Comparing experimental loss framing methods in a multi-leveled lying context

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1 Introduction

Lying can taint research, unnecessarily raise the cost of goods, and lead consumers to make sub-optimal decisions. Researchers and policymakers frequently rely on survey responses to identify problems and evaluate programs' effectiveness at alleviating those problems. When participants in those surveys lie, it can lead researchers to draw incorrect conclusions about the populations they are studying and thwart attempts to institute helpful policies. In one notable example, research on poverty-alleviation policies in developing economies (Banerjee et al., 2020; Martinelli and Parker, 2009) has uncovered evidence of households underreporting their ownership of luxury goods that may lead to their being deemed ineligible for program assistance.

Concerning markets, Akerlof's (1978) famed "market for lemons" is a prime example of a situation in which lying can lead to poor economic decisions. If the seller of a used car knows that their car is a lemon, the seller could dishonestly convince a buyer that the car is in fact good and sell it for a higher price than its value, leading to the buyer's wasting money on a low-value car. Conversely, insurance fraud represents a situation in which consumers can lie to improve their outcomes (Djawadi and Fahr, 2015), possibly hiding preexisting medical conditions or property damage in order to reduce their premiums or get the insurance company to pay for repairs. In the labor market, lying on a resume or in an interview can increase the likelihood of an applicant being offered a job (Djawadi and Fahr, 2015), while lying about the workplace environment, opportunities for advancement, or benefits offered could persuade an applicant to accept a job offer. Without external interventions like lemon and insurance fraud laws, lying within a market can lead to its collapse.

While traditional economic theory suggests that agents will lie when given an incentive to do so, people are frequently honest despite seeming incentives to behave otherwise. Two common explanations for not lying despite incentives to do so are risk aversion—specifically, avoiding potential "reputation costs" (Crede and Bieberstein, 2020)—and the notion of a "moral cost" of lying (Lundquist et al., 2009; Dai et al., 2019). Reputation costs relate to social image (Crede and Bieberstein, 2020; Bursztyn and Jensen, 2017) and agents' desire to be perceived as fair (Andreoni and Bernheim, 2009) and honest (Mazar et al., 2008); when an agent is caught in a lie, they suffer an adverse reaction from the damage done to their public image. However, there is no guarantee that a lying agent will be caught, so the agent suffers the reputation cost with a probability less than one and must make the decision to lie or not under risk. Moral cost, by contrast, is an intrinsic aversion to lying (Lundquist et al., 2009)—the feeling of guilt experienced due to a lifetime of socialization. Due to its intrinsic nature, a lying agent is certain to experience the moral cost of lying.

Considering reputation and moral costs as disincentives to lying, it stands to reason that incentives of sufficient magnitude and certainty could overcome the costs associated with lying and lead an agent to lie. In light of Kahneman and Tversky's (1979) theory of loss aversion—that "losses loom larger than gains"—a worthwhile question is whether potential losses are more convincing incentives to lie than gains. Theoretically, a potential loss of x would be a greater incentive to lie than a potential gain of x for a loss-averse agent, so we would expect the agent to lie to avoid losing x if they are on the margin for lying to gain x. More concretely, suppose a loss-averse person is indifferent between lying and not lying when lying leads to a gain of \$10. Then the person's moral and reputational costs perfectly offset the utility of gaining \$10. When faced with a loss of \$10, however, the cost of lying is equal in magnitude to the utility of gaining \$10, but the cost of *not* lying is greater, so the person should lie.

While the theory is clear, the influence of loss aversion on lying is uncertain in reality. Certainly, there are numerous instances in which the potential for loss could be an incentive to lie or otherwise behave dishonestly—lying to avoid getting fired from a job for actions at work and cheating on a test to avoid an unexpectedly bad grade among them. However, existing experimental research on the intersection of loss aversion and lying features a surprising amount of disagreement that has yet to be resolved. Because researchers are trying to study both loss and dishonesty, they employ disparate methods of framing outcomes as losses and rely on different games that allow participants to lie. A hallmark of scientific research is the ability to reproduce results and methods in a variety of contexts, a feat that has yet to be accomplished in considering the intersection of loss and lying. Before generalizing experimental results to practical questions, experimenters must reach a consensus that isn't contradicted by each new study. I aim to identify whether the difference in loss-framing method or lying activity is responsible for the discrepancy in experimental conclusions and in doing so offer possible explanations for the existing disagreement. I find evidence that the paradigm used to study lying is responsible for the main difference (that some research shows evidence of loss aversion while others do not) but that the framing method is instrumental in *reducing* lying in the loss condition compared to the gain treatment. In Section 2, I describe the existing literature related to lying and explore the disagreement over the influence of loss aversion on dishonesty further.

2 Background

There are three paradigms that economists have used most frequently to study deceptive behavior: the coin-toss paradigm (Bucciol and Piovesan, 2011), the die-roll paradigm (Fischbacher and Föllmi-Heusi, 2013), and the matrix task (Mazar et al., 2008). In the coin-toss paradigm, participants learn that their payout is determined by the outcome of a coin toss (Bucciol and Piovesan, 2011); they privately flip a fair coin and report the observed result. Because the experimenters do not observe the coin toss or the outcome, there is no way of knowing whether an individual subject was honest or not in reporting their observation. The result of the coin-toss paradigm is a dichotomous outcome: participants receive a full amount for observing the "good" outcome and nothing otherwise. Consequently, participants also face a binary decision and cannot choose to lie sub-maximally (meaning that there is not an opportunity to misreport the outcome so that the participant earns a nonzero amount that is still less than the maximum payout). In their meta-analysis of experimental deception paradigms, Gerlach et al. (2019) argue that the dichotomous nature of the coin-toss paradigm may decrease the rate of lying relative to other paradigms (namely, the die-roll paradigm) due to the high moral cost of maximal lying.

Similar to the coin-toss paradigm, the die-roll paradigm (Fischbacher and Föllmi-Heusi, 2013) relies on subjects privately observing a random outcome. Participants receive six- (Fischbacher and Föllmi-Heusi, 2013) or ten-sided (Charness et al., 2019) dice and earn a different payoff for each possible outcome. Unlike in the coin-toss paradigm, subjects in the die-roll paradigm can observe outcomes that result in payoffs less than the maximal amount but greater than zero. As a result, subjects have the option to lie along a scale (sub-maximally) instead of choosing only between maximal lying and not lying at all. This feature of the die-roll paradigm adds complexity to the decision and, as Gerlach et al. (2019) note, generally produces a higher rate of lying than observed in coin-toss experiments.

The matrix task (Mazar et al., 2008) differs from the coin-toss and die-roll paradigms in that the outcome for each participant depends on their performance in the task. Each subject views a series of pairs of three-by-three matrices containing non-integer entries. They must then identify pairs of entries (the (i, j)th entry in the first matrix and the corresponding (i, j)th entry in the second matrix) whose sum is an integer. For example, if the top left entry in the first matrix was 9.23 and the top left entry in the second matrix was 1.77, the subject would need to identify that those entries comprised a pair of corresponding entries summing to an integer (11). In the matrix task, the number of entry pairs participants find determines how much they earn. Since individual performance, not a random event, decides payoffs, subjects in matrix activity experiments likely view the decision to lie as being dishonest about their personal skills and abilities instead of a random outcome that was equally likely to yield a different result. Gerlach et al. (2019) provide evidence that lying is less common in experiments using the matrix activity, arguing that individuals are less inclined to lie about their performance and abilities than they are about events outside of their control.

In addition to the three paradigms described above, economists have used other activities to study dishonesty in experiments. In sender-receiver games (Gneezy, 2005), pairs of participants are assigned to sender and receiver roles. Senders view two possible options for payoffs for each player, and receivers (without having seen the payoffs for each) select the option for both players. Before receivers make their decisions, senders have the opportunity to send a message to the receiver to try to influence their decision. Importantly, the best payoff for the receiver also results in the worst payoff for the sender, and vice-versa. Numerous other, less common methods have been used in experiments studying dishonesty as well, including online quizzes where participants can cheat (Hugh-Jones, 2016) and activities in which each participant randomly draws a number that determines their payoff from an envelope (Gneezy et al., 2018). I have chosen to focus on the die-roll and coin-toss paradigms because each has been used often to study deception and because they avoid many of the confounding factors involved in interpersonal interactions (the sender-receiver game) and lying about personal performance (the matrix activity).

In recent years, the literature concerning the influence of loss aversion (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992) on dishonest behavior has grown substantially. Unfortunately, the variety of possible paradigms for studying dishonesty intersected with the different methods for framing outcomes as losses has yielded ambiguity and conflicting results. While Charness et al. (2019) and Ezquerra et al. (2018) use the die-roll paradigm and could not show results indicative of the effects of loss aversion, numerous publications (Garbarino et al., 2019; Duc Huynh, 2020; Gneezy et al., 2018; Grolleau et al., 2016) using the coin-toss paradigm and other, less common activities have offered evidence of loss aversion increasing deceptive behaviors. For replication purposes, I focus most of my attention on Charness et al. (2019) and Garbarino et al. (2019). Of the two main studies that use the die-roll paradigm while studying loss aversion (Charness et al., 2019; Ezquerra et al., 2018), Charness et al. (2019) provide the more thorough explanation of their experimental design and results and offer more insights and potential explanations in their discussion. In the coin-toss paradigm, Garbarino et al.'s (2019) study is unique in not studying the interaction of other factors (as, for example, Duc Huynh (2020) does) and in specifically studying loss aversion. Notably, Charness et al. (2019) use a different method for framing outcomes as losses than Garbarino et al. (2019) do. This discrepancy raises the question of whether the lack of loss aversion effects in Charness et al. (2019) was the product of the experimental paradigm or the loss framing method.

Under the Charness et al. (2019) design, players are assigned to either a money manipulation (MM) or no money manipulation (NMM) treatment arm. From there, the experimenters assign them to either a loss frame (MM-L, NMM-L) or a gain frame (MM-G, NMM-G). In the NMM treatment arm, outcomes in both loss and gain domains are not realized until after the experiment; NMM-L (NMM-G) participants expect to receive a fixed payout (nothing), minus (plus) whatever they "lose" ("gain") in the game. Conversely, both sets of players in the MM treatment arm receive physical cash before playing the game. MM-G players receive an empty envelope for their earnings as well as a full envelope of bills containing their potential earnings, while MM-L players receive a full envelope for their earnings and an empty envelope for money they will return to the experimenters.

An anonymous referee for Charness et al. (2019) expressed concern that the NMM condition represented a gain domain and the MM condition represented a loss frame, as all NMM participants received their payments after finishing the experiment and all MM participants were given envelopes of cash at the beginning of the activity. However, the results within the MM treatments are significantly different, suggesting the presence of a distinction between the loss and gain framing of the MM condition. Namely, Charness et al. (2019) show that while MM-G participants demonstrated dishonest behavior (albeit at a somewhat lower level than both groups of NMM players), MM-L participants did not behave significantly differently from players in the baseline group, who appear to have behaved honestly. Charness et al. (2019) consider that giving the participants money could have implicitly imparted a burden of trust onto the players, making those in the MM treatment arm want to behave more honestly.

Garbarino et al. (2019) describe a model for loss aversion in risky situations and validate their model using the probability of a "good" outcome as the instrument for framing an outcome as a gain or loss. The model put forth by Garbarino et al. (2019) asserts that for a given lottery of possible outcomes, agents set the lottery's expected value as their reference point. Under this design, an agent facing a low probability of a high payoff and a high probability of a low payoff would have a relatively low reference point. Thus, receiving the low payoff would be a loss, but the loss experienced after having a high *ex-ante* probability of a high payoff and receiving a low payoff would be substantially greater in magnitude.

To validate their model, Garbarino et al. (2019) conduct an experiment using the coin-toss paradigm in which players flipped a coin four times and received payment based on the number of correct *ex-ante* guesses they made about the outcome of the coin toss. While the sequence of four coin tosses introduces the possibility of designing a game in which players can lie at sub-maximal levels, Garbarino et al. (2019) maintain the dichotomous structure of the typical coin-toss paradigm. In the high-probability treatment (H), players earned \$2 if they correctly guessed the outcome at least twice and nothing otherwise. In the low-probability treatment (L), players earned \$2 if they correctly guessed the outcome at least three times and nothing otherwise.

A possible concern related to the Garbarino et al. (2019) experiment is that payoffs depended on players' *guesses* about the observed outcome of the coin flip. While the correctness of a guess is determined randomly in reality, it is possible that subjects perceive it as a measure of skill. A meta-analysis of deception paradigms shows that participants lie less in games when they view their payout as the result of skill (Gerlach et al., 2019). In light of the literature concerning skill-based payoffs in dishonesty activities, it seems likely that the Garbarino et al. (2019) design would decrease deceptive behavior, so we would expect to see more dishonesty by removing the perceived skill component.

As noted in Section 1, the purpose of this research is to address the disagreement in the methodological literature studying the impact of loss aversion on dishonesty. In particular, I seek to compare the methods used by Garbarino et al. (2019) and Charness et al. (2019) to identify why Garbarino et al. (2019) find evidence of loss aversion increasing lying but Charness et al. (2019) do not. In Section 3, I present a model adapting Garbarino et al.'s (2019) model to be applied to the die-roll paradigm in which multiple levels of lying are available. In Section 4, I describe the experiment I carried out to evaluate the differences in experimental methods, and I highlight some critical methodological tradeoffs. Section 5 details the results of the experiment, and Section 7 concludes.

3 Theoretical Model

While Garbarino et al. (2019) present and validate a model of the decision to lie for loss-averse agents, their model considers only two possible outcomes: a high and a low payoff. One of the advantages of the die-roll paradigm over the coin-toss paradigm is the ability to examine lying behavior across multiple *levels* of lying and the potential for sub-maximal lying. In order to use the die-roll paradigm, I adapt the Garbarino et al. (2019) model to the polytomous die-roll case.

Suppose there is a vector of possible payoffs $X \in \mathbb{R}^n$. For each outcome $x_i \in X$, let $x_i < x_{i+1}$. Assigning a uniform distribution to the possible outcomes, the probability of observing each payoff is $\Pr(x_i) = \frac{1}{n}$. In the six-sided die case with distinct payoffs for each outcome, $n = 6$. Then the *ex-ante* expected payoff is $x_e = \sum_{i=1}^{n} \frac{1}{n} x_i$. In accordance with the Garbarino et al. (2019) model, I assume that an agent sets their reference point (Kahneman and Tversky, 1979) at x_e. Under the assumption that an agent is hurt more by a loss of x than is benefited by a gain of x, an exogenous increase in the *ex-ante* expected payoff would intuitively worsen the sense of loss experienced by observing a constant low outcome (below x_e) and thus increase the likelihood of lying.

Assume an agent's utility from reporting a payoff of x_R after observing a payoff of x_O is a function of the moral cost of lying $m(\cdot)$ and the utility of the loss ($l(\cdot)$) or gain ($g(\cdot)$) relative to the reference point x_e:

$$U(x_R \mid x_O) = g(x_R - x_e) \cdot \mathbb{1}(x_R \geq x_e) - l(x_e - x_R) \cdot \mathbb{1}(x_R \leq x_e) - m(x_R - x_O) \cdot \mathbb{1}(x_R \neq x_O) \quad (1)$$

where $\mathbb{1}(x)$ is a function equal to 1 if x is true and 0 if x is false. Also assume that g, l, and m are twice differentiable and that $g', l' > 0$ and $g'', l'' < 0$. Fischbacher and Föllmi-Heusi (2013), Lundquist et al. (2009), and Mazar et al. (2008) offer evidence that $m' > 0$, so I will also assume (consistent with Garbarino et al. (2019)) that $m' > 0$. By the nature of utility functions, I will also assume that $g(0) = l(0) = m(0) = 0$. Finally, we must assume that the agent is loss averse—that is, that $l(x) \geq g(x)\ \forall\, x$ and that l is steeper than g ($l'(x) > g'(x)\ \forall\, x$).

3.1 Effect of increasing *ex-ante* expected payoff on lying

Suppose x_1 and x_2 are fixed payoffs such that $x_1 < x_2$. Let x_e be the expected payoff of unknown value between x_1 and x_2. Let $U(L) = U(x_2 \mid x_1) - U(x_1 \mid x_1)$ be the utility of dishonestly reporting an outcome of x_2 when observing x_1. Then

$$U(L) = g(x_2 - x_e) + l(x_e - x_1) - m(x_2 - x_1)$$

Then an agent should lie when $U(L) > 0$. I now consider how $U(L)$ is affected by changes in x_e.

$$\frac{\partial U(L)}{\partial x_e} = l'(x_e - x_1) - g'(x_2 - x_e) \tag{2}$$

Then $U(L)$ is increasing on x_e when $l'(x_e - x_1) > g'(x_2 - x_e)$. Without knowing the exact utility functions involved, it is impossible to know the specific domain on which $U(L)$ is increasing on x_e. However, since $l' > g'$, we know that $l'(x_e - x_1) > g'(x_2 - x_e)$ when $x_e - x_1 = x_2 - x_e$.

To identify more about the model, I assume CRRA utilities for losses and gains, with l steeper than g by a factor of γ. Then $g(x) = x^\rho$, $l(x) = \gamma x^\rho$. I assume $\rho \in (0, 1)$ and $\gamma > 1$. I also temporarily neglect m.

$$\frac{\partial U(L)}{\partial x_e} = \gamma\rho(x_e - x_1)^{\rho-1} - \rho(x_2 - x_e)^{\rho-1} \tag{3}$$

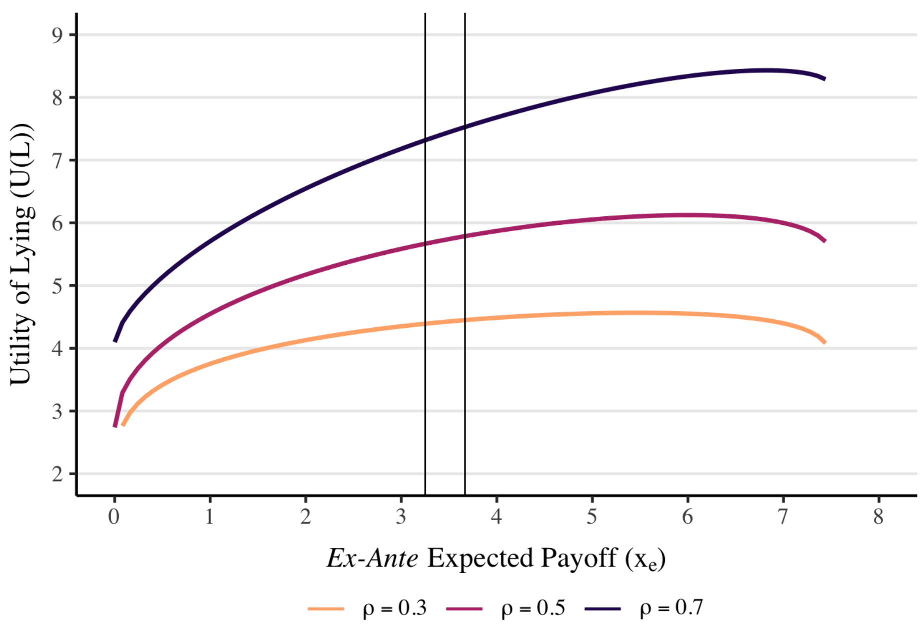
Now it is clear that $U(L)$ is increasing on x_e when

$$x_e < \frac{x_2 + \gamma^{\frac{1}{\rho-1}} x_1}{1 + \gamma^{\frac{1}{\rho-1}}} = x_e^*$$

Notably, $U(L)$ is then *decreasing* on x_e when $x_e > x_e^*$. This result initially seems counterintuitive but reflects the fact that as x_e approaches x_2, the utility gained from lying approaches zero while the effect of the loss suffered marginally diminishes. Under the model without a moral cost associated with lying, agents should always lie when faced with an opportunity to do so,[1] aligning with traditional theory.

In this experiment, I have chosen *ex-ante* expected payoffs of 3.25 and 3.67. Figure 1 shows the utility of lying ($U(L) = U(x_2 \mid x_1) - U(x_1 \mid x_1)$) with a variable *ex-ante* expected payoff for three values of ρ used in $l(\cdot)$ and $g(\cdot)$. Vertical lines at 3.25 and 3.67 represent the *ex-ante* expected payoffs I use in this experiment and show that $U(L)$ is increasing on x_e on the interval from 3.25 to 3.67.

Figure 1: Utility of lying as a function of x_e



Note: Utilities of losses and gains are CRRA with $l = 2g$. x_1 and x_2 span the entire range of possible payoffs ($x_1 = 0$, $x_2 = 7.5$) in the Expected Value treatments (see Section 4) of this experiment. Vertical lines represent the values of x_e, 3.25 and 3.67, I use for gain and loss, respectively. Moral cost is omitted.

[1] $U(L) = g(x_2 - x_e) + l(x_e - x_1)$.

Reintroducing m, assume $m(x) = kx^\alpha$ for $k > 0, \alpha \geq 1$. Now agents should only lie when

$$(x_2 - x_e)^\rho + \gamma(x_e - x_1)^\rho > k(x_2 - x_1)^\alpha \tag{4}$$

Equation 4 represents a general situation in which agents should lie. Turning instead to a more concrete example, suppose Tom and Stacey are participants in this experiment. Tom was raised outside of society and was not conditioned to experience guilt when lying, so his moral cost is zero ($m(x) = 0$). Tom has the utility functions $g_T(x) = x^{0.5}$, $l_T(x) = 2x^{0.5}$. The *ex-ante* expected payoff for both players is \$3.25. Suppose Tom observes a payoff of \$0 but knows he can lie and report a payoff of \$7.50. Then $U_T(7.5 \mid 0) - U_T(0 \mid 0) = \sqrt{4.25} + 2\sqrt{3.25} \approx 5.67$, so Tom should lie and report earning \$7.50. Suppose that instead, the *ex-ante* expected payoff was \$3.67. Then if Tom observed a payoff of \$0, $U_T(7.5 \mid 0) - U_T(0 \mid 0) = \sqrt{3.83} + 2\sqrt{3.67} \approx 5.79$, so Tom should lie. That Tom should lie when the expected payoff is higher is no surprise given that he was already going to lie with the low expected payoff. However, note that his utility gained from lying increases from $x_e = 3.25$ to $x_e = 3.67$.

In contrast to Tom, Stacey experiences guilt when lying. Suppose Stacey has the same utilities as Tom for losses and gains ($l_S(x) = 2x^{0.5}$, $g_S(x) = x^{0.5}$) but also a moral cost of $m_S(x) = \frac{1}{8}x^{1.9}$. If Stacey observes a payoff of \$0 but considers lying to obtain \$7.50 under an *ex-ante* expected payoff of \$3.25, she should lie if and only if $U_S(7.5 \mid 0) - U_S(0 \mid 0) > m_S(7.5)$. Since $\sqrt{4.25} + 2\sqrt{3.25} - \frac{1}{8}(7.5)^{1.9} \approx -0.08$, Stacey should not lie to obtain a payoff of \$7.50.[2] Consider that the *ex-ante* expected payoff was instead \$3.67. Then Stacey should lie to obtain \$7.50 if and only if $\sqrt{3.83} + 2\sqrt{3.67} - \frac{1}{8}(7.5)^{1.9} \approx 0.04 > 0$, which is true. Then Stacey should lie to obtain \$7.50 when $x_e = 3.67$ but not when $x_e = 3.25$. As with Tom, Stacey's utility of lying increases as x_e increases.

In Section 4, I test this model by implementing a loss and a gain treatment that rely on the *ex-ante* expected payoff. In the loss treatment, $x_e = 3.67$, and in the gain treatment, $x_e = 3.25$. The model described above predicts an increase in lying among participants who face the higher *ex-ante* expected payoff. However, note that in the example of Stacey's

[2] However, Stacey would be willing to lie for a payoff of up to \$7.43 if given the option to do so.

decision, Stacey was very close to the margin of lying to begin with; it is unclear how sensitive agents are to changes in x_e without identifying specific values (or intervals) for ρ and α in particular.

4 Method

I use a cross-sectional experimental design to test the theoretical model outlined in Section 3 and evaluate the influence of loss aversion of lying. I recruited 409 participants through Amazon's Mechanical Turk (MTurk). MTurk workers tend to be older on average than college students typically recruited for experimental studies, and the MTurk platform allows for workers to participate anonymously and without any chance of being observed—a characteristic that is critical for avoiding the influence of possible fears of observability and reputation costs. However, Gerlach et al. (2019) raise concerns that participants obtained through MTurk may be "professional survey takers" and thus behave more deceptively than student samples, a problem I discuss in more detail in Section 6.

Each participant had an equal probability of being assigned to each of the five treatment arms:

No Incentive (C): All participants earn \$2.50, regardless of what they roll.

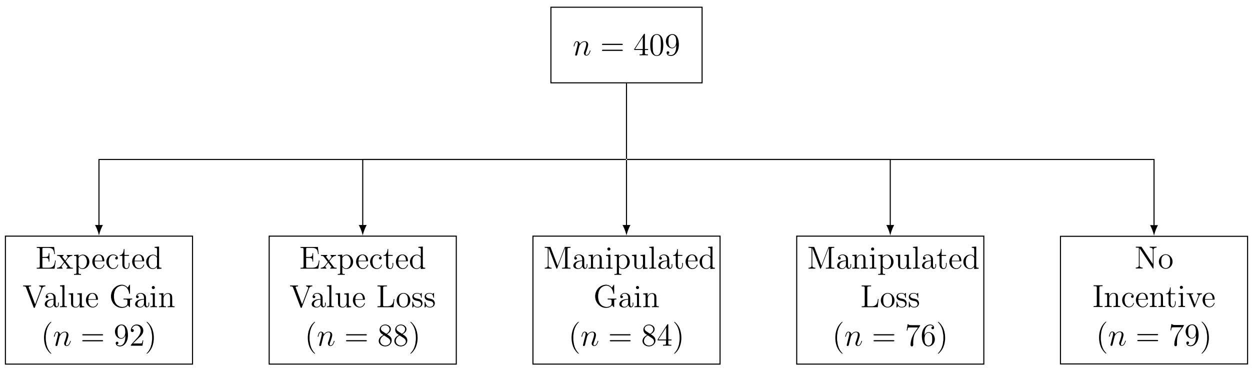
Money Manipulation Gain (MG): Outcomes are framed as gains. A participant who rolls the number n received $\$(n-1)$ (i.e., rolling a 6 is worth \$5.00, rolling a 2 is worth \$1.00).

Money Manipulation Loss (ML): Participants earn the same amount for each roll that they would in the Money Manipulation Gain arm, but I frame the outcome as a loss by informing them that they are endowed with \$5.00 to start and will lose the corresponding amount based on their roll.

Expected Value Gain (EVG): Outcomes are framed as gains, but the *ex-ante* expected payoff is \$3.25 with a maximum payoff of \$7.50.

Expected Value Loss (EVL): Outcomes are framed as gains, but I increase the *ex-ante* expected payoff to \$3.67 with a maximum payoff of \$7.50.

Figure 2: Treatment Arms



4.1 Experimental Design

Participants completed the experiment individually on a computer through the Qualtrics survey platform. There were no synchronous experimental sessions for participants to attend; instead, each participant completed the activity on their personal devices at their leisure. While completing the experiment, participants observed their private (treatment arm-dependent) instructions and were directed to a digital, six-sided die[3]. I used an external website for the die roll instead of alternative options like a random number generator embedded within the Qualtrics survey for two main reasons. First, I structured the external site so that participants had the sense of agency from pressing the "Roll" button and the visual cue of seeing the result of their roll that they would have experienced if they had rolled a physical die. Second, I was concerned that if participants observed their roll embedded in the survey, they might doubt that the roll was private to them or that it was truly random. While I created the website used for the virtual die roll, there was no way of tracking participants as they rolled the die, and I did not directly collect data from the die roll website.[4] While I would have preferred not to create the website used for the die roll and risk leading

[3]An archived version of the website participants were directed to can be viewed at https://bit.ly/dierollarchive. Images of the rolled die also appeared on the site.

[4]Furthermore, the site's code was entirely client-sided, so participants could have viewed the code on their own and verified that the die roll was random and was not recorded or saved.

some participants to believe I would be able to observe their individual rolls, most existing sites either had too many settings to change (like the number of dice or the number of sides on each die) or ads and other features. To avoid confusing settings and having to make the instructions more complicated, and to avoid ads that may influence decisions,[5] the only reasonable option was to create the website myself. Figure A.1 shows the outcomes of 10,000 individual digital die rolls. The result is a uniform distribution,[6] indicating that the digital die roll is an accurate representation of rolling a fair, six-sided die.

In the instructions, participants learned that they could roll the virtual die as many times as they would like but that they should record only the first number they saw (1, 2, 3, 4, 5, or 6) in the online survey. There was a "practice round" in which participants were told that they had rolled a four and recorded what their hypothetical earnings would be based on their treatment arm. In addition to ensuring that subjects understood the instructions, the practice round guaranteed that they were paying attention to the survey, as the survey would not let them advance to the activity until they correctly completed the practice round.

To translate the Expected Value method for loss framing (Garbarino et al., 2019) from the coin-toss paradigm to the die-roll paradigm, I manipulate the *ex-ante* expected payoff of the die-roll activity. Based on the models presented by Garbarino et al. (2019) and in Section 3, the increase in the expected value of rolling the die theoretically increases the probability of an individual lying. In the EVL treatment, I increase payoffs by 50% for rolls of three or higher, yielding an *ex-ante* expected payoff of \$3.67. In the EVG treatment, I increase payoffs by 50% only for rolls of 5 or higher. The *ex-ante* expected payoff in the EVG treatment is \$3.25. According to the model described in Section 3, the higher expected value in the EVL treatment makes low payoffs more painful and theoretically produces more lying than would be present in the EVG treatment. For example, a participant in the loss treatment theoretically sets their anchor point at \$3.67. If the participant rolls a 2, they will feel a sense of loss corresponding to the loss of \$2.67. However, if that same participant is in the gain treatment, they will set their anchor point at \$3.25 and feel a loss of only \$2.25 after rolling a 3. The full instructions can be found in Appendix C.

[5]For example, an Amazon ad for a religious text could induce a subject to report their die roll honestly when they otherwise might not.

[6]A Kolmogorov-Smirnov test comparing the distribution to a discrete uniform distribution over the integers from 1 to 6 reports a p-value of 0.939.

Table 1 shows the amount earned by participants based on their treatment group and the number they report having rolled. After completing the activity and survey, I selected half of the subjects at random to receive the payoff they earned in the experiment.

Table 1: Payoffs by Treatment

		Die roll value					
		1	2	3	4	5	6
Payoff	EVG	\$0.00	\$1.00	\$2.00	\$3.00	\$6.00	\$7.50
	EVL	\$0.00	\$1.00	\$3.00	\$4.50	\$6.00	\$7.50
	MG	\$0.00	\$1.00	\$2.00	\$3.00	\$4.00	\$5.00
	ML	\$0.00	\$1.00	\$2.00	\$3.00	\$4.00	\$5.00
	C	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50	\$2.50

After participants rolled the die and recorded the outcomes, they completed a survey asking about demographics, risk attitudes and behaviors, and extraneous questions designed to distract from the risk attitudes question. The question about risk attitudes[7] comes from the 2004 German Socio-Economic Panel (SOEP) questionnaire and has been experimentally validated as a measure of risk aversion (Dohmen et al., 2011). Extraneous questions come from the General Social Survey questionnaire, and the survey platform placed all of the survey questions, including the SOEP risk question, in random order. Appendix C contains the full experimental instructions, and Subsection C.6 shows the survey participants completed.

4.2 Balance Across Treatments

The survey results from the 409 participants show that participant characteristics are generally spread evenly across treatment groups. Table 2 shows that the number of participants in each group ranges from 18.6% of the sample to 21.5% and that participants' mean and median ages are within a five-year range. Similarly, the proportions of male participants in each treatment are clustered around the true proportion of male participants in the study (0.494).

[7] "Please indicate the degree to which you agree or disagree with the following statement: I am generally a person who is fully prepared to take risks."

Table 2 also shows the responses to the SOEP question about risk attitudes. A value of one indicates a high degree of risk aversion, and a value of seven indicates a high degree of risk seeking. The overall mean response to the risk question is 1.49, corresponding to an average response about halfway between "strongly disagree" and "generally disagree." In other words, participants were largely risk averse. There is a noticeable increase in risk aversion among participants in the Money Manipulation treatments compared to participants in the control and Expected Value groups (a mean value of 1.34 compared to 1.58), but this difference is not statistically significant. Furthermore, all treatments exhibit the same median risk value (2).

Table 2: Summary Statistics

	Obs.	Mean Age	Med. Age	Prop. Male	Mean Risk
Control	79	37.97	36.00	0.49	1.57
Expected Value Gain	82	33.80	31.00	0.46	1.60
Expected Value Loss	88	33.52	32.00	0.52	1.59
Money Manipulation Gain	84	36.50	35.00	0.48	1.30
Money Manipulation Loss	76	36.52	34.00	0.51	1.38

Due to the number of possible racial identities, I have separated the proportions of treatment members identifying with each race into Table 3. Racial identities appear to be balanced across treatments, even though white participants, including those of Middle Eastern origin, make up the vast majority of the sample.

Table 3: Racial Identities Across Treatments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Control	0.714	0.143	0.065	0.065	0.000	0.000	0.013
Expected Value Gain	0.744	0.110	0.122	0.024	0.000	0.000	0.000
Expected Value Loss	0.682	0.125	0.125	0.045	0.011	0.011	0.000
Money Manipulation Gain	0.726	0.083	0.071	0.107	0.012	0.000	0.000
Money Manipulation Loss	0.658	0.145	0.132	0.066	0.000	0.000	0.000

Note: Each column represents the proportion of the treatment's sample identifying with a specific racial group. The following are the racial identities represented by each column: (1) - White (including Middle Eastern origin); (2) - Asian; (3) - American Indian or Alaska Native; (4) - Black or African American; (5) - Multiracial; (6) - Native Hawaiian or Other Pacific Islander; (7) - Other.

4.3 Hypotheses

The two main questions at the heart of this research ask how loss aversion affects dishonest behavior (if at all) and how the Expected Value and Money Manipulation methods for loss framing compare in an activity that allows multiple levels of lying.

HYPOTHESIS 1. *Loss will not produce more extreme lying, but it will increase the incidence of lying.*

In evaluating why they were unable to observe behavior consistent with loss aversion using a loss framing method other than money manipulation, Charness et al. (2019) demonstrate that most of the participants who lied in both the loss and gain treatments did so at the maximal level. Therefore, it was impossible for them to find evidence of loss framing leading to more extreme lying. Since Charness et al. (2019) also used the die-roll paradigm, it would be reasonable to expect similar behavior in this experiment. However, I do expect to find evidence that more participants lie in the loss treatments than in the gain treatments (i.e., that the rate of lying increases), even if the lying itself cannot possibly be more extreme. I form this hypothesis based on the results of Garbarino et al. (2019), who find evidence of increased lying to avoid a bad outcome in their (Expected Value) loss treatment compared to their gain treatment. While I am conducting this experiment using the die roll paradigm and therefore do not have a single "good outcome" and a single "bad outcome," I still expect the Expected Value method to produce loss aversion, as seen in Garbarino et al. (2019). In the Money Manipulation methods, I similarly expect to see the rate of lying rise in the loss treatment compared to the gain treatment, consistent with results outside of the die-roll paradigm (Gneezy et al., 2018; Garbarino et al., 2019; Duc Huynh, 2020; Grolleau et al., 2016). However, as I note in Hypothesis 2, I do not expect lying as a whole to be greater in the ML treatment than the MG, so I anticipate that while fewer participants will be honest in the ML treatment, liars in the ML treatment will also predominantly lie sub-maximally (consistent with Charness et al. (2019)).

HYPOTHESIS 2. *Money manipulation will not show more lying in the domain of losses than in gains.*

It can be reasonably argued that Money Manipulation treatments will not demonstrate evidence of loss aversion affecting lying, in line with the results from Charness et al. (2019). Since Ezquerra et al. (2018) find the same results as Charness et al. (2019) while using a similar experimental design, it is highly unlikely that the results presented by Charness et al. (2019) represent one-time random null results. However, there is also a strong argument that the Money Manipulation treatments will be perceived differently in this experiment than in those of Charness et al. (2019) and Ezquerra et al. (2018). Since I have not given participants physical cash and have instead only informed them of their initial endowments, it is possible that they will not feel that they have been entrusted with money as Charness et al. (2019) argue is a possible explanation for their results. Since experiments across coin-toss (Duc Huynh, 2020; Garbarino et al., 2019) and other paradigms (Grolleau et al., 2016; Gneezy et al., 2018) have asserted that lying is more common when outcomes are framed as losses, it would be surprising not to observe similar results when additional factors, like a feeling of being entrusted with money, have been eliminated. Still, participants in this experiment may have felt that their endowments reflected trust being placed in them to behave honestly, so I predict that the effects of the Money Manipulation treatments will be consistent with the current literature. While the discrepancy in experimental settings and methods is a weakness in the replication of the Charness et al. (2019) method, it could also shed light on the mechanisms responsible for the results they observed.

Hypothesis 3. *Loss in Expected Value treatments will increase lying relative to gains.*

I expect the Expected Value treatment to yield a significant increase in dishonesty among participants in the loss treatment. Garbarino et al. (2019) found evidence consistent with loss aversion using the coin-toss paradigm, and Gerlach et al. (2019) demonstrate that experimental subjects are less likely to lie when sub-maximal lying is not possible. Therefore, I expect that by bringing the Garbarino et al. (2019) method of loss framing into a paradigm that allows for sub-maximal lying, I will observe levels of dishonesty no lower than those found by Garbarino et al. (2019). Further, Garbarino et al. (2019) validate a theoretical model of the influence of the expected value of a random variable on dishonest behavior under the assumption of a loss-averse agent. In Section 3, I have adapted their validated model to the die-roll case and arrived at the same conclusion, indicating that the same theory that was validated with the coin-toss paradigm should hold with the die-roll paradigm.

5 Results

I begin by examining the general behaviors exhibited in the experiment. Figure 3 shows the distributions of reported die rolls within each treatment group. Red horizontal lines at $\frac{1}{6}$ represent the expected frequency of each reported roll under a uniform distribution (if no one lied). Visually, it is clear that the distributions of reported die rolls are not uniform for the Expected Value Gain (EVG), Expected Value Loss (EVL), and Money Manipulation Gain (MG) treatments, and that the distribution may be non-uniform for the Money Manipulation Loss (ML) treatment as well. Table A.1 shows the p-values from Kolmogorov-Smirnov tests comparing the observed distributions to the theoretical uniform distribution and confirms that we can conclude that all of the distributions except for the Money Manipulation Loss and control groups did not come from a uniform distribution. In particular, there appears to be evidence of underreporting "low" values (1-3) and overreporting "high" values (4-6) in all of the treatments except for the ML and control groups. The uniformity of the control group supported by Figure 3 and Table A.1 indicates that the control group is a valid comparison group and that participants in the control group did not experience any incentive to lie about their observed die roll. Comparing the other distributions to the control group, it is evident that, as expected, participants in the EVG, EVL, and MG treatments made false reports of what number they rolled.

In Table 4, I present the mean and standard error of the die rolls from each treatment group, and I report the cumulative density of each roll. As expected from Figure 3, the control group has the mean die roll closest to 3.5 (the expected mean under no lying) and doesn't display any unexpectedly large increases in the cumulative density from roll to roll (the largest, from 3 to 4, being only 27% larger than expected). While Table A.1 shows that the Money Manipulation Loss distribution is not significantly different from the uniform distribution at the 5% significance level, only 35.5% of observations come in the lowest-paying half of die rolls (1-3). While not as extreme as the other treatment groups, this effect, combined with the higher mean die roll, suggests that lying may still be taking place in the Money Manipulation Loss treatment.

Figure 3: Observed Die Roll Distributions

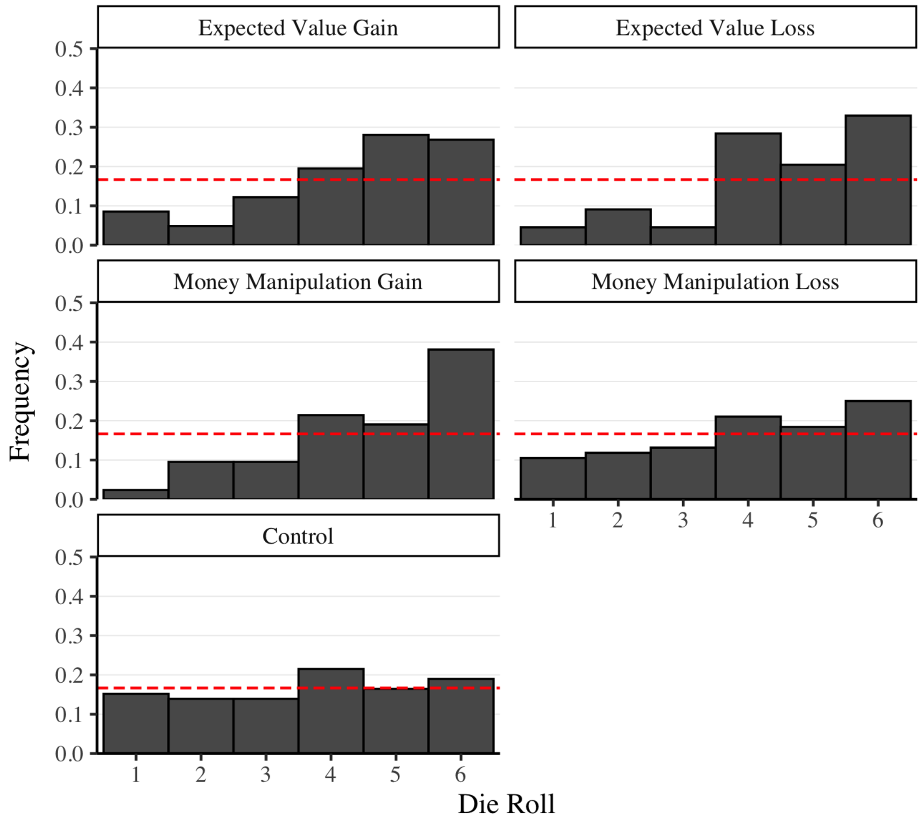


Table 4: Cumulative Roll Density

	Obs.	Mean	SE	1	2	3	4	5	6
C	79	3.671	0.192	0.152	0.291	0.430	0.646	0.810	1.000
EVG	82	4.341	0.169	0.085	0.134	0.256	0.451	0.732	1.000
EVL	88	4.500	0.155	0.045	0.136	0.182	0.466	0.670	1.000
MG	84	4.595	0.157	0.024	0.119	0.214	0.429	0.619	1.000
ML	76	4.000	0.191	0.105	0.224	0.355	0.566	0.750	1.000

Table 5 shows the results of two-sided Mann-Whitney tests comparing (a) the mean die roll and (b) the proportion of participants who reported rolling a one in each treatment group to the control group. Based on the assumption made by Gerlach et al. (2019) that participants will only lie to *increase* their earnings, we can view the proportion of participants who reported rolling one as a proxy for the proportion of honest participants in each group.[8]

Table 5 further confirms the conclusions evident from Figure 3 and Table A.1, that partic-

[8]Gerlach et al. (2019) propose that $6 \cdot \Pr(\mathit{RolledOne})$ represents the lower bound of the proportion of honest reporters.

Table 5: Mean Differences Between Treatments and Control (Mann-Whitney)

	Outcome	
	Die Roll	Rolled One
Expected Value Loss	0.829***	−0.106**
	(1.454)	(0.209)
Expected Value Gain	0.671**	−0.067
	(1.533)	(0.281)
Money Manipulation Loss	0.329	−0.047
	(1.665)	(0.309)
Money Manipulation Gain	0.924***	−0.128***
	(1.441)	(0.153)
Control Mean	3.671	0.152
Control SD	1.708	0.361

*p< 0.1, **p< 0.05, ***p< 0.01

Note: Coefficients represent the difference in mean outcome value between the specified treatment group and the control group. p-values were obtained through Wilcoxon rank sum (Mann-Whitney) tests. Outcome standard deviations for each treatment are specified in parentheses.

ipants in the treatment groups lied about their observed die rolls. In addition to supporting this result, Table 5 reveals the magnitude of lying and an approximation of the rate of lying (through the proportion of participants who reported rolling a one) within each treatment arm. Notably, there appear to have been more liars in the EVL treatment than EVG, yielding a higher mean die roll. Conversely, the ML treatment produced an increase in the mean die roll that is not statistically significant, and we cannot conclude that fewer participants reported ones than in the control group. The weakness of the results displayed in Table 5 is consistent with Charness et al.'s (2019) revelation that applying a Money Manipulation treatment in the domain of losses does not result in the behavior we would expect under the theory of loss aversion.

Result 1. *There is no significant evidence that loss increases the incidence of lying in Expected Value treatments.*

Concerning the first hypothesis, that "loss will not produce more extreme lying, but it will increase the incidence of lying," Table 6 shows that two-sided Mann-Whitney tests comparing loss and gain treatments do not find significant differences in either outcome for Expected Value treatments. Although the results are not significant, Figure 3 visually indicates that both gain and loss treatments exhibit a substantial number of participants lying at the maximal (or near-maximal) level. Additionally, lying does not appear to be more extreme in the Expected Value Loss treatment than in the Expected Value Gain treatment. However, the mean reported roll in the EVL treatment is greater than the mean reported roll for EVG participants. While this difference is not statistically significant, it is clear that within this sample, there were more liars in the loss treatment than in the gain.

Because the differences in mean roll and proportion of participants reporting ones are small relative to the standard deviation in the outcomes in the EVG treatment (both are less than 0.12 standard deviations from the EVG value), it is worth considering the minimum detectable effect size in this sample, an issue I address further in Section 6.

Table 6: Mean Differences Between Loss and Gain Treatments (Mann-Whitney)

	Outcome	
	Die Roll	Rolled One
Expected Value		
Gain	4.341	0.085
	(1.533)	(0.281)
Loss−Gain	0.159	−0.040
	(1.454)	(0.209)
Money Manipulation		
Gain	4.595	0.024
	(1.441)	(0.153)
Loss−Gain	−0.595**	0.081**
	(1.665)	(0.309)

*p< 0.1, **p< 0.05, ***p< 0.01

Note: Coefficients in the "Gain" rows represent the mean outcome value in the gain treatment group. Coefficients in the "Loss−Gain" rows represent the mean outcome value of the gain treatment group subtracted from the mean outcome value of the loss treatment group. In the "Gain" rows, the gain treatment group's standard deviation is reported in parentheses; in the "Loss−Gain" rows, the standard deviation of the loss treatment group's outcome is reported in parentheses.

Result 2. *Money manipulation does not show more lying in the domain of losses than in gains.*

Table 6 shows evidence in support of my second hypothesis: in Money Manipulation treatments, lying is not more common in the loss treatment than in the gain treatment. In fact, the loss treatment exhibits a significant *decrease* in lying compared to the gain treatment. From the increase in the proportion of participants who reported rolling a one, it is likely that the decrease in mean die roll is the product of both fewer participants in the ML treatment lying and liars in the ML treatment doing so at a less extreme level than in the MG treatment.

Result 3. *There is no significant evidence that loss in Expected Value treatments increases lying relative to gains.*

Table 6 shows that the proportion of participants who reported ones is lower in the EVL treatment than the EVG treatment (0.045 compared to 0.085). This difference suggests that there were more liars in the EVL treatment than in the EVG treatment. The proportion of EVL participants who reported ones is slightly more than half that of EVG participants, and both are significantly less than the proportion observed in the control group. However, a two-sided Mann-Whitney test reveals that the difference between EVG and EVL proportions is not statistically significant. Therefore, we cannot conclude that there is a difference in the incidence of lying between Expected Value treatments.

5.1 Replication Validity

Due to the methodological differences between this experiment and the one conducted by Charness et al. (2019), it is critical to statistically verify whether my results are similar to theirs. A major obstacle to comparing these results to Charness et al.'s (2019) is that they use a ten-sided die in their experiment, while I use a six-sided die.

To compare our results, I coerce Charness et al.'s (2019) die roll values (0-9) to those of a six-sided die (1-6) by payoff amount. Table 7 shows the payoffs Charness et al. (2019) used for each reported die roll value.

Table 7: Charness et al. (2019) Payoffs

	Reported die roll									
	0	1	2	3	4	5	6	7	8	9
Payoff (EUR)	0.00	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00

Because Charness et al. (2019) use increments of 0.5 that I do not include in my Money

Manipulation treatments, I use two methods to obtain comparable data: "rounding up" and "rounding down" the payoffs to the nearest whole currency unit value. Table 8 shows what each value on the ten-sided die is translated to on the six-sided die under each conversion method. Assuming participants report their die rolls to obtain a particular payoff, rounding up implies that participants at half-value amounts would choose to report the die roll giving them a higher payoff if given the choice. Conversely, rounding down implies that those same participants would instead choose to report the die roll giving them a lower payoff. The behavior participants at half-value amounts would truly report likely falls somewhere between the extremes of the rounding up and rounding down methods, depending on what value they actually observed and how prone they are to lying. Because these factors are impossible to determine without substantially more information, I use the extreme cases for reference points.

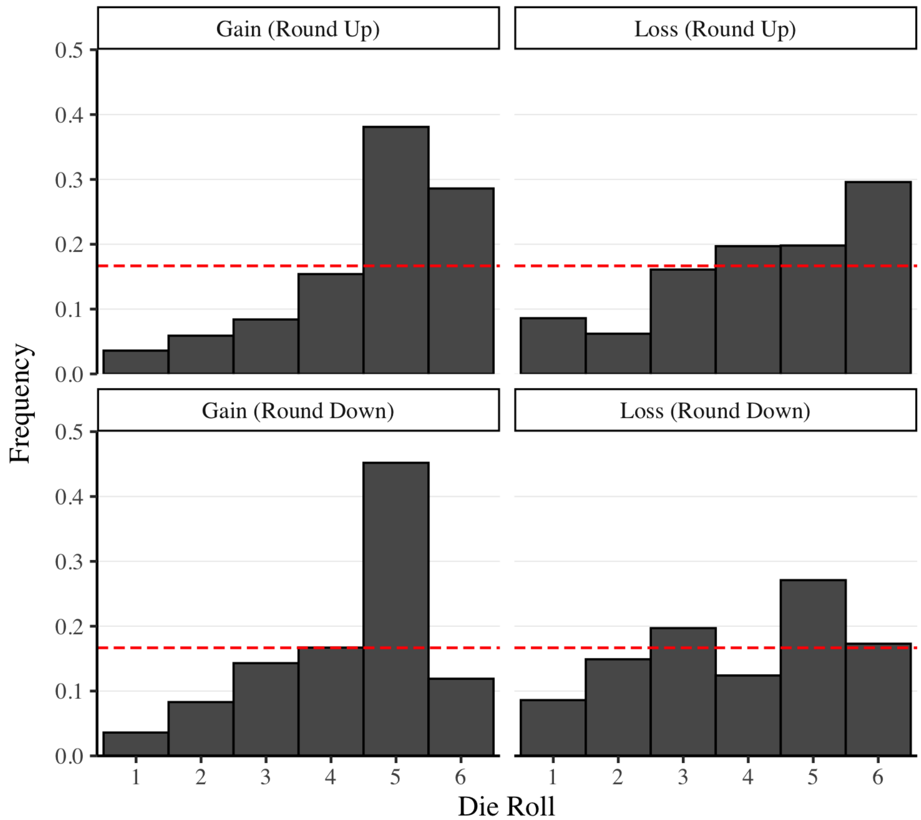
Using the cumulative density of reports at each roll value provided by Charness et al. (2019), I produce replicated discrete density distributions for six-sided dice pictured in Figure 4. Based on a visual comparison of these histograms to those presented by Charness et al. (2019), it appears that the rounding down method is more accurate to Charness et al.'s (2019) results due to the sub-maximal spike in reports in the gain treatment and the more uniform distribution of reports in the loss treatment. Nevertheless, I compare the results of both conversion methods to my observed results.

Table 8: Charness et al. (2019) Payoffs

		Reported die roll									
		0	1	2	3	4	5	6	7	8	9
6-sided die	Rounded Up	1	2	3	3	4	4	5	5	6	6
	Rounded Down	1	2	2	3	3	4	4	5	5	6

Table 9 displays p-values resulting from Kolmogorov-Smirnov tests comparing the observed distributions of reports to the reconstructed distributions from results that Charness et al. (2019) obtained. From these results, it appears that the rounding up method is more representative of what I observed than the rounding down method. Importantly, we cannot say that the ML distribution of reports comes from a different distribution than the Charness et al. (2019) loss treatment distributions from either conversion method, supporting the validity of this experiment's replication of Charness et al. (2019).

Figure 4: Hypothetical Roll Distributions



Although the ML distribution is consistent with the Charness et al. (2019) distributions, the MG distribution is significantly different from the Charness et al. (2019) gain distribution after rounding down. This discrepancy likely arises because the sub-maximal lying tendency in the gain treatment that Charness et al. (2019) observed is not present in my observed results. Instead, MG participants in this experiment heavily favored maximal lying, as is evident in Figure 3. While this is an important inconsistency in the replication, it is at least partly attributable to a shortcoming of the methods used to convert the ten-sided die rolls to six-sided dice; participants in the gain treatment of Charness et al.'s (2019) experiment reported payoff-maximizing values (eights and nines) more than the expected amount under a uniform distribution (above the horizontal red line), a glaring difference between the rounded down gain distribution and the actual Charness et al. (2019) distribution.

Table 9: Kolmogorov-Smirnov Tests with Charness et al. (2019) Replicated Distributions

	Kolmogorov-Smirnov p-values	
	Loss Domain	Gain Domain
Rounded Up		
Expected Value	0.116	0.202
Money Manipulation	0.777	0.427
Rounded Down		
Expected Value	0.000	0.052
Money Manipulation	0.758	0.000

Note: In the "Loss Domain" ("Gain Domain") column, the numbers reported represent the p-value obtained from Kolmogorov-Smirnov tests comparing the observed distribution of die rolls in the loss (gain) frame of the indicated treatment type to the reconstructed money manipulation loss (gain) treatment from Charness et al. (2019). In the "Rounded Up" ("Rounded Down") panel, reconstructed distributions from Charness et al. (2019) were obtained through the rounding up (rounding down) method described above.

6 Discussion

In Section 5, I offer ample evidence demonstrating that participants in the treatment groups lied about their observed die roll value in order to increase their payoffs in the experiment. This conclusion is expected but important nonetheless, as it confirms that participants in this experiment behaved in a way that is generally consistent with the decisions observed in prior research on lying. Some—but not all—subjects lied about their die roll, and some dishonest subjects lied at the payoff-maximizing level (in this case, dishonestly reporting a six) while others lied at sub-maximal levels.

Importantly, the control group in this experiment did not exhibit any clear lying behavior. In addition to allowing the control group to serve as a comparison group for all other treatments, this outcome further confirms this experiment's validity in assessing dishonest behavior under incentives to lie: because the control group was not given any incentive to lie, it would be surprising and indicative of a methodological error if participants in the control group regularly lied. Instead, I have not found any substantial evidence of lying in the control group. I also test the robustness of the control group as a baseline comparison for the treatments in Appendix B by creating 1000 simulated control groups drawn from a discrete uniform distribution of possible die rolls and comparing the actual treatment results to these simulated control groups. The main conclusion from this simulated robustness test is that the real control group in this experiment is a valid comparison group. Additionally, none of the significant results that the Mann-Whitney tests identified in Section 5 appear to have been produced by random characteristics of the observed control group.

In comparisons between treatment groups, I focused on two outcomes: the mean die roll and the proportion of subjects who reported having rolled a one. There is no doubt that the mean reported die roll is useful for evaluating dishonest behavior within treatments, but it does not distinguish between the number of participants who lied and the "extremeness" of each lie—that is, the absolute difference between the true observed die roll and the reported number. To make this distinction, I include the proportion of subjects who reported rolling a one based on the method that Gerlach et al. (2019) used to estimate an upper bound for the rate of liars in dishonesty experiments using the die-roll paradigm.[9] As noted in Section 5, Gerlach et al. (2019) must assume that subjects will not lie to report rolling a one. I do not find any evidence that suggests that this assumption is incorrect in the results from the ML treatment of this experiment, and I have been unable to find a substantial body of literature contradicting Gerlach et al.'s (2019) assumption. Therefore, I am comfortable viewing the proportion of subjects who reported rolling a one as a proxy for the rate of honesty within each treatment group.

In Section 4, I predicted statistically significant differences between the loss and gain treatments of the Expected Value method of inducing a sense of loss. Neither of these results came to fruition. By contrast, the results from the EVG and EVL treatments are nearly statistically indistinguishable. While contradictory to my initial hypotheses, this outcome is in line with the conclusions that Charness et al. (2019) and Ezquerra et al. (2018) draw from their die-roll experiments. Specifically, the lack of distinction between the EVL and EVG results suggests that loss aversion may not play a role in the decision to lie—at least when there are five or more possible levels of lying.

Charness et al. (2019) and Ezquerra et al. (2018) put forward evidence contrary to the

[9] The exact formula used by Gerlach et al. (2019) is $M_{liar} = 1 - \frac{C(t_{min})}{\mathbb{E}(t_{min})}$, where M_{liar} is the estimated rate of liars, $C(t_{min})$ is the proportion of participants who claimed the lowest-paying outcome (in this experiment, a one), and $\mathbb{E}(t_{min})$ is the *expected* incidence of the lowest-paying outcome, assuming no one lies (in this experiment, $\frac{1}{6} \approx 0.167$).

hypothesis that framing an outcome as a loss increases the likelihood of lying to avoid it compared to framing the same outcome as a gain. However, Charness et al. (2019) suggest that loss framing may actually *decrease* lying relative to gain framing, a result that evidence from my ML treatment appears to support. While my ML and MG treatments align with Charness et al.'s (2019) results, I cannot identify any significant difference between my EVL and EVG outcomes. The comparison of the Expected Value and Money Manipulation treatments yields two important conclusions.

The first conclusion is that the Money Manipulation and Expected Value methods for framing outcomes as losses (or gains) differ in both method and result. Where dishonesty appears to decrease from the MG to ML treatments, it stays the same between EVG and EVL treatments. This determination is expected but still meaningful for designing experiments relating to lying and loss aversion in the future; to definitively argue the influence of loss aversion on dishonesty in specific situations, it is essential to consider both methods of framing random outcomes as losses. Additionally, further research and replications are necessary to lend support to the conclusion that the Money Manipulation and Expected Value methods suggest different effects of loss aversion on lying behavior.

I have argued that the Expected Value and Money Manipulation treatments yield different results. However, the outcomes of both treatment types support the conclusion previously asserted by Charness et al. (2019) and Ezquerra et al. (2018)—that loss aversion does not lead agents to lie more when faced with a loss than a gain. Such a conclusion contradicts a seminal theory of human behavior and seems to be refuted by numerous other lying experiments (Duc Huynh, 2020; Grolleau et al., 2016; Gneezy et al., 2018; Garbarino et al., 2019). Within the domain of dishonesty, there must be an explanation for why loss aversion seems to increase lying in some studies and not in others. Momentarily setting aside study-specific methodological and environmental explanations, one possibility worth further consideration is the role of defaults (Johnson and Goldstein, 2003). One of the defining characteristics of the die-roll paradigm is that there are more than two possible levels of lying available, including several sub-maximal levels. Because the difficulty of making a decision increases as the set of alternatives grows (Iyengar and Lepper, 2000; Van 't Veer et al., 2014), it is plausible that agents view their true observed roll as the default option and elect to report that default instead of spending energy choosing a different number.

Turning instead to considerations of the method and experimental context involved in studying this question, one possible explanation for loss aversion's seeming lack of effect on dishonesty is that the marginal benefit of reporting a higher payoff is not large enough to overcome the moral cost of that higher report. As a result, a question that remains to be answered is whether raising the stakes in the experiment and widening the gap between possible payoffs leads to different behaviors. The answer to this question is not evident without further research, as the moral cost of lying is believed to be increasing on the magnitude of the marginal benefit (Fischbacher and Föllmi-Heusi, 2013; Lundquist et al., 2009; Mazar et al., 2008).[10] Another explanation—also addressed by Charness et al. (2019)—is that so many participants were already maximally lying when the outcome was framed as a gain that reasonable changes in dishonesty among loss-treatment participants were undetectable.

Although the distributions of reported die rolls appear similar for the EVG and EVL treatments, it is clear from Table 6 that in this experiment, participants in the EVL treatment lied more than those in the EVG treatment. As stated in Section 5, this difference is not statistically significant. Given the relatively large standard deviations compared to the difference in mean, it is unclear whether the result is null because there is truly no effect present or because the sample does not lend enough power to the test to identify the result as significant. Because I use the non-parametric Mann-Whitney (Wilcoxon ranked sum) test, I am unable to conduct a formal power analysis to identify the minimum detectable effect size. However, I was able to estimate a minimum detectable effect of greater than 0.6 for the mean die roll difference between the EVG and EVL treatments through simulations assuming a normal distribution of die rolls centered at 3.5, the expected value of a fair, six-sided die with no lying.

A difference of means of 0.6 or greater is unrealistic in this experiment for two reasons. First, it is a relatively large difference; the difference between the EVG and control groups' mean roll is only 0.671, only 12% larger than the proposed difference of 0.6. Second, die rolls are constrained to a limited range of values. Since we already expect lying to be prevalent in the domain of gains, it would be exceedingly difficult to observe such a large increase in

[10] Recall from Section 3 that $m' > 0$ for the function $m(x)$ describing the moral cost of lying to gain an additional payoff of x.

lying on top of the dishonesty from the gain treatment. Due to the limitations involved in testing whether the EVG and EVL treatments exhibit differences in lying behavior, I cannot conclude that the failure to identify a significant difference is strong enough evidence to argue that loss aversion does not play a role in the decision to behave dishonestly.

In Section 5 (Subsection 5.1), I offered a brief discussion of how well this experiment replicated the results observed by Charness et al. (2019). A noteworthy distinction between these results and Charness et al.'s (2019) is that participants in this experiment appeared to lie more than those in Charness et al.'s (2019) experiment. In the gain treatment, Charness et al. (2019) observe a sub-maximal mode die roll, while I find that the modal die roll is the maximal value (six), clearly indicating that gain-treatment subjects in this experiment were more likely to maximally. Concerning the loss treatment, the differences between Charness et al.'s (2019) results and mine are not statistically significant, but they are worth discussing, nonetheless. Where Charness et al. (2019) do not find evidence that participants in their loss treatment lie, I find some weak evidence that participants in my loss treatment may lie to increase their earnings.

Noting that lying may be more common in this experiment than in that of Charness et al. (2019), I lay out three fundamental possibilities to explain this difference. This experiment was conducted entirely online, so I was unable to provide endowments to loss-treatment (ML) participants in physical cash the way Charness et al. (2019) did. If Charness et al. (2019) are correct that participants lie less because of a feeling of having been entrusted with their endowments, an intangible endowment may be less likely to lead to that same sense of trust, thereby resulting in a higher incidence of lying. If, however, none of my participants felt that they had been entrusted with their endowments, there would seemingly be little distinguishing the Money Manipulation and Expected Value methods of framing outcomes as losses. Therefore, I would expect the results to be similar to those observed in the Expected Value treatments. The Money Manipulation results do not resemble the Expected Value results, so I must conclude that some degree of the sense of being entrusted or another defining trait of the Money Manipulation method survived the transition from a physical experiment to online.

Another plausible explanation for the increased lying observed in this experiment compared to Charness et al. (2019) is the use of MTurk for recruiting participants. Gerlach et al. (2019) find evidence that MTurk participants have a higher rate of lying than student participants across all experimental paradigms for studying dishonesty. Specifically, MTurk participants have an average rate of liars that is eleven percentage points (Gerlach et al., 2019) higher than that of student populations. One possibility for why MTurk participants are more likely to lie is that they are "professional survey takers" (Gerlach et al., 2019), so they may have participated in a similar experiment or be more prepared to identify ways to maximize their earnings. In a related explanation, MTurk participants may use MTurk as their primary source of income, a hypothesis anecdotally supported by the reasoning given by some participants[11] for why they chose to report the die roll value that they did (see Appendix D for more). While students may have other sources of income and therefore be less dependent on what they earn from the experiment, MTurk participants may rely on earnings from the tasks they complete to pay for basic living expenses. Consequently, an important extension on this research is to use student and MTurk samples to draw comparisons between the behaviors exhibited by members of each population.

Finally, there were not any virtual or in-person experimental sessions for completing this study. Instead, all participants completed the experiment on Qualtrics at their leisure using their own devices. This arrangement grants participants a greater degree of privacy than they could expect to experience under any other format. Gneezy et al. (2018) and Crede and Bieberstein (2020) find evidence that participants are less likely to lie when the experimenters can observe their decisions, avoiding the "reputation cost" (Crede and Bieberstein, 2020) of being caught lying. Gneezy et al. (2018) also focus on the situation in which loss aversion can influence participants' decisions and find similar results. Therefore, this experiment's relatively high degree of privacy for participants may have led to a slight increase in lying. That said, experimenters in physical experiments have gone to great lengths to ensure privacy (Van 't Veer et al., 2014; Duc Huynh, 2020; Lewis et al., 2012; Shalvi et al., 2011), including by having participants roll the die or observe their random outcome in a covered cup. Consequently, it is unlikely that the use of personal devices had a large impact on dishonesty.

[11] Appendix D contains all given reasons, but one notable example explicitly states "MAIN INCOME SOURCE."

So far, I have discussed the results as they relate to Charness et al.'s (2019) findings in great detail. Most existing evidence in support of loss aversion's impact on dishonesty comes from experiments using other paradigms (Duc Huynh, 2020; Garbarino et al., 2019; Gneezy et al., 2018; Grolleau et al., 2016). To answer the fundamental question of whether the discrepancy in the influence attributed to loss aversion is the consequence of the difference in paradigms or the methods for inducing loss, I now briefly discuss the comparison of this experiment's results to those of Garbarino et al. (2019).

Because Garbarino et al. (2019) use the coin-toss paradigm, their experiment allows a dichotomous outcome for participants that they can separate into a "good outcome" (earning money) and a "bad outcome" (earning nothing). In their experiment, Garbarino et al. (2019) show that participants with a high *ex-ante* expected payoff are more likely to lie to avoid the bad outcome than participants with a low *ex-ante* expected payoff. By contrast, I am unable to find any significant difference in behavior between participants with a high *ex-ante* expected payoff (EVL) and those with a low *ex-ante* expected payoff (EVG). A critical distinction between Garbarino et al.'s (2019) method and this experiment's is that the marginal benefit of lying in Garbarino et al. (2019) is equal to the maximum possible payment where in this experiment, the marginal benefit of lying is only one-fifth the maximum possible payment.[12] Based on the results of this experiment, it appears that the smaller marginal benefit of lying and the ability to lie at multiple sub-maximal levels nullified much, if not all,[13] of the effect of loss observed by Garbarino et al. (2019).

7 Conclusion

In this thesis, I investigate the influence of loss aversion on dishonesty when experimental subjects are asked to provide information that does not affect other participants, involve social interactions, or reflect their personal abilities. In the control group, participants do not receive an incentive to lie, and the control group's results are consistent with the expected die rolls obtained from a uniform distribution (no lying). When reported information affects

[12]This also represents only one half the marginal benefit of lying in Garbarino et al. (2019).

[13]As discussed above, the question of minimum detectable effect size precludes me from arguing that loss does not affect lying behavior.

participant payoffs, subjects show statistically significant signs of lying to increase their earnings.

Regarding loss aversion, I seek to explore the discrepancy in the existing literature exemplified by the disparity between the results from Garbarino et al. (2019) and Charness et al. (2019). While Garbarino et al. (2019) found evidence in support of loss aversion increasing lying, Charness et al. (2019) find no such evidence. Because Garbarino et al. (2019) and Charness et al. (2019) use different methods for both framing outcomes as losses and connecting participant outcomes to self-reported information, I compare their loss-framing methods in the context of the die-roll lying paradigm. I find results consistent with those of Charness et al. (2019) when using their method for framing outcomes as losses. However, I find results contradictory to those of Garbarino et al. (2019) when using their loss-framing method.

From the results of this experiment, it appears that the experimental paradigm used to allow participants to lie to alter their earnings changes the apparent influence of loss aversion on dishonesty. One explanation for this conclusion is that using the coin-toss paradigm (as Garbarino et al. (2019) do) instead of the die-roll paradigm increases the marginal benefit of lying, thus encouraging more lying. As another explanation, I suggest that agents' utilities are not sensitive enough to respond differently (at least at a statistically significant level) to a small change in the *ex-ante* expected payoff.

It is evident that the methodological differences between dishonesty studies are responsible for their inconsistent results. As such, the experimental methods used to investigate lying and cheating must be researched and compared further. In particular, researchers should examine the role of default effects on (not) lying and whether the stakes and marginal benefits of lying increase dishonesty. Additionally, more research on the characteristics of the moral and reputational costs of lying is necessary to derive an accurate model of cheating.

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A Supplemental Figures and Tables

Figure A.1: Die Roll Randomness

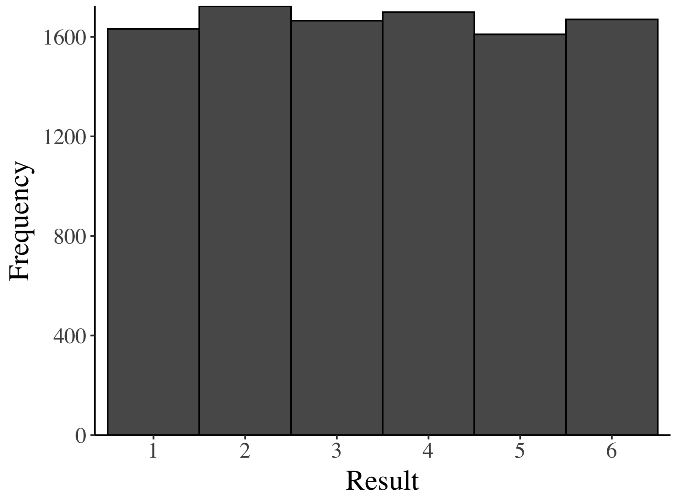


Figure A.1 represents the distribution of 10,000 die rolls conducted on https://www.dieroll.net/ (the website participants used for obtaining their die rolls). A Kolmogorov-Smirnov test comparing this distribution to the theoretical discrete uniform distribution yields a p-value of 0.9386.

Table A.1: Kolmogorov-Smirnov p-values

	p-value
Compared to Uniform Distribution	
C	0.838
EVL	0.000
EVG	0.000
ML	0.083
MG	0.000
Loss Compared to Gain Distribution	
EV	0.717
M	0.097

Note: In the "Compared to Uniform Distribution" panel, p-values were obtained from Kolmogorov-Smirnov tests comparing the indicated treatment group's distribution of die rolls to the theoretical discrete uniform distribution over the integers from 1 to 6. In the "Loss Compared to Gain Distribution" panel, p-values were obtained from Kolmogorov-Smirnov tests comparing the Expected Value (Money Manipulation) loss treatment's distribution of die rolls to that of the Expected Value (Money Manipulation) gain treatment.

B Simulated Controls

Figure B.1: Mean Roll Difference

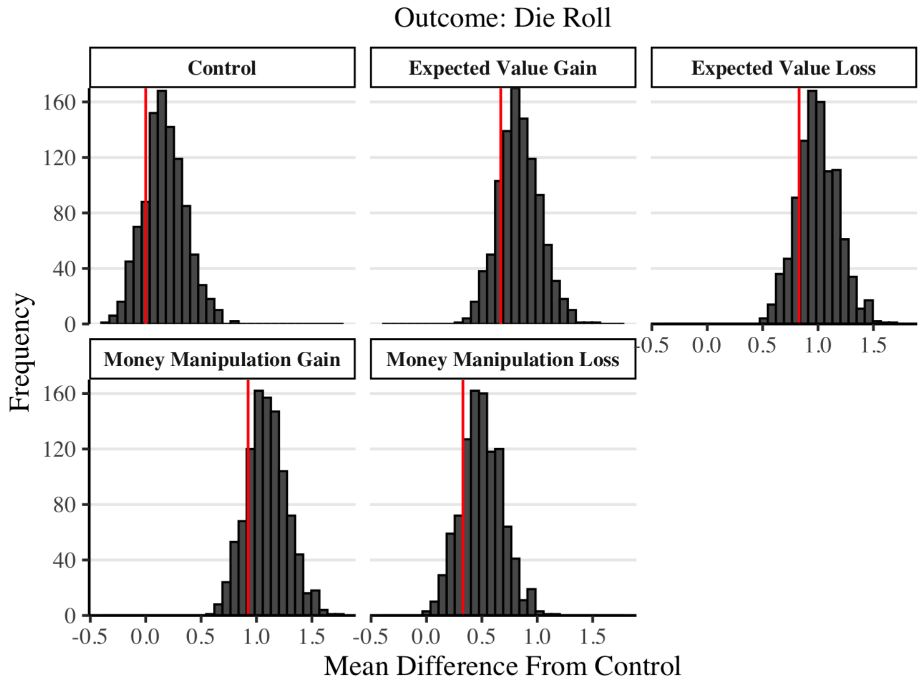


Figure B.2: Roll p-values

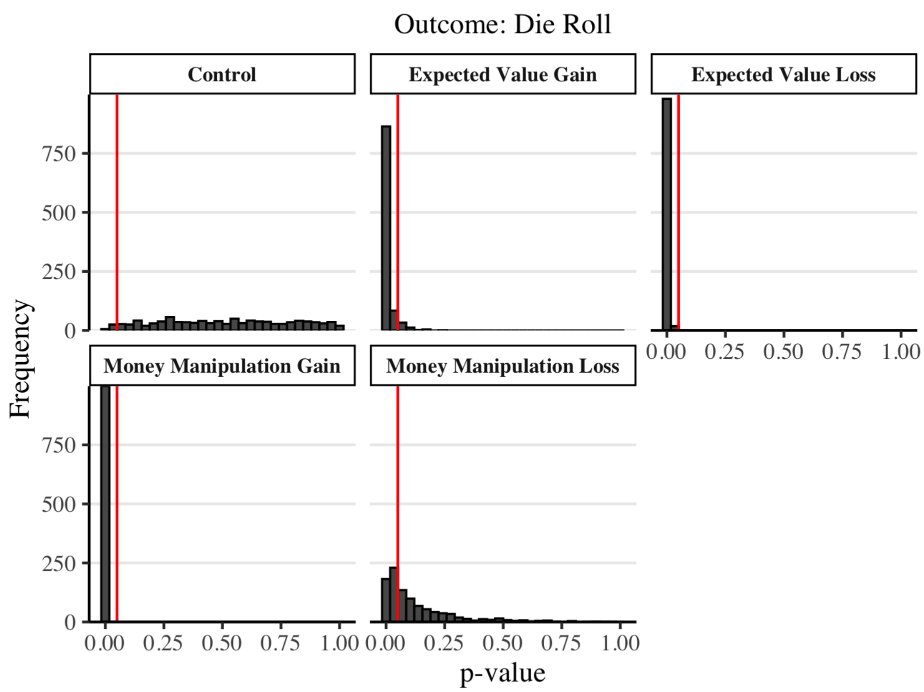


Figure B.3: Rolled One Mean Difference

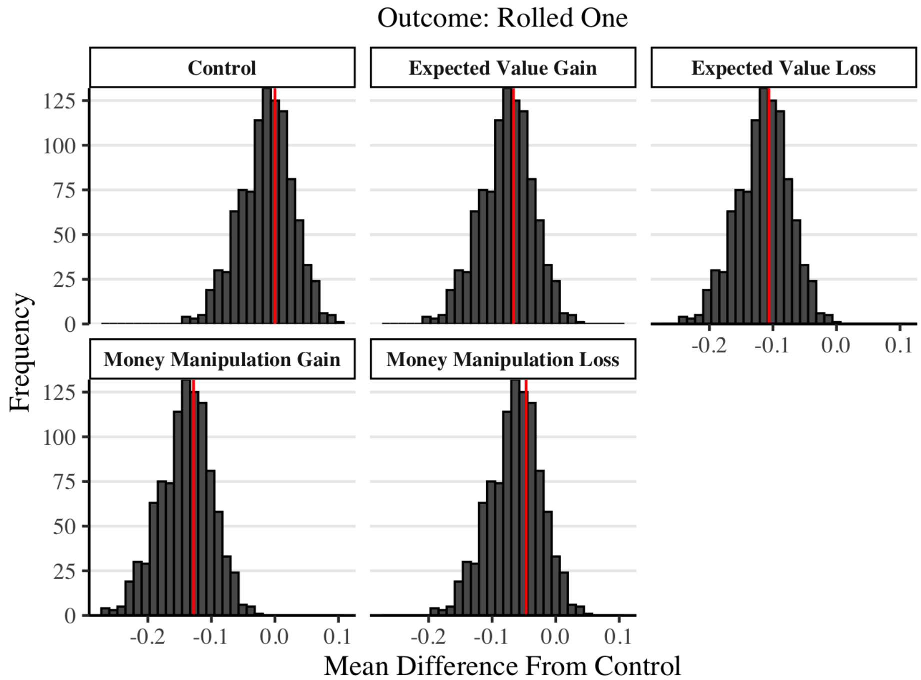
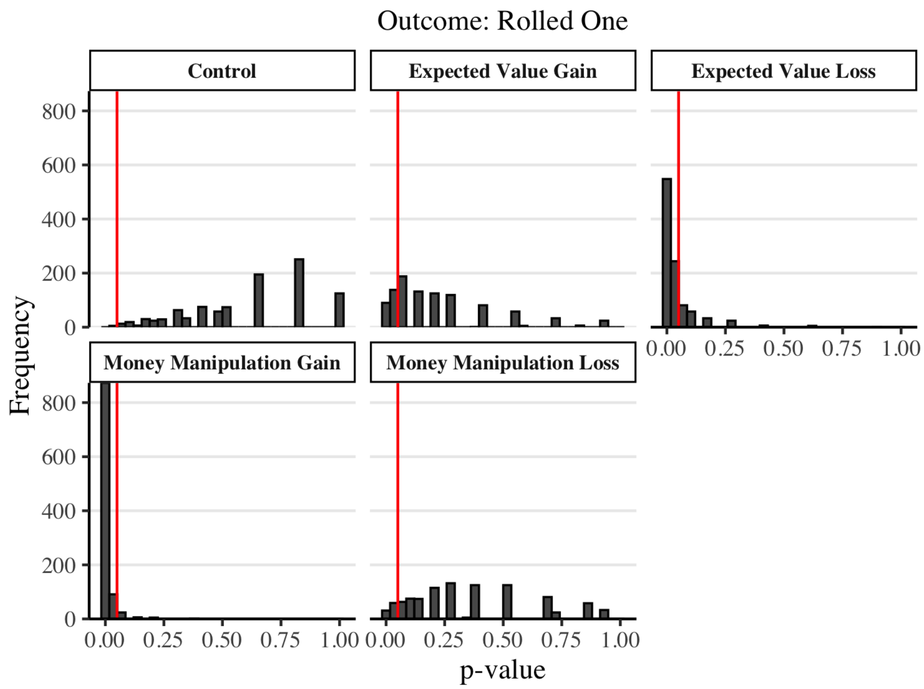


Figure B.4: Rolled One p-values



C Instructions

For each participant, one of the following sets of treatment-specific instructions was shown at random. All participants received the same survey at the end.

C.1 Expected Value Loss

You will now complete an activity in which you have the opportunity to earn real money. At the end of the experiment, several participants will be randomly selected to receive the money you earn by completing this activity.

In this activity, you will roll a six-sided die. Your earnings depend on what you roll. The table below shows what you will earn for each possible roll.

	Die roll value					
	1	2	3	4	5	6
Earnings (USD)	\$0.00	\$1.00	\$3.00	\$4.50	\$6.00	\$7.50

Now suppose you have rolled a 4. How much money would you have earned?

\$________

You will now complete the activity.

You will roll a die and then report the number you have rolled. You may roll the die as many times as you would like, but you must only report the first number that you roll.

Your earnings depend on what you roll. The table below shows what you will earn for each possible roll.

If you have a fair, six-sided die nearby, you may roll that. If not, please go to http://www.dieroll.net in a new tab or window and click "Roll." Then return to this page and record your roll.

What number did you roll?

	Die roll value					
	1	2	3	4	5	6
Earnings (USD)	\$0.00	\$1.00	\$3.00	\$4.50	\$6.00	\$7.50

_____

C.2 Expected Value Gain

You will now complete an activity in which you have the opportunity to earn real money. At the end of the experiment, several participants will be randomly selected to receive the money you earn by completing this activity.

In this activity, you will roll a six-sided die. Your earnings depend on what you roll. The table below shows what you will earn for each possible roll.

	Die roll value					
	1	2	3	4	5	6
Earnings (USD)	\$0.00	\$1.00	\$2.00	\$3.00	\$6.00	\$7.50

Now suppose you have rolled a 4. How much money would you have earned?

\$________

You will now complete the activity.

You will roll a die and then report the number you have rolled. You may roll the die as many times as you would like, but you must only report the first number that you roll.

Your earnings depend on what you roll. The table below shows what you will earn for each possible roll.

If you have a fair, six-sided die nearby, you may roll that. If not, please go to http://www.dieroll.net in a new tab or window and click "Roll." Then return to this page and record your roll.

	Die roll value					
	1	2	3	4	5	6
Earnings (USD)	\$0.00	\$1.00	\$2.00	\$3.00	\$6.00	\$7.50

What number did you roll?

_____

C.3 Manipulated Loss

You will now complete an activity in which you have the opportunity to earn real money. At the end of the experiment, several participants will be randomly selected to receive the money you earn by completing this activity.

You have been given \$5.00 (USD). In this activity, you will roll a six-sided die. The amount you keep from your endowment of \$5.00 depends on what you roll. The table below shows what you amount you will lose for each possible roll.

	Die roll value					
	1	2	3	4	5	6
Losses (USD)	\$5.00	\$4.00	\$3.00	\$2.00	\$1.00	\$0.00

Now suppose you have rolled a 4.

How much money would you have lost from your original \$5.00?

\$________

How much money would you have kept from your original \$5.00?

\$________

You will now complete the activity.

You will roll a die and then report the number you have rolled. You may roll the die as many times as you would like, but you must only report the first number that you roll.

The amount you keep from your endowment of $5.00 depends on what you roll. The table below shows what you amount you will lose for each possible roll.

	Die roll value					
	1	2	3	4	5	6
Losses (USD)	$5.00	$4.00	$3.00	$2.00	$1.00	$0.00

If you have a fair, six-sided die nearby, you may roll that. If not, please go to http://www.dieroll.net in a new tab or window and click "Roll." Then return to this page and record your roll.

What number did you roll?

_____

C.4 Manipulated Gain

You will now complete an activity in which you have the opportunity to earn real money. At the end of the experiment, several participants will be randomly selected to receive the money you earn by completing this activity.

In this activity, you will roll a six-sided die. Your earnings depend on what you roll. The table below shows what you will earn for each possible roll.

	Die roll value					
	1	2	3	4	5	6
Earnings (USD)	$0.00	$1.00	$2.00	$3.00	$4.00	$5.00

Now suppose you have rolled a [random integer between 1 and 6]. How much money would you have earned?

$________

You will now complete the activity.

You will roll a die and then report the number you have rolled. You may roll the die as many times as you would like, but you must only report the first number that you roll.

Your earnings depend on what you roll. The table below shows what you will earn for each possible roll.

	Die roll value					
	1	2	3	4	5	6
Earnings (USD)	$0.00	$1.00	$2.00	$3.00	$4.00	$5.00

If you have a fair, six-sided die nearby, you may roll that. If not, please go to http://www.dieroll.net in a new tab or window and click "Roll." Then return to this page and record your roll.

What number did you roll?

_____

C.5 Control

You will now complete an activity for which you are receiving $2.50. At the end of the experiment, several participants will be randomly selected to be paid.

You will roll a die and then report the number you have rolled. You may roll the die as many times as you would like, but you must only report the first number that you roll.

If you have a fair, six-sided die nearby, you may roll that. If not, please go to http://www.dieroll.net in a new tab or window and click "Roll." Then return to this page and record your roll.

What number did you roll?

_____

C.6 Survey

You will now complete the survey. You may decline to answer any question. **Your responses to these survey questions will not affect your earnings**.

1. What is your gender?

   ☐ Male

   ☐ Female

   ☐ Non-binary/other gender

   ☐ Prefer not to say

2. What is your age?

   ______

3. Are you of Hispanic, Latino, or Spanish origin?

   ☐ Yes

   ☐ No

   ☐ Other (please specify): ________________________

   ☐ Prefer not to say

4. How would you best describe your race?

   ☐ American Indian or Alaska Native

   ☐ Asian

   ☐ Black or African American

   ☐ Native Hawaiian or Other Pacific Islander

   ☐ White (including Middle Eastern origin)

   ☐ Other (please specify): ________________________

   ☐ Prefer not to say

5. For the following questions, please indicate the degree to which you agree or disagree with each statement.

Strongly Disagree (1)	Generally Disagree (2)	Mildly Disagree (3)	Neither Agree nor Disagree (4)	Mildly Agree (5)	Generally Disagree (6)	Strongly Disagree (7)

The rate of TV watching among people today is alarming.

1 2 3 4 5 6 7

Only a few people have the ability to judge excellence in the arts.

1 2 3 4 5 6 7

There should be more government support for industry to develop new products and technology.

1 2 3 4 5 6 7

I am generally a person who is fully prepared to take risks.

1 2 3 4 5 6 7

Air pollution caused by cars is dangerous.

1 2 3 4 5 6 7

I rely on my religious belief system when making important decisions.

1 2 3 4 5 6 7

6. Please briefly describe why you chose the number you recorded in the die-roll activity.

---

7. Are you a participant from Emory University or MTurk?

☐ Emory University

☐ MTurk

D Decision Motivation Comments

The following are self-reported reasons for reporting the die roll value specified in parentheses.

Free Response: Please briefly describe why you chose the number you recorded as your die roll in the die-roll activity.

MTurk: Control Treatment

"I gave an honest report of my roll because I felt it was the right thing to do" (3)
"That is the number that I rolled." (5)
"I chose the largest number of options as determined by my intuition" (6)
"easy to allocate number" (4)
"I truthfully report the number I got from the website." (5)
"website randomly rolls" (5)
"Because It is the outcome in the die roll" (6)
"I rolled only once. It shows 4 as my answer. So i entered 4." (4)
"for bonus reward" (2)
"the expected value of my die roll" (2)
"It was randomly assigned to me" (1)
"This website randomly rolls a fair luckily i got number 6" (6)
"It comes when I roll the die." (2)
"It was the number I rolled" (4)
"it was the first and only number i rolled" (4)
"good game" (4)
"The virtual dice rolled a 6, so I reported a 6, there was no deeper reason than that." (6)
"4" (4)
"I reported the first outcome of the die roll." (3)
"nothing" (5)
"The instruction was stated to roll the die and mark the first obtained number. So I did follow the instructions." (5)
"I rolled a 3 on the die roll website so I recorded it as such." (3)
"interesting" (4)

“It was the first number I rolled.” (3)

“I used the website to roll the dice and got 6. So recorded that number.” (6)

“I have got that number.” (3)

“I CHOOSE BONUS POINT” (6)

“because i like the number” (6)

“I randomly click roll button it rolled 3. So I have recorded the number 3.” (3)

“none” (1)

“Die-roll activity” (6)

“Die-roll activity” (1)

“3” (4)

“it is the num r0lled” (3)

“lucky number” (2)

“This is my thoughts” (4)

“3” (4)

“It was the number that I rolled” (4)

“Because I was instructed to write the first roll” (2)

“why wouldnt i” (3)

“It is randomly chosen number” (5)

“because in rolling one six-sided die, rolling an even number could occur with one of three outcomes:” (5)

“46” (2)

“good” (6)

“The total number of possible outcomes is the size of the sample space. When you roll one dice, for example, the sample space” (1)

“dieroll dot net site has selected the number for me” (3)

“It was the first number I rolled.” (1)

“I was asked to report the number that I rolled.” (6)

“it was the number that was rolled” (2)

“I want to some save money” (2)

“it was the first result” (6)

“Roll 4 is favourite” (4)

“thats what i really rolled” (2)

“It was the first number that came out when I rolled the die.” (2)

“i roll the die then it came” (6)

“It was an honest thing to do” (1)

“Own decision” (1)

“4” (4)

“I score bonus points” (3)

“NA” (3)

“The number that rolled for me was two.” (2)

“That was the first number when I roll a die.” (5)

“I like it.” (1)

“I have chosen number four because of the instruction given ”Enter the 1st number u get”.” (4)

“I didn’t really choose it, that is just what it rolled” (4)

“It was the first one.” (5)

“Because it is the number which I got when I rolled first.” (1)

“i think that this number is correct for me” (5)

“I had the computer roll the die and number 1 is what came up on the first roll.” (1)

“I AM FIRST DIE-ROLL NUMBER IS 5” (5)

“it is number i got when i rolled .” (4)

“Because I just followed that link and that’s the number I got. There isn’t any big reason behind it.” (1)

“by the given link” (5)

“NA” (6)

“6” (6)

“NA” (6)

“5 is a number that when it is multiplied can bring great numbers in a whole.” (5)

“4 is my lucky number” (4)

“I used a website for a random die roll and was provided with and reported 1.” (1)

MTurk: Expected Value Gain Treatment

“Believe.” (6)

“I chose this number because it was the first number that came up when I rolled the dice.”

(6)

“It is the actual number that I rolled.” (5)

“website randomly rolls” (4)

“because that was the number I rolled” (1)

“The dieroll.net dice recorded a 6 when I rolled it.” (6)

“I was told to report the first roll so that’s what I did. I didn’t bother to roll more after that.” (2)

“The first die-roll in the activity” (5)

“It was the number I got randomly when I rolled the dice.” (5)

“NA” (5)

“the expected value of my die roll” (3)

“It was the number I was drawn” (6)

“to earn real money as per entering the die roll number enters in the study” (5)

“It was the number I rolled.” (6)

“I chose it because it is the first number that appeared” (1)

“4” (4)

“IT IS VERY LUCKY NUMBER.” (6)

“Easy to understand and easily get my number choice and receive chance” (6)

“This website randomly rolls a fair, six-sided die. Click ”Roll” to roll the die.” (3)

“I went to the link you mentioned. and pressed the roll button. The number that came in was 1 and I wrote this. I did it this way because it was the right thing to do.” (1)

“It is my thoughts” (4)

“Because it was my fixed number” (3)

“I just got that number in the first attempt. I can provide the screenshot if needed.” (6)

“THE INCOME WAS DEPENDENT ON THE ROLL.THE NUMBER CAME AS SOON AS THE DIE WAS ROLLED.THAT SEEMED TO BE ENOUGH.” (4)

“i roll the die first round and i record the number.” (2)

“I went to the given link and selected the number coming after pass roll.” (5)

“I achieved the bonus point” (4)

“4” (4)

“none” (2)

“Attention activity” (5)

“Just my Opinion” (4)

“lucky number” (6)

“Because I think that suppose my number when I roll it.” (6)

“I rolled the die and the number 5 came up so I recorded that.” (5)

“Its landed on the number 4, so i chose it” (4)

“give the best choice” (1)

“very like” (4)

“I was being honest” (4)

“ACTUAL INCOME” (6)

“thats the number i got” (6)

“As First time result I recorded.” (5)

“Probability is a metric for determining the possibility of an event occurring. The number of conceivable outcomes divided by the total number of possible outcomes is the probability of an event, similar to rolling an even number.” (5)

“i recorded a number which i got in first roll” (3)

“In the die-roll activity after pressing the roll button, I was provided with the number 6.” (6)

“Based on the die roll activity, I was allotted with the number 6 in the die.” (6)

“At the first time of rolling the die, I was allotted with the number 6 in the die-roll activity.” (6)

“I want to earn maximum money.” (6)

“WE CHOOSE THE NUMBER WE RECORDED AS OUR DIE IN ROLL ACTIVITY KEEPS MY UNDERSTANDING.” (3)

“i am choose for 5.” (5)

“It is very well.” (3)

“it is the num in die” (5)

“5” (5)

“I chose this number because this is what I rolled. I wanted to be honest because that is how I live my everyday life.” (2)

“Depend upon my lottery number outcome.” (5)

“It was the first one to come up.” (1)

“i choose 3 because die roll shows 3.” (3)

"Because it was the first number I rolled in the die roll simulator" (3)

"3" (4)

"I chose bouns poants" (5)

"i choose the bonus points" (4)

"I CHOOSE BONUS POINT" (6)

"I chose bouns poants" (6)

"I achieved bonus points" (5)

"It is the number that I rolled on the dice roll website." (5)

"4" (4)

"4" (5)

"4" (5)

"I entered the number that I get when I rolled the die" (1)

"4" (4)

"I chose this number because it offers the largest bonus" (6)

"6" (6)

"When I rolled a die I got 6 and I recorded it." (6)

"JUST ROLLED DIE ONCE AND RECORD IT" (3)

"6" (6)

"the dollar amount is 6" (4)

"3 is my favourite number" (3)

"I did as instructed and opened the link in the new tab. Because I was only supposed to report the first roll, I only rolled it once. It landed on 5, so that is what I reported." (5)

"Its a good number." (5)

"1" (1)

"I had a dice with me in my room and I rolled it once, and the result was 5. So I selected 5 as the answer." (5)

"Its the first number when I rolled the die." (4)

"Because I rolled it becomes 5" (5)

MTurk: Expected Value Loss Treatment

"I chose that number because that was the first number that was rolled on the die roll website." (5)

"it made the most money" (6)

"It was the first and only number I rolled." (1)

"Roll die as a very quick and easy to manage the number" (4)

"I think I could gain more money" (5)

"I used the dieroll.net website." (6)

"To roll my lucky number four." (4)

"i got that number so only" (4)

"its my lucky one" (5)

"Because it is the actual outcome." (6)

"good game" (6)

"because it was the first one i rolled" (6)

"my lucky number" (4)

"It is what I rolled. I didn't see any reason to lie. I'm a glass half empty guy so if I win then great, if not oh well then." (4)

"Just my opinion" (5)

"That is what came up when I rolled a real die." (6)

"good" (6)

"My best number and bonus" (4)

"I choose 6, but die-roll given as 5. Very happy." (5)

"YES I CHOOSE NUMBER 4" (4)

"I rolled a physical die which gave me a six on roll 1" (6)

"I used the random die roller link and rolled a 6 on the first (and only) roll I did." (6)

"when I opened the new tab to roll the die, the number I rolled the first time was the number I recorded." (6)

"The set of all the possible outcomes is called the sample space" (5)

"I choose bonus point" (6)

"interesting" (4)

"interesting" (5)

"I choose the bonus points. so, i recorded the number" (5)

"when roll the die it shows number , so i put it" (2)

"i roll 4 because it is easy" (4)

"6" (4)

“none” (4)

“i will choose three” (3)

“Attention Activity” (1)

“Because it is the actual outcome.” (6)

“I roll the dice and i receive this no so i choose the number” (6)

“it is earn money.” (6)

“I click the die-roll, Automatically dies result is 6.So i choose 6” (6)

“i imagine that number before roll the die” (2)

“I clicked the online die roll ONE time and it came up a six! I couldn’t believe it. I reported it honestly but I wondered if it would seem dishonest to the researchers.” (6)

“6” (4)

“4” (4)

“CHOOSE THE BOUNES POIANT” (5)

“It was the number I rolled on the dice roll page. I reported my answer honestly.” (4)

“I didn’t have a dice, so I entered the link that was available, clicked to roll the dice and the number 4 came out” (4)

“Because it is the number that I rolled” (6)

“because it was the number that appeared” (6)

“I allowed my daughter to roll for me we rolled a real dice” (4)

“that is my lucky number” (2)

“Click die roll option for my luck best number in the roll..” (6)

“that is my fav no” (4)

“For my luck and best click die roll” (6)

“because it was the first one I rolled” (5)

“at first i though that it’s really easy to fake my dice roll. you can just pick six and nobody will know that you got another roll, but i was thinking that i’m not gonna do that beacuase i will feel bad later xD i still picked 6 but not because i wanted to but beacuse i rolled it :D i guess god gave me some luck for my good thoughts :p” (6)

“Nothing” (3)

“5” (5)

“That is the number i rolled on the website the hit instructed me to go to.” (5)

“I recorded that I rolled a 6 because that was the first number I rolled on the site.” (6)

“i wanted to earn a maximum bonus” (6)

“NA” (4)

“It is what was rolled.” (3)

“i roll the die for first time then six number was came.” (6)

“25” (4)

“I chose ”4” because that was the number I rolled.” (4)

“It was the first roll. The first number” (1)

“my best number” (4)

“I chose bonus points.” (4)

“I chose bonus points” (4)

“I chose bonus points” (5)

“I score bonus points” (2)

“because that is what i got by rolling dice” (2)

“I will roll the dies first the number was 1 I choose number one because I believe first priority is the best one.” (1)

“I rolled there dice they number was my favorite.” (6)

“Because my die show number 6” (6)

“lucky number” (4)

“I chose that number because it was a numbet I rolled with the dice and it is also a number which eould maximize my potential bonus.” (6)

“It was my number to rolled” (5)

“6” (6)

“i was die roll activity i choose number 5” (5)

“die indicate me on 2” (2)

“I chose that number because it was exactly what I rolled on the page I was taken to.” (5)

“That was the number that showed on dieroll.net” (5)

“very approach that number” (6)

“the instructions said to enter the first number rolled, no matter how many times you roll it” (2)

“earing money” (3)

“I WILL CHOCE NUMBER5” (5)

“NA” (4)

"2" (2)

MTurk: Money Manipulation Gain Treatment

"That was the first number I rolled." (4)

"I should random role to the die" (6)

"I chose the number that was my die roll. It was a five. I rolled it, and along with the picture of the die it said: "You have rolled a 5."" (5)

"It is game for fun entertainment dice roll game" (3)

"Simulate rolling on first die" (6)

"That was the number that came out on the dice website that was provided" (6)

"got that point so I gave" (6)

"I rolled the die and it showed 5. So i entered my answer 5." (5)

"when I rolling the die its show number six. as per given number I recorded." (6)

"I reported the number I rolled" (6)

"6" (6)

"This was the number I rolled the first time." (2)

"i hit the link to the site with the imaginary die and it came up "6." (it really did!) that was the result so that is what i recorded." (6)

"when I rolling die its shown I recorded number" (6)

"this is my first roll number" (4)

"Which number on a die are you most likely to roll? Dice Roll Probability As you can see, 7 is the most common roll with two six-sided dice. You are six times more likely to roll a 7 than a 2 or a 12, which is a huge difference. You are twice as likely to roll a 7 as you are to roll a 4 or a 10" (4)

"I rolled a three and recorded it as the instructions stated." (3)

"I rolled a 5 on a die roll website. In essence, I actually put down what I rolled." (5)

"Nothing like this" (2)

"6" (6)

"because in the link i rolled the roll" (2)

"Because that the number showed up" (5)

"because it is the number i got after I rolled" (4)

"interesting" (6)

“interesting” (4)

“Becouse its come while die roll” (4)

“Because its come” (4)

“I visited the website provided, and I actually did roll a six. In advance, I admit that I did consider reporting a higher number if I rolled a low one; however, it turned out to not be needed.” (6)

“12” (6)

“Because it was the number I rolled on the website. It was a terrible roll, but an honest one.” (1)

“because i am earning lot of money” (6)

“i clicked the roll button it shows 6 number , so i entered this no.” (6)

“I just roll the die and choose the number no other reason to choose that number.” (5)

“I am very interesting to roll die. I roll and it falls first 5 and then 6. I recorded number 6. I like very much. So. I choose this.” (6)

“when i clicked the roll die it shows number as a 4 , so i recorded the same number” (4)

“I chose the number four because that was what I rolled on my first, and only role.” (4)

“I chose the number 6, because it gives me a great benefit for me. I like very much.” (6)

“when I play the die shown that number so I recorded that number” (6)

“IT IS HIGHEST NUMBER SO I CHOSE THE NUMBER” (6)

“My lucky number” (4)

“Roll in activity” (5)

“By using link I used to roll the die. From that I receive number 2.” (2)

“most very interest” (4)

“4” (5)

“MAIN INCOME SOURCE” (5)

“it was the actual number I rolled” (6)

“I was drawn with this number on the website ”https://www.dieroll.net/”” (5)

“I recorded a number which I got in first roll” (5)

“I PLAYED THE GAME HONESTLY, IN THE INSTRUCTIONS ARE VERY CLEAR SO IAM NOTE THE FIRST NUMBER I GET.” (2)

“I click die roll option for my lucky number spin and best...” (6)

“I’m so glad, I prayed to a god, I needed 6 in the first roll, I got it, thank you, I was so happy, number 6 I got the highest bonus, I honestly got 6 in the first roll" (6)

"NA" (5)

"Because of i want earn more money." (6)

"Nothing" (5)

"Often called transgender by outsiders, Indian society and most hijras consider." (3)

"I rolled the dice, one time and reported that number. took a screen shot also." (6)

"It was the first number I rolled." (6)

"nover" (3)

"because that is the die I rolled and I wanted to be truthful" (1)

"i roll the die then six came it in the die." (6)

"I use the link for the dice and dice have number 5." (5)

"Because the number was rolled" (4)

"I CHOOSE BONUS POINT" (6)

"I chose bonus points" (4)

"I CHOSE BONUS POINT" (3)

"I CHOSE BONUS POINT" (5)

"That was my lucky number" (4)

"3" (3)

"Number 2. It forms the basis of a duality, it has religious and spiritual significance in many cultures." (2)

"I entered the number that I get when I rolled the die." (3)

"Probability is a metric for determining the possibility of an event occurring. The number of conceivable outcomes divided by the total number of possible outcomes is the probability of an event, similar to rolling an even number." (6)

"6" (6)

"4" (4)

"Because it is the number that I rolled on the site you provided." (5)

"i can roll the die so i can choose" (6)

"NA" (6)

"I had rolled the die and it gave a number." (3)

"I must be honest." (2)

"it was prefix instruction" (4)

“That was the number that I rolled, and I value being honest in my life.” (2)
“I followed the link, rolled a dice, and reported the number. I got a 6 but thought maybe I should put a lower number because everyone will probably say they got a six. But ultimately decided to go with the number I got.” (6)
“Because I was told to report the first number that is rolled.” (4)
“porque saiu no giro do dado” (5)
“It was the near sided 6” (4)

MTurk: Money Manipulation Loss Treatment

“Because I rolled and i got that number” (5)
“Because it was the number I rolled” (2)
“Belives.” (3)
“Roll on first die in the activity” (6)
“Roll and click” (1)
“Because it was the first number that came up when I used the online dice roll.” (4)
“NA” (5)
“good game” (1)
“I just reported what I actually rolled.” (3)
“It didn’t chose the number. The number recorded by me is the actual result of die roll.” (5)
“The first number I have chosen while die roll in the die-roll activity” (6)
“To roll die three,i like to roll a die.” (3)
“That is the number I rolled.” (2)
“That the mid term and helps me gain some dollars” (3)
“It is my opinion” (1)
“I reported the random outcome that I received” (5)
“2” (2)
“I was asked to roll a die and then report the number I have rolled. I can roll the die as many times as I would like , But I must report the first number that I roll. The earnings will depend on what I roll.” (2)
“I got that number while I rolled on the internet. For thr first time it showed 4. so i selected the number.” (4)

"It was the number i got from the rolling of die" (5)

"I chose it as i have got that number" (3)

"FOR TAKING A BONUS" (6)

"i achinved the bonus point" (6)

"I AM ROLE THE DIE I HAVE A NUMBER 4.SO,I WILL CHOOSE A NUMBER 4." (4)

"I know I will lose money and although I have decided with the truth." (4)

"I chose the number our die roll in 6 is the best confident to achieve the next $7.50 study. I am very confident to complete the next study so please give an next study." (6)

"I LIKE" (1)

"it is very nice.i will choose number 6." (6)

"I WILL CHOOSE NUMBER 6" (6)

"LUKY NUMBER" (4)

"1" (5)

"Because it was high meaning a lower loss, and/or, believe It or not it was my first and only roll." (5)

"i recorded the original outcome i got." (6)

"as you have mentioned to do so" (3)

"That's the real one I got when rolled the dice. I dont want to lie to get the reward." (1)

"most likely" (4)

"3" (3)

"its the number shown" (4)

"Because it was the one i rolled" (5)

"Because I want to save some money" (1)

"I want to save money" (6)

"I want to save my more money." (6)

"i am choosing number 1 because favorite number" (1)

"i roll the activity show number 6." (6)

"I chose the number 6 because when I clicked on the link and hit 'Roll', it stated that I rolled a 6 on the first roll." (6)

"4" (4)

"i roll the die then it came" (3)

"A fair die have an equal chance of getting" (2)

"6" (6)

"Roll die decision" (2)

"Its the number that was rolled by the website" (6)

"It was the number that I rolled." (3)

"my favorite number" (4)

"i chose the bonus points" (4)

"i choose the bonus point" (2)

"I chose bouns poants" (4)

"I achieved bonus points" (6)

"I chose bouns poants" (5)

"I CHOSE BONUS POINT" (5)

"Because it was the actual number that I rolled." (4)

"I rolled there dice its my favorite number." (5)

"I chose the number that was given by the website." (2)

"for playing" (5)

"it is what I rolled" (6)

"1" (1)

"I rolled the die and I got the number 4." (4)

"It was the number I actually rolled on the website." (4)

"It is the number I got on the die roll website" (5)

"4" (6)

"4" (4)

"because it has the smallest loss" (6)

"I choose it randomly" (4)

"it was what I rolled" (6)

"I selected 5 because, it was the result of my dice. I had a dice in my office and I rolled the dice once." (5)

"it was the number that was rolled and i wanted to be truthful." (3)

"The link to the random die roll website provided me with the number 2." (2)