



Honest Lies

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Abstract: We report data from a two-stage prediction game, where the accuracy of predictions (in the first stage) regarding die roll outcomes (in the second stage) is rewarded using a proper scoring rule. Thus, given the opportunity to self-report the die roll outcomes, participants have an incentive to bias their predictions to maximize elicitation payoffs. However, we find participants to be surprisingly unresponsive to this incentive, despite clear evidence that they cheated when self-reporting die roll outcomes. These data lend support to Akerlof's (1983) suggestion that people may prefer to appear honest without actually being honest. In particular, the vast majority (95%) of our subjects were willing to incur a cost to preserve an honest appearance. At the same time, only 44% exhibited intrinsic preference for honesty. Moreover, we found that after establishing an honest appearance people cheat to the greatest possible extent. These results suggest that “incomplete cheating” behavior frequently reported in the literature can be attributed more to a preference for maintaining appearances than an intrinsic aversion to maximum cheating.

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“There is a return to *appearing* honest, but not to *being* honest.”
- Akerlof (1983, p. 57)

1. Introduction

It is widely believed that, while people sometimes cheat for economic betterment, they always prefer to appear honest. The argument is that the importance of maintaining an honest appearance stems from the substantial long-run economic returns available to those who develop a reputation for integrity (Akerlof 1983). Indeed there is evidence that people are willing to incur costs to preserve an honest appearance. For example, a market has emerged that enables one to pay to obtain alibis and excuses for absences¹. Despite this widespread belief and some suggestive empirical evidence of the importance people place on appearing honest, we are aware of no systematic data that provide direct evidence regarding the preference for *appearing*, as opposed to *being*, honest. We report data from a novel experiment that separates the appearance of honesty from honest behavior. In particular, people announce predictions about events that either can or cannot be verified. We find that while people are willing to forgo earnings to preserve an honest appearance, they will nevertheless cheat when outcomes are not verifiable.

A preference for appearing rather than being honest has important implications for anyone interested in designing institutions to deter misconduct. For example, firms can implement information systems to encourage appearance-motivated honest behavior as a supplementary motivation to contracts, especially when contracting on all possible contingencies becomes too costly and even infeasible (Williamson 1975). Likewise, transparency in governments can greatly mitigate corruption. Finally, individuals can exploit their preference to deter temptation (i.e., the temptation to embezzle money) by avoiding environments where dishonest behavior is difficult to detect.

Previous research strongly suggests that people of all ages are averse to lying (see, e.g., Bucciol and Piovesan 2008; Fischbacher and Heusi 2008; Gneezy 2005; Greene and Paxton

¹ For example, the company “Alibi Network” (www.alibinetwork.com) offers customized alibis to clients. The company provides fabricated airline confirmation, hotel stay and car rental receipts for any location and time of the client’s choice. For those who want excuses for an upcoming absence, a 2-5 day alibi package is offered so that one can pretend he/she is going to a conference or career training. The package is extremely comprehensive and individually tailored, including the conference invitation, confirmation emails and/or phone calls, mailed conference programs such as timetable and topic overview, virtual air ticket and hotel stay confirmation, and even a fake hotel number that is answered by a trained receptionist.

2009; Houser et al. 2010; Lundquist et al. 2009; Mazar et al. 2008). One interesting and persistent pattern reported in these studies is that when given the opportunity, people cheat, but shy away from cheating for the maximum earnings. However, the source of this “incomplete cheating” behavior has been difficult to trace. The reason is that in previous research, the preferences for appearance and actuality of honesty are jointly expressed in a single action. Our innovation is to allow two actions that manifest the preferences for appearing honest and being honest separately. This enables us to take the first step towards quantifying the relative importance of these two preferences, and to shed light on behavioral puzzles such as incomplete cheating.

Our experiment included two stages. In the first stage, the subject predicted the percent chance of rolling each potential outcome with a fair four-sided die. In the second stage, the subject rolled the die and observed the outcome. The accuracy of the prediction in the first-stage was evaluated by die-roll outcomes in the second stage, according to a proper scoring rule. Subjects earned more with more accurate predictions. We conducted two treatments, and the only difference is that the experimenter verified the second-stage die roll outcomes in the “*Control*” treatment, but did not in the “*Opportunity*” treatment; in the latter, subjects self-reported outcomes. Importantly, at the prediction stage, participants knew whether the roll would be verified².

We find that subjects in *Opportunity* made significantly more accurate predictions than those in *Control*. Indeed, while accuracy in *Control* was in line with what one would expect from the toss of a fair four-sided die, prediction accuracy in *Opportunity* was far better than random. The implication is that a sizable fraction of subjects in *Opportunity* cheated by mis-reporting outcomes to match their predictions. Despite substantial cheating in self-reported outcomes, we find the announced predictions to be statistically identical between the two treatments. In particular, participants in both treatments deviated in the same way from the prediction that all outcomes are equally likely (which they knew objectively to be the case in both treatments).

A simple explanation for these results is that subjects in *Opportunity* try to maintain the appearance of honesty by announcing predictions as if they were being perfectly monitored (it

² Due to its sensitive nature, the possibility of cheating was not explicitly announced. However, the fact that the die roll would be private in *Opportunity* was emphasized three times in the instructions. Hard copy instructions were in front of the subjects during the entire experiment, and were also read aloud by the experimenter.

should be emphasized, of course, that participants in *Opportunity* were not aware of the *Control* treatment). Thus, they allow themselves the opportunity for additional earnings, but nevertheless forgo substantial potential profits (on average around \$6). Our data suggest that the vast majority of our subjects exhibit a strong preference for appearing honest. At the same time, those who cheated in the second stage are better characterized by “maximum cheating”. These results suggest that the source for incomplete cheating can be mainly attributed to the desire to maintain an honest appearance, rather than an intrinsic aversion to maximum cheating.

It is worth pointing out that the desire to appear honest also has important implications for empirical research involving belief elicitation. Examples include field experimental studies and survey research (e.g., Bellemare et al. 2008, Manski 2004), where it is common to use non-saliently-rewarded procedures to elicit beliefs. A reason some choose not to use salient rewards is the “verification problem” (e.g., Manski 2004, footnote 11). The idea is that incentive-compatible mechanisms (such as the quadratic scoring rule) pay according to the outcome of the event, but realized outcomes are often difficult to verify in survey research. Hence, when the investigator relies on respondents’ self reports, a sophisticated individual could maximize elicitation payoffs by first skewing her probabilistic prediction and then misreporting an outcome to match the prediction perfectly.

However, our results suggest that participants might not bias their predictions, even for those outcomes that cannot be verified. If this is true, then the elicited probabilities might in fact still hold value for out-of-sample inferences. This could weigh in favor of using incentivized approaches for belief elicitation, especially in light of the repeatedly demonstrated value of incentives for increasing participant attention and focus on the task (see, e.g., Smith 1965; Houser and Xiao 2011).

The paper proceeds as follows. Section 2 reviews related literature; Section 3 describes the design of the experiment; Section 4 specifies behavioral types we consider in the two stages; Section 5 reports the results; and the final section concludes the paper.

2. Related Literature

Recent studies have repeatedly shown that humans exhibit an aversion to lying. In Gneezy's (2005) sender-receiver game, only Player 1 was informed about the monetary consequences of

the two options, and Player 2 chose which option should be implemented based on the message sent from Player 1. Hence, Player 1 could either: (i) tell the truth and obtain Option A, in which his payoff was lower than Player 2's; or (ii) lie and obtain Option B for a slight monetary gain at a greater cost to Player 2. In an otherwise identical dictator game, Player 1 chose between Options A and B; Player 2 had no choice but to accept the payoff division. The paper reported that the proportion of Option B was significantly lower in the sender-receiver game than in the dictator game, thus suggesting an aversion to lying as opposed to preferences over monetary allocations. In addition, Gneezy (2005) also found that people lie less when the lie results in a greater cost to others.

Gneezy's (2005) findings stimulated subsequent work that reported consistent results (see, e.g., Hurkens and Kartik (forthcoming); Lundquist et al. 2009; Rode 2010; Sánchez-Page's and Vorsatz, 2007, 2009). For example, Lundquist et al. (2009) found that lying aversion is greater when the size of the lie (i.e., the difference between the truth and the lie) is greater. In their experiment, Player 1 reported his type to Player 2, who decided whether to enter into a contract with Player 1. Upon completing the contract, Player 1 always gained. Player 2 gained if Player 1's type was above a threshold, but lost otherwise. They found that the further away Player 1's type was from the threshold, the less likely he would lie about his type.

Mazar et al. (2008) argue a theory of self-concept maintenance; they observe that "people behave dishonestly enough to profit, but honestly enough to delude themselves of their own integrity." The authors suggest two mechanisms that allow for such self-concept maintenance: (i) inattention to moral standards; and (ii) categorization malleability. For example, in one of their experiments, subjects self-reported their own performance on a real-effort task, and were paid accordingly. However, some subjects were asked to write down the Ten Commandments before the task, while others were not. The result is that those who were reminded of moral standards lied less, supporting the hypothesis that inattention to moral standards serves as a mechanism through which people cheat for profit without spoiling a positive self-concept.

In Fischbacher and Heusi's (2008) experiment, subjects rolled a six-sided die privately and self-reported the first roll. The outcome of the first roll was the amount of payment they received for the experiment. The fraction of self-reported highest payoff outcomes was significantly higher than one sixth, as expected; however, the fraction of the second highest payoff was also

significantly higher than one sixth. This is a type of “incomplete cheating,” which the authors speculated might be due to greed aversion and the desire to appear honest.

A more closely related paper is Hannan et al. (2006). In this paper, the authors conducted a laboratory experiment to study the reporting decision of a manager. The manager had a monetary incentive to mis-report the production cost to the owner. More specifically, the manager first obtained the private information about the true cost, a realization from a uniform distribution known to both parties. The manager then submitted the cost report face-to-face to the owner, who could only receive and accept all reports. The authors found that even though there was no consequence from mis-reporting, cost reports were more honest when owners were provided with an information signal about true costs. Their results suggest the preference for appearing honest. Nevertheless, in this study and all others we are aware of that address this topic, preferences for appearing honest and being honest were inferred from a single decision.

To the best of our knowledge, our paper is the first attempt to include two decisions, and thus offer a way to separately identify the preference for appearing honest and the preference for being honest³.

3. Experimental Design

The key innovation of our experiment is that it allows subjects to express preferences for appearing honest and being honest separately. The first stage elicits subjects' probabilistic predictions regarding a well-defined random process with a known probability distribution; hence, those who value the appearance of honesty would avoid making predictions that might appear dishonest⁴. In contrast, the second-stage die roll is private (not verified by the experimenter), so it is plausible that only those who hold intrinsic preferences for being honest would choose to report realized outcomes truthfully.

³ On the distinction between the appearance and actuality of other socially desirable traits, Andreoni and Bernheim (2009) showed that, theoretically and experimentally, people care not only about fairness, but also about being perceived as fair.

⁴ To whom are subjects trying to appear honest? In our experiment, subjects could send such signals to everyone who potentially would observe their predictions, including subjects themselves. The idea that people use self-signaling to learn about themselves and to preserve favorable self-conceptions has been widely discussed (see e.g., Bodner and Prelec 2003; Benabou and Tirole 2004; Mazar et al. 2008; Ariely et al. 2009).

An important feature of our design is that we did not explicitly announce the opportunity to cheat. We did, however, fully endeavor to ensure that subjects in the “*Opportunity*” treatment understood that cheating was possible (while at the same time doing our best to avoid any experimenter demand effects). For example, subjects in *Opportunity* were instructed at the very beginning of the instructions to “*take your time and roll the die as many times as you wish on your own. You will need to remember and report the first number you rolled, because this number will determine your final earnings.*”⁵ This sentence appeared again in the summary at the end of the instructions. Moreover, the experimenter read the instructions aloud and went through examples, including the earnings-maximizing case of assigning 100% probability to the number that turned out (or was reported) to occur in the second stage.

Finally, we announced to subjects that the dice were fair, so predictions different from the objective distribution cannot be attributed to suspicions that the dice might be biased. However, we also encouraged subjects to play hunches if they believed certain outcomes were more likely than others. The goal was to mitigate a potential experimenter demand effect associated with the fair dice announcement, so that subjects felt comfortable making other than the uniform probability prediction.

3.1. Treatment Design

The experiment consists of two stages. At the first stage, the *Opportunity* and *Control* treatments were identical: subjects, prior to rolling a fair four-sided die, predicted the percent chance of each potential outcome of the die roll. The four probabilities were required to be between 0% and 100% and to add up to exactly 100%. After subjects submitted their predictions to the experimenter (via pencil and paper), the experiment proceeded to the second stage.

At the second stage, a fair four-sided die was handed to each subject. What followed varied according to treatment, as described below.

***Opportunity* treatment:** Each subject was instructed to roll the die on his/her own as many times as he/she wished, but only remember the first roll. Subjects were told that they would need to report the first roll to the experimenter, which was used for calculating payoffs, according to the

⁵ We explained to subjects that this was meant for them to double-check that the dice were fair. However, it also sends a message to subjects that it would be very easy to hide their cheating behavior (see also Fischbacher and Heusi 2008). For symmetry, the *Control* group was also asked to roll the dice as many times as they wished, although only the single roll in front of the experimenter was used to calculate earnings.

quadratic scoring rule detailed in the next subsection.

Control treatment: Each subject was free to roll the die many times, but only the single roll monitored and recorded by the experimenter was relevant for calculating payoffs.

Instructions were distributed and read aloud (attached as Appendix 1). A comprehension quiz was conducted, and subjects were required to answer all questions correctly to continue.

3.2. Payoff Incentive: Quadratic Scoring Rule

Each subject's first-stage probabilistic prediction was compared with the relevant roll in the second stage. Earnings are calculated according to the following quadratic scoring rule, which rewards prediction accuracy.

$$Earnings = \$25 - \$12.5 \sum_{i=1}^4 (\chi_i - p_i)^2 \quad (1)$$

where i indexes the four faces of the die: $i \in \{1, 2, 3, 4\}$, and p_i is the probability that the subject assigned to face i . The indicator χ_i is 1 if face i is the outcome of the roll, and 0 otherwise (so we have $\sum_{i=1}^4 \chi_i = 1$). In the first stage, the subject submitted a vector of four probabilities: $p = (p_1, p_2, p_3, p_4)$, where $0 \leq p_i \leq 1$, and $\sum_{i=1}^4 p_i = 1$.

Quadratic scoring rules are widely used incentive-compatible mechanisms for eliciting subjective probabilities in experimental studies (see e.g., Nyarko and Schotter 2002, Andersen et al. 2010). Kadane and Winkler (1988, p. 359) showed that an expected utility maximizer would report truthfully, assuming the individual's utility is linear in money⁶.

To facilitate subjects' understanding of the payoffs, we provided an interactive Excel tool in which subjects could type in any probabilistic prediction and view the payoffs conditional on the rolling outcome (a screenshot is reproduced in Appendix 2).

3.3. Procedures

Subjects were recruited via email from registered students at George Mason University. Upon arrival, subjects were seated in individual cubicles, separated by partitions, so that their actions could not be observed by others. Sessions lasted 40 minutes on average, and earnings

⁶ The other assumption, the no-stakes condition, is not violated here, because subjects' wealth outside the laboratory experiment is independent of the outcome of the die roll.

ranged between \$6.25 and \$24.76, in addition to a show-up bonus of \$5. Subjects were randomly assigned to only one treatment.

4. Behavioral Types

Recall that our two-stage design allows subjects to express separately preferences for appearing honest and being honest. In the first stage, people who value the appearance of honesty would not want to make predictions that look dishonest, but those less concerned about appearances would be willing to deviate more. However, when they self-report private die roll in the second-stage, people who do not hold intrinsic preferences for honesty would be willing to lie. In this section we distinguish “types” regarding each of the two preferences based on subjects’ decisions.

Consider first the inferences about types that can be drawn from the first stage. How much can a prediction in *Opportunity* deviate from the objective distribution without looking dishonest? For subjects who desire to appear honest, a simple strategy is to make predictions as if he/she is being monitored. Intuitively, a prediction in *Opportunity* would be “honest-looking” if it does not differ from “typical” predictions in *Control*. To define “typical,” we must draw inferences from the empirical predictions in *Control*. It turns out that reporting the objective distribution is not a universal strategy in *Control*,⁷ and 69 out of 70 subjects in *Control* stated 50% or less as their highest probability. Therefore, we use 50% as the upper bound for “typical” or “honest-looking” predictions⁸. Note that the highest probability determines the amount of the highest payoff, and thus is critical for a prediction to appear “honest.”

Type 1a: (Honest-looking): A prediction in *Opportunity* is “honest-looking” if it assigns no more than 50% probability to any single outcome of the die roll.

Type 1b: (Dishonest-looking): A prediction in *Opportunity* is “dishonest-looking” if it assigns more than 50% probability to any single outcome of the die roll.

⁷ Deviations can be attributed, perhaps, to risk-seeking preferences.

⁸ This threshold says that roughly 99% of the time that a random draw from *Control* is no greater than 50%. In the *Control* treatment, the highest prediction is 57%, which is followed by two predictions at 50%, and quite a few predictions between 50% and 45%. Hence, 50% seems a natural focal point that subjects in *Control* were comfortable with.

For the second stage, we consider three types of intrinsic preferences for honesty: (i) “truth-telling”; (ii) “maximum cheating”; and (iii) “one-step cheating.” The “truth-telling” type describes dogmatic truth tellers who report truthfully regardless of whether they are monitored. The “maximum cheating” type characterizes people who suffer little psychic disutility from cheating, and thus always report an outcome corresponding to the maximum profit. Finally, the “one-step cheating” type deviates from truth-telling, but only partially cheats by reporting the next available payoff level, which is not always the highest payoff⁹.

Note that we use the “one-step cheating” type to model the incomplete cheating behavior as an intrinsic preference not to deviate “too much” from honesty (see e.g., Mazar et al. 2008; Lundquist et al. 2009). If people hold such preferences, then “one-step cheating” would explain second-stage decisions better than the “maximum cheating” type.

Our three types of preference for being honest can be summarized as follows.

Type 2a: (“Truth-telling”): The subject truthfully reports the die roll outcome, which follows the objective uniform distribution.

Type 2b: (“Maximum Cheating”): The subject reports an outcome corresponding to the highest payoff.

Type 2c: (“One-step Cheating”): The subject reports an outcome one payoff level higher than the actual realized outcome. In particular, the subject’s strategy is always to report the highest-payoff outcome if he/she obtained such an outcome, and otherwise report an outcome corresponding to the next higher payoff level in relation to his/her realized outcome.

5. Results

We present our results in three parts: (i) first-stage results regarding the preference to appear honest; (ii) second-stage results addressing the preference for being honest; and finally (iii) subjects’ earnings and their willingness to pay for an honest appearance.

⁹ The number of payoff levels in a prediction varies according to the number of ties. In particular, the “one-step cheating” type is identical to the “maximum cheating” type when there are only two payoff levels.

We obtained a total of 146 independent observations: 70 in *Control* and 76 in *Opportunity*. We call a prediction an “objective prediction” if it is identical to the objective distribution (25%, 25%, 25%, 25%). For subject i ’s prediction, we rank the four probabilities and denote the highest probability by p_i^{max} and the lowest probability by p_i^{min} . Also, “highest-payoff outcome” refers to an outcome to which the subject assigned the highest probability¹⁰.

5.1. First Stage: Preference for Appearing Honest

Table 1 summarizes first-stage predictions. The first row reveals that the fractions of objective predictions are nearly identical: 33% and 32% in *Control* and *Opportunity*, respectively. In order to further compare predictions between treatments, consider the distribution of p_i^{max} . In our data, p_i^{max} is as low as 25% (due to objective predictions), and as high as 57% in *Control* and 88% in *Opportunity*. The means of p_i^{max} are nearly identical between treatments (34.0% in *Control* and 35.1% in *Opportunity*), and the medians are similar (34.0% in *Control* and 31.5% in *Opportunity*). Similarly, for p_i^{min} , these statistics are also identical between treatments, as shown in Table 1.

< Table 1 >

Recall that we use 50% as the upper bound for “typical” or “honest-looking” predictions. The reason is that majority (69 out of 70) of predictions in *Control* are no greater than 50%. This leads to our first result.

RESULT 1: *In the Opportunity treatment, 95% of predictions are “honest-looking.”*

Evidence: In *Opportunity*, 72 of 76 subjects’ (95%) predictions were within the range of “typical” predictions defined by the *Control* treatment, providing clear evidence that the majority of our participants hold a preference for honest appearances¹¹.

We next compare the distributions of predictions, and present the second result.

¹⁰ In the event of ties, there are multiple highest-payoff outcomes.

¹¹ In *Control*, the highest among all p_i^{max} is 57%, followed by two subjects at 50%. The fourth is 48%, which is also the 95th percentile of the distribution of p_i^{max} in *Control*. If we instead use the 95th percentile to define the upper bound of “typical” or “honest-looking” predictions, 90% of predictions in *Opportunity* are “honest-looking.”

RESULT 2: *The distribution of predictions in Opportunity is statistically identical to that of Control.*

Evidence: We find that the fractions of objective predictions between the two treatments are the same: 33% and 32% ($p=0.90$, two-sided proportion test), and the means of p_i^{max} are also statistically indistinguishable: 34% and 35.1% ($p=0.95$, two-sided rank sum test). Moreover, the distributions of predictions are identical between treatments even after excluding objective predictions (see Figure 1). Using only non-objective predictions, we compare the means of the four probabilities from p_i^{max} to p_i^{min} . We find no evidence of significant differences (p-values equal 0.99, 0.47, 0.58 and 0.35 for respectively)¹². These results provide strong evidence that the predictions between the two treatments are statistically indistinguishable.

<Figure 1>

5.2. Second Stage: Preference for being Honest

In the second stage, the die roll outcomes in *Opportunity* were not verified by the experimenter, so subjects had the opportunity to mis-report for profit. As a first pass, we compare the subjects' die-roll outcomes with the objective distribution of a fair die. We find that the self-reported die rolls from *Opportunity* differ significantly from the uniform distribution ($p=0.10$, chi-squared test), while those from *Control* do not differ ($p=0.42$, chi-squared test).

5.2.1. Cheating Behavior

In this section, we draw inferences with respect to cheating behavior by investigating whether highest-payoff outcomes are reported more often than what we expect from a fair die. Since objective predictions yield identical payoffs for all outcomes, they are excluded from this analysis.

With a fair die, the expected frequency of a highest-payoff outcome is 25% if the highest prediction p_i^{max} is unique. However, when it is not unique, we must adjust for ties. For example, if a subject predicts [32%, 32%, 20%, 16%], it is expected that a highest-payoff outcome turns up with probability 50%. Hence, the expected frequency is 25% multiplied by the number of ties

¹² Conducting multiple hypothesis tests artificially inflates the chance of rejecting one of the hypotheses. This works against our hypothesis and thus supports our conclusion that there is indeed no difference between distributions.

at p_i^{max} . As summarized in Table 2, the expected frequency of highest-payoff outcomes is 32.4% and 30.2% in *Control* and *Opportunity*, respectively.

Next, we calculate the frequency of highest-payoff outcome reports in the second stage. We find the empirical frequency of highest-payoff outcomes is 36.2% and 71.2% in *Control* and *Opportunity*, respectively. The fact that highest-payoff outcomes are reported more often than expected leads to our third result.

<Table 2>

RESULT 3: *Cheating occurs in self-reported outcomes.*

Evidence: The frequency of highest-payoff outcomes reported by subjects in *Opportunity* is significantly higher than what the objective distribution of a fair dice suggests ($p < 0.001$, two-sided proportion test). By contrast, the two do not differ in *Control* ($p=0.588$, two-sided proportion test). Between treatments, the empirical frequencies are significantly different ($p < 0.001$, two-sided proportion test), while the expected frequencies are the same ($p=0.814$, two-sided proportion test). These results suggest that cheating occurs when outcomes are self-reported.

5.2.2. Truth-telling Behavior

We also observe substantial truth-telling behavior, and thus report our fourth result,

RESULT 4: *A significant number of people report truthfully.*

Evidence: First, almost one third of subjects in *Opportunity* reported objective predictions, suggesting that many people follow the truth-telling strategy. Moreover, seven out of the 52 non-objective predictions reported outcomes corresponding to their lowest payoff in the second stage (13.5%)¹³. This is evidence that these people are intrinsically averse to cheating even when not monitored.

5.2.3. Truth-telling, Maximum and Incomplete Cheating

¹³ We adopt the common assumption in the literature that people would not cheat for worse outcomes.

Our analysis reveals a mixture of types in our population: some people are “truth-tellers,” while others are “maximum cheaters,” or “one-step cheaters.” To draw inferences regarding the nature of this mixture, we employ a variant of the El-Gamal and Grether (1995) algorithm.

Allowing an error rate ε that is the same for all subjects, we say that each subject follows his/her decision rule (i.e., type) with probability of $1 - \varepsilon$; with probability of ε , he/she trembles and reports all outcomes equally likely. Importantly, our “truth-telling” type also reports all outcomes equally likely due to the fact that the objective distribution is uniform. This implies two important features: (i) that the error rate ε is interpreted as the fraction of “truth-tellers” in the population, and (ii) that the “truth-telling” type is implicitly built into each mixture.

Before we specify the components of the likelihood function, we define the following notations. Let M_i denote the number of distinct payoff levels given by subject i 's prediction; rank all payoff levels from the lowest to highest. Let $t_i^{(j)}$ (where $j \in \{1, \dots, M_i\}$) be the number of ties at the j th lowest payoff level, so we have $\sum_{j=1}^{M_i} t_i^{(j)} = 4$ and that $t_i^{(M_i)}$ is the number of ties at the highest payoff level. The indicator $D_i^{(j)}$ is 1 if subject i 's reported outcome corresponds to her j th lowest payoff level, and 0 otherwise; thus, we have $\sum_{j=1}^{M_i} D_i^{(j)} = 1$ and that $D_i^{(M_i)}$ indicates whether subject i 's reported outcome corresponds to the highest payoff.

Consider first the mixture of “truth-telling” and “maximum cheating” types. With probability $1 - \varepsilon$, a subject reports the highest-payoff outcome (“maximum cheating”); with probability ε , he/she reports each of the four outcomes with equal probability of 25% (“truth-telling”). This implies the following likelihood function (adjusted for ties) for the mixture of “maximum cheating” and “truth-telling” types.

$$\prod_{i=1}^n L_i(t_i^{(M_i)}, D_i^{(M_i)}) = \prod_{i=1}^n \left(1 - \varepsilon + \frac{\varepsilon}{4} t_i^{(M_i)}\right)^{D_i^{(M_i)}} \left(\frac{\varepsilon}{4} (4 - t_i^{(M_i)})\right)^{1 - D_i^{(M_i)}}$$

Next consider the “one-step cheating” type, which predicts that subjects report outcomes corresponding to the next higher payoff level in relation to their realized outcomes. In particular, (i) the highest-payoff outcome is reported with the objective probability of obtaining the top two highest payoff levels; (ii) the lowest-payoff outcome is never reported; and (iii) the intermediate-payoff outcomes (which exist when $M_i > 2$) are reported with the objective probability of obtaining outcomes from the one-step lower payoff level. Adjusting for ties, we obtain the following likelihood function for the mixture of “one-step cheating” and “truth-telling”:

$$\prod_{i=1}^n L_i(t_i^{(j)}, D_i^{(j)}) = \begin{cases} \prod_{i=1}^n ((1 - \varepsilon) \frac{t_i^{(M_i)} + t_i^{(M_i-1)}}{4} + \frac{\varepsilon}{4} t_i^{(M_i)}) & \text{if } D_i^{(M_i)} = 1 \\ \prod_{i=1}^n ((1 - \varepsilon) \frac{t_i^{(j-1)}}{4} + \frac{\varepsilon}{4} t_i^{(j)}) & \text{if } D_i^{(j)} = 1 \text{ and } 2 \leq j \leq M_i - 1 \\ \prod_{i=1}^n \frac{\varepsilon}{4} t_i^{(1)} & \text{if } D_i^{(1)} = 1 \end{cases}$$

Finally, we consider the mixture of all three types, and obtain the likelihood as follows.

1. For each individual i , calculate the likelihoods for both mixtures: “maximum cheating and truth-telling” and “one-step cheating and truth-telling”; find the highest likelihood; and
2. Multiply the obtained highest likelihood across all n individuals, and find its maximal value by choosing the frequency of “truth-telling” ε .

To select among the three mixtures, we must include a penalty that increases with k , the number of types in the mixture. Following El-Gamal and Grether (1995, pp.1140-1141), our penalty is an uninformative “prior” distribution consisting of three parts. The first term is the prior for having k decision rules: $1/2^k$. The second term is the prior for selecting any k tuple of decision rules out of the universe of three decision rules: $1/3^k$. The third term says that each individual is assigned to one of the k decision rules independently and with equal probability: $1/k^n$.

Hence, our posterior mode estimates are obtained by maximizing the following:

$$\log\left(\prod_{i=1}^n \max L_i(t_i^{(j)}, D_i^{(j)})\right) - k \log(2) - k \log(3) - n * \log(k)$$

Table 3 reports the result of our analysis using the 52 non-objective predictions¹⁴.

<Table 3>

Our final result is as follows.

¹⁴ Objective predictions are excluded, because they do not distinguish among the three types.

RESULT 5: *The mixture of “maximum cheating” and “truth-telling” best characterizes second-stage behavior, with the latter type estimated to occur at a rate of 44%.*

Evidence. The posterior mode is maximized with the mixture of “maximum cheating” and “truth-telling.” Moreover, the estimates suggest that 44% of subjects followed the “truth-telling” strategy. This rate of truth-tellers is in line with what has been suggested in previous studies, including 39% reported by Fischbacher and Heusi (2008) and 51% reported by Houser et al. (2010).

5. 3. Earnings and Price for Appearing Honest

Table 4 summarizes subjects’ earnings. As a point of reference, expected earnings in *Control* were maximized at \$15.63, and occurred when a subject reported the objective distribution (25% for each outcome). However, in *Opportunity*, one could obtain the maximum possible earnings (\$25) by deciding to report any number in the second stage and place 100% probability on that number in the first-stage prediction task.

<Table 4>

Regarding actual earnings, the range is larger in *Opportunity*, spanning \$6.25 to \$24.76, as compared to \$8.12 and \$20.81 in *Control*. The medians are nearly identical, at \$15.63 and \$15.75. However, mean earnings are significantly higher (by \$1.54) in *Opportunity* ($p < 0.00$, two-sided t -test). To see this, we plot individual earnings in Figure 2, sorted from the lowest to the highest within each treatment. We observe that earnings in *Opportunity* are almost uniformly larger than earnings in *Control*, suggesting that subjects took advantage of the cheating opportunity to realize monetary gains.

<Figure 2>

Finally, we turn to subjects’ willingness to pay for the appearance of honesty. Subjects who reported highest-payoff outcomes in the second stage nonetheless gave up a large amount of profit in the first stage in order to preserve an appearance of honesty. We measure this willingness-to-pay by the difference between earnings of subjects who reported the highest-payoff outcomes and the maximum profit. We find that the average earnings by highest-payoff outcome reporters ($n=36$) are \$18.81, 75% of the maximum profit \$25. Despite these subjects’

willingness to lie, they voluntarily left a quarter of their potential earnings on the table, suggesting a significant willingness-to-pay to appear honest.

6. Discussion

The prevalence of the preference for an honest appearance among our subjects is perhaps not surprising; after all, the importance of an honest appearance is acknowledged in everyday life. For instance, it is especially emphasized in leadership trainings¹⁵: “The appearance of dishonesty is just as deadly as dishonesty. Leaders must make every effort to avoid the appearance of dishonesty.” The majority of our subjects seemed to be keen on avoiding the appearance of dishonesty, even in an artificial laboratory setting where they were encouraged to “play hunches.”

Our results suggest that “incomplete cheating” behavior observed in many previous studies can be attributed more to a preference for maintaining appearances than an intrinsic aversion to maximum cheating. The majority of our subjects took the opportunity to signal an honest appearance. After establishing their appearance of honesty, their second-stage decisions regarding the intrinsic preference for honesty can be better characterized by “maximum cheating” rather than “one-step cheating” (Result 5).

Two concerns regarding the subjects’ understanding of the experiment deserve discussions. The first is that the *Opportunity* group could be worried about the possibility and consequences of being caught cheating. To minimize this mis-understanding, we emphasized to subjects three times in the instructions that the die rolls would be completely on their own. We also encouraged them to roll many times and only remember and report the first roll, which makes a stronger case that the chance of being caught is minimal. Moreover, subjects’ answers in ex-post survey indicated clear awareness that they would be able to cheat¹⁶. Consequently, we are confident that this issue did not significantly influence subjects’ behavior.

The second concern is that subjects could be unaware of the earnings-maximizing strategy of assigning 100% to one outcome. This, however, seems unlikely to have been the case. The reason is that all participants were required to complete a quiz that assessed whether they

¹⁵ See <http://www.docentus.com/articles/81>.

¹⁶ For example, when asked about their strategies for predictions, several subjects indicated that they were trying to maximize earnings.

understood how to assign probabilities to achieve maximum earnings. Participants could not continue the experiment without demonstrating this knowledge.

We next explore an alternative explanation for our results, which says that subjects' first-stage predictions were not for signaling an honest appearance, but instead were used to restrict the size of their lies in the second stage. This explanation seems improbable in light of the fact that probabilistic predictions in *Opportunity* are statistically identical to those in *Control*. It would be strikingly coincidental if decisions implied by maximum cheating-averse preferences were exactly consistent with preferences revealed under monitoring, as our data would require when combined with this alternative explanation.

Our results contribute to the literature by providing a unified explanation for a variety of behaviors reported in previous studies. For example, Mazar et al. (2009, p. 642) argued that subjects managed a positive self-view even after cheating. Their evidence was that there was no difference between the self-reported sense of honesty before and after a task in which subjects clearly cheated. However, our results suggest that due to the desire to maintain an honest appearance, it is plausible that subjects would report the same level of honesty, *especially after they cheated*.

7. Conclusion

Previous research has established that people cheat, but less than economic theory predicts. Building on a distinction discussed by Akerlof (1983), we attempt to explain this puzzling behavior and hypothesize that incomplete cheating is due to an aversion to *appear* dishonest. We provide evidence supporting this hypothesis.

This paper offers both methodological and substantive contributions. Methodologically, our two-stage experiment is, to our knowledge, the first experiment in which subjects are able to separately express their preferences for appearing honest and being honest. This innovation allows us to make two substantive contributions: (i) assessing the relative importance of these two preferences, and (ii) shedding light on the behavioral puzzle of “incomplete cheating.” In particular, the preference for an honest appearance exists in nearly all (95%) of our subjects, while only 44% of subjects exhibit a preference for honest behavior. Further, after establishing an honest appearance, those who cheat are best characterized by maximum cheating. Hence, our results suggest that the puzzle of “incomplete cheating” reported in previous studies (see e.g.,

Fischbacher and Heusi 2008) can be explained as the price people pay to preserve their honest appearance. Indeed, in our experiment predictions by those (56% of participants) who ultimately lie imply a mean reduction of over \$6 (25%) in possible profit.

More broadly, our results also lend support to the claim that incentivized mechanisms can be used to elicit beliefs even when the event outcomes cannot be verified. The reason is the ubiquitous preference for an honest appearance. When the outcome is not verifiable, in-sample predictions may be too “accurate”: 71% subjects in *Opportunity* reported that they indeed “obtained” the outcome they predicted was most likely to occur, as compared to the expected frequency of 30% (Table 2). On the other hand, the predictions do well out-of-sample in the sense that the first-stage predictions in *Opportunity* are identical to those in *Control*.

A limitation of this study is that its results might depend on the specific payoffs we employed. Whether people are less concerned about their honest appearance when monetary incentives are sufficiently high is one of many testable hypotheses left for future studies.

Another important question is to understand how willingness to cheat varies across people and settings. In particular, understanding how demographics, religious and political views affect the rationalization of cheating behavior might shed light on institutions to mitigate forms of terrorism, misconduct and corruption.

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Table 1. Summary Statistics of Probabilistic Predictions

Treatment	Control (n=70)	Opportunity (n=76)
Faction of Objective Predictions	33%	32%
p_i^{max} :		
[Min, Max]	[25%, 57%]	[25%, 88%]
Median	34.0%	31.5%
Mean	34.0% (1.0%)	35.1% (1.4%)
p_i^{min} :		
[Min, Max]	[0%, 25%]	[0%, 25%]
Median	20.0%	20.0%
Mean	17.4% (0.9%)	18.1% (0.9%)

Note: Standard errors are in parenthesis.

Table 2. Expected and Empirical Frequencies of Highest-payoff Outcomes (Excluding Objective Predictions)

Treatment	Control (n=47)	Opportunity (n=52)	Between-treatment Equality Test
Expected Frequency of Highest-payoff outcomes	32.4%	30.2%	p=0.814
Empirical Frequency of Highest-payoff outcomes	36.2%	71.2%	p < 0.001
Equality Test	p = 0.588	p < 0.001	-

Notes: All p-values are obtained via the proportion test (two-sided).

The *expected frequency of a highest-payoff outcome* according to a fair die is 25% if a prediction has a unique highest probability p_i^{max} ; otherwise, the expected frequency must be adjusted for ties at p_i^{max} . For example, for the prediction [32%, 32%, 20%, 16%], the expected frequency of highest-payoff outcomes is 50%. The *empirical frequency of highest-payoff outcomes* is the fraction of subjects who actually reported that they obtained the highest-payoff outcome in the second round.

Table 3. Type Selection

(n=52)	“Truth-telling” and “One-step Cheating”	“Truth-telling” and “Maximum Cheating”	“Truth-telling,” “One- step Cheating” and “Maximum cheating”
Number of Types	2	2	3
Posterior Mode	-128.98	-126.96	-143.18
Frequency of Truth-tellers	34%	44%	28%

Table 4. Earnings

	<i>Control</i> (n=70)	<i>Opportunity</i> (n=76)
Min	\$8.12	\$6.25
Max	\$20.81	\$24.76
Median	\$15.63	\$15.75
Mean	\$15.26 (\$ 0.30)	\$16.90 (\$ 0.29)

Note: Standard errors are in parenthesis.

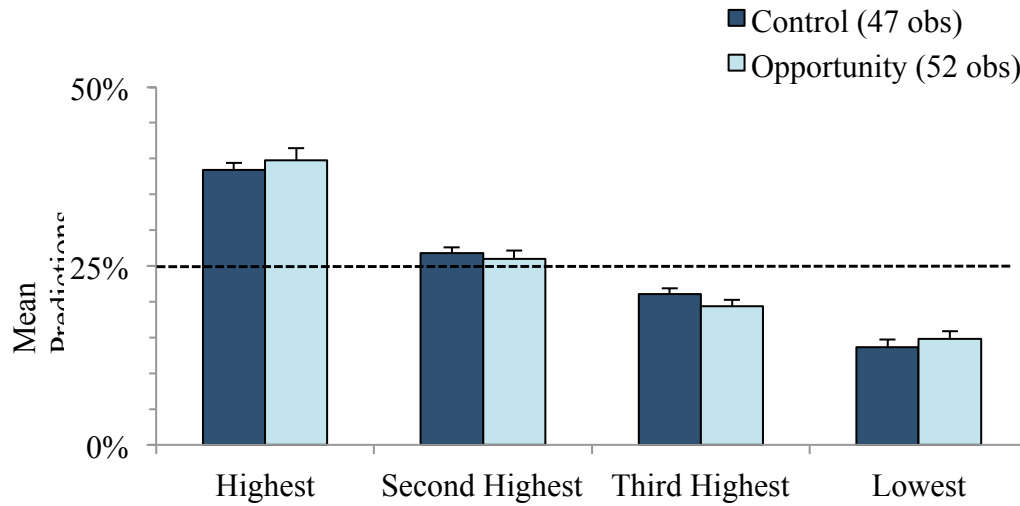


Figure 1. Mean Probabilistic Predictions: Excluding Objective Predictions

Note: Error bars are one s.e. of the means.

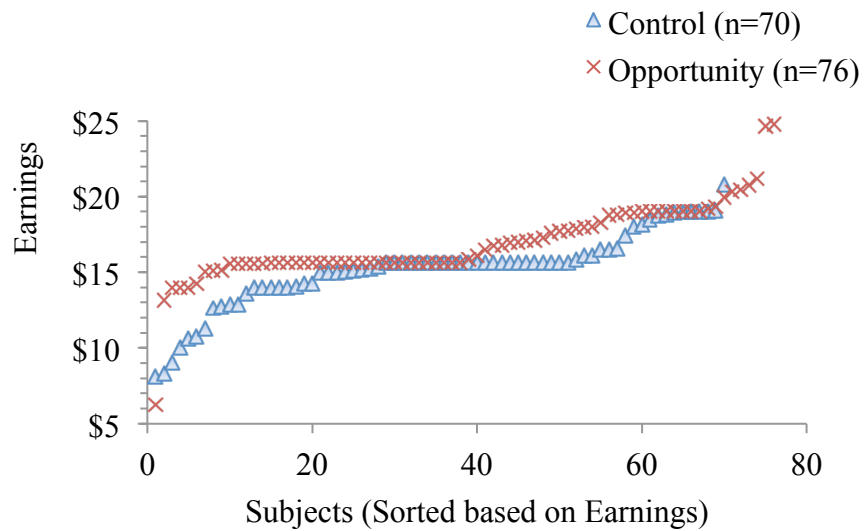


Figure 2. Scatter Plot of Earnings (Sorted from Low to High)

Appendix 1: Instructions and Decision Sheets.

(Control Treatment)

Instructions

Welcome to this experiment. In addition to \$5 for showing up on time, you will be paid in cash based on your decisions in this experiment. Please read the instructions carefully. No communication with other participants is allowed during this experiment. Please raise your hand if you have any questions, and the experimenter will assist you.

There are two parts to this experiment. In Part I, you predict the percent chance that you will roll a one, two, three or four on a single roll of a fair four-sided die. In Part II, you will roll the die as many times as you wish on your own, and the experimenter will come to your desk and ask you to roll it exactly once. The experimenter will watch your roll and record the outcome.

Your earnings depend on how close your prediction in part I is to the outcome of your single roll in front of the experimenter in Part II. We'll now explain each part in more detail.

How You Earn Money:

In Part I, your task is to predict the percent chance that your single roll of a four sided die in front of the experimenter will be a one, two, three or four. *Your predictions are not what you hope will happen, but what you believe will happen.* Remember the die is “fair”, which means each number should be equally likely. However, sometimes people have a “hunch” that rolling one number is more likely, and if you have a hunch you should indicate this when you write down your percent chances.

You earn more money when your predictions are closer to the outcome of your single roll. For example, you earn the most if you predict 100% chance that you will roll a certain number, and then you actually do roll that number. On the other hand, you earn the least if you predict 100% chance you will roll some number, and then you don't roll that number.

Please use the spreadsheet tool on your computer to explore how different predictions affect your earnings depending on the number you roll in front of the experimenter. Below we provide a few examples.

If you predict percent chances:	If your single roll in front of the experimenter is	Your earnings are
1: 0%; 2: 100%; 3: 0%; 4: 0%	2	\$25.00
	4	\$0.00
1: 0%; 2: 50%; 3: 50%; 4: 0%	2	\$18.75
	4	\$6.25
1: 25%; 2: 25%; 3: 25%; 4: 25%	2	\$15.63
	4	\$15.63
1: 20%; 2: 20%; 3: 20%; 4: 40%	2	\$14.00
	4	\$19.00
1: 33%; 2: 0%; 3: 34%; 4: 33%	2	\$8.33
	4	\$16.58

To summarize, the formula for calculating your earnings is

*Earnings = \$12.5 + \$25 * percent chance you predicted for the outcome of your single roll in front of the experimenter*

*–\$12.5 * (percent chance you predicted for number 1)²*

*–\$12.5 * (percent chance you predicted for number 2)²*

*–\$12.5 * (percent chance you predicted for number 3)²*

*–\$12.5 * (percent chance you predicted for number 4)²*

This formula shows how exactly your earnings are calculated. To understand how different predictions affect your earnings, please take your time and use the spreadsheet on your computer terminal to explore.

After you submit your decision sheet, the experimenter will come to your table and ask you to roll the die exactly once, and record the number. This number will determine your earnings.

Decision Sheet:

Your experiment ID: _____

Print your name: _____

Part I:

Before you roll the four-sided die, please predict the percent chance that each number turns up of your single roll in front of the experimenter.

A. What is the percent chance that the number 1 turns up? _____

B. What is the percent chance that the number 2 turns up? _____

C. What is the percent chance that the number 3 turns up? _____

D. What is the percent chance that the number 4 turns up? _____

Important: the sum of all four answers **MUST** be 100%. Is the total of your four answers equal to 100%? Please circle one of the following: Yes No

(Opportunity Treatment)

Instructions

Welcome to this experiment. In addition to \$5 for showing up on time, you will be paid in cash based on your decisions in this experiment. Please read the instructions carefully. No communication with other participants is allowed during this experiment. Please raise your hand if you have any questions, and the experimenter will assist you.

There are two parts to this experiment. In Part I, you predict the percent chance that you will roll a one, two, three or four on your first roll of a fair four-sided die. **In Part II, you will roll the die as many times as you wish on your own, but you will need to remember the first number you roll.**

Your earnings depend on how close your prediction in part I is to the outcome of your first roll in Part II. We'll now explain each part in more detail.

How You Earn Money:

In Part I, your task is to predict the percent chance that your first roll of a four sided die will be a one, two three or a four. *Your predictions are not what you hope will happen, but what you believe will happen.* Remember the die is “fair”, which means each number should be equally likely. However, sometimes people have a “hunch” that rolling one number is more likely, and if you have a hunch you should indicate this when you write down your percent chances.

You earn more money when your predictions are closer to the outcome of your first roll. For example, you earn the most if you predict 100% chance that you will roll a certain number, and then you actually do roll that number. On the other hand, you earn the least if you predict 100% chance you will roll some number, and then you don't roll that number.

Please use the spreadsheet tool on your computer to explore how different predictions affect your earnings depending on the first number you roll. Below we provide a few examples.

If you predict percent chances:	If your first roll is	Your earnings are
1: 0%; 2: 100%; 3: 0%; 4: 0%	2	\$25.00
	4	\$0.00
1: 0%; 2: 50%; 3: 50%; 4: 0%	2	\$18.75
	4	\$6.25
1: 25%; 2: 25%; 3: 25%; 4: 25%	2	\$15.63
	4	\$15.63
1: 20%; 2: 20%; 3: 20%; 4: 40%	2	\$14.00
	4	\$19.00
1: 33%; 2: 0%; 3: 34%; 4: 33%	2	\$8.33
	4	\$16.58

To summarize, the formula for calculating your earnings is

$$\text{Earnings} = \$12.5 + \$25$$

** percent chance you predicted for the outcome of your first roll*

$$-\$12.5 * (\text{percent chance you predicted for number 1})^2$$

$$-\$12.5 * (\text{percent chance you predicted for number 2})^2$$

$$-\$12.5 * (\text{percent chance you predicted for number 3})^2$$

$$-\$12.5 * (\text{percent chance you predicted for number 4})^2$$

This formula shows how exactly your earnings are calculated. To understand how different predictions affect your earnings, please take your time and use the spreadsheet on your computer terminal to explore.

After you submit your Decision Sheet 1, please take your time and roll the die as many times as you wish on your own. You will need to remember and report the first number you rolled, because this number will determine your final earnings.

Decision Sheet 1:

Your experiment ID: _____

Print your name: _____

Part I:

Before you roll the four-sided die, please predict the percent chance that each number turns up for your first roll.

A. What is the percent chance that the number 1 turns up? _____

B. What is the percent chance that the number 2 turns up? _____

C. What is the percent chance that the number 3 turns up? _____

D. What is the percent chance that the number 4 turns up? _____

Important: the sum of all four answers **MUST** be 100%. Is the total of your four answers equal to 100%? Please circle one of the following: Yes No

Decision Sheet 2:

Your experiment ID: _____

Part II:

Now take your time and roll the die as many times as you wish on your own, but please remember the first number you roll, because you will need to write it down and it will determine your earnings:

Please write down the first number you rolled: _____

Appendix 2: Screenshot of Excel Tool for the Quadratic Scoring Rule

