Do risk-averse people lie less? A comparison of risk-taking behavior in deceptive and non-deceptive scenarios

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Abstract

We studied decision making in situations in which there is a monetary incentive to take risk, and in which the risk taking option sometimes involves deception. We conducted a within participant experiment in which we compared risk taking in deception conditions to pure (non-deceptive) gambles with equivalent risks and outcomes. We confirmed the four-fold pattern of risk attitudes in both conditions. We found that participants chose fewer risky options when the risky option was associated with deception, but that those who deceived more in the deception condition also took more risks in the gamble condition. We conclude that people who tend to take risks in gambles, also take them when it involves deception, although to a lesser extent.

Keywords: Decision making; risk attitudes; deception; incentives.

Introduction

Despite being a fundamental construct in many economic theories, individual risk attitude does not exhibit the construct stability generally associated with personality traits. Many studies (e.g. Berg, Dickhaut, & McCabe, 2005; Holt & Laury, 2002; Isaac & James, 2000) have shown that inconsistency in people's risk taking depends for instance on the nature (hypothetical vs. real) and magnitude of outcomes, the task and the situation they are facing (e.g., lottery vs. auction vs. game show), and the risk elicitation method (e.g., questionnaires vs. laboratory experiments).

Just as people are willing to take risk in certain situations and not in others, there are also situations in which people are willing to deceive and others in which they are not. We studied the interplay of these two tendencies in situations where deception was risky but the decision maker could choose not to deceive and not to take risk. In these situations there was, by design, no trade-off between risk-taking and deception.

Sakamoto, Laine, and Farber (forthcoming) found that perceived detection risk is one of the factors that determines whether people decide to deceive or not, and that it is evaluated differently in gain- and loss-facing situations. In the current study we sought to find out whether people's decisions to deceive are driven by their attitudes towards dishonest behavior or towards risk taking, and whether their non-deceptive risky choices can predict their decisions to deceive. Particularly, we were interested in if people's risk taking behavior in the deceptive domain also follows the *four-fold pattern of risk attitudes* (Tversky & Kahneman, 1992), namely that on average people are risk averse when facing high probability gains and low probability losses (e.g., buying insurance) and risk seeking when facing low probability gains (e.g., buying a lottery ticket) and high probability losses.

In the extensive decision making literature, few studies have addressed the four-fold pattern directly (Harbaugh, Krause, & Vesterlund, 2009). Those that have, have not found convincing evidence in support of the pattern, supposedly due to methodological issues related to e.g. the elicitation method, usage of complicated or hypothetical prospects, or presence of low and high probability prospects in the gain domain only.

Often the number of participants and the number of decisions per participant have also been relatively small. In order to test the four-fold pattern of risk attitudes we designed a within participant study, and collected data from substantial number of individuals. We compared risk-taking decisions in two hypothetical situations, one of which was an abstract gamble and the other a real-life decision situation presumably familiar to many of our participants, namely filing a tax return. Using several analysis and modeling techniques we found support for the four-fold pattern of risk attitudes, as well as differences in risk-seeking vs. risk-avoiding behaviors in these two conditions. Despite differences in risk taking between participants who decided to deceive and those who did not, we found consistency in individual decisions across the two conditions.

Risk attitudes when facing gain vs. loss

An abundance of empirical evidence has shown that people weight losses and gains asymmetrically, so that a loss is generally considered worse than an equivalent gain (Kahneman & Tversky, 1979). This gain versus loss trade-off has been termed *loss aversion*. The principle of loss aversion is controversial since, as Gal (2006) points out, it is used in an ad hoc manner to explain a number of phenomena involving losses and gains, such as the sunk-cost effect, the endowment effect and status-quo bias (Harinck, Dijk, Beest, & Mersmann, 2007); while at the same time, these phenomena have been presented as *evidence* for the existence of loss aversion. Tversky and Kahneman (1991) notwithstanding, it remains unclear how strong the experimental evidence is for loss aversion (Bateman, Kahneman, Munro, Starmer, & Sugden, 2005; Novemsky & Kahneman, 2005).

In general people prefer avoiding losses to making gains, and when facing gains they exhibit *risk aversion*, which is considered a fundamental element in theories of human decision making under risk (Holt & Laury, 2002). Its true nature is not well understood, for instance how its existence depends on the size of the risky outcomes (Holt & Laury, 2002), as laboratory experiments usually use relatively low monetary incentives. The observed pattern of human risky behavior is more complex than briefly described above, and it relates not only to the magnitudes of gains and losses but also to their probabilities.

Markowitz (1952) proposed a value function, defined over gains and losses, that underweights small gains and small losses relative to large gains and large losses. This implies risk-seeking behavior for small gains and risk-avoiding behavior for large gains, whereas the reverse is true for losses (Haisley, Mostafa, & Loewenstein, 2008). Kahneman and Tversky (1979) explain the equivalent risk preference pattern — dubbed the four-fold pattern of risk attitudes — with a probability weighting function that overweights low probabilities and underweights moderate and high probabilities.

Lie aversion

We are interested in whether and how the risk preference changes when risk is associated with deceptive behavior that results in a better outcome than risk-avoiding behavior. Pure lie aversion would mean that the cost of lying is derived from the act of lying only. Even if there is evidence that lie aversion exists, it is not always pure, but is relative to the circumstances or linked to the consequences of lying (especially in repeated interactions where reputation is at stake) or beliefs about the outcomes and expectations of others (Erat & Gneezy, 2012; Gneezy, 2005; Hurkens & Kartik, 2009; López-Pérez & Spiegelman, in press; Lundquist, Ellingsen, Gribbe, & Johannesson, 2009).

López-Pérez and Spiegelman (in press) devise an experiment to isolate pure lie aversion. To rule out altruistic or guilt-avoidance motivations for truth-telling, none of their treatments induced loss for the receiver, but instead involved a slight increase in the sender's payoff if she decided to lie. Even if the majority of the participants lied, the number of participants (about one third) who never did was the same in each treatment. This led the authors to conclude that pure lie aversion does exist. Lundquist, Ellingsen, and Johannesson (2009) also find evidence for lie aversion, with the effect increasing with the size of the lie (people prefer not to stretch the truth too much), and with free communication as opposed to predefined messages.

Erat and Gneezy (2012) as well find strong evidence for lie aversion, but also convincing evidence that people are willing to lie, even at their own cost, if it significantly helps the other person, and even more so if their own payoff increases without increasing the other person's costs. Gneezy (2005) also finds that people tend to lie if there is no cost associated with lying itself, and if the lying benefits themselves without hurting others.

Hurkens and Kartvik (2009) argue that people can be categorized roughly into two kinds: to those who would never lie and to those who will always lie if the benefit from lying exceeds the benefit from telling the truth. Gibson, Tanner and Wagner's results (2012) reject this static type-based model, but they argue that significant within and among individual heterogeneity exists in lie aversion and willingness to engage in deceptive behavior, providing evidence that intrinsic preferences are non-separable form economic incentives. In summary, people are sensitive to the outcomes attainable by lying, and aversion to lying cannot be explained solely by the negative (guilt) feeling from the act of lying itself, but rather must take some account of what can be achieved (benefits) or avoided (costs) by lying.

Experiment

We designed an experiment to study how incentives, i.e, monetary gain vs. no-gain and monetary loss vs. no-loss, and the associated risks affect people's propensity to choose a deceptive risky option, in conditions where the risky option is associated with a better outcome (if successful) than the sure option. We compared risky choices in the deception condition to the pure gamble condition in which there was no deception. As the deception condition we chose a real-life scenario of filling in an annual income tax return. The risk in these scenarios was defined as the probability that the tax return would be audited and the information found to be in error.

Mainly supportive but also mixed evidence exists about the effectiveness of audit probability and fines as a deterrent for tax evasion. Maciejovsky, Schwarzenberger, and Kirchler (2012) review several studies that found a positive effect of audit probability on tax compliance, and also studies that failed to find any support for tax fines as effective deterrents for tax evasion. The authors suggest affect as a determinant of tax behavior, but other sources have also been suggested, such as trust, fairness, and social norms (Maciejovsky et al., 2012). We are not aware of any studies that have linked deception aversion to tax behavior or that have focused primarily on willingness to deceive in taxes across conditions of variable risk and outcome size.

Method

Participants Using Amazon Mechanical Turk (MTurk, http://www.mturk.com/) we recruited 690 participants to complete an online questionnaire in Qualtrics software (http://www.qualtrics.com). After discarding data from participants who failed the attention check question we had 672 participants (362 women, 308 men, 2 unknown; median age 29 years, age range: 18-73 years). All participants were native English speakers, aged 18 or above, and residing in the US. Each participant received USD 1.00 for their participation.

Material We prepared 18 questions in two conditions that asked for choices between a sure and a risky option. The difference between the conditions was that one of them used simple monetary gambles, whereas the other used real-life scenarios of filling the tax return (deception scenario). In the deception condition risky outcome was always associated with the deceptive option, and the sure outcome with the honest option. We chose this design because of the inherent risky nature of deception: there is always a chance, however minimal, that the deception is detected, leading to an adverse outcome. In other words, examples in which risk taking is associated with a sure outcome would have been, in our opinion, so artificial — especially the cases with sure losses — that we expected them to bias our participants' decision behavior.

We chose the tax return as our deception scenario since it has the extremely valuable feature of being usable symmetrically for the gain and loss domains, depending on whether the taxpayer is facing additional taxes or a tax refund.[1]

Four types of scenarios were prepared in both conditions: high probability gain, high probability loss, low probability gain, and low probability loss, so that for each outcome level (gain and loss) we created both a low probability and a high probability scenario. These types were designed to test the four-fold pattern of risk attitudes, and the value of the sure option was chosen to match the expected value of the risky option. For each type we created four outcome and probability variations, as shown in Table 1.[2]

Table 1: The money to gain or lose, and their probabilities.

p	0.20	0.05	0.05	0.10	0.80	0.95	0.95	0.90
Risky option $	20	100	1000	5000	20	100	1000	5000
Sure option $	4	5	50	500	16	95	950	4500

Example scenarios in the gain condition are shown in Figure 1. The wording in the corresponding loss scenarios was "have to pay", instead of "get back" (deception), and "lose" instead of "win" (gamble). The choice options were presented horizontally next to each other, and their order was randomized.

Procedure After giving their informed consent the participants were asked to make their choices in 18 deception scenarios and 18 gamble scenarios (the order of sets was selected randomly for each participant). All participants answered all 36 questions, so the deception vs. gamble manipulation was within participant. After finishing the choice questionnaire they filled in optional background information, such as age, gender, and education. The questionnaire ended with a debriefing. It took them about 20 minutes to finish the whole experiment.

[1]We acknowledge that using lying in one's taxes as the deception domain may have resulted in effects that we were unable to control. The reason we saw much less risk taking in deception scenarios may be that some participants did not base their decisions on the outcomes and associated probabilities, or moral considerations of deceiving in general, but were driven by a specific aversion to lying in their taxes or to the government.

[2]We also designed two additional questions with a medium probability of 55% and outcome of (-)$1000, but they were excluded from the analysis for the purpose of this paper, since the focus here is the four-fold pattern of risk attitudes.

Deception scenario John is doing his yearly taxes. He has to answer a question about how many dependents he has. John is aware that only children under 19 years of age qualify as dependents for tax purposes; his son recently turned 19, and so does not qualify. If he tells the truth, indicating he has zero dependents, he will get back $950. Alternatively he could say he has one dependent, in which case he would instead get back $1000. He knows that such mistakes are fairly common, and that he can relatively easily find an excuse for his "clerical error" if his tax return is audited. If in the audit his answer is found to be in error, however, he would get back $0. He also knows that 5% of such errors are caught. If you were John, would you say

[] You have zero dependents and get back $950 for sure.

[] You have one dependent, in which case you have a 95% chance of getting back $1000, but also a 5% chance of getting back $0.

Gamble scenario Imagine that you face the following two alternatives and you must choose one of them. Which one would you choose?

[] Win $950 for sure.

[] 95% chance to win $1000, $0 otherwise.

Figure 1: Example questions.

Results

We started by plotting the relative frequencies of risk takers in gains and losses for each question separately (Figure 2). When facing losses, clearly far more participants took risks in gamble scenarios than in deception scenarios across all probabilities of losing, and even more so for the higher probabilities. In gains, the risk taking varied with the amount to be gained in both conditions, but more so for gambles in which more participants took risk when facing small rather than large gains with low probabilities, whereas not much difference was seen between scenarios with high probabilities.

First we wanted to ensure that the concepts of gain/loss and gamble/deception really explain the variance in the data. Even if the overall frequency of risk taking is only 28.4%, two-way repeated-measures ANOVA (2 scenario conditions $\times$ 2 outcome conditions) found significant main effects both for gamble (M=6.51)[3] vs. deception (M=2.82), $F(1,671)=666.03$, $p<0.01$, and for gain (M=3.19) vs. loss (M=5.78), $F(1,671)=651.43$, $p<0.01$, as well as an interaction, $F(1,672)=420.11$, $p<0.01$. Pairwise t-tests with Bonferroni adjustment showed that all pairwise differences between these four conditions (i.e., deception gain, M=1.19 (Risk taking score $\in [0,8]$); deception loss, M=1.64; gamble gain, M=2.00; and gamble loss, M=4.50) were significantly different, $p<0.001$.

Risk seeking and risk aversion To see if the data supports the concepts of risk seeking and risk aversion, we applied factor analysis that uses a multidimensional item response model

[3]For each participant we calculated a risk taking score ($\in [0,16]$) as the number of times they chose the risky option in 16 questions.

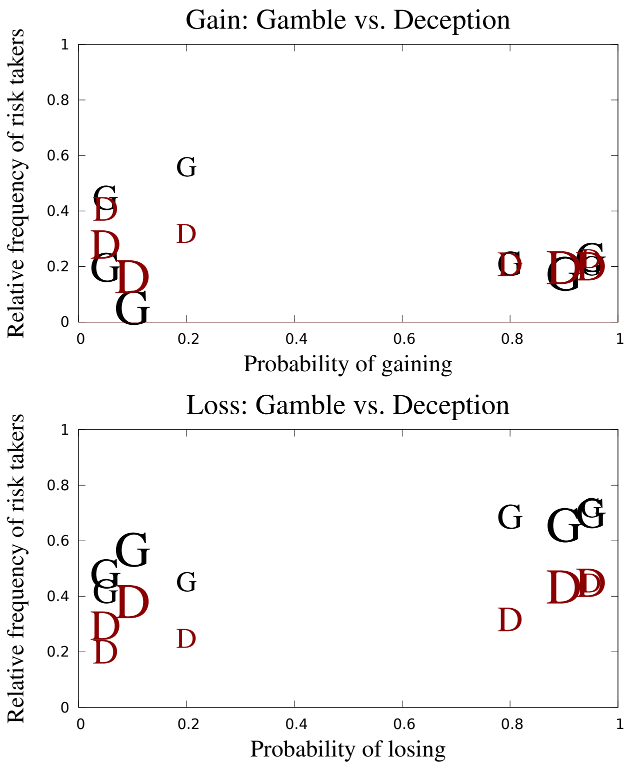

Figure 2: Relative frequencies of risk takers; the larger the icon (G/D), the larger the associated outcome in that question.

Table 2: Promax rotated factor loadings.

p	Question Outcome	$	Gamble F1	Gamble F2	Deception F1
High	Gain	1000	0.174	**0.660**	**0.698**
		20	0.001	**0.406**	**0.773**
		100	0.221	**0.546**	**0.689**
		5000	0.185	**0.614**	**0.664**
High	Loss	1000	**-0.864**	-0.026	**0.867**
		20	**-0.700**	0.050	**0.923**
		100	**-0.840**	0.063	**0.917**
		5000	**-0.797**	-0.021	**0.782**
Low	Gain	1000	**-0.352**	-0.130	**0.816**
		20	**-0.391**	-0.065	**0.900**
		100	**-0.417**	-0.152	**0.839**
		5000	**-0.353**	0.245	**0.717**
Low	Loss	1000	-0.065	**0.686**	**0.651**
		20	-0.260	**0.483**	**-0.820**
		100	-0.091	**0.682**	**0.700**
		5000	-0.180	**0.670**	**0.660**

Items in bold denote the largest factor loading for the question.
p=probability

for binary data. We chose solutions with the smallest number of factors that showed a meaningful structure: a one-factor solution for deception and a two-factor solution for gambles. The Promax rotated factor loadings are shown in Table 2.

For gambles the factor loadings clearly align with the four-fold pattern of risk attitudes, if we interpret the Factor 1 as "risk seeking" and Factor 2 as "risk aversion." Even though not shown in Table 2, a two-factor solution for deception also showed a similar pattern to the gamble data. It thus seems that our participants were driven by the risk attitude in both gamble and deception conditions.

However, as shown in Table 2, just one factor was enough to explain all responses in the deception condition, whereas no such meaningful pattern was detected in the gamble data. It thus seems that in the gamble condition our participants were driven by risk attitudes, but in the deception condition these attitudes were joined by other considerations.

On another note, unlike what would be suggested by the four-fold pattern of risk attitudes, the participants tended to choose the sure option in more than half of the low probability gain questions ($t(671)=18.30$, $p<0.01$). More specifically, their risk taking in this condition was heavily affected by the value of the gamble, so that they were much more willing to trade off a sure $4 for unsure $20 than a sure $500 for unsure $5000, so they gambled in the former case but chose the sure option in the latter. This clearly contradicts what one would expect from the four-fold pattern of risk attitudes, which predicts risk-seeking in all of these cases. We hypothesize that this may be an effect of our participant population, but more rigorous analysis of the difference the amount of money makes in risky and deceptive choices is a subject for future studies.

Risk aversion or deception aversion We have already established that the participants chose less risky options in the deception condition than in the pure gambling condition. However, the interesting question is whether their gambling behavior and deception behavior are statistically related.

We initially run χ^2-analyses to find out if our participants' risk taking in the gamble scenarios and in the corresponding deception scenarios were correlated. For all questions the responses in these two conditions were not independent; the results were very or extremely significant for all questions except high probability loss with risky outcome of $20 (for which it was still significant).

We also conducted another factor analysis for the whole dataset, i.e. gamble and deception responses combined. For the same reason as before, we chose a four-factor model. The Promax rotated factor loadings are shown in Table 3. For each question we chose the factor on which it loaded the strongest. We see Factor 1 appearing as a "deception aversion" factor, and Factor 3 as "risk aversion." Compared to the two-factor solution for gambles, in this solution the "risk seeking" factor is split into two, Factors 2 and 4. Also some questions in deception condition, which are expected to load the strongest on "deception aversion" load strongly on "risk aversion" factor.

We then considered the determinants of deceptive behav-

Table 3: Promax rotated factor loadings.

Question							
D?	*p*	OC	$	F1	F2	F3	F4
Yes	High	Gain	1000	0.355	0.180	**-0.458**	-0.108
			20	**0.539**	0.193	-0.344	-0.088
			100	0.328	0.138	**-0.555**	0.063
			5000	0.324	0.314	**-0.497**	-0.012
Yes	High	Loss	1000	**0.970**	-0.168	0.205	-0.037
			20	**0.956**	-0.043	0.034	0.042
			100	**0.981**	-0.100	0.090	0.061
			5000	**0.907**	-0.223	0.228	0.048
Yes	Low	Gain	1000	**0.750**	-0.158	0.027	-0.124
			20	**0.867**	0.119	0.029	0.002
			100	**0.806**	-0.053	0.076	-0.151
			5000	**0.649**	-0.112	0.016	-0.102
Yes	Low	Loss	1000	0.435	0.051	**-0.475**	0.158
			20	**0.562**	0.080	-0.429	-0.050
			100	0.400	0.205	**-0.411**	0.072
			5000	**0.528**	0.098	-0.322	0.296
No	High	Gain	1000	-0.140	0.117	**-0.844**	-0.188
			20	-0.235	0.042	**-0.601**	-0.363
			100	-0.170	0.203	**-0.693**	-0.136
			5000	-0.083	0.138	**-0.758**	-0.212
No	High	Loss	1000	0.027	**-0.875**	-0.038	-0.240
			20	0.135	**-0.741**	-0.059	-0.115
			100	0.079	**-0.838**	-0.083	-0.193
			5000	0.180	**-0.787**	0.016	-0.104
No	Low	Gain	1000	0.041	-0.104	0.066	**-0.652**
			20	0.043	-0.259	-0.042	**-0.691**
			100	-0.011	-0.260	0.099	**-0.752**
			5000	-0.020	-0.136	-0.229	**-0.518**
No	Low	Loss	1000	-0.105	-0.254	**-0.730**	0.319
			20	-0.135	-0.361	**-0.584**	-0.011
			100	-0.140	-0.289	**-0.745**	0.257
			5000	-0.130	-0.360	**-0.740**	0.253

D?=deception condition(Yes)/gamble condition(No); OC=Outcome. *p*=probability

ior by correlating factor scores of Factor 2 in the gamble data (which we interpreted as "pure" risk aversion) to the factor scores of the four factors in the combined data. The correlations are 0.46 (p<0.01), 0.04 (p = n.s.), 0.75 (p<0.01), and -0.11 (p<0.01) for combined factors 1, 2, 3, and 4, respectively. Note that the correlation to the combined Factor 1 is relatively high even though most questions highly associated with that factor are not highly associated with Factor 2 in gambles.

The factor pattern, together with the correlation of factor scores, suggests that deception aversion does not fully explain the reluctance to choose the risky option in the deception scenarios, but rather that something profound in the risk attitudes also plays a role.

As many as 279 (out of 672) participants never chose the risky option in the deception condition, i.e. they never deceived. We wanted to see how these participants behaved in the gamble condition. The relative risk taking frequencies of non-deceptive and deceptive participants in the gamble questions are plotted in Figure 3 for gains and losses. Compared to the participants who never deceived, the participants who chose at least one risky option in the deception condition also more often chose a risky option in all gamble conditions.

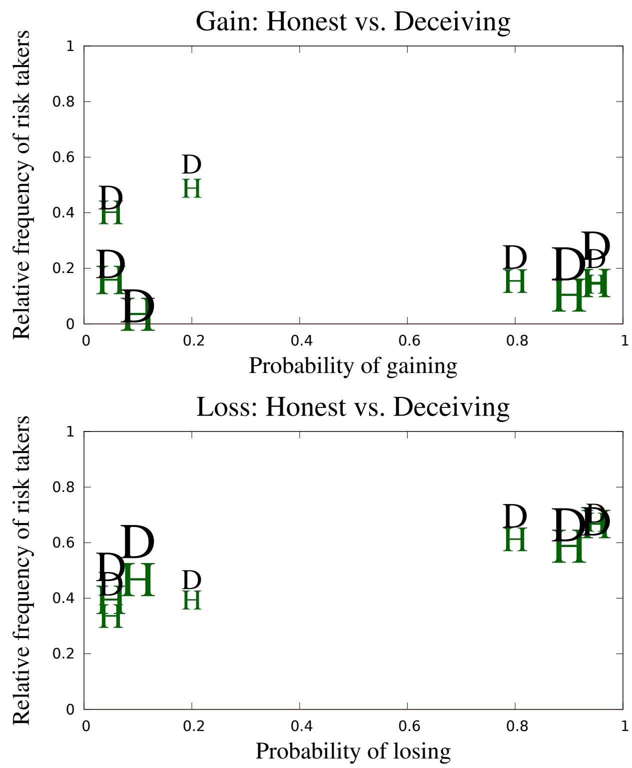

Figure 3: Relative frequencies of risk takers; the larger the icon (H/D), the larger the associated outcome in that question.

To quantify the statistical significance of this observation, we conducted a mixed 2 (never deceived vs. sometimes deceived) $\times$ 4 (four-fold pattern) ANOVA that showed a significant main effect of those who never deceived (M=5.735) (Score $\in$ [0,16]) vs. those who deceived at least once (M=7.056), F(1,672)=36.83, p<0.001. Non-deceiving participants also appeared to be risk averse in gambles.

The factor structure for non-deceiving participants' gamble responses follows the structure for the rest of the participants, shown in Table 2. As the above ANOVA shows, they took significantly fewer risks overall, and more specifically they chose significantly fewer risky options in low probability gain questions (M=1.072) (Score $\in$ [0,4]), compared to the others (M=1.310), F(1,614)=7.6308 (p<0.01). There is something particular in these participants and their responses, which is also reflected in the factor solution (see Table 3): the low probability gain questions are explained by their own factor, separate from the other supposedly risk seeking questions.

Zooming down to the individual question level, a 1-sided proportion test showed a very significant reduction in risk taking for this participant group in all high probability gain questions ($p<0.001$), and also a significant reduction in all low probability loss questions ($p<0.01$). High probability loss and low probability gain groups both contained questions for which the test results were not significant. None of the questions in these groups showed statistically very significant ($p<0.01$) results.

In summary, honest participants chose less risky options in the gamble conditions in which one would expect risk aversion. Compared to the rest of the participants, the honest participants were more risk averse overall, and especially so in conditions in which one would expect risk avoidance.

Discussion

Our central finding is that the participants who always chose the honest option in deception scenarios also displayed a distinctive pattern of behavior in non-deceptive gamble scenarios. They took fewer risks than normal in conditions that normally elicit risky responses, and were also more risk averse than other participants in conditions that normally elicit risk aversion. From this we conclude that it may not be pure lie aversion that determines the likelihood of risky deceptive behavior even in seemingly perfectly lie-averse people, but rather that risk attitude also plays a role. In other words, these "honest" participants may still be driven in part by an unusually strong aversion to risk, rather than purely by aversion to deception itself. Our results also support a (less surprising) generalization about risk-takers, namely that people who tend to take risks under normal conditions also tend to take them in deception context. Together, these results can be summed up as indicating that there is some within participant consistency in risk taking across conditions that do or do not involve deception. In other words, deception aversion cannot be regarded as a "pure" factor, and does not totally overrun risk seeking in the deception domain. However, the nature of our experimental design does not allow a fully conclusive distinction between these two forces. Future studies are planned to address this issue.

Acknowledgments

We are grateful to Ilya Farber for the feedback and suggestions related to this work. We would also like to thank Wan Kum Seong for creating the Qualtrics survey for us, and managing the data collection.

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