9-2013

Cheating in Mind Games: The Subtlety of Rules Matters

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Recommended Citation
Jiang, T. (2013). Cheating in Mind Games: The Subtlety of Rules Matters. *Journal of Economic Behavior & Organization, 93* 328-336. http://dx.doi.org/10.1016/j.jebo.2013.04.003

JEL classification: C91, D63, H26, K42

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Abstract
This paper employs two variants of the "mind game" to show how a subtle variation in the game's rules affects cheating. In both variants of the game, cheating is invisible because subjects make their choices purely in their minds. The only difference stems from the ordering of steps that subjects are instructed to follow when playing the game. The order of play has a significant impact on cheating behavior, even though the rules cannot be enforced.

Keywords
cheating, mind game, rule design, moral image, decision time

Disciplines
Experimental Analysis of Behavior

Comments
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Cheating in Mind Games: The Subtlety of Rules Matters

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Abstract

This paper exploits two variants of the "mind game" to show how a subtle variation in the rules of the game affects cheating. In both variants of the game, cheating is invisible because subjects make their choices purely in their minds. The only difference rests on the order of the steps in which subjects should play the game. I find that the order of play has a significant impact on cheating behavior, even though the rules are not enforceable.

Keywords: cheating, the mind game, rules of the game, order of play
JEL codes: C91, D63, H26, K42

1. Introduction

Society needs rules, and these rules need to be enforced since there is often an incentive to break rules for monetary gains. The enforcement of rules, however, does not always require costly punishment mechanisms. Though motivated by economic incentives to cheat, people often refrain from cheating out of social and moral considerations. Sometimes all it takes is a little tinkering with the rules of the game to curb cheating. By exploiting two variants of a simple cheating game, which I call the "mind game", I show in this paper how cheating behavior is significantly affected by the mere order of play.

The mind game adds a choice made purely in the mind to the die-rolling task devised by Heusi and Fischbacher (2008). Instead of getting paid by the die outcome that turns up, subjects choose in advance which side of the die counts for their earnings: the side facing up or the side facing down. Since subjects self-report their choice after they see the die outcome, they can cheat by lying about the side chosen to get a higher earning. Thus, the three essential steps are: "choose a side", "throw a die online" and "write the chosen side on paper".

The experimental manipulation rests on the prescribed order of the last two steps. In the "Throw-first" treatment, subjects are supposed to first throw the die and then write the chosen side, "U" or "D". In "Write-first", subjects are supposed to write the chosen side prior to throwing the die, which would prevent them from cheating if the order of the steps is followed. Because the order of the steps are only prescribed and not enforced, subjects can still cheat in "Write-first", but with greater effort or psychological barrier. In order to cheat, they have to either overwrite the side they wrote down, which can leave a trace of cheating, or disregard the prescribed order of play and play the game like those in "Throw-first" are asked to.

Cheating in both variants refers to lying about the side chosen that results in a higher payoff than that of the honest side. I use the term "cheating" to distinguish it from pure lying since subjects can also lie for earning less. Thus, the type of cheating studied here is similar to what Erat and Gneezy (2012) classify as "selfish black lies", except that here cheating is in expense of the experimenter instead of other experimental subjects.

The mind games used in this paper add to the recent experimental paradigms that utilize the known distributions of die or coin tosses to infer cheating (See e.g., Bucciol and Piovesan, 2011; Hao and Houser, 2010; Heusi and Fischbacher, 2008; Greene and Paxton, 2009). In particular, the Throw-first variant resembles the coin-flip task by Greene and Paxton (2009).

Subjects need not fear the exposure of their lying even under camera surveillance since the choice is made purely in the mind.[1] Nevertheless, using a six-sided die instead of a coin has the advantage that the cheating gain varies with die outcomes. Since the gain equals the difference between the points of the opposite sides, which always add up to 7, it ranges from five points of difference with die outcomes “6” and “1” (high), three points with “5” and “2” (medium), to one point with “4” and “3” (low).

The results show that while no one cheats 100% in both variants, subjects in Write-first cheat significantly less. Moreover, subjects in Write-first only cheat for low gains whereas those in Throw-first cheat the most for medium gain. There are mainly two potential explanations for the distinct cheating patterns. First, subjects may dislike rule-breaking *per se*, and they cheat less in Write-first because cheating implies not only lying, as in Throw-first, but also breaking the rule of following the prescribed order of play. This explanation however cannot easily explain the result that subjects in Write-first only cheat for low gains and forego the opportunities to cheat in the face of other gains after the rule of the prescribed order is already broken. Second, recent theories and findings suggest that people care about keeping a moral image (See, e.g., Heusi and Fischbacher, 2008; Benabou and Tirole, 2002), and they only cheat to the extent that their moral image is maintained (Ariely, 2012; Mazar, Amir and Ariely, 2008). For moral judgement, intentions matter (Charness & Dufwenberg, 2006; Falk, Fehr & Fischbacher, 2008). In Write-first, it is harder to keep a moral image because one’s bad intent to cheat is harder to deny or ignore given the deliberate act of postponing writing in order to cheat. In Throw-first, cheating is less deliberate as it only requires an internal twist of the mind. One can more easily get away with excuses that the cheating outcomes are due to errors or “luck”. Process can matter more than the mere outcome as it helps to discern the actor’s good or bad moral disposition.

2. Experimental Design

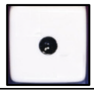
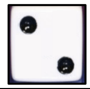
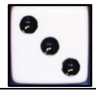
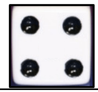
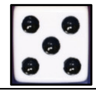
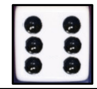
2.1 The Mind Game

The mind game consists of three steps: “choose a side”, “throw a die online” and “write the chosen side on paper”. Subjects choose purely in mind which side of the die counts for their

[1] See also Shalvi, Handgraaf & De Dreu (2011) who try to eliminate the fear of detection by lettings subjects roll the die under a cup instead of in the open.

final earnings, the side facing up (U) or the side facing down (D), and get paid based on the actual die outcomes and their corresponding self-reported choices of sides (see Table 1).

Table 1: Earning points corresponding to "Up" or "Down"

						
U	1	2	3	4	5	6
D	6	5	4	3	2	1

Note*:* Every point is equivalent to five Euro-cents.

Subjects can cheat by writing down a different side than the one chosen in mind on the paper outcome forms. Moreover, they can only cheat by misreporting the side, since they do not self-report the die outcomes that are randomly generated and recorded online. By repeating the game twenty times, cheating can be inferred both at the aggregate and at the individual level if the proportion of "lucky" choices reported is statistically improbable. The non-intrusive within-subject treatment of cheating gains 5 points (1 vs. 6), 3 points (2 vs. 5) and 1 point (3 vs. 4) enables further investigations on the more subtle and automatic cheating "strategies". To examine how the order of play affects cheating behavior, the two treatments differ only in the prescribed order of the last two steps (see Table 2):

Table 2: Steps of the two mind game variants

	The order of the steps
Throw-first:	Choose → Throw → Write
Write-first:	Choose → Write → Throw

In order to cheat, subjects in Write-first have to, in addition to lying, either overwrite the side they wrote down or mentally disregard the prescribed order of play and throw before writing. It turns out that no one made any correction on the outcome form. Thus, the order of steps that cheaters follow is identical in the two variants: choose a side, throw the die and write the side.

2.1 Experimental Procedure

The experiment was conducted in CentER lab at Tilburg University in September 2010. There were six sessions and 43 subjects in total participated.[2] A session lasted 30 minutes on average

[2] Four out of forty-three subjects cannot be included in the analysis: two self-reported confusion about the game and expressed disagreement with the answer to the understanding test in the post-experimental survey; another two had a same password which made it impossible to match their choices of sides to the die outcomes since the password was the only source of information for the matching.

including 20 rounds of the mind game as well as a short questionnaire. On average, subjects earned 6 Euro. Instructions were read aloud to subjects in the waiting hall followed by a test of understanding (see Appendix A1 for the instructions). Afterwards, they sat in front of separated computers with a paper outcome form and played the game at their own speed (see Appendix A2 for the outcome form and Appendix B for the screen shots). On the welcoming page online, they were asked to come up and fill in a personal password for picking up their payment in the secretaries' office one week later. In this way, anonymity toward the experimenter was assured.

It is reasonable to expect that subjects hold the belief that the experimenter has no access to their minds in both treatments. The experimenter also has no possibility to make any statistical inference about the honesty of the subjects when subjects submit their outcome forms since only "U" or "D" were written on the outcome form, but not the die outcomes. The act of switching the steps, not the lying of the side, can in theory be caught but with great difficulty. Since subjects go through the entire experiment at their own speed for every step and every round, it is very difficult for the experimenter to eyeball if subjects follow these steps or not, unless the experimenter pauses the whole experiment for investigation. Even if the experimenter could have all of a sudden walked towards a certain subject during the experiment, all three steps would have been finished within a few seconds before the experimenter arrived.

3. Results

Result 1: *Subjects in Write-first cheat significantly less than those in Throw-first.*

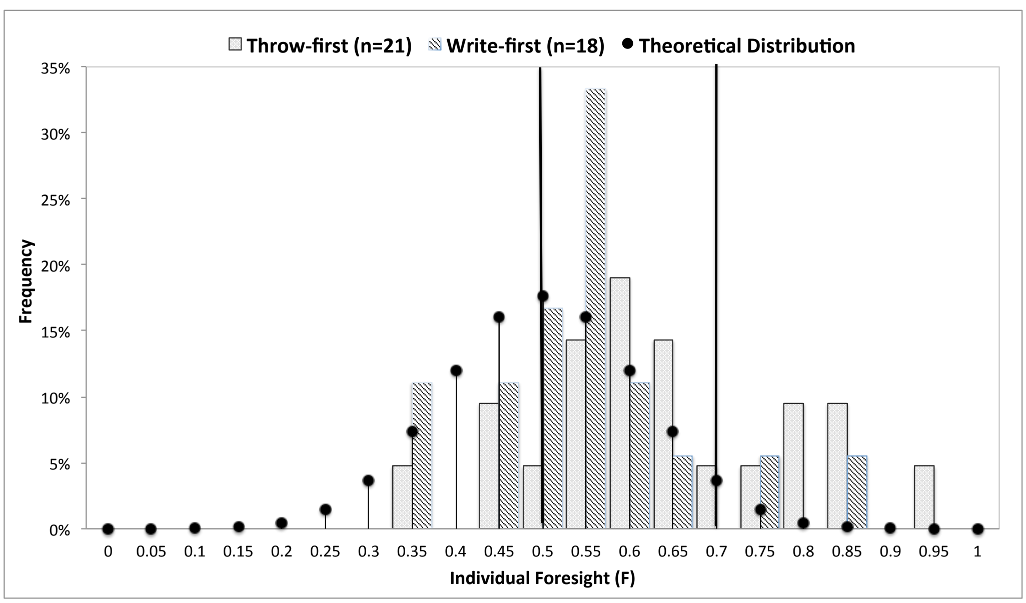
There are a number of ways to infer the probability of cheating in the mind game. A straightforward approach is to test if subjects earn improbably more "4", "5", "6" than "1", "2", "3", as if they had "foresight" of the die outcomes when they choose the side. First, let f_{ij} be the indicator of earnings higher than three for individual i in round j; let individual "foresight" $\mathrm{F_i}$ denote the average of f_{ij} over the 20 rounds of individual i:

$$\mathrm{F_i} = \frac{\sum_{j=1}^{20} f_{\mathrm{ij}}}{20}, where\ f_{\mathrm{ij}} = 1 \text{ if earning} > 3;\ 0\ otherwise.$$

Likewise, the treatment foresight is the average foresight over all rounds of the treatment. As the die is fair, the expected foresight is 0.5. Thus, inference of cheating can be drawn when the foresight significantly deviates from the theoretical level of 0.5. It turns out that Throw-first clearly exhibits improbably high foresight ($F_T = 0.64$) at the treatment level (one-tailed binomial test, $p < 0.001$, $n = 420$), which implies that lying occurs in about 14% of all rounds. The significance level is lower in Write-first ($F_W = 0.55$) as lying occurs in only 5% of all rounds (one-tailed binomial test, $p = 0.041$, $n = 360$). Above all, less cheating is found in Write-first [Fisher's exact test (FE), $p = 0.005$]. The results suggest that subjects in Write-first (n=18) cheat less frequently as their foresights are significantly lower than those in Throw-first (n=21) [two tailed Mann-Whitney-Wilcoxon test (MWW) based on independent observations, $p = 0.032$]. These results are robust using an earning-based measure that takes into account the size of the gain instead of purely the frequency (see Appendix C1).

An interesting question remains in what way subjects cheat less in Write-first. Is the difference due to fewer subjects cheating in Write-first or subjects in Write-first cheating to a lesser extent? As partly depicted in Figure 1, although no one has the foresight level of 100%, Throw-first features a higher proportion of statistically identifiable "cheaters" (33% vs. 11%, FE, $p = 0.1$), defined as those who exhibit improbably high individual foresight ($F \geq 0.7$, $p = 0.056$). However, in the light of the "small cheating" found in Mazar et al. (2008), if subjects sometimes cheat so little that cheating is not even statistically inferable, it is then still possible that there are as many subjects who cheated in Write-first except that they only cheated for a few rounds.

Figure 1: Distributions of Individual Foresights



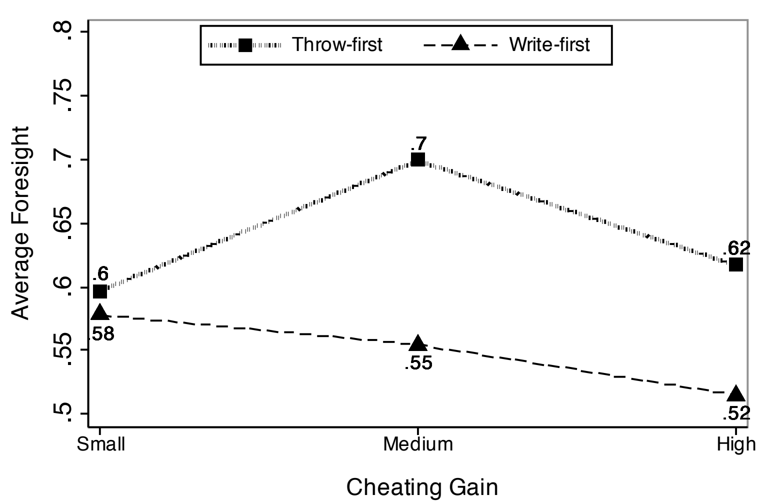
One piece of evidence that points to the potential existence of cheaters in disguise is that the proportion of subjects whose foresights are at least 0.5 or above in Throw-first is not statistically different from that in Write-first (85% vs. 78%, FE, $p = 0.4$). This is mainly due to the spike at the level of 0.55 in Write-first, which might even suggest a small cheating threshold around 0.6 although more data is needed to confirm this. Overall, it points to the intricacy in the cheating patterns and the possibility that the difference in the order of play might have caused subjects to cheat more or less in disguise (at ease).

To cheat in disguise, there are a number of possibilities in the context of this experiment: to avoid being suspected by statistical inference, one can try to either cheat marginally in gain to disguise earnings or cheat in only a few rounds to disguise foresight; to avoid being suspected by experimenters' eyeballing, one can try to restrict cheating only to rounds with low gains or again cheat in fewer rounds. As follows, *Result 2* suggests that subjects in Write-first seem to have cheated more in disguise or more cautiously, though not necessarily have intended to.

Result 2: *While significant cheating can only be found for small gains in Write-first, it is found for all levels of gains in Throw-first with its peak for medium gains.*

Previous studies have shown slightly different results on the exact cheating patterns corresponding to different cheating gains. While Fischbacher and Heusi (2008) found that not all subjects cheat for the highest gain, the highest gain is still more often reported than the second highest gain. In contrast, Lundquist et al. (2009) find that aversion to lying increases with the gain. Similarly, Mazar et al. (2008) showed that subjects cheat for the two lower gains, but not for the two higher gains. Shalvi et al. (2011) shows that subjects avoid both major and minor lies. In this experiment, the cheating levels seem to differ both across and within treatments, corresponding to cheating gains of 1, 3 and 5, as depicted in Figure 2.

Figure 2: Average Foresight and Cheating Gains



In Throw-first, cheating is found for all levels of gains since the average foresights are all significantly higher than 0.5 (one-tailed binomial test, $F_T^{3,4} = 0.6$, $p = 0.014$; $F_T^{2,5} = 0.7$, $p < 0.001$; $F_T^{1,6} = 0.62$, $p = 0.005$). Moreover, the average foresight level is at its peak at the medium gain and higher than that at the high and small gains (FE, $p = 0.06$, n = 272 vs. n = 508). This indicates that some subjects might have avoided both major and minor lies, confirming the pattern shown in Shalvi et al. (2011). In Write-first, significant deviation from the theoretical level of 0.5 is only the case for the foresight of small gain when die outcomes are 3 and 4 ($F_W^{3,4} = 0.58$, one-tailed binomial test, $p = 0.06$, $n = 109$), consistent with the findings in Lundquist et al. (2009) and Mazar et al. (2008). This suggests that subjects in Write-first not only cheat less frequently, but also avoid cheating for higher gains.

Since subjects play the game repeatedly for twenty times, the question remains if the difference in cheating patterns is robust over time. Do they cheat differently in the latter rounds after gaining more experience of the game? It turns out that while the foresight level remain the same in the first half and in the second half in Throw-first (FE, $p = 0.419$), foresight level drops in the second half in Write-first (FE, 0.58 vs. 0.51, $p = 0.102$). Treatment difference in foresight is only significant in the second half (MWW, $p = 0.038$), but not in the first half ($p = 0.245$). Moreover, the distinct cheating patterns regarding different gains are also more pronounced in the latter rounds (see Appendix C2 for more details on the time trend of cheating patterns). All in all, the result seems to confirm a stronger treatment difference in cheating behavior over time.

An important implication of the result that subjects in Write-first only cheat for small gain is that subjects forego cheating in some rounds, even though they would have already broken the prescribed rule of the order of play and postponed writing down the side. This implication casts doubt on the "rule-breaking aversion *per se*" explanation as the main drive behind the treatment difference. If subjects cheat less in Write-first because they want to break fewer rules, then they should simply switch the order of the steps less often and cheat always regardless of the level of gain. Rather, this result is more in line with the explanation that subjects cheat less in Write-first because their moral image is hurt by the additional deliberate act of switching the order of step. Foregoing cheating in the face of high cheating gain (or only cheat for small gain) can help reconcile subjects' moral image and the desire to cheat (Mazar et al., 2008). Meanwhile, it raises an interesting question if a more deliberate cheating process may potentially trigger more or less cognitive efforts in resisting the cheating temptation.

Result 3: *The honest in Throw-first spend more decision time than those in Write-first.*
Result 3 is based on reaction time data, assuming that more reaction time indirectly indicates more cognitive efforts exerted (e.g., Rubinstein, 2007). Since subjects go through the exact same steps, it allows us to draw inferences based on the decision time about the cognitive efforts required for subjects to stay honest. Would the exerted cognitive efforts differ in the two variants? According to Greene and Paxton (2009), the cognitive efforts exerted should not differ since their findings suggest that honesty results from the absence of temptation rather than the active resistance of temptation. However, I find that non-cheaters ($F < 0.7$) in Throw-first spent on average 15 seconds per round, which is significantly more than the average of 11 seconds spent by the non-cheaters in Write-first [$F(1, 30) = 6.08$, $p = 0.02$, $n = 589$]. Moreover, in Throw-first, subjects also spent 1.6 seconds more on average in the honest rounds ($f = 0$) than the dishonest or unlucky rounds ($f = 1$) while no difference as such is found in Write-first. The results seem to suggest that subjects struggle more to be honest in Throw-first, potentially because the harm on the moral image, if one cheats, is not sufficiently big to induce more clear and active cheating resistance.

So far, all the results are in line with the moral image explanation. Nevertheless, the somewhat puzzling and intricate cheating patterns triggered by the small variation in the rules of the game call for further investigations on the underlying psychological processes. It also remains an interesting topic to disentangle the effects of subjects caring about self-image or the image perceived by others. Moreover, one potential danger that people care about their moral image rather than having an intrinsic cheating-averse preference is that they might be even willing to lie about their lying. When subjects were asked how they decide about the side in the survey, deciding randomly or deciding ahead for a few rounds or all rounds, about two-third in Write-first and half in Throw-first reported deciding ahead, appearing to have played the game honestly. As it turns out, cheating was found among those who reported "deciding ahead" in both variants ($F_W = 0.554$, $F_T = 0.63$), but not among those "deciding randomly" in Write-first.

4. Conclusion

By exploiting two novel variants of the mind game, I show in this paper how the variation in the mere order of play, which makes the cheating process more or less deliberate, significantly affects cheating behavior. While subjects in Throw-first only need to lie about the choice made purely in the mind, those in Write-first need to play the game in a different order than the one prescribed in order to cheat. The overall results suggest that cheating in Write-first is curbed by the required act of changing the order of play. Subjects not only cheat less frequently, they also forego cheating in the face of medium and high cheating gain. The most plausible explanation for the results is that the moral image is more hurt in Write-first because the deliberate choice of changing the order of play not only implies that subjects have more control over the act and thus more responsible for the cheating outcome, but also reveals the bad intent to cheat. The reaction time results further suggests that the additional deliberate act required to cheat in fact helps subjects in reducing the cognitive efforts to stay honest and resist the cheating temptation. As a policy implication, my results suggest that sometimes even small changes in the rules of the game, like the order of the steps, are enough to render cheating more effortful and the intent to cheat more clear, and in turn prevent people from cheating. Lastly, as the mind game is unobtrusive, easily implementable and yet versatile, it enables a wide range of investigations on intricate cheating patterns and can serve as a useful tool for future research on cheating.

Acknowledgement

I wish to thank Jan Boone, Eric van Damme, Jan Potters, Jan Willem Lindemans, Marta Serra Garcia, Ype Poortinga, Ernesto Reuben and Sigrid Suetens for their invaluable comments and suggestions. This study was carried out during my stay at the two research institutes that provided great support and facilities: Department of Economics, Tilburg University and LICOS, KU Leuven. I am grateful to the Netherlands Organization for Scientific Research (NWO) for its generous financial support with the Mozaiek grant. Contact: tingj@sas.upenn.edu

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Appendix A

A1. Instructions

Introduction:

It is known that human beings seem to expect dependencies between successive events in spite of the fact that they know that the events occur independently of each other. Individuals' successive responses tend to be mutually dependent towards outcomes that are randomly generated. This experiment studies individuals' successive responses towards outcomes that are randomly generated in an incentivized lottery setting.

Payment：

At the beginning of the experiment, you will be asked to come up with a personal password for the sake of the payment. As of 20th September, you can pick up your payment by presenting your password to the secretaries of Department of Economics in K412. At the end of the experiment, you will be also asked to fill in a short online questionnaire in which you have to fill in the same password as the one for the experiment in order to guarantee an additional reward for the questionnaire.

Die-throwing game: Instructions

You are about to play a die-throwing game. In this game, you can throw a virtual online die 20 times for earning points. All resulting points will be exchanged to Euros. Every point you earn is equivalent to 5 Eurocents.

The die has six sides and each side has a different number of dots. The pairs of numbers add up to 7 on the opposite sides: 1 vs. 6, 2 vs. 5 and 3 vs. 4, and vice versa. We call the visible side facing up of any dice you throw the up side "U" and the opposite invisible side which faces down the down side "D". For instance, if the up side is 1, the down side of the die is 6 (See the table below for all the sides.)

U	1	2	3	4	5	6
D	6	5	4	3	2	1

In each round, the number of points that you score, depends on the throw of the die as well as on the side that you have chosen in that round. Each round consists of one throw. Before throwing, you have to choose the relevant side for that round. Note that the die outcomes are random and the outcome you see on the screen corresponds to the upside. We will explain you the detailed procedure of each round in steps:

[Treatment Throw-first]

Step 1: before every throw, make a choice of side in your mind between "U" (Up) and "D" (Down).
Step 2: throw the virtual die by clicking on the "Throw Die" button on the screen.
Step 3: fill in the side ("U" or "D") you have chosen in your mind in Step 1 in the outcome form.

[Treatment Write-first]

Step 1: before every throw, make a choice of side in your mind between "U" (Up) and "D" (Down).
Step 2: fill in the side ("U" or "D") you have chosen in your mind in Step 1 in the outcome form.
Step 3: throw the virtual die by clicking on the "Throw Die" button on the screen.

On the basis of the outcomes in step 2 stored on our web server and the corresponding side filled in the outcome form, your final earning points will be calculated and converted to Euros as your payment. For instance, if you have chosen "D" in your mind and the die outcome turns up to be "4", your earn 3 points for that throw, whereas if you have chosen "U" in your mind, you earn 4 points.

Test questions:

1. If you chose side "D" in your mind and the die outcome turns up to be "5", how many points do you earn?_____________
2. If you chose side "U" in your mind and the die outcome turns up to be "6", how many points do you earn?_____________

A2. Outcome Forms

Treatment Throw-first

Please fill in your personal password for picking up your payment: ___________.

Please repeat the following three steps for each of the 20 Throws:

Step 1: before each throw, make a choice of side in your mind between "U" (Up) and "D" (Down).

Step 2: throw the virtual die by clicking on the "throw die" button on the screen.

Step 3: fill in the side ("U" or "D") you have chosen in your mind in Step 1 in the outcome table.

	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}	T_{13}	T_{14}	T_{15}	T_{16}	T_{17}	T_{18}	T_{19}	T_{20}
The Side "U" or "D"																				

When you are finished with all the steps, please put the outcome form in the envelope and open the website under Internet Explorer's favorite menu - "a short questionnaire". When you are finished with the questionnaire, please turn off all IE windows and inform the experimenter.

Treatment Write-first

Please fill in your personal password for picking up your payment: ___________.

Please repeat the following three steps for each of the 20 Throws:

Step 1: before each throw, make a choice of side in your mind between "U" (Up) and "D" (Down).

Step 2: fill in the side ("U" or "D") you have chosen in your mind in Step 1 in the outcome table.

Step 3: throw the virtual die by clicking on the "throw die" button on the screen.

	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}	T_{11}	T_{12}	T_{13}	T_{14}	T_{15}	T_{16}	T_{17}	T_{18}	T_{19}	T_{20}
The Side "U" or "D"																				

When you are finished with all the steps, please put the outcome form in the envelope and open the website under Internet Explorer's favorite menu - "a short questionnaire". When you are finished with the questionnaire, please turn off all IE windows and inform the experimenter.

Appendix B

B1. Screen Shots

Treatment Throw-first

Screen Start:

If you are ready, please start the game by filling in your personal password: _______

Screen 1:

Round X

If you have chosen the side ("U" or "D") in your mind, please click on the button below:

Throw the Die

Screen 2:

The die outcome for this round is:

Please fill in the side on the outcome form and click on the button below:

Next Round

Screen Final:

You have finished all the 20 rounds. You can proceed by clicking on "a short questionnaire" under the IE "Favorites" menu.

Treatment Write-first

Screen Start:

If you are ready, please start the game by filling in your personal password: ________

Screen 1:

Round X

If you have chosen the side ("U" or "D") in your mind, please fill in the side on the outcome form and click on the button below:

Throw the Die

Screen 2:

The die outcome for this round is:

Next Round

Screen Final:

You have finished all the 20 rounds. You can proceed by clicking on "a short questionnaire" under the IE "Favorites" menu.

Appendix C: Additional Data Analysis

C1. Earning Measure

One potential concern of the foresight measure is that it only takes into account the cheating frequency, but not the cheating gain. For instance, though subjects cheat more frequently in Throw-first, it is still possible that subjects cheat for the same amount of points in both treatments if subjects in Throw-first would only cheat for the low gain and those in Write-first would only cheat for the high gain. Thus, I use a second measurement related to total earnings. Since subjects are randomly exposed to cheating opportunities of earning five, three or one points corresponding to different die outcomes, the actual realization of die throws over the 20 rounds is not the same across subjects. To capture the proportion of the actual earning relative to the maximal possible earning with cheating given the individual's draw of die throws, the earning measurement is defined as the aggregate of the actual earnings per round e_{ij} normalized over the difference of the aggregate maximum earnings $\overline{e}_{\mathrm{ij}}$ (when $\mathrm{F_i} = 1$) and minimal earnings $\underline{e}_{\mathrm{ij}}$ (when $\mathrm{F_i} = 0$):

$$\mathrm{E_i} = \frac{\sum_{j=1}^{20} e_{\mathrm{ij}} - \sum_{j=1}^{20} \underline{e}_{\mathrm{ij}}}{\sum_{j=1}^{20} \overline{e}_{\mathrm{ij}} - \sum_{j=1}^{20} \underline{e}_{\mathrm{ij}}}, where\ \underline{e}_{\mathrm{ij}} = (e_{\mathrm{ij}} | f_{\mathrm{ij}} = 0);\ \overline{e}_{\mathrm{ij}} = (e_{\mathrm{ij}} | f_{\mathrm{ij}} = 1).$$

$\mathrm{E_i}$ is between 0 and 1. Without cheating, $\mathrm{E_i}$ is also expected to be 0.5. The results show that Throw-first again exhibits improbably high earning levels ($\mathrm{E_T} = 0.64$) based on the individual earnings (Wilcoxon signed-ranked test, $p = 0.001$, $n = 21$). Subjects in Throw-first also cheat for more points than those in Write-first based on $\mathrm{E_i}$ [Mann-Whitney-Wilcoxon (MWW) test, $p = 0.055$). Write-first, however, does not exhibit significant cheating ($\mathrm{E_R} = 0.54$, Wilcoxon signed-ranked test, $p = 0.139$, $n = 18$). This is potentially due to the specific cheating pattern in place: as shown in *Result 2*, subjects in Write-first only cheat only for low gains. As a result, though cheating could still be captured by the foresight measure, but not by the earnings measure. That was also one of the reasons why I used the foresight measure, instead of the earning measure, for most of the other analyses.

C2. Time Trend of Foresight

As depicted in Figure 3, the treatment difference in foresights is most pronounced in the last five rounds (15-20) regardless of the level of the cheating gain. While Write-first displays persistently lower foresight when the gain is medium throughout all rounds and more so in the last ten rounds, it displays a much lower foresight when the gain is high only in the last five rounds.

Figure 3. Time Trend of Foresight by Cheating Gain