Facilitation in Dishonesty is Subject to Task Constraints

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Abstract

A recent line of research suggests that in a tempting situation, a dishonest decision can be executed more quickly and easily than an honest one. Some theories have purported that dishonesty is a default and automatic tendency, while honesty requires a more deliberative process. We argue that the facilitation observed in past studies is closely dependent on the nature of the task. In the current study we added a memory constraint to a cognitive task that prompts dishonest responses. Participants were rewarded for their accuracy in privately predicting the outcome of computerized coin flips. They reported their prediction by clicking their mouse on one of the two options on the screen (i.e., heads or tails). We collected the mouse movements for each participant and analyzed the mouse trajectories to study decision-making dynamics. Results revealed that patterns of facilitation are subtle and likely shaped by task constraints, rather than dishonesty simply being "automatic."

Keywords: Decision-making, Dishonesty, Action Dynamics.

Introduction

Deception appears to be a surprisingly common element of everyday social interactions (DePaulo, Kashy, Kirkendol, Wyer, & Epstein, 1996). People often choose to behave dishonestly because they find an advantage in lying. Although this advantage could be motivated by a variety of reasons it is often rooted in self-interest. People are tempted to lie when it serves their self-interest, be it financial, social, or emotional. This prompts an important question: In a tempting situation where being dishonest is self-beneficial, are people cognitively facilitated to lie or do they have to actively inhibit the truth in order to serve their self-interest?

There are at least two competing theories that seem to tackle this debate by addressing the underlying processes of dishonest decisions. One theory, inspired by Spinoza's hypothesis about the inevitable truth bias in human belief systems (Gilbert, 1991), suggests that honesty is the grounded process and is therefore more accessible and immediate. This theory suggests that in order to act dishonestly one has to overcome a truth bias, which results in additional time and effort (Duran, Dale, & McNamara, 2010; Duran & Dale, 2012; McKinstry, Dale, & Spivey, 2008; Spence, Farrow, Herford, Wilkinson, Zheng, & Woodruff, 2001). In fact, a great proportion of the studies that address the mechanisms underlying deception imply that lying is more cognitively costly (Vrij, Mann, Fisher, Milne, & Bull, 2008).

Some evidence supporting this view is provided by Spence et al. (2001). They used fMRI in a behavioral task to show that lying takes significantly more time, and results in reliable activation within brain regions that are associated with response inhibition. The authors relate activation in these areas to withholding the truth. Additional evidence is presented by a study on action dynamics of overcoming the truth bias. Duran et al. (2010) showed that participants who are instructed to give false responses to autobiographical questions exhibit more complex response dynamics. They tracked participants' arm movements while choosing the false or truthful answer by a Nintendo Wii Remote. Arm trajectories revealed an ongoing competition during the course of false responses.

A more recent line of research, however, argues that dishonesty can be greatly facilitated, perhaps even be "automatic," in any tempting situation where lying pays. This hypothesis predicts that when dishonesty serves self-interest, people will need extra time and self-control to be honest and refrain from cheating (Shalvi, Eldar, & Bereby-Meyer, 2012). It is also consistent with the literature concerning how depletion of self-control can increase the chance of performing dishonestly (Gino, Schweitzer, Mead, & Ariely, 2011).

To support this hypothesis, Shalvi and colleagues (2012) have shown that when people are tempted to cheat under time pressure, dishonesty appears to be the default response. They asked participants to privately roll a die and self-report the outcome to win money (more money for higher numbers). Participants who completed the task under time pressure tended to lie significantly more often. The authors conclude that when lying pays, people will automatically choose dishonesty over truth unless they have enough time to deliberately refrain from lying. Furthermore, it has been argued that when self-control resources are depleted in a non-related task, people are more likely to behave dishonestly (Gino et al., 2011).

Additionally, Greene and Paxton's (2009) study on the neural bases of honest and dishonest choices offers evidence in favor of this view. In a behavioral task where participants were also imaged with fMRI, Greene and Paxton covertly encouraged cheating. Participants were rewarded for correct self-reported predictions and lost points for wrong ones. Dishonest participants showed robust brain activation in control-related areas when refraining from lying. The

authors suggest that when temptation is present it takes extra effort and control to be honest.

Action Dynamics

Rather than emphasizing on variables that measure only the outcome of a decision (e.g. reaction times), we explored the unfolding decision processes that give rise to the outcome. Using a methodology that tracks the dynamics of movement over time, we investigated the changes in people's behavior as they make a decision, from the earliest moments of movement initiation to final execution.

It has been shown that spatial and temporal dynamics of motor movements can shed light on the progression of high-level cognitive processes such as decision-making (for reviews see Spivey & Dale, 2006; Song & Nakayama, 2008; Freeman, Dale, & Farmer, 2011). This growing line of research on action dynamics suggests that, despite what traditional interpretations assume, a decision is not necessarily finalized in the brain by the time action is initiated. Instead, the ongoing competition between alternative options is reflected in a person's movement dynamics such as eye movements or reach movements. In this trend of work we hope to characterize dishonest decisions by investigating micro-behavioral properties of a response by tracking reach movements as participants use a computer mouse.

Previous Work

In a previous study (Tabatabaeian, Dale, & Duran, 2013), we utilized a novel task to test the two competing hypotheses concerning the cognitive processes involved in dishonesty (described above). We indirectly tempted participants to cheat and collected their mouse movements while performing the deceitful action. The goal was to track the action dynamics of potentially dishonest decisions to investigate underlying cognitive processes.

Participants completed an online task, in which they were instructed to privately predict the outcomes of a series of virtual coin flips and report their accuracy. They were rewarded for each accurate prediction. In order to report their accuracy, after each coin flip, participants were led to a page with two options on the top left and top right of the screen ("Correct" and "Wrong"). Participants were not explicitly asked to cheat; nevertheless, opportunities to act in a dishonest manner were present. As a cover story for the task, participants were told that we were interested in the influence of monetary rewards in the implicit learning of head and tail sequence patterns.

We analyzed the temporal and trajectory properties of the mouse movements. The goal was to differentiate dishonest and honest decisions based on these trajectories. The results revealed that people show less complexity in their mouse trajectories when they are being dishonest in incentivized tasks. "Dishonest" participants (who reported more than 70% accuracy while the expected accuracy was at the chance level),[1] showed facilitated action dynamics in choosing the "Correct" response. While being dishonest, they exhibited significantly shorter reaction times and more direct mouse trajectories, which did not deviate towards the alternative truth option. Moreover, changes in direction of mouse movements happened less often in "Dishonest" participants, indicating that they had more confidence in their decision. In contrast, "Honest" participants experienced more hesitation, which was reflected in their longer reaction times, more complex trajectories, and more attempts to change the direction of the mouse cursor. This all suggests the facilitation of dishonesty in a self-serving situation where lying is beneficial.

The Current Study

In the previous work, participants were instructed to click on the box labeled "Correct" if their prediction matched the actual outcome of the coin flip and click on "Wrong" otherwise. One possible criticism of this procedure is the ease of the task; one can automatically choose "Correct" all the time without getting engaged in decision-making processes throughout the experiment. In other words, participants can decide to always immediately click on "Correct" regardless of their actual accuracy. In order to address this concern we added difficulty to the task. Participants were instructed to click on boxes labeled as "Heads" and "Tails" instead of "Correct" and "Wrong." We hypothesize that by doing so, participants cannot decide about the answer at the beginning of a trial; instead they need to actively track the outcome of the coin flips in order to cheat. Thus, it is impossible to win extra money if they are not actively engaged in the task. If dishonesty is always facilitated in a tempting situation, independent from the task nature, we expect to replicate the results from the previous work.

Experiment

Participants

We recruited 91 participants online through Amazon's Mechanical Turk (AMT). They were paid $0.40 for their time. A numeric code on the server was assigned to the participants to ensure that they had actually completed the task, and approved their payment on AMT.

Procedure

Participants were instructed to privately predict the outcome of a computerized coin flip 20 times. They were notified that there is a pattern across the coin flips that they may or may not notice. The instructions informed participants that they would be rewarded for each correct prediction. After

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[1] As we note below, this "Dishonest" designation is a convenience; some responses may in fact have been honest. However, given the low probability of such performance in a random task, it is plausible to suspect that many of these responses *were* dishonest.

seeing the instructions, participants were shown a page where they were asked to make a prediction. When ready, the participants could click on a button labeled as "Flip," which triggered a computer animated coin flip. The outcome of the coin flip was determined using a list made by a random generator with equal probability for heads and tails (50% chance of heads/tails throughout the experiment). Once the coin landed, participants clicked on a button that led them to a page, where they could report their prediction. This page contained two boxes labeled as "Heads" and "Tails" on the top left and top right of the screen. The assignment of the labels to each side of the screen was counterbalanced between subjects. The mouse cursor was automatically placed on the bottom center of the screen and the participants were expected to move the mouse towards the desired option. The trial only finished after the participants finalized their decision by clicking on one of the responses. If their prediction was consistent with the actual outcome of the coin flip, they were shown a message indicating that they have won a bonus. Otherwise, they were informed that no bonus was awarded. The mouse trajectory and final response for each trial were collected for further analysis. It is important to note that this procedure implicitly assured participants that they would never be caught cheating and therefore enhanced the temptation to lie. At the end, every participant received the same bonus payment ($0.25 total). Following the last trial, participants were asked if they noticed any patterns in the sequence of heads and tails. Finally, they were debriefed that the study was about response movements of people who tend to cheat when lying serves self-interest and there is no risk of being caught. Figure 1 displays the task sequence.
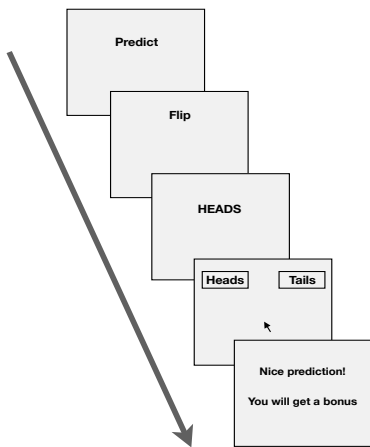

Figure 1: Task sequence: subjects 1) make a prediction, 2) flip the virtual coin, 3) see the outcome and 4) report their prediction by clicking on one of the two boxes on top of the screen (i.e. Heads and Tails) which were assigned to left or right side counterbalanced. 5) They will be informed that they got a bonus (or not) if their report was consistent (or inconsistent) with the actual outcome.

Results

Ten subjects failed to complete all 20 trials and were excluded from the analysis. Data from 81 remaining participants were used to run the statistical analysis. Trials with total times greater than 5000ms were discarded prior to analysis (0.4% of data). As participants' predictions were private, we detected lying by comparing the distribution of self-reported accuracy with the expected distribution of fair coin-flips. The distribution of reported correct predictions (M= 12.70, SD = 3.1) was significantly different from a fair distribution of random coin-flips (M = 10), $t(80)$ = 7.70, $p <$ .001. The analysis suggests that participants have been dishonest at the group level. Figure 2 shows the distribution of self-reported percent correct. Even though the task set up makes it impossible to distinguish dishonesty on an individual basis, dishonest responses are expected to be more prominent in the rightmost portion of the distribution. Here we investigate the shape and properties of the mouse trajectories for potential honest and dishonest decisions.
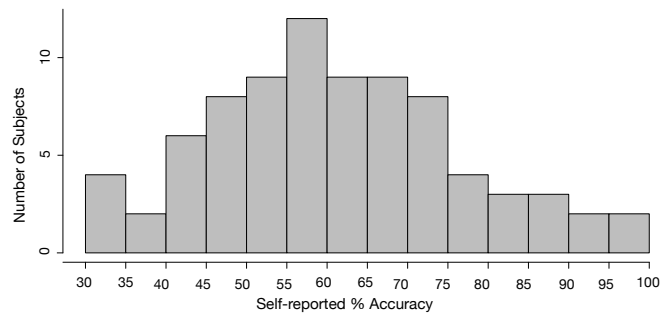

Figure 2: The distribution of percentage of self-reported correct predictions.

Mouse-trajectory shape. Participants were labeled as "Honest" and "Dishonest" based on their performance in the experiment. 31 participants with more than 70% accuracy were classified as "Dishonest" while other participants were considered as "Honest." 70% was chosen as a point where is significantly beyond what was expected from a binomial distribution considering conventional .05 level probability cutoffs. It is worth noting that these labels are assigned to participants based merely on their performance in the current task, and do not stand for any general personality categorization of the participants.

In order to investigate the average performance of each group, we interpolated mouse trajectories of "Honest" and "Dishonest" participants to 101 time steps. The time steps were superimposed to produce average trajectories, which are represented in Figure 3. Trials in which the reported prediction (heads or tails) was consistent with the outcome of the coin flip were considered "Correct" and trials of the opposite kind were marked as "Wrong." Showing a different pattern from the previous findings, average trajectories for correct do not illustrate any significant disparity between "Honest" and "Dishonest" participants. However,

surprisingly, the difference appears to be captured by *wrong* trajectories. A possible explanation, given that there is approximately no difference between "Honest" and "Dishonest" in *correct* trajectories, is the influence of repetition priming. In correct trials participants only have to choose the option that is consistent with what they saw on the screen (heads or tails), thus they are much faster in choosing the matching option. On the other hand, when reporting a wrong prediction, they have to click on an option that is inconsistent with what they were shown on the screen. Thus they are expected to take more time to respond. However, there is a substantial difference between "Honest" and "Dishonest" trajectories in *wrong* trials with "Dishonest" participants exhibiting more complexity when being honest. Their average trajectory captures a desire to report the alternative deceitful option. Although, both groups are slower in reporting an inconsistent response, "Dishonest" people are slower with more deviated trajectories. Next, we compare these trajectory shapes by extracting measures from them and conducting further analysis on their quantified properties in terms of extent, complexity, etc. Figure 3 demonstrates the difference between the current findings (the graph on top) and the previous study (bottom graph).
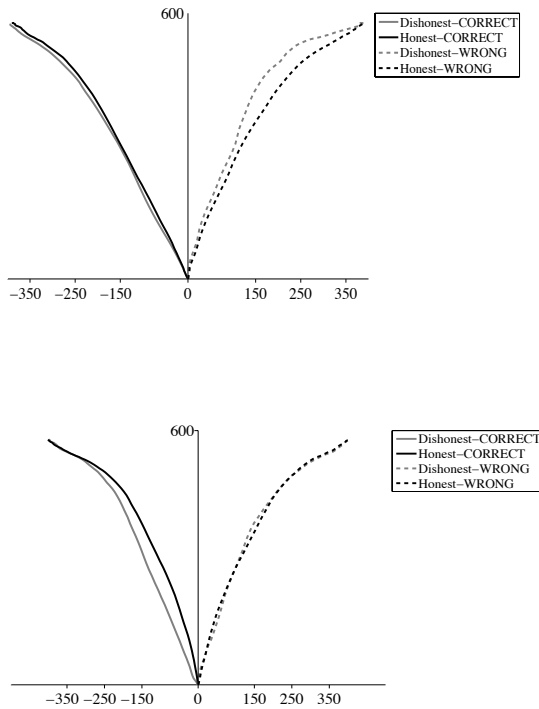

Figure 3: The figure on top shows the average trajectories of "Honest" (black) vs. "Dishonest" (gray) subjects while reporting correct (solid line) or wrong (dashed line) predictions in the current experiment. The bottom figure shows the corresponding trajectories from the previous study (Tabatabaeian et al., 2013).

Mouse-trajectory properties. The participants' mouse movements offer a variety of dependent variables that can be extracted by analyzing the trajectory (x,y) coordinates across time. The measures are interpreted together to reveal overall patterns of cognitive processes underlying the decisions. In the current study we extracted four variables to characterize the temporal and trajectory behavior of participants in each trial:

- *Total time*: This includes the overall time of one trial from the moment participants see the page containing two choices (Heads, Tails) to the moment they click on one of the two.
- *Distance*: The Euclidean distance traveled by the trajectory from the initiation point until clicking on the final answer (Heads or Tails).
- *x-flips*: Number of x-flips indicates the number of times the mouse cursor changes direction along the *x*-axis (i.e., the axis of decision). This variable can be understood as a measure for hesitation, or response complexity.
- *x-range*: This is defined as the absolute distance between the smallest and the largest x-coordinate that the mouse reached through transition towards the chosen answer. This measure can capture the pull toward the alternative response, interpreted loosely as the competition between the responses.

The total time and motion time are temporal measures, whereas other variables mainly capture the dynamic changes along the mouse trajectory coordinates. Table 1 provides the mean values and standard deviations of the dependent variables for *correct* and *wrong* trajectories grouped by honesty. For each of the four dependent variables, we conducted a linear mixed effects model with a fully specified random effects structure. We used honesty (Honest vs. Dishonest), response type (Correct vs. Wrong), and the interaction term between them as fixed effects. As random effects, we had intercepts for subjects, as well as by-subject random slopes for the fixed effects.

In the previous work, we treated total accuracy as both a continuous and discrete effect (Tabatabaeian et al., 2013). For simplicity and clarity of presentation, in the present work, we report the results more clearly by classifying the participants into "Dishonest" (total accuracy >= 70%) and "Honest" (total accuracy < 70%). Thus, in the current analysis we chose honesty as a discrete fixed effect. A summary of results is provided in Table 2.

The models for temporal measures showed that response type has significant effects on total time ($B = -138.42$, $p < .001$). All participants exhibited shorter reaction times (about 138 millisecond faster) when reporting a correct prediction; by clicking on the response that was consistent with the outcome of the coin flip. The results fit with the intuitive interpretation that emphasizes the effect of repetition priming.

Table 1: Means and standard deviations of the mouse-trajectory variables by honesty and response type

	Dishonest				Honest			
	Correct		Wrong		Correct		Wrong	
Variable	M	SD	M	SD	M	SD	M	SD
Total time (ms)	1021.89	420.70	1184.05	634.22	1025.47	465.72	1138.90	630.03
Distance (pixels)	853.88	271.50	963.79	383.46	874.51	376.02	896.76	357.27
x-range(pixels)	447.63	128.58	484.33	152.07	457.60	181.74	463.55	163.87
x-flips	0.90	1.01	1.46	1.45	0.95	1.07	1.17	1.26

Table 2: Coefficient estimates from mixed-effects models predicting variables

Variable	Dishonesty			Response type			Interaction		
	B	SE	t	B	SE	t	B	SE	t
Total time (ms)	11.17	65.76	0.17	-138.42	33.65	-4.11[**]	-65.21	72.42	-0.90
Distance (pixels)	14.16	47.58	0.30	-70.45	18.04	-3.90[**]	-84.88	40.26	-2.10[*]
x range(pixels)	2.72	22.07	0.12	-25.20	7.32	-3.44[**]	-26.91	15.49	-1.73
x flips	0.10	0.11	0.90	-.31	0.06	-4.93[**]	-0.20	0.13	-1.49

* p<.05. ** p<.01.

The model for x-range also supports the effect of response type. Reporting a trial as correct is a significant predictor of x-range ($B = -25.2$, $p < .001$). Correspondingly, we found a marginally significant interaction between response type and dishonesty for x-range ($B = -26.91$, $p = .08$), suggesting that "Dishonest" participants had less curved mouse trajectories when answering correct versus wrong. However, "Honest" participants experienced a less dramatic change in their x-range when reporting a correct versus a wrong prediction. This offers some preliminary evidence that mouse trajectories of "Dishonest" participants were pulled towards the deceitful alternative when they were being honest, whereas "Honest" participants did not show any substantial difference in their trajectories regardless of the response type. Figure 4 illustrates the interaction between response type and honesty.
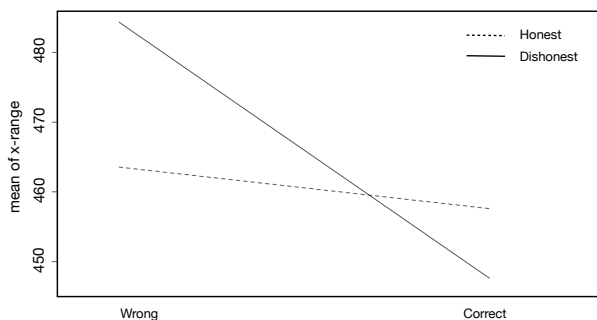

Figure 4: Average x-range grouped by honesty and response type.

The number of x-flips, which can be an indicator of hesitation, is significantly influenced by response type ($B = -0.31$, $p < .001$). When reporting a correct prediction, participants changed the direction of their mouse cursor about 30% less compared to trials reported as wrong. This suggests that all participants experienced less hesitation while choosing the consistent response either truthfully or as a deceptive answer.

The other variable that shows the cognitive process correspondent to the mouse trajectory is the absolute distance that the mouse cursor has traveled. Distance is significantly predicted by response type ($B = -70.45$, $p < .001$), as correct trials contain shorter and more direct trajectories. Moreover, there is a significant interaction between honesty and response type ($B = -84.8$, $p = .03$), suggesting that "Dishonest" participants had longer and more curved mouse trajectories while reporting a prediction as wrong.

General Discussion

A recent line of research suggests that in a situation where dishonesty serves self-interest, acting dishonestly is an "automatic" tendency, while honesty requires a more deliberative process (Shalvi, Dana, Handgraaf, & De Dreu, 2011; Shalvi, et al., 2012). In a previous study we used action dynamics to investigate people's behavior when they were naturally tempted to act dishonestly (Tabatabaeian et al., 2013). Consistent with this new line of research, our previous findings showed that in a tempting situation where lying pays, people are more facilitated in lying than telling the truth. In the current study, however, we argue that the facilitation observed in past studies is closely dependent on the nature of the task. We added a level of difficulty to a cognitive task that tempts people to cheat. Participants were rewarded for their accuracy in privately predicting the outcome of a computerized coin flip. They reported their prediction by clicking the mouse on one of the two options on the screen (Heads and Tails instead of Correct and Wrong). The new task differs from the previous tasks, as it increases the level of engagement. In the previous study

participants could passively choose a response (Correct or Wrong), however, the current task forces them to actively track the outcome of the coin flip in order to win. We analyzed participants' mouse trajectories to study their decision-making dynamics. Hence, in the current task, it is not dishonesty that is facilitated; rather the more intuitive process that maintains response consistency is the dominant process.

The difference between "Honest" and "Dishonest" participants, which was previously captured in *correct* trajectories, is now evident in *wrong* trajectories. Put another way, "Dishonest" participants merely exhibit a deviation from others when they are reporting their prediction as wrong (i.e. being honest). In such situations their trajectories demonstrate a pull towards the deceitful answer, indicating a desire for lying. More than facilitation in lying, the results revealed a signature of temptation to cheat in "Dishonest" participants, while being honest. Thus, it appears that changing the nature of the task directly influences the facilitated process. In the current task, it is not dishonesty that is facilitated; rather the more intuitive process that maintains response consistency is the dominant process.

One possible explanation for the collapse of the difference between average trajectories in *correct* trials is provided by repetition priming. The task setup dictates an advantage for responses that are consistent with the outcome of the coin flip. These responses happen to be the tempting option and therefore make it difficult to study the dynamics of dishonest responses. Although repetition priming makes correct responses easier for all participants, it helps distinguish "Honest" and "Dishonest" participants when they select an answer opposite to what they were shown. It is hard for everyone to report an inconsistent response but more so for "Dishonest" participants, as they attempt to develop a self-serving strategy as well. The results revealed that the task modification forces the difference between the two groups to appear in *wrong* trajectories rather than *correct* trajectories. "Dishonest" participants tended to be slower and more hesitant compared to "Honest" participants. They showed longer and more curved trajectories, indicating their desire to lie when they chose the truthful option.

The current study suggests that task variables indeed determine whether and how self-serving biases are reflected in cognitive dynamics. The present manipulation of the task seems to offer a more realistic picture of naturalistic deception by capturing the temptation to behave dishonestly. In a tempting situation, dishonesty is not always the facilitated tendency; rather it is one of the competing processes that may or may not come to govern responses.

Importantly, it is not easy to disentangle all different task variables that are producing the effects. We cannot be sure if repetition priming is responsible for all of the observed effects. However, these findings start a promising trend for discussion.

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