYER 1's DECISION
A. ☑ Experimenter has required Player 1 to send $ 10 to Player 2, and Player 1 will keep $ 0

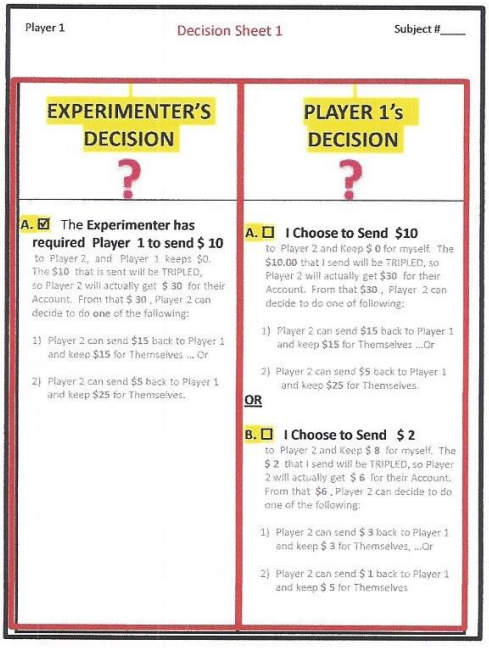

Player 1
Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
PLAYER 1's DECISION
A. ☑ The Ex required Player 1 to send $10 to Player 2, and Player 1 keeps $0.
A. ☑ I Choose to nd $10 to Player 2 an eep $ 0 for myself.
OR
B. ☑ I Choose to Send $ 2 to Player 2 and Keep $ 8 for myself.

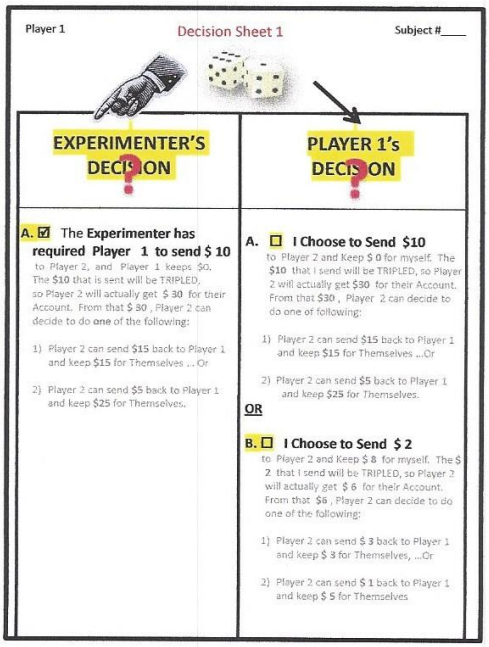

Player 1
Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
PLAYER 1's DECISION
A. ☑ The required
A ☑ I Choose to Send $10 to Player 2 and Keep $ 0 for myself.
OR
B. ☐ I Choose to Send $ 2 to Player 2 and Keep $ 8 for myself.

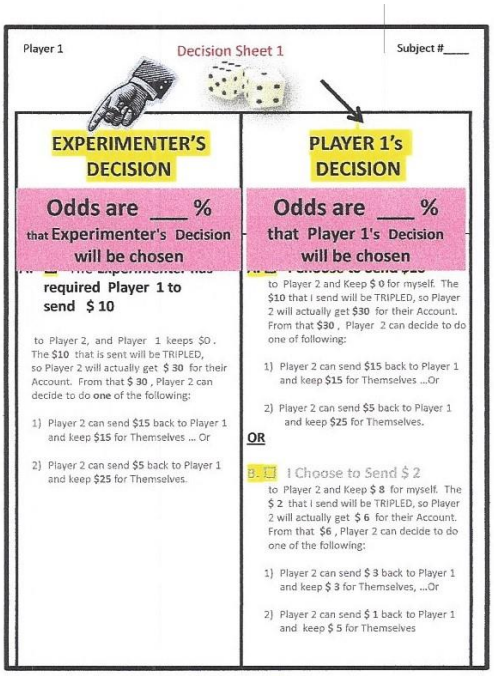

Player 1
Example Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
PLAYER 1's DECISION
☑ The Experimenter has required Player 1 to send $ 10 to Player 2, and Player 1 keeps $ 0.
☑ I Choose to Send $10 to Player 2 and Keep $ 0 for myself.
The $10 will be TRIPLED, so Player 2 will actually get $ 30. Then...
The $10 will be TRIPLED, so Player 2 will actually get $30. Then...
1) Player 2 can send $15 back to Player 1 and keep $15 for themselves
OR
2) Player 2 can send $5 back to Player 1 and keep $25 for themselves.
1) Player 2 can send $15 back to Player 1 and keep $15 for themselves
OR
2) Player 2 can send $5 back to Player 1 and keep $25 for themselves.


Player 1
Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
PLAYER 1's DECISION
A. ☑ The Experimenter has required Player 1 to send $ 10 to Player 2, and Player 1 keeps $ 0.
A. ☐ I Choose to Send $10 to Player 2 and Keep $ 0 for myself.
OR
☑ I Choose to Send $ 2 to Player 2 and Keep $ 8 for myself.
The $ 2 will be TRIPLED, so Player 2 will actually get $ 6. Then ...
1) Player 2 can send $ 3 back to Player 1 and keep $ 3 for Themselves
OR
2) Player 2 can send $ 1 back to Player 1 and keep $ 5 for Themselves


Player 1
Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
PLAYER 1's DECISION
A. ☑ Experimenter has required Player 1 to send $ 10
to Player 2, and Player 1 keeps $0.. The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30, Player 2 can decide to do one of the following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
A. ☐ I Choose to send $10
to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30, Player 2 can decide to do one of following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ...Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
B. ☐ I Choose to send $ 2
to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6, Player 2 can decide to do one of the following:
1) Player 2 can send $ 3 back to Player 1 and keep $ 3 for Themselves, ...Or
2) Player 2 can send $ 1 back to Player 1 and keep $ 5 for Themselves


Player 1
Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
?
PLAYER 1's DECISION
?
A. ☑ The Experimenter has required Player 1 to send $ 10 to Player 2, and Player 1 keeps $0. The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30 , Player 2 can decide to do one of the following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
A. ☐ I Choose to Send $10
to Player 2 and Keep $ 0 for myself. The $10.00 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30 , Player 2 can decide to do one of following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ...Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
OR
B. ☐ I Choose to Send $ 2
to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6 , Player 2 can decide to do one of the following:
1) Player 2 can send $ 3 back to Player 1 and keep $ 3 for Themselves, ...Or
2) Player 2 can send $ 1 back to Player 1 and keep $ 5 for Themselves


Player 1
Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
?
PLAYER 1's DECISION
?
A. ☑ The Experimenter has required Player 1 to send $ 10 to Player 2, and Player 1 keeps $0. The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30 , Player 2 can decide to do one of the following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves .. Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
A. ☐ I Choose to Send $10
to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30 , Player 2 can decide to do one of following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ...Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
OR
B. ☐ I Choose to Send $ 2
to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6 , Player 2 can decide to do one of the following:
1) Player 2 can send $ 3 back to Player 1 and keep $ 3 for Themselves, ...Or
2) Player 2 can send $ 1 back to Player 1 and keep $ 5 for Themselves


Player 1 Decision Sheet 1 Subject #____

EXPERIMENTER'S DECISION

Odds are ___ % that Experimenter's Decision will be chosen

required Player 1 to send $ 10

to Player 2, and Player 1 keeps $0. The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30 , Player 2 can decide to do one of the following:

1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or

2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.

PLAYER 1's DECISION

Odds are ___ % that Player 1's Decision will be chosen

to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30 , Player 2 can decide to do one of following:

1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ...Or

2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.

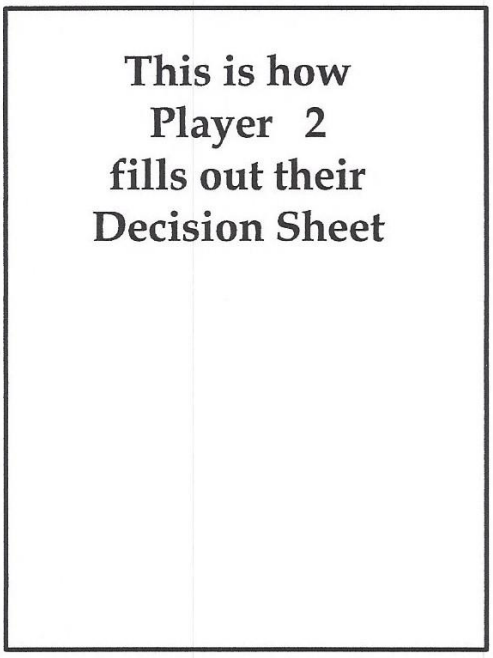
OR

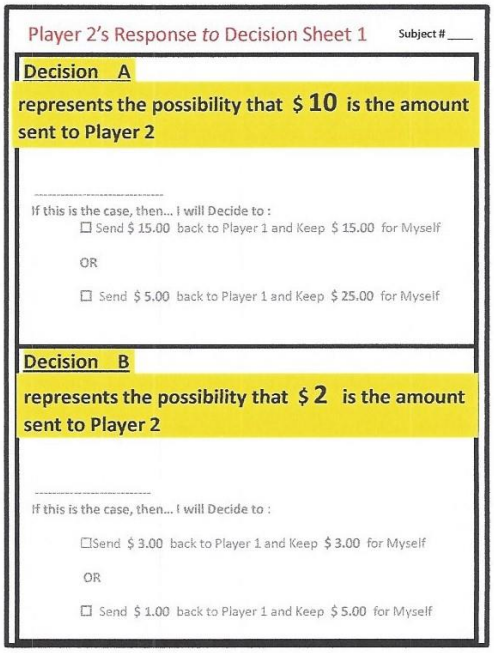
B. ☐ I Choose to Send $ 2

to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6 , Player 2 can decide to do one of the following:

1) Player 2 can send $ 3 back to Player 1 and keep $ 3 for Themselves, ...Or

2) Player 2 can send $ 1 back to Player 1 and keep $ 5 for Themselves




Player 2's Response *to* Decision Sheet 1 Subject #____

Decision A

represents the possibility that $ 10 is the amount sent to Player 2

If this is the case, then... I will Decide to :

☐ Send $ 15.00 back to Player 1 and Keep $ 15.00 for Myself

OR

☐ Send $ 5.00 back to Player 1 and Keep $ 25.00 for Myself

Decision B

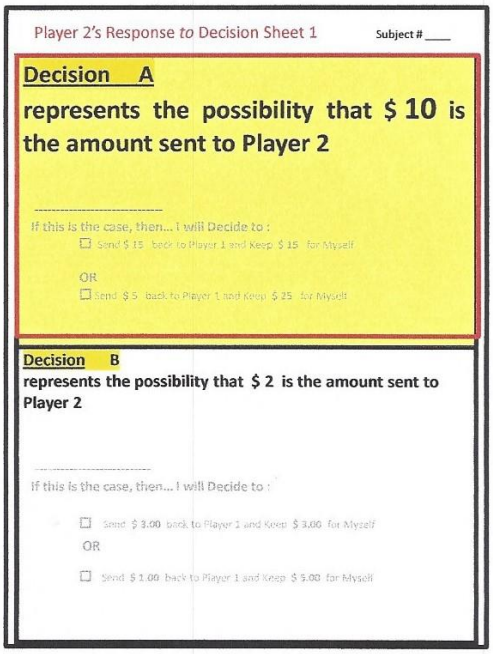
represents the possibility that $ 2 is the amount sent to Player 2

If this is the case, then... I will Decide to :

☐Send $ 3.00 back to Player 1 and Keep $ 3.00 for Myself

OR

☐ Send $ 1.00 back to Player 1 and Keep $ 5.00 for Myself


Player 2's Response *to* Decision Sheet 1 Subject #____

Decision A

represents the possibility that $ 10 is the amount sent to Player 2

If this is the case, then... I will Decide to :

☐ Send $ 15 back to Player 1 and Keep $ 15 for Myself

OR

☐ Send $ 5 back to Player 1 and Keep $ 25 for Myself

Decision B

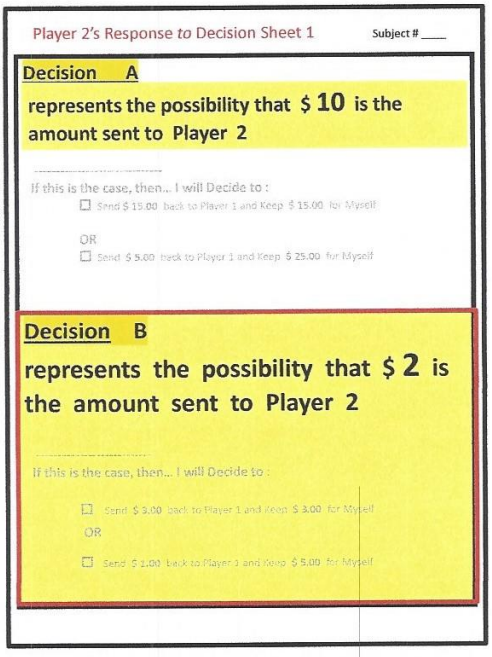
represents the possibility that $ 2 is the amount sent to Player 2

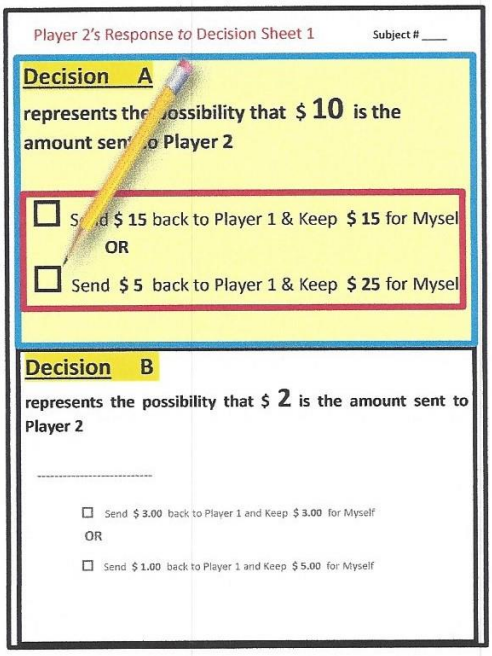
If this is the case, then... I will Decide to :

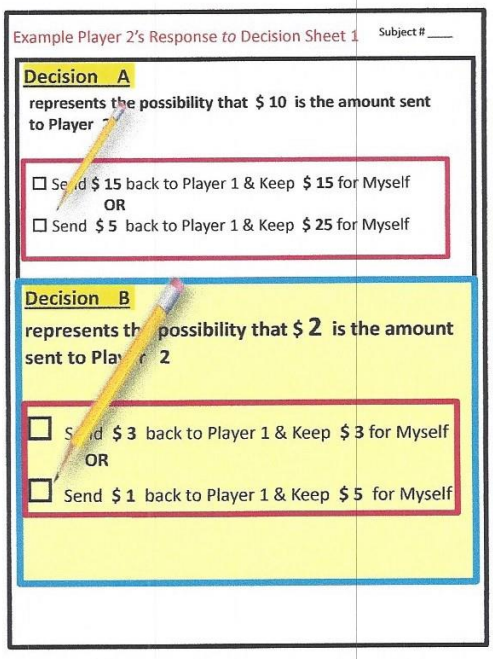
☐ Send $ 3.00 back to Player 1 and Keep $ 3.00 for Myself

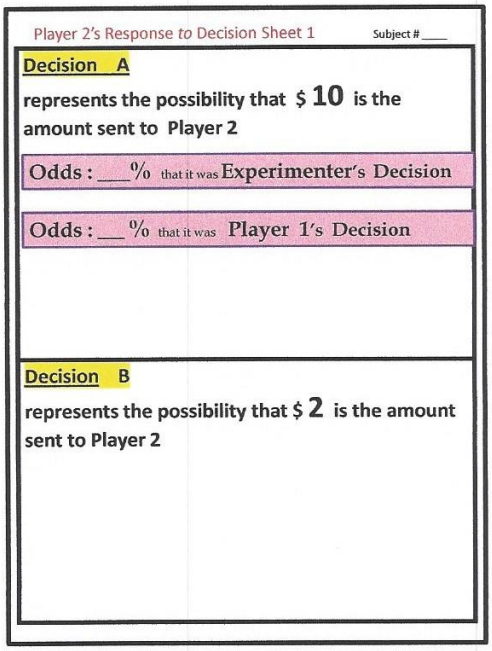
OR

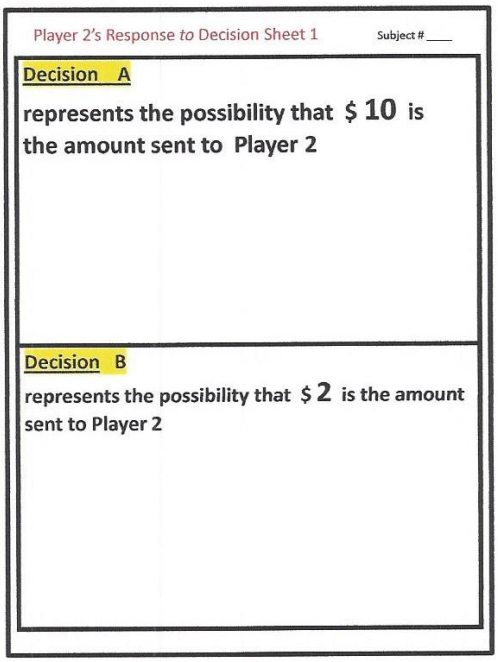
☐ Send $ 1.00 back to Player 1 and Keep $ 5.00 for Myself

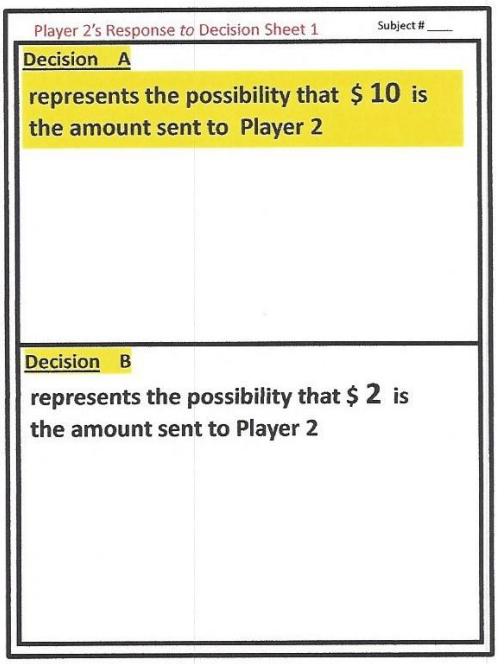

Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $ 10 is the amount sent to Player 2
If this is the case, then... I will Decide to :
Send $ 15.00 back to Player 1 and Keep $ 15.00 for Myself
OR
Send $ 5.00 back to Player 1 and Keep $ 25.00 for Myself
Decision B
represents the possibility that $ 2 is the amount sent to Player 2
If this is the case, then... I will Decide to :
Send $ 3.00 back to Player 1 and Keep $ 3.00 for Myself
OR
Send $ 1.00 back to Player 1 and Keep $ 5.00 for Myself

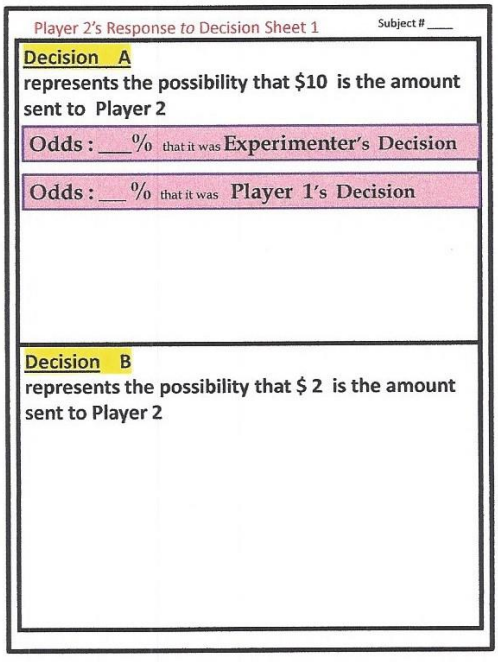

Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $ 10 is the amount sent to Player 2
Send $ 15 back to Player 1 & Keep $ 15 for Myself
OR
Send $ 5 back to Player 1 & Keep $ 25 for Myself
Decision B
represents the possibility that $ 2 is the amount sent to Player 2
Send $ 3.00 back to Player 1 and Keep $ 3.00 for Myself
OR
Send $ 1.00 back to Player 1 and Keep $ 5.00 for Myself

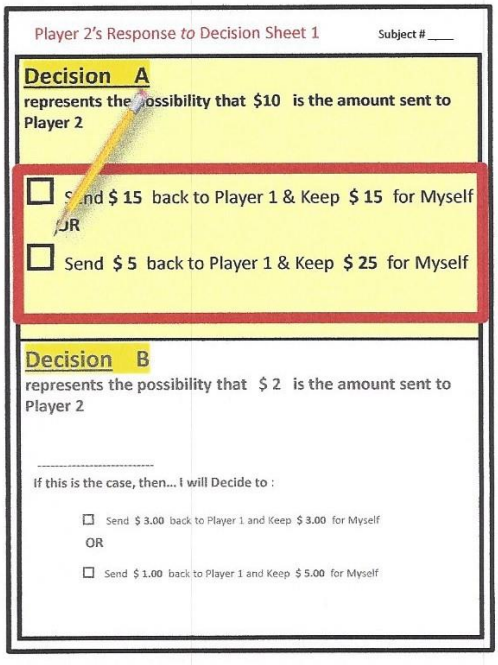

Example Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $ 10 is the amount sent to Player 2
Send $ 15 back to Player 1 & Keep $ 15 for Myself
OR
Send $ 5 back to Player 1 & Keep $ 25 for Myself
Decision B
represents the possibility that $ 2 is the amount sent to Player 2
Send $ 3 back to Player 1 & Keep $ 3 for Myself
OR
Send $ 1 back to Player 1 & Keep $ 5 for Myself

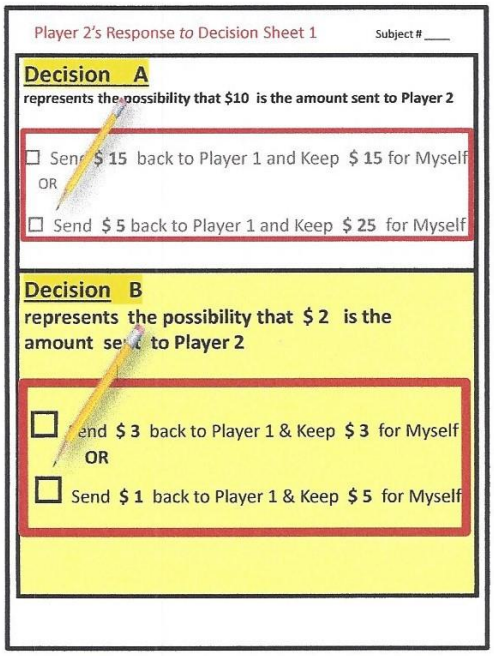

Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $ 10 is the amount sent to Player 2
Odds : ___% that it was Experimenter's Decision
Odds : ___% that it was Player 1's Decision
Decision B
represents the possibility that $ 2 is the amount sent to Player 2

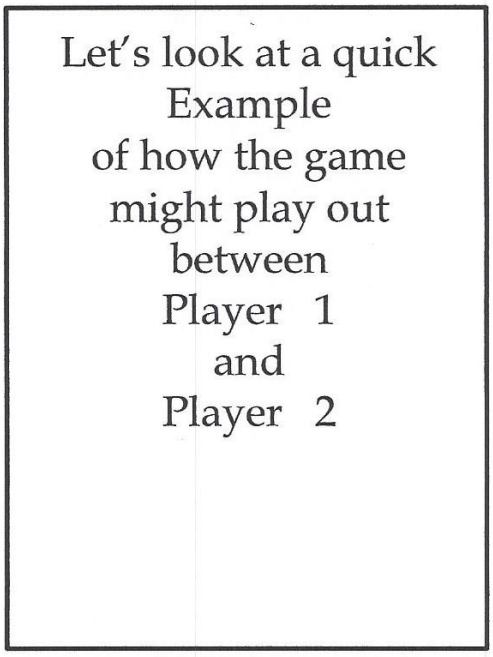

Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $ 10 is the amount sent to Player 2
Decision B
represents the possibility that $ 2 is the amount sent to Player 2

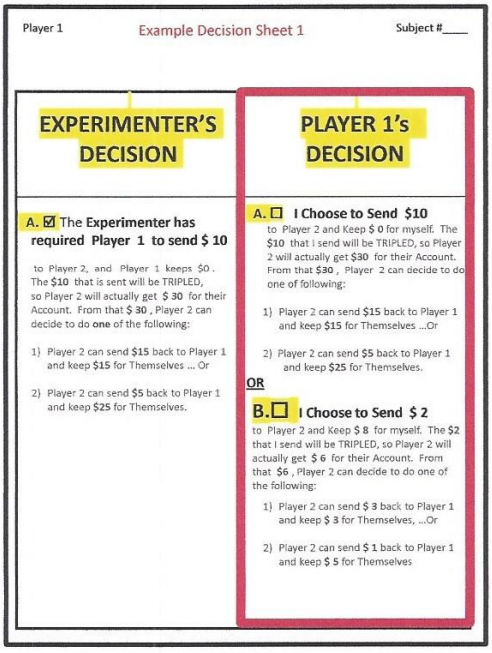

Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $ 10 is the amount sent to Player 2
Decision B
represents the possibility that $ 2 is the amount sent to Player 2


Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $10 is the amount sent to Player 2
Odds : ___% that it was Experimenter's Decision
Odds : ___% that it was Player 1's Decision
Decision B
represents the possibility that $ 2 is the amount sent to Player 2


Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $10 is the amount sent to Player 2
Send $ 15 back to Player 1 & Keep $ 15 for Myself
OR
Send $ 5 back to Player 1 & Keep $ 25 for Myself
Decision B
represents the possibility that $ 2 is the amount sent to Player 2
If this is the case, then... I will Decide to :
Send $ 3.00 back to Player 1 and Keep $ 3.00 for Myself
OR
Send $ 1.00 back to Player 1 and Keep $ 5.00 for Myself


Player 2's Response to Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $10 is the amount sent to Player 2
☐ Send $ 15 back to Player 1 and Keep $ 15 for Myself
OR
☐ Send $ 5 back to Player 1 and Keep $ 25 for Myself
Decision B
represents the possibility that $ 2 is the amount sent to Player 2
☐ Send $ 3 back to Player 1 & Keep $ 3 for Myself
OR
☐ Send $ 1 back to Player 1 & Keep $ 5 for Myself


Let's look at a quick Example of how the game might play out between Player 1 and Player 2


Player 1
Example Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
PLAYER 1's DECISION
A. ☑ The Experimenter has required Player 1 to send $ 10
to Player 2, and Player 1 keeps $0. The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30, Player 2 can decide to do one of the following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
A. ☐ I Choose to Send $10
to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30, Player 2 can decide to do one of following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ...Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
OR
B.☐ I Choose to Send $ 2
to Player 2 and Keep $ 8 for myself. The $2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6, Player 2 can decide to do one of the following:
1) Player 2 can send $ 3 back to Player 1 and keep $ 3 for Themselves, ...Or
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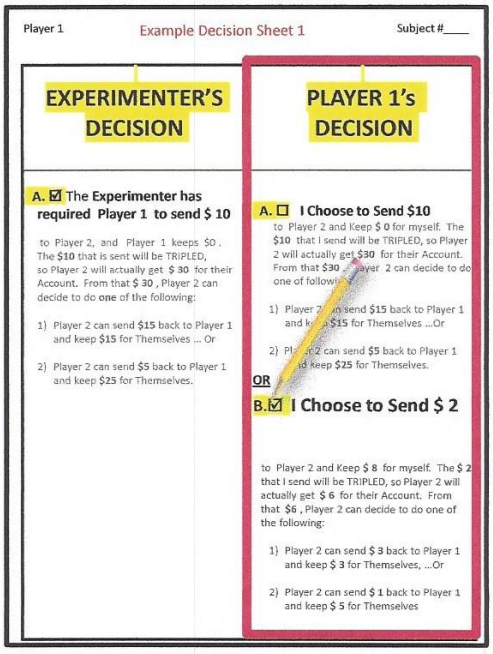
Player 1
Example Decision Sheet 1
Subject #____
EXPERIMENTER'S DECISION
PLAYER 1's DECISION
A. ☑ The Experimenter has required Player 1 to send $ 10
to Player 2, and Player 1 keeps $0. The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30, Player 2 can decide to do one of the following:
1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
A. ☐ I Choose to Send $10
to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30
1) Player 2 can send $15 back to Player 1
2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.
OR
B.☑ I Choose to Send $ 2
to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6, Player 2 can decide to do one of the following:
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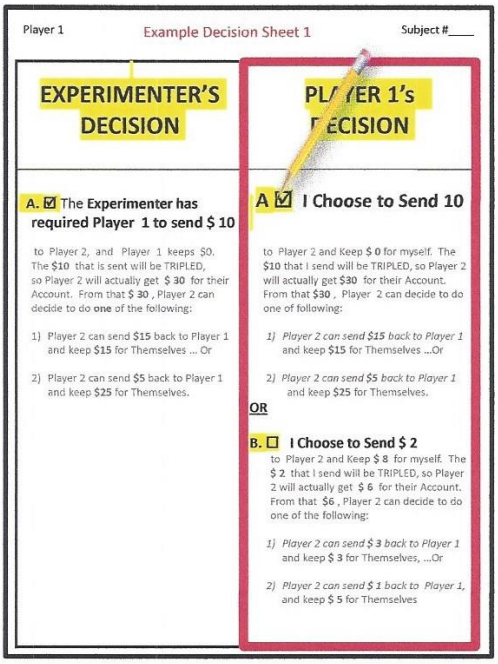


Player 1 Example Decision Sheet 1 Subject #____

EXPERIMENTER'S DECISION

A. ☑ The **Experimenter has required Player 1 to send $ 10**

to Player 2, and Player 1 keeps $0. The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30 , Player 2 can decide to do **one** of the following:

1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or

2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.

PLAYER 1's DECISION

A ☑ **I Choose to Send 10**

to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30 , Player 2 can decide to do one of following:

1) *Player 2 can send $15 back to Player 1* and keep $15 for Themselves ...Or

2) *Player 2 can send $5 back to Player 1* and keep $25 for Themselves.

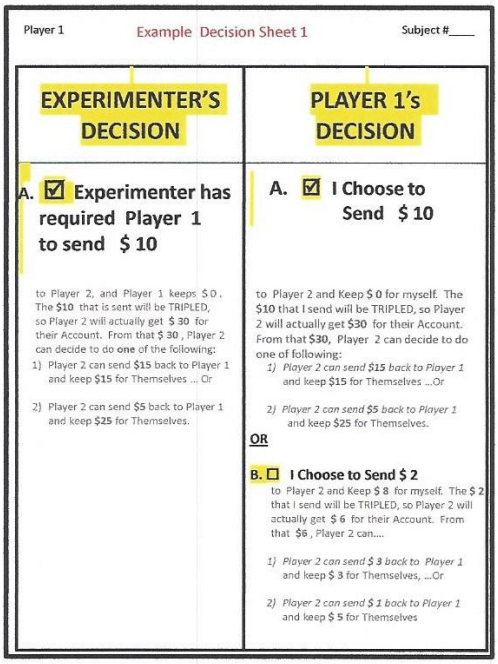
OR

B. ☐ **I Choose to Send $ 2**

to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6 , Player 2 can decide to do one of the following:

1) *Player 2 can send $ 3 back to Player 1* and keep $ 3 for Themselves, ...Or

2) *Player 2 can send $ 1 back to Player 1,* and keep $ 5 for Themselves



Player 1 Example Decision Sheet 1 Subject #____

EXPERIMENTER'S DECISION

A. ☑ **Experimenter has required Player 1 to send $ 10**

to Player 2, and Player 1 keeps $ 0 . The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30 , Player 2 can decide to do **one** of the following:

1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or

2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.

PLAYER 1's DECISION

A. ☑ **I Choose to Send $ 10**

to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30, Player 2 can decide to do one of following:

1) *Player 2 can send $15 back to Player 1* and keep $15 for Themselves ...Or

2) *Player 2 can send $5 back to Player 1* and keep $25 for Themselves.

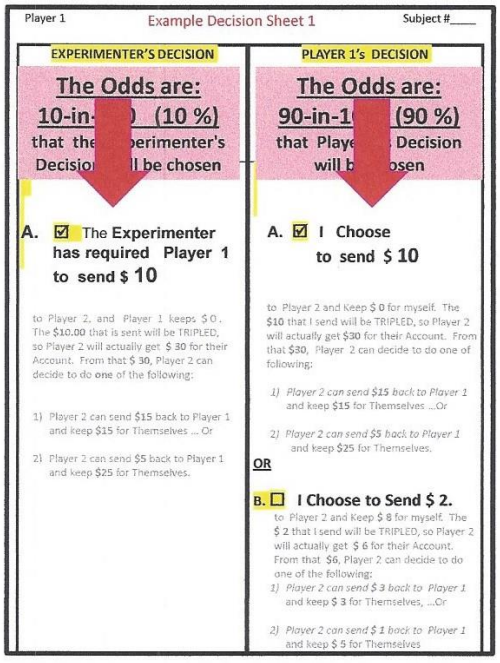
OR

B. ☐ **I Choose to Send $ 2**

to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6 , Player 2 can....

1) *Player 2 can send $ 3 back to Player 1* and keep $ 3 for Themselves, ...Or

2) *Player 2 can send $ 1 back to Player 1* and keep $ 5 for Themselves



Player 1 Example Decision Sheet 1 Subject #____

EXPERIMENTER'S DECISION

The Odds are: 10-in-[illegible] (10 %) that the [illegible]perimenter's Decisio[illegible]l be chosen

A. ☑ The **Experimenter has required Player 1 to send $ 10**

to Player 2, and Player 1 keeps $ 0 . The $10.00 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30, Player 2 can decide to do **one** of the following:

1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or

2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.

PLAYER 1's DECISION

The Odds are: 90-in-1[illegible] (90 %) that Playe[illegible] Decision will b[illegible]osen

A. ☑ **I Choose to send $ 10**

to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30, Player 2 can decide to do one of following:

1) *Player 2 can send $15 back to Player 1* and keep $15 for Themselves ...Or

2) *Player 2 can send $5 back to Player 1* and keep $25 for Themselves.

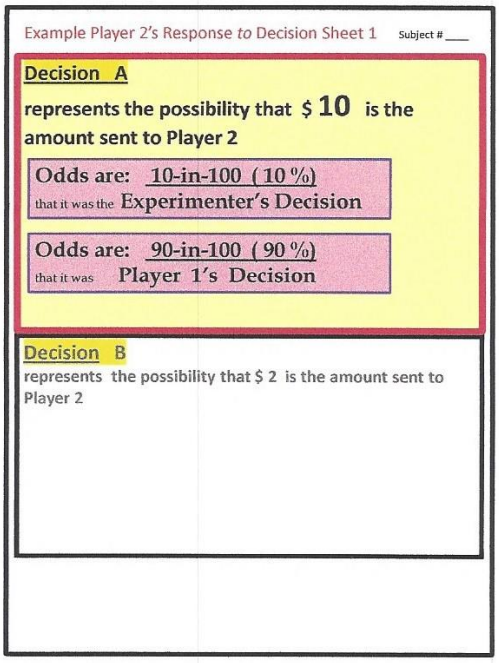
OR

B. ☐ **I Choose to Send $ 2.**

to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6, Player 2 can decide to do one of the following:

1) *Player 2 can send $ 3 back to Player 1* and keep $ 3 for Themselves, ...Or

2) *Player 2 can send $ 1 back to Player 1* and keep $ 5 for Themselves



Example Player 2's Response *to* Decision Sheet 1 Subject # ___

Decision A

represents the possibility that $ 10 is the amount sent to Player 2

Odds are: 10-in-100 (10 %) that it was the **Experimenter's Decision**

Odds are: 90-in-100 (90 %) that it was **Player 1's Decision**

Decision B

represents the possibility that $ 2 is the amount sent to Player 2

Example 2

Player 1 Example Decision Sheet 1 Subject #____

EXPERIMENTER'S DECISION	PLAYER 1's DECISION
The Odds are: 90-in-100 (90 %) that the Experimenter's Decision will be chosen	**The Odds are: 10-in-100 (10 %) that Player 1's Decision will be chosen**
A. ☑ The **Experimenter has required Player 1 to send $ 10** to Player 2, and Player 1 keeps $0. The $10 that is sent will be TRIPLED, so Player 2 will actually get $ 30 for their Account. From that $ 30, Player 2 can decide to do **one** of the following: 1) Player 2 can send $15 back to Player 1 and keep $15 for Themselves ... Or 2) Player 2 can send $5 back to Player 1 and keep $25 for Themselves.	A. ☑ **I Choose to send $ 10** to Player 2 and Keep $ 0 for myself. The $10 that I send will be TRIPLED, so Player 2 will actually get $30 for their Account. From that $30, Player 2 can decide to do one of following: *1) Player 2 can send $15 back to Player 1* and keep $15 for Themselves ..Or *2) Player 2 can send $5 back to Player 1,* and keep $25 for Themselves. **OR** B. ☐ **I Choose to Send $ 2** to Player 2 and Keep $ 8 for myself. The $ 2 that I send will be TRIPLED, so Player 2 will actually get $ 6 for their Account. From that $6, Player 2 can: *1) Player 2 can send $ 3 back to Player 1* and keep $ 3 for Themselves, ...Or *2) Player 2 can send $ 1 back to Player 1* and keep $ 5 for Themselves

Example Player 2's Response *to* Decision Sheet 1 Subject # ___

Decision A

represents the possibility that $ 10 is the amount sent to Player 2

Odds are: 90-in-100 (90 %) that it was the **Experimenter's Decision**

Odds are: 10-in-100 (10 %) that it was **Player 1's Decision**

Decision B

represents the possibility that $ 2 is the amount sent to Player 2

Player 2's Response *to* Decision Sheet 1 Subject # ____

Decision A

represents the possibility that $ 10 is the amount sent to you on Decision Sheet 1

☐ Send **$ 15** back to Player 1 & Keep **$ 15** for Myself

OR

☐ Send **$ 5** back to Player 1 & Keep **$ 25** for Myself

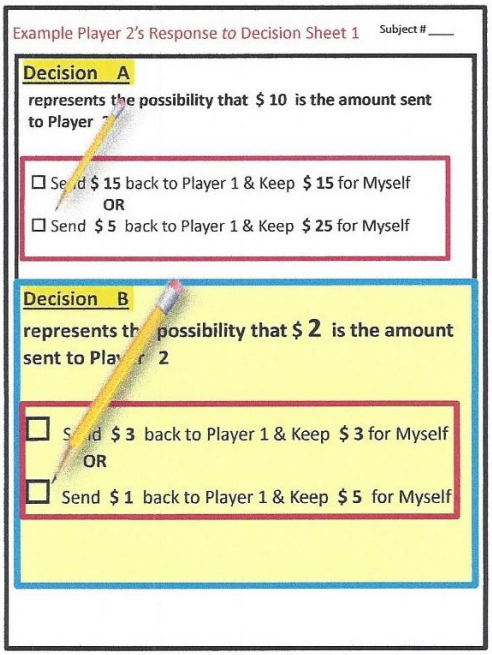
Decision B

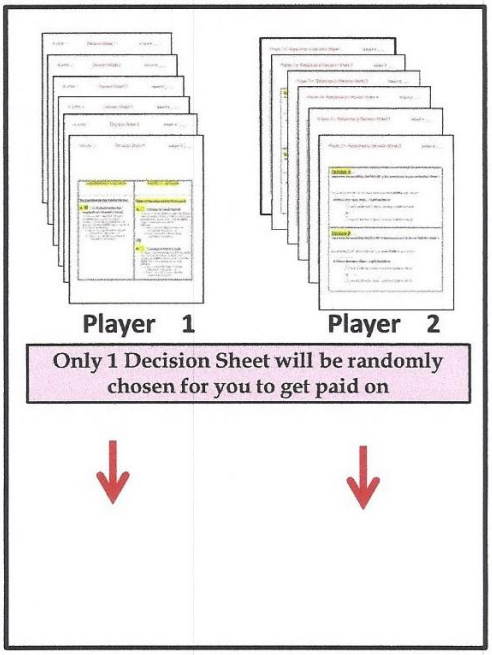
represents the possibility that $ 2.00 is the amount sent to you on Decision Sheet 1

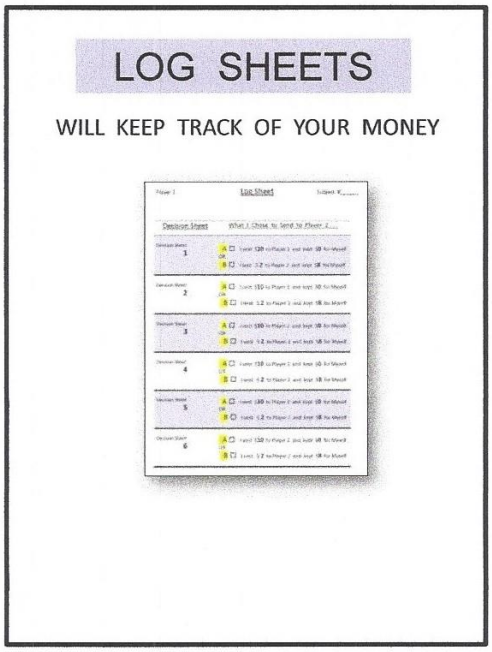
☐ Send $ 3.00 back to Player 1 and Keep $ 3.00 for Myself

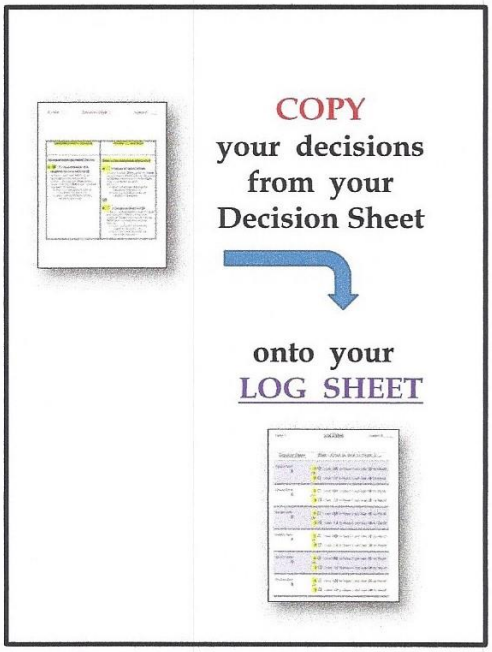
OR

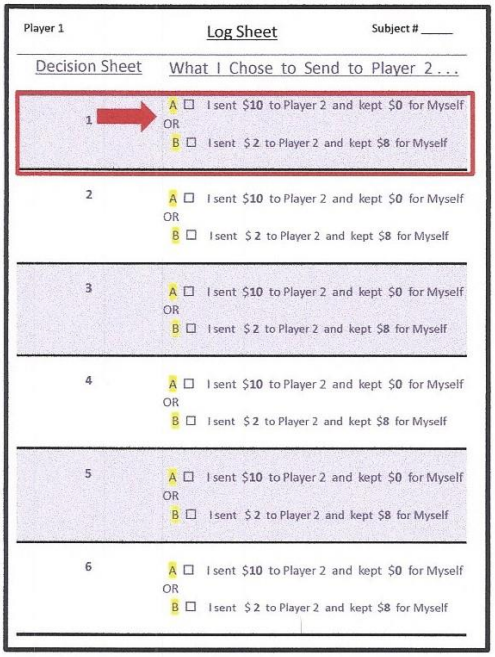
☐ Send $ 1.00 back to Player 1 and Keep $ 5.00 for Myself


Example Player 2's Response *to* Decision Sheet 1
Subject # ____
Decision A
represents the possibility that $ 10 is the amount sent to Player
☐ Send $ 15 back to Player 1 & Keep $ 15 for Myself
OR
☐ Send $ 5 back to Player 1 & Keep $ 25 for Myself
Decision B
represents the possibility that $ 2 is the amount sent to Player 2
☐ Send $ 3 back to Player 1 & Keep $ 3 for Myself
OR
☐ Send $ 1 back to Player 1 & Keep $ 5 for Myself


Player 1
Player 2
Only 1 Decision Sheet will be randomly chosen for you to get paid on

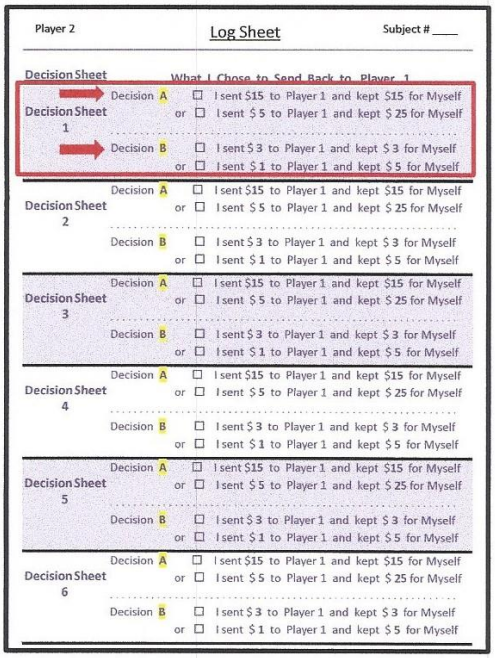

LOG SHEETS
WILL KEEP TRACK OF YOUR MONEY


COPY
your decisions from your Decision Sheet
onto your
LOG SHEET



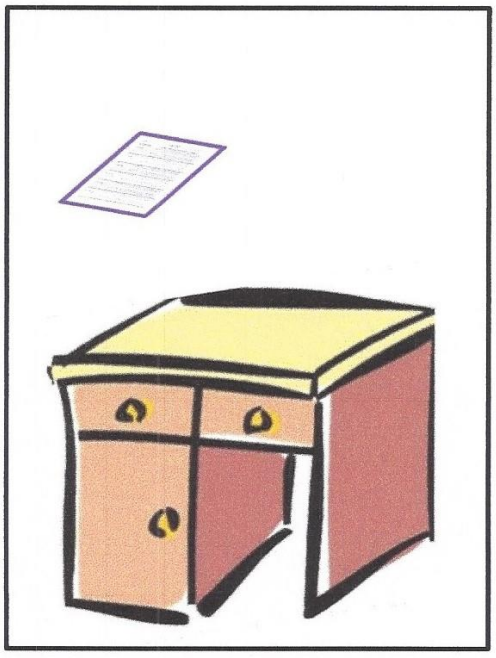
Player 1 Log Sheet Subject # _____

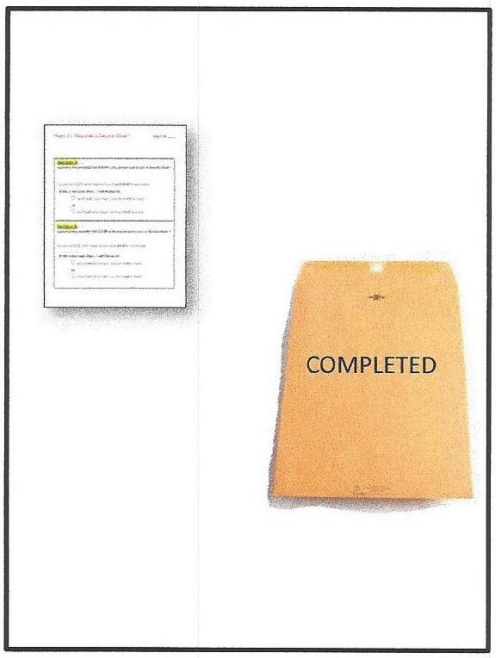
Decision Sheet	What I Chose to Send to Player 2 . . .
1	A ☐ I sent $10 to Player 2 and kept $0 for Myself OR B ☐ I sent $ 2 to Player 2 and kept $8 for Myself
2	A ☐ I sent $10 to Player 2 and kept $0 for Myself OR B ☐ I sent $ 2 to Player 2 and kept $8 for Myself
3	A ☐ I sent $10 to Player 2 and kept $0 for Myself OR B ☐ I sent $ 2 to Player 2 and kept $8 for Myself
4	A ☐ I sent $10 to Player 2 and kept $0 for Myself OR B ☐ I sent $ 2 to Player 2 and kept $8 for Myself
5	A ☐ I sent $10 to Player 2 and kept $0 for Myself OR B ☐ I sent $ 2 to Player 2 and kept $8 for Myself
6	A ☐ I sent $10 to Player 2 and kept $0 for Myself OR B ☐ I sent $ 2 to Player 2 and kept $8 for Myself



Player 2 Log Sheet Subject # ____

Decision Sheet	What I Chose to Send Back to Player 1
Decision Sheet 1	Decision A ☐ I sent $15 to Player 1 and kept $15 for Myself or ☐ I sent $ 5 to Player 1 and kept $ 25 for Myself
	Decision B ☐ I sent $ 3 to Player 1 and kept $ 3 for Myself or ☐ I sent $ 1 to Player 1 and kept $ 5 for Myself
Decision Sheet 2	Decision A ☐ I sent $15 to Player 1 and kept $15 for Myself or ☐ I sent $ 5 to Player 1 and kept $ 25 for Myself
	Decision B ☐ I sent $ 3 to Player 1 and kept $ 3 for Myself or ☐ I sent $ 1 to Player 1 and kept $ 5 for Myself
Decision Sheet 3	Decision A ☐ I sent $15 to Player 1 and kept $15 for Myself or ☐ I sent $ 5 to Player 1 and kept $ 25 for Myself
	Decision B ☐ I sent $ 3 to Player 1 and kept $ 3 for Myself or ☐ I sent $ 1 to Player 1 and kept $ 5 for Myself
Decision Sheet 4	Decision A ☐ I sent $15 to Player 1 and kept $15 for Myself or ☐ I sent $ 5 to Player 1 and kept $ 25 for Myself
	Decision B ☐ I sent $ 3 to Player 1 and kept $ 3 for Myself or ☐ I sent $ 1 to Player 1 and kept $ 5 for Myself
Decision Sheet 5	Decision A ☐ I sent $15 to Player 1 and kept $15 for Myself or ☐ I sent $ 5 to Player 1 and kept $ 25 for Myself
	Decision B ☐ I sent $ 3 to Player 1 and kept $ 3 for Myself or ☐ I sent $ 1 to Player 1 and kept $ 5 for Myself
Decision Sheet 6	Decision A ☐ I sent $15 to Player 1 and kept $15 for Myself or ☐ I sent $ 5 to Player 1 and kept $ 25 for Myself
	Decision B ☐ I sent $ 3 to Player 1 and kept $ 3 for Myself or ☐ I sent $ 1 to Player 1 and kept $ 5 for Myself





Remember …

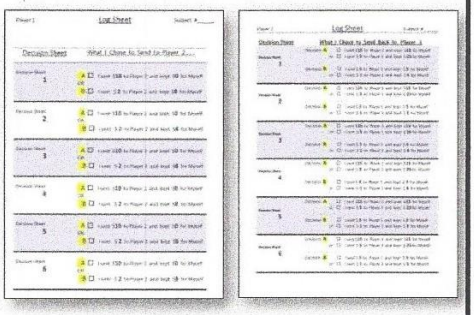
- **Your IDENTITY is ANONYMOUS**
  No one will ever know what decisions you personally make.
- **Look at the Different Odds** before making your Decisions

Let's Get Started !

Pull Out
LOG SHEET

Your SUBJECT Number is on your Envelopes.
Your Subject Number is DIFFERENT than your Player Number

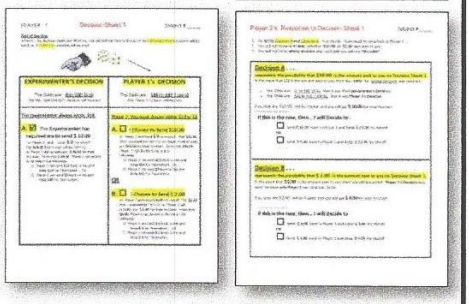
Player 1 | Player 2



Pull Out
Decision Sheet 1

- **Player 1** - You write ONLY **1** choice:
  Either **$ 10 OR $ 2**
- **Player 2** - You must write **2** choices:
  1 for Decision A *and*
  1 for Decision B

Player 1 | Player 2

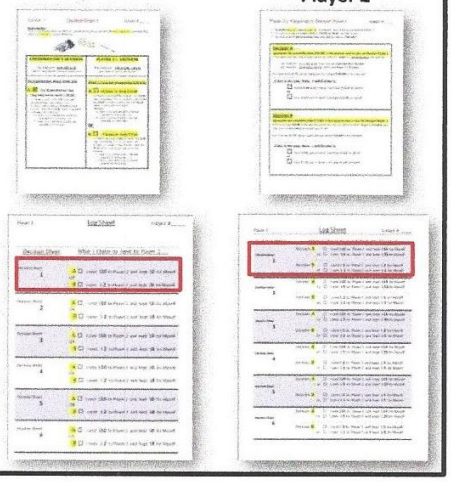


Write Answers on BOTH:

Decision Sheet

and **Log Sheet**

Player 1 **Player 2**



After you have written your decisions on both your Decision Sheet and your Log Sheet, then …

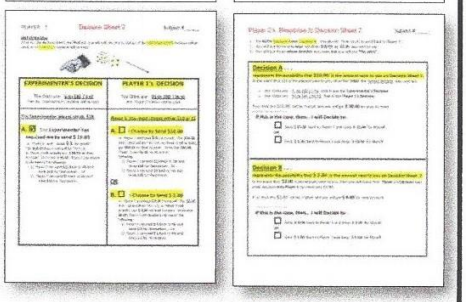
- Put **Decision Sheet 1** in the envelope labeled "COMPLETED Decision Sheets"
- Keep your **Log Sheet** on your Desk

Pull Out

Decision Sheet 2

- **Player 1** - You write ONLY **1** choice:
  Either **$ 10 OR $ 2**
- **Player 2** - You must write **2** choices:
  1 for Decision A *and*
  1 for Decision B

Player 1	Player 2

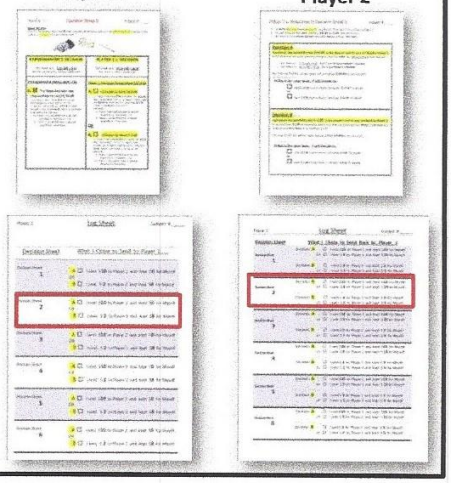


Write Answers on BOTH:

Decision Sheet

and **Log Sheet**

Player 1 **Player 2**



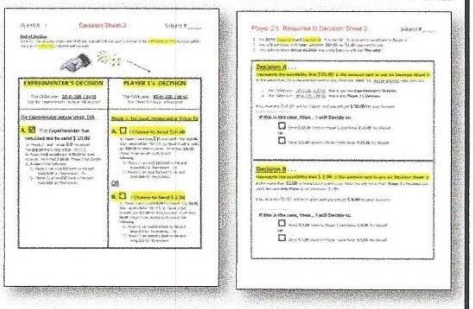
After you have written your decisions on both your Decision Sheet and your Log Sheet, then …

- Put Decision Sheet 2 in the envelope labeled "COMPLETED Decision Sheets"
- Keep your Log Sheet on your Desk

Pull Out
Decision Sheet 3

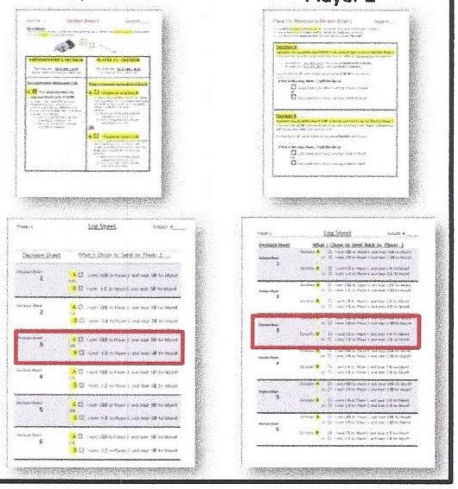
- **Player 1** - You write ONLY 1 choice:
  Either **$ 10 OR $ 2**
- **Player 2** - You must write **2** choices:
  1 for Decision A *and*
  1 for Decision B

Player 1	Player 2



Write Answers on BOTH:
Decision Sheet
and Log Sheet

Player 1 Player 2



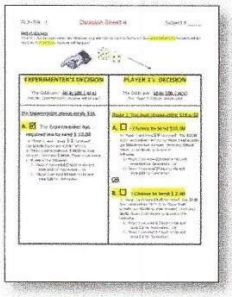
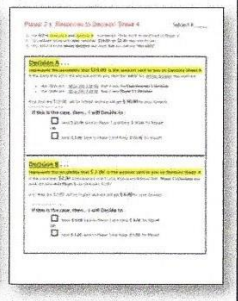
After you have written your decisions on both your Decision Sheet and your Log Sheet, then …

- Put Decision Sheet 3 in the envelope labeled "COMPLETED Decision Sheets"
- Keep your Log Sheet on your Desk

Pull Out

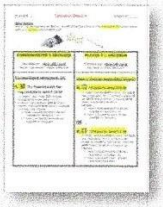
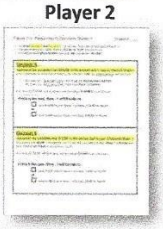
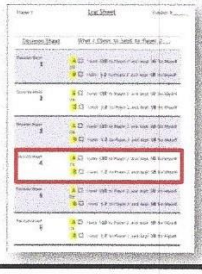
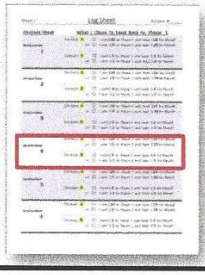
Decision Sheet 4

- **Player 1** - You write ONLY **1** choice:
  Either **$ 10 OR $ 2**
- **Player 2** - You must write **2** choices:
  1 for Decision A *and*
  1 for Decision B

Player 1	Player 2
	

Write Answers on BOTH:

Decision Sheet
and Log Sheet

Player 1	Player 2
	
	

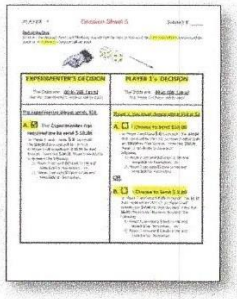
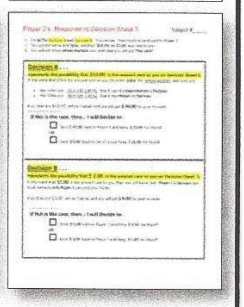
After you have written your decisions on both your Decision Sheet and your Log Sheet, then …

- Put Decision Sheet 4 in the envelope labeled "COMPLETED Decision Sheets"
- Keep your Log Sheet on your Desk

Pull Out

Decision Sheet 5

- **Player 1** - You write ONLY **1** choice:
  Either **$ 10 OR $ 2**
- **Player 2** - You must write **2** choices:
  1 for Decision A *and*
  1 for Decision B

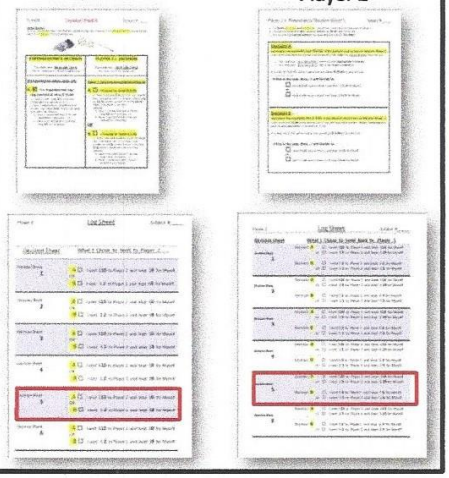
Player 1	Player 2
	

Write Answers on BOTH:

Decision Sheet

and Log Sheet

Player 1 Player 2



After you have written your decisions on both your Decision Sheet and your Log Sheet, then …

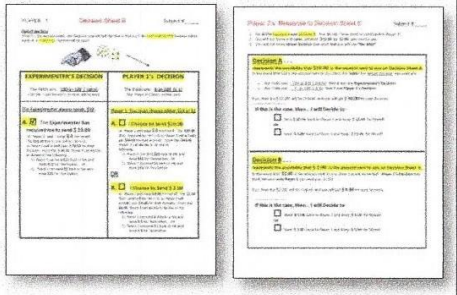
- Put Decision Sheet 5 in the envelope labeled "COMPLETED Decision Sheets"
- Keep your Log Sheet on your Desk

Pull Out

Decision Sheet 6

- **Player 1** - You write ONLY **1** choice:
  Either **$ 10 OR $ 2**
- **Player 2** - You must write **2** choices:
  1 for Decision A *and*
  1 for Decision B

Player 1	Player 2

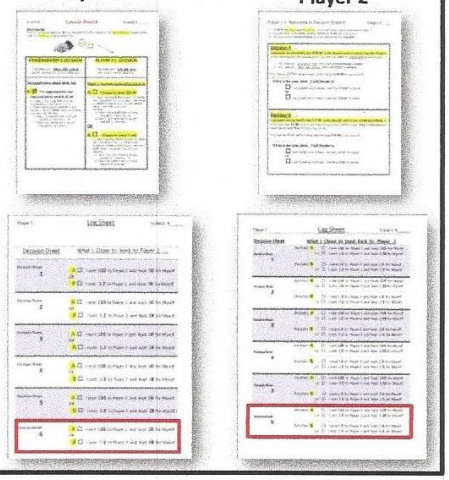


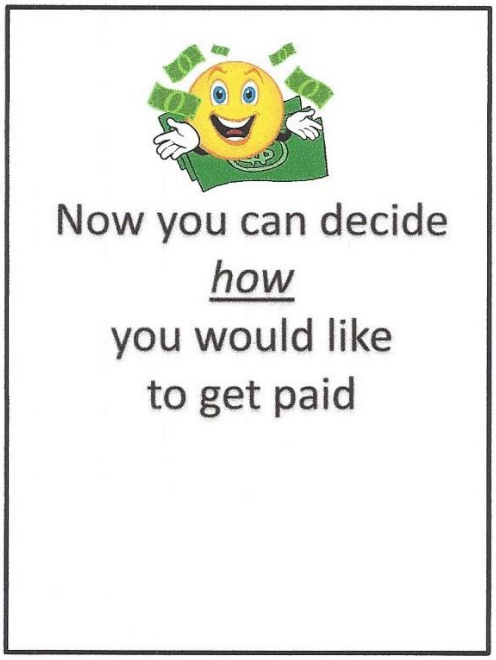
Write Answers on BOTH:

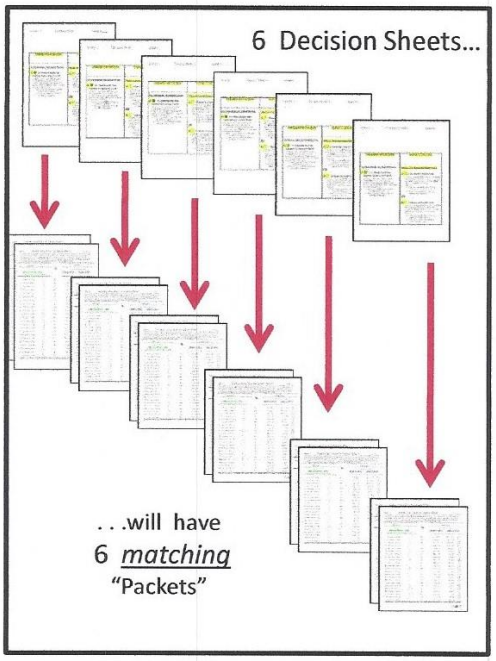
Decision Sheet

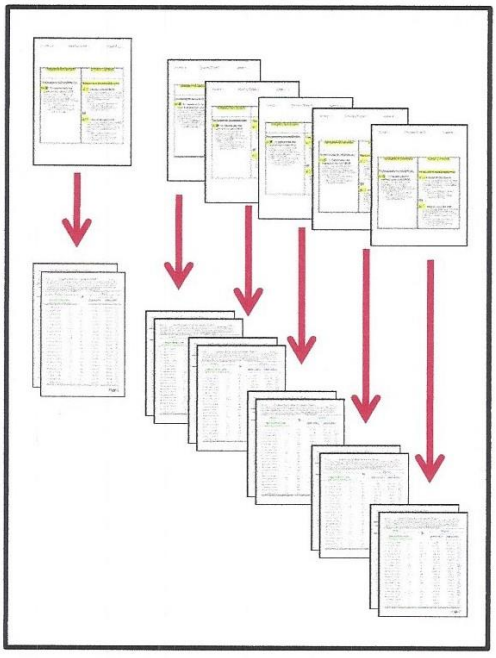
and Log Sheet

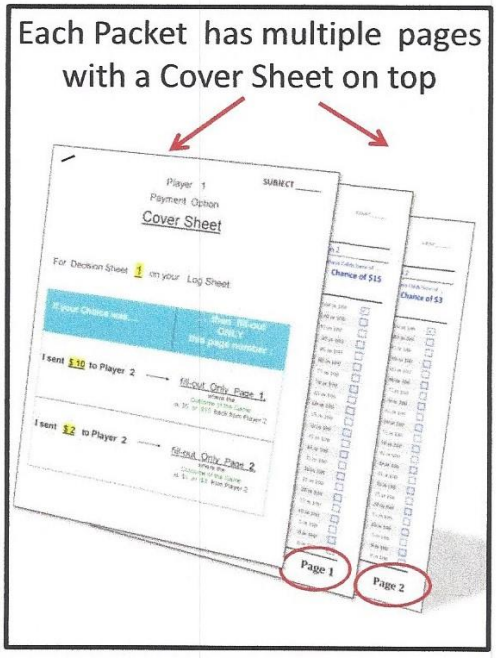
Player 1 Player 2

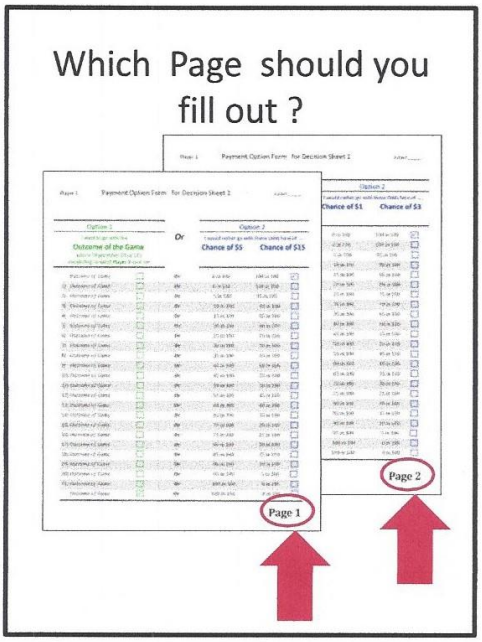


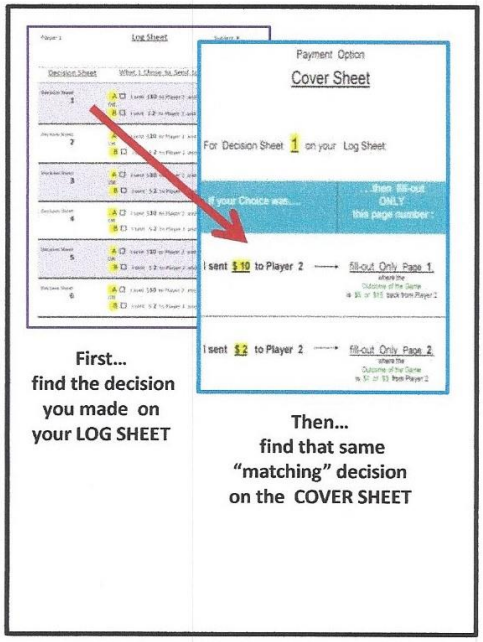

Now you can decide
how
you would like
to get paid

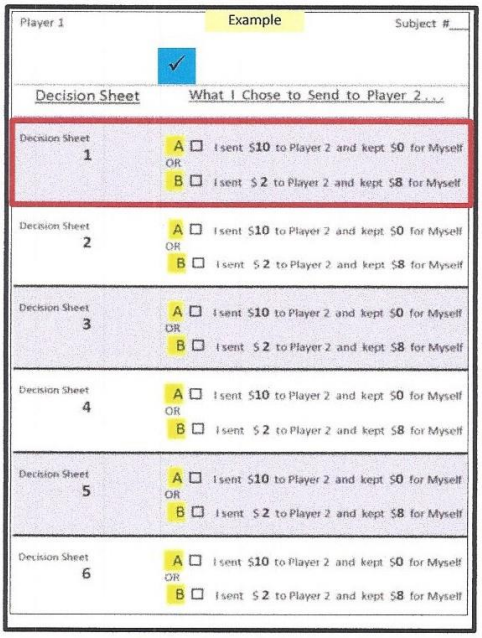

6 Decision Sheets...
. . .will have
6 matching
"Packets"

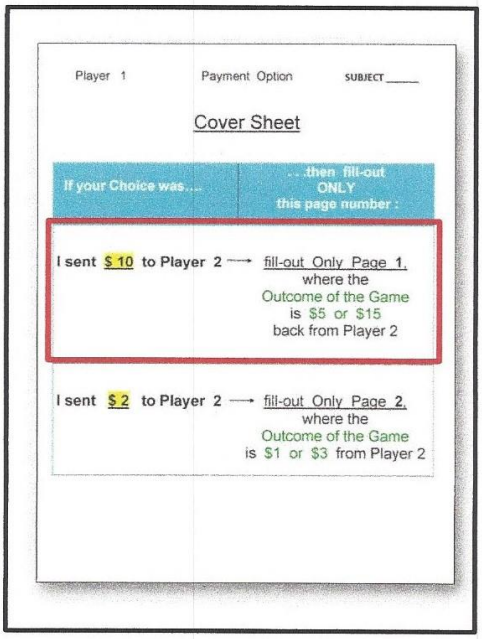


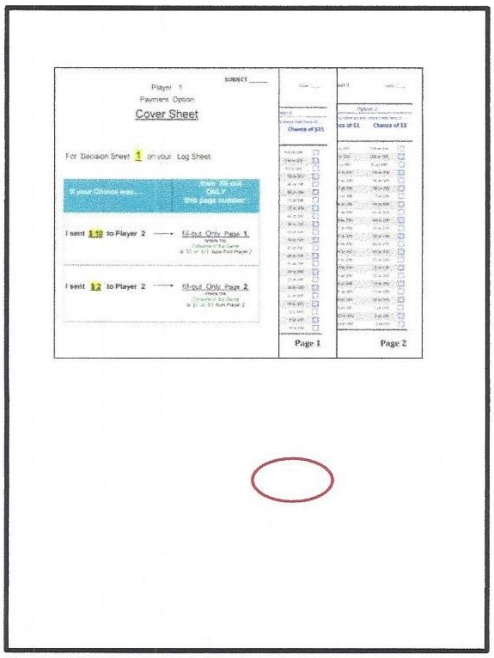

Each Packet has multiple pages
with a Cover Sheet on top
Player 1
Payment Option
Cover Sheet
SUBJECT
For Decision Sheet 1 on your Log Sheet
I sent $10 to Player 2
fill-out Only Page 1
I sent $2 to Player 2
fill-out Only Page 2
Page 1
Page 2

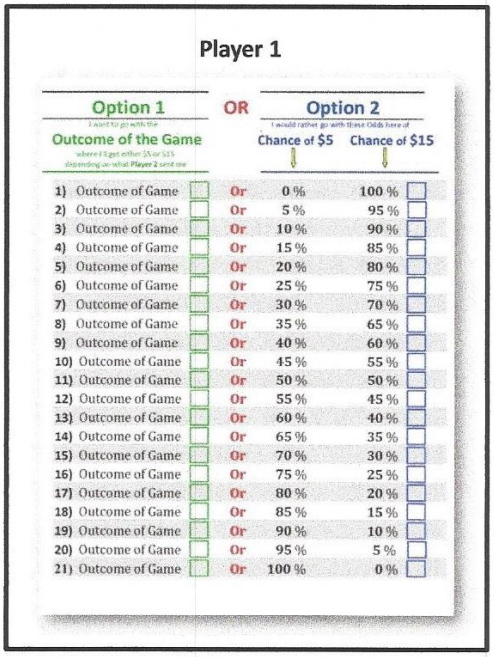

Which Page should you fill out ?
Page 2
Page 1

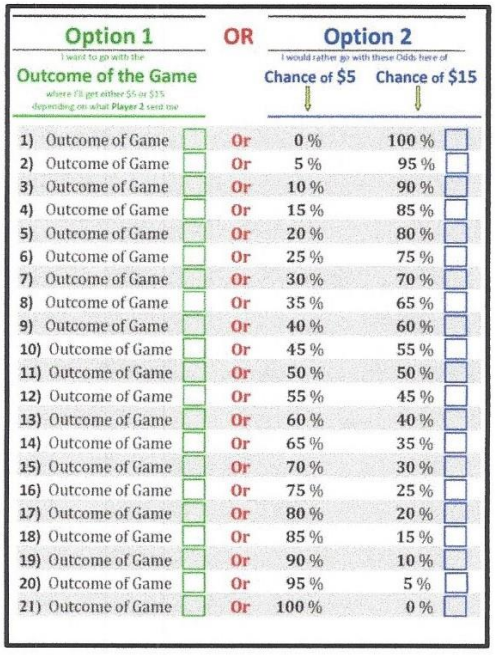

Payment Option
Cover Sheet
For Decision Sheet 1 on your Log Sheet
If your Choice was....
then fill-out ONLY this page number :
I sent $ 10 to Player 2 ⟶ fill-out Only Page 1
I sent $2 to Player 2 ⟶ fill-out Only Page 2
First... find the decision you made on your LOG SHEET
Then... find that same "matching" decision on the COVER SHEET

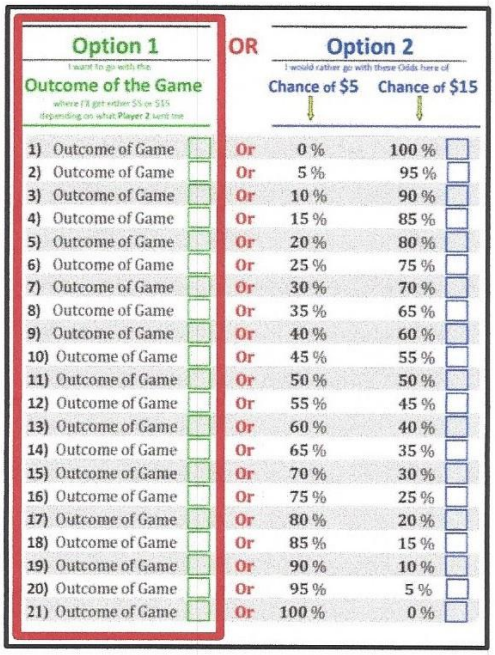

Player 1
Example
Subject #___
Decision Sheet
What I Chose to Send to Player 2 . . .
Decision Sheet 1
A I sent $10 to Player 2 and kept $0 for Myself
OR
B I sent $ 2 to Player 2 and kept $8 for Myself
Decision Sheet 2
A I sent $10 to Player 2 and kept $0 for Myself
OR
B I sent $ 2 to Player 2 and kept $8 for Myself
Decision Sheet 3
A I sent $10 to Player 2 and kept $0 for Myself
OR
B I sent $ 2 to Player 2 and kept $8 for Myself
Decision Sheet 4
A I sent $10 to Player 2 and kept $0 for Myself
OR
B I sent $ 2 to Player 2 and kept $8 for Myself
Decision Sheet 5
A I sent $10 to Player 2 and kept $0 for Myself
OR
B I sent $ 2 to Player 2 and kept $8 for Myself
Decision Sheet 6
A I sent $10 to Player 2 and kept $0 for Myself
OR
B I sent $ 2 to Player 2 and kept $8 for Myself

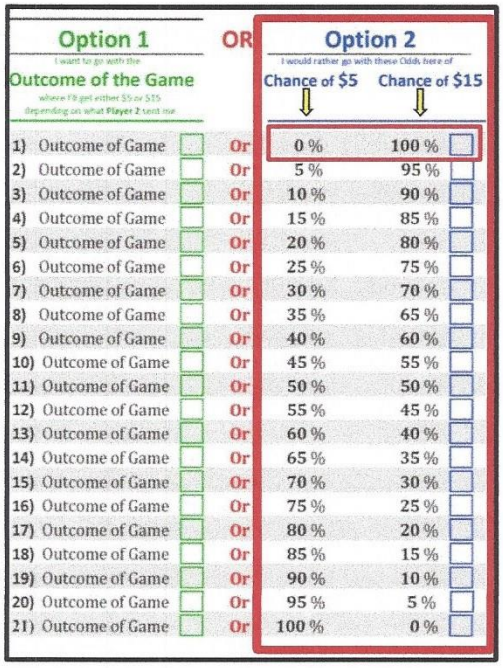

Player 1
Payment Option
SUBJECT ____
Cover Sheet
If your Choice was....
. . .then fill-out ONLY this page number :
I sent $ 10 to Player 2 ⟶ fill-out Only Page 1, where the Outcome of the Game is $5 or $15 back from Player 2
I sent $ 2 to Player 2 ⟶ fill-out Only Page 2, where the Outcome of the Game is $1 or $3 from Player 2


Player 1
Payment Option
Cover Sheet
For Decision Sheet 1 on your Log Sheet
If your Choice was...
Then fill out ONLY this page number
I sent 1:10 to Player 2
fill-out Only Page 1
I sent 1:2 to Player 2
fill-out Only Page 2
Page 1
Page 2

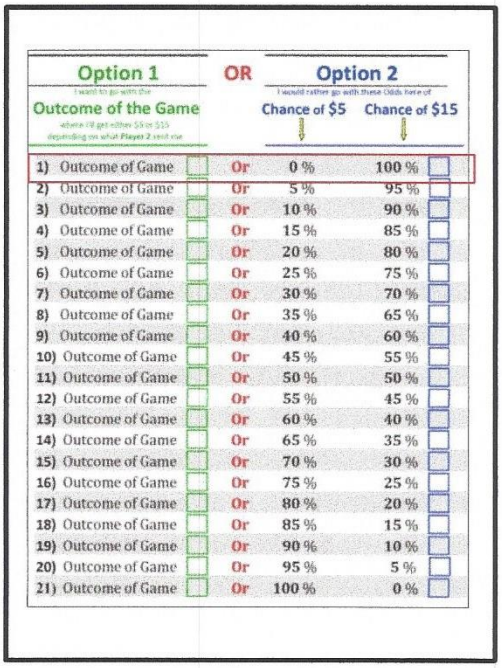

Player 1
Option 1
I want to go with the
Outcome of the Game
where I'll get either $5 or $15 depending on what Player 2 sent me
OR
Option 2
I would rather go with these Odds here of
Chance of $5
Chance of $15
1) Outcome of Game Or 0 % 100 %
2) Outcome of Game Or 5 % 95 %
3) Outcome of Game Or 10 % 90 %
4) Outcome of Game Or 15 % 85 %
5) Outcome of Game Or 20 % 80 %
6) Outcome of Game Or 25 % 75 %
7) Outcome of Game Or 30 % 70 %
8) Outcome of Game Or 35 % 65 %
9) Outcome of Game Or 40 % 60 %
10) Outcome of Game Or 45 % 55 %
11) Outcome of Game Or 50 % 50 %
12) Outcome of Game Or 55 % 45 %
13) Outcome of Game Or 60 % 40 %
14) Outcome of Game Or 65 % 35 %
15) Outcome of Game Or 70 % 30 %
16) Outcome of Game Or 75 % 25 %
17) Outcome of Game Or 80 % 20 %
18) Outcome of Game Or 85 % 15 %
19) Outcome of Game Or 90 % 10 %
20) Outcome of Game Or 95 % 5 %
21) Outcome of Game Or 100 % 0 %


Option 1
I want to go with the
Outcome of the Game
where I'll get either $5 or $15 depending on what Player 2 sent me
OR
Option 2
I would rather go with these Odds here of
Chance of $5
Chance of $15
1) Outcome of Game Or 0 % 100 %
2) Outcome of Game Or 5 % 95 %
3) Outcome of Game Or 10 % 90 %
4) Outcome of Game Or 15 % 85 %
5) Outcome of Game Or 20 % 80 %
6) Outcome of Game Or 25 % 75 %
7) Outcome of Game Or 30 % 70 %
8) Outcome of Game Or 35 % 65 %
9) Outcome of Game Or 40 % 60 %
10) Outcome of Game Or 45 % 55 %
11) Outcome of Game Or 50 % 50 %
12) Outcome of Game Or 55 % 45 %
13) Outcome of Game Or 60 % 40 %
14) Outcome of Game Or 65 % 35 %
15) Outcome of Game Or 70 % 30 %
16) Outcome of Game Or 75 % 25 %
17) Outcome of Game Or 80 % 20 %
18) Outcome of Game Or 85 % 15 %
19) Outcome of Game Or 90 % 10 %
20) Outcome of Game Or 95 % 5 %
21) Outcome of Game Or 100 % 0 %

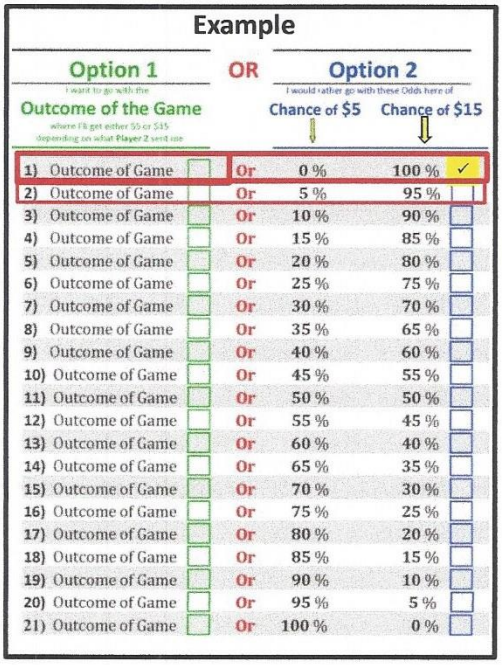

Option 1
I want to go with the
Outcome of the Game
where I'll get either $5 or $15 depending on what Player 2 sent me
OR
Option 2
I would rather go with these Odds here of
Chance of $5
Chance of $15
1) Outcome of Game Or 0 % 100 %
2) Outcome of Game Or 5 % 95 %
3) Outcome of Game Or 10 % 90 %
4) Outcome of Game Or 15 % 85 %
5) Outcome of Game Or 20 % 80 %
6) Outcome of Game Or 25 % 75 %
7) Outcome of Game Or 30 % 70 %
8) Outcome of Game Or 35 % 65 %
9) Outcome of Game Or 40 % 60 %
10) Outcome of Game Or 45 % 55 %
11) Outcome of Game Or 50 % 50 %
12) Outcome of Game Or 55 % 45 %
13) Outcome of Game Or 60 % 40 %
14) Outcome of Game Or 65 % 35 %
15) Outcome of Game Or 70 % 30 %
16) Outcome of Game Or 75 % 25 %
17) Outcome of Game Or 80 % 20 %
18) Outcome of Game Or 85 % 15 %
19) Outcome of Game Or 90 % 10 %
20) Outcome of Game Or 95 % 5 %
21) Outcome of Game Or 100 % 0 %



Option 1		OR	Option 2	
I want to go with the Outcome of the Game where I'll get either $5 or $15 depending on what Player 2 sent me			I would rather go with these Odds here of Chance of $5	Chance of $15
1) Outcome of Game		Or	0 %	100 %
2) Outcome of Game		Or	5 %	95 %
3) Outcome of Game		Or	10 %	90 %
4) Outcome of Game		Or	15 %	85 %
5) Outcome of Game		Or	20 %	80 %
6) Outcome of Game		Or	25 %	75 %
7) Outcome of Game		Or	30 %	70 %
8) Outcome of Game		Or	35 %	65 %
9) Outcome of Game		Or	40 %	60 %
10) Outcome of Game		Or	45 %	55 %
11) Outcome of Game		Or	50 %	50 %
12) Outcome of Game		Or	55 %	45 %
13) Outcome of Game		Or	60 %	40 %
14) Outcome of Game		Or	65 %	35 %
15) Outcome of Game		Or	70 %	30 %
16) Outcome of Game		Or	75 %	25 %
17) Outcome of Game		Or	80 %	20 %
18) Outcome of Game		Or	85 %	15 %
19) Outcome of Game		Or	90 %	10 %
20) Outcome of Game		Or	95 %	5 %
21) Outcome of Game		Or	100 %	0 %

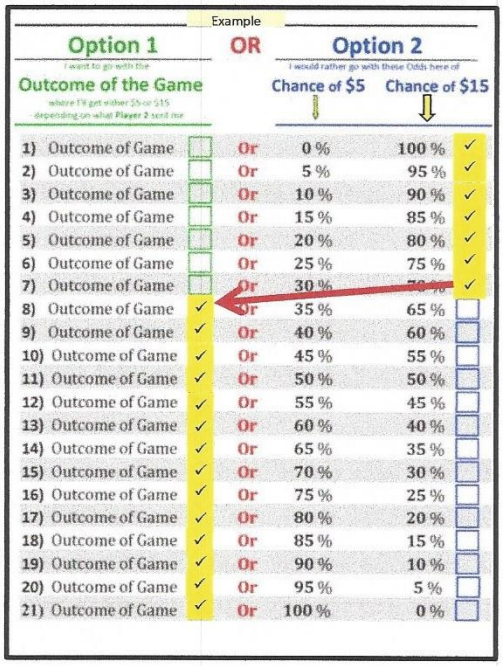


Option 1		OR	Option 2	
I want to go with the Outcome of the Game where I'll get either $5 or $15 depending on what Player 2 sent me			I would rather go with these Odds here of Chance of $5	Chance of $15
1) Outcome of Game		Or	0 %	100 %
2) Outcome of Game		Or	5 %	95 %
3) Outcome of Game		Or	10 %	90 %
4) Outcome of Game		Or	15 %	85 %
5) Outcome of Game		Or	20 %	80 %
6) Outcome of Game		Or	25 %	75 %
7) Outcome of Game		Or	30 %	70 %
8) Outcome of Game		Or	35 %	65 %
9) Outcome of Game		Or	40 %	60 %
10) Outcome of Game		Or	45 %	55 %
11) Outcome of Game		Or	50 %	50 %
12) Outcome of Game		Or	55 %	45 %
13) Outcome of Game		Or	60 %	40 %
14) Outcome of Game		Or	65 %	35 %
15) Outcome of Game		Or	70 %	30 %
16) Outcome of Game		Or	75 %	25 %
17) Outcome of Game		Or	80 %	20 %
18) Outcome of Game		Or	85 %	15 %
19) Outcome of Game		Or	90 %	10 %
20) Outcome of Game		Or	95 %	5 %
21) Outcome of Game		Or	100 %	0 %



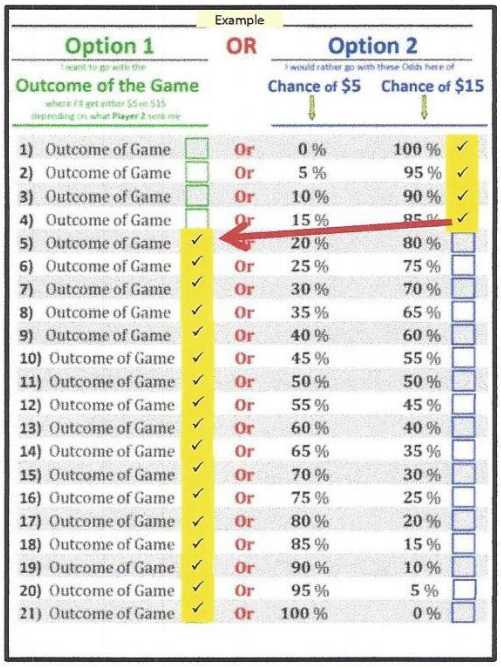
Example

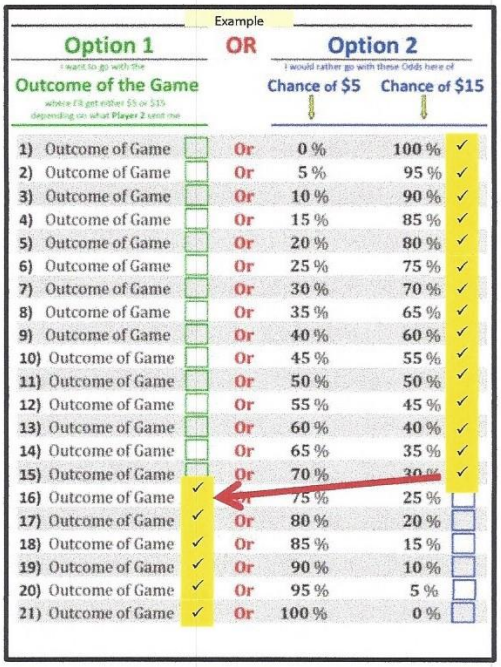
Option 1		OR	Option 2	
I want to go with the Outcome of the Game where I'll get either $5 or $15 depending on what Player 2 sent me			I would rather go with these Odds here of Chance of $5	Chance of $15
1) Outcome of Game		Or	0 %	100 % ✓
2) Outcome of Game		Or	5 %	95 %
3) Outcome of Game		Or	10 %	90 %
4) Outcome of Game		Or	15 %	85 %
5) Outcome of Game		Or	20 %	80 %
6) Outcome of Game		Or	25 %	75 %
7) Outcome of Game		Or	30 %	70 %
8) Outcome of Game		Or	35 %	65 %
9) Outcome of Game		Or	40 %	60 %
10) Outcome of Game		Or	45 %	55 %
11) Outcome of Game		Or	50 %	50 %
12) Outcome of Game		Or	55 %	45 %
13) Outcome of Game		Or	60 %	40 %
14) Outcome of Game		Or	65 %	35 %
15) Outcome of Game		Or	70 %	30 %
16) Outcome of Game		Or	75 %	25 %
17) Outcome of Game		Or	80 %	20 %
18) Outcome of Game		Or	85 %	15 %
19) Outcome of Game		Or	90 %	10 %
20) Outcome of Game		Or	95 %	5 %
21) Outcome of Game		Or	100 %	0 %



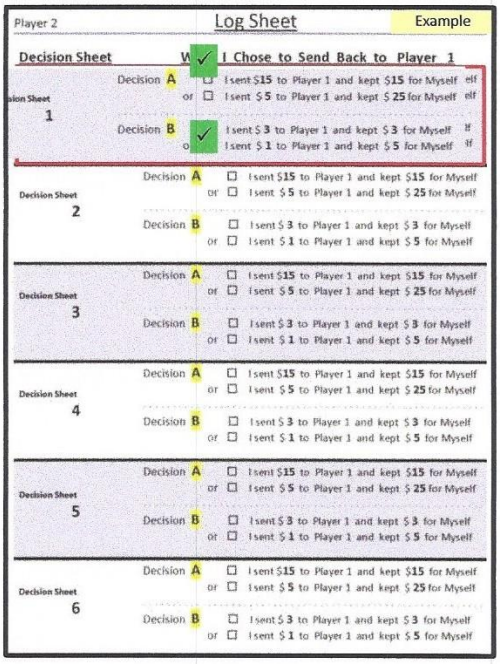
Example

Option 1		OR	Option 2	
I want to go with the Outcome of the Game where I'll get either $5 or $15 depending on what Player 2 sent me			I would rather go with these Odds here of Chance of $5	Chance of $15
1) Outcome of Game		Or	0 %	100 % ✓
2) Outcome of Game		Or	5 %	95 % ✓
3) Outcome of Game		Or	10 %	90 % ✓
4) Outcome of Game		Or	15 %	85 % ✓
5) Outcome of Game		Or	20 %	80 % ✓
6) Outcome of Game		Or	25 %	75 % ✓
7) Outcome of Game		Or	30 %	70 % ✓
8) Outcome of Game	✓	Or	35 %	65 %
9) Outcome of Game	✓	Or	40 %	60 %
10) Outcome of Game	✓	Or	45 %	55 %
11) Outcome of Game	✓	Or	50 %	50 %
12) Outcome of Game	✓	Or	55 %	45 %
13) Outcome of Game	✓	Or	60 %	40 %
14) Outcome of Game	✓	Or	65 %	35 %
15) Outcome of Game	✓	Or	70 %	30 %
16) Outcome of Game	✓	Or	75 %	25 %
17) Outcome of Game	✓	Or	80 %	20 %
18) Outcome of Game	✓	Or	85 %	15 %
19) Outcome of Game	✓	Or	90 %	10 %
20) Outcome of Game	✓	Or	95 %	5 %
21) Outcome of Game	✓	Or	100 %	0 %



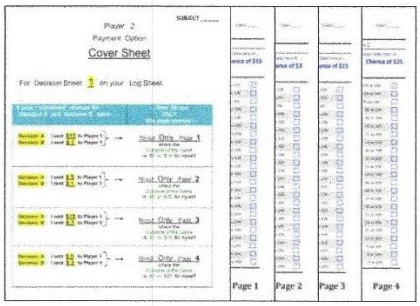


PLAYER 2
PAYMENT OPTION FORMS



Cover Sheet

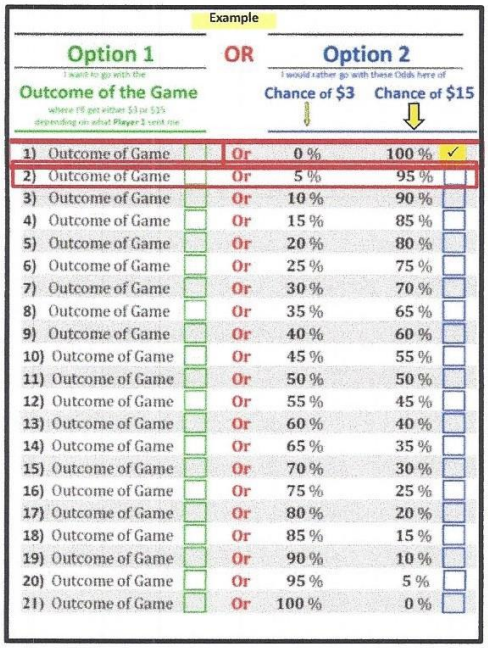
If your "combined" choices for Decision A and Decision B were . .	. . .then fill-out ONLY this page number:
Decision A : I sent $15 to Player 1 Decision B : I sent $ 1 to Player 1	fill-out Only Page 1 where the Outcome of the Game is $5 or $15 for myself
Decision A : I sent $ 5 to Player 1 Decision B : I sent $ 1 to Player 1	fill-out Only Page 2 where the Outcome of the Game is $5 or $25 for myself
Decision A : I sent $15 to Player 1 Decision B : I sent $ 3 to Player 1	fill-out Only Page 3 where the Outcome of the Game is $3 or $15 for myself
Decision A : I sent $ 5 to Player 1 Decision B : I sent $ 3 to Player 1	fill-out Only Page 4 where the Outcome of the Game is $3 or $25 for myself



Option 1 I want to go with the Outcome of the Game where I'll get either $3 or $15 depending on what Player 1 sent me	OR	Option 2 I would rather go with these Odds here of: Chance of $3	Chance of $15
1) Outcome of Game	Or	0 %	100 %
2) Outcome of Game	Or	5 %	95 %
3) Outcome of Game	Or	10 %	90 %
4) Outcome of Game	Or	15 %	85 %
5) Outcome of Game	Or	20 %	80 %
6) Outcome of Game	Or	25 %	75 %
7) Outcome of Game	Or	30 %	70 %
8) Outcome of Game	Or	35 %	65 %
9) Outcome of Game	Or	40 %	60 %
10) Outcome of Game	Or	45 %	55 %
11) Outcome of Game	Or	50 %	50 %
12) Outcome of Game	Or	55 %	45 %
13) Outcome of Game	Or	60 %	40 %
14) Outcome of Game	Or	65 %	35 %
15) Outcome of Game	Or	70 %	30 %
16) Outcome of Game	Or	75 %	25 %
17) Outcome of Game	Or	80 %	20 %
18) Outcome of Game	Or	85 %	15 %
19) Outcome of Game	Or	90 %	10 %
20) Outcome of Game	Or	95 %	5 %
21) Outcome of Game	Or	100 %	0 %

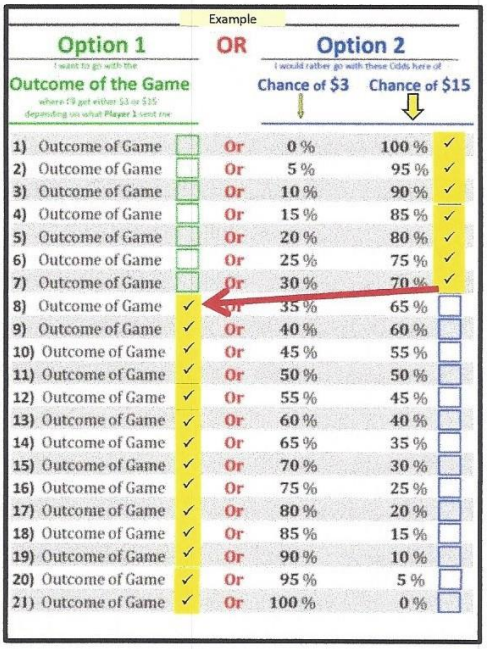
Player 2

Option 1 I want to go with the Outcome of the Game where I'll get either $3 or $15 depending on what Player 1 sent me	OR	Option 2 I would rather go with these Odds here of: Chance of $3	Chance of $15
1) Outcome of Game	Or	0 %	100 %
2) Outcome of Game	Or	5 %	95 %
3) Outcome of Game	Or	10 %	90 %
4) Outcome of Game	Or	15 %	85 %
5) Outcome of Game	Or	20 %	80 %
6) Outcome of Game	Or	25 %	75 %
7) Outcome of Game	Or	30 %	70 %
8) Outcome of Game	Or	35 %	65 %
9) Outcome of Game	Or	40 %	60 %
10) Outcome of Game	Or	45 %	55 %
11) Outcome of Game	Or	50 %	50 %
12) Outcome of Game	Or	55 %	45 %
13) Outcome of Game	Or	60 %	40 %
14) Outcome of Game	Or	65 %	35 %
15) Outcome of Game	Or	70 %	30 %
16) Outcome of Game	Or	75 %	25 %
17) Outcome of Game	Or	80 %	20 %
18) Outcome of Game	Or	85 %	15 %
19) Outcome of Game	Or	90 %	10 %
20) Outcome of Game	Or	95 %	5 %
21) Outcome of Game	Or	100 %	0 %



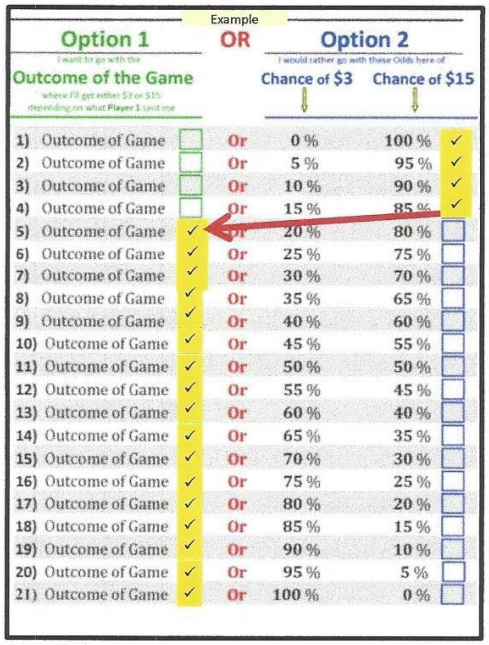
Example

Option 1 — I want to go with the Outcome of the Game (where I'll get either $3 or $15 depending on what Player 1 sent me)		OR	Option 2 — I would rather go with these Odds here of: Chance of $3	Chance of $15	
1) Outcome of Game		Or	0 %	100 %	✓
2) Outcome of Game		Or	5 %	95 %	
3) Outcome of Game		Or	10 %	90 %	
4) Outcome of Game		Or	15 %	85 %	
5) Outcome of Game		Or	20 %	80 %	
6) Outcome of Game		Or	25 %	75 %	
7) Outcome of Game		Or	30 %	70 %	
8) Outcome of Game		Or	35 %	65 %	
9) Outcome of Game		Or	40 %	60 %	
10) Outcome of Game		Or	45 %	55 %	
11) Outcome of Game		Or	50 %	50 %	
12) Outcome of Game		Or	55 %	45 %	
13) Outcome of Game		Or	60 %	40 %	
14) Outcome of Game		Or	65 %	35 %	
15) Outcome of Game		Or	70 %	30 %	
16) Outcome of Game		Or	75 %	25 %	
17) Outcome of Game		Or	80 %	20 %	
18) Outcome of Game		Or	85 %	15 %	
19) Outcome of Game		Or	90 %	10 %	
20) Outcome of Game		Or	95 %	5 %	
21) Outcome of Game		Or	100 %	0 %	



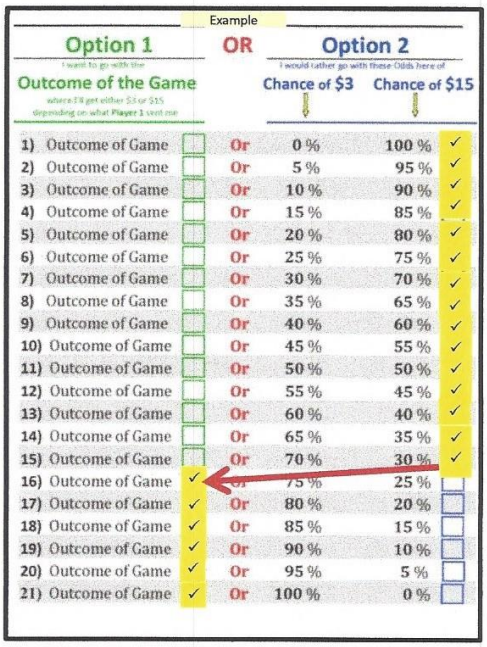
Example

Option 1 — I want to go with the Outcome of the Game (where I'll get either $3 or $15 depending on what Player 1 sent me)		OR	Option 2 — I would rather go with these Odds here of: Chance of $3	Chance of $15	
1) Outcome of Game		Or	0 %	100 %	✓
2) Outcome of Game		Or	5 %	95 %	✓
3) Outcome of Game		Or	10 %	90 %	✓
4) Outcome of Game		Or	15 %	85 %	✓
5) Outcome of Game		Or	20 %	80 %	✓
6) Outcome of Game		Or	25 %	75 %	✓
7) Outcome of Game		Or	30 %	70 %	✓
8) Outcome of Game	✓	Or	35 %	65 %	
9) Outcome of Game	✓	Or	40 %	60 %	
10) Outcome of Game	✓	Or	45 %	55 %	
11) Outcome of Game	✓	Or	50 %	50 %	
12) Outcome of Game	✓	Or	55 %	45 %	
13) Outcome of Game	✓	Or	60 %	40 %	
14) Outcome of Game	✓	Or	65 %	35 %	
15) Outcome of Game	✓	Or	70 %	30 %	
16) Outcome of Game	✓	Or	75 %	25 %	
17) Outcome of Game	✓	Or	80 %	20 %	
18) Outcome of Game	✓	Or	85 %	15 %	
19) Outcome of Game	✓	Or	90 %	10 %	
20) Outcome of Game	✓	Or	95 %	5 %	
21) Outcome of Game	✓	Or	100 %	0 %	



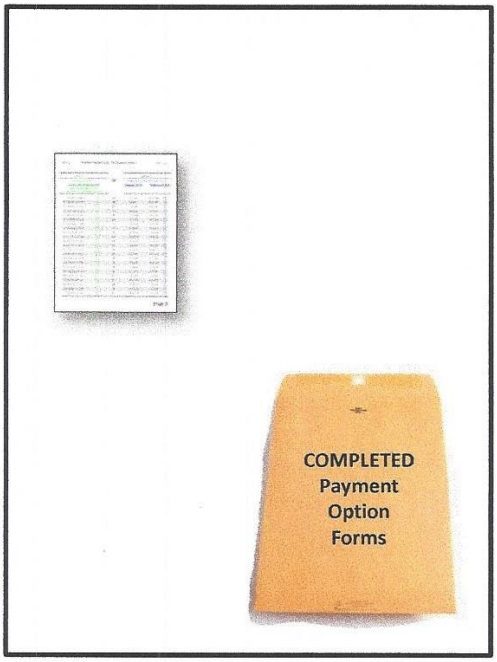
Example

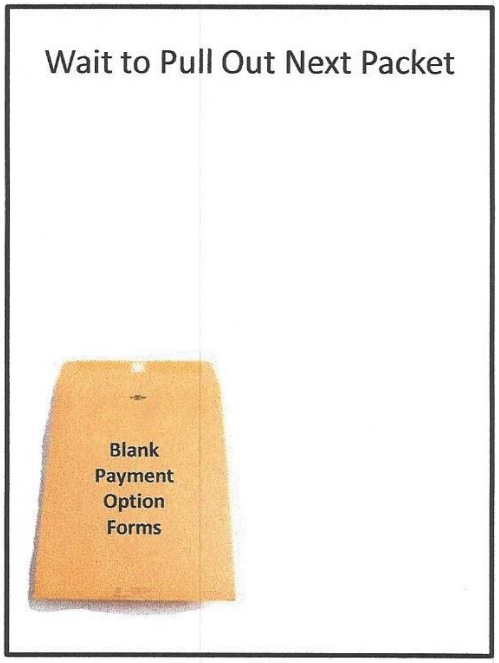
Option 1 — I want to go with the Outcome of the Game (where I'll get either $3 or $15 depending on what Player 1 sent me)		OR	Option 2 — I would rather go with these Odds here of: Chance of $3	Chance of $15	
1) Outcome of Game		Or	0 %	100 %	✓
2) Outcome of Game		Or	5 %	95 %	✓
3) Outcome of Game		Or	10 %	90 %	✓
4) Outcome of Game		Or	15 %	85 %	✓
5) Outcome of Game	✓	Or	20 %	80 %	
6) Outcome of Game	✓	Or	25 %	75 %	
7) Outcome of Game	✓	Or	30 %	70 %	
8) Outcome of Game	✓	Or	35 %	65 %	
9) Outcome of Game	✓	Or	40 %	60 %	
10) Outcome of Game	✓	Or	45 %	55 %	
11) Outcome of Game	✓	Or	50 %	50 %	
12) Outcome of Game	✓	Or	55 %	45 %	
13) Outcome of Game	✓	Or	60 %	40 %	
14) Outcome of Game	✓	Or	65 %	35 %	
15) Outcome of Game	✓	Or	70 %	30 %	
16) Outcome of Game	✓	Or	75 %	25 %	
17) Outcome of Game	✓	Or	80 %	20 %	
18) Outcome of Game	✓	Or	85 %	15 %	
19) Outcome of Game	✓	Or	90 %	10 %	
20) Outcome of Game	✓	Or	95 %	5 %	
21) Outcome of Game	✓	Or	100 %	0 %	



Example

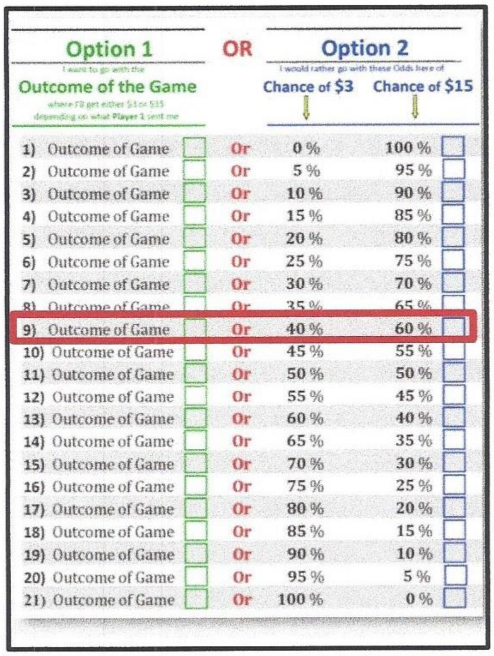
Option 1 — I want to go with the Outcome of the Game (where I'll get either $3 or $15 depending on what Player 1 sent me)		OR	Option 2 — I would rather go with these Odds here of: Chance of $3	Chance of $15	
1) Outcome of Game		Or	0 %	100 %	✓
2) Outcome of Game		Or	5 %	95 %	✓
3) Outcome of Game		Or	10 %	90 %	✓
4) Outcome of Game		Or	15 %	85 %	✓
5) Outcome of Game		Or	20 %	80 %	✓
6) Outcome of Game		Or	25 %	75 %	✓
7) Outcome of Game		Or	30 %	70 %	✓
8) Outcome of Game		Or	35 %	65 %	✓
9) Outcome of Game		Or	40 %	60 %	✓
10) Outcome of Game		Or	45 %	55 %	✓
11) Outcome of Game		Or	50 %	50 %	✓
12) Outcome of Game		Or	55 %	45 %	✓
13) Outcome of Game		Or	60 %	40 %	✓
14) Outcome of Game		Or	65 %	35 %	✓
15) Outcome of Game		Or	70 %	30 %	✓
16) Outcome of Game	✓	Or	75 %	25 %	
17) Outcome of Game	✓	Or	80 %	20 %	
18) Outcome of Game	✓	Or	85 %	15 %	
19) Outcome of Game	✓	Or	90 %	10 %	
20) Outcome of Game	✓	Or	95 %	5 %	
21) Outcome of Game	✓	Or	100 %	0 %	



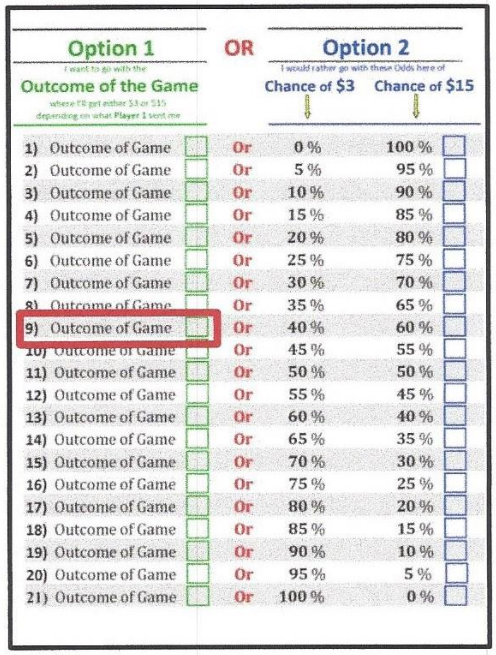


Which
Decisions
will determine
your final payment?

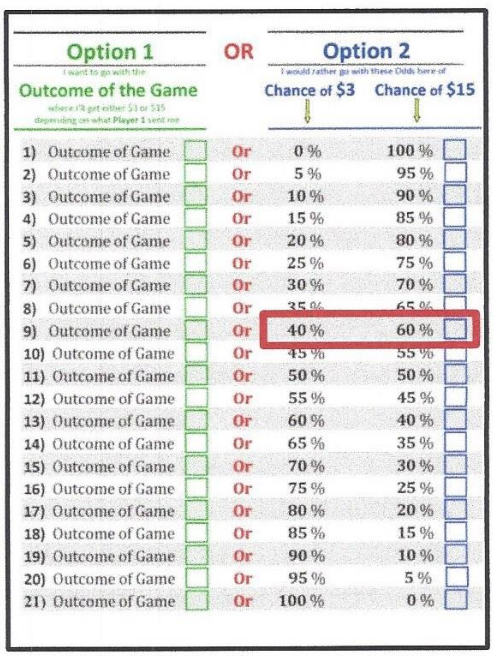
Option 1 (I want to go with the Outcome of the Game where I'll get either $3 or $15 depending on what Player 1 sent me)		OR	Option 2 (I would rather go with these Odds here of) Chance of $3	Chance of $15	
1) Outcome of Game	☐	Or	0 %	100 %	☐
2) Outcome of Game	☐	Or	5 %	95 %	☐
3) Outcome of Game	☐	Or	10 %	90 %	☐
4) Outcome of Game	☐	Or	15 %	85 %	☐
5) Outcome of Game	☐	Or	20 %	80 %	☐
6) Outcome of Game	☐	Or	25 %	75 %	☐
7) Outcome of Game	☐	Or	30 %	70 %	☐
8) Outcome of Game	☐	Or	35 %	65 %	☐
9) Outcome of Game	☐	Or	40 %	60 %	☐
10) Outcome of Game	☐	Or	45 %	55 %	☐
11) Outcome of Game	☐	Or	50 %	50 %	☐
12) Outcome of Game	☐	Or	55 %	45 %	☐
13) Outcome of Game	☐	Or	60 %	40 %	☐
14) Outcome of Game	☐	Or	65 %	35 %	☐
15) Outcome of Game	☐	Or	70 %	30 %	☐
16) Outcome of Game	☐	Or	75 %	25 %	☐
17) Outcome of Game	☐	Or	80 %	20 %	☐
18) Outcome of Game	☐	Or	85 %	15 %	☐
19) Outcome of Game	☐	Or	90 %	10 %	☐
20) Outcome of Game	☐	Or	95 %	5 %	☐
21) Outcome of Game	☐	Or	100 %	0 %	☐



Option 1 I want to go with the Outcome of the Game where I'll get either $3 or $15 depending on what Player 1 sent me	OR	Option 2 I would rather go with these Odds here of Chance of $3	Chance of $15
1) Outcome of Game	Or	0 %	100 %
2) Outcome of Game	Or	5 %	95 %
3) Outcome of Game	Or	10 %	90 %
4) Outcome of Game	Or	15 %	85 %
5) Outcome of Game	Or	20 %	80 %
6) Outcome of Game	Or	25 %	75 %
7) Outcome of Game	Or	30 %	70 %
8) Outcome of Game	Or	35 %	65 %
9) Outcome of Game	Or	40 %	60 %
10) Outcome of Game	Or	45 %	55 %
11) Outcome of Game	Or	50 %	50 %
12) Outcome of Game	Or	55 %	45 %
13) Outcome of Game	Or	60 %	40 %
14) Outcome of Game	Or	65 %	35 %
15) Outcome of Game	Or	70 %	30 %
16) Outcome of Game	Or	75 %	25 %
17) Outcome of Game	Or	80 %	20 %
18) Outcome of Game	Or	85 %	15 %
19) Outcome of Game	Or	90 %	10 %
20) Outcome of Game	Or	95 %	5 %
21) Outcome of Game	Or	100 %	0 %



Option 1 I want to go with the Outcome of the Game where I'll get either $3 or $15 depending on what Player 1 sent me	OR	Option 2 I would rather go with these Odds here of Chance of $3	Chance of $15
1) Outcome of Game	Or	0 %	100 %
2) Outcome of Game	Or	5 %	95 %
3) Outcome of Game	Or	10 %	90 %
4) Outcome of Game	Or	15 %	85 %
5) Outcome of Game	Or	20 %	80 %
6) Outcome of Game	Or	25 %	75 %
7) Outcome of Game	Or	30 %	70 %
8) Outcome of Game	Or	35 %	65 %
9) Outcome of Game	Or	40 %	60 %
10) Outcome of Game	Or	45 %	55 %
11) Outcome of Game	Or	50 %	50 %
12) Outcome of Game	Or	55 %	45 %
13) Outcome of Game	Or	60 %	40 %
14) Outcome of Game	Or	65 %	35 %
15) Outcome of Game	Or	70 %	30 %
16) Outcome of Game	Or	75 %	25 %
17) Outcome of Game	Or	80 %	20 %
18) Outcome of Game	Or	85 %	15 %
19) Outcome of Game	Or	90 %	10 %
20) Outcome of Game	Or	95 %	5 %
21) Outcome of Game	Or	100 %	0 %



Option 1 I want to go with the Outcome of the Game where I'll get either $3 or $15 depending on what Player 1 sent me	OR	Option 2 I would rather go with these Odds here of Chance of $3	Chance of $15
1) Outcome of Game	Or	0 %	100 %
2) Outcome of Game	Or	5 %	95 %
3) Outcome of Game	Or	10 %	90 %
4) Outcome of Game	Or	15 %	85 %
5) Outcome of Game	Or	20 %	80 %
6) Outcome of Game	Or	25 %	75 %
7) Outcome of Game	Or	30 %	70 %
8) Outcome of Game	Or	35 %	65 %
9) Outcome of Game	Or	40 %	60 %
10) Outcome of Game	Or	45 %	55 %
11) Outcome of Game	Or	50 %	50 %
12) Outcome of Game	Or	55 %	45 %
13) Outcome of Game	Or	60 %	40 %
14) Outcome of Game	Or	65 %	35 %
15) Outcome of Game	Or	70 %	30 %
16) Outcome of Game	Or	75 %	25 %
17) Outcome of Game	Or	80 %	20 %
18) Outcome of Game	Or	85 %	15 %
19) Outcome of Game	Or	90 %	10 %
20) Outcome of Game	Or	95 %	5 %
21) Outcome of Game	Or	100 %	0 %

Remember…

In addition to the money you earn in the study, we will add an

Extra $ 7

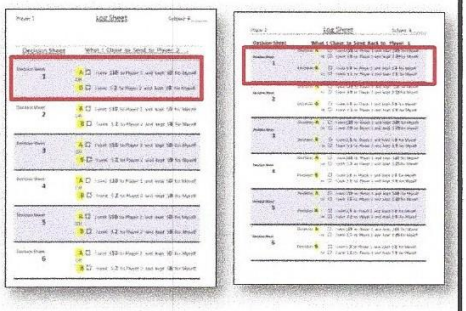
to increase the amount of money you take home

Let's Begin

Look at your Log Sheets to find the choices you made for

Decision Sheet 1

Player 1 **Player 2**

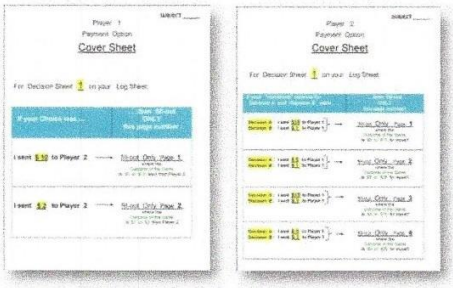


Pull Out Payment Option Packet for

Decision Sheet 1

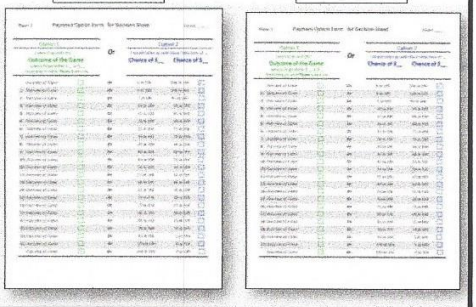
- **On your cover sheet, find the same choices that match your Log Sheet**
- **Turn to the ONE Page that the Cover Sheet tells you to fill out**

Player 1 Player 2



- **Now that you have found the correct page, fill that one page out by starting with Row 1**
- **For each Row, compare the two Options. Check the box you want next to either Option 1 or Option 2.**
- **After you've made your choice for Row 1, move down to Row 2.**
- **Repeat until you have made a choice for each one of the 21 rows.**

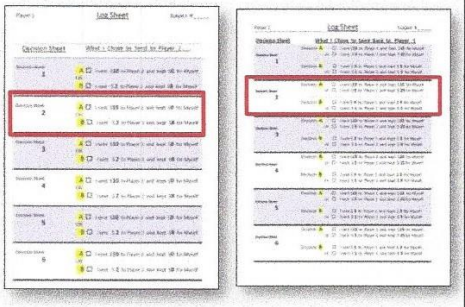
Player 1 **Player 2**



Look at your Log Sheets to find the choices you made for

Decision Sheet 2

Player 1 **Player 2**

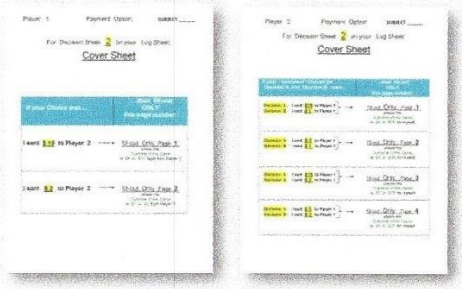


Pull Out Payment Option Packet for

Decision Sheet 2

- **On your cover sheet, find the same choices that match your Log Sheet**
- **Turn to the ONE Page that the Cover Sheet tells you to fill out**

Player 1 **Player 2**



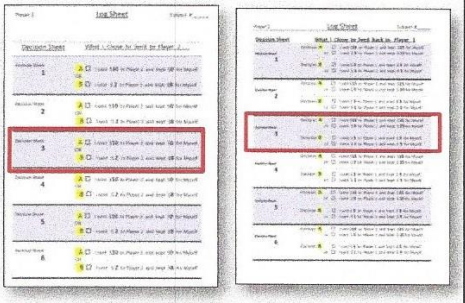
- **Now that you have found the correct page, fill that one page out by starting with Row 1**
- **For each Row, compare the two Options. Check the box you want next to either Option 1 or Option 2.**
- **After you've made your choice for Row 1, move down to Row 2.**
- **Repeat until you have made a choice for each one of the 21 rows.**

Player 1 **Player 2**

Look at your Log Sheets to find the choices you made for

Decision Sheet 3

Player 1 **Player 2**

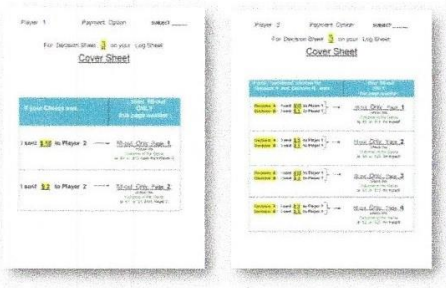


Pull Out Payment Option Packet for

Decision Sheet 3

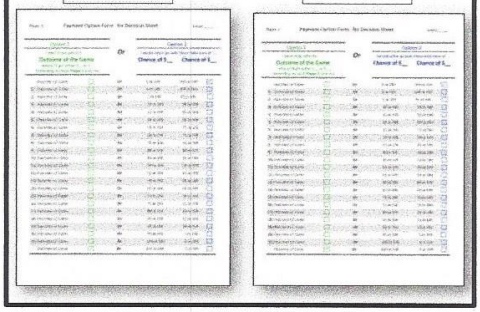
- On your cover sheet, find the same choices that match your Log Sheet
- Turn to the ONE Page that the Cover Sheet tells you to fill out

Player 1 Player 2



- Now that you have found the correct page, fill that one page out by starting with Row 1
- For each Row, compare the two Options. Check the box you want next to either Option 1 or Option 2.
- After you've made your choice for Row 1, move down to Row 2.
- Repeat until you have made a choice for each one of the 21 rows.

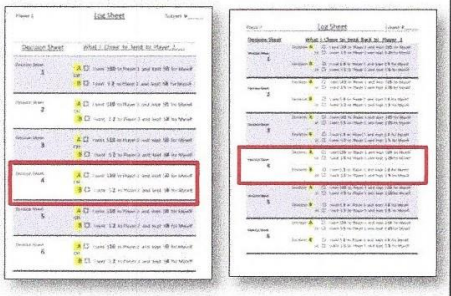
Player 1 **Player 2**



Look at your Log Sheets to find the choices you made for

Decision Sheet 4

Player 1 **Player 2**

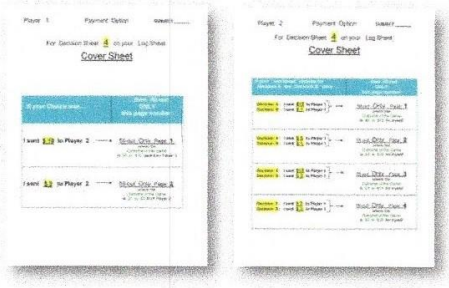


Pull Out Payment Option Packet for

Decision Sheet 4

- On your cover sheet, find the same choices that match your Log Sheet
- Turn to the ONE Page that the Cover Sheet tells you to fill out

Player 1 Player 2



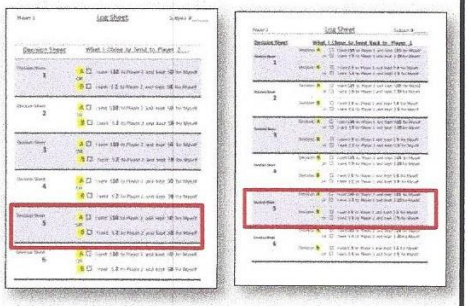
- Now that you have found the correct page, fill that one page out by starting with Row 1
- For each Row, compare the two Options. Check the box you want next to either Option 1 or Option 2.
- After you've made your choice for Row 1, move down to Row 2.
- Repeat until you have made a choice for each one of the 21 rows.

Player 1 **Player 2**

Look at your Log Sheets to find the choices you made for

Decision Sheet 5

Player 1 **Player 2**

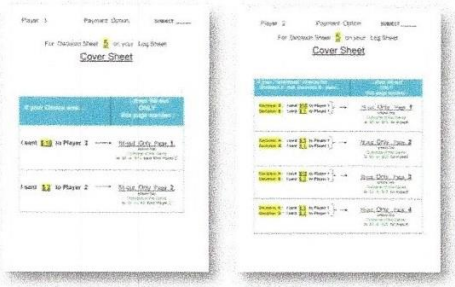


Pull Out Payment Option Packet for

Decision Sheet 5

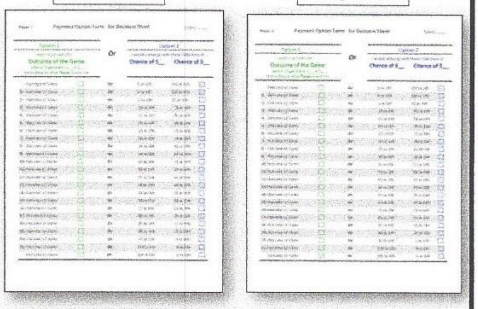
- On your cover sheet, find the same choices that match your Log Sheet
- Turn to the ONE Page that the Cover Sheet tells you to fill out

Player 1 Player 2



- Now that you have found the correct page, fill that one page out by starting with Row 1
- For each Row, compare the two Options. Check the box you want next to either Option 1 or Option 2.
- After you've made your choice for Row 1, move down to Row 2.
- Repeat until you have made a choice for each one of the 21 rows.

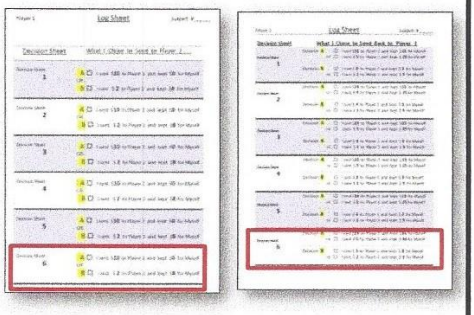
Player 1 **Player 2**



Look at your Log Sheets to find the choices you made for

Decision Sheet 6

Player 1 **Player 2**

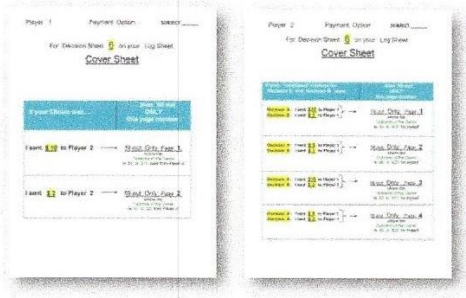


Pull Out Payment Option Packet for

Decision Sheet 6

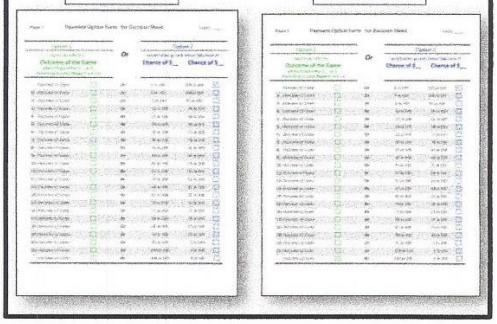
- **On your cover sheet, find the same choices that match your Log Sheet**
- **Turn to the ONE Page that the Cover Sheet tells you to fill out**

Player 1 Player 2



- **Now that you have found the correct page, fill that one page out by starting with Row 1**
- **For each Row, compare the two Options. Check the box you want next to either Option 1 or Option 2.**
- **After you've made your choice for Row 1, move down to Row 2.**
- **Repeat until you have made a choice for each one of the 21 rows.**

Player 1 **Player 2**



Now it's time to Roll the Dice

Chapter 2

The Role of Self-Image and Social Image in Deception and Charitable Giving Avoidance

2.1 Introduction

Americans donated over $350 billion dollars to charity in 2014. However, a recent survey[13] reveals that the donor retention rate from 2013 was only 43%. This means that only 43% of those who gave to charity in 2013 continued to give to non-profits in 2014. Additionally, only 47% of dollars raised in 2013 were raised again in 2014. Explanations offered for this pattern include the proposal that giving by new donors often occurs only once. New donors can be motivated by any one of the motives established by the broad economic literature: the warm-glow they experience from helping others (Andreoni, 1989, 1990), fear of punishment from not returning kindness (Fehr and Gacther, 1999), the reward they receive from peer approval (Ariely, et. al, 2012), and the social pressure they feel from not giving (DellaVigna, et. al, 2012). However, it would appear that once the effect of these motivations diminishes, many donors decline to continue giving. It has been estimated that for every $100 gained in new gifts, $95 was lost through gift attrition[14]. In this paper we offer a new mechanism that may explain attrition rates in giving. While many studies have demonstrated the connection between image motivation and prosocial behavior, relatively few studies have explored the possibility that image concerns can result in anti-social behavior in addition to prosocial behavior. We explore the possibility that an individual's desire to gain social approval or maintain a positive self-image can accidentally incentivize individuals to engage in deception in order to maintain a positive image.

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[13] 2015 Fundraising Effectiveness Survey
http://www.afpnet.org/files/ContentDocuments/FEP2015FinalReport.pdf
[14] https://bloomerang.co/blog/infographic-2015-fundraising-effectiveness-project-survey-report/

The desire to acquire others' approval implies that people will behave more prosocially in settings where their decisions are made public than in settings where only they are aware of their own decision. A number of studies have confirmed this in both laboratory and field experiments (Andreoni and Peatrie, 2004; Dana et. al, 2006; Rege and Telle, 2004). Being charitable is often seen as a "good" trait and being selfish is often portrayed as being "bad". Therefore, individuals wanting to gain social approval and/or maintain their self-image will want to signal that they are charitable. We posit that social image has at least two components that incentive someone to behave prosocially. The first component is the utility received from acquiring peer approval. This utility reward is acquired through compliance with group norms and being viewed as "good" by the group. By contrast, the second component is the suite of consequences received from non-compliance with prosocial norms. Individuals may experience shame and embarrassment, or, in some cases receive material punishment from failure to behave prosocially. Anticipated peer reward and peer punishment can promote prosocial behavior. Ellinginsen and Johanesson (2008) conduct a dictator game and find that Dictator behavior is affected by verbal feedback from recipients. Donations to recipients increased by 20% when recipients could directly communicate with dictators. Recipients praised dictators who proposed equal splits, but verbally chastised dictators who made zero donations. This pattern is exhibited in many real world situations. For example, consumers have complained that many professional face-to-face fundraising canvassers employ both public punishment and reward components when soliciting donations. For example, canvassers from a well-known charity often

ask shoppers outside grocery stores and malls "You want to save starving children, don't you?" If the consumer passes by without signing up to contribute monthly to the charity, the canvassers scowl or mock them. If the consumer signs up to contribute, the canvasser claps and loudly congratulates the consumer on being "good" and charitable human being[15].

However, it is not necessary to be charitable if all one desires is to *signal* (to others or one's self) that they are charitable. Image motivation produces a desire for one to *appear* charitable. We propose that this appearance can be accomplished in one of two ways by either contributing to charity or by lying and saying they have contributed when they have not. Further, maintaining social approval need not always involve donating to charity. Refusing to donate to "bad" charities is not perceived as being "uncharitable". We propose that one can maintain their social and self-image if they portray the charity as undeserving of donations. Gneezy, et. al (2014) find that consumers are sensitive to the type of charities to which they give. Donors exhibit a strong preference for charities with low overhead costs with a high portion of donations going directly toward program activities. Charity evaluators, such as Charity Navigator and ChartiyWatch, provide potential donors with ratings of charities performance on a variety of dimensions: transparency, fundraising techniques, percent of donations applied directly to program activities, etc. The purpose of these ratings is to help donors avoid "bad" charities and scams. However, it has also been documented that these ratings are sometimes used as an excuse *not* to give. Studies exploring the use of

[15] A quick search on Yelp reveals stories of shoppers' complaints about being harassed and publically shamed for not contributing, whereas those who do contribute are positively reinforced for contributing.

excuses in charitable giving have shown that individuals seek out excuses in order to avoid charitable giving. Exley (2015) finds that subjects purposefully overweight their dislike of charities' low ratings as an excuse not to donate. Exley (2014) finds evidence of the existence of excuse-driven types of individuals who use risk as an excuse to avoid giving. Andreoni and Sanchez (2014) finds that selfish subjects intentionally misstate their beliefs about others' contributions in order to justify their selfish behavior.

We expand on the excuses literature by demonstrating that image concerns drive excuses and deception. We separate the effects of social image from the effects of self-image on this behavior through an experiment designed to measure of the effects of each in a situation in which an individual prefers to act selfishly, but will face a perceived image cost in doing so. Subjects play a modified Dictator game in which dictators are faced with a choice of contributing to a charity or keeping their endowment for themselves. We explore the hypothesis that image concerns may not always result in cooperative behavior, but rather act as an impetus to hide selfish behavior. Key to our investigation is whether individuals will engage in deceptive behavior to provide themselves an excuse for their selfish behavior. However, it remains an open question as to how much of deception and excuse-driven behavior is motivated by social image and how much is motivated by self-image? Although Andreoni and Sanchez (2014) established that selfish subjects manipulate others' perceptions, the experiment design did not explicitly test for the separate effects of social image and self-image. In order to address this, we have designed a new experiment with two conditions where we directly

test the effect of image manipulation on social image. In the first condition subjects play the dictator game with only a self-image factor present and no social-image component. In the second condition subjects are asked to publically announce their donation decisions to the rest of the subjects in the room.

When people anticipate that they are expected to donate, they donate (Dufwenberg, 2006). However, our results suggest that this expectation may produce prosocial behavior, but may not change people's attitudes toward prosocial behavior. Instead, these individuals may give because they are yielding to the pressure that a damaged image brings. This is an important distinction, both for welfare concerns and also for the potential policy implications. A person who gives because they are truly motivated by social preferences such as altruism or warm-glow may continue prosocial acts well beyond the initial donation, whereas those who have given due to social expectation may find alternative means of satisfying that expectation. Akerlof and Kranton (2005) suggest that individuals experience a utility loss from giving under social pressure. This may account for donor and gift attrition.

2.2 Related Literature on Deception

This paper falls into the experimental literature studying deception. Of these studies of deception, many focus on cheap-talk and bluffing or signaling to others. Many existing studies of deception and deceit have established that individuals use lies as a tool to achieve personal gain. For example, Gneezy (2005) conducted a Cheap-Talk Sender-Receiver game in which senders willingly lied to receivers to increase the sender's payoff at the receiver's expense. Importantly, Gneezy established that people

are sensitive to the consequences of their lies. When there is a large gain to be had, individuals will intentionally deceive their counterparts. Conversely, when there is relatively little gain to be had, but their counterpart will suffer greatly, individuals refrain from lying and revert to truth-telling. Mazar, et. al (2008) found that subjects are willing to lie to the experimenter in order to increase their payoff. In their experiment subjects were asked to complete a 50-question test and were paid according to the number of correct answers. In one condition the experimenter corrected the subjects' test sheets, whereas in other conditions subjects graded their own test sheets. Conditions varied by how easily experimenters could detect fraud. The authors find that, on average, subjects self-report about 10% more questions solved correctly when they had the possibility to cheat. Interestingly, subjects lie "just enough" in the hopes of evading detection. That is, none of the subjects in any of the treatments self-reported that they solved all of the questions correctly. This suggests that individuals are sensitive to getting caught defrauding others. Fishcbacher and Heusi (2008) investigate the distribution of lying among a subject population. They estimate that at most, 22% of their sample population engaged in direct deception. The authors concluded that subjects' concern for their self-concept (self-image) leads them to "disguise" their lies in an attempt to not appear "too greedy".

A majority of the previous studies on lies and deception focus on the attempt to increase monetary payoff. The focus of our paper is the use of deception as a means to increase image utility. That is, the willingness to deceive others to gain utility

associated with the maintenance of social or self-image utility without direct monetary payoff.

2.3 Experiment Design and Hypotheses

The ability to track subject's deception is a new and defining feature of this study and distinguishes it from other studies of deception. Previous studies conducted by psychologists attempting to study deception have themselves deceived their own subjects in order to track subject data. However, no other study within the economics literature has been able to track subjects' decisions because of the strict standards against deceiving experimental subjects. We have devised a method of recording the actual charity assignments of each individual subject without deceiving our subjects.

We conduct a modified Dictator game where the subjects are asked to allocate $10 between themselves and an assigned charity. There were two possible charities to which subjects could be randomly assigned: the American Red Cross (ARC) and the National Police Defense Foundation (NPDF). Subjects were provided with information about each charity before they were informed of their assignment and before they made their allocation decisions. Subjects heard a brief description of both charities, who the charities help and were shown each charity's website. Figure 2.1 shows screenshots of both charities' homepages and what subjects viewed. Additionally, subjects were shown the ratings assigned to both charities by Charity Navigator as well as the percentage of donations spent on charity's main programs and overhead. Table 2.1 shows each charity's ratings and the percentages spent on program activities and overhead at the time the experiment took place. We assigned charities based on

subjects' "Private Numbers" (PNs). PNs were determined by a subject's roll of a die. Assigning PNs to charities occurred after the instructions were completed and before allocation decisions were made by subjects.

Figure 2.1: Charities

Left: American Red Cross website. Right: National Police Defense Foundation

Table 2.1: Description of Charities

Charity Navigator Information:	**American Red Cross (ARC)**	**National Police Defense Foundation (NPDF)**
Rating (out of 4 stars)	3 stars	0 stars
% Spent on Programs	90 %	18 %
% Spent on Fundraising & Admin Costs	10 %	82 %

Subjects were then provided with three envelopes, two of which contained $5 each. The third envelope was empty. There was no indication or markings on the outside of the envelope that indicated whether the envelope contained cash. The only way to determine if the envelope contained cash was to look inside. Each envelope was preprinted with three options: Keep for Myself, American Red Cross, or National Police Defense Foundation. Figure 2.2 shows a mock up what was printed on the envelopes.

Subjects were instructed that they could keep any two of the envelopes for themselves, by marking two envelopes “Keep for Myself”, and assign one of the envelopes to their assigned charity by marking the name of their assigned charity.

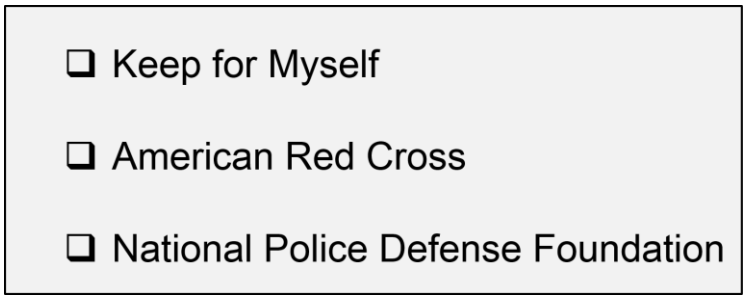


Figure 2.2: Mock-up of Envelopes

Note: Subjects checked the box next to the entity to which they wished to assign the contents of that envelope.

2.3.1 Charity Assignment

A critical feature of the experiment design is the ability to track each subject’s assigned charity without their knowledge *and* without deceiving them. In order to accomplish this we implemented the following procedure. Each subject was asked to roll a die in view of the experimenter, but not within view of the other subjects in the room, to obtain what we identified as the subject’s “Private Number” (PN). The experimenter wrote the resulting “private number” on a slip of paper so that the subject could retain the number for later in the experiment. Underneath each slip of paper was a carbon sheet. This carbon sheet allowed the experimenter to quietly retain a copy of the subject’s ID and the subject’s “private number”. Subjects were told that no other subject

in the room would ever find out the value of their private number[16]. Retaining a copy allowed us to keep track of subjects' true assigned charities. Previous studies of deception have not been able to track assignments without deceiving the subjects themselves. We believe we are the first to come close to being able to track assignments without deceiving subjects. Subjects were informed that their names would never be collected or connected with their response data. However, no promises or presumptions of anonymity beyond this were ever made.

2.3.2 Testing for Self-Image vs. Social Image

While we cannot fully separate the influence of social-image on self-image[17], we can attempt to isolate self- from social image by having two distinct treatments which differ based on the degree of social visibility the subjects experience. The level of self-image should be the same *Control* and *Treatment* groups. What differs between treatments is the level of social image associated with having to announce one's decision and assigned charity:

2.3.2.1 Control Group

The Control group ("Self-Image Only") played the Dictator game as described above. After rolling the dice and learning their assigned charity, subjects made their allocation decisions by marking each of the three envelopes. After they marked their envelopes they were asked to fill out a brief questionnaire which asked them to self-

[16] At no time were any subjects promised that the experimenter would not be able to track their private number. Additionally, the die was rolled in front of the experimenter so there would be no expectation of privacy from the experimenter.

[17] There is much debate regarding the effect of social image on self-image. That is, how much of one's own identity is determined by how others view a person?

report their assigned charity, the amount they donated ($0 or $5), as well as a number of questions regarding their donation habits and attitudes[18]. Subjects were instructed that they could leave any part of the questionnaire blank if they did not wish to answer. Subjects then exited the lab without speaking to one another.

2.3.2.2 Treatment Group

Subjects in the Treatment group ("Self + Social Image") were given the same set of instructions as the Control group. However, the Treatment group was given additional instructions. They were informed after the instructions, but before the die roll and charity assignment, that they would have an opportunity to earn an additional $5 if they were to publicly announce the decisions that they made during the experiment. Subjects were asked to announce the following to the other subjects in the room: which charity they were assigned, how much (if anything) they donated to that charity, and which charity they believed was most deserving of donations. Subjects were told that they could decline, but that they would have to do so publicly (i.e. announce "I do not wish to announce.") and that they would not receive the additional $5 if they chose not to announce their donation decisions.

Table 2.2: Treatments

	Control (Self Image Only)	**Treatment (Self + Social Image)**
Envelope Assignment	Yes	Yes
Self-Report	Yes	Yes
Public Announcement (Assigned Charity and $ Donated)	No	Yes

[18] See Appendix A for the complete questionnaire.

Hypothesis 1: *Social image will be a stronger motivator to change behavior than self-image alone.*

Hypothesis 1 predicts that self-image alone will not be enough motivation to induce charitable donations or deceptive behavior. Social interaction provides more opportunities to receive reward and face punishment and thus should provide a stronger motivation than self-image alone. The increased social interaction inherent in social situations increases the number of opportunities to receive rewards from peer approval and punishments from peer disapproval. In addition to charitable giving, these social rewards and punishments can also incentivize deceptive behavior. If a subject wishes to keep the entire $10 for themselves but either desires the social rewards received from donating or fears social punishment from not donating, then they may choose an alternative path. These selfish subjects may engage in deception to fool their peers.

Hypothesis 2 : *Social image concerns will drive some selfish individuals to mitigate their selfish behavior by either lying about their donation or creating an excuse as to why they were unable to donate.*

Hypothesis 2 predicts that subjects will manufacture either lies or excuses in order to mitigate the damage to their image from a selfish action.

Lying: We define a "lie" as follows. If the subject falsely states that they took an action, when in fact they took a different action. For example, if a subject states that they donated $5 to their assigned charity when in fact they donated nothing, then this is defined as a lie. If the subject states that they were assigned to the NPDF when in fact they were assigned to the ARC, this is a lie. The presence of multiple charities will

provide an opportunity for individuals to deceive others about their decision not to give. We predict that selfish subjects assigned to the American Red Cross will deceive their peers about either their decision to donate or their assigned charity. Selfish subjects assigned to the ARC could choose to lie to their peers and falsely report that they donated to the ARC when in fact they did not. The benefits of lying about their donation decision provides two simultaneous benefits: utility received from social approval and avoidance of social punishment (i.e. guilt, shame, embarrassment). Alternatively, these selfish subjects could also falsely report that they were assigned to the National Police Defense Foundation. Previous studies have shown that low-rated charities, such as the NPDF, are less popular among donors. Furthermore, college-aged millennials' trust of government institutions such as police and military has been in steady decline over the years[19], whereas attitudes towards humanitarian charities such as the ARC have been increasingly positive[20]. Thus, it would be socially acceptable to refuse to donate if one has been assigned to the NPDF and thus, selfish subjects can avoid negative social consequences.

Excuses – In our study, an excuse is defined as a statement that alleviates an individual's social or self- obligation to be charitable. For example, if a selfish subject self-reports that they usually donate to charity then this would be categorized as an excuse for the purposes of our experiment. Excuses are distinguished from lies in that

[19] Harvard University Institute of Politics' Harvard Youth Poll found that 60% of those 18-29 year olds surveyed felt that police should be required to wear body cameras to reduce racial inequality. Approximately 49% of those surveyed support national protests over police treatment of residents. Another 49% of survey respondents answered that they lack confidence in the justice system.
[20] Previous studies have established the college students have a favorable opinion of the ARC. For example, Ariely, et. al (2009) found that 92% of Princeton students positively identified with the ARC.

excuses cannot be verified by the experimenter. If for example, a subject self-reports that they believe that people in need should be responsible for helping themselves then this is a statement which cannot be verified. Some subjects may find it aversive to blatantly lie about a fact that can be verified, such as which charity they were assigned or whether they chose to donate[21]. Therefore, we predict that there will be a subset of selfish subjects who prefer to honestly declare their refusal to donate to their true assigned charity and instead offer an excuse to justify this selfish behavior. Excuses mitigating selfish behavior might include: "I don't believe the [charity] will use my donation to help people." ; "I believe people are responsible for helping themselves. (I don't believe in giving to charity) " ; "I give regularly to charity."; or "My friends and I do not give to charity." These statements are differentiated from lying because they mix an honest report of non-donation and/or true assigned charity with a statement that diminishes the selfish nature of the act. These excuses may in fact be lies, but are more subtle deceptions than falsely claiming one made a donation.

2.3.3 Questionnaire

In order to assess attitudes towards the two charities and general attitudes toward charitable giving, we administered a Likert-type scale questionnaire. The questionnaire also serves as an opportunity to send a cheap-talk signal to themselves or the experimenter. The questionnaire did not vary across treatments and all subjects were informed that they could choose to not answer all or any part of the survey without

[21] There have been several studies demonstrating subjects' aversion to lying under various circumstances. Gneezy (2005), Gneezy, et. al (2013), Hurkens & Kartik (2009), Lundquist, et. al (2009).

consequence. Table 2.3 presents the statements seen by subjects. Subjects rated the degree to which they agreed with the statement (Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, Strongly Agree).

Table 2.3: Questions from Likert-type Scale Questionnaire

Please rate how strongly you agree or disagree with the following statements:	
Q1	*I help those in need when I am convinced that they are deserving of my help.*
Q2	*I think people in need should be responsible for helping themselves.*
Q3	*I help people in need more than other people my age.*
Q4	*I believe that the American Red Cross uses donations effectively to help people in need.*
Q5	*I believe that the National Police Defense Foundation uses donations effectively to help people in need.*
Q6	*The type of people that the American Red Cross helps are people who are deserving of donations.*
Q7	*The type of people that the National Police Defense Foundation helps are people who are deserving of donations.*
Q8	*How often do you give to charity ? (Never, Rarely, Sometimes, Often, Very Often)*
Q9	*How often do your friends give to charity ? (Never, Rarely, Sometimes, Often, Very Often)*

2.4 Results

All experiment sessions were conducted at UC San Diego. There were 73 total undergraduate participants in four sessions in April 2015: 39 in the *Self-Image Only* condition and 34 subjects in the *Social + Self-Image* condition. Average earnings were $9.62 in the *Self-Image Only* condition and $8.38 in the *Social + Self-Image* condition.

In addition to these earnings, subjects in the *Social + Self-Image* condition earned an additional $4.71 on average from publicly announcing their donation decisions.

2.4.1 Effect of Image on Donations

Result 1: Effect on Donations – *Social image is responsible for a larger increase in donations than is self-image.*

Overall, donations to either charity were quite low as the overall donation rate for both conditions combined was just below 20%. However, we find that, consistent with previous studies of social image, an increase in social image does increase the number of subjects who choose to give. Table 2.4 and Figure 2.3 show that in the Control group only three people chose to give to their assigned charity, whereas in the Treatment group 11 people chose to give to their assigned charity. This difference is statistically significant at the 1% level (Two-Sample Mann Whitney test, $Z =$ -2.65, $p =$0.008). Thus, it seems that individuals are mainly motivated to give in order to maintain their social image, rather than to maintain their self-image.

Table 2.4: Donations

Subject Breakdown – Donation Behavior			
	Self Image Only (Control)	**Self + Social (Treatment)**	**Total**
Donated $ 5 (Generous)	3	11	14
Donated $ 0 (Selfish)	36	23	59
Total	39	36	73

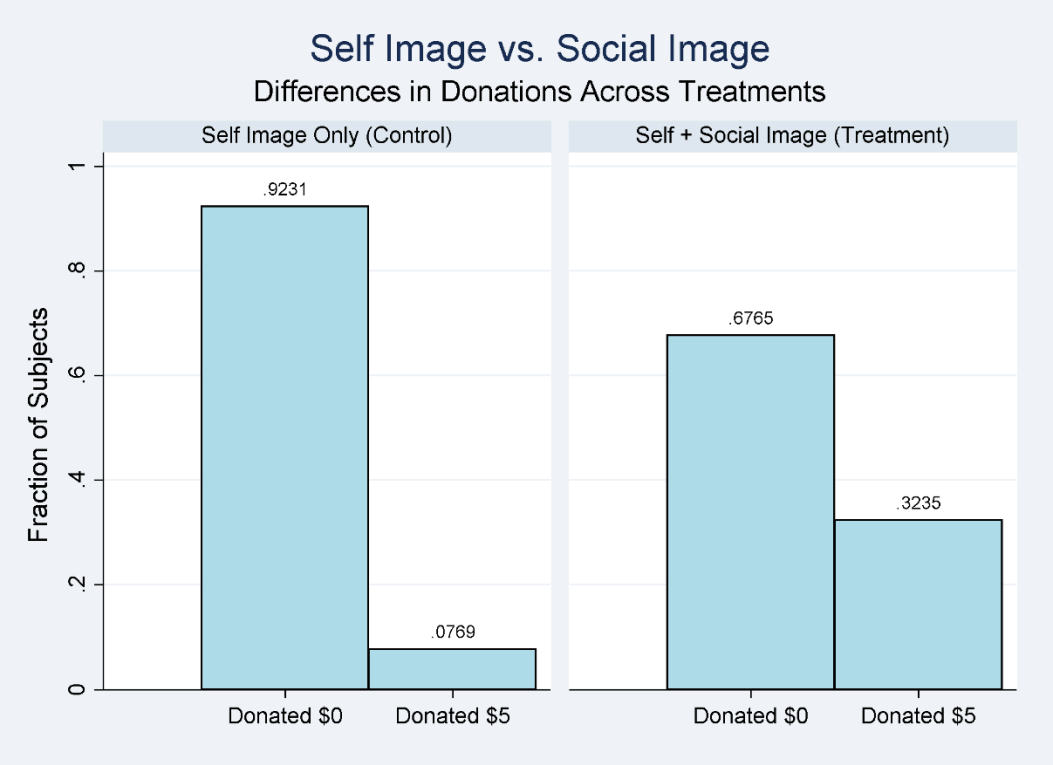


Figure 2.3: Fraction of Subjects Donating by Treatment

Difference between social and self-image. Significantly more subjects donated to charity under social image conditions than when social image factors were not present.

Table 2.5 presents the results of a probit regression with the decision to donate as the dependent variable. The Treatment variable is a dummy indicating whether subject was taking part in the *Social + Self-Image* condition. The coefficient is positive and significant at the 1% level, indicating that participating in the treatment condition where social image is present increases the probability that an individual will donate to their assigned charity. The "Assigned Charity" variable is a dummy indicating whether subjects were assigned to the ARC (Assigned Charity = 0) or to the NPDF (Assigned Charity =1). The coefficient on Assigned Charity is negative and significant indicating that subjects assigned to the NPDF were less likely to donate than subjects assigned to

the ARC. Looking at the data collected from the Likert-type scale questionnaire, some questions seem to be correlated with the decision to donate. For example, the coefficient on Q1 ("I help those in need when I am convinced that they are deserving of my help.") is positive and significant at the 1% level. This indicates that those subjects who had higher degrees of agreement with that statement were more likely to donate than those subjects who rated that they disagreed with that statement. The coefficient on Q3 ("I help people in need more than other people my age.") is positive and significant at the 5% level indicating that subjects who respond that they are in agreement with this statement are more likely to donate than those subjects who disagree with this statement.

Interestingly, a surprising finding is that the coefficient on Q8 ("How often do you give to charity?") is negative and significant at the 5% level. This suggests that those subjects who rate themselves as giving to charity "often" or "very often" are the subjects who in this experiment are the ones less likely to donate to their assigned charity. There are two possible explanations for this finding. One possible explanation is that the subjects do in fact give to charity often and thus cannot afford to give to charity in this experiment. A second, more intriguing, explanation is provided by the literature on moral licensing. Subjects who have made a selfish decision to refuse to donate are using this question as a signal that they are usually generous and therefore can allow themselves to act selfishly in this one instance. No subjects in the *Self-Image Only* condition avoided self-reporting or answering any of the survey questions.

Table 2.5: Decision to Donate

Probit Model: Effect on Decision to Donate	
Variable	**Coefficient**
Treatment	1.58***
	(0.54)
Assigned Charity	-1.47***
	(0.48)
Survey Q1	1.11***
	(0.45)
Survey Q2	-0.36
	(0.23)
Survey Q3	0.72**
	(0.33)
Survey Q4	-0.14
	(0.33)
Survey Q5	0.12
	(0.23)
Survey Q6	0.90**
	(0.42)
Survey Q7	0.01
	(0.26)
Survey Q8	-0.94**
	(0.42)
Survey Q9	0.17
	(0.42)
Constant	-7.19***
	(2.37)

Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, *p<0.10

Result 2 : Lying and Deception *– Social image concerns produce deceptive behavior in selfish subjects.*

Deceptive behavior is defined as any of the following: self-reporting a different charity than subject was assigned, misreporting the donation amount (i.e. claiming subject donated when they did not), or having a discrepancy between announced rating

of deservingness of the assigned charity and the written deservingness of the assigned charity. Figure 2.4 and Table 2.6 show the incidences of deception across treatments. Looking at Figure 2.4 it is apparent that deceptive behavior increases in the *Social + Self* condition.

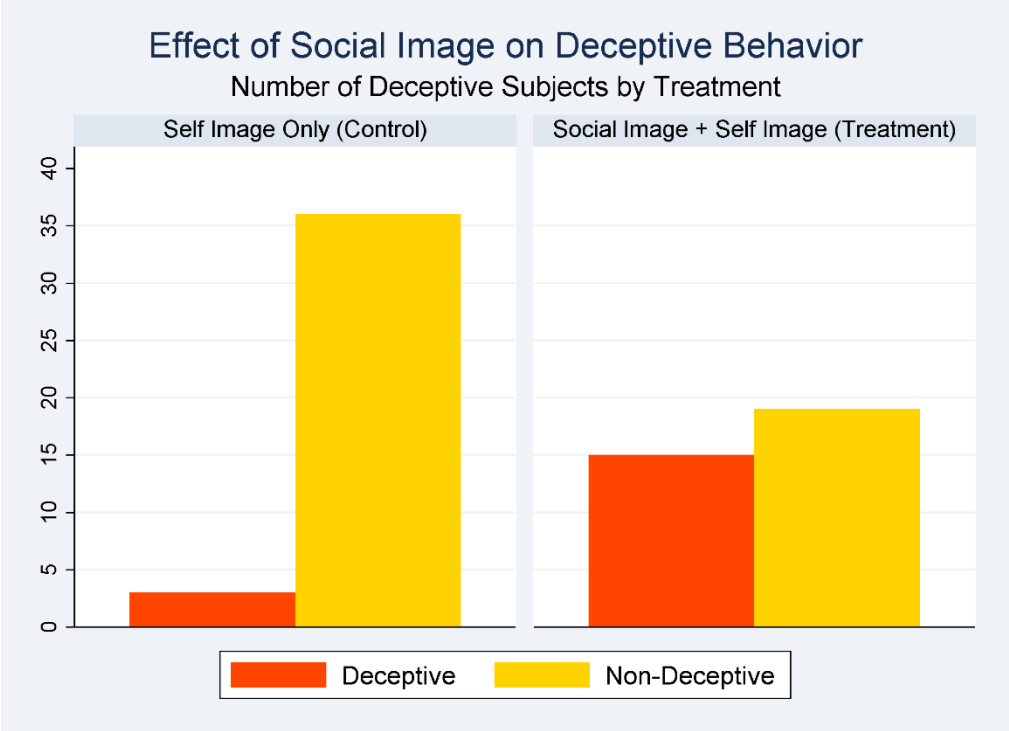


Figure 2.4: Comparison of Deceptive Behavior by Condition.

In the *Self-Image Only* condition, only 8% of subjects engage in deceptive behavior, whereas 42% subjects engage in deceptive behavior in the *Self + Social Image* treatment condition. This difference is statistically significant at the 1% level (Two-Sample Mann-Whitney test, $Z = -3.577$, $p = 0.0003$). Two subjects in the *Self + Social Image* treatment declined to make a public announcement and therefore forfeited their chance at earning the additional $5.

Table 2.6: Deception by Condition

Subject Breakdown – Deceptive Behavior			
	Self-Image only (Control)	**Self + Social (Treatment)**	**Total**
Deceptive	3 (8%)	15 (42%)	18 (25%)
Non-Deceptive	36 (92%)	19 (64%)	55 (75%)
Total	39 (100%)	36 (100%)	73 (100%)

The very fact that subjects had the opportunity to make announcements increased the number of available ways in which subjects could engage in deceptive behavior. It is natural to wonder if the very nature of social interaction allows for more deception than in situations where only self-image is at stake. In order to assess the motivation behind the observed deception we ran a probit regression, the results of which are presented in Table 2.7. The coefficient on the Donate dummy variable is negative and significant at the 1% level suggesting that it is those subjects who behave selfishly by refusing to donate that engage in deceptive behavior. Furthermore, the coefficient on the Treatment dummy is positive and significant at the 1% level. Thus, selfish subjects within the *Social + Self Image* condition are the most likely to engage in deception. Therefore, it would appear that social image, rather than self-image, is the primary driver of deceptive behavior.

Table 2.7: Explaining Deception

Probit Model: Effect of Treatment and Donation Behavior on Deception	
Variable	**Pr(Deceptive)**
Treatment	1.66***
	(.401)
Donate	-1.62***
	(.590)
Constant	-1.38***
	(.301)

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, *p<0.10

A possible explanation is that social nature associated with social image presents more opportunities (the chance for public announcements) for subjects to convince themselves and others that their selfish choices are justified. By contrast, in the Self-Image Only condition the only opportunity to justify selfish behavior is on the survey/questionnaire. This may account for the rise in deceptive behavior between the Self-Image Only and Social + Self-Image conditions.

Result 3 – *Rather than a causing a change in attitudes toward charitable giving, Social Image creates a "pressure" to give.*

Table 2.8 shows a breakdown of the median responses of subjects in both the *Self-Image Only* and the *Social + Self-Image* conditions. There is a statistically significant difference between donors' reported attitudes towards the needy between the Self-Image Only condition and the Social+Self-Image condition. Donors in the Self-Image Only condition are more likely to report disagreement with the statement "*I think people in need should be responsible for helping themselves*", whereas donors in the

Social+Self-Image condition are more likely to report agreement with the statement. (Mann-Whitney test, Z =-1.827, p =0.0678). Further investigation reveals that this difference is caused by the presence of two distinct types of donors in the Social+Self condition: those who agree with this statement and those donors who disagree with this statement. Out of the 11 subjects who donated in the Social+Self condition, six agreed or strongly agreed with this statement. Why would subjects who agree with this statement then donate? We would expect selfish subjects who did *not* donate to express agreement with the statement, which in fact, we do find[22]. We propose that this pattern is indicative of two different motivations to give in the Social+Self condition: some subjects are motivated to give because they are yielding to social pressure to give and some are motivated to give because they experience a warm-glow from giving in front of their peers. We propose that the six donors who state they believe others are responsible for helping themselves were motivated by social pressure to give. This could explain why their attitudes toward charity recipients are so similar to predicted non-donor responses. These six donors may have donated only to avoid possible perceived social consequences (i.e. public embarrassment, shame, etc.) and not because they received an intrinsic reward from donating. By contrast, the remaining 5 donors who expressed disagreement with the statement responded similarly to those subjects who donated in the Self-Image Only condition. We posit that these donors are the type who are motivated by the reward produced from warm-glow associated with giving to others publicly.

[22] This is consistent with previous findings that people who assign responsibility to others often do not give to charity. See Weiner (1995) for an in-depth review.

Table 2.8: Survey Responses

Modal Response of Donors on Survey				
	Self-Image Only		**Social + Self Image**	
Question	**Donors**	**Non-Donors**	**Donors**	**Non-Donors**
***Q1**: I help those in need when I am convinced that they are deserving of my help.*	Strongly Agree	Agree	Agree	Agree
***Q2**: I think people in need should be responsible for helping themselves.*	Disagree	Agree	Agree	Agree
***Q3**: I help people in need more than other people my age.*	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree
***Q4**: I believe that the American Red Cross uses donations effectively to help people in need.*	Strongly Agree	Agree	Agree	Strongly Agree
***Q5**: I believe that the National Police Defense Foundation uses donations effectively to help people in need.*	Neither Agree nor Disagree	Disagree	Disagree	Neither Agree nor Disagree
***Q6**: The type of people that the American Red Cross helps are people who are deserving of donations.*	Strongly Agree	Agree	Agree	Neither Agree nor Disagree
***Q7**: The type of people that the National Police Defense Foundation helps are people who are deserving of donations.*	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree	Neither Agree nor Disagree ***AND*** Agree
***Q8**: How often do you give to charity ?*	Rarely	Sometimes	Sometimes	Sometimes
***Q9**: How often do your friends give to charity ?*	Rarely	Rarely	Rarely	Rarely

Further evidence supporting our claim that some donors are motivated by negative social consequences, rather than by warm-glow, is found by looking at subjects ratings' of deservingness of charity recipients. Donors in the Self-Image Only

condition *agree* significantly more often with the statement "*The type of people that the American Red Cross helps are people who are deserving of donations*" than do non-donors (Mann-Whitney test, Z =-2.275, p =0.0229). These differences between survey responses in donors and non-donors are not present within the *Social + Self-Image* treatment condition. Deeper investigation reveals that this difference is driven, again, by a difference in responses by *donors* between the Self-Image Only condition and the Social+Self condition. Donors in the Self-Image Only condition report higher ratings of the deservingness of the American Red Cross recipients than do donors in the Social+Self treatment (Mann-Whitney test, $Z = 2.089$, $p = 0.0367$). This corroborates our claim that some donors give only because of social pressure. Low ratings of deservingness are usually consistent with low donation rates[23]. Why would people who claim that charity recipients are undeserving of donations give to charity? We postulate that these individuals are motivated by the threat of potential embarrassment and shame associated with not donating. These donors are not convinced of recipients' deservingness. By their own admission on Survey Q1 ("*I help those in need when I am convinced that they are deserving of my help.")*, these individuals will donate to those they feel are deserving and refrain from donating to those who are not deserving. Thus, it would appear that these donors are giving only because they feel a social obligation to

[23] See Weiner (1995) and Feather (2006) for a nice review.

give[24]. This type of behavior is akin to people's reluctant willingness to be "politically correct" in social situations, even when they privately hold different values[25].

2.5 Conclusion

It has been established that concerns over image can be a powerful motivator of prosocial behavior. What are less understood are the various individual features of social image concern that motivate subject behavior. We are able to document that individuals' concern for social image can manifest in different types of behavior. Social image motivates a 24% increase in charitable giving. Consistent with previous findings, we find that 45% of donors are motivated by the warm-glow reward from peer approval. However, 55% of subjects who participate in the *Social+Self-Image* condition of our experiment donate to charity, but report preferences similar to those of selfish subjects. We conclude that these individuals give to charity, but only do so because they fear the shame or embarrassment associated with not giving. We are also able to document a new finding that social image can in some instances motivate anti-social behavior. We are able to document a subset of non-givers who use lies and excuses to justify their selfish behavior, respectfully. Forty-two percent of selfish subjects either lie, or give an excuse to justify their selfish behavior.

A fruitful direction of future work may involve studying the long-term effects of social image on donation behavior. For example, an individual facing social pressure

[24] An alternative explanation is that these types of donors are not yielding to social pressure, but receive an extra boost in warm-glow from helping those who are undeserving of aid.
[25] It's been suggested that Donald Trump's rapid rise in popularity in the 2016 U.S. Presidential Campaign is due to his willingness to publically spurn political correctness and the appeal this holds with his fans who are "fed up" with the social pressure to be "politically correct".

may donate once, but then may later find ways to avoid these negative social consequences without having to be generous. Given the high rates of donor and gift attrition seen in recent years, this line of research may have serious policy implications.

2.6 Acknowledgement

Chapter 2, in full, is currently being prepared for submission for publication of the material. Sanchez, Alison; Andreoni, James. The dissertation author is the primary investigator and author of this material.

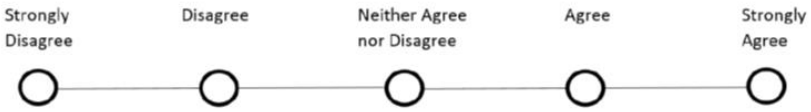
2.7 Appendix

Below are the Likert-type scale survey questions each subject answered after the conclusion of the experiment.

Subject # _____

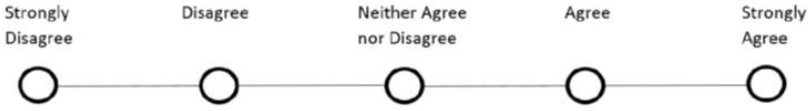
Please rate how strongly you agree or disagree with the following statements:

1. I help those in need when I am convinced that they are deserving of my help.



2. I think people in need should be responsible for helping themselves.

3. I help people in need more than other people my age.



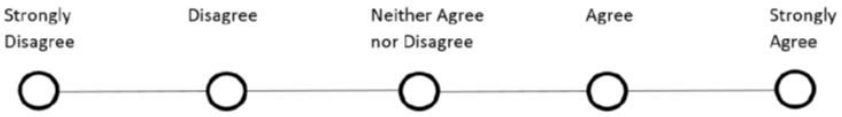
4. I believe that the **American Red Cross** uses donations effectively to help people in need.

5. I believe that **The National Police Defense Foundation** uses donations effectively to help people in need.

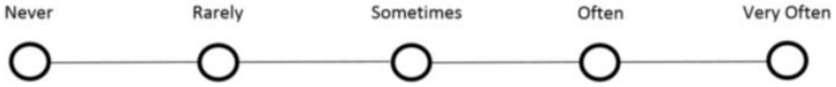
Now, TURN PAGE OVER and answer questions on other side →

6. The type of people that the **American Red Cross** helps are people who are deserving of donations.

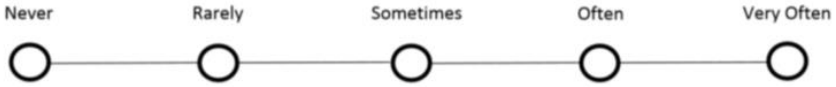
7. The type of people that the **National Police Defense Foundation** helps are people who are deserving of donations.



8. How often do you give to charity ?



9. How often do your friends give to charity ?



10. **My assigned charity was**:
    - ☐ American Red Cross
    - ☐ National Police Defense Foundation

11. **The amount I donated to my assigned charity was**:
    - ☐ $ 0
    - ☐ $ 5

Chapter 3

An Experimental Study of Search and Decision Processes Using the Prometheus Mobile Application

3.1 Introduction

Every day people make numerous decisions ranging from relatively small decisions, such as which brand of toilet paper to purchase, to major life choices such as finding a home to purchase, choosing a health care and retirement plan. Information search is a critical feature of the decision-making process. Consumers have access to multiple sources of information to aid them in their decisions. It has been estimated that 80% of consumers conduct online research and conduct on average 68 days of research before making a major purchase[26]. Consumers are interested in finding all relevant information so that they can make the optimal decision. However, information acquisition is costly in terms of time and cognitive effort. A crucial calculation for an individual is establishing when the acquired information is sufficient to stop searching and make a choice. Individuals must balance conflicting constraints of efficiency (minimizing time) and effectiveness (maximizing information value). Searching for and acquiring all available information may ultimately result in a more optimal choice, but is costly in terms of time and cognitive effort. On the other hand, allocating less time to information acquisition saves time and effort, but may result in a sub-optimal choice. In addition to calculating the optimal quantity of information to acquire, individuals must also calculate the optimal search method by which they will search. Should they search deeply within a choice alternative or broadly across choice alternatives? For example, would it be best to learn about all of the features of one

[26] Synchrony Financial Fourth Annual Major Purchase Consumer Study. A "major" purchase is defined here as being a purchase exceeding $500.

healthcare plan, or, is it better to research one feature (say, price) across multiple healthcare plans?

Optimal search policies and stopping rules have been characterized for a wide variety of search environments and various assumptions (Stigler, 1961; Kohn, et. al 1974; Lippman and McCall, 1976; Morgan and Manning, 1985). These previous studies characterize normative solutions for optimal search in very simple search problems, usually with only single attribute choice alternatives present. However, as noted by Gabaix, et. al (2006) and Sanjurjo (2014b) these types of problems are less representative of the real world information search problems faced by individuals. As the search problems increase in complexity to more closely reflect real world environments, analytic and computational tractability declines[27]. Despite difficulties in characterizing theoretical solutions, a rich experimental literature has emerged studying search behavior in more dynamic and complex search environments (Shi, et. al, 2003; Schram and Sonnemans, 2011; Sanjurjo, 2014a). These experiments make use of tools such as eye-tracking (Krajbich, et. al, 2010 and Reustkaja, et. al 2011) and software designed to track subject "click" data (Crawford, 2008; Gabaix, et. al, 2006) to track not only the choices made by individuals, but also their search pattern and behavior. Of course, when evaluating experimental data a theoretical optimal search policy serves as a natural benchmark for observed search behavior. Given the intractability of such formal solutions, previous studies have relied upon partial characterizations and behavioral models to evaluate individuals' search behavior. For example, Gabaix and

[27] See Sanjurjo (2014) for a review of theoretical results on optimal search policies

Laibson (2005) propose the "directed cognition" model which modifies the traditional dynamic programming approach to optimal stopping problems by using bounded rationality assumptions. The directed cognition model simplifies the dynamic programming problem by assuming that individuals optimize their search by focusing on acquiring information about the alternatives which are most likely to be chosen. Importantly, this approach allows the directed cognition model to overcome the "curse of dimensionality" to formulate predictions for complex search problems that more closely approximate real world search environments. Further, lab behavior is found to match the predictions of the directed cognition model.

Despite the great strides towards more realistic models, these previous studies assume that observed human behavior is sub-optimal when compared to theoretical "optimal" search policies. This paper takes the opposite view. That is, that observed human behavior is the result of optimizing "some" decision rule that is unknown to the observer. Our objective is to recover that decision rule from an individual's *observed* search policy. We accomplish this using a technique we call Inverse Optimal Stochastic Planning (IOSP). The premise of IOSP is simple: given measurements of an individual's (search) behavior over time and a model of the decision environment, one can determine the utility function that the individual optimized to produce that behavior. In other words, we propose that the *observed* search patterns, behavior and choices are the "optimal policy" produced by a decision rule. This "observed optimal" policy may in fact differ from theoretically derived "optimal" policies produced from traditional "forward" dynamic programming techniques which start with an objective function and

solve for a prescriptive search policy. Previous studies may have labeled observed search behavior that deviates from traditional "optimal" search policies as "irrational". However, we posit that while observed behavior might not be "optimal" according to traditional dynamic programming predictions, it is nevertheless "optimal" according to the individual's own unique decision rule and having been the result of an optimization process is "rational". The motivation for this perspective stems from the known fact that the human brain is capable of solving challenging problems that artificial intelligence systems and machine learning algorithms have yet to successfully solve (Grossberg, 2013; Abbeel, et. al, 2004; Abbeel, et. al, 2007). The brain is a self-organizing system, capable of rapid learning and categorizing large quantities of real-time data from a world that is dynamic and full of unexpected events. Therefore, discovering how the brain solves information search and optimal stopping problems can lend researchers valuable insight. We refer to the brain's solution to the information search problem as *cognitive optimality* in order to distinguish it from the *traditional optimality* stemming from the normative forward dynamic programming solution.

We argue that our IOSP approach has many advantages. First, as it is more tractable than the "forward" dynamic programming toolbox it does not suffer from the curse of high dimensionality and is thus capable of describing real world search behavior. Second, we posit that identifying an individual's decision rule through the "inverse" approach can provide a more succinct description of underlying behavioral motivations than a prescriptive policy function. The argument here is that since the human brain is able to solve complex problems it must possess unique information that

has yet to be discovered by researchers. The inverse approach has been successful in recovering this unique information. For example, Abbeel, Coates, and Ng (2010) used the inverse approach to identify how helicopter pilots are able to perform complex maneuvers, such as flying the helicopter upside-down. They were then able to apply what they had learned about individual pilots' objective functions to aid an artificial intelligence system to perform these previously "human-only" maneuvers. The AI system could not accomplish these maneuvers using the optimal policy prescribed by the "forward" approach. Our hope is that the IOSP method described here can be used in the future to predict human behavior in new environments.

In order to validate our model we conduct a search experiment using the mobile application, Prometheus, developed by Sanchez and Coleman (2014). Prometheus has many advantages. First, subjects are able to interact with the technology in much the same way that they would interact with many online search query systems or websites designed to compare product choices. The second advantage is that the flexibility of the software running Prometheus allows us to carefully design the experiment environment in order to isolate causal effects, while at the same time maintain the complexity needed to match real world search environments. Third, Prometheus can be deployed on mobile devices, allowing us to step out from the traditional lab environment. We believe we are the first to study search processes using a mobile app technology like Prometheus.

Subjects were asked to choose from a list a "tasks" to complete for money. They are not informed ahead of time what each task is, but rather are allowed to search for information describing the nature of each task. Subjects are allowed to search for as

much or as little information as they desire before choosing a task. Participants were given 15 minutes to search for and complete as many tasks as they liked. Importantly, Prometheus allows us to observe subject search patterns in addition to their final choices.

Using the search pattern data we are able to identify a variety of subject search "types". Whereas some subjects adhere to standard prescriptive search policies, many subjects deviate from these policies. For example, some subjects do not search through alternatives at all, whereas other subjects search deeply within each task alternative. The IOSP method allows us to identify individual objective functions for each subject which provides an explanation for why some subjects over-value search and others do not. The search pattern results yield insights that would not appear in choice data alone. For example, we find gender differences between male and female subjects that do not appear in any choice data. We find that males place less value on "certainty" about choice alternatives than do females. We propose this as an explanation for why females search for longer periods of time than do males.

The rest of the paper is organized as follows. Section 3.2 describes the theoretical setup of IOSP. Section 3.3 describes the Prometheus Mobile Application in full detail. Section 3.4 presents results. Section 3.5 concludes.

3.2 Theoretical Setup

Inverse Optimal Control[28] was first proposed by Kalman (1964) and our

[28] Optimal Control is used by many fields from computer science to machine learning, to electrical engineering to operations research to economics and has thus appeared in various literatures under

theoretical framework builds on that developed by Ziebart et. al (2009), Abbeel and Ng (2004) and Ng and Russell (2000). Although we believe that we are the first in any literature to apply IOSP to optimal stopping problems in information search, the "inverse" problem was previously studied by macroeconomists Chang (1988) and He and Huang (1994). Both of these papers use the inverse optimal approach to recover agents' utility functions from observed consumption-portfolio policies. Our experimental approach to monitoring step-by-step information search builds on the work of Reutskaja, et. al (2011) and Crawford (2008), which utilize the MouseLab computer interface to monitor subjects' search decisions. Our approach to monitoring information search builds on the work of Camerer, et. al (1993, 2002), Gabaix, et. al (2006). This computation is well-defined so long as we assume that the agent is *optimizing*. We overcome the "curse of dimensionality" (Bellman, 1957) since our problem is a convex optimization. Thus, our method is scalable to high-dimensional problems.

3.2.1 Model and Estimation Strategy

Consumers routinely choose between multiple goods and services. We begin with the simplest of decision problems: the consumer must choose between two choices, Task 1 and Task 2. The value of the two tasks is not initially known, but can be learned over time. For example, an individual may be considering two job offers. After acquiring information about the features of the offers (i.e. salary, health benefits, retirement benefits, etc.), the individual can then make a choice about which job they

---

different names. It is also known as dynamic programming and reinforcement learning. Thus, the "inverse" of these methods also appear under various names.

believe will be the best option. The true nature of the job, however, is not revealed until one has chosen the job and experienced it firsthand. Likewise, the true nature of the task is not revealed until after it has been chosen.

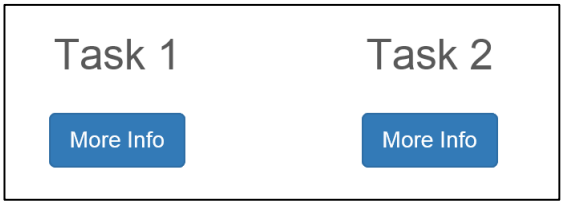


Figure 3.1: Example of Decision Problem faced by agent

Consider an agent who must choose either Task 1 or Task 2 as displayed in Figure 3.1. Tasks can be either Math tasks or English tasks. The agent is paid for correctly solving the problems correctly and is thus incentivized to choose the task which is best suited to their own abilities/strengths. However, since it is unknown to the agent at the time of their choice which task is Math and which task is Verbal, they are allowed to search for information about the features of each task. Define Ω to be the possible states of nature, ω, pertaining to the order of the tasks. In our example, Ω has two elements: $\omega_1 = ME$ denotes the state where (Task 1 = Math task, Task 2 = English task) and $\omega_2 = EM$ denotes the state where (Task 1 = English task, Task 2 = Math task). Agents can view one piece of information at a time about each of the tasks and are unlimited in the amount of information they can seek. At each time,t, agents can view information observations about each task, $o \in O$. Agents can take any action $a \in \mathcal{A}$:

$$\mathcal{A} = \begin{cases} C_A: continue\ searching - \ query\ for\ information\ about\ Task\ 1 \\ C_B: continue\ searching - \ query\ for\ information\ about\ Task\ 2 \\ S_A: stop\ searching - \ choose\ Task\ 1 \\ S_B: stop\ searching - \ choose\ Task\ 2 \end{cases}$$

We can define the probability that a user views a particular information observation as $P(o_t|a_t, \omega)$. Defining the information that agents have gathered up to time *t* as $I_t = (o_1, a_1, \ldots, o_t, a_t)$, we can write their belief about the state as $\rho_t(\omega) = P(\Omega = \omega|I_{t-1})$. We can now define the state of the system at time *t*, s_t, to be the agent's belief of the state at that time point: $s_t \triangleq \rho_t$. We assume that $P(a_t|I_{t-1}) = P(a_t|s_t)$. However, just as there are time constraints in choosing an offer of employment, agents are constrained by time. The agent is allowed to complete as many tasks as they choose in the allotted time. After viewing each new piece of information the agent updates their belief about which category of question lies behind each task box. At every time step, the agent must decide whether to continue searching for information about the tasks or stop and choose a task to complete. Information acquisition is costly as there is a time limit imposed on the total amount of time allotted for agents to find and solve tasks. Thus, the agent must trade off two competing factors: efficiency (minimizing time) and accuracy. Agents prefer to choose a task for which they are most suited, but are also incentivized to complete as many tasks as possible.

Each agent has an intrinsic probability of error associated with answering Math and English questions which we define as being $\alpha_E = P(e|\omega = EM, a = S_A)$ and $\alpha_M = P(e|\omega = ME, a = S_B)$. The probability of error reflects each agent's competence or proficiency at solving questions. The agent sequentially updates their belief, ρ_t about Ω

after viewing a new piece of information about each task, o_t. Our current model assumes that agents update their belief about the state, ρ, according to Bayes' Rule. While there is much evidence to the contrary[29], we assume Bayesian beliefs as a "base case". Further extensions of our model should incorporate other pseudo-Bayesian approaches such as those proposed in Rabin and Schrag (1999), Rabin (2002), or Mullainathan (2002). We define each agent's problem as follows. The agent picks a stopping time,τ, which minimizes:

$$J(\pi) = \tau + LP_a(e|I_\tau) + \lambda U(\rho_\tau) \qquad (3.1)$$

where J is the total cost associated with an observed policy π, L is the agent's self-imposed penalty for incorrect questions, and $P_a(e|I_\tau)$ captures each agent's probability of error given all of the information, I, they have gathered up until the stopping time, τ. Every policy π induces a stopping time τ. The function $U(\rho_\tau)$ represents each agent's "uncertainty" function. The uncertainty function captures an individual's preference in deciding how much information is "sufficient" enough to stop searching and make a choice. Uncertainty can affect behavior and decisions in ways not predicted by standard theories of risk (Andreoni and Sprenger, 2012; Gneezy, List and Wu, 2006; Rydval, Ortmann, Prokosheva and Hertwig, 2009; Keren and Willemsen, 2008; Simonsohn, 2009). Thus, we suggest that uncertainty over the value of information can alter behavior. We posit that how much agents value "being certain" can induce agents to "over-search" for information. For example, suppose an individual is equally proficient at math and English tasks and thus that $\alpha_M = \alpha_E$. This implies that the agent should

[29] See Ortoleva (2012) for a nice review of studies showing non-Bayesian behavior

stop immediately without searching and choose a task. To see why, consider the following. Suppose $a_\tau = S1$. By the total probability theorem it can be shown that:

$$LP(e|I_\tau) = LP(e, \omega = ME|a_\tau, I_\tau) + LP(e, \omega = EM|a_\tau, I_\tau)$$

$$LP(e|I_\tau) = LP(\ \omega = ME|a_\tau, I_\tau)P(e|a_\tau, I_\tau, \omega = ME) + LP(e|a_\tau, I_\tau)P(e|a_\tau, I_\tau, \omega = EM)$$

$$LP(e|I_\tau) = \alpha_M LP_\tau(ME) + \alpha_E LP_\tau(EM)$$

Since $\alpha_M = \alpha_E$ the agent will perform equally well at either task. That is that no matter which task the agent chooses they will face the same error rate. In this case, searching for information about either task adds no value to the agent's decision problem. Since the agent will perform equally well at either task, the agent can more efficiently minimize their cost function by refraining from searching for information. This allows the agent to apply the saved time from not having to search for information to solving tasks and thus increase earnings. However, if an agent places value on being "confident" in their choice, the agent will search for information "just to be sure" about the tasks they are choosing from. Even if the agent can perform equally well on either task, the agent may still need to ensure that they are confident about the state of nature before they make their final task choice. This is why we add an additional term $\lambda U(\rho_\tau)$ to capture how each agent values reducing their uncertainty about their decision[30]. A crucial assumption we make about the uncertainty function is that uncertainty about the decision problem does not increase as the amount of information collected by the agent increases. That is, gathering more information does not confuse the agent. This

[30] See Degroot (1962) for a nice discussion of what characteristics a "natural" uncertainty function should have.

assumption may need to be relaxed in future extensions of our model as it could be the case that gathering more information can lead the agent to suffer from "information overlaod" (Shapiro and Varian, 1999; Sims, 2000). We define each agent's Optimal Value Function as:

$$V_{stop}(\rho) = \min_{a} LP_a(e|I_\tau) + \lambda U(\rho_\tau)$$
$$V_{stop}(\rho) = \min\{\underbrace{\alpha_M P(ME) + \alpha_E P(EM) + \lambda U(\rho_\tau)}_{a_{\tau=S_1}}, \underbrace{\alpha_M P(EM) + \alpha_E P(ME) + \lambda U(\rho_\tau)}_{a_{\tau=S_2}}\} \quad (3.2)$$

At every time instant, the agent has two options. The agent can either continue to search for information, or the agent can decide to stop and make a choice. A Bayesian decision maker relies on her most current belief to select the next best action. Thus, we follow (Naghshvar and Javidi, 2013) and characterize the optimal policy at any stage as satisfying:

$$V^*(\rho) = \min\left(\underbrace{V_{stop}(\rho)}_{\text{optimal cost for stopping}}, \underbrace{\min_a 1 + \mathbb{E}_O\left[\underbrace{\mathcal{B}(\rho, L_{O,a})}_{\text{Bayes Operator}}\right]}_{\text{optimal cost for continuing}}\right) \quad (3.3)$$

where $\mathcal{B}$ is the Bayes operator[31] and the expectation is taken with respect to the conditional distribution on *o* given action *a* and information, *I*, so far:

$$p(o) = \sum_\omega p(o|a,\omega)p(\omega) \quad (3.4)$$

Equivalently we can say that for being in any state, *s*, the optimal action is the minimizer of $V^*(\rho)$. We can define a *Q*-function, whose maximum is the negative of

[31] Agents' posterior beliefs are updated according to Bayes' Rule
$\rho_{t+1} = \frac{\rho(\omega)P(o|a,\omega)}{\{\sum_{\omega'} \rho(\omega')P(o|a,\omega)\}} = \mathcal{B}(\rho, P(o|a,\omega))$

the value function in (3.3) can be used to find the optimal policy. By defining the *Q*-function to be such that:

$$\max_{a} Q(\rho, a) = -V^{*}(\rho) \qquad (3.5)$$

we can then define the optimal action as:

$$a^{*}(\rho) = \text{argmax}_{a}\, Q(\rho, a) \quad (3.6)$$

Define $\mathcal{A}_C$ as the set of actions pertaining to the agent's decision to *continue searching* and $\mathcal{A}_S$ as the set of actions pertaining to the agent's decision to *stop and choose.* Let the associated *Q*-function for *continue* be denoted as $Q_c(s, a)$ and the associated *Q*-function for *stop* be denoted as $Q_S(s, a)$. In our setup, $\mathcal{A}_C = \{C_1, C_2\}$ and $\mathcal{A}_S = \{S_1, S_2\}$. We define $Q_c(s, a)$ and $Q_S(s, a)$ as follows:

$$Q_c(s, a) = -1 - \mathbb{E}_O\left[\underbrace{\mathcal{B}(\rho, L_{O,a})}_{\text{Bayes Operator}}\right] \quad (3.7)$$

which can be estimated by:

$$Q(\rho, C_1) = \sum_{1}^{K} \delta_k^{C_1} \phi_k(\rho)$$

$$Q(\rho, C_2) = \sum_{1}^{K} \delta_k^{C_2} \phi_k(\rho)$$

where ϕ_k are the Legendre polynomials and we place a uniform prior on ρ. The Q-function for *stop* is

$$\begin{aligned} Q_S(s, a) &= -LP_a(e|I_\tau) - \lambda U(\rho_\tau) \\ &= -LP_a(e|I_\tau) - \textstyle\sum_{m=1}^{M} \beta_m U_m(\rho_\tau) \end{aligned}$$

$$Q_S(s,a) = \begin{cases} -\alpha_M \rho(ME) - \alpha_E \rho(EM) - \sum_{m=1}^{M} \beta_m U_m(\rho), & a = S_1 \\ -\alpha_M \rho(EM) - \alpha_E \rho(ME) - \sum_{m=1}^{M} \beta_m U_m(\rho), & a = S_2 \end{cases} \quad (3.8)$$

In order to estimate the parameters $\theta = \{\boldsymbol{\alpha}, \boldsymbol{\beta}, \boldsymbol{\delta}\}$ we formulate a likelihood model. We can observe the agent's actions, a, their belief of the state, ρ, the information observed by the subject, o, and the true state, ω. We estimate β coefficients for a convex combination of two known concave uncertainty functions:

$$\sum_{m=1}^{M} \beta_m U_m(\rho_\tau) = \beta_1 \underbrace{\left[-\sum_{i=1}^{\tau} \rho_i \log_2 \rho_i \right]}_{\text{Shannon entropy}} + \underbrace{\beta_2 [1 - \max(\rho_i)]}_{\text{Absolute entropy}} \quad (3.9)$$

We chose Shannon entropy and Absolute entropy as measures of uncertainty since they are both non-negative, concave functions and thus are the most tractable to use in the IOSP algorithm. We restrict $\boldsymbol{\beta} \geq 0$ to guarantee that the non-negative combination of concave functions remains concave (DeGroot, 1962). Further extensions of our model should incorporate more and/or different measures of uncertainty. However, we begin with these two measures as a "base case". Higher values of β would indicate that the agent places a higher value on reducing uncertainty, while lower values of β suggest that the agent places a lower value on reducing uncertainty. Further, an agent with high values of β suggests that the agent has a higher "certainty" threshold and thus requires more information to reduce uncertainty than does an agent with low β values. Our model makes the following predictions:

Prediction 1*: Agents with higher values of α_M will choose Math tasks with higher frequency than agents with lower values. Agents with higher values of α_E will choose*

Word Scrambles tasks with higher frequency than agents with lower values. Those agents for which $\alpha_M = \alpha_E$, will choose with equal frequency.

Prediction 2: *For agents with similar values of* ***β,*** *search times will be longer for agents with $\alpha_M \neq \alpha_E$ than agents for which $\alpha_M = \alpha_E$.*

Prediction 3*: Agents with high values of β will search longer periods of time and seek out a higher volume of information than those agents with low values of β.*

In order to estimate our model we follow Ziebart, et. al (2008) and approximate $P_\theta(a|\,\rho)$ using a "soft-max" function:

$$P_\theta(a|\rho) = \begin{cases} \dfrac{e^{Q_C(a,\rho)}}{\left(\sum_{a\in A_C} e^{Q_C(a,\rho)}\right)+\left(\sum_{a'\in A_C} e^{Q_C(a',\rho)}\right)}, & a \in A_C \\ \dfrac{e^{Q_S(a,\rho)}}{\left(\sum_{a\in A_S} e^{Q_S(a,\rho)}\right)+\left(\sum_{a'\in A_S} e^{Q_S(a',\rho)}\right)}, & a \in A_S \end{cases} \tag{3.9}$$

Define *y* to be all of the information available to the the experimenter: $y = (\omega, \rho_1, o_1, a_1, \dots, o_\tau, a_\tau, \rho_\tau)$. For all observed ρ_t, o_t, a_t and for time steps, $1 \leq t \leq \tau$, we have the likelihood:

$$\log p(y|\theta) = \log\left(P(\omega)\prod_{i=1}^{\tau} P(\rho_t|\rho_{1:t-1}, a_{1:t-1}, o_{1:t-1}, \omega)P_\theta(a_t|\rho_t)P(o_t|a_t,\omega)\right)$$

$$\log p(y|\theta) = \log\left(P(\omega)\prod_{i=1}^{\tau} 1_{\{\rho_t=\mathcal{B}(\rho_{t-1},a_{t-1},o_{t-1})\}}P_\theta(a_t|\rho_t)P(o_t|a_t,\omega)\right)$$

$$\propto \sum_{t=1}^{\tau} P_\theta(a_t|\rho_t)$$

The likelihood is log-concave in θ, which allows our model to perform high dimensional inference in a convex, efficient and scalable manner.

3.3 Prometheus Mobile Application

Prometheus is a mobile application designed by Sanchez and Coleman (2014) to replicate online choice environments. Figure 3.2 shows three screenshots of what subjects view on their smartphones. When subjects log on to Prometheus they are taken to the Welcome Screen which provides a short description of the experiment and how they will be paid. After receiving instructions for the experiment session, Prometheus assigns each subject a unique Participant Identification Number. All subjects' click data is tracked using this Participant ID. Once subjects have begun their Prometheus session, they are taken to the Task Search Screen. On this screen, subjects are presented with a series of up to six different "task" choices.

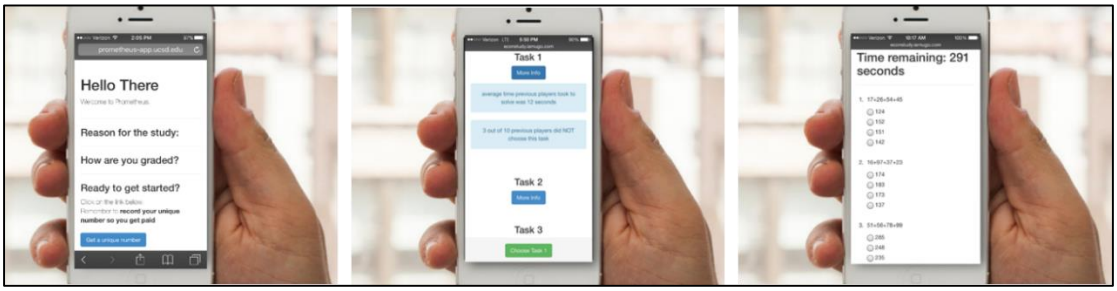


Figure 3.2: Prometheus Mobile App Subject View[32]

Tasks are labeled ambiguously so as not to reveal the nature of the task itself. Instead, subjects can search for information about each task by clicking the "More Info"

[32] Images presented here are adapted from an original image obtained from <http://www.gadgetpics.com/gallery/4910/what-do-all-iphone-users-need-to-know/46586>

button. Subjects can search for as much or as little information as they would like. When subjects have satiated themselves with enough information, they can click on the "Choose Task" button which allows them to choose any of the tasks displayed on their screen. Once subjects have chosen a task they are taken to the Task Question Screen where they are directed to solve the task. Finally, when subjects have solved their task and submitted their answer/solution for that task they are then taken to the next round where they view a new Task Search Screen. When subjects have reached their time allotted, the screen displays the amount earned during the session.

Click Data for each subject is retrieved using the Experimenter Administration branch of Prometheus. Experimenters can access data from any session using the Experiment Results feature of the Prometheus. Each subject's click data is stored as a CSV file. Data collected include: time stamp of each click, time difference between clicks, description of what subject saw on each click (i.e. what clue subject viewed), which task was chosen, whether subject solved task correctly, and how much each subject earned.

Figure 3.3 shows screenshots from the Experimenter Administrative branch of Prometheus. The Experimenter can customize the setup of each experiment from their mobile device using Experimenter view. Task labels and task question sets can be completely customized using the upload feature of Prometheus.

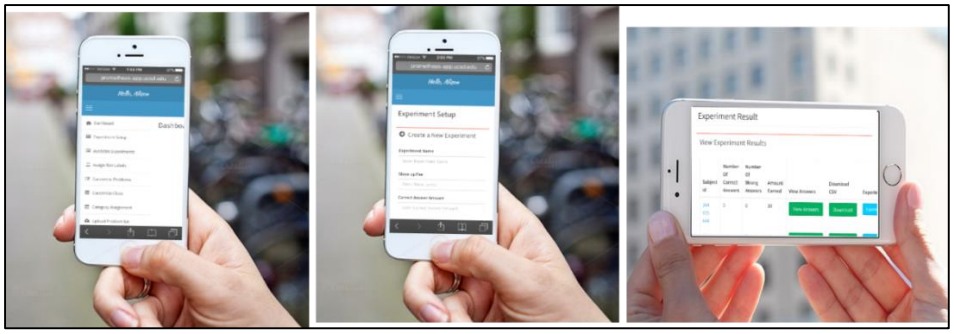


Figure 3.3: Prometheus Mobile App Experimenter View[33]

3.4 Experiment Design

All experiments were carried out using the Prometheus mobile application.

3.4.1 Tasks

Two tasks were loaded into the Prometheus system: a Math task (MA) and a Word Scrambles task (WS). Math tasks consisted of summing three two-digit numbers. Word Scrambles tasks involved identifying the correct word that is represented by four letters. All tasks were multiple choice style tasks. Figure 3.4 shows an example of a Math task and an example of a Word Scrambles task. Subjects were instructed that their assignment was to complete tasks for money. Each correctly completed task would yield $0.50. Subjects had 15 minutes to complete as many tasks as they chose. Subjects viewed a total of six task "slots" on their screen. They were informed that only two of these slots had tasks loaded and it was part of their assignment to find the "loaded" slots. Tasks randomly reassigned task slots each round so that there was no

[33] These images were adapted using original images from https://creativemarket.com/Medialoot/90077-iPhone-6-In-Hand-PSD-Mockup and https://www.support.creativemarket.com/show.it.better/51071-iPhone-in-the-city-photo

guarantee that task types would remain in the same slot between rounds.

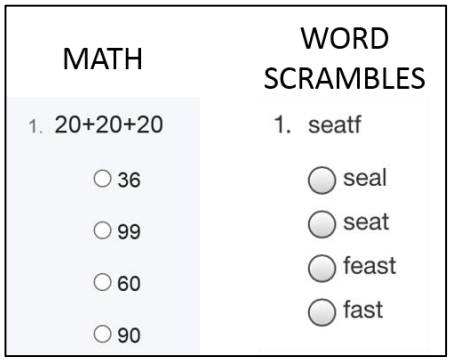


Figure 3.4: Example of Math Task and Word Scrambles Task

Prometheus recorded the following: time between clicks, which tasks were searched for clues, which clues were viewed by subject, how long each subject viewed each initial clue before clicking for an additional clue, type of task chosen, answers to tasks[34], and submitted "final" answers to tasks. All subject "clicks" were recorded. That is, every time a subject clicked any button on the screen Prometheus recorded the time of that click as well as what the subject viewed on screen as a result of that click.

3.5 Results

All experiment sessions took place between August and November 2015 on the University of California, San Diego Jacobs School of Engineering campus. Subjects were invited to participate in a study involving decision-making in an online environment. Subjects were informed to bring their own personal electronic device to the session. They were instructed to use the device they felt most comfortable using to

[34] Subjects were allowed to switch answers before submitting their "final" answer. After the "Submit" button was clicked, subjects could no longer return to the previous task to change their answer.

make decisions: laptop, phone, or tablet. One Pilot Session took place with five subject participants with an average earnings of $38.40. An additional 29 subjects participated in Session 1 and Session 2 with average earnings of $55.93. Cash payments to subjects were capped in sessions 1 and 2 at $20 due to budget restrictions[35]. Subjects were informed of this before beginning each of those sessions. Table 3.1 shows summary statistics for all sessions although for the remainder of the paper we focus on the results from subjects participating in Sessions 1 and 2. Our sample population size is relatively small at 29 subjects for Sessions 1 and 2. However, those 29 subjects who participated in Sessions 1 and 2 played a combined total of 1700 rounds and generated over 7500 pieces of click data for an average of 259 observations per subject. Figure 3.5 shows the frequency with which each subject chose math and word scrambles tasks. On average, word scrambles were chosen 51% of the time and Math 49% of the time. Subjects' task category preferences range from choosing math and word scrambles in equal frequency to choosing one task almost exclusively.

For example, Figure 3.5 shows that Subject 9 chose word scrambles tasks exclusively, whereas Subject 14 appears to be indifferent between the two types of tasks and chose each with (almost) equal frequency.

[35] Although cash payments were capped, this did not seem to affect subject effort.

Table 3.1: Summary Statistics

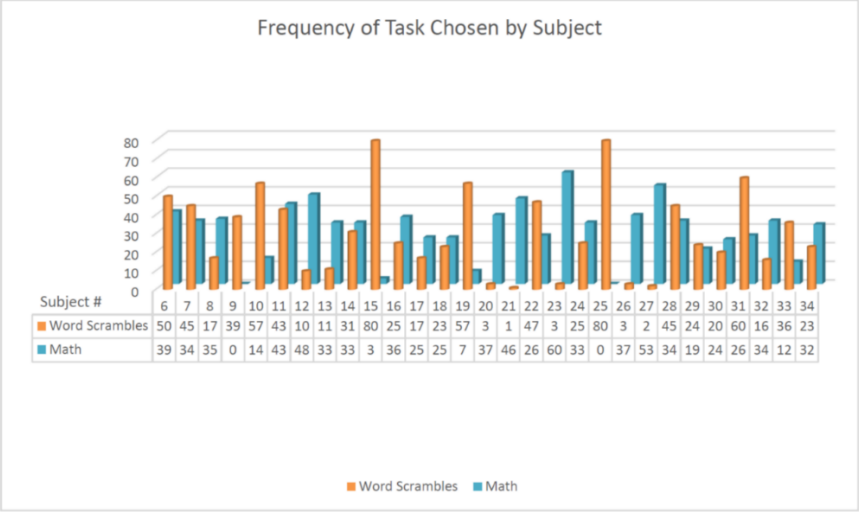
	All Sessions
Max Rounds Played	89
Min Rounds Played	37
Mean Rounds Played	60
Math Task Chosen	848 (49%)
Word Scrambles Task Chosen	893 (51%)
Mean Time Spent Searching for Clues Per Round	14, 682.02 ms
Mean Number of Clues Viewed Before Choosing Task	6
Mean Time Spent Solving Task	11, 366.18 ms

Result 1: *Probability of error has a mildly significant effect on type of task chosen.*

As predicted by our model, those subjects who have (approximately) equal probability of error for both math and word scrambles chose those each with almost equal frequency. Subjects for which $\alpha_M = \alpha_E$ did not choose one category significantly more than the other category of task[36]. Again as predicted by our model subjects who have a higher probability of error for math choose math tasks 46% on average, whereas as those subjects with a lower probability of error for math choose math tasks 62% of

[36] A one-sample t-test fails to reject the hypothesis that ratiomath=ratiows for subjects with $\alpha_M = \alpha_E$, t = -0.1426, p = 0.8897.

the time, a statistically significant difference of 16%[37]. While subjects with low probability of error for word scrambles tasks choose word scrambles 53% of the time and those with high probability of error choose word scrambles 40% of the time, this difference is not statistically significant[38]. This suggests that while subjects' perceived probability of error (and their self-imposed penalty *L*, refer back to equation 3.2 for details) does seem to have some effect on choice of task it does not fully explain all of subjects' choice behavior.



Subject #	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Word Scrambles	50	45	17	39	57	43	10	11	31	80	25	17	23	57	3	1	47	3	25	80	3	2	45	24	20	60	16	36	23
Math	39	34	35	0	14	43	48	33	33	3	36	25	25	7	37	46	26	60	33	0	37	53	34	19	24	26	34	12	32

Figure 3.5: Breakdown of Subject's Task Choices

3.5.1 Search Behavior Patterns

Subjects varied greatly in their search patterns and strategies. However, four general search type patterns emerge in the data. We categorize subjects in the following manner. Subjects who consistently searched for less than 7 clues per round are

[37] Two-sample t-test with equal variances, t = 1.4035, p = 0.0861.
[38] Two-sample t-test with equal variances, t = 1.2509, p = 0.1111.

categorized as having engaged in "*Very Little Search*". Subjects who consistently searched for at least 7 clues per round are categorized as engaged in "*Constant Search*". Subjects who show a decay in clue search are categorized into an additional two categories: *"Slow Learning"* and *"Rapid Learning"* based on the rate of decay in their search behavior. Figure 3.6 shows examples of four subjects who displayed these four stereotypical search patterns.

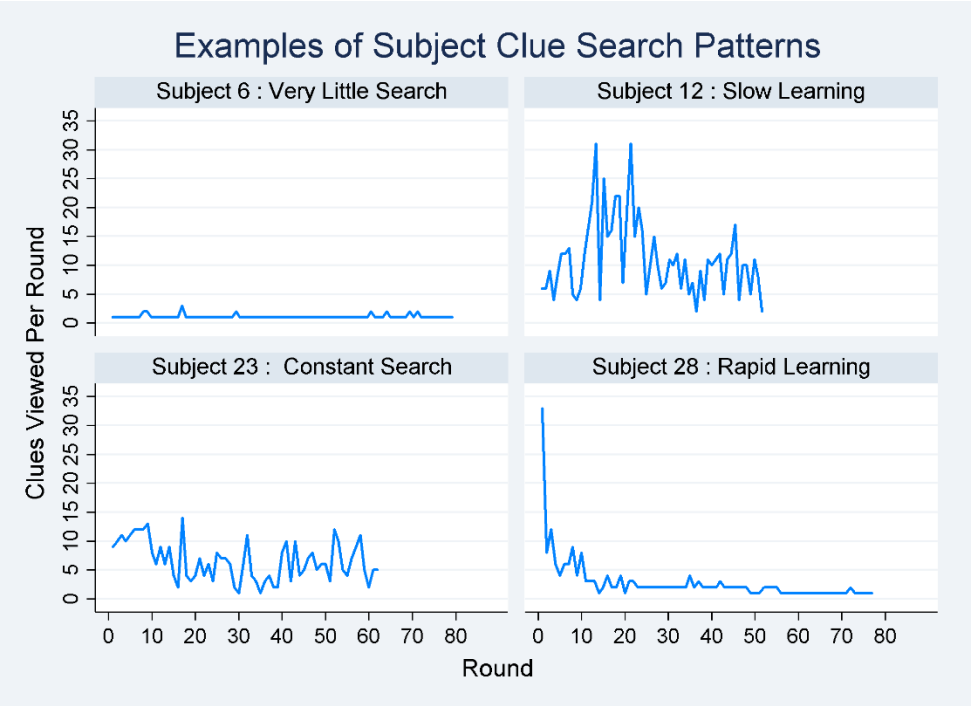


Figure 3.6: Four examples of search patterns

3.5.2 Time Allocation Strategies and Effect on Earnings

Subjects who spend longer searching for clues earn less than those subjects who devote less time to clue search. Figure 3.7 compares the average milliseconds spent

searching for information and solving tasks for High Earners and Low Earners[39]. Low earners spend significantly more time searching for clues than High earners (Kolmogorov-Smirnoff test, $D = -.4562$, $p = 0.056$). Although High earners spend on average 38 more seconds *solving* tasks per round than do Low earners, this difference is not statistically significant[40].

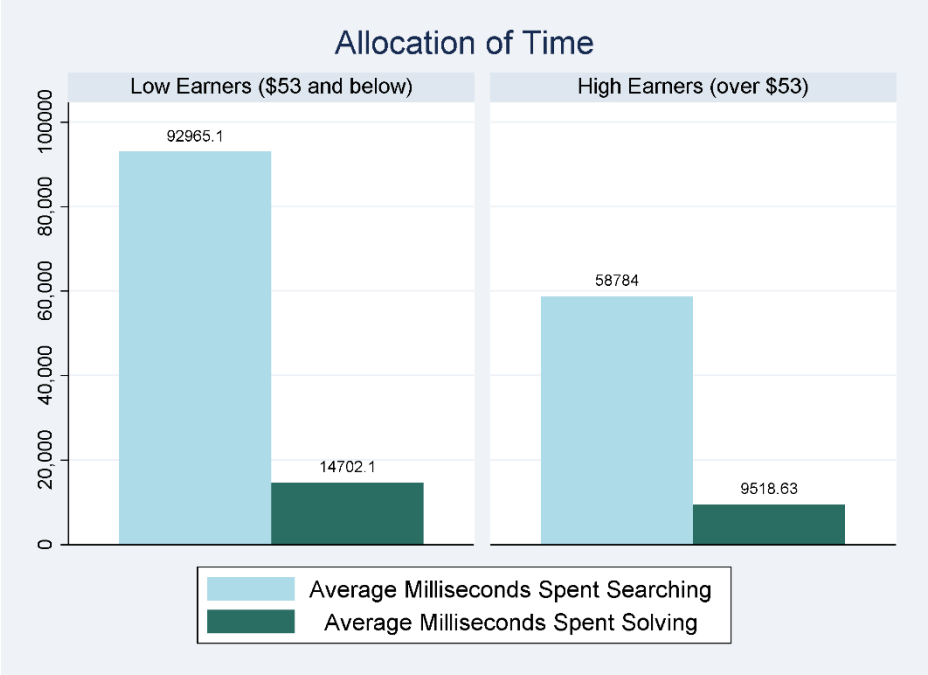


Figure 3.7: Differences in Allocation of Time Between High and Low Earners

Result 2: *Subjects with* $\alpha_M \gg \alpha_E$ *or* $\alpha_M \ll \alpha_E$ *search significantly longer than subjects for which* $\alpha_M = \alpha_E$.

Subjects who have a lower probability of error for one type of task, spend more

[39] We define "High" earners as those subjects who have earned greater than the median level of earnings. "Low" earners are those subjects earning at or below the median. The median level of earnings in Sessions 1 and 2 was $53.
[40] Kolmogorov-Smirnoff test, p-value=0.192

time on average searching for information about each task[41]. This suggests subjects who have a strong preference for one task over the other spend more time searching for that particular task. This additional time spent searching prevents these subjects from attempting more task rounds which ultimately lowers their earnings. Subjects with $\alpha_M = \alpha_E$ complete on average 72 rounds, whereas subjects for which $\alpha_M \neq \alpha_E$ complete only 48 rounds on average.

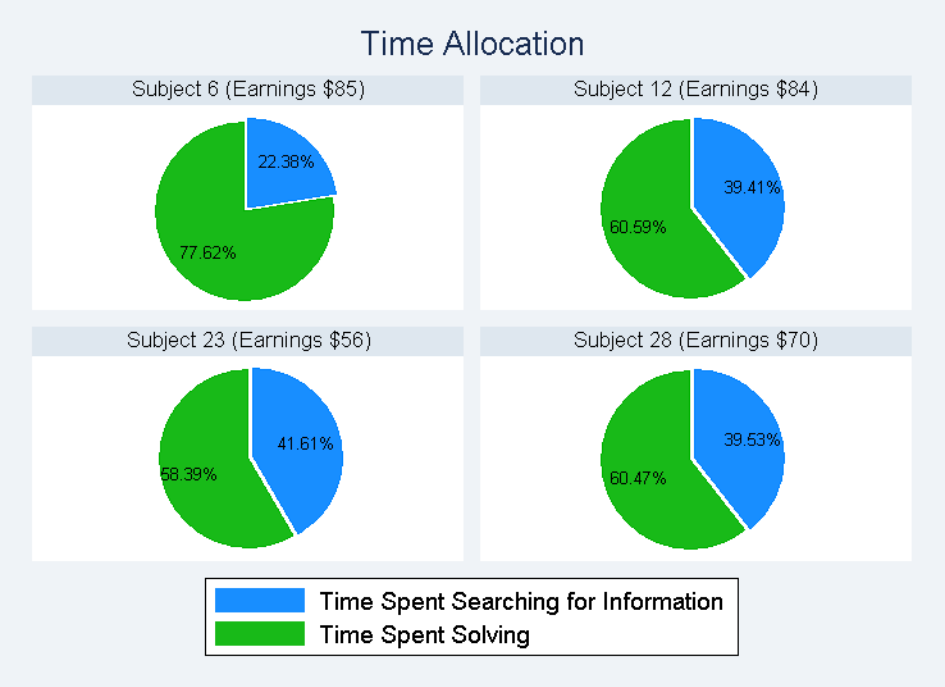


Figure 3.8: Time Allocation

In order to highlight the differences between subject types, we have collected four example subjects in Figure 3.8 to showcase how our four example subjects allocate their time between information search and solving. Subject 6 spent only 23% of their time searching for clues and subsequently earned $85. Looking back at Figure 3.6 we

[41] Mann-Whitney test, z = -2.158, p = 0.0310.

can see that Subject 6 viewed very few clues (1 clue viewed per round on average). Contrast this with Subject 23 who spent 42% of their time searching for information, almost double that of Subject 6, and subsequently earned only $28, approximately one third of that of Subject 6. Again, looking back at Figure 3.6 we can see that Subject 23 viewed 7 clues per round on average. Furthermore, Subject 23 spent more time in the "search" phase than did Subject 6 and took longer to form a decision. Although the probability of error appears to have a significant effect on earnings we can see from Table 3.2 that neither of the $\{\alpha_M, \alpha_E\}$ coefficients have a significant effect on earnings. However, we can see that the β-coefficients on the uncertainty measures are negative and significant. This implies that having increased uncertainty about the state of the system (i.e. which task was the math task and which was the word scrambles task) decreases subjects' earnings. We address the role of uncertainty further in Section 3.5.3.

Subjects who spend longer searching for information are searching for a particular category of task. Figure 3.9 shows the task allocation ratios for four sample subjects. Recall from Figure 3.8 that Subject 23 allocated approximately 20% more time to searching for information than did Subject 6. Looking now at Figure 3.9 we can see that Subject 23 chose Math tasks approximately 95% of the time, whereas Subject 6 appears to be almost indifferent between math and word scrambles tasks. This pattern suggests that Subject 23, and those other subjects spending a majority of their time on search, are searching for a particular task.

Table 3.2: Determinants of Earnings

VARIABLES	**Earnings**
RatioMath	-95.06
	(59.08)
α_M	-10.85
	(8.824)
α_E	11.11
	(8.839)
β_1	-0.00923*
	(0.00443)
β_2	-0.141*
	(0.0780)
Time Spent Solving	0.000151**
	(.0000708)
Time Spent Searching	.0000447
	(.0000595)
Constant	27.43
	(42.79)
Observations	26
R-squared	0.558

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Table 3.3 reports regressions of total time spent searching on probability of error for math and word scrambles and uncertainty measures for two groups: those subjects who chose tasks in equal proportion ("50-50") and those who chose one task predominantly over the other ("High Ratio"). Again we can see that although subjects choosing one task in higher proportion to the other task have higher α-values, neither α coefficient has a statistically significant effect on search time. However, both β-coefficients have a statistically significant effect on search time.

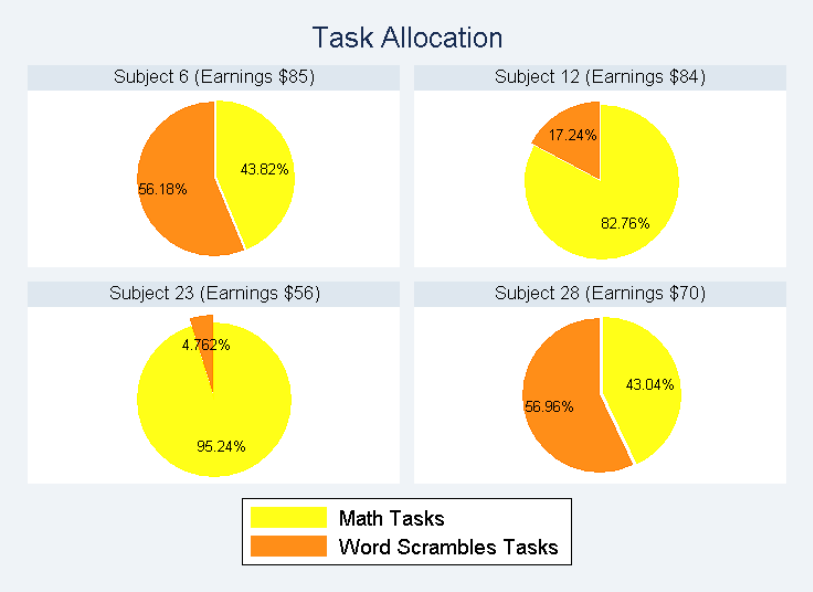


Figure 3.9: Task Allocation

Table 3.3: Determinants of Search Time

VARIABLES	(1) **50-50 Ratio Time Search**	(2) **High Ratio Time Search**
α_M	34,884	-3,732
	(46,361)	(4,806)
α_E	-15,060	2,110
	(42,787)	(4,831)
β_1	-730.0**	57.23***
	(205.8)	(12.97)
β_2	-4,086**	1,894***
	(1,341)	(436.8)
Constant	136,351***	213,472***
	(26,920)	(14,116)
Observations	10	16
R-squared	0.757	0.648

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Uncertainty seems to have a negative effect on time spent searching for individuals who choose math and word scrambles tasks in equal proportion. However,

we see the exact opposite effect in the High Ratio group: higher values of β lead to an increase in total search time. The differential effect that uncertainty seems to have on different populations could arise from three possible explanations. First, it could be that agents are not Bayesian updaters as we have assumed. Second, the assumption that increasing information gathered does not increase uncertainty could also be wrong. It could easily be the case that for some individuals collecting more information may lead to increase in confusion or "information overload". These types of individuals may purposefully limit the amount of information that they gather in order to reduce their uncertainty about a decision. This leads to a third possible explanation: rational inattention. It has suggested that individual limits in information-processing capacity can lead to a decrease in the amount of information sought out by individuals (Sims, 2000). All three of these possible explanations are ripe areas for future research in information search studies.

3.5.3 Role of Uncertainty

Given the small role that probability of error plays in search behavior, we now turn our attention to the role that uncertainty plays in the decision process. We posited that individuals' need to reduce uncertainty would drive information search.

Result 3: *Subjects who place a higher value on reducing uncertainty (i.e. have high values of* $\boldsymbol{\beta}$*) search longer and view more information before making a decision than those subjects who place a lower value on reducing uncertainty*[42].

[42] We define "low" values of β as those which value at or below the median value of either β-coefficient. Likewise, "high" values of β are those which are greater than the median value.

We find that subjects with high β-values search significantly longer than those who have low β-values[43]. The regression results presented in Table 3.3 show that uncertainty has significant, albeit opposite, effects on behavior for different groups. In order to explore what might explain this effect, we ran the same regression of search time for two groups of subjects: those with Low uncertainty values and those with High uncertainty values. As can be seen in Table 3.4 subjects with Low uncertainty values, an increase in the desire to lower uncertainty paradoxically leads to a decrease in search time. By contrast, the coefficient on β_1 for Low types is negative and significant, whereas the coefficient on β_2 is positive, but not significant. The coefficient on α_M is positive and significant for Low types, implying that those low-uncertainty types who also have a higher probability of error for math will spend more time searching for information. Subjects who feel that they cannot perform math tasks as well as word scrambles tasks will take time to find the word scrambles task. However, the regression results suggest that they will not take *extra* time to lower their uncertainty. However for High types we see that both β-coefficients are positive and significant meaning that an increase in the desire to lower uncertainty leads to an increase in search time.

We are also interested in exploring any effects uncertainty might have on High Earner types and Low Earner types. Table 3.5 shows results from a regression of search time within two groups of subjects: High Earners and Low Earners. The β-coefficients on the uncertainty function are both positive and significant for Low Earner types. This

[43] Mann-Whitney test, z = -2.797, p=0.0052.

leads us to conclude that individuals for whom uncertainty is a factor in decision-making spend a longer time searching in order to satisfy their need to raise certainty.

Table 3.4: Determinants of Search Time for High and Low Uncertainty-Value Types

VARIABLES	**(1) Low Uncertainty Time Searching**	**(2) High Uncertainty Time Searching**
α_M	14,259*	-6,015
	(4,829)	(4,919)
α_E	-196.7	4,582
	(6,746)	(4,917)
β_1	-37,031**	51.44***
	(9,930)	(14.14)
β_2	30,817	997.1***
	(38,575)	(217.7)
Constant	146,339	224,611***
	(98,410)	(14,843)
Observations	8	18
R-squared	0.956	0.540

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Looking now at the differences between Female and Male subjects we see that while there are no significant differences in earnings[44], there are significant differences in uncertainty[45] and consequently search behavior. Table 3.6 shows the results of a regression of search time for Female and Males subjects on probability of error for math and word scrambles as well as the uncertainty measures.

[44] Mann-Whitney test, z = -1.483, p = 1380.
[45] Mann-Whitney test, z = 2.403, p =0163.

Table 3.5: Differences in Search Activity between High and Low Earners

VARIABLES	(1) **High Earner** **Time Searching**	(2) **Low Earner** **Time Searching**
α_M	-14,603	-5,453
	(9,898)	(8,295)
α_E	15,830	3,709
	(13,993)	(7,875)
β_1	13.34	64.47**
	(78.62)	(26.24)
β_2	-5,657	1,209***
	(15,165)	(322.3)
Constant	215,146***	208,238***
	(35,564)	(19,774)
Observations	10	16
R-squared	0.407	0.518

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.6: Differences in Search Time between Females and Males

VARIABLES	(1) **Female** **Time Searching**	(2) **Male** **Time Searching**
α_M	-5,957	-1,448
	(7,715)	(9,037)
α_E	4,472	372.5
	(7,436)	(9,495)
β_1	53.40**	45.24
	(21.74)	(38.20)
β_2	949.1*	2,507**
	(451.7)	(784.6)
Constant	221,557***	177,590***
	(15,218)	(14,202)
Observations	16	10
R-squared	0.410	0.766

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

While there are no significant differences in earnings between male and female subjects, we do find significant differences in search patterns and uncertainty measures. First, females spend approximately 20 seconds more per round searching for information than do males, a statistically significant difference[46]. Looking at the regression results of Table 3.6 we can see that both β-coefficients are positive and significant for females, whereas only β_2 is significant for males. It would appear that male subjects, on average, tolerate higher levels of uncertainty than do female subjects.

3.5.4 Does Type of Uncertainty Matter ?

What is even more interesting is that the type of uncertainty measure that is significant differs for males and females. Females place value on reducing both Shannon entropy (β_1) and absolute entropy (β_2), whereas males place value only on reducing absolute entropy. Overall, those subjects with higher values of Shannon entropy (β_1) search significantly[47] longer than those subjects with low values of β_1 whereas there are no significant differences in search time between subjects with high and low values of absolute entropy (β_2)[48]. Do female subjects truly have a stronger preference for reducing uncertainty than males? Evidence on gender differences in ambiguity aversion is mixed, with some studies finding that women are more ambiguity averse than men (Schubert et. al, 1999; Powell and Ansic, 1997) and some finding no gender difference (Borghans, et. al, 2009). As we are the first study to incorporate entropy measures of uncertainty into an information search study, we are unsure as to

[46] Mann-Whitney test, z = 1.905, p=0.0568 and Kolmogrov-Smirnoff test, D = -0.4278, p= 0.087
[47] Mann-Whitney test, z = -3.017, p = 0.0026
[48] Mann-Whitney test z = -1.083, p = 0.2790.

what conclusions, if any, we can draw from this particular subject sample and leave it to future studies to validate this particular finding.

3.6 Conclusion

We conduct an experiment using the Prometheus mobile app in order to assess individuals' search behavior patterns. In contrast to previous experiments on search behavior, which focus on abstract search environments, we utilize the dynamic nature of the Prometheus app to test subject behavior in an environment that more closely mimics real world search environments. An advantage of using Prometheus is that it can generate large amounts of data using fewer subjects than conventional methods of experimental data collection. Our small sample of 29 subjects generated over 7500 pieces of click data, or an average of 259 observations per subject. We find that in contradiction to prescriptive "optimal" policies, some subjects spend a disproportionate amount of time searching for information. When viewed through the traditional lens of dynamic programming, this behavior seems irrational. However, through our method of Inverse Optimal Stochastic Planning we are able to identify each subjects' objective function which sheds light on their seemingly "irrational" behavior. We conclude that subjects' so-called deviant behavior can be attributed to a rational optimization process of this objective function. The model we present in this paper is merely a "base case" and further work should focus on extending the model to accommodate more realistic assumptions about human behavior. One possible extension should include quasi- or pseudo-Bayesian updating of beliefs. Another important extension should include expanding the choice set from two alternatives to many more choice alternatives. A

third extension would be to add more measures of uncertainty, as well as test different measures. Our hope is that IOSP can illuminate how the brain solves certain problems and thus provide predictions of behavior in *new* environments.

3.7 Acknowledgement

Chapter 3, in full, is currently being prepared for submission for publication of the material. Sanchez, Alison; Coleman, Todd. The dissertation author was the primary investigator and author of this material.

3.8 Appendix

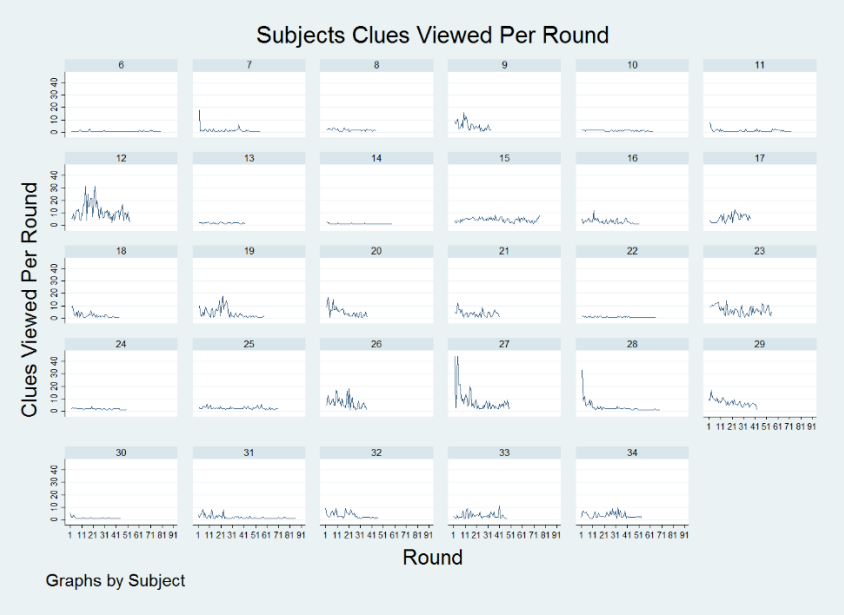


Figure 3.10: Sessions 1 and 2 Clues Viewed Per Round

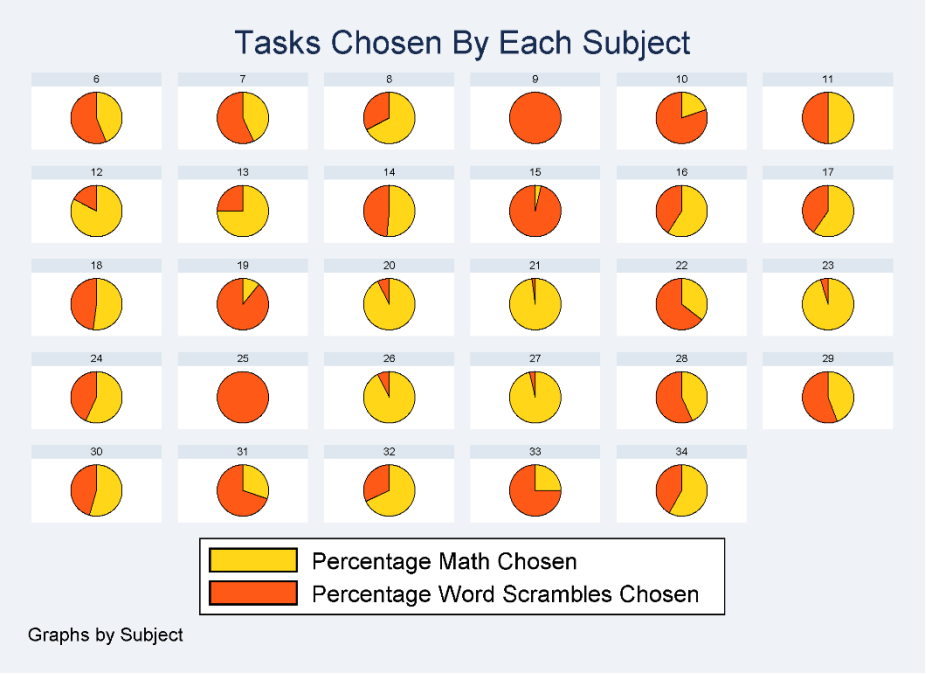


Figure 3.11: Tasks Chosen By Each Subject in Sessions 1 and 2

Below is the survey participants filled out after the experiment.

Participant Number: _____

Type of device used : Smartphone _____ OR Tablet _____ OR Laptop _____

Please answer the following questions to the best of your ability. If you do not wish to answer a particular question, leave that question blank.

1. Do you read left to right _____ or right to left _____ ?
    a. What order to you search the tasks for clues ?
        i. Random Order ? _____
        ii. Left to Right (Start with Task 1 and move right) ? _____
        iii. Right to left (Start with Task 6 and move left) ? _____
2. What is your parents' annual income ? _____
3. What is your parents' occupation :
    a. Mother _____
    b. Father _____
4. What is your major ? _____
5. What is your minor ? _____
   If you do not have a minor, write "no minor"
6. What is your current GPA :
    a. Overall GPA ? _____
    b. Major GPA ? _____
       If you do not know your major GPA, you write "IDK" or you can give an estimate and write "Estimate = x ".
7. What was your GPA when you graduated high school ? _____
8. What percentage of your high school graduating class now attends a 4-year college? ___
9. What other universities were you accepted to ?
   _____
   _____
10. Are you the first in your family to attend a 4-year university? _____
11. SAT or ACT scores:
    a. SAT scores:
        i. Math _____
        ii. Writing _____
        iii. Reading _____
    b. Or, if you took the ACT:
        i. _____
           _____
12. What is your gender (how do you identify) ? _____

What did you think of the test questions we gave you today:

13. If you answered any Word Scrambles questions, were they:

Too Easy — Easy — Neither Easy nor Hard — Hard — Too Hard

14. If you answered any Math questions, were they :

Too Easy — Easy — Neither Easy nor Hard — Hard — Too Hard

15. If you answered any Sentence Completion questions, were they :

Too Easy — Easy — Neither Easy nor Hard — Hard — Too Hard

17. How do you think you did compared to other students :

Much Worse — Worse — About the Same — Better — Much Better

18. What percentage of your time do you spend on your:
    a. Laptop _____
    b. Tablet _____
    c. Phone _____

19. What type of information or "clues" would you have liked to have seen today ? List and explain.

Survey continued on next page ----->

Do you agree with the following statements :

20. I care about what my friends & family think of me. :

Strongly Disagree Disagree Neither Disagree nor Agree Agree Strongly Agree

21. I care about what people other than my friends & family think of me. :

Strongly Disagree Disagree Neither Disagree nor Agree Agree Strongly Agree

22. Please tell us about any strategies that you used today to make money:

23. Other comments:

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