The Role of Pre-play Learning in Understanding and Eliminating the Preference Reversal Phenomenon

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Abstract

The preference reversal phenomenon is an iconic empirical puzzle in decision theory: inconsistent preference rankings for and pricing of a low-payoff, high-probability lottery and a high-payoff, low-probability lottery. The preference reversal phenomenon has long challenged standard economic theory. We test whether pre-play learning removes preference reversals. Pre-play learning denotes ex-ante lottery learning, where subjects observe playing lotteries before making decisions. In our experiment, we find that, with pre-play learning, subjects indicate minimum willingness to sell prices for lotteries consistent with their choices, suggesting that pre-play learning removes preference reversals.

Key words: pre-play learning, preference reversal, BDM mechanism

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Introduction

The preference reversal phenomenon is an iconic empirical puzzle in decision theory. The preference reversal phenomenon means inconsistent preference rankings for and pricing of, low-payoff, high-probability and high-payoff, low-probability lotteries. The preference reversal phenomenon has received much attention from economists and psychologists because it challenges standard expected utility theory (Lichtenstein and Slovic, 2006). Standard economic theory predicts consistent preference rankings for the choices between and the pricing of lotteries, but that prediction is contradicted by the preference reversal phenomenon. Preference reversals have a predictable pattern which cannot be explained simply by error or noise. The pattern has been confirmed in many studies (Seidl, 2002). Thus, researchers have proposed explanations of why preference reversals occur and developed new preference theories to accommodate preference reversals. The last four decades of research are reviewed in Slovic and Lichtenstein (1983), Tversky and Thaler (1990) and Cox (2008). There is a large volume of literature attempting to explain preference reversals, but few attempts to understand conditions under which preference reversals disappear.

Our study shows that pre-play learning effectively removes preference reversals. We operationalize pre-play learning as ex-ante lottery learning, where subjects observe a series of lotteries actually played out before making decisions. We add pre-play learning to Grether and Plott’s (1979) experimental design and test whether pre-play learning removes preference reversals. We find that it does.

We are not aware that pre-play learning has received any attention in the literature. For example, the lack of pre-play learning is not one of the four main causes of preference reversals in Seidl's (2002) review. The four main causes listed in the review are lack of incentive compatibility in elicitation modes (e.g., Holt, 1986), intransitive preferences (Loomes and Sugden, 1983), overpricing and underpricing of lotteries (Tversky et al. 1990), and nonlinear probabilities (Rachlin et al. 1991). Later researchers' attention has been drawn to other directions than pre-play learning: imprecise preferences (Butler and Loomes, 2007) and salience (Bordalo et al. 2012).

The preference reversal phenomenon has been conjectured to be "a product of inexperience and lack of motivation" (p.231) in Plott's (1996) preference discovery hypothesis. Plott hypothesized that learning about one's own preferences and decision environments through "repeated choices, practice, incentives (feedback)" and "sobering and refocusing experiences" (p.227) allows one to reach rational choices. Braga and Starmer (2005) reviewed empirical works on the preference reversal phenomenon and speculated that learning one's own preferences and understanding decision environments could remove preference reversals.

Research on issues other than preference reversals has shown that learning promotes subjects' choices under risk consistent with standard expected utility theory (van de Kuilen and Wakker, 2006). They found that lottery feedback decreases the common ratio effect inconsistent with standard economic theory.[1] Myagkov and Plott (1997) found that risk aversion in gains combined with risk-seeking in losses seemed to disappear with experience, leading to choices more consistent with expected utility theory. In another example, trading experience removed the endowment effect (List, 2004; Engelmann and

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[1] The common ratio effect or Allais Paradox (Allais, 1953) refers to the following set of inconsistent lottery choices: first, subjects are asked to choose between a sure thing and a lottery with a higher expected value. Subjects typically choose the sure thing. However, if the same amount is reduced from all outcomes, more subjects choose the riskier outcome, which is inconsistent with expected utility theory.

Hollard, 2010). Learning about a complicated elicitation method through detailed instructions and practice rounds removed the disparity between willingness-to-pay and willingness-to-accept (Plott and Zeiler, 2005). Together, these pieces of evidence allow us to predict that pre-play learning will mitigate or remove preference reversals.[2]

There is empirical evidence suggesting that one learning mechanism, lottery feedback, does play a limited role in removing a preference reversal pattern typically observed in the literature. Feedback is a different learning process from pre-play learning. Feedback allows subjects to observe realized lottery outcomes round-by-round after each of their decisions. The preference reversal phenomenon is more likely to be observed in the behavior of subjects choosing a low-payoff, high-probability lottery than in those choosing a high-payoff, low-probability lottery. With repeated decisions and lottery feedback after each decision, this form of preference reversal can be eliminated (Cox and Grether, 1996).

Unfortunately, the lottery feedback effect is limited. Braga et al. (2009) found that lottery feedback removed this type of preference reversal in the first few rounds, but created another form of preference reversal in later rounds. The new preference reversal pattern is a mirror image of the original preference reversal pattern: inconsistent preference rankings become more likely to be observed in subjects choosing a high-payoff, low-probability lottery than in those choosing a low-payoff, high-probability lottery. From what we can tell from the literature, the effects of pre-play learning on the preference reversal phenomenon have not been examined.

Pre-play learning differs from lottery feedback in that pre-play learning occurs before any decision is made. Pre-play learning allows subjects to observe a set of lottery outcomes

[2] For a review of how learning influences lottery choices, see Hertwig and Erev (2009).

before any decision is made. In contrast, lottery feedback occurs after each decision. Thus, the outcome of the latest lottery can affect decisions on each successive lottery (Braga et al. 2009). Moreover, lottery feedback describes a repeated set of decisions. In our study, pre-play learning occurs before a single pair of decisions is made. These two experiments are different from a decision-theoretic perspective. When a sequence of lotteries is played, the set of decisions may be properly analyzed as if it were a portfolio of lotteries, in contrast to a decision about a single pair of lotteries. The preference reversal phenomenon usually refers to a single pair of decisions about choice and pricing.

To test the effect of pre-play learning on preference reversals, we add pre-play learning to Grether and Plott's (1979) experiment. We replicate their experimental design and instructions, both because their experiment carefully controls for potential concerns in other researchers' previous preference-reversal experiments, such as strategic responses and subject confusion (e.g., Lichtenstein and Slovic, 1971), and also because their experiment was the prototype for subsequent studies. In our experiment, we use only one pair of lotteries selected from the Grether and Plott experiment. Subjects participate in a pre-play learning exercise before making decisions in choice and pricing tasks. We demonstrate, in front of the subjects, how the outcome of each lottery will be determined, by spinning a bingo cage and drawing a ball (with replacement) twenty times (ten times for each lottery) and we ask them to keep a record of the outcomes. As in Grether and Plott, we use the BDM mechanism (Becker, DeGroot and Marschak, 1964)[3] to elicit minimum willingness to sell prices for lotteries. As we will show later, we find that, with pre-play learning, subjects'

[3] In the BDM mechanism, a subject is asked to name the lowest price between $0.00 and $9.99 at which he or she would be willing to sell a lottery. Each subject's named selling price is then compared with a price between $0.00 and $9.99, drawn randomly. If the subject's named selling price is lower than or equal to the randomly selected price, he or she sells the lottery and receives the randomly selected price. If the subject's named selling price is higher than the randomly selected price, the lottery is played.

distributions of minimum selling prices for lotteries become consistent with their choices, which implies consistent preference rankings between choice and pricing. Thus, pre-play learning virtually removes the preference reversal phenomenon.

Why does pre-play learning remove the preference reversal phenomenon? It might be because pre-play learning makes a non-linear probability weight function converge toward linearity, especially in the high probability range. Our conjecture is empirically supported by Hau et al. (2008) and van de Kuilen (2009). In their experiments, with lottery learning, elicited probability weight functions converged to linearity. This line of explanation also seems likely because the majority of people have non-linear probability weight functions in the absence of pre-play learning. Bruhin et al. (2010) found that, without pre-play learning, about 80% of subjects exhibited non-linear probability weight functions, while the rest exhibited a linear probability weight function.

Pre-play learning may remove preference reversals in such a way that subjects use consistent information processing when they decide selling prices for the p-bet and the $-bet. Grether and Plott (1979) found evidence that different information processing for the p-bet and the $-bet would lead to preference reversals. In other words, without pre-play learning, subjects may focus on the probability of winning in the p-bet whereas they may focus on dollars in the $-bet when they price the bets. If pre-play learning makes subjects focus on potential winnings in the p-bet and if the larger weight on winnings increases the perceived value of the p-bet, subjects' selling prices for the p-bet would increase with pre-play learning. This explanation is consistent with our results.

Pre-play learning may also remove preference reversals in such a way that subjects' attention is drawn to the same attribute when considering the p-bet and the $-bet. In

Bordalo et al.'s (2012) salience model, without pre-play learning, subjects' attention is drawn to potential loses in the p-bet, but to potential winnings in the $-bet when they price the bets. If pre-play learning makes subjects' attention switch to potential winnings in the p-bet, subjects' selling prices for the p-bet would increase with pre-play learning. This explanation is also consistent with our results. These lines of explanation require further research.

Experiment

Our experiment replicated Grether and Plott's (1979) experimental design and instructions, except for the number of lottery pairs: we used only one pair of lotteries rather than six. The lotteries used in our experiment were a low-payoff, high-probability lottery with a 35/36 chance of winning $4 and a 1/36 chance of losing $1 (Expected value=$3.86), and a high-payoff, low-probability lottery with an 11/36 chance of winning $16 and a 25/36 chance of losing $1.50 (Expected value=$3.85). Following previous studies, we call the lotteries a p-bet and a $-bet, respectively. In keeping with Grether and Plott's experiment, in our experiment subjects participated in one choice task and two pricing tasks. In the choice task, subjects were asked to choose between two lotteries. In pricing tasks, subjects were asked to determine a minimum price for which they were willing to sell each lottery. These selling prices for lotteries were elicited using the BDM mechanism. At the end of the experiment, subjects were compensated for one of those three tasks. If subjects were compensated for a pricing task, one of the possible BDM prices was randomly selected for subjects' compensation.[4] (See footnote 3 for an explanation of how the price was selected).

[4] To decide which task subjects were compensated for, we put three balls numbered one through three into a bingo cage and drew one ball. If a choice task was chosen for subjects' compensation, we put 36 balls, with replacement, into the bingo cage and drew one ball for each lottery. If a pricing task was chosen for subjects' compensation, we put ten balls numbered zero through nine into the bingo cage and drew one ball, with replacement, three times, generating a random price for the BDM method. For subjects who kept a lottery in the pricing task, we put 36 balls into the bingo cage and drew one ball to determine the lottery outcome.

A bingo cage with 36 balls was used to determine lottery outcomes. Experimental instructions are available in the Appendices B and C.

We repeated our experiment with a simplified version of the BDM mechanism, because subjects tend to be confused about the BDM mechanism and may not report their true values (Cason and Plott, 2014). To avoid subjects' confusion about the BDM mechanism, detailed instructions and repeated practice of the BDM mechanism are required (Plott and Zeiler, 2005). The original instructions of Grether and Plott (1979) on the BDM mechanism were not sufficiently detailed to remove subjects' confusion. To improve subjects' understanding of and ability to report minimum willingness to sell prices by means of the BDM mechanism, as well as maintain the original experimental setting of Grether and Plott, we employed a modified BDM mechanism which uses a multiple-price-list format. This kind of elicitation method has been widely used in other studies (e.g., Kahneman et al. 1990; Butler and Loomes, 2007; Loomes et al. 2010).

In this version of our experiment, subjects were asked whether they would sell or play a lottery at each of a set of varying prices. Then, one price was randomly selected and subjects' recorded decisions at the randomly selected price were implemented. If a subject had indicated a willingness to sell the lottery at that price, he or she sold the lottery and received the randomly selected price. If a subject had indicated a preference to keep the lottery at the randomly selected price, the lottery was played. The possible prices, between $9.99 and $0, were displayed in decreasing order, in $.50 decrements. For the purpose of analyzing our results, if a subject indicated a willingness to sell a lottery for $X but not for $X-$0.50, we used the midpoint ($X-$0.25) as the subject's lowest named selling price.

There were four groups of subjects in our experiment. Two groups were treatment groups, with pre-play learning, while the other two groups were control groups, without pre-play learning. Both the treatment and the control group experiments were conducted using the original BDM mechanism and the BDM mechanism with a multiple-price-list format. In treatment groups, subjects participated in a pre-play learning exercise before making any decisions in choice and pricing tasks. In the pre-play learning treatments, we demonstrated each of the lotteries ten times by drawing one of 36 balls from a bingo cage (with replacement each time), and subjects kept a record of the outcomes.[5] In each of the four sets of experiments, we controlled for possible order effects by switching the order of tasks: (pricing tasks)-(choice task) and (choice task)-(pricing tasks).[6]

All sessions were conducted in a lab on a university campus in 2015. Each session lasted 30 minutes and was conducted using paper and pencil. We recruited 167 students. Subjects earned a show-up fee of $10 and the additional earnings (or losses) from their decisions. In treatment and control groups using the BDM mechanism with a multiple-price-list format, there were nine subjects who indicated more than one switching point or who indicated unusual choices of keeping a lottery at high prices and selling it at low prices. We included responses of those subjects in our analysis by using a first switching point in the case of multiple switching points, and using a maximum price of $9.99 in the case of an unusual choice pattern. We also ran the data analysis without the responses of the nine subjects. Excluding those data does not change the general findings in our analysis.

Results

[5] Note that subjects were provided information about the lotteries, such as payoffs and probabilities, prior to pre-play learning. In contrast, in some psychology studies (e.g., Hertwig et al. 2004), subjects made decisions without having any specific information about the lotteries; subjects only had opportunities to draw samples from unknown lotteries.

[6] In detail, the orders of tasks for treatment groups were (pre-play learning for the $-bet)-(pricing task for the $-bet)-(pre-play learning for the p-bet)-(pricing task for the p-bet)-(choice task) and (pre-play learning for the p-bet and the $-bet)-(choice task)-(pricing tasks for the p-bet and the $-bet). The control groups did not experience pre-play learning. We did not find evidence of order effects.

Table 1 presents the effects of pre-play learning on subjects' preference rankings for lotteries, expressed as choices and minimum willingness to sell prices. In particular, we compare the average minimum willingness to sell prices for lotteries with subjects' choices between the p-bet and the $-bet.

Panel (a) reports mean minimum willingness to sell prices for lotteries elicited using the original BDM method. Recall that the p-bet denotes a low-payoff, high-probability lottery, and the $-bet denotes a high-payoff, low-probability lottery. Likewise, a p-bid denotes a minimum willingness to sell price for the p-bet and a $-bid denotes a minimum willingness to sell price for the $-bet. In columns (1) and (2) (with pre-play learning), subjects choosing the p-bet assign higher minimum willingness to sell prices to the p-bet ($5.42) than to the $-bet ($4.04), a result which is weakly supported in a one-sided t-test (p-value: 0.09). In contrast, in columns (6) and (7) (without pre-play learning), subjects choosing the p-bet assign similar minimum willingness to sell prices to the p-bet ($3.57) and the $-bet ($4.02), a result which is supported by a one-sided Wilcoxon rank-sum test and a t-test (p-values: 0.81 and 0.73, respectively). With and without pre-play learning, subjects choosing the $-bet consistently assign significantly higher minimum willingness to sell prices to the $-bet. These results show that, using the original BDM mechanism and pre-play learning, the choice and pricing preference rankings of subjects choosing the p-bet are weakly consistent. Thus, the results summarized in panel (a) of Table 1 (where the original BDM mechanism is used) provide weak support for the statement that pre-play learning eliminates the preference reversal phenomenon.

This result becomes stronger in panel (b), where minimum willingness to sell prices are elicited using the BDM method with a multiple-price-list format. In columns (1) and (2) (with pre-play learning), on average, subjects choosing the p-bet valued the p-bet higher than the $-bet (p-bid=$5.16, $-bid=$4.41), a result which is supported by both a one-sided Wilcoxon rank-sum test and a t-test (p-values: 0.02 and 0.03, respectively). In contrast, in columns (6) and (7) (without pre-play learning), subjects choosing the p-bet valued the p-bet and the $-bet similarly (p-bid= $3.94, $-bid=$4.26), a result supported by the same two tests (p-values: 0.76 and 0.74, respectively). As in panel (a), subjects choosing the $-bet valued the $-bet significantly higher than the p-bet, with and without pre-play learning. Collectively, these results strongly suggest that, with pre-play learning and the more-understandable BDM mechanism, subjects express consistent preference rankings between choice and pricing. Thus, pre-play learning, combined with the BDM mechanism with a multiple-price-list format, virtually eliminates the preference reversal phenomenon.[7]

TABLE 1 HERE

Another way of testing the consistency of preference rankings between choice and pricing is to compare preference rankings between choice and pricing directly at the individual level. Table 2 classifies subjects in terms of their lottery choices and minimum willingness to sell prices (here after “selling prices”). Selling prices were elicited using the original BDM method in panel (a) and the BDM method with a multiple-price-list format in panel (b). In the first row of the left half of panel (a) (with pre-play learning), using the original BDM method, 18 subjects chose the p-bet and valued the p-bet higher than the $-bet. 15 subjects chose the p-bet, but valued the $-bet higher than the p-bet. Four subjects chose the p-bet, but valued the p-bet and the $-bet equally. In these cases, with pre-play learning,

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[7] Bostic et al. (1990) presented subjects with a series of gamble choices and also asked them to choose between a gamble and a certain amount of money over a series of questions. The money amount was gradually adjusted in a way to reach a point where subjects feel indifferent between a gamble and money. Their pricing method was similar to the BDM method with a multiple price list format. The authors found that their method decreased (but did not eliminate) the proportion of subjects showing preference reversals. Thus, the direction of their result is consistent with our result, but their experimental design is quite different from the standard preference reversal study, as in Grether and Plott (1979).

18 subjects had consistent preference rankings between choice and pricing, whereas between 15 and 19 subjects had inconsistent preference rankings.

Similarly, in the second row, also using pre-play learning and the original BDM method, one subject chose the $-bet, but valued the p-bet higher than the $-bet. Seven subjects chose the $-bet and valued the $-bet higher than the p-bet. In these cases, with pre-play learning and the original BDM mechanism, seven subjects choosing the $-bet had consistent rankings between choice and pricing and one subject had an inconsistent preference ranking. Thus, in the left half of panel (a) (pre-play learning and the original BDM mechanism), the proportion of inconsistent preference rankings of subjects who chose the p-bet is higher than that of subjects who chose the $-bet. This is the typical preference reversal pattern observed in other studies. We see a similar pattern in the other comparisons in the right halves of panels (a) (original BDM without-pre-play learning) and (b) (multiple-price-list BDM without pre-play learning). Thus, the original BDM mechanism does not fully eliminate the preference reversal phenomenon, even with pre-play learning. However, the left half of panel (b) (pre-play learning and the BDM with a multiple-list-format) does show near complete elimination of the preference reversal phenomenon.

We next conduct a test of the hypothesis that distributions of inconsistent preference rankings are the same between subjects who chose the p-bet and those who chose the $-bet. If those distributions are the same, the typical preference reversal pattern is no longer present, and inconsistent preference rankings may be interpreted as a consequence of error and noise. Note that we do not include subjects who chose an indifferent option between the p-bet and the $-bet in the test, due to the small number of observations. In panel (a), columns (1)-(3) (with pre-play learning and the original BDM mechanism), inconsistent preference rankings are asymmetric between subjects who chose the p-bet and those who chose the $-bet, a result which is supported by a two-sided Wilcoxon rank-sum test (p-value: 0.05). In columns (4)-(6) (without pre-play learning and the original BDM mechanism), inconsistent preference ranks are also asymmetric (p-value: 0.02).

These asymmetric patterns disappear with pre-play learning, when selling prices are elicited using the BDM mechanism with a multiple-price-list format. This result is shown in columns (1)-(3) of panel (b), supported by the Wilcoxon rank-sum test (p-value: 0.27). In contrast, in columns (4)-(6) (the multiple-price-list BDM mechanism without pre-play learning), inconsistent preference rankings are asymmetric between subjects choosing the p-bet and those choosing the $-bet (p-value<0.01). These results indicate that the typical preference reversal pattern is removed with pre-play learning and the multiple-price-list BDM mechanism, which we think provides subjects with a better understanding of the BDM mechanism.

TABLE 2 HERE

We next examine how pre-play learning changes subjects' selling prices for the p-bet and the $-bet in Table 3. Columns (1) and (2) report mean selling prices elicited by the original BDM mechanism. Pre-play learning increases selling prices for the p-bet from $3.64 to $5.25, a result which is supported by both a Wilcoxon rank-sum test and a two-sample t-test (p-values: 0.01 and 0.06, respectively). This result is shown in column (5). On the other hand, pre-play learning with the original BDM mechanism does not change selling prices for the $-bet; $4.42 with pre-play learning and $4.78 without pre-play learning (p-values: 0.48 and 0.52, respectively). These pre-play learning effects are replicated when selling prices are elicited using the BDM method with a multiple price list. In columns (3) and (4), using the BDM with a multiple list price, pre-play learning increases selling prices for the p-bet but does not change selling prices for the $-bet.

Our results are consistent with Erev et al.'s (2010) finding that the effect of lottery learning on lottery choice is stronger when probabilities for higher payoffs in lotteries are very large or very small (in their case, larger than 0.8 or smaller than 0.2). Recall that the p-bet in our experiment has a very large probability (35/36) of a higher payoff, but the $-bet does not have very small probability (11/36) of a higher payoff, according to their criteria.

Pre-play learning equalizes selling prices for the p-bet and the $-bet. In column (1), with pre-play learning and the original BDM mechanism, selling prices are not statistically different. This result is supported by both the Wilcoxon signed-rank test and the paired sample t-test, as shown at the second to last row (p-values: 0.69 and 0.33, respectively). This is also true in column (3) with pre-play learning and the multiple-list-format (p-values: 0.95 and 0.92, respectively). In contrast, in columns (2) and (4) (without pre-play learning), selling prices are statistically significantly different (p-values of 0.03 and 0.04 / <0.01 and <0.01). Our results without pre-play learning are consistent with Grether and Plott (1979) in that the prices for the $-bet are greater than those for the p-bet.

TABLE 3 HERE

We next check whether pre-play learning affected subjects' lottery choices between the p-bet and the $-bet. Columns (1)-(3) of Table 4 report the number of subjects who chose the p-bet or the $-bet, or were "indifferent" between the two bets. The first two rows report subjects' choices in groups where selling prices were elicited using the original BDM mechanism. In the first row, with pre-play learning, 79% of the subjects chose the p-bet and 17% of them chose the $-bet, percentages which are statistically significantly different (p-value of Wilcoxon signed-rank test<0.01). In contrast, in the next row, without pre-play learning, 47% of subjects chose the p-bet and 51% of them chose the $-bet, percentages which are not statistically significantly different (p-value of 0.76). These results are replicated in the next two rows, which report subjects' choices when selling prices were elicited using the BDM mechanism with a multiple-price-list format. In the third row, with pre-play learning, 71% of subjects chose the p-bet, and 26% chose the $-bet, percentages which are statistically significantly different (p-value<0.01). In contrast, in the last row, without pre-play learning, 57% of subjects chose the p-bet, and 40% of them chose the $-bet, percentages which are not statistically significantly different (p-value of 0.30). Thus, these results indicate that pre-play learning increases the probability of choosing the p-bet over the $-bet. Perhaps pre-play learning simply shows subjects that they are likely to lose $1.50 if they play the $-bet and highly likely to win $4 if they choose the p-bet. Since the fact that most people buy insurance suggests that most people are risk averse, pre-play learning may help subjects express, in an experimental context, preferences toward risk that are consistent with the typical risk aversion associated with purchasing insurance.

TABLE 4 HERE

Discussion

We have shown that pre-play learning results in subjects naming minimum prices at which they are willing to sell lotteries consistent with their choices. Thus, pre-play learning virtually removes the preference reversal phenomenon, particularly when subjects have a better understanding of the BDM mechanism. We have also shown that pre-play learning has different effects on the p-bet and the $-bet: pre-play learning increases selling prices for the p-bet but does not change the prices for the $-bet. Pre-play learning, combined with a better understanding of the BDM mechanism, effectively equalizes minimum prices at which subjects are willing sell the two bets.

Why does pre-play learning remove preference reversals? Pre-play learning might make probability weight functions converge toward objective probabilities, especially in the high probability range. This hypothesis is empirically confirmed by Hau et al. (2008), Jessup et al. (2008) and van de Kuilen (2009). They found that lottery learning increased underweighted probabilities to their objective probabilities. This explanation seems probable because the majority of people appear to have non-linear probability weight functions in the absence of pre-play learning. Bruhin et al. (2010) found that, without pre-play learning, around 80% of subjects had inverse S-shaped probability weight functions, whereas the remainder had linear ones. The 80% of people with non-linear probability weight functions are likely to produce most of the preference reversals. There are theoretical explanations about preference reversals using non-linear subjective probabilities. Rachlin et al. (1991) demonstrated how non-linear hyperbolic subjective probabilities explain preference reversals. Bordalo et al. (2012) argued that the preference reversal phenomenon occurs because people pay more attention to salient lottery outcomes. In their salience theory, subjects pay more attention to potential losings when they price the p-bet but to potential winnings when they price the $-bet. Such asymmetric attention would lead to non-linear subjective probabilities and thus preference reversals. In this line of discussion, pre-play learning may remove preference reversals in such a way that subjects' attention switch from losings to winnings when they price the p-bet. In other words, pre-play learning may induce subjects to use different information processing for the p-bet.

With pre-play learning, subjects are provided lottery draws and descriptions of lotteries. In this decision environment, subjects may view lotteries from two different perspectives when they make decisions. If we follow Kahneman's (2011) fast and slow thinking, subjects' decisions with pre-play learning may be closer to slow thinking, whereas ones without pre-play learning may be closer to fast thinking. Slow thinking is an analytical and effortful decision-making process, including complex computations; whereas, fast thinking is an automatic and immediate decision-making process, which may rely on heuristics. If subjects' decisions with pre-play learning are indeed closer to slow thinking and if their decisions from slow thinking are more consistent with objective probabilities than decisions resulting from fast thinking, pre-play learning might be viewed as a nudge (Thaler and Sunstein, 2008) to induce subjects to think differently, such that they make deliberate decisions that more closely reflect objective probabilities.

How does pre-play learning compare with lottery feedback? Braga et al. (2009) found that lottery feedback removed a typical preference reversal pattern in the first few rounds, but created another form of preference reversal pattern after about ten rounds. On the contrary, we found that pre-play learning removed a typical preference reversal pattern but did not create the other form of preference reversal pattern even with ten pre-play drawings when the BDM method with a multiple-price-list format was used. Our results may differ from Braga et al. (2009) because subjects participating in a lottery feedback experiment may long for a certain outcome favorable to their decisions. If a realized outcome is worse than what they wanted, they might change their next decisions to avoid repeating the same losses. To illustrate this effect, when subjects keep the $-bet and realize a loss, they might lower selling prices for the $-bet enough to make sure they do not keep the $-bet again in the next round. This line of explanation is consistent with Braga et al.'s (2009) results. However, pre-learning may be free from such concern because subjects observe a full sequence of lottery outcomes before making any decisions.[8]

Our results also provide testable insights into Cox and Grether (1996). In their experiment, repeating the BDM mechanism with lottery feedback did not remove a preference reversal pattern typically observed in other studies. In contrast, market-like elicitation methods, such as the second-price auction, removed a typical reversal pattern with lottery feedback. Based on those results, they concluded that using market-like elicitation methods is important in removing a typical preference reversal pattern. However, in our view, subjects' limited understanding of the BDM mechanism may also lead to their result. Perhaps combining lottery feedback and the multiple-price-list price BDM mechanism would remove the typical preference reversal pattern using Cox and Grether's (1996) experimental design. In our experiment, pre-play learning did not completely remove a typical preference reversal pattern when the original BDM mechanism was used. However, pre-play learning virtually removed it when the BDM mechanism with a multiple-price-list format was used.

[8] In our data, we found evidence that realized lottery outcomes with pre-play learning influenced subjects' pricing for the $-bet, which is consistent with Hertwig et al. (2004). But recent draws such as the last three draws did not have a significant influence on subject' pricing for the $-bet, which is consistent with Rakow et al. (2008). We could not conduct a test for the p-bet because only higher payoffs were observed during pre-play learning of the p-bet. For more details, see Appendix A.

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Table 1 Subjects' mean selling prices for lotteries by their lottery choice

(a) Original BDM mechanism

	With pre-play learning					Without pre-play learning				
Choice	Mean p-bid	Mean \$-bid	H_0: p-bid=\$-bid H_1: p-bid>\$-bid	H_0: p-bid=\$-bid H_1: p-bid<\$-bid	# of subjects (n=47)	Mean p-bid	Mean \$-bid	H_0: p-bid=\$-bid H_1: p-bid>\$-bid	H_0: p-bid=\$-bid H_1: p-bid<\$-bid	# of subjects (n=43)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
p-bet	\$5.42	\$4.04	0.12 / 0.09	-	37	\$3.57	\$4.02	0.81 / 0.73	-	20
\$-bet	\$4.00	\$6.44	-	0.03 / 0.06	8	\$3.60	\$5.58	-	<0.01 / <0.01	22
Indif.	\$7.00	\$3.50	-	-	2	\$6.00	\$2.00	-	-	1

Note: P-values of Wilcoxon signed rank test / t-test are reported. The p-bet denotes a high-payoff low-probability lottery while the \$-bet denotes a low-payoff high-probability lottery. The p-bid and the \$-bid denote selling prices for the corresponding lotteries.

(b) BDM mechanism with a multiple price list format

	With pre-play learning					Without pre-play learning				
Choice	Mean p-bid	Mean \$-bid	H_0: p-bid=\$-bid H_1: p-bid>\$-bid	H_0: p-bid=\$-bid H_1: p-bid<\$-bid	# of subjects (n=42)	Mean p-bid	Mean \$-bid	H_0: p-bid=\$-bid H_1: p-bid>\$-bid	H_0: p-bid=\$-bid H_1: p-bid<\$-bid	# of subjects (n=35)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
p-bet	\$5.16	\$4.41	0.02 / 0.03	-	30	\$3.94	\$4.26	0.76 / 0.74	-	20
\$-bet	\$3.84	\$6.34	-	0.01 / <0.01	11	\$3.52	\$6.78	-	<0.01 / <0.01	14
Indif.	\$4.25	\$6.25	-	-	1	\$3.75	\$6.25	-	-	1

Table 2 Frequencies of subjects by their lottery choice and selling price

(a) Original BDM mechanism

	Higher selling price: With pre-play learning (n=47)			Higher selling price: Without pre-play learning (n=43)		
Choice	p-bet (1)	$-bet (2)	Equal (3)	p-bet (4)	$-bet (5)	Equal (6)
p-bet	18	**15**	**4**	8	**12**	-
$-bet	**1**	7	-	**5**	17	-
Indifferent	**2**	-	-	**1**	-	-
P-value of Wilcoxon rank-sum test	0.05			0.02		

Note: The numbers of subjects having inconsistent preference rankings are in bold. A null hypothesis is that inconsistent preference rankings have same distributions between subjects choosing the p-bet and those choosing the $-bet. In the test, subjects choosing an indifferent option between the p-bet and the $-bet are not included.

(b) BDM mechanism with a multiple price list format

	Higher selling price: With pre-play learning (n=42)			Higher selling price: Without pre-play learning (n=35)		
Choice	p-bet (1)	$-bet (2)	Equal (3)	p-bet (4)	$-bet (5)	Equal (6)
p-bet	19	**7**	**4**	7	**9**	**4**
$-bet	**1**	9	**1**	**2**	12	-
Indifferent	-	**1**	-	-	**1**	-
P-value of Wilcoxon rank-sum test	0.27			<0.01		

Table 3 Mean selling prices for lotteries

	Original BDM mechanism		BDM mechanism with a multiple price list format		P-values of Wilcoxon rank-sum test / two-sample t-test for equality of p-bids ($-bids) between pre-play learning and no pre-play learning for…	
	Pre-play learning (1)	No pre-play learning (2)	Pre-play learning (3)	No pre-play learning (4)	columns (1) & (2) (5)	columns (3) & (4) (6)
p-bid	$5.25	$3.64	$4.80	$3.76	0.01 / 0.06	0.03 / 0.04
$-bid	$4.42	$4.78	$4.74	$5.34	0.48 / 0.52	0.44 / 0.39
P-values of Wilcoxon signed-rank test / paired sample t-test for p-bid=$-bid	0.69 / 0.33	0.03 / 0.04	0.95 / 0.92	<0.01 / <0.01	-	-
# of subjects	47	43	42	35	-	-

Table 4 Frequencies of lottery choices

		Choosing p-bet (1)	Choosing $-bet (2)	Indifferent (3)	# of subjects (4)	P-values of Wilcoxon signed-rank test for equality of proportions choosing p-bet and $-bet (5)
Original BDM mechanism	Pre-play learning	37 (79%)	8 (17%)	2 (4%)	47 (100%)	<0.01
	No pre-play learning	20 (47%)	22 (51%)	1 (2%)	43 (100%)	0.76
BDM mechanism with a multiple price list format	Pre-play learning	30 (71%)	11 (26%)	1 (2%)	42 (100%)	<0.01
	No pre-play learning	20 (57%)	14 (40%)	1 (3%)	35 (100%)	0.30

[Appendix A: Does the number of realized higher payoffs in pre-play learning influence subjects' pricing for the $-bet?]

We analyzed whether the realized higher payoffs during pre-play learning affected subjects' pricing for the $-bet. To answer this question, we ran linear regressions. The dependent variable was subjects' minimum selling prices for the $-bet. An explanatory variable was the number of realized higher payoffs of the $-bet in pre-play learning. We did not conduct a test for the p-bet because there was no variation in the number of realized higher payoffs of the p-bet in pre-play learning; only higher payoffs (winning draws) were realized in all trials in pre-play learning.

Table A1 reports regression results. In column (1), where minimum selling prices for the $-bet were elicited using the BDM method, the coefficient for the number of realized higher payoffs was 0.18, which is not significantly different from zero. On the contrary, in column (3), using the BDM method with a multiple price list format, the coefficient for the number of realized higher payoffs was 1.29, which is significantly positive. This result suggests that one more realization of a higher payoff in pre-play learning increased the selling price for the $-bet by $1.29. This finding is consistent with Hertwig et al. (2004). This raises a question for further research: would increasing the number of pre-play learning draws using the BDM method with a multiple price list format increase $-bids enough to reintroduce the preference reversal phenomenon? Moreover, would experiencing loss with the p-bet reduce the perceived value of the p-bet? These results raise interesting questions for further research.

We tested whether the last three draws in pre-play learning influence subjects' selling prices for the $-bet. In columns (2) and (4) in Table A1, estimated coefficients for the number of realized higher payoffs in the last three trials of pre-play learning are not significantly different from zero (0.24 and -0.04, respectively), which suggests that more recent draws in pre-learning are not more influential for subjects' selling prices for the $-bet compared to early draws. Those results are consistent with Rakow et al. (2008).

Table A1 Effects of the number of realized higher payoffs in pre-play learning on subjects' pricing for the $-bet

Dependent var.: minimum selling price for the $-bet	BDM method		BDM method with a multiple price list format	
	(1)	(2)	(3)	(4)
# of realized higher payoffs in pre-play learning	0.18 (0.24)	-	1.29 (0.63)**	-
# of realized higher payoffs in the last three trials of pre-play learning	-	0.24 (0.34)	-	-0.04 (0.94)
Constant	3.91 (0.81)***	4.10 (0.60)***	0.58 (2.06)	4.76 (0.63)***
Adj. R-squared	-0.01	-0.01	0.07	-0.03
Obs.	47		42	

Note: Standard errors are reported in parentheses. ***: p-value<0.01, **: p-value<0.05

[Appendix B: Experimental instructions using the original BDM mechanism]

Study Title: Economic Valuation

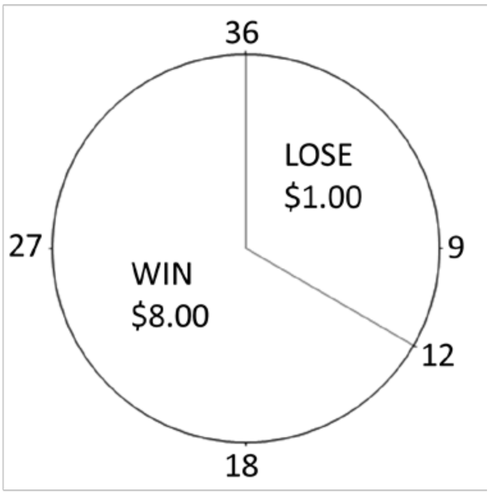
This is a research study about economic valuation. You MUST be at least 18 years old to participate. This lab session is completely anonymous and will take approximately 25 minutes to complete. You will be compensated $10 for your participation. Your final compensation may vary depending on your decisions made on study tasks. If you have questions during the session, please raise your hand and the facilitator will assist you. Please do not talk with other participants or use your smartphone during the session. Please do not go to subsequent pages of the packet until the facilitator asks you to do so.

Please find the Informed Consent document in front of you and sign at the bottom of the second page.

Please do NOT go to subsequent pages of the packet until the facilitator asks you to do so.

Instructions

We are trying to determine how people make decisions. We have designed a simple choice experiment and will ask you to make one decision in each of three items. Each decision you make will involve one or two *bets*. If a bet is played, then one ball will be drawn from a bingo cage that contains 36 balls numbered 1 to 36. Depending upon the nature of the bet, the number drawn will determine whether you lose an amount of money or win an amount of money. The figure below is an example of the type of bets used in the experiment. In the example, if you play the following bet, then you will lose $1 if the number drawn is less than *or equal to* 12, and you will win $8 if the number drawn is greater than 12.



You will be paid in the following fashion. We will first give you $10. After you have made a decision on each item, one item will be chosen at random by drawing a ball from a bingo cage. The bet(s) in the chosen item will then be played. You will be paid an amount depending upon your decisions and upon the outcomes of the bets in the chosen item—any amount you win will be added to the $10, and any amount you lose will be subtracted from the $10. However, the most you can lose on a bet is $1.50, so you will receive at least $8.50. All actual payments will occur after the experiment.

If you have questions, please raise your hand.

Please do NOT go to the next page until the facilitator asks you to do so.

PART 1

For each of the items below, you have been presented a ticket that allows you to play a bet. You will then be asked for the *smallest* price at which you would sell the ticket to the bet.

If an item from this part is chosen at the end of the experiment, we will do the following. First, a bingo cage will be filled with 10 balls numbered 0 to 9. Then 3 balls will be drawn from this cage, with each ball being replaced before the next is drawn. The numbers on these 3 balls will determine the digits of an offer price between $0.00 and $9.99, with the first number being the penny (right) digit, the second number the dime (middle) digit, and the third number the dollar (left) digit. If this offer price is greater than or equal to your minimum selling price for the item's bet, you would receive the offer price. If the offer price is less than your selling price, you would play the bet and be paid according to its outcome.

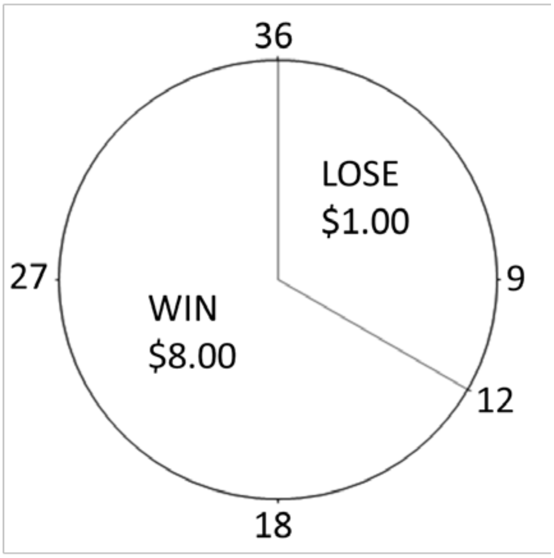
It is in your best interest to be accurate; that is, the best thing you can do is to be honest. If the price you state is too high or too low, then you are passing up opportunities that you prefer. For example, suppose you would be willing to sell the bet for $4 but instead you say that the lowest price you will sell it for is $6. If the offer price drawn at random is between the two (for example $5), you would be forced to play the bet even though you would rather have sold it for $5. Suppose that you would sell it for $4 but not for less, and that you state that you would sell it for $2. If the offer price drawn at random is between the two (for example $3) you would be forced to sell the bet even though at that price you would prefer to play it.

If you have questions, please raise your hand. You will have three practice tasks soon.

Please do NOT go to the next page until the facilitator asks you to do so.

Practice Task 1

What is the *smallest* price for which you would sell a ticket to the following bet? $________



Please wait for other participants to finish their decisions.

Suppose that the offer price is $___ . ___ ___.

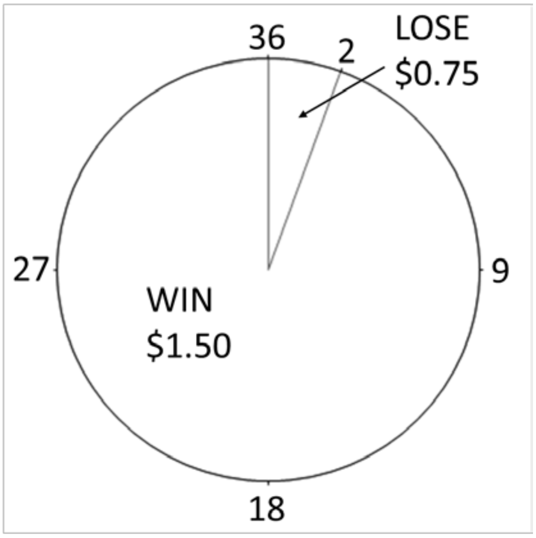
Please fill in ONLY ONE SIDE in the table below.

i) If the offer price is greater than or equal to your selling price, you receive the offer price.	ii) If the offer price is less than your selling price, you play the bet.
I get: $	**The number drawn:**
	I get / lose: (Circle one) $

Please do NOT go to the next page until the facilitator asks you to do so.

Practice Task 2

What is the *smallest* price for which you would sell a ticket to the following bet? $_______



Please wait for other participants to finish their decisions.

Suppose that the offer price is $___ . ___ ___.

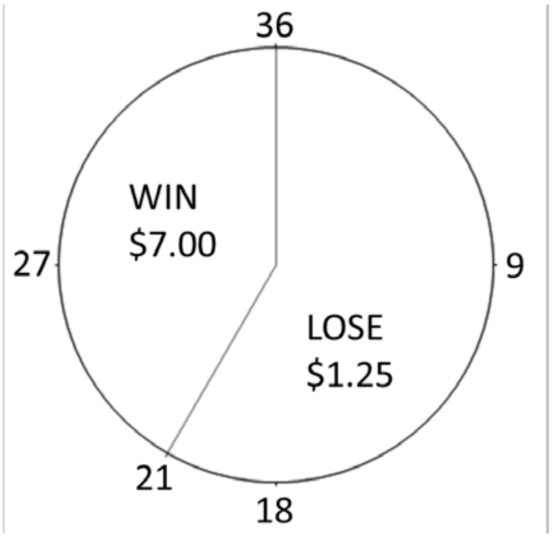
Please fill in ONLY ONE SIDE in the table below.

i) If the offer price is greater than or equal to your selling price, you receive the offer price.	ii) If the offer price is less than your selling price, you play the bet.
I get: $	**The number drawn:**
	I get / lose: (Circle one) $

Please do NOT go to the next page until the facilitator asks you to do so.

Practice Task 3

What is the *smallest* price for which you would sell a ticket to the following bet? $_______



Please wait for other participants to finish their decisions.

Suppose that the offer price is $___ . ___ ___.

Please fill in ONLY ONE SIDE in the table below.

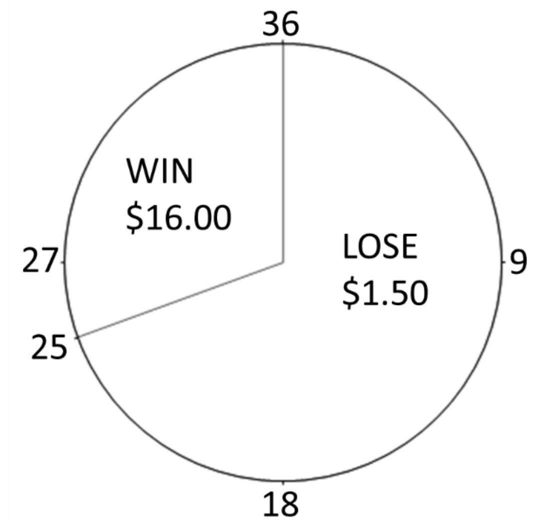
i) If the offer price is greater than or equal to your selling price, you receive the offer price.	ii) If the offer price is less than your selling price, you play the bet.
I get: $	**The number drawn:**
	I get / lose: (Circle one) $

All practice tasks are over. We will give you two items that may influence your compensation.

Please do NOT go to the next page until the facilitator asks you to do so.

Item 1

Consider carefully the following bet shown below:



To give you a sense of outcomes from the bet, we will draw a ball from a bingo cage ten times. Please keep records of the numbers drawn and circle the corresponding money outcome in the table below.

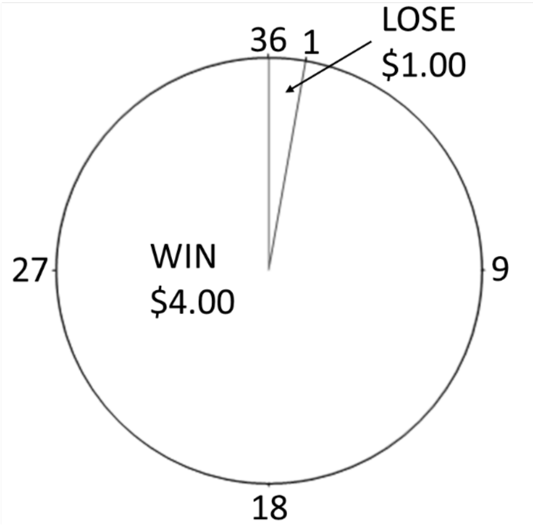
Trial	Write the number drawn	Circle the corresponding money outcome
1		Win $16 / Lose $1.50
2		Win $16 / Lose $1.50
3		Win $16 / Lose $1.50
4		Win $16 / Lose $1.50
5		Win $16 / Lose $1.50
6		Win $16 / Lose $1.50
7		Win $16 / Lose $1.50
8		Win $16 / Lose $1.50
9		Win $16 / Lose $1.50
10		Win $16 / Lose $1.50

Please answer the following question:
What is the *smallest* price for which you would sell a ticket to the bet? $_______

Please do NOT go to the next page until the facilitator asks you to do so.

Item 2

Consider carefully the following bet shown below:



To give you a sense of outcomes from the bet, we will draw a ball from a bingo cage ten times. Please keep records of the numbers drawn and circle the corresponding money outcome in the table below.

Trial	Write the number drawn	Circle the corresponding money outcome
1		Win $4 / Lose $1
2		Win $4 / Lose $1
3		Win $4 / Lose $1
4		Win $4 / Lose $1
5		Win $4 / Lose $1
6		Win $4 / Lose $1
7		Win $4 / Lose $1
8		Win $4 / Lose $1
9		Win $4 / Lose $1
10		Win $4 / Lose $1

Please answer the following question:
What is the *smallest* price for which you would sell a ticket to the bet? $_______

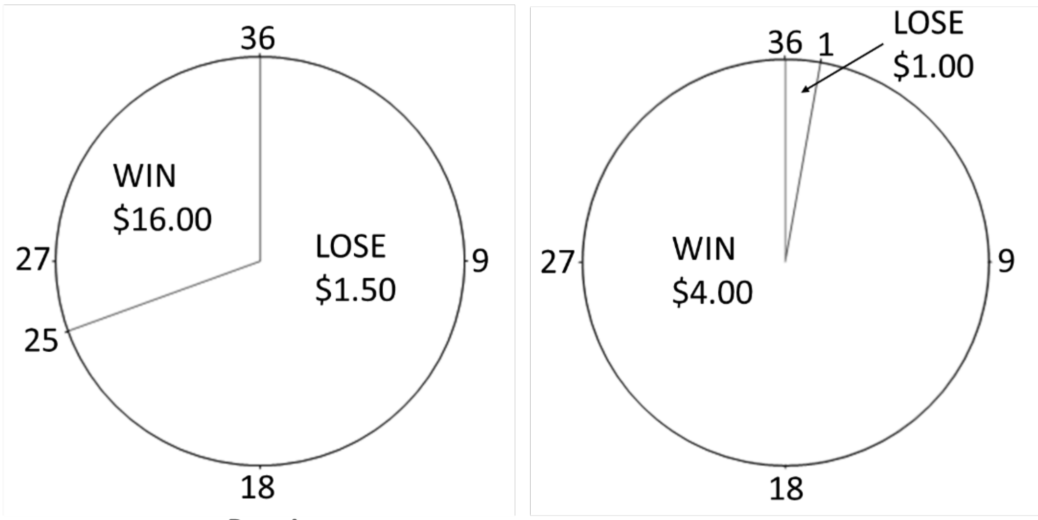
Please do NOT go to the next page until the facilitator asks you to do so.

PART 2

If an item from this part is chosen at the end of the experiment, you will play the bet you select. If you check “Don’t care,” the bet you play will be determined by a coin toss.

Item 3

Consider carefully the following two bets shown below.



Bet A Bet B

Suppose you have the opportunity to play one of these bets. Make one check below to indicate which bet you would prefer to play:

Bet A	**Bet B**	**Don’t care**
☐	☐	☐

Please do NOT go to the next page until the facilitator asks you to do so.

Your Earnings

You will calculate your earnings. The facilitator will randomly draw one ball. The number on the ball will decide which item would be considered for your compensation.

The item number drawn: [ ]

1) If the item number is 1 or 2, the facilitator will draw a ball three times to decide the offer price.

The offer price: **$___.___ ___**

Please fill in ONLY ONE SIDE in the table below.

i) If the offer price is greater than or equal to your selling price, you receive the offer price.	ii) If the offer price is less than your selling price, you play the bet.
I get: $	**The number drawn:** [ ] **I get / lose: (Circle one)** $

2) If the item number is 3, please fill in ONLY ONE SIDE in the table below.

i) If you have chosen bet A in item 1,	ii) If you have chosen bet B in item 1,	iii) If you have chosen "Don't care" in item 1,
The number drawn: [ ] **I get / lose: (Circle one)** $	**The number drawn:** [ ] **I get / lose: (Circle one)** $	**The coin flip: (Circle one)** Head / Tail Heads mean bet A, and tails mean bet B. **The number drawn:** [ ] **I get / lose: (Circle one)** $

My total earnings: $10 plus or minus $_______ = $________
(Circle one)

Please go to the next page.

Please answer the following questions:

A. What is your gender? [Male ☐ / Female ☐]
B. What is your age? [ ]
C. What year are you in school?
[Freshman ☐ / Sophomore ☐ / Junior ☐ / Senior ☐ / Graduate ☐ / Other ☐]

Please find a receipt on the next page and fill it out using the total earnings you calculated on the previous page. Then detach it from this packet to keep your responses anonymous. Please submit the receipt and all decision sheets when you receive your compensation. You will receive a debriefing form for this study when you leave the lab.

[Appendix C: Experimental instructions using the BDM mechanism with a multiple price list format]

Study Title: Economic Valuation

This is a research study about economic valuation. You MUST be at least 18 years old to participate. This lab session is completely anonymous and will take approximately 25 minutes to complete. You will be compensated $10 for your participation. Your final compensation may vary depending on your decisions made on study tasks. If you have questions during the session, please raise your hand and the facilitator will assist you. Please do not talk with other participants or use your smartphone during the session. Please do not go to subsequent pages of the packet until the facilitator asks you to do so.

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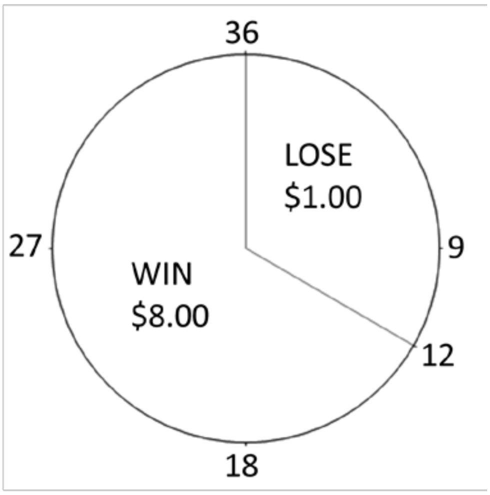
Instructions

We are trying to determine how people make decisions. We have designed a simple choice experiment and will ask you to make decision(s) in each of three items. Each decision you make will involve one or two *bets*. If a bet is played, then one ball will be drawn from a bingo cage that contains 36 balls numbered 1 to 36. Depending upon the nature of the bet, the number drawn will determine whether you lose an amount of money or win an amount of money. The figure below is an example of the type of bets used in the experiment. In the example, if you play the following bet, then you will lose $1 if the number drawn is less than *or equal to* 12, and you will win $8 if the number drawn is greater than 12.



You will be paid in the following fashion. We will first give you $10. After you have made a decision on each item, one item will be chosen at random by drawing a ball from a bingo cage. The bet(s) in the chosen item will then be played. You will be paid an amount depending upon your decisions and upon the outcomes of the bets in the chosen item—any amount you win will be added to the $10, and any amount you lose will be subtracted from the $10. However, the most you can lose on a bet is $1.50, so you will receive at least $8.50. All actual payments will occur after the experiment.

If you have questions, please raise your hand.

Please do NOT go to the next page until the facilitator asks you to do so.

PART 1

For each of the items below, you have been presented a ticket that allows you to play a bet. You will then be asked for the *smallest* price at which you would sell the ticket to the bet. To help you find your minimum selling price for the ticket, we will ask you 21 questions of whether or not you would like to sell the ticket at given prices.

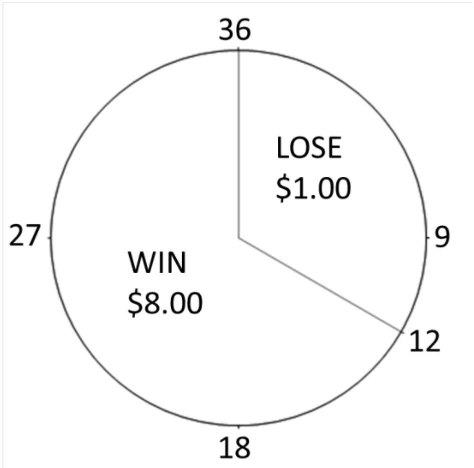
If an item from this part is chosen at the end of the experiment, we will do the following. First, a bingo cage will be filled with 21 balls numbered 1 to 21. Then one ball will be drawn from this cage, and the number on the ball will determine which question number would be considered for your compensation.

It is in your best interest to be accurate; that is, the best thing you can do is to be honest. If your selling price is too high or too low, then you are passing up opportunities that you prefer. For example, suppose you would be willing to sell the bet for $4 but instead you say that the lowest price you will sell it is $6. If the price in the chosen question is between the two (for example $5), you would be forced to play the bet even though you would rather have sold it for $5. Suppose that you would sell it for $4 but not for less, and that you state that you would sell it for $2. If the price in the chosen question is between the two (for example $3) you would be forced to sell the bet even though at that price you would prefer to play it.

If you have questions, please raise your hand. You will have three practice tasks soon.

Please do NOT go to the next page until the facilitator asks you to do so.

Practice Task 1: What is the *smallest* price for which you would sell a ticket to the following bet? To help you find your minimum selling price for the ticket, we will ask you questions of whether or not you would like to sell the ticket at given prices.



Please check one box for each of the following questions.

Question	I will sell the ticket.	I will NOT sell the ticket.	Question	I will sell the ticket.	I will NOT sell the ticket.
1. If the price is $9.99,	☐	☐	12. If the price is $4.50,	☐	☐
2. If the price is $9.50,	☐	☐	13. If the price is $4.00,	☐	☐
3. If the price is $9.00,	☐	☐	14. If the price is $3.50,	☐	☐
4. If the price is $8.50,	☐	☐	15. If the price is $3.00,	☐	☐
5. If the price is $8.00,	☐	☐	16. If the price is $2.50,	☐	☐
6. If the price is $7.50,	☐	☐	17. If the price is $2.00,	☐	☐
7. If the price is $7.00,	☐	☐	18. If the price is $1.50,	☐	☐
8. If the price is $6.50,	☐	☐	19. If the price is $1.00,	☐	☐
9. If the price is $6.00,	☐	☐	20. If the price is $0.50,	☐	☐
10. If the price is $5.50,	☐	☐	21. If the price is $0.00,	☐	☐
11. If the price is $5.00,	☐	☐		-	

Please wait for other participants to finish their decisions.

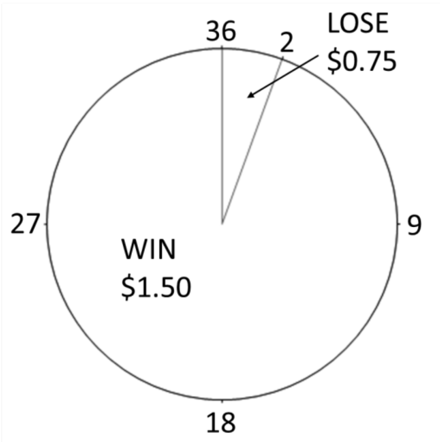
Suppose that the question number randomly drawn is ____. Please fill in either (1) or (2) below.

(1) If you have decided to sell the ticket in that question: I get the price of $_____.

(2) If you have decided NOT to sell the ticket, you play the bet.
Suppose that the number drawn for the bet is ___. I get / lose $____.
(Circle one)

Please do NOT go to the next page until the facilitator asks you to do so.

Practice Task 2: What is the *smallest* price for which you would sell a ticket to the following bet? To help you find your minimum selling price for the ticket, we will ask you questions of whether or not you would like to sell the ticket at given prices.



Please check one box for each of the following questions.

Question	I will sell the ticket.	I will NOT sell the ticket.	Question	I will sell the ticket.	I will NOT sell the ticket.
1. If the price is $9.99,	☐	☐	12. If the price is $4.50,	☐	☐
2. If the price is $9.50,	☐	☐	13. If the price is $4.00,	☐	☐
3. If the price is $9.00,	☐	☐	14. If the price is $3.50,	☐	☐
4. If the price is $8.50,	☐	☐	15. If the price is $3.00,	☐	☐
5. If the price is $8.00,	☐	☐	16. If the price is $2.50,	☐	☐
6. If the price is $7.50,	☐	☐	17. If the price is $2.00,	☐	☐
7. If the price is $7.00,	☐	☐	18. If the price is $1.50,	☐	☐
8. If the price is $6.50,	☐	☐	19. If the price is $1.00,	☐	☐
9. If the price is $6.00,	☐	☐	20. If the price is $0.50,	☐	☐
10. If the price is $5.50,	☐	☐	21. If the price is $0.00,	☐	☐
11. If the price is $5.00,	☐	☐		-	

Please wait for other participants to finish their decisions.

Suppose that the question number randomly drawn is ____. Please fill in either (1) or (2) below.

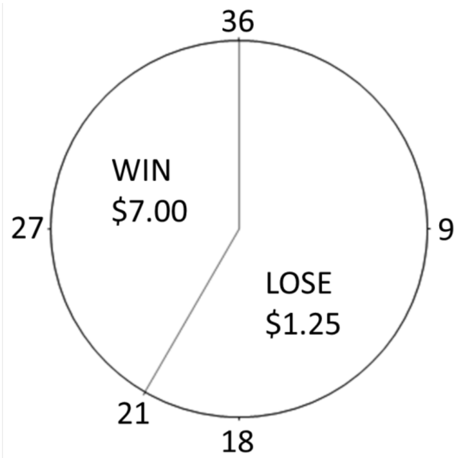
(1) If you have decided to sell the ticket in that question: I get the price of $_____.

(2) If you have decided NOT to sell the ticket, you play the bet.

Suppose that the number drawn for the bet is ___. I get / lose $____.
(Circle one)

Please do NOT go to the next page until the facilitator asks you to do so.

Practice Task 3: What is the *smallest* price for which you would sell a ticket to the following bet? To help you find your minimum selling price for the ticket, we will ask you questions of whether or not you would like to sell the ticket at given prices.



Please check one box for each of the following questions.

Question	I will sell the ticket.	I will NOT sell the ticket.	Question	I will sell the ticket.	I will NOT sell the ticket.
1. If the price is $9.99,	☐	☐	12. If the price is $4.50,	☐	☐
2. If the price is $9.50,	☐	☐	13. If the price is $4.00,	☐	☐
3. If the price is $9.00,	☐	☐	14. If the price is $3.50,	☐	☐
4. If the price is $8.50,	☐	☐	15. If the price is $3.00,	☐	☐
5. If the price is $8.00,	☐	☐	16. If the price is $2.50,	☐	☐
6. If the price is $7.50,	☐	☐	17. If the price is $2.00,	☐	☐
7. If the price is $7.00,	☐	☐	18. If the price is $1.50,	☐	☐
8. If the price is $6.50,	☐	☐	19. If the price is $1.00,	☐	☐
9. If the price is $6.00,	☐	☐	20. If the price is $0.50,	☐	☐
10. If the price is $5.50,	☐	☐	21. If the price is $0.00,	☐	☐
11. If the price is $5.00,	☐	☐	-		

Please wait for other participants to finish their decisions.

Suppose that the question number randomly drawn is ____. Please fill in either (1) or (2) below.

(1) If you have decided to sell the ticket in that question: I get the price of $_____.

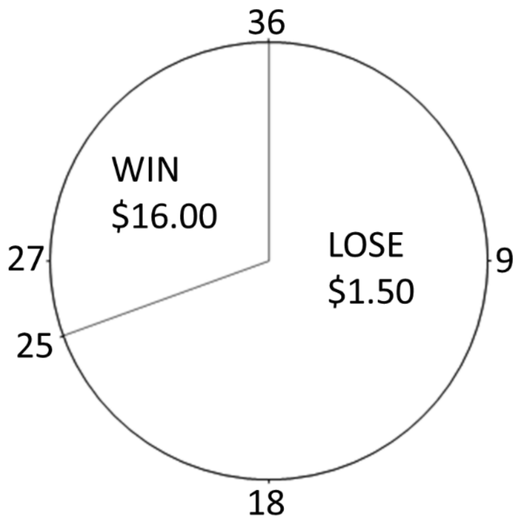
(2) If you have decided NOT to sell the ticket, you play the bet.
Suppose that the number drawn for the bet is ___. I get / lose $____.
(Circle one)

Please do NOT go to the next page until the facilitator asks you to do so.

All practice tasks are over. We will give you two items that may influence your compensation.

Item 1

Consider carefully the following bet shown below:



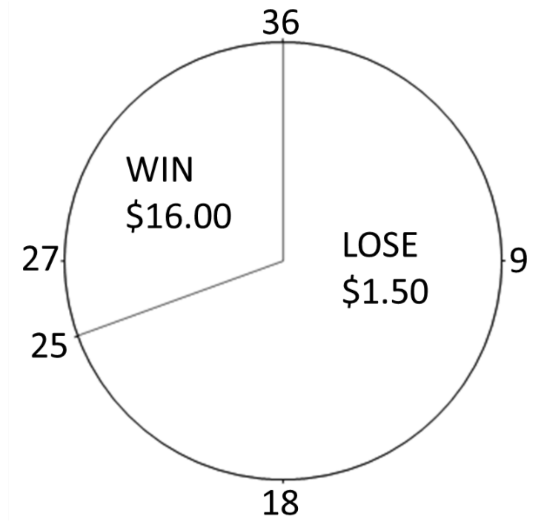
To give you a sense of outcomes from the bet, we will draw a ball from a bingo cage ten times. Please keep records of the numbers drawn and circle the corresponding money outcome in the table below.

Trial	Write the number drawn	Circle the corresponding money outcome
1		Win $16 / Lose $1.50
2		Win $16 / Lose $1.50
3		Win $16 / Lose $1.50
4		Win $16 / Lose $1.50
5		Win $16 / Lose $1.50
6		Win $16 / Lose $1.50
7		Win $16 / Lose $1.50
8		Win $16 / Lose $1.50
9		Win $16 / Lose $1.50
10		Win $16 / Lose $1.50

Please go to the next page.

(Continued from the previous page)

What is the *smallest* price for which you would sell a ticket to the bet you saw on the previous page? The same bet is shown below. To help you find your minimum selling price for the ticket, we will ask you questions of whether or not you would like to sell the ticket at given prices.



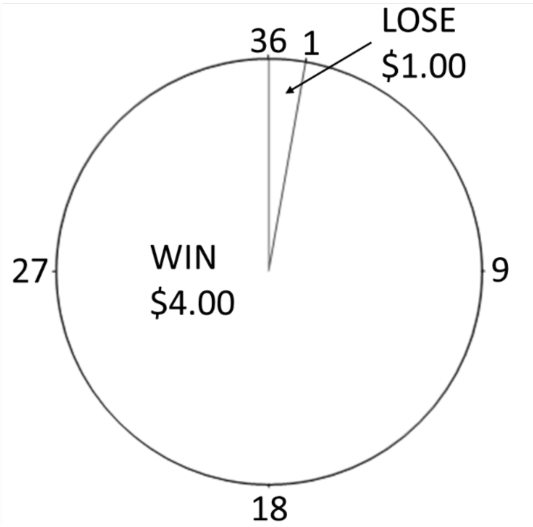
Please check one box for each of the following questions.

Question	I will sell the ticket.	I will NOT sell the ticket.	Question	I will sell the ticket.	I will NOT sell the ticket.
1. If the price is $9.99,	☐	☐	**12.** If the price is $4.50,	☐	☐
2. If the price is $9.50,	☐	☐	**13.** If the price is $4.00,	☐	☐
3. If the price is $9.00,	☐	☐	**14.** If the price is $3.50,	☐	☐
4. If the price is $8.50,	☐	☐	**15.** If the price is $3.00,	☐	☐
5. If the price is $8.00,	☐	☐	**16.** If the price is $2.50,	☐	☐
6. If the price is $7.50,	☐	☐	**17.** If the price is $2.00,	☐	☐
7. If the price is $7.00,	☐	☐	**18.** If the price is $1.50,	☐	☐
8. If the price is $6.50,	☐	☐	**19.** If the price is $1.00,	☐	☐
9. If the price is $6.00,	☐	☐	**20.** If the price is $0.50,	☐	☐
10. If the price is $5.50,	☐	☐	**21.** If the price is $0.00,	☐	☐
11. If the price is $5.00,	☐	☐	-		

Please do NOT go to the next page until the facilitator asks you to do so.

Item 2

Consider carefully the following bet shown below:



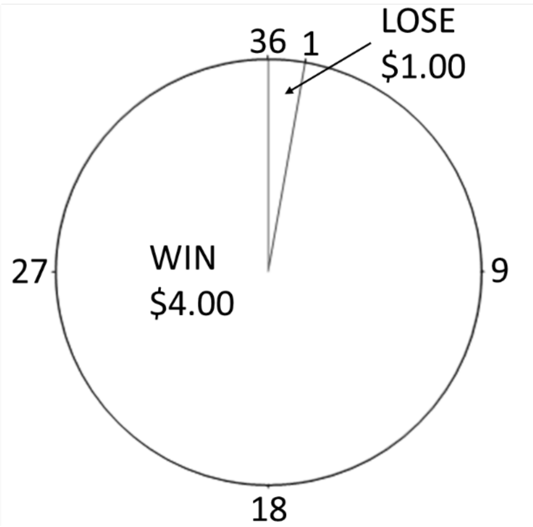
To give you a sense of outcomes from the bet, we will draw a ball from a bingo cage ten times. Please keep records of the numbers drawn and circle the corresponding money outcome in the table below.

Trial	Write the number drawn	Circle the corresponding money outcome
1		Win $4 / Lose $1
2		Win $4 / Lose $1
3		Win $4 / Lose $1
4		Win $4 / Lose $1
5		Win $4 / Lose $1
6		Win $4 / Lose $1
7		Win $4 / Lose $1
8		Win $4 / Lose $1
9		Win $4 / Lose $1
10		Win $4 / Lose $1

Please go to the next page.

(Continued from the previous page)

What is the *smallest* price for which you would sell a ticket to the bet you saw on the previous page? The same bet is shown below. To help you find your minimum selling price for the ticket, we will ask you questions of whether or not you would like to sell the ticket at given prices.



Please check one box for each of the following questions.

Question	I will sell the ticket.	I will NOT sell the ticket.	Question	I will sell the ticket.	I will NOT sell the ticket.
1. If the price is $9.99,	☐	☐	12. If the price is $4.50,	☐	☐
2. If the price is $9.50,	☐	☐	13. If the price is $4.00,	☐	☐
3. If the price is $9.00,	☐	☐	14. If the price is $3.50,	☐	☐
4. If the price is $8.50,	☐	☐	15. If the price is $3.00,	☐	☐
5. If the price is $8.00,	☐	☐	16. If the price is $2.50,	☐	☐
6. If the price is $7.50,	☐	☐	17. If the price is $2.00,	☐	☐
7. If the price is $7.00,	☐	☐	18. If the price is $1.50,	☐	☐
8. If the price is $6.50,	☐	☐	19. If the price is $1.00,	☐	☐
9. If the price is $6.00,	☐	☐	20. If the price is $0.50,	☐	☐
10. If the price is $5.50,	☐	☐	21. If the price is $0.00,	☐	☐
11. If the price is $5.00,	☐	☐	-		

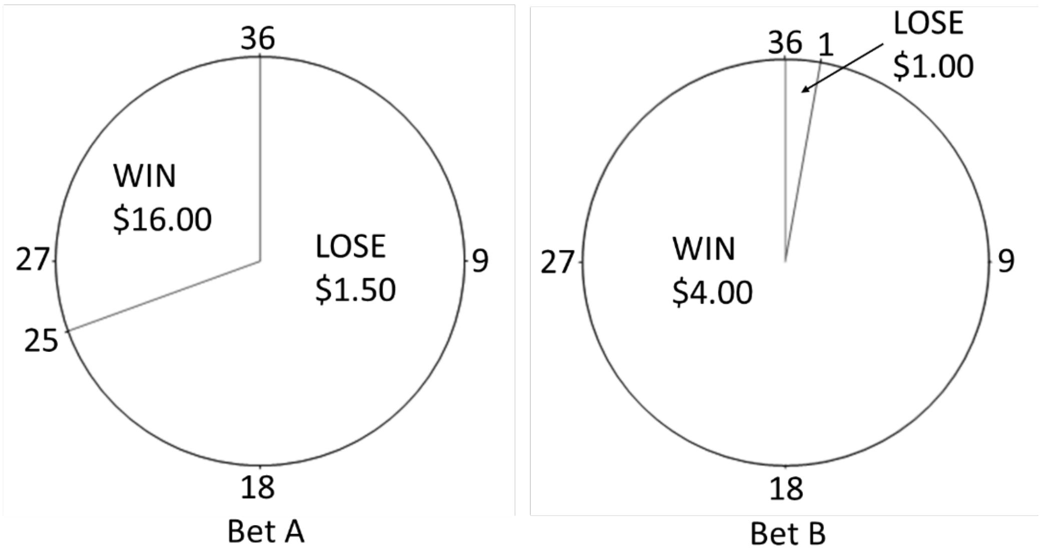
Please do NOT go to the next page until the facilitator asks you to do so.

PART 2

If an item from this part is chosen at the end of the experiment, you will play the bet you select. If you check “Don’t care,” the bet you play will be determined by a coin toss.

Item 3

Consider carefully the following two bets shown below.



Suppose you have the opportunity to play one of these bets. Make one check below to indicate which bet you would prefer to play:

Bet A	Bet B	Don’t care
☐	☐	☐

Please do NOT go to the next page until the facilitator asks you to do so.

Your Earnings

You will calculate your earnings. The facilitator will randomly draw one ball. The number on the ball will decide which item would be considered for your compensation.

The item number drawn: [ ]

1) If the item number is 1 or 2, the facilitator will randomly draw one ball. The number on the ball will decide which question number would be considered for your compensation.

The question number drawn: [ ]

Please fill in either i) or ii) below.

i) If you have decided to sell the ticket in that question: I get the price of $_____.

ii) If you have decided NOT to sell the ticket, you play the bet.

Suppose that the number drawn for the bet is ___. I get / lose $____.

(Circle one)

2) If the item number is 3, please fill in ONLY ONE SIDE in the table below.

i) If you have chosen bet A in item 1,	ii) If you have chosen bet B in item 1,	iii) If you have chosen "Don't care" in item 1,
The number drawn: [ ]	**The number drawn:** [ ]	**The coin flip: (Circle one)** Head / Tail
I get / lose: (Circle one) $	**I get / lose: (Circle one)** $	Heads mean bet A, and tails mean bet B.
		The number drawn: [ ]
		I get / lose: (Circle one) $

My total earnings: $10 plus or minus $_______ = $________
(Circle one)

Please go to the next page.

Please answer the following questions:

A. What is your gender? [Male ☐ / Female ☐]

B. What is your age? [   ]

C. What year are you in school?

[Freshman ☐ / Sophomore ☐ / Junior ☐ / Senior ☐ / Graduate ☐ / Other ☐]

Please find a receipt on the next page and fill it out using the total earnings you calculated on the previous page. Then detach it from this packet to keep your responses anonymous. Please submit the receipt and all decision sheets when you receive your compensation. You will receive a debriefing form for this study when you leave the lab.