Big and Small Lies*

Diogo Geraldes† Franziska Heinicke‡ Duk Gyoo Kim§

June 9, 2020

Abstract

Lying involves many decisions that can yield big or small benefits. We investigate how big and small lies are interdependent by conducting a laboratory experiment with three treatments. In the *Big and Small Lie* treatment (BSL), participants can simultaneously tell a big and a small lie. In the *Big Lie* treatment (BL), participants can misreport only a high-stakes outcome because a computer exogenously determines the low-stakes outcome. The *Small Lie* treatment (SL) reverses BL. We find that the BSL participants lie in both the low and the high stakes, but they lie more about the high-stakes outcome. We also find that participants' behavior—either lying or truth-telling—is consistent between the big and small lie dimensions. Although shutting down one dimension of lying opportunities (BSL to BL and BSL to SL) does not affect overall lying behavior on the comparing dimension, we find that repeatedly being lucky (unlucky) on a high-stakes prize leads to less (more) lying in the report of a low-stakes outcome.

JEL Classification: C91, D03, D82

Keywords: Laboratory experiment, Lying, Luck, Honesty

*We thank Collin Raymond and the participants of the HeiKaMaX Workshop and the ESA European Meeting 2019 for invaluable comments and suggestions. Duk Gyoo Kim gratefully acknowledges financial support from the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation)–Project-ID 139943784–SFB 884.

†Utrecht University, Utrecht School of Economics – Section Economics. Email: diogogeraldes@gmail.com

‡Department of Economics, University of Mannheim, Germany. Email: f.heinicke@uni-mannheim.de

§Department of Economics, University of Mannheim, Germany. Email: d.kim@uni-mannheim.de

1 Introduction

Lying behavior is pervasive in social, political, and economic life. Nevertheless, the lies that people can tell are not all made equal but rather differ considerably regarding the consequences they have. Some lies do not cause much harm relative to the counterfactual truth-telling situation. Other lies, however, have considerable consequences because they create a significant shift relative to the situation that would have occurred under truth-telling. For instance, whereas deceiving an employer regarding oversleeping is likely innocuous to a corporation, obtaining a job by misstating items in a resume will, in all likelihood, jeopardize it.

Moreover, big and small lying opportunities commonly occur together in real-world settings. A compelling example is tax declarations because people have to report private information regarding several items, and the combination of all self-reports will ultimately determine the tax return. Thus, if people intend to adjust the total outcome in their favor, they can misreport all or just some of the individual items. However, misreports are not necessarily equal in size. That is, the consequence of a particular lie in the tax return depends on the misreported item. For example, misreporting the capital gains from assets held in a foreign country may lead to a considerable effect on the final tax payment, while overstating miscellaneous expenses will have a minor effect.

Although a recent growing literature in experimental economics has considerably advanced our understanding of the determinants of lying behavior, little is known about the interplay of lying behaviors. Our primary research question regards the interaction between big and small lies in a simultaneous two-decision setting. When there are two lying opportunities involving different stakes, how do people lie? Are big and small lies complementary? That is, do some people always lie for both big and small benefits? Or, do people supplement lies? If the latter, do people supplement one honest, less rewarding behavior, with a big rewarding lie? Or do they lie more for petty stakes because it is not a "big deal"?

We conduct a laboratory experiment where a participant can make big and small lies. Specifically, in our experiment, participants toss a coin and roll a dice and receive a payoff based on the reports of both outcomes. Their actual outcomes are unobservable by the experimenter. The report on the coin toss represents the big lie because we associate it with higher stakes than the dice. Participants who lie in the coin accept a larger deviation relative to the outcome under truthful reporting than the deviation possible on the dice. Moreover, we compare behavior in this main treatment—which we call the *Big and Small Lie* treatment (BSL)—with two control treatments. In the *Big Lie* treatment (BL), participants report only the coin while the dice is determined exogenously. In the *Small Lie* treatment (SL), participants report only the dice while the coin is determined exogenously. The two control treatments are designed to clearly identify the effect of reporting, and possibly misreporting, two outcomes as compared to merely having an additional payment dimension.

Our results show that lying behavior is complementary when both big and small lying opportunities are available. That is, participants who lie in the coin are also more likely to lie in the dice, and vice versa. In absolute terms, we observe more liars in the dice than in the coin. However, taking into account the size of participants' lies, we observe significantly more lying in the coin than in the dice.

The complementarity of lies does not lead to more lies when there are more lying opportunities. Neither the average coin reports in BL nor the average dice reports on SL differ from the corresponding reports in the main treatment. In other words, these findings indicate that lying is complementary when big and small lies can be reported jointly, but we do not observe more big-stake (small-stake) lies when only one type of lying opportunity is available. In short, our results show that participants behave consistently across two lying opportunities.

Besides analyzing jointly reported big and small lies, we also test the effect of observing a (un)favorable outcome on lying behavior. We find that the observation of an exogenous low-stakes outcome does not affect telling a big lie. Notably, however, we find that repeatedly observing a positive high-stakes exogenous outcome leads to decreased lying regarding the small lie.

This paper contributes to a growing body of research on lying behavior by exploring the interaction of lies with different stakes in a two-dimensional setting. In particular, we expand the understanding of lying behavior by analyzing the interaction of jointly told big and small lies while varying the size of a lie. Many economically relevant real-world settings present simultaneous lying opportunities. Thus, for deriving accurate policy implications, it is of utmost importance to examine settings in the lab that preserve vital features of real-world settings.

The remainder of this paper is organized as follows. First, we provide an overview of the relevant literature. Section 3 outlines the experimental design, the hypotheses, and the procedures. In Section 4, we report the results of the experiment. Section 5 concludes.

2 Literature

Concerned with the adverse effect of self-serving dishonesty in economically relevant settings, a recent growing literature in experimental economics has been uncovering the determinants of lying behavior.[1] Traditionally, economists have considered lying to be inevitable as long as the material gains from a lie outweigh the risk and consequences of being detected (Lewicki, 1983). However, the experimental literature on lying behavior has come to a different conclusion. Two recent meta-studies (Abeler et al., 2019; Gerlach et al., 2019), taking the impressively vast work conducted in the last few years altogether, identify a considerable proportion of people that hold preferences for honesty. In particular, many people not only fear the material consequences of lying but also suffer moral costs from lying. Although this recent literature has largely enriched our understanding of lying behavior, little is known regarding the interaction of two lies that vary by size. This paper aims to study the latter element by examining people's lying behavior when allowed to provide lies with asymmetric consequences simultaneously.

Gneezy et al. (2018) identify the essential components of the size of a lie. The *stake size* component is the payoff that can be gained from lying. The *outcome* component is the deviation measure from the true state.[2] In our experiment, we manipulate the size of a lie considering both the outcome and the payoff components. Specifically, lying in a dice involves a small stake with several possible deviations from the true outcome, while lying in a coin involves a big stake with one possible deviation. In the following, we discuss evidence on the effect of these two components.

The question of stake size has been discussed in the lying literature from the start. In the experimental study of Mazar et al. (2008), participants can get a higher payment by overreporting their performance of a real-effort task. To analyze the effect of the size of payoffs on lying, the authors vary the payoff incentives of the real-effort task. They find no significant difference in lying when the stake sizes quadrupled. Similarly, Fischbacher and Föllmi-Heusi (2013) conduct a low-stakes baseline treatment and a high-stakes treatment where the stakes tripled. Belot and van de Ven (2019) conduct similar experiments to see

[1] Abeler et al. (2014) and Arbel et al. (2014) investigate what individual characteristics shape the costs of lying. Charness et al. (2019) show how the moral cost of lying may prevent lying in a loss frame. Cohn and Maréchal (2018), Dai et al. (2018), and Potters and Stoop (2016) examine whether and to what extent the laboratory measure of lying predicts misconduct in real situations. Hurkens and Kartik (2009), Houser et al. (2012), and Cojoc and Stoian (2014) study the relationship between social preferences and lying behaviors.

[2] A third component is the *self-image concerns* of a lie, which relates to how blatant one's lie is. This component represents a challenge to maintain one's positive self-image. We do not manipulate the self-image concerns component in our experiment.

whether dishonesty is persistent. Ruffle and Wilson (2018) examine how participants respond to the different stakes concerning one visible characteristic, a tattoo. These studies find no significant effect of stake size on lying either.

The two aforementioned meta-studies confirm the null effect of the stake size. Considering 90 studies in which participants could misreport a randomly generated outcome, Abeler et al. (2019) find that stake size affects neither the average report nor the patterns of lying. For all stake sizes, outcomes at the lower end of the distribution are under-reported, and high outcomes are over-reported. Gerlach et al. (2019) compile data from 565 experiments, including lying about real-effort tasks and random outcomes and lying in sender-receiver games. They find that a higher maximum gain increases lying in studies using a coin toss to generate a random outcome, but this effect is not present when reducing the analysis to those studies which compare different stake sizes directly. For all other individual lying tasks, stake size does not affect reports. We should highlight that although stakes are varied in these studies, each treatment corresponds to a single stake level, not an interaction between two lying opportunities with different stakes.

The null empirical response to stake size can be due to two opposing directions of the effect. Stake size affects lying through two channels. First, a larger reward increases the marginal benefit of lying, which should lead to more lying. The literature finds lying to be a trade-off between the monetary benefits from a lie and the psychological costs of lying, including direct moral costs for breaking a moral norm and reputational costs for possibly being considered as a liar by others (Gneezy et al., 2018; Abeler et al., 2019; Dufwenberg, 2018). Thus, increasing the benefit of a lie while keeping all else equal will lead to more lying (Mazar et al., 2008; Hilbig and Thielmann, 2017). Second, psychological or reputational cost of lying increases with the marginal benefit of lying, which should lead to less lying. People are more likely to tell a lie if they can justify the lie (Shalvi et al., 2015), and lack of justification for lying increases the costs of lying for higher stakes (Mazar et al., 2008). Further, the reputational cost, incurred by the fear of being regarded as a liar, increases with the stake size of a lie (Kajackaite and Gneezy, 2017). These two opposing effects can explain the neutral effect of stake sizes on lying.

Further evidence by Hilbig and Thielmann (2017) suggests that the effect is confounded by the fact that stakes affect different types of liars differently. While people who are always lying (or always answering truthfully) are unaffected by stakes, people who tell partial lies can be divided into two groups. The "corruptible" group reacts to high stakes by lying more, while the other group is becoming more honest under high stakes because this group is only willing to tell small lies.

The size of a lie due to the outcome component has received less attention in the literature. Gerlach et al. (2019) consider dice roll and coin flip experiments separately in their meta-study. They argue that with a binary task, people have no option to lie partially. If they decide to lie, they have to do so to the full extent. Thus, in a task with more possible outcomes, people can tell smaller lies in the sense that they are closer to the true state. Gerlach et al. (2019) find that coin and dice tasks do not differ concerning the average level of lying but that more people lie in dice tasks than in coin tasks. The interpretation of this finding is that some people who tell small (partial) lies in dice tasks would not have lied in a coin task.

The closest studies to our paper are Chowdhury et al. (forthcoming), Geraldes et al. (2019) and Barron (2019). Chowdhury et al. (forthcoming) experimentally investigate high- and low-stakes lies, but in sequential order. Their focus is on isolated big and small lies for which the context might be very different. More specifically, they study the effect of a participant knowing (or not) about a follow-up second-round low-stakes lie in a first-round high-stakes lying opportunity. They show that people lie more in the first-round high-stakes opportunity than in the second-round low-stakes opportunity only when aware of the second round. In other words, high-stakes lying is increased if participants could plan ahead. Using two dice, Geraldes et al. (2019) investigate individual lying behavior in a two-dimensional context to test whether multi-dimensional decision-making affects lying behavior. Participants' decision-making in their experiment is also simultaneous, but the stake and outcome components of a lie are kept constant between dimensions. They find that participants over-report significantly more on the lower outcome dice than on the high outcome dice. Barron (2019) also asks participants to report two (one high-stakes and one low-stakes) dice. The author finds that compared to a uniform distribution, people over-report on the high-stakes dice but under-report on the low-stakes dice.

3 Experimental design

3.1 Treatments

We design laboratory experiments to observe how participants behave when two misreporting opportunities differ in size. In the *Big and Small Lie* treatment (BSL), participants are asked to toss a coin, roll a dice, and self-report the outcomes separately on the computer interface. This elicitation is repeated over ten rounds.

A participant's report, (C,D), where $C \in \{Head, Tail\}$ and $D \in \{1,2,\ldots,6\}$, determines the points a participant earns in the following way:

$$\begin{cases} 15+D & \text{if } C = Head \\ 7+D & \text{if } C = Tail \end{cases}$$

At the end of the experiment, one round was selected randomly for actual payment to properly incentivize them (Azrieli et al., 2018). The conversion rate into Euros was 1 point = 0.50 EUR. Since the marginal benefit of lying in the outcome of the coin toss is eight points larger than that of the dice roll, the coin toss is associated with a big lie. More specifically, although the small lie is scalable, the maximum benefit from the small lie is 5 (reporting 6 when the outcome of the dice is 1), which is strictly smaller than the marginal benefit of the big lie (reporting *Head* when the outcome of the coin is *Tail*). This treatment serves to capture the realm of real-life settings that involve big and small lies.

In the *Big Lie* treatment (BL), participants are asked only to toss a coin and self-report its outcome and receive a low-stakes prize based on the outcome of a dice roll, which is exogenously determined by the server computer. This elicitation is also repeated ten times. The *Small Lie* (SL) treatment is the reverse of BL. That is, the participants self-report the outcome of a dice roll, and receive a high-stakes prize based on the outcome of a coin toss, which is exogenously determined by the server computer. These two treatments serve to examine whether, and to what extent, an exogenous random event (relative to a self-reported random event) affects lying behavior on the other dimension. Table 1 summarizes the key differences in the three treatments.[3]

Table 1: Experimental Treatments

	Coin ($\Delta_C = 8$)	Dice ($\Delta_D = 1$)
BSL	self-report	self-report
BL	self-report	exogenous
SL	exogenous	self-report

Δ_I is a marginal benefit of misreporting the outcome of $I \in \{Coin, Dice\}$.

[3]The full experimental instructions for BSL are included in the Appendix. We also conducted BSLBL (BSL for ten rounds and BL for another ten rounds) and BSLSL (BSL for ten and SL for another ten) to examine within-subject changes. The results in these additional treatments are similar to the comparisons of BSL with BL and SL, respectively. Thus for the sake of relevance, we do not report that data (available upon request).

3.2 Hypotheses

The primary purpose of our experiments is to enhance the understanding of individual lying behavior by observing the interactions between big and small lies. Thus, we do not posit "desired" conjectures before running the experiments. Although we learn many findings in the literature, we do not aim to verify or falsify extrapolated conjectures from previous studies. We do not aim to build an ex-post (or reverse-engineered) theoretical model either. Hence, we list "null hypotheses" as benchmarks for interpreting our observations.

Hypothesis 1 (Complete lying)**.** *Every report, except for the exogenous outcomes, consists of Head and 6.*

If we assume self-interested rational individuals who maximize their monetary payoffs, then the theoretical predictions are trivial: Every participant reports *Head* and 6 for all ten rounds. If our data rejects this hypothesis, then our results would suggest that the participants have costs of lying (e.g., moral and/or psychological costs), as many previous studies have found (Abeler et al., 2019).

Hypothesis 2 (Complete honesty)**.** *The distribution of the reports is uniform, that is, the probability of observing Head is 1/2, and the probability of any dice outcome is 1/6.*

If the costs of lying are sufficiently large, it is possible that participants truthfully report the actual outcomes. Due to the law of large numbers, the empirical probability distribution of the repeated random draws with replacement will converge to the theoretical probability distribution. In addition, since we allow each participant to report their outcomes ten times, albeit noisy, we also test this hypothesis within a participant. If our data rejects this hypothesis, then our results would suggest that the participants' costs of lying (assuming they exist) are not sufficient to overcome the temptation to make monetary gains.

Hypothesis 3 (Lying costs are not proportional to the stake size)**.** *The size of lying in the coin reports is the same as the size of lying in the dice reports.*

If the participants' costs from lying are positively (negatively) associated with the size of the stakes, we could observe more (less) lying in the dice reports than the coin reports. Alternatively, if the costs of lying are unrelated with the size of stakes, we should then expect more lying in the coin since the monetary gain from lying in the coin is larger. Importantly, to access the size of lying we need to measure both the number of liars and the extent of lying because the latter element is different between a dice and a coin. Unlike the binary coin outcomes, the dice outcomes allow us to observe more deviations from the theoretical probability distribution.

Hypothesis 4 (No complementary lies)**.** *An individual's distribution of coin reports and that of dice reports are unrelated.*

This hypothesis relates to our main research question. If lies are complementary, then a participant who reports *Head* more frequently will report higher dice outcomes more often. On the other hand, if a participant finds the two lying opportunities supplementary, then a right-skewed distribution on one dimension will be associated with a left-skewed distribution on the other dimension.

Hypothesis 5 (No spillovers)**.** *Having two lying opportunities does not make an individual lie more or less, compared to having only one opportunity.*

This hypothesis concerns the comparison between BSL and BL and SL, respectively. If the empirical distributions from BSL are more skewed to the left (right) than those from BL and SL, then it suggests that more lying opportunities facilitate more (less) lying in each dimension.

Hypothesis 6 (No time-varying justification)**.** *The realizations of the exogenous outcomes do not affect the distribution of the outcome reports.*

Our final hypothesis addresses the effect of exogenous outcomes in BL and SL. If we find a negative correlation between exogenous outcomes and reports, our results would suggest that participants use the exogenous outcome to justify their lies. Lying after receiving a low exogenous outcome would be justified because of the bad luck, while lying after a high exogenous outcome would lack this justification.

3.3 Procedures

The experimental sessions were conducted in English at the Mannheim Laboratory for Experimental Economics (mLab) of the University of Mannheim. The participants were drawn from the mLab participant pool. Four sessions were conducted for each treatment, and a total of 152 participants participated in one of the 12 ($= 3 \times 4$) sessions. The number of participants per session varies from 8 to 17 due to no-shows, but the number of participants per treatment varies little (from 48 in SL to 55 in BSL). Python and its application Pygame were used to establish a server-client platform. After the participants were randomly assigned to separate computer cubicles, the experimenter read the general descriptions of the experiment out loud. Participants were asked to carefully read the instructions displayed on the monitor and to pass a comprehension quiz. Importantly, we do not track where participants are seated and emphasized to the participants that their decision would stay anonymous.

In all treatments, participants were subsequently asked to fill out a survey asking their basic demographic characteristics, risk preferences, and degree of familiarity with the experiment. The participants' risk preferences were measured by the dynamically optimized sequential experimentation (DOSE) method (Chapman et al., 2018; Imai and Camerer, 2018).

The average payment per participant was 8.31 EUR. The payments were made in private, and participants were asked not to share their payment information. Each session lasted less than 25 minutes.

4 Results

In each treatment, participants completed ten rounds of the same task, which means that we have ten observations per participant. We call each of these observations a single report. In some parts of the analysis, we consider the aggregated observation at the participant level, which aggregates the single observations across the ten rounds. Unless indicated otherwise, the following analysis considers single reports, or reports for short.

This section consists of four subsections. Sections 4.1 to 4.3, respectively, summarize findings from BSL, BL, and SL. Section 4.4 compares BSL with BL and SL.

4.1 Big and small lies

4.1.1 Over-reporting on coin and dice

Table 2 summarizes reports in BSL. In this treatment, reports show that *Head* was reported significantly more frequently than the 50% expected under truth-telling ($p<0.001$, binomial test (BT)).

Considering observations at the participant level, Figure 1 shows the distribution of coin reports over the ten rounds. Compared to a binomial distribution with ten draws and probability 0.5, reports are significantly shifted towards higher numbers of *Head* (two-sided Kolmogorov-Smirnov test (KS), $p<0.001$). This shift is particularly salient regarding the (too high) share of participants reporting ten rounds of *Head*.

The distribution of reports on the dice roll in BSL is significantly shifted from the value

Table 2: Overview of results in BSL

	Single reports Mean (SD)	N
Head	0.6727 (0.4696)	550
Head for dice≤ 4	0.6085 (0.4889)	281
Head for dice≥ 5	0.7398 (0.4396)	269
Dice	4.0800 (1.6849)	550
Dice for *Tail*	3.7500 (1.6507)	180
Dice for *Head*	4.2405 (1.6801)	370

Note: Under truth-telling, the expected average of *Head* is 0.5 and the expected average of Dice is 3.5.

expected under truth-telling of 3.5 ($p<0.001$, two-sided Wilcoxon signed-rank test (WT)). Figure 2 shows that reports are shifted towards higher outcomes, which results in a distribution significantly different from the uniform distribution expected from a fair dice ($p<0.001$, KS). More specifically, lying resulted in over-reporting of the outcomes 5 and 6 on the dice. Both of these outcomes were reported significantly more frequently than expected under truth-telling ($p=0.005$ and $p<0.001$, respectively, BT).

The analysis of reports on the coin and the dice leads us to reject Hypothesis 1 and 2 and to conclude the following.

Result 1. *Participants lie significantly but not fully on the dice and the coin.*

4.1.2 Comparing lying in the coin and the dice

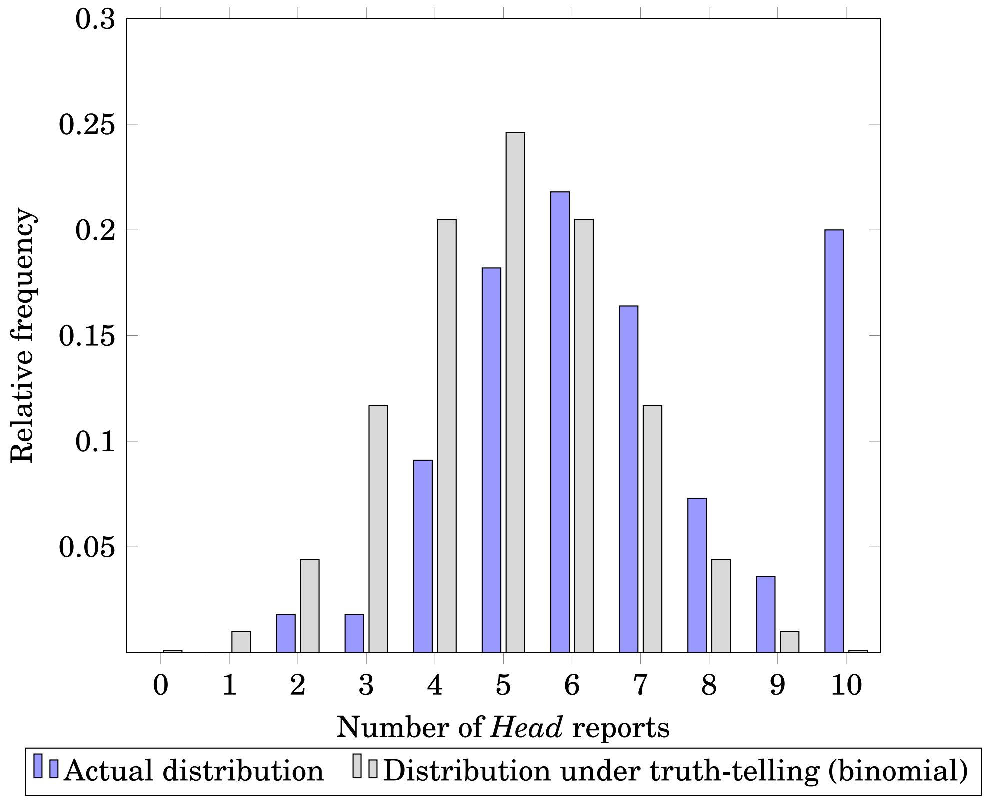
From Figure 2, we can estimate that the percentage of truthful reports regarding the die roll is 57.6%.[4] Regarding the coin, from Table 2, we can estimate that the percentage of truth-tellers is 65.4%.[5] These two estimates indicate that there were slightly more truth-tellers regarding the coin toss. However, that does not necessarily mean that the level of lying—which besides the *number* of lies, takes into account the *size* of the lies—is lower in the coin toss.

The report on the coin is binary, while the report on the dice can take six different outcomes. Importantly, the latter report also has a lower marginal contribution to the overall

[4] Assuming that participants do not report a lower number than observed, the percentage of reports of 1 is an adequate estimate of true reports for each reported number (i.e., 9.6%$\times$6).

[5] Assuming that participants who report *Tail* are not lying, the percentage of *Tail* reports is an adequate estimate of true reports for each reported outcome (i.e., 32.7%$\times$2).

Figure 1: Distribution of the number of *Head* reported in BSL

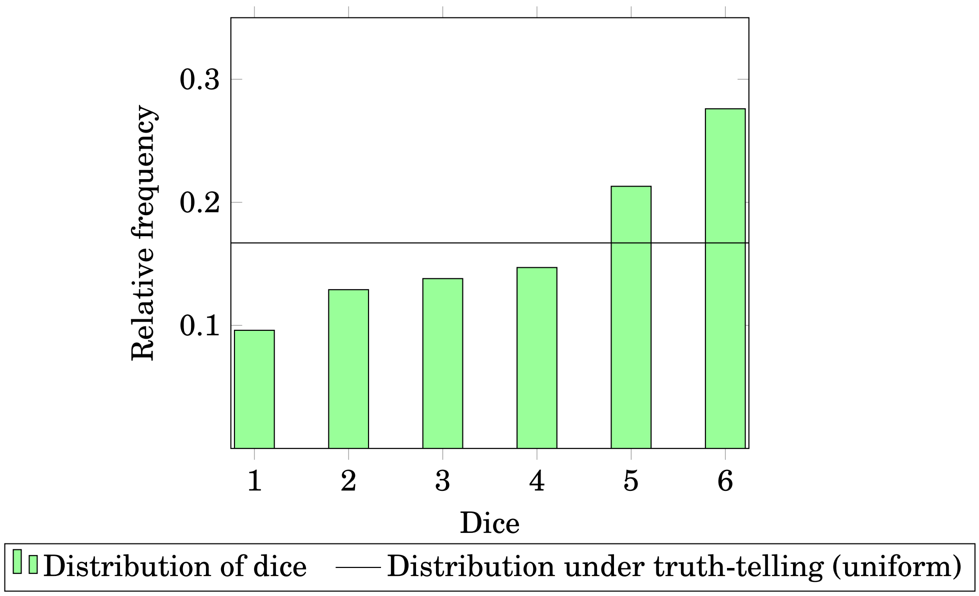


payoff. To compare lying behavior between the two dimensions, we standardize the reports (Abeler et al., 2019). Specifically, the reports are standardized so that the lowest possible report takes the value -1, and the highest possible report takes the value 1. For a dice roll with linear payments the reports $[1,2,3,4,5,6]$ become $[-1,-0.6,-0.2,0.2,0.6,1]$. For a coin toss with *Head* paying the higher amount, *Head* will be evaluated at 1 and *Tail* at -1. The average standardized report is 0.3455 (sd 0.9393) for the coin and 0.232 (sd 0.6739) for the dice. The standardized single reports on the coin are significantly higher than on the dice, which indicates a higher level of lying in the coin (p=0.001, WT).

As a robustness check, we further use the Bayesian method proposed by Hugh-Jones (2019)[6] to compare lying in the coin and the dice. Since this method is designed for a binary event, we consider a report of 5 or 6 on the dice as the high outcome because Figure 2 shows that lying led to over-reporting of these two outcomes. Figure 3 shows that the method by Hugh-Jones (2019) corroborates that there is more lying in the coin than on the dice in

[6]The measure uses the total number of reports, the number of reports that indicate the high outcome, and the probability of receiving the low payoff outcome under truth-telling to update an initial prior and to calculate a point estimate of the share of misreported answers as well as corresponding confidence intervals.

Figure 2: Distribution of single dice reports in BSL



BSL.[7] In other words, we reject hypothesis 3.

Result 2. *Participants lie to a greater extent on the coin than on the dice.*

4.1.3 Lying conditional on the second dimension

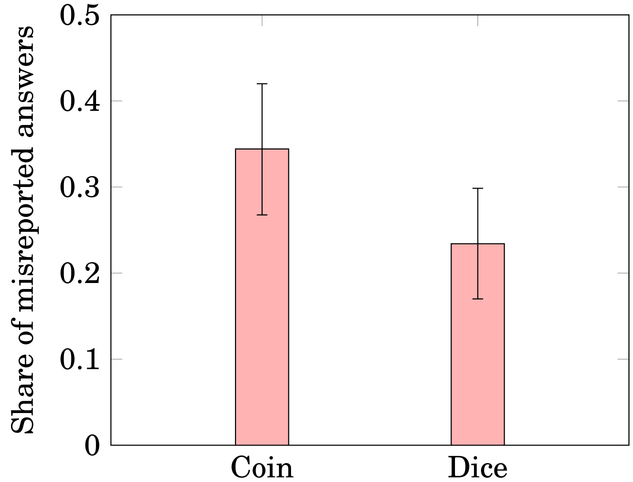
To understand how reporting on one dimension is related to that on the other dimension, we analyze the connection of a coin report to the dice report that was submitted on the same screen (i.e., in the same round) and vice versa. Reports conditional on the other dimension are included in the overview in Table 2.

Since lying in the dice resulted in over-reporting of 5 and 6, we analyze whether *Head* was reported significantly more often when the dice report was 5 or 6. Table 2 indicates that higher shares of *Head* were reported for higher reports on the dice. The difference is significant (p=0.001, Fisher's exact test (FE)), which shows that participants reporting behavior (either lying or truth-telling) is consistent between the coin and the dice dimensions.

We find the same connection between reports when analyzing the reports on the dice conditional on the report of the coin. When *Head* was reported, the average report on the

[7] Alternatively, we can consider the confidence intervals resulting from the method by Garbarino et al. (2018). This method provides narrower confidence intervals than the method of Hugh-Jones (2019), which is more conservative in the estimation of confidence intervals and is more reliable for small sample sizes. This alternative method estimates a 95% confidence interval of 0.287–0.397 for the coin and of 0.191–0.280 for the dice.

Figure 3: Estimates of lying and 95% confidence intervals based on Hugh-Jones (2019)

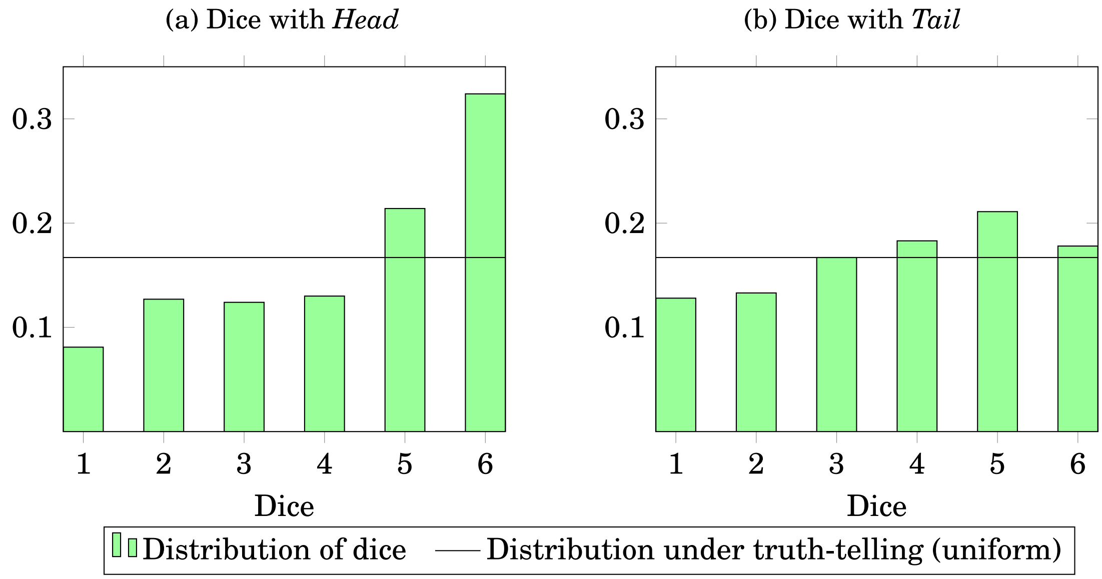


dice was higher than when *Tail* was reported. The difference is significant (p=0.001, two-sided Mann-Whitney U test (MW)), which further shows that participants are consistent on their reports, i.e., high reports on the coin correspond to high reports also on the dice. Figure 4, which shows the distributions of dice reports for *Tail* and *Head*, corroborates the latter finding. Conditional on reporting *Head*, we see significant over-reporting of the outcomes 5 and 6 (p=0.018 and p<0.001, respectively, BT). Conditional on reporting *Tail*, we observe that reporting of 5 and 6 is more than 17%, respectively, but these inclinations are not significant (p=0.110 and p=0.689, respectively, BT). Moreover, the two distributions shown in Figure 4 are significantly different (p=0.009, KS). Notably, we cannot reject that the distribution of the dice reports conditional on reporting *Tail* is different from the expected distribution under truth-telling (p=0.304, KS).

To account for the fact that reports are clustered at the participant level, we conduct a regression analysis with the dice report as the dependent variable and the coin as an independent variable.[8] In Model 1a in Table 3, we report a regression analysis with standard errors clustered at the participant level. The regression results of Model 1a support the positive correlation of coin and dice described above. However, when we include participant fixed effects (Models 1b and 1c), there is no significant correlation between the reports. The change caused by introducing fixed effects indicates that the correlation between single reports is driven by some participants always reporting high outcomes on both dimensions, while others always report lower outcomes on both dimensions. In other words, the dif-

[8]Since participants report two outcomes simultaneously, this analysis does not capture any causal relationships. It only captures the correlation between the two reports.

Figure 4: Distribution of dice single reports for each coin outcome in BSL



ferences in the report level are due to between-participant differences rather than within-participant differences, which further supports our finding that lies on the two outcomes are complementary.

As a robustness check, we conduct a regression analysis at the participant level. The dependent variable in the new specification represents the average dice report across the ten rounds per participant, and the independent variable represents the sum of *Head* reports across the ten rounds per participant. Models 2a and 2b in Table 3 show that participants who made many *Head* reports also made higher reports on the dice. Individual characteristics have no effect on reporting.[9]

This analysis rejects hypothesis 4. We summarize in our third result.

Result 3. *Lies on a high-stakes and low-stakes outcome are complementary.*

4.2 Big lie under an exogenous low-stakes prize

Table 4 gives an overview of the results in BL, where participants reported the outcome of a coin toss while the outcome of a dice was exogenously randomly determined. In this treatment, we also find significant over-reporting on the coin ($p<0.001$, BT). In Figure 5, we look at the distribution of participant's coin reports in the ten rounds of BL. The distribution

[9]This result also holds when excluding the sum of *Head*, which might already contain the effect of individual characteristics, from the model.

Table 3: Linear regression analysis of dice reports in BSL

Dep. variable:	Single dice report			Average dice report	
	Model 1a[a]	Model 1b[b]	Model 1c[b]	Model 2a[b]	Model 2b[b]
Head	0.491*	−0.118	−0.136		
	(0.190)	(0.157)	0.159)		
sum_*Head*				0.289***	0.287***
				(0.0367)	(0.0387)
constant	3.750***	4.159***	4.344***	2.135***	2.475***
	(0.127)	(0.125)	(0.233)	(0.259)	(0.407)
Participant FE	No	Yes	Yes	–	–
Round FE	No	No	Yes	–	–
Controls	–	–	–	No	Yes
N	550	550	550	55	55
adj. R^2	0.017	−0.110	−0.111	0.531	0.536

[a] Standard errors clustered at the participant level in parentheses.

[b] Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

is significantly different from a binomial distribution with ten draws and probability 0.5 (p<0.001, KS). The difference is driven by an increase in the frequency of 7,8,9, and, in particular, of 10 rounds of *Head*.

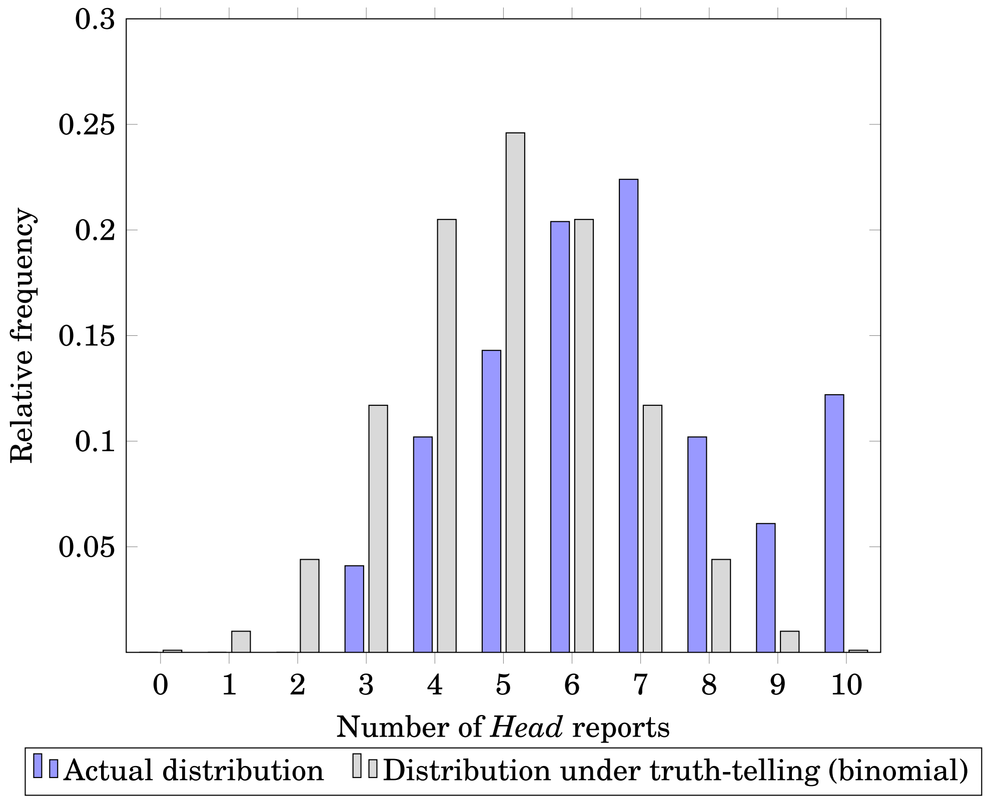
Regarding the effect of receiving an exogenously drawn low-stakes prize, we observe that there is less lying in the coin for participants who observed a high outcome on the dice, but the difference is not significant (p=0.259, FE). The linear regression analysis of single coin reports shown in Table 5 provides further support that coin reports in BL are not affected

Table 4: Overview of results in BL

	Single reports Mean (SD)	N
Head	0.6633 (0.4731)	490
Head for dice≤ 4	0.6752 (0.4691)	314
Head for dice≥ 5	0.6420 (0.4808)	176

Note: Under truth-telling, the expected average of *Head* is 0.5.

Figure 5: Distribution of the number of *Head* reported in BL



by the dice outcome that determines the exogenous low-stakes prize.[10] The coefficient for the dice is negative but insignificant, and this result is robust when including participant- and round-fixed effects.

Finally, we also conduct a regression analysis for BL at the participant level. Specifically, we use a linear regression model in which the dependent variable is the sum of *Head* that a participant reported over all the ten rounds, and the independent variable is the average dice report across the ten rounds per participant. Models 2a and 2b in Table 5 indicate that neither the average observed dice outcome nor individual characteristics affect the number of rounds in which *Head* was reported.

4.3 Small lie under an exogenous high-stakes prize

Table 6 summarizes reports in SL. Recall that participants in this treatment only reported the outcome of a dice while the outcome of the coin was exogenously randomly determined.

[10]The results are qualitatively the same when using the logistic regression instead of the linear probability model.

Table 5: Linear regression analysis of coin reports in BL

Dep. variable:	=1 if *Head* reported			Sum of *Head*	
	Model 1a[a]	Model 1b[b]	Model 1c[b]	Model 2a[b]	Model 2b[b]
dice	−0.0149	−0.0180	−0.0198		
	(0.0140)	(0.0123)	(0.0124)		
avg_dice				0.153	0.0755
				(0.521)	(0.551)
constant	0.716***	0.727***	0.761***	6.091**	7.506**
	(0.0544)	(0.0481)	(0.0775)	(1.861)	(2.400)
Participant FE	No	Yes	Yes	–	–
Round FE	No	No	Yes	–	–
Controls	–	–	–	No	Yes
N	490	430	430	49	49
adj R^2	0.001	−0.106	−0.102	−0.019	−0.079

[a] Standard errors clustered at the participant level in parentheses.

[b] Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Reports on the dice are significantly shifted from the expected value under truth-telling of 3.5 (p<0.001, WT). As shown in Figure 6, reports are shifted away from smaller outcomes towards the outcomes of 5 and 6, which are both reported significantly more frequently than expected (p=0.005 and p<0.001, respectively, BT).

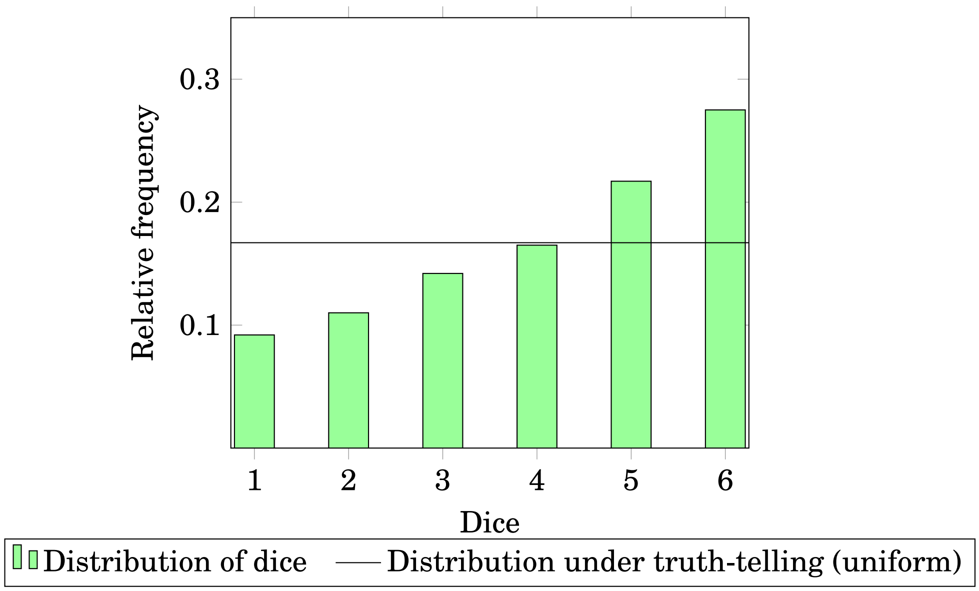
Regarding the effect of receiving an exogenously drawn high-stakes prize, we observe that there is less lying in the dice for participants who observed *Head* on the coin, but the difference is not significant (p=0.711, MW). A graphical analysis supports the latter finding. Figure 7 shows the distribution of dice reports for each outcome of the coin. We observe that

Table 6: Overview of results in SL

	Single reports Mean (SD)	N
Dice	4.1292 (1.6474)	480
Dice for *Tail*	4.1745 (1.5850)	235
Dice for *Head*	4.0857 (1.7073)	245

Note: Under truth-telling, the expected average of Dice is 3.5.

Figure 6: Distribution of single dice reports in SL



both distributions have a clear shift towards high outcomes and, most importantly, the two distributions are not significantly different (p=0.963, KS), which indicates that observing an exogenous outcome for the coin in a specific round does not affect reporting on the dice in the same round. The regression analysis in Table 7 corroborates that dice reports in SL are not affected by the participants' observation of the coin outcome. The coefficient for the *Head* is not significant, and this result is robust when including participant and round fixed effects.

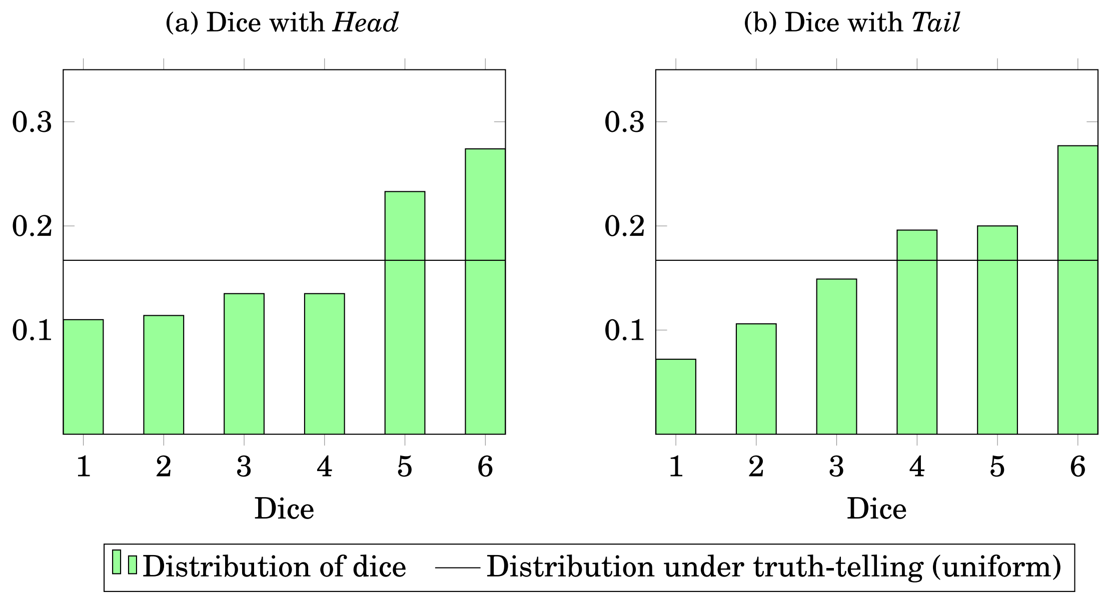
In Models 2a and 2b of Table 7, we report the results of a linear regression analysis at the participant level where the independent variable is the average dice report a participant made over ten rounds. Notably, these models' results show that the number of rounds of *Head* is negatively correlated with the average dice report. In other words, this analysis unveils that participants who observed more rounds of *Head* (i.e., had more luck) report on average lower outcomes for the dice.Individual characteristics have no significant effect on reporting.

4.4 Comparison of treatments

4.4.1 BSL vs. BL: Comparison of self-reports on the coin

First, we test whether receiving a low-stakes prize had a significant effect on reports on the coin outcome, i.e., whether the overall level of reporting on the coin is different between BSL

Figure 7: Distribution of single dice reports for each coin outcome in SL



and BL. We find that the share of *Head* does not differ significantly between BSL and BL (p=0.792, FE). Thus, the overall level of lying in the coin is similar, regardless of whether the outcome of the dice is reported by the participant or exogenously determined.

Second, we assess how the coin reports depend on the dice outcome, which is either self-reported or exogenously determined. While in BSL *Head* is reported more frequently together with high reports on the dice, the pattern is reversed in BL, i.e., *Head* is reported less frequently when participants observe a high dice outcome. The difference in patterns for coin reports conditional on reporting (BSL) or observing (BL) high outcomes on the dice is significant (p=0.018, FE). The same holds for coin reports, conditional either on reporting (BSL) or observing (BL) low outcomes on the dice (p=0.054, FE).

In Section 4.1, we have shown a positive correlation between the number of *Head* a participant reports and the average dice report, whereas in Section 4.2 we have shown no significant effect of the observed average die roll on the amount of *Head* reports. Figure 8 corroborates this difference between treatments graphically. Regarding BSL, we observe a positive correlation between the two reports. In BL, however, we observe evidence for no correlation between the observed dice and the reported coin.[11]

[11]Table A.1 in the Appendix provides a quantitative analysis of the difference in correlations between BSL and BL.

Table 7: Linear regression analysis of dice reports in SL

Dep. variable:	Single dice report			Average dice report	
	Model 1a[a]	Model 1b[b]	Model 1c[b]	Model 2a[b]	Model 2b[b]
Head	−0.0888	0.111	0.117		
	(0.128)	(0.138)	(0.138)		
sum_*Head*				-0.248^{***}	-0.317^{***}
				(0.0889)	(0.0943)
constant	4.174^{***}	4.072^{***}	4.151^{***}	5.396^{***}	5.010^{***}
	(0.143)	(0.0966)	(0.226)	(0.470)	(0.655)
Participant FE	No	Yes	Yes	–	–
Round FE	No	No	Yes	–	–
Controls	–	–	–	No	Yes
N	480	480	480	48	48
adj. R^2	−0.001	−0.110	−0.077	0.126	0.111

[a] Standard errors clustered at the participant level in parentheses.

[b] Standard errors in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

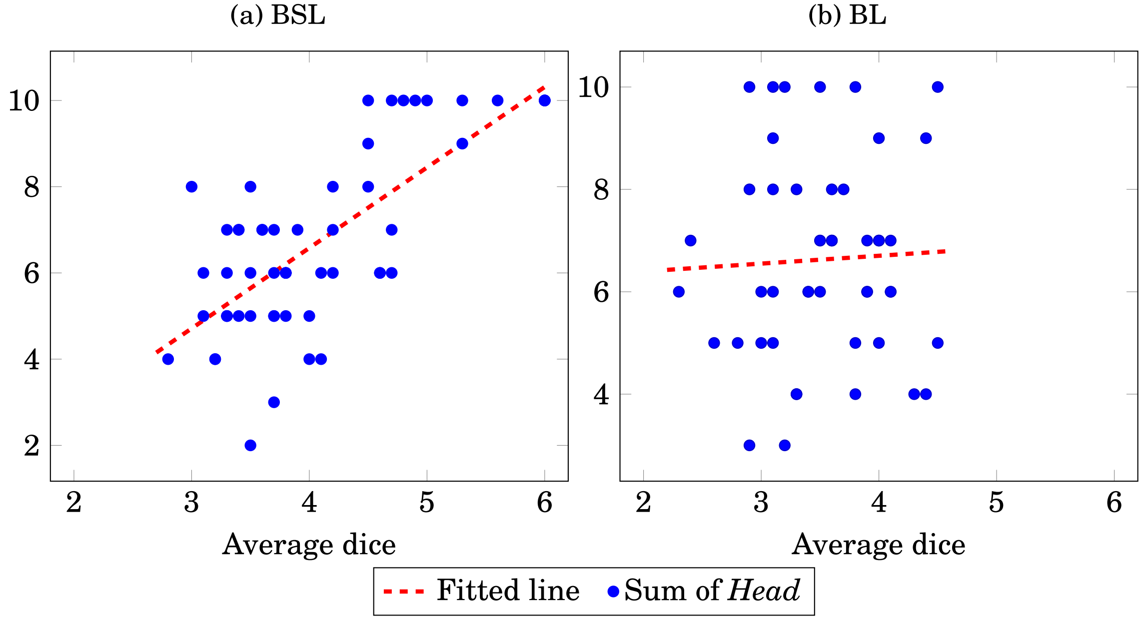
4.4.2 BSL vs. SL: Comparison of self-reports on the dice

First, we test whether receiving a high-stakes prize had a significant effect on reports on the dice outcome, i.e., whether the overall level of reporting on the dice is different between BSL and SL. We find that lying in the dice is not significantly different between BSL and SL (p=0.999, KS; p=0.708, MW). Thus, whether there was a possibility to lie on the coin, or not, did not significantly affect the dice report.

For participants who self-report (BSL) or observe (SL) *Head*, the reports on the dice do not differ significantly (p=0.840, KS; p=0.235, MW). After reporting or observing *Tail*, the distribution of reports in SL is shifted more towards high outcomes than reports in BSL (p=0.009, MW), but this shift is not significant (p=0.259, KS).

From Sections 4.1 and 4.3, respectively, we know that the effect of the total number of *Head* reported, or observed, over the ten rounds on the average dice report is different in the two treatments. In BSL, participants who reported a higher number of *Head* made higher dice reports. In SL, participants who observed a higher number of *Head* drawn by the computer made on average lower reports on the dice. Figure 9 shows the difference between treatments graphically. We see a positive correlation between participant reports

Figure 8: Relation of sum of *Head* and average dice in BSL and BL



on the coin and the dice in BSL, whereas the correlation between the observed coin and dice reports is negative in SL.[12]

The comparison of treatments leads us to not reject Hypothesis 5.

Result 4. *Having two lying opportunities does not make participants lie more or less, compared to having one opportunity.*

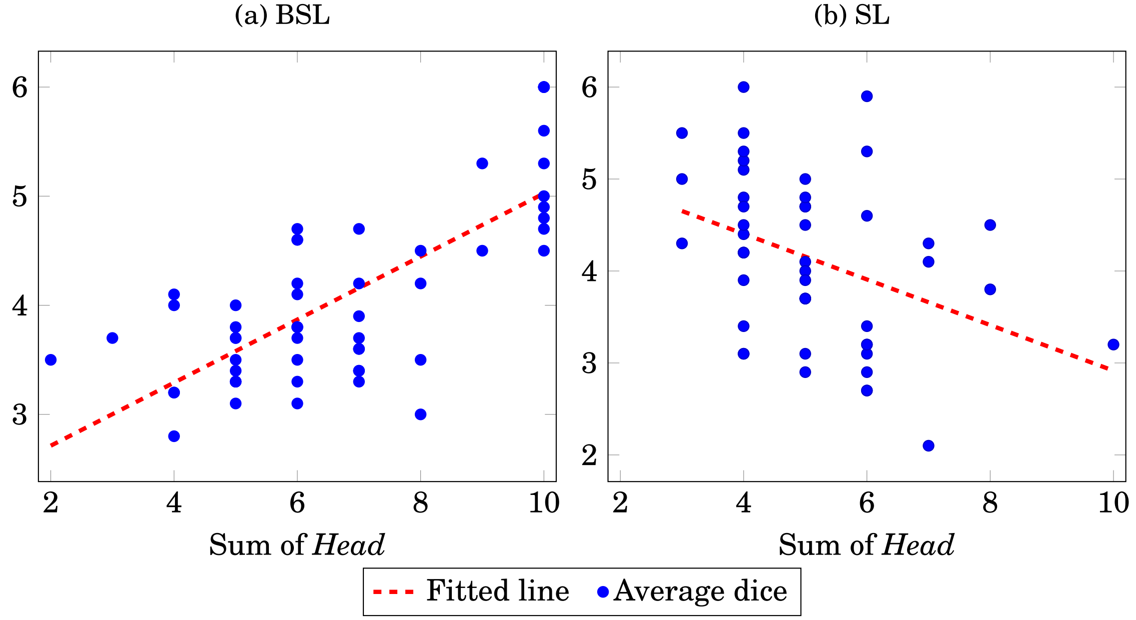
Regarding hypothesis 6, we cannot reject it for reports on the coin. Notably, however, we reject hypothesis 6 for aggregate dice reports.

Result 5. *The realizations of the exogenous outcomes do not affect the distribution of the high-stakes outcome reports (i.e., reports on the coin). However, being repeatedly lucky on the coin—i.e., observing Head several times—significantly decreases the reports on the dice.*

The latter result essentially indicates that being unlucky on a high-stakes prize leads to justifying more lying in the report of a lower-stakes outcome.

[12]Table A.2 in the Appendix provides a quantitative analysis of the difference in correlations between BSL and SL.

Figure 9: Relation of average dice and sum of *Head* in BSL and SL



5 Conclusion

Our study of jointly-reported high- and low-stakes lies shows that lies are complementary: people who are more willing to tell a big lie are also more willing to tell a small lie. Further, we find that people lie more about a high-stakes outcome than a low-stakes outcome. We also find that offering more than one lying option does neither facilitate nor suppress lying behavior. In light of this evidence, we conclude that people behave consistently across different lying options.

Our experiment also allows us to analyze the effect of observing an exogenous, payoff-relevant outcome on lying behavior. Observing an exogenous outcome does not immediately affect the same-round lying behavior. However, when taking the dynamics across rounds into account, we find that being repetitively lucky in high-stakes outcomes decreases lying on a small-stakes report. In contrast, when the exogenous income involves small stakes, observing multiple lucky high-stakes outcomes in the previous rounds does not affect lying behavior on a high-stakes report.

References

Abeler, Johannes, Anke Becker, and Armin Falk, "Representative evidence on lying costs," *Journal of Public Economics*, 2014, *113*, 96–104.

_ , **Daniele Nosenzo, and Collin Raymond**, "Preferences for truth-telling," *Econometrica*, 2019, *87* (4), 1115–1153.

Arbel, Yuval, Ronen Bar-El, Erez Siniver, and Yossef Tobol, "Roll a die and tell a lie—What affects honesty?," *Journal of Economic Behavior & Organization*, 2014, *107*, 153–172.

Azrieli, Yaron, Christopher Chambers, and Paul J. Healy, "Incentives in Experiments: A Theoretical Analysis," *Journal of Political Economy*, 2018, *126* (4), 1472–1503.

Barron, Kai, "Lying to appear honest," WZB Discussion Paper SP II 2019–307 2019.

Belot, Michèle and Jeroen van de Ven, "Is dishonesty persistent?," *Journal of Behavioral and Experimental Economics*, 2019, *83*, 101464.

Chapman, Jonathan, Erik Snowberg, Stephanie Wang, and Colin Camerer, "Loss Attitudes in the U.S. Population: Evidence from Dynamically Optimized Sequential Experimentation (DOSE)," 2018. CESifo Working Paper, No. 7262, Center for Economic Studies and Ifo Institute (CESifo), Munich.

Charness, Gary, Celia Blanco-Jimenez, Lara Ezquerra, and Ismael Rodriguez-Lara, "Cheating, incentives, and money manipulation," *Experimental Economics*, 2019, *22*, 155–177.

Chowdhury, Subhasish M., Chulyoung Kim, and Sang-Hyun Kim, "Pre-planning and its effects on repeated dishonest behavior: An experiment," *Bulletin of Economic Research*, forthcoming, *n/a* (n/a).

Cohn, Alain and Michel André Maréchal, "Laboratory Measure of Cheating Predicts School Misconduct," *The Economic Journal*, 2018, *128* (615), 2743–2754.

Cojoc, Doru and Adrian Stoian, "Dishonesty and charitable behavior," *Experimental Economics*, 2014, *17*, 717–732.

Dai, Zhixin, Fabio Galeotti, and Marie Claire Villeval, "Cheating in the Lab Predicts Fraud in the Field: An Experiment in Public Transportation," *Management Science*, 2018, *64* (3), 1081–1100.

Dufwenberg, Martin, "Lies in Disguise - A Theoretical Analysis of Cheating," *Journal of Economic Theory*, December 2018, *175*, 248–264.

Fischbacher, Urs and Franziska Föllmi-Heusi, "Lies in Disguise—an Experimental Study on Cheating," *Journal of the European Economic Association*, June 2013, *11* (3), 525–547.

Garbarino, Ellen, Robert Slonim, and Marie Claire Villeval, "Loss Aversion and lying behavior: Theory, estimation and empirical evidence," *Journal of the Economic Science Association*, 2018, *4*, 136–150.

Geraldes, Diogo, Franziska Heinicke, and Stephanie Rosenkranz, "Lying in two dimensions and moral spillovers," Working Paper 2019.

Gerlach, Philipp, Kinneret Teodorescu, and Ralph Hertwig, "The truth about lies: A meta-analysis on dishonest behavior.," *Psychological bulletin*, 2019, *145* (1), 1.

Gneezy, Uri, Agne Kajackaite, and Joel Sobel, "Lying Aversion and the Size of the Lie," *American Economic Review*, 2018, *108* (2), 419–53.

Hilbig, Benjamin E and Isabel Thielmann, "Does everyone have a price? On the role of payoff magnitude for ethical decision making," *Cognition*, 2017, *163*, 15–25.

Houser, Daniel, Stefan Vetter, and Joachim Winter, "Fairness and cheating," *European Economic Review*, 2012, *56* (8), 1645–1655.

Hugh-Jones, David, "True Lies: Comment on Garbarino, Slonim and Villeval (2018)," *Journal of the Economic Science Association*, 2019.

Hurkens, Sjaak and Navin Kartik, "Would I lie to you? On social preferences and lying aversion," *Experimental Economics*, 2009, *12*, 180–192.

Imai, Taisuke and Colin Camerer, "Estimating Time Preferences from Budget Set Choices Using Optimal Adaptive Design," Working Paper 2018.

Kajackaite, Agne and Uri Gneezy, "Incentives and cheating," *Games and Economic Behavior*, 2017, *102*, 433–444.

Lewicki, Roy J., "Lying and Deception: A Behavioral Model," in M. H. Bazerman and R. J. Lewicki, eds., *Negotiation in Organizations*, Sage Publications 1983, pp. 68–90.

Mazar, Nina, On Amir, and Dan Ariely, "The Dishonesty of Honest People: A Theory of Self-Concept Maintenance," *Journal of Marketing Research*, December 2008, *45* (6), 633–644.

Potters, Jan and Jan Stoop, "Do cheaters in the lab also cheat in the field?," *European Economic Review*, 2016, *87*, 26–33.

Ruffle, Bradley J. and Anne E. Wilson, "The truth about tattoos," *Economics Letters*, 2018, *172*, 143–147.

Shalvi, Shaul, Francesca Gino, Rachel Barkan, and Shahar Ayal, "Self-Serving Justifications: Doing Wrong and Feeling Moral," *Current Directions in Psychological Science*, April 2015, *24* (2), 125–130.

A Appendix - Additional results

Table A.1: Linear regression analysis of coin reports at the participant level in BSL and BL

Dep. variable: Sum of *Head*, by participant	Model 1	Model 2
avg_dice	1.404^{***}	1.867^{***}
	(0.248)	(0.277)
BL	0.677	6.980^{***}
	(0.376)	(1.997)
avg_dice*BL		-1.713^{**}
		(0.534)
constant	0.998	-0.889
	(1.039)	(1.155)
N	104	104
adj. R^2	0.058	0.292

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: In this regression, the dice variable is endogenous in BSL but exogenous in BL. The models show no causal relationships. The large significant coefficient for BL has to be interpreted jointly with the interaction term. For an average dice of 3.5, participant reports on the coin in BL were, on average, $6.98 + 3.5 * (-1.713) = 0.9845$ points higher than in BSL.

Table A.2: Linear regression analysis of dice reports at the participant level in BSL and SL

Dep. variable: Average dice report, by participant	Model 1	Model 2
sum_*Head*	0.142^{**}	0.289^{***}
	(0.0500)	(0.0399)
SL	0.279	3.260^{***}
	(0.181)	(0.481)
sum_*Head**SL		-0.537^{***}
		(0.0885)
constant	3.126^{***}	2.135^{***}
	(0.313)	(0.263)
N	103	103
adj. R^2	0.070	0.319

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In this regression, the coin variable is endogenous in BSL but exogenous in SL. The models show no causal relationships. The coefficient of SL has to be interpreted together with the interaction term. For five rounds of *Head*, the average dice in SL is $3.26 + 5 * (-0.537) = 0.575$ points higher than in BSL.

B Appendix - Experimental Instructions (BSL)

Welcome to this experiment. Please read these instructions carefully.

Overview: The experiment consists of 10 rounds. In each round, your task is to toss a coin, roll a dice, and report the outcomes. Your cash payment will be based on your reports. The details follow.

Your task: You can find one coin and one dice in front of you on the table. Please inspect them to verify that they are fair. In each round, toss a coin and roll a dice. Report the outcomes on the computer. You repeat this procedure for 10 rounds. In each round, your points will be determined as follows:

- 15+[outcome of the dice] if the coin lands Head
- 7+[outcome of the dice] if the coin lands Tail

For example, if you report (Head, 4), your points will be 19 (=15+4). If you report (Tail, 6), your points will be 13 (=7+6).

Payment: The server computer will randomly select one round, and your points in that round will be paid. This means that each round has an equal chance to be selected for the final cash payment. Thus, it is in your best interest to take each round equally seriously. Your points will be converted into Euros at the exchange rate of 2 points = 1 euro.

Anonymity: Your choices and answers will be linked with a computer number of your seat. We will never link your identity with your responses in any way. Your personal information provided for your payments will never be stored nor used for any research. In addition, since we do not track where you seat, we cannot match you with your reports, although we match the reports with the computer number.

Quiz: To ensure your understanding of the instructions, we will provide you with a quiz. If you have one or more wrong answers, you have to re-take the quiz. This quiz is only intended to check your understanding of the instructions. It will not affect your earnings.
Q1. If the coin lands head, and the outcome of the dice is 4, how many points do you receive?
Q2. If the coin lands tail, and the outcome of the dice is 1, how many points do you receive?
Q3. If the coin lands head, and the outcome of the dice is 6, how many points do you receive?
Q4. If the coin lands tail, and the outcome of the dice is 5, how many points do you receive?