Loss Aversion in Social Image Concerns

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Abstract

This paper explores whether loss aversion applies to social image concerns. In a simple model, we combine loss aversion in social image concerns and attitudes towards lying. We then test its predictions in a laboratory experiment. Subjects are first ranked publicly in a social image relevant domain, intelligence. This initial rank serves as within-subject reference point. After subjects have experienced a change in rank over time, they are offered scope for lying to improve their final, publicly reported rank. We find evidence for loss aversion in social image concerns. Subjects who face a loss in social image lie more than those experiencing gains if they care about social image. Individual-level analyses document a discontinuity in lying behavior when moving from rank losses to gains, indicating a kink in the value function for social image. (JEL: C91; D91)

Keywords: Loss aversion; Social image concerns; Lying behavior; Laboratory experiment.

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AEA RCT Registry: https://www.socialscienceregistry.org/trials/3422. Our experimental study complies with the code of conduct for experiments at the DICE Lab. According to rules of Heinrich-Heine-University Duesseldorf, study-specific IRB approval was not required for this study because the experiment did not create any harm or distress beyond participants' everyday experiences and because we comply with German laws, particular legislation pertaining to physical integrity, privacy rights, and data protection. Declaration of interest: none.

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1. Introduction

Humans care how they are perceived by their fellow humans and go a great length to build up a positive image of themselves (e.g., Bénabou and Tirole, 2006; Bursztyn and Jensen, 2017; Andreoni and Bernheim, 2009; Ariely et al., 2009; Soetevent, 2011; Ewers and Zimmermann, 2015). These carefully crafted images are at stake in everyday interaction, and reputation can decline rapidly. Casual observations suggest that when social image is at risk of being lost people engage in lies and denial to maintain it in many domains of economic life. Managers who do not reach expected targets may engage in fraudulent behavior—as happened recently in the manipulation of car emission tests (Aurand et al., 2018). A person losing her job may leave the house everyday pretending to her family that she is still employed. However, the reference point for status loss does not necessarily have to come from own achievements or calamities, it may also be transmitted through generations as a sense of class entitlement (Alsop, 2008). In the 2019 college admission scandal, affluent parents criminally conspired to influence admission decisions of prestigious colleges (Halleck, 2019; Lovett, 2020). While the special role of losses has been extensively documented in the monetary domain (Kahneman and Tversky, 1979; Camerer, 1998; Wakker, 2010; Barberis, 2013), the effect of losses on moral behavior deserves a closer look.

Does trying to shield oneself from a loss in social image generally lead to more morally deviant behavior than striving for a gain in social image? Or is it a particular behavior of those people who are more inclined to immoral decisions that can lead to tragic fall in the first place? Measuring losses of social image is hard to imagine in the field and the extent of lying difficult to observe. Hence, we design a parsimonious laboratory experiment to test for the presence of loss aversion in social image concerns.

To fix ideas, we develop a simple model combining loss aversion in social image concerns and attitudes towards lying to derive testable hypotheses. In the experiment, subjects either experience a potential loss or gain in their social image over time, while keeping average social image constant. We then offer subjects scope for improving their social image by lying about their true type. This allows us to test whether—on average—subjects lie more (and are thus willing to incur higher lying costs) when they experience losses than when they experience gains in their social image.

Our results provide evidence for loss aversion in social image concerns. We find that subjects who sufficiently care about their social image—as measured by an independent survey instrument—lie more when experiencing losses as opposed to similar-sized gains in social image over time. Further individual-level analyses document that the extent of lying decreases discontinuously when moving from small losses to small gains in social image. This pattern in lying behavior is compatible with loss aversion in social image concerns but not a simple concave utility function for changes in social image.

Our main contribution is thus documenting loss aversion in social image concerns. Importantly, our findings imply that loss aversion can also play a role in the non-material domain of social image. So far, loss aversion is widely documented for money (e.g., Booij and Van de Kuilen, 2009; Pennings and Smidts, 2003) and material goods (e.g., Kahneman et al., 1990)[1], but evidence on whether humans have the same inclination when it comes to social image utility is lacking.

Image concerns expand over various domains:[2] People care about being perceived smart and skillful (e.g., Ewers and Zimmermann, 2015; Burks et al., 2013), prosocial and altruistic (e.g., Carpenter and Myers, 2010), pro-environmental (e.g., Sexton and Sexton, 2014) and supportive of fair trade (e.g., Friedrichsen and Engelmann, 2018), trustworthy (Abeler et al., 2019), promise-keeping (Grubiak, 2019), or wealthy (Leibenstein, 1950).

In our experiment, we induce social image concerns by letting subjects perform an IQ test and reporting its results publicly. However, signaling skillfulness can be a two-sided sword as Austen-Smith and Fryer Jr (2005) show in a two-audience signaling model. For example, high ability students may under-invest in education because such investments lead to rejection by their peer group.[3] So it is important to establish that an IQ test is indeed suitable to induce social image that is worth striving for in our university student sample. This is underlined by Ewers and Zimmermann (2015) who document that, in a student sample similar to the one used in this study, subjects misreport their private information on ability in a laboratory context in order to appear more skillful even when strong monetary incentives are given to tell the truth.

While there is plenty of evidence that many people care about social image, recent, both theoretical and empirical work stresses that there is heterogeneity in the extent to which people care about social image and whether they do so at all. For example, Bursztyn and Jensen (2017) expand the model of Bénabou and Tirole (2006) to explicitly account for heterogeneity in social image concerns.[4] Friedrichsen and Engelmann (2018) empirically reject the hypothesis of homogeneous image concerns and show that individuals react differently to image-building opportunities. In our experiment, we will therefore measure each subject's individual extent of social image concerns.

1. See Bleichrodt et al. (2001) for an application to health outcomes.

2. Bursztyn and Jensen (2017) present a detailed overview of the recent literature on social image concerns.

3. Bursztyn et al. (2019) show that students are less likely to sign up for an SAT preparation course and to take an SAT exam itself, if their choices are observable. They therefore forgo educational investment due to possible social stigma.

4. Their theoretical framework distinguishes conformists who experience social pressure to act in a socially desirable way, contrarians who feel pressured to act differently from what is socially desirable, and those who are not subject to social image concerns at all.

On top of addressing image concerns, this study also contributes to the growing literature on lying behavior, extensively summarized in Abeler et al. (2019).[5] Based on a comprehensive meta-analysis, Abeler et al. (2019) identify two main channels why people prefer to tell the truth, namely, lying costs that increase in the size of a lie and image concerns for being perceived as an honest person. Our theoretical framework and experiment design build on their work. First, our experimental design ensures that lying cannot be detected such that image concerns for being seen as an honest person by others cannot play a role in the context of our experiment. Second, in order to avoid possible interactions between loss aversion in the monetary and social image domain, our design offers subjects a flat payment and uses the extent of lying, i.e., the lying costs subjects are willing to incur, to quantify how much they suffer from losing or gain from improving their social image. Therefore, our finding that subjects who care about their social image report more dishonestly than others speaks to situations in which honest reporting of private information is key but not incentive-compatible. Since lying in the laboratory is a predictor of dishonesty and rule violations in real life (Hanna and Wang, 2017; Dai et al., 2018), our findings suggest that monitoring efforts should be targeted at individuals who strongly care about their reputation.

We also relate to the literature which links the concept of loss aversion to lying behavior. Grolleau et al. (2016) and Schindler and Pfattheicher (2017) compare the extent of lying for individuals who face monetary losses and gains. They find that participants misreport more to avoid a monetary loss than they do to increase their monetary gain. Garbarino et al. (2019) show that the less likely a low monetary payoff is, the more likely individuals lie to avoid it. In a series of experiments involving deception, Pettit et al. (2016) show that subjects threatened by status loss cheat more.

The paper proceeds as follows: Section 2 describes the experiment design and procedures, before we outline our hypotheses in Section 3. Results are presented in Section 4 and Section 5 concludes.

2. Experiment design

General setup. Our experiment consists of two stages. Stage 1 is designed to establish a personal reference point for social image utility—a publicly reported rank in an intelligence test—against which subjects can fall short of or improve their image in Stage 2. In the second stage, we induce a change of the rank. Subjects are then informed about their true rank and offered scope to manipulate the reporting of their rank to their peers. We test

5. Abeler et al. (2019) provide a web interface where they present a detailed overview on recent experiments on lying.

whether subjects whose average rank deteriorates—who experience a loss in social image—misreport their rank more strongly than those who experience an improvement in their rank. We pay special attention towards analyzing misreporting behavior around the reference point in social image in order to identify a possible discontinuity in misreporting as predicted by loss aversion.

We create social image concerns through reporting a subject's ranking in a standardized test of fluid intelligence—Raven's Progressive Matrices test (1983)—to two randomly selected peers. Fluid intelligence encompasses logical reasoning and abstract thinking and constitutes an image providing trait for university students.[6] Public reporting of results shall hence create social image utility. In order to strengthen this link we explicitly mention in the instructions that the matrices (labeled as picture puzzles) are designed to measure fluid intelligence, that fluid IQ is an important part of an individual's overall IQ, and that such or related tasks are often employed in recruitment processes.

At the beginning of each session, two subjects per session are randomly assigned the role of peer observers. We randomly draw one observer from all male subjects and the other from all female subjects. This avoids possible gender-specific observer effects. After the observers have been determined, they stand up in front of the other subjects and announce "I am one of the two observers". The other subjects are randomly assigned to one of two sequences that vary the order of the quizzes over the two stages of the experiment. In sequence *HardEasy* subjects work on a *Hard* quiz in Stage 1 and an *Easy* quiz in Stage 2 and in *EasyHard* on an *Easy* quiz in Stage 1 and a *Hard* quiz in Stage 2. At the end of the experiment, all subjects in both sequences have worked on the exactly same 48 matrices. All subjects—including the observers—received the same instructions. Then subjects performed two quizzes (consisting of 24 matrices each) and after each quiz report their relative performance (rank) to the observers. In the second stage, subjects have the possibility to lie in order to improve their rank before reporting it. Figure 1 illustrates the timeline of the experiment that we explain in detail below.

Matrices task and sequences. The original Raven's Progressive Matrices test (RPM) consists of 60 matrices that are divided into 5 equally sized sets (A to E) which increase in difficulty. Figure 2 provides an example of a Raven's Progressive Matrix. Subjects have to choose that box below the picture puzzle which is the best logical fit to the empty box within the picture. Progressive means that the matrices are increasing in difficulty. In our design, we do not use the 12 matrices of the easiest set A since we expect our student subjects to solve them all correctly. We split the remaining 48 matrices in two parts consisting of 24 matrices each that we will use for the quizzes. One quiz is easier (*Easy*), while the other is harder (*Hard*). We calibrated the two sets such that *Hard*

6. Our approach is similar to Falk and Szech (2020), Ewers and Zimmermann (2015), and Burks et al. (2013) who also use reporting of the performance in IQ or knowledge tests to induce image concerns.

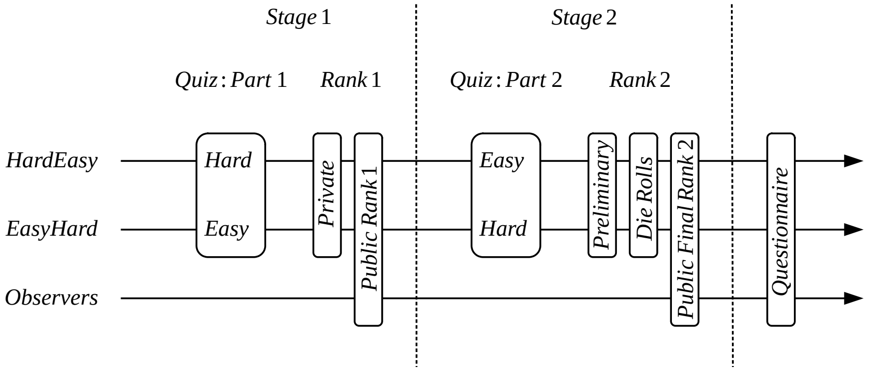


FIGURE 1. Timeline

has a higher likelihood to contain matrices that have been solved by fewer subjects in a reference sample. The reference sample includes 413 observations (students) from a previous experiment which took place at the same lab in 2014. Subjects of the reference group solved exactly the same overall 48 matrices as our subjects.[7] In both quizzes, the difficulty of the tasks is gradually increasing over time. Importantly, both quizzes contain tasks from sets B (easy) to E (difficult) to ensure that subjects do not perceive the difference in difficulty across quizzes as major. Matrices in quiz *Easy* and *Hard* do not repeat or overlap.

Subjects have 30 seconds to work on each matrix. The time limit ensures that performance is comparable across subjects: both within our experiment and with respect to the reference sample we use, in which subjects also had 30 seconds to work on each matrix. On average, it took subjects 11.5 seconds to answer a matrix. 2.7% of answers were provided in the last five seconds and in only 0.7% of cases subjects ran out of time, which suggests that the time limit was not restrictively binding. For each correctly solved matrix, subjects get one point. Wrong answers or no answer within the 30 seconds time limit do not give any points.

Stage 1. After completing the sequence specific Raven's Matrices, subjects received private feedback on their relative performance (i.e., Rank 1) on their screen telling them that "X% of the participants of the reference group have a higher rank than you in Quiz 1". A lower X (lower rank) implies better relative

7. The *Easy* quiz consists of the following matrices: B1, B5, B6, B7, B8, B9, B10, B11, B12, C1, C2, C3, C7, C8, C9, C10, C12, D2, D3, D5, D7, E2, E6, and E11. The *Hard* quiz contains the following matrices: B2, B3, B4, C4, C5, C6, C11, D1, D4, D6, D8, D9, D10, D11, D12, E1, E3, E4, E5, E7, E8, E9, E10, and E12.

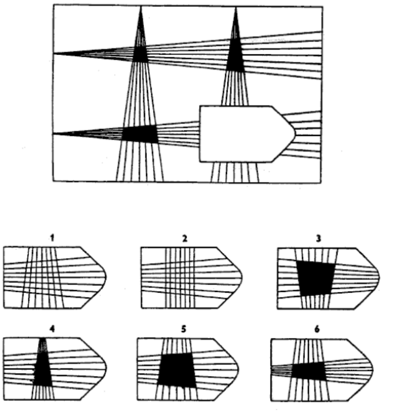


FIGURE 2. Example of a Raven's progressive matrix

performance. The instructions provide several examples how individual rank is calculated and how to interpret it.[8]

To determine the rank, we compare the share of correctly solved matrices among the first 24 matrices to the distribution of the share of correctly solved matrices among all 48 matrices of the reference sample. Our calibration of the matrix distribution between *Easy* and *Hard* ensures that subjects in sequence *EasyHard* will on average rank better than subjects in sequence *HardEasy* in Quiz 1 since both groups are compared to the same reference sample but the first 24 matrices are easier for subjects in sequence *EasyHard* than in *HardEasy*.

Subjects report their rank in the first stage to the observers. This establishes the individual Rank 1 as a personal reference point for social image concerns. Since subjects are randomized into sequences, their initial reference points before the feedback on Rank 1 are the same on average (given skill, ability, etc.). We give both subjects and observers detailed instructions on the reporting procedure to control the reporting process using the same protocol for all sessions. We instruct subjects to fill in report sheets named "Rank 1" and "Rank 2" in Stages 1 and 2, respectively, and to present these sheets to observers who verify the report. No further verbal communication between subjects and observers is allowed, i.e., the entire reporting procedure happens in silence. Report sheets contain two pieces of information: a 4-digit individual

8. We explicitly explain in instructions:
"For example, the statement "9% of participants of the reference group have a higher rank than you in part 1" implies that "9% performed better than you (i.e., they solved a higher share of the overall 48 matrices from part 1 and 2 correctly than you) and 90% worse (i.e., they solved a lower share of the matrices correctly than you). That means you belong to the 10% of best performers in solving the matrices that were designed to measure fluid IQ."

code and a rank. After each Stage, observers see a table on their computer screen in which each individual code corresponds to a rank, and thus can compare the report sheet to the true information from the table. If the reported rank matches the true rank, observers stamp the report sheet to verify it.[9] We organized our laboratory setup in a way that subjects cannot see observers' computer screens while reporting their rank. Additionally, to assure anonymity, we use 4-digit individual codes instead of cubicle numbers which, in the unlikely case of a subject seeing the table on the observer's screen, makes it uninformative.

Stage 2. Subjects work on the remaining 24 matrices. For subjects in sequence *EasyHard*, Stage 2 is more complicated than Stage 1. In expectation, they rank worse than in Stage 1. For subjects in sequence *HardEasy*, rank improves in expectation. We construct a Preliminary Rank 2 by comparing the overall individual correctly solved number of matrices to their distribution in the reference group. After completing the task in this stage, both Rank 1 and the Preliminary Rank 2 are displayed privately to each subject, so that subjects can compare their ranking in the two stages. While average Preliminary Rank 2 (that is calculated based on the performance on the same 48 matrices for all subjects) does not differ systematically across sequences, subjects' average reference point (Rank 1) will be better in sequence *EasyHard* than *HardEasy*. The purpose of the two sequences is thus twofold: first, to add an element of variation to subjects' reference points (Rank 1) in Stage 1 and second, to ensure a balanced data set in which about 50% of subjects will experience losses and gains in social image when moving from Stage 1 to 2.

Die reports. After learning about their ranks, subjects are asked to throw a die twice and report the rolled numbers. The first reported number is then added to the number of correctly solved matrices in the reference group. The second reported number is added to a subject's own number of correctly solved matrices, giving the subjects two ways of cheating on the final reported rank that bear exactly the same consequences for their social image.

We use a modified version of the die roll task by Fischbacher and Föllmi-Heusi (2013).[10] Each subject rolls the die in private in the cubical so that no one, including the experimenters, can observe the actually rolled numbers.[11]

9. Examples of filled in and verified report sheets (in German) as well as their translations to English are shown in Appendix Figures C.1 and C.2 for Ranks 1 and 2, respectively.

10. In Fischbacher and Föllmi-Heusi (2013), subjects roll a die once, report on the rolled number (which does not necessarily need to be the truly rolled number), and are paid according to the reported number (i.e., higher numbers give a higher payoff except for 6, which pays zero). We build on the original die roll task but adjust it for our purposes in two aspects. First, instead of using monetary payoffs, we reward subjects with additional points which add up to the number of correctly solved matrices. Thus, lying enables subjects to improve their rank. Second, our subjects are told to throw the die twice.

11. According to Gneezy et al. (2018), the fact that the experimenter cannot observe participants' true outcomes facilitates lying.

Lying cannot be detected at the individual level in the die roll task. However, the underlying distribution of true die roll outcomes is known such that it can be observed whether and how much subjects lie on average as a group. Hence, we will conduct our main analysis on the group level, e.g., comparing subjects who experience gains and losses in social image.

Building on the work of Abeler et al. (2019), we use lying costs which increase in the size of the lie to quantify utility changes due to changes of social image. Importantly, this approach enables us to isolate loss aversion in social image concerns. If subjects could pay to improve their final reported rank, paying money would induce a loss in the monetary domain and a gain in social image at the same time. Using lying costs to quantify utility changes due to changes of social image instead avoids the additional monetary domain of loss aversion and possible interaction effects with loss aversion in the social image domain that would make it impossible to isolate loss aversion in social image concerns.

Including two die rolls instead of only one has the advantage that subjects are not forced to over-report their Rank 2. With just one die roll, any reported rolled number would result in a better Final Rank 2 than Preliminary Rank 2. With two die rolls, however, a subject's Final Rank 2 can either be better or worse than or equal to the Preliminary Rank 2, depending on whether subjects report a lower, higher or equal number to be added to the own score compared to the number to be added to the reference group's score.

In order to avoid that subjects' lying behavior depends on their beliefs on others' lying and to be able to interpret lying as a reflection of image concerns independent of individual beliefs, it is important to construct a ranking system which compares subjects to a predetermined reference group one by one. In contrast, if we based the ranking system on comparing subjects only within the current experiment (for example, ranking them from best to worst score), there would be an incentive to add a higher number to the own score if subjects expect others to add a high number to their score.

Further remarks. Introducing observers instead of allowing subjects to report their rank to each other has two major advantages. First, our subjects do not get feedback on others' rank which could affect their perception of their own social image. Second, observers only know about the existence of a "further task" on top of the second quiz in Stage 2 and that the score in this task will feed into a subject's Final Rank 2. Observers are not informed about the exact nature of the die roll task, do not know how and to which extent the further task influences final ranks, and this is common knowledge to all subjects.[12] Consequently, subjects do not risk losing social image because of possible reputation cost of being seen as a liar. The remaining subjects receive

12. The role of observers is passive: They are not allowed to communicate with subjects.

the instructions regarding the die roll task on their computer screen after they have worked on Part 2 of the quiz.

Once the reported die rolls have been added and Final Rank 2 calculated, subjects go to observers again and report their Final Rank 2. After Stage 2, observers' information tables include, for each subject, the individual code, Final Rank 2, Rank 1 and the difference between Final Rank 2 and Rank 1. This is common knowledge for all subjects. Reporting procedures are the same as in Stage 1.

Procedural details and implementation. Our experiment design and hypotheses are preregistered on AEA RCT Registry.[13] We conducted our experiment using zTree (Fischbacher, 2007). After two pilot sessions as a prerequisite for power calculations, we run 19 main sessions in the DICE Lab, University of Düsseldorf between November 2018 and November 2019. 383 subjects participated, 38 as observers. Our sample mainly consists of a student population and was recruited using ORSEE (Greiner, 2015). 142 subjects were male, 203 were female. Age varied between 18 and 63 years with a median age of 23 years and 95% of subjects being younger than 33 years. No particular exclusion criteria applied. Subjects were randomized to sequences within each session.

All participants received a flat payment of 12 Euro, but no additional performance-contingent payment for correctly solving the matrices, which was clearly communicated to the subjects. Subjects' behavior thus indicates image concerns as a possible motive for exerting effort on solving the matrices correctly, even if this does not increase their monetary reward. On average, subjects earned €12.65, which includes the €12 flat payment plus one lottery outcome (as described below). In total, the experiment lasted about 90 minutes (including payment).

Post-experimental questionnaire. The questionnaire provides information on socio-economic and demographic characteristics (age, gender, high school GPA, last math grade at school, student status and field of study, previous participation in experiments). It also assessed subjects' general willingness to take risks, based on a question from the German Socio-Economic Panel (GSOEP) questionnaire as well as the importance of social image, using the following question (similar to the one used by Ewers and Zimmermann (2015)): "How important is the opinion that others hold about you to you?". Additionally, following Gächter et al. (2007) and Fehr and Goette (2007), we measure loss aversion in the monetary domain using a set of incentivized lotteries which subjects can choose to accept or decline. Appendix E provides the exact wording of the entire questionnaire.

13. Petrishcheva, Vasilisa, Gerhard Riener, and Hannah Schildberg-Hörisch. 2019. "Loss Aversion in Social Image Concerns." AEA RCT Registry. April 09. https://doi.org/10.1257/rct.3422-5.0.

3. Hypotheses

We derive our hypotheses based on theoretical predictions described in Appendix A. Our model integrates three key psychological features that—up to now have been treated separately—into individual utility: (1) agents gain positive utility from social image, (2) agents experience loss aversion in the social image domain, i.e., losses of social image loom larger than gains of the same size, and (3) agents dislike lying, i.e., they experience costs of misreporting the true state of the world. First, we show that individuals with social image concerns will not under-report, leading to Hypothesis 1.

Hypothesis 1. (Social-image relevance of task)
On average, subjects will weakly over-report their score.

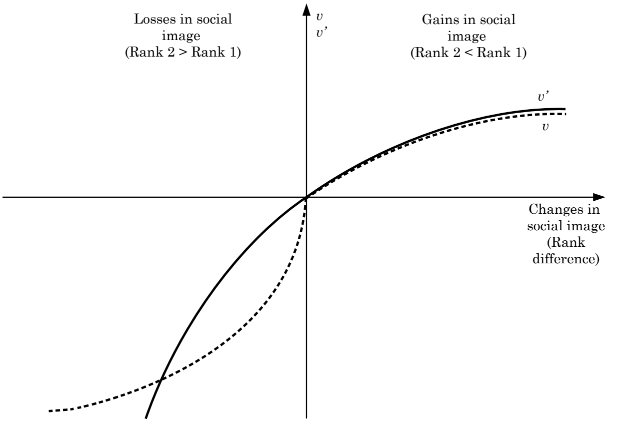
In our experiment design, over-reporting implies that subjects report higher die rolls for themselves than for the reference group to be able to report a better Final Rank 2 to the observers. Since subjects have already been informed about their own Preliminary Rank 2 before their decision which die rolls to report, it seems plausible to assume that subjects can only misreport their rank to the observers but not lie to themselves. Over-reporting then establishes the relevance of social as opposed to self-image concerns for our subjects as a whole.

Hypothesis 2. (Loss aversion in social image concerns)
(a) Losses versus Gains: On average, subjects with sufficiently strong social image concerns over-report more if they experience a loss than a gain in social image.
(b) Discontinuity: There is a discontinuity in the extent of over-reporting at the reference point, i.e., when moving from losses to gains in social image.

Hypothesis 2 follows directly from Proposition A.1. According to Hypothesis 2(a), we expect subjects who experience a loss in social image (i.e., Rank 2>Rank 1) to over-report more than subjects who experience a gain in social image (Rank 2<Rank 1). Over-reporting is reflected in the difference in die roll reports, i.e., the reported number to be added to own performance minus the reported number to be added to the reference group's performance. If, on average, this difference is higher for subjects experiencing losses than gains, this provides first evidence in line with loss aversion in social image concerns: on average, subjects who risk losing social image are ready to lie more than those with social image gains.

However, an alternative explanation for such a pattern is a simple concave utility function for changes in social image, which also implies that losses in social image induce stronger changes in utility than equally sized gains in social image. For an illustration of a standard concave utility function, see the solid, black line in Figure 3. Losses in social image realize if Rank 2 is larger than

Rank 1 that marks the intersection of both axes in Figure 3. In contrast, the dashed line depicts a value function that is compatible with the assumption of loss aversion.



Note: We illustrate possible functions for changes in social image utility as realized at the end of Stage 2: the solid, black line a standard concave utility function v', the dashed line a value function v that is compatible with the assumption of loss aversion. The horizontal axis measures changes in social image. We define Rank 1 and Rank 2 as values between 0 and 100, with lower values corresponding to better performance. Negative values on the horizontal axis are hence realized if Rank 2>Rank 1 and stand for losses in social image, positive values on the horizontal axis are realized if Rank 2<Rank 1 such that subjects experience gains in social image.

FIGURE 3. Illustration of potential utility functions for changes in social image

Hypothesis 2(b) serves the purpose to differentiate between these two competing explanations for evidence in line with Hypothesis 2(a). The hypothesis is derived from a particularity in the shape of the value function as postulated in prospect theory. Figure 3 illustrates the existence of a kink in the value function of social image at a rank difference of zero when Rank 2 coincides with Rank 1. This kink implies a discontinuity in the first derivative of the value function when subjects move from the loss to the gain domain. We thus expect to observe a discontinuity in the extent of over-reporting as well when subjects move from losses to gains in social image. Since the value function's first derivative is higher for losses than gains close to the reference point, over-reporting should decrease. Evidence in line with Hypothesis 2(b) is compatible with loss aversion in social image concerns, but not a concave utility function for changes in social image.

4. Results

We will first establish that the matrices task is a source of social image-concerns, before we analyze how subjects react to losses as opposed to gains in social image.

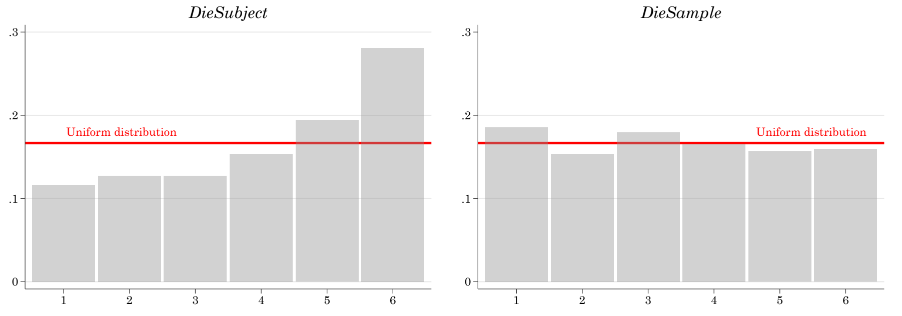
4.1. Social image relevance of the matrices task

Subjects exerted substantial effort on the quizzes. They solved on average 38.8 out of all 48 matrices correctly. No subject solved less than 20 matrices, and more than 90% of subjects gave 34 or more correct answers. Since correct answers are not incentivized monetarily, substantial effort provision suggests image concerns as one of the driving forces behind solving the matrices along with a potential intrinsic motivation for solving this type of tasks.

Subjects reported two values about their die rolls: The variable $DieSubject$ which is added to their own score and the variable $DieSample$ which is added to the scores of all subjects in the reference sample. In the absence of lying, die roll reports for each of the variables should follow a discrete uniform distribution with the support $\{1,\ldots,6\}$ and an average of 3.5. Figure 4 displays histograms of $DieSubject$ (left) and $DieSample$ (right) as well as the probability density function of the uniform distribution (red line). The average of $DieSubject$ is 4.03 and we reject the null hypothesis for the point prediction (t-test, H_0: $DieSubject = 3.5$, $p < 0.0001$).[14] The distribution of $DieSubject$ is also highly significantly different from the discrete uniform distribution (Pearson's χ^2-test, $p < 0.0001$) and left-skewed. In contrast, the average of $DieSample$ is 3.43 which is not significantly different from 3.5 (t-test, $p = 0.4614$). Moreover, the distribution of $DieSample$ does not differ significantly from the discrete uniform distribution (Pearson's χ^2-test, $p = 0.881$).

Subtracting $DieSample$ from $DieSubject$ results in the die roll difference, $DieDiff$, which indicates whether subjects improve or worsen their Final Rank 2 through reporting. The higher $DieDiff$, the better becomes Final Rank 2. In principle, $DieDiff$ can vary between -5 and 5, and, in the absence of lying, follows a discrete binomial distribution with zero mean. Our subjects report an average die roll difference of 0.59 which is highly significantly different from zero (t-test, $p < 0.0001$). As illustrated in Figure 5, the values of 4 and 5 are significantly over-reported (binomial probability tests, two-sided $p = 0.0253$ and $p < 0.0001$ for the values of 4 and 5, respectively). Thus, subjects lie both fully (maximal over-reporting) and partially (less than maximal over-reporting) which is in line with our theoretical predictions in Appendix B and experimental evidence of Gneezy et al. (2018) and Fischbacher and Föllmi-Heusi (2013).

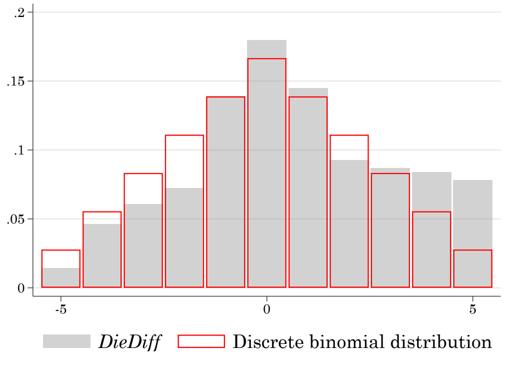
14. Throughout the paper, we report two-sided tests and refer to results as (weakly/highly) significant if the two-tailed test's p-value is smaller than 0.05 (0.10/0.01).



Note: Figures illustrate histograms of *DieSubject* (left) and *DieSample* (right). Horizontal axis indicates reported die rolls (from 1 to 6). Vertical axis indicates the fraction of subjects who reported the respective die rolls. Absent misreporting, die rolls should follow uniform distributions (red lines).

FIGURE 4. Distributions of *DieSubject* and *DieSample* by treatment

Over-reporting high values of $DieDiff$ provides further evidence that subjects perceive our matrices task as image-relevant and additionally shows that *social* image concerns matter: as all subjects know their Preliminary Rank 2, over-reporting their own score is unlikely to improve their self-image.[15]



Note: Figure illustrates histogram of $DieDiff$. Horizontal axis indicates a reported die roll difference (from -5 to 5, higher $DieDiff$ means adding more to one's own score). Vertical axis indicates the fraction of subjects who reported the respective die roll difference. Absent misreporting, die roll difference should follow the discrete binomial distribution (red outlines).

FIGURE 5. Reported die roll difference

RESULT 1. *Subjects report higher die rolls to be added to their own score than expected by rolling a fair die.*

15. Similarly, Burks et al. (2013) conclude that individuals' overstatement of own abilities is more likely induced by social as opposed to self-image concerns.

This first set of results suggests that, on average, public reporting of own performance in the Raven's matrices induces social image concerns and that subjects engage in lying in order to report better ranks to the observers.

4.2. Gains and losses in social image

We now turn to the role of gains and losses in social image for reporting behavior. Obviously, loss aversion in social image can only be observed for those subjects who indeed care about their social image and do so sufficiently to bear the lying costs involved. While we have shown above that many of our subjects do over-report, it is also well documented that people are heterogeneous in the degree of social image concerns (see Bursztyn and Jensen, 2017; Friedrichsen and Engelmann, 2018) and lying costs (Abeler et al., 2019). This is also true in our sample, as Figure C.3 in Appendix C shows.

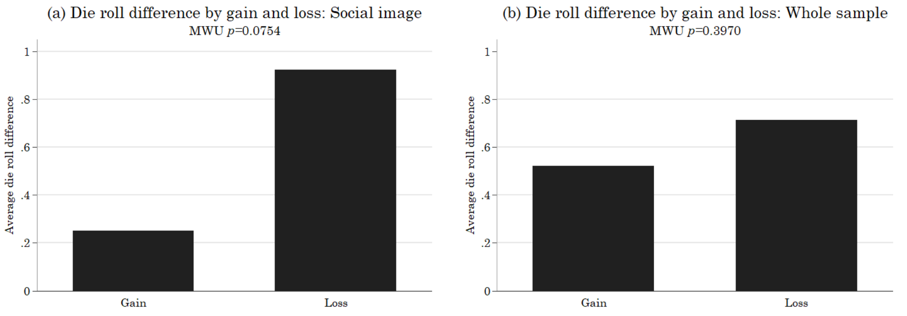
We are particularly interested in testing whether subjects with social image concerns are loss averse in social image. We therefore present two sets of results: (a) evidence from subjects with social image concerns and (b) evidence for our sample as a whole. We classify subjects based on a median sample split on social image concerns as measured at the individual level through our survey instrument: "How important is the opinion that others hold about you to you?" (11-point Likert scale, social image concerns if answer 6 or higher).

We push subjects into the gain or loss domain by randomly varying the sequence in which subjects performed the tasks. In 87.8 percent of the cases, we were successful in inducing losses and gains as intended by the respective sequence.[16] In the following, we will provide evidence based on whether subjects are in the loss or gain domain of social image, our subject of interest.

The gain-loss border. In Figure 6, we compare reported die roll differences for subjects who experience gains and losses in social image. Positive rank differences are labeled as "Gain" indicating better performance in Part 2 than in Part 1, and negative rank differences as "Loss". As illustrated in Figure 6(a), subjects with image concerns who experience a loss in social image misreport more than those who experience a gain (MWU test, $p = 0.0754$), which is in line with Hypothesis 2(a). We see a similar, however statistically insignificant, pattern for the sample as a whole in Figure 6(b), i.e., irrespective of whether subjects care about their social image or not.

Additionally, Figure 7(a) illustrates that for *any* reference point (Rank 1), subjects with image concerns who experience a loss in social image misreport

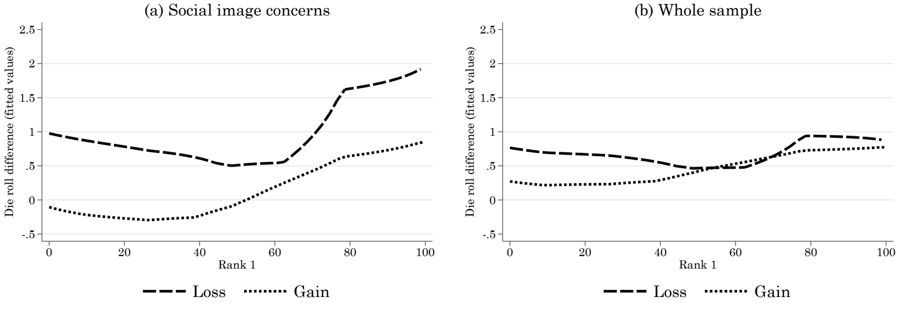
16. There are 10 subjects with a rank difference of zero and 3 subjects with a negative rank difference in *HardEasy*. In *EasyHard*, 20 subjects have a zero rank difference and 19 subjects a positive rank difference. Subjects with a rank difference of zero are assigned to the Gain category. By introducing Gain and Loss, we reassign those overall 42 of 345 individuals to the intended category.



Note: This Figure illustrates reported die roll differences for subjects who experience gains versus losses in social image. Vertical axis indicates average die roll difference (from -5 to 5, higher $DieDiff$ means adding more to one's own score). Absent misreporting, average die roll difference should be zero. Figure (a) shows differences for subjects with social image concerns, while Figure (b) reports differences in the sample as a whole. Above each figure, we report MWU test results comparing distributions of $DiceDiff$ for the respective groups.

FIGURE 6. Reported die roll difference by gains and losses in social image

more than those who experience a gain. Again, we observe a similar, but weaker tendency for all subjects.



Note: Figures (a) and (b) illustrate the dynamics of die roll differences by Rank 1 for different samples: (a) shows subjects with social image concerns and (b) the whole sample. Both Figures display differences between subjects who experience losses versus gains in social image. Fitted values are estimated using Epanechnikov kernels with a bandwidth of 20.

FIGURE 7. Die roll difference by Rank 1

RESULT 2. *On average, subjects with social image concerns over-report more if they experience a loss than a gain in social image.*

Assuming loss aversion in social image concerns and the standard shape of the value function, it is not surprising that differences in misreporting are not that large when comparing rank losses and gains of all sizes. As the value function depicted in Figure 3 illustrates, a further implication of the standard assumptions regarding the value function is that small rank losses and gains will induce the largest marginal changes in social image utility. We thus expect to observe larger differences in misreporting when comparing small losses and gains in rank, but only small differences for larger losses and gains in rank.

In order to differentiate between the two possible explanations of misreporting behavior—a concave utility function for changes in social image concerns versus loss aversion in social image concerns—, we proceed by taking a look at the behavior of subjects close to the gain-loss border. We present results from a regression discontinuity design in Table 1. The regression discontinuity specification maps the first derivative of the value function v which is commonly assumed to be larger for losses than for gains around zero and discontinuous at zero. Allowing for a discontinuity (RD) at a rank difference of zero (i.e., at the origin in Figure 3), we explore whether subjects report systematically different die roll differences when moving from the loss to the gain domain in social image. If we find such a significant discontinuity in the derivative of the value function at the rank difference of zero, the empirical approximation of the value function has a kink—as is generally assumed in prospect theory. In contrast, such a kink is not compatible with a standard concave utility function v' for changes in social image.

Table 1 indeed documents a significant discontinuity at the rank difference of zero, both for subjects with social image concerns and for the sample as a whole. Findings are similar in two different specifications: (i) an RD tobit specification focusing on subjects with rank differences between -10 and 10 in columns (1) and (3) and (ii) the robust procedure of Calonico et al. (2014) (CCT), employing the MSE-optimal bandwidth selection criterion in columns (2) and (4). On average, subjects below the threshold who experience a small loss in social image report 1.2–1.6 higher die roll differences than those above who experience a small gain in social image, see columns (3) and (4) in Panel A. For subjects with social image concerns, this discontinuity is even more pronounced: those below the threshold report on average 1.9–2.0 higher die roll differences than those above, see columns (1) and (2) in Panel A.

The results from the RD design can be interpreted in a causal manner under the assumption that subjects just below and above the threshold (with rank differences of $[-10, 0]$ compared to $(0, 10])$ do not differ systematically in other dimensions than the one that defines the threshold. Using the comprehensive data from our post-experimental questionnaire[17], we establish in Table 2 that subjects do not differ significantly with respect to their extent of social image concerns, loss aversion in the monetary domain, risk aversion, field of study, final GPA at school, and fluid IQ (measured by Preliminary Rank 2).[18] This is

17. Exact variable definitions are provided in Appendix E.

18. The absence of significant differences in Preliminary Rank 2 implies that differences in rank differences are driven by differences in Rank 1. This is exactly what we intended by the design of the two matrix sequences.

Table 1. Regression discontinuity design

	Social image concerns		Whole sample	
	Tobit	CCT	Tobit	CCT
	(1)	(2)	(3)	(4)
Panel A: Without individual characteristics				
RD estimates	1.856***	1.975**	1.205**	1.599**
Clustered Std. Err.	(0.658)	(0.866)	(0.562)	(0.782)
Conventional p-value	0.006	0.023	0.034	0.041
Robust p-value		0.037		0.075
Number of obs.	66	94	123	190
Panel B: With individual characteristics				
RD estimates	2.235***	2.004***	1.228**	1.912**
Clustered Std. Err.	(0.514)	(0.698)	(0.517)	(0.818)
Conventional p-value	0.000	0.004	0.019	0.019
Robust p-value		0.005		0.035
Number of obs.	66	81	123	176

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ based on conventional p-values. Standard errors clustered at the session level in parentheses. Reported estimations in columns (1) and (2) refer to subjects who reported the importance of social image concerns to be 6 or higher and to the whole sample in columns (3) and (4). In columns (1) and (3), we estimate a two-limit tobit model focusing on subjects with rank differences between -10 and 10. In columns (2) and (4), we use local-linear estimators around a rank difference of zero with Epanechnikov kernels, the MSE-optimal bandwidth selection criterion (Calonico et al. (2014), CCT). For CCT, number of observations indicates the number of effective observations for an optimal bandwidth in a given regression. For model (2), total number of observations is 173; for model (4), 345. Individual characteristics include gender, age, squared age, field of study (indicators for economics, psychology as opposed to other), high school GPA, IQ (measured by Preliminary Rank 2) and measures for loss aversion in the monetary domain, intensity of social image concerns, and risk aversion.

true for both subjects with social image concerns and the sample as a whole. Differences in age are significant for the sample with social image concerns only. However, according to the results presented in the online appendix of the meta-analysis of Abeler et al. (2019), age is not a significant predictor of misreporting behavior when controlling for age and age squared as we do in our specifications. There are less female than male participants with rank differences of $[-10, 0]$ compared to $(0, 10]$. If we only consider those subjects with image concerns, the most relevant group under study, the difference in gender composition is no longer significant. Moreover, we do not find significant differences in misreporting by gender in our data.

Table 2. Individual characteristics around the gain-loss border

Rank difference	Social image [-10, 10]	Whole sample [-10, 10]
	(1)	(2)
Social image concerns	0.645	0.404
Loss aversion	0.472	0.186
Risk aversion	0.389	0.398
High school GPA	0.515	0.814
Fluid IQ (Preliminary Rank 2)	0.643	0.508
Field of study: Economics	0.419	0.506
Field of study: Psychology	0.673	0.727
Field of study: Other	0.391	0.376
Gender (1 if female)	0.202	0.020
Age	0.004	0.114

Note: We compare individual characteristics of subjects we use in the RDD (see column (1) of Table 1, i.e., those subjects with rank differences of [-10, 0) who experience a small loss to those with rank differences of [0, 10] who experience a small gain. For gender (1 if female, 0 else) and field of study (1 if economics or psychology or other, respectively, 0 else), we report p-values of Fisher's exact tests and of MWU tests for all other variables. Column (1) refers to subjects who report the importance of social image concerns to be 6 or higher, column (2) to the sample as a whole.

Finally, Panel B of Table 1 that displays the regression discontinuity results when including all control variables confirms the significant discontinuity at the rank difference of zero; estimated coefficients remain rather stable. Subjects who experience a small loss in social image report 1.2–1.9 higher die roll differences than those who experience a small gain in social image; these numbers increase to 2.0–2.2 for subjects with social image concerns. In sum, we thus feel confident that a causal interpretation of our RD estimates is warranted.

Result 3. *We observe a significant discontinuity in over-reporting at the reference point, indicating a kink in the value function for social image as predicted by loss aversion.*

5. Conclusion

Does loss aversion apply to social image concerns? We observe that individuals who care about their reputation lie more if they are threatened by a loss than when facing a gain in social image. Taking a closer look at subjects' behavior when moving from losses to gains in social image, we find a sharp decrease in lying—providing evidence for loss aversion in social image irrespective of the individual extent of social image concerns.

More generally, our findings underline that loss aversion can also play a role in the non-material domain. While loss aversion is a well-established phenomenon for money and material goods (Kahneman et al., 1991), our findings take a first step in a new line of research investigating the relevance of loss aversion to non-material sources of utility such as various drivers of reputation or self-image.

Since our experimental paradigm quantifies utility changes due to changes in social image by the amount of lying that individuals are willing to engage in, our findings also speak to the manifold situations in which honest reporting of private information is of great importance but not necessarily incentive-compatible. Dai et al. (2018) have shown that dishonesty in the lab can predict fraud and rule violation in real life. Our results reveal that individuals who care about their social image tend to report more dishonestly than others when their reputation is at stake. Monitoring efforts should thus be targeted at those individuals. One could also try to make it harder to lie while keeping a good reputation, e.g., via transparency, naming-and-shaming, or reputation systems (see also Abeler et al., 2019).

Finally, we find that the way social image evolves over time affects behavior. While making a decision, this reference-dependence implies that individuals may not only take present or discounted future reputation into consideration, but also account for the history of their social image. Two otherwise identical individuals may thus take opposite actions only due to differences in their social image in the past.

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All material from here on should go into an online appendix.

Appendix A: Theoretical Framework

Our model integrates three key psychological features that — up to now have been treated separately — into individual utility: (1) agents gain positive utility from social image, (2) agents experience loss aversion in the social image domain, i.e., losses of social image loom larger than gains of the same size, and (3) agents dislike lying, i.e., they experience costs of misreporting the true state of the world. We assume that the three components are additively separable.

Consider a two-period decision-making environment where $t \in \{1, 2\}$ indicates the period. In the first period, the agent receives a signal of her type s_1 that is communicated to herself and her peers. One can think of it as her social image relevant performance, and we assume that this signal establishes a reference point concerning her true type.

In the second period, she learns about her true type $\tilde{s}_2$, while peers are only going to see a signal of the true type s_2. This signal can be actively misrepresented in an unverifiable manner by the agent. In each period t, she derives $u(s_t)$ from the signal of her social image, where $u(\cdot)$ is assumed to be linear in s.

We model the cost of misrepresenting the true state following Abeler et al. (2019) and Khalmetski and Sliwka (2019). The true state of the world is $\omega \in [-\overline{\omega}, \overline{\omega}]$. The agent's report of the true state is $r \in [-\overline{r}, \overline{r}]$ with $\overline{\omega} = \overline{r} > 0$. In period $t = 2$, her final public signal s_2 consists of her actual performance $\tilde{s}_2$ plus her report of the true state r ($s_2 = \tilde{s}_2 + r$). The agent dislikes misreporting the true state and experiences lying costs $c(\omega, r)$. Lying costs are zero if the state is reported truthfully, i.e., $c(\omega, \omega) = 0$, and positive otherwise. Lying costs depend on the size of misreporting and are symmetric around ω, i.e., $c(\omega, \omega + a) = c(\omega, \omega - a)$ for all $a \in \mathbb{R}$. Moreover, we assume that lying costs are linear.[19] So we can write $c(\omega, r) = |\omega - r|$.[20] As the agent only makes a choice in period 2, we limit our attention to the utility in the second period:

19. Abeler et al. (2019) assume lying costs to be two-part, including a fixed cost of lying and a cost that is linear in the probability that an agent lied. Our analyses investigate the first-order derivatives and we can omit the fixed cost of lying by focusing on interior solutions, i.e., we consider cases where fixed costs of lying are not high enough to observe only truthful reporting.

20. Note that in our model, agents follow a teleological moral theory that can be seen as a form of act consequentialism. In contrast, agents who adhere to a deontological normative moral reasoning would never engage in lying as it is considered a moral wrong, independent of the cost structure and the other parameters of the model. Also, in contrast to Abeler et al. (2019), we do not model social image concerns of being seen as a liar as we explicitly rule them out in our experimental design.

$$\varphi_2(r) = \theta^{social}[u(\tilde{s}_2 + r) + v(\tilde{s}_2 + r - s_1)] - \theta^{lying}|\omega - r|,$$

which she maximizes with respect to her report r. θ^{social} represents the sensitivity to social image that may differ across agents (Bursztyn and Jensen, 2017). θ^{lying} represents the agent's sensitivity to lying (Gibson et al., 2013). We assume that social image utility is linear. The signals of ability, s_1 and $\tilde{s}_2$ are parameters,[21] hence utility in period 1 is fixed ($\varphi_1 = \theta^{social}u(s_1)$), and we just consider the utility function in period 2 for maximization. We assume the following value function for changes in social image, which has a first derivative that is discontinuous at zero but differentiable otherwise:

$$v(s): \quad v(\Delta) < -v(-\Delta).$$

The value function satisfies the standard assumptions of prospect theory (Kahneman and Tversky, 1979). Negative deviations from the reference point s_1 have a larger absolute impact on utility than equally sized positive deviations, i.e., $v'(\Delta) < v'(-\Delta)$. Additionally, the value function is concave for gains ($v''(\Delta) < 0$ for $\Delta > 0$) and convex for losses ($v''(\Delta) > 0$ for $\Delta < 0$).

The first observation follows directly: An agent without social image concerns never misreports the true state. If $\theta^{social} = 0$, agent's utility in period 2 is reduced to $\varphi_2 = -\theta^{lying}|\omega - r|$, which reaches its maximum when lying costs are minimized, i.e., in the absence of lying. Hence, an agent who does not care about her social image will always report truthfully: $r = \omega$.

From now on, we focus on agents with social image concerns, i.e., $\theta^{social} > 0$. The utility derived from social image is weakly increasing when the agent's report increases ($\partial u(\tilde{s}_2 + r)/\partial r \geq 0$) because the agent obtains positive marginal utility when the signal improves. $\partial v(\tilde{s}_2 + r - s_1)/\partial r > 0$ is independent of whether an agent is in the loss or gain domain (or shifts from the loss to the gain domain) with regard to social image. Lying costs are positive whenever the true state is misreported and $\partial c(\omega, r)/\partial r > 0$ if $\omega < r$ and $\partial c(\omega, r)/\partial r < 0$ if $\omega > r$.

The following observation is straightforward: An agent never underreports the true state. Given the true state ω, an agent always strictly prefers to report $r = \omega$ to any $\tilde{\omega} < \omega$ because under-reporting lowers utility due to three factors. First, an individual obtains weakly lower utility derived from social image: $u(\tilde{s}_2 + \tilde{\omega}) \leq u(\tilde{s}_2 + \omega)$. Second, the level of value function is lower at $\tilde{\omega}$ than at ω for any value of Δ, i.e., $v(\Delta + \tilde{\omega}) < v(\Delta + \omega)$, because $\partial v(\tilde{s}_2 + r - s_1)/\partial r > 0$. Third, reporting $r = \omega$ yields zero lying costs while reporting $\tilde{\omega}$ misreports the true state, which is costly, i.e., $c(\omega, \tilde{\omega}) > c(\omega, \omega)$. Additionally, if $\omega = \overline{\omega}$ and

21. In laboratory experiments, subjects tend to exert close to maximal effort in real-effort tasks (Araujo et al., 2016; Corgnet et al., 2015; Gächter et al., 2016; Goerg et al., 2019). The same is true in IQ tests like the Raven's Progressive Matrices that we will use (Eckartz et al., 2012). Hence, we assume s_1 and $\tilde{s}_2$ to be parameters, not variables.

an agent does not under-report, it directly follows that the agent will report truthfully (i.e., $r = \omega$).

Comparing Gains and Losses. We derive the level of optimal misreporting behavior for agents who experience gains and losses in social image in Appendix B. Our main interest, however, concerns behavior closely around the reference point.

PROPOSITION A.1. *There is more incentive to lie if an agent experiences a loss rather than a gain in social image of the same size. There is a discontinuity in lying at the reference point.*

Proof. We compare cases denoted $(\Delta+\omega)^+$ and $(\Delta+\omega)^-$ in which $(\Delta+\omega)^+ = -(\Delta+\omega)^-$. Those cases are driven by changes in s_1 or ω, i.e., holding $\tilde{s}_2$ constant, and they both imply zero lying costs and symmetry. We assume that an agent makes a lying decision after observing the true state ω. We illustrate the proof in Figure A.1. Since agents will not lie downwards, we only consider the case of $r \geq \omega$. We know that for $r = \omega$ the following holds:

$$v'\left((\Delta+\omega)^+\right) < v'\left((\Delta+\omega)^-\right). \tag{A.1}$$

Moreover, the value function is convex for losses, i.e., for any $a > 0$ it is true that

$$v'\left((\Delta+\omega)^-\right) < v'\left((\Delta+\omega+a)^-\right),$$

and concave for gains, such that

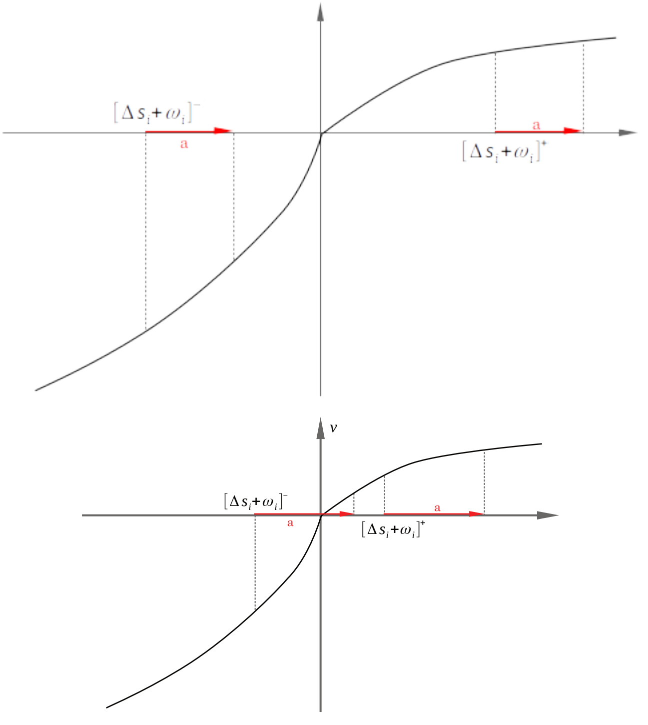
$$v'\left((\Delta+\omega)^+\right) > v'\left((\Delta+\omega+a)^+\right).$$

Then Condition A.1 also holds for $r = \omega + a$:

$$v'\left((\Delta+r)^+\right) < v'\left((\Delta+r)^-\right) \tag{A.2}$$

and therefore reporting $r = \omega + a > \omega$ is more attractive if an agent is in the loss domain than the gain domain. Note that if a is sufficiently large, $v\left((\Delta+\omega)^-\right) < 0$ but $v\left((\Delta+r)^-\right) > 0$ which means that the agent has been in the loss domain before reporting but has entered the gain domain by over-reporting. Condition A.2 still holds in this case. Additionally, as $(\Delta+r) \to 0$, i.e., the change in social image becomes marginal, Condition A.2 still holds strictly. Therefore, we observe a discontinuity in over-reporting at the reference point. □

To summarize, our model predicts that an agent with social image concerns never under-reports the true state. If an agent cares about her social image and the true state is not the best possible, she might engage in misreporting. Importantly, an agent has more incentives to misreport her true state if she



Note: We display a value function that is in line with standard assumptions of prospect theory (Kahneman and Tversky, 1979) to illustrate the intuition of the proof of Proposition A.1. In the top figure, we show the case of sufficiently small a, such that an agent in the loss domain remains in the loss domain after reporting $r = \omega + a$. In the bottom figure, we present a case of a sufficiently large a: In that case, an agent in the loss domain who reports $r = \omega + a$ switches to the gain domain.

FIGURE A.1. Illustration of a value function

experiences a loss in social image than a gain in social image of the same size and we expect to observe a discontinuity in over-reporting at the reference point for social image.

Appendix B: Optimal misreporting

In the following, we analyze behavior with respect to gains and losses in social image. We assume that subjects care about social image — $\theta^{social} > 0$ — and define $\theta = \theta^{lying}/\theta^{social}$ which expresses the agent's relative sensitivity to lying. We restrict the following analysis to over-reporting since we have already established that under-reporting will not occur. Following Fischbacher and Föllmi-Heusi (2013), we study the conditions under which an agent engages in full and partial lying. In the following, we refer to "full lying" whenever an agent reports $r = \overline{\omega} > \omega$ and to "partial lying" whenever an agent reports $\omega < r < \overline{\omega}$.

An agent makes a decision about r by comparing marginal benefits ($\partial u/\partial r + \partial v/\partial r$) and marginal costs θ of misreporting. For $r > \omega$, θ and $u' = \partial u/\partial r$ are constant, so the agent's trade-off boils down to comparing a constant $C = \theta - u'$ to $\partial v/\partial r$, which varies with r.

We discuss all the cases for gains in social image in Appendix B.1 and illustrate them Figure B.1. In Appendix B.2, we consider all the cases for losses in social image and illustrate them in Figure B.2. We display C and $\partial v/\partial r$ on the vertical axis and $r - \omega$ on the horizontal axis. The horizontal axis shows normalized reports: zero on the horizontal axis corresponds to truthful reporting and positive values on the horizontal axis correspond to over-reporting. We denote an interior solution for reporting $\tilde{r}$.

B.1. Gain in social image

What happens if the agent finds herself in the gain domain after learning about her true type $\tilde{s_2}$? Positive misreporting may only further increase the gain in social image, as $\partial v/\partial r$ is positive and $\partial^2 v/\partial^2 r$ is negative. We show that there exist threshold levels of θ that determine the extent of lying. We derive the following proposition:

PROPOSITION B.1. *An agent who experiences a gain in social image*

- *reports truthfully if* $\theta \geq \theta^{true}_{gain}$,
- *lies fully if* $\theta \leq \theta^{full}_{gain}$, *and*
- *lies partially if* $\theta \in (\theta^{full}_{gain}; \theta^{true}_{gain})$.

We provide a case-by-case proof of Proposition B.1 in Lemmas B.1, B.2 and B.3.

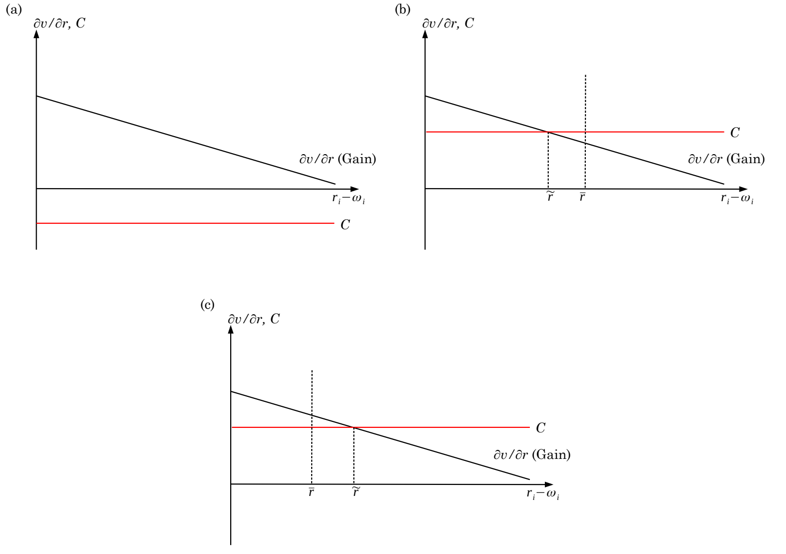
LEMMA B.1. *An agent who experiences a gain in social image lies fully if* $\theta \leq \theta^{full}_{gain}$.

Proof. The agent chooses to lie fully if reporting $r = \overline{r} = \overline{\omega}$ yields marginal costs that are the same or lower than the marginal benefits of lying:

$$\underbrace{\theta - u'}_{C} \leq \underbrace{\frac{\partial v(\tilde{s}_2 + \overline{\omega} - s_1)}{\partial r}}_{\partial v/\partial r}.$$

By rearranging with respect to θ we get

$$\theta \leq \theta^{full}_{gain} = \left(\frac{\partial v(\tilde{s}_2 + r - s_1)}{\partial r} \Big|^{-}_{r=\overline{\omega}} + u' \right).$$



Note: C and $\partial v/\partial r$ are on the vertical axis and the normalized reports $(r - \omega)$ are on the horizontal axis. Zero on the horizontal axis corresponds to truthful reporting and positive values on the horizontal axis correspond to over-reporting. In Figures (a) and (c) we illustrate cases where full over-reporting $(r = \bar{r})$ is optimal. In Figure (b) we illustrate the case where partial over-reporting $(r = \tilde{r} < \bar{r})$ is optimal.

FIGURE B.1. Gain in social image concerns: Partial versus full lying

Since $\partial v/\partial r$ is strictly decreasing for agents who experience a gain in social image and C remains constant, the maximization problem is always concave. Therefore, if the agent is sufficiently insensitive to lying, i.e., $\theta \leq \theta^{full}_{gain}$, she will lie fully $(r = \overline{\omega})$. □

LEMMA B.2. *An agent who experiences a gain in social image reports truthfully if* $\theta \geq \theta^{true}_{gain}$.

Proof. An agent with a gain in social image will engage in misreporting if

$$\theta < \theta^{true}_{gain} = \left(\frac{\partial v(\tilde{s}_2 + r - s_1)}{\partial r}\Big|_{r=\omega} + u' \right).$$

θ^{true}_{gain} indicates a threshold lying sensitivity: An agent with $\theta \geq \theta^{true}_{gain}$ prefers truthful reporting because costs of lying outweigh the benefits of reporting the true state $r = \omega$.

□

Additionally, if the agent's sensitivity to lying is not low enough to lie fully but not high enough to report truthfully, she will engage in partial misreporting.

Lemma B.3. *An agent who experiences a gain in social image lies partially if* $\theta \in (\theta_{gain}^{full}; \theta_{gain}^{true})$.

Results from Lemmas B.1, B.2 and B.3 lead to Proposition B.1.

B.2. Loss in social image

In this subsection, we consider an agent who experiences a loss in social image. Importantly, positive misreporting may lead to various consequences in case of a loss in social image, namely, it may (a) decrease an existing loss in social image, (b) fully eliminate an existing loss in social image and (c) fully eliminate an existing loss and induce a gain in social image. Hence, $\partial v/\partial r$ is discontinuous and consists of two pieces as shown in Figure B.2. The value function is convex in losses. Therefore, for small $(r-\omega)$, $\partial v/\partial r$ is positive and increasing which indicates that the agent moves from a larger loss to a smaller loss in social image. The discontinuity point corresponds to the social image loss being fully eliminated by overreporting such that the agent does neither experience a loss nor a gain in the social image domain. However, increasing $(r-\omega)$ even more puts the agent in the gain domain in social image. The value function is concave for gains in social image, hence, $\partial v/\partial r$ remains positive but becomes decreasing. In the gain domain, lying becomes instantly relatively less attractive due to discontinuity of the value function at the reference point. We derive the following conditions for lying:

Proposition B.2. *An agent who experiences a loss in social image*

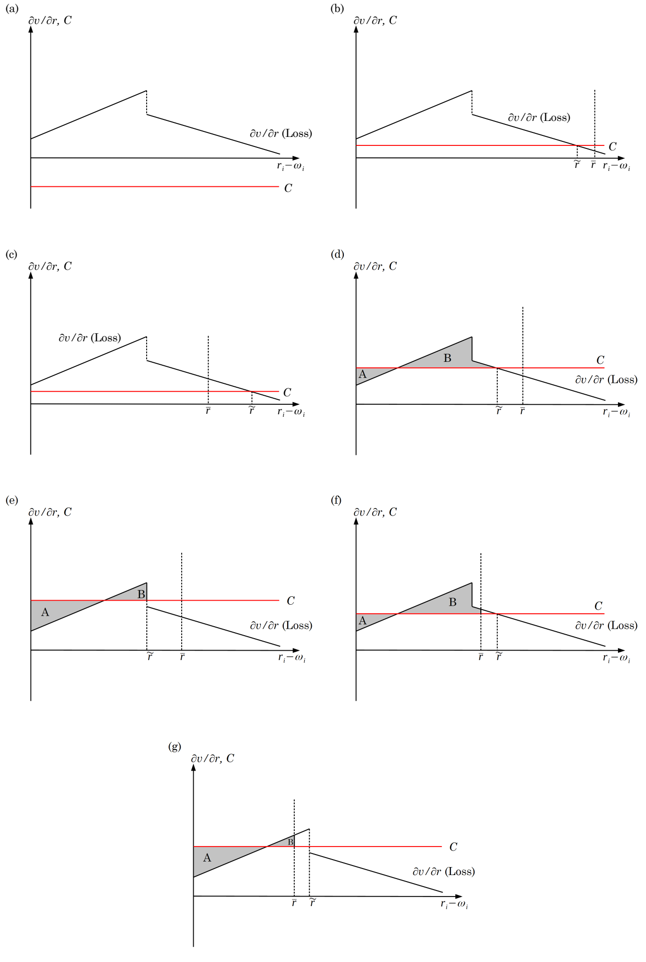
- *reports truthfully if* $\theta \geq \theta_{loss}^{true}$ *or* $\varphi_2(\omega) \geq \varphi_2(\tilde{r})$,
- *lies fully if* $\theta < \theta_{loss}^{full}$ *or* $\varphi_2(\omega) < \varphi_2(\bar{r})$, *and*
- *lies partially otherwise.*

We discuss agents' incentives to lie case by case. First, we consider a case with $C \leq 0$ as shown in Figure B.2(a).

Lemma B.4. *If* $C \leq 0$, *an agent who experiences a loss in social image lies fully.*

Proof. C is non-positive whenever the marginal utility gain from misreporting u' outweighs the marginal lying costs θ even without taking into consideration additional marginal benefits from the value function $\partial v/\partial r$. Therefore, lying comes at relatively low costs and the agent chooses to misreport maximally. Her optimal report is then $r = \bar{\omega}$. □

Next, we consider a case shown in Figures B.2(b) and B.2(c), namely, $C(r=\omega) \leq \partial v/\partial r(r=\omega)$.



Note: C and $\partial v/\partial r$ are on the vertical axis and the normalized reports $r - \omega$ are on the horizontal axis. Zero on the horizontal axis corresponds to truthful reporting and positive values on the horizontal axis correspond to over-reporting. In Figure (a) we illustrate the case where $C \leq 0$ and full over-reporting is optimal. Figure (b) shows the case with $C \in (0, \partial v/\partial r(r = \omega)]$ and $\bar{r} \geq \tilde{r}$, where partial over-reporting is optimal. Figure (c) shows the case with $C \in (0, \partial v/\partial r(r = \omega)]$ and $\bar{r} < \tilde{r}$, where full over-reporting is optimal. In Figures (d)-(g), we present cases with $C \in (\partial v/\partial r(r = \omega), \partial v/\partial r(r = s_1 - \tilde{s}_2)]$. We highlight areas A and B to demonstrate the intuition for identifying the global maximum, i.e., the comparison of $\varphi_2(\omega)$ and $\varphi_2(\tilde{r})$. In Figure (d), it is optimal to over-report partially because $\tilde{r} < \bar{r}$ and $\varphi_2(\omega) < \varphi_2(\tilde{r})$ (area A is smaller than area B). In Figure (e), it is optimal to report truthfully because $\tilde{r} < \bar{r}$ and $\varphi_2(\omega) \geq \varphi_2(\tilde{r})$ (area A is larger than area B). In Figure (f), agents' optimal strategy is to over-report fully because $\tilde{r} \geq \bar{r}$ and $\varphi_2(\omega) < \varphi_2(\bar{r})$ (area A is smaller than area B). Finally, in Figure (g), the optimal strategy is to report truthfully because $\tilde{r} \geq \bar{r}$ and $\varphi_2(\omega) \geq \varphi_2(\bar{r})$ (area A is larger than area B).

FIGURE B.2. Loss in social image concerns: Partial versus full lying

LEMMA B.5. *If $C \in (0, \partial v/\partial r(r = \omega)]$, an agent who experiences a loss in social image lies fully if $\bar{r} \leq \tilde{r}$, and lies partially otherwise.*

Proof. For any $r < \tilde{r}$, $\partial v/\partial r$ is always larger than C and hence $r = \tilde{r}$ is a global maximum. If $\tilde{r} \leq \bar{r}$ as in Figure B.2(b), the agent reports $r = \tilde{r}$. Otherwise, she chooses the highest possible report $r = \bar{r}$ as in Figure B.2(c). □

We proceed to cases shown in Figures B.2(d)-B.2(g). The results are summarized in the following Lemma:

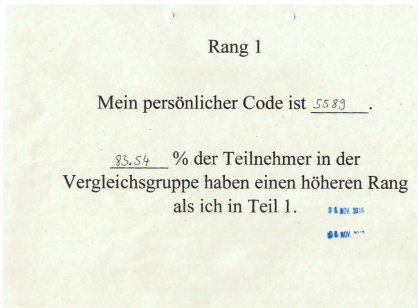
LEMMA B.6. *If $C \in (\partial v/\partial r(r = \omega), \partial v/\partial r(r = s_1 - \tilde{s}_2)]$, an agent who experiences a loss in social image reports truthfully if $\varphi_2(\omega) \geq \min(\varphi_2(\tilde{r}); \varphi_2(\bar{r}))$, lies fully if $\varphi_2(\omega) < \varphi_2(\bar{r})$ and $\tilde{r} \geq \bar{r}$, and lies partially otherwise.*

Proof. For $C \in (\partial v/\partial r(r = \omega), \partial v/\partial r(r = s_1 - \tilde{s}_2)]$, we can no longer be sure that reporting $\tilde{r}$ or $\bar{r}$ yields the global maximum because $\partial v/\partial r$ is no longer larger than C for any $r < \tilde{r}$. In contrast, the agent strictly prefers truthful reporting to ε-misreporting. Hence, we should (a) consider whether the agent is able to report $\tilde{r}$ and can only report at most $\bar{r}$, and (b) additionally focus on whether she chooses the optimal misreporting or no misreporting at all.

If $\tilde{r} \leq \bar{r}$, the agent faces a trade-off between reporting truthfully $(r = \omega)$ and lying partially $(r = \tilde{r})$. She chooses to report truthfully if $\varphi_2(\omega) \geq \varphi_2(\tilde{r})$. If $\tilde{r} > \bar{r}$, the agent has a choice between full overreporting $(r = \bar{r})$ and truthful reporting $(r = \omega)$. Analogously, she reports truthfully if $\varphi_2(\omega) \geq \varphi_2(\bar{r})$. □

Finally, taking all the cases from Lemmas B.4, B.5 and B.6 into consideration, we formulate Proposition B.2. The thresholds θ^{true}_{loss} and θ^{full}_{loss} are derived analogously to θ^{true}_{gain} and θ^{full}_{gain}. However, since these thresholds depend on changes in social image, we mark them “gain” and “loss” to indicate that this difference.

Appendix C: Additional Figures



Rang 1

Mein persönlicher Code ist 5589.

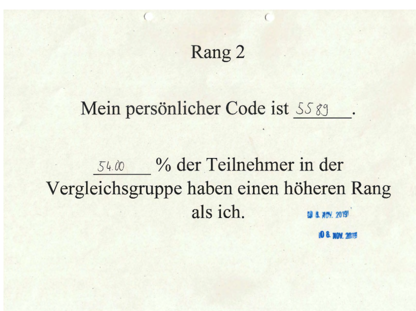
83.54 % der Teilnehmer in der Vergleichsgruppe haben einen höheren Rang als ich in Teil 1.

Rank 1

My individual code is ______.

______ % of the participants of the reference group have a higher rank than me in part 1.

FIGURE C.1. Rank 1 report sheet (original in German and translated to English)



Rang 2

Mein persönlicher Code ist 5589.

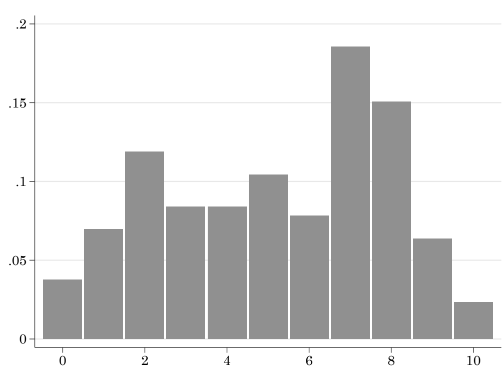
54.00 % der Teilnehmer in der Vergleichsgruppe haben einen höheren Rang als ich.

Rank 2

My individual code is ______.

______ % of the participants of the reference group have a higher rank than me.

FIGURE C.2. Rank 2 report sheet (original in German and translated to English)



Note: Importance of social image concerns is measured on a 11-point Likert scale based on the question "How important is the opinion that others hold about you to you?".

FIGURE C.3. Self-reported importance of social image

Appendix D: Instructions of the Experiment

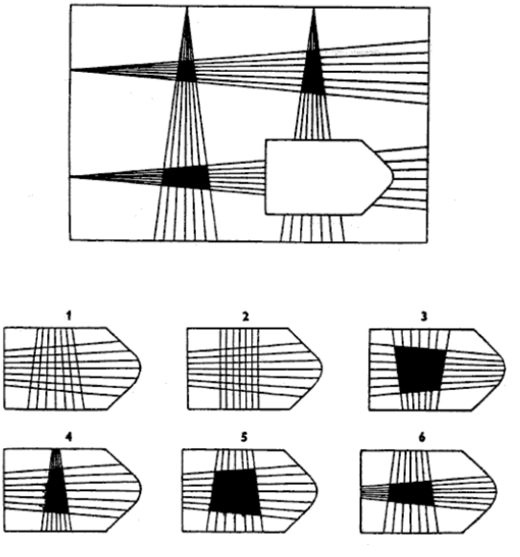
D.1. English

General Instructions

We warmly welcome you to this economic experiment. Please read the following instructions carefully! If you have any questions, please raise your hand from the cubicle—we will then come to your seat. It is not allowed to talk to other participants of the experiment, use mobile phones or start other programs on the computer during the experiment. Non-compliance with these rules will result in exclusion from the experiment and all payments. You will receive a fixed payment of €12 for participating in this experiment, which will be paid in cash at the end of the experiment. On the following pages we describe the exact procedure of the experiment.

Part 1 of the Experiment

Parts 1 and 2 consist each of 24 tasks, which are often used to measure so-called fluid intelligence of a person. The fluid intelligence is an important part of the general intelligence of humans. These or similar tasks are also often used by companies in the context of recruitment procedures. Each task corresponds to a picture puzzle. Here you can see an example:



Each picture puzzle shows in its upper part a pattern in a box, in which a "piece of the puzzle" in the lower right corner is left out. Your task is to select one of the puzzle pieces listed below the box, which will logically fill the blank lower right corner of the pattern in the box. Please enter the number of the puzzle piece that you think fits best on the screen. The number of a puzzle piece is stated above each puzzle piece. There is always exactly one piece that fits best.

You have 30 seconds to complete each picture puzzle. For each correctly completed picture puzzle you receive one point. As commonly done with intelligence tests, correct answers are not paid extra. You will receive 0 points for each wrongly answered picture puzzle or if you do not enter the best fitting piece of the puzzle within 30 seconds.

After you have completed all 24 picture puzzles in Part 1, you will first receive a private feedback on your rank on the computer screen, indicating how well you performed in solving the picture puzzles. The feedback has the following form: "X % of the participants of the reference group have a higher rank than you in Part 1". The reference group consists of 413 participants of a previous laboratory experiment conducted in 2014 here at the DICE Lab of the University of Düsseldorf, who have worked on the same picture puzzles as you do in the course of this experiment. So the feedback "9% of the participants of the reference group have a higher rank than you in Part 1" means that 9% performed better than you (i.e., solved a higher percentage of the total 48 picture puzzles from Parts 1 and 2 correctly than you) and 90% performed worse (i.e., solved a lower percentage of picture puzzles correctly than you). So you belong to the 10% of the best at answering the picture puzzles designed to measure individual fluid intelligence. The feedback "83% of the participants of the reference group have a higher rank than you in Part 1" means that 83% performed better and 16% worse than you. So you are among the 17% of the worst in answering the picture puzzles.

Before Part 2 of the experiment starts, you have to inform two so-called "Observers" about your performance in the experiment. Please use the report sheet available in your cubicle. Your cubicle number is already entered. Please enter legibly the number, which you received as feedback on the computer screen, in the sentence "__ % of the participants of the reference group have a higher rank than me in Part 1" in the report sheet "Rank 1". Please enter your personal code, which is also displayed on the screen, in the free field next to it: "My personal code is __". Observers sit in the cubicles number 1 and 2 in the laboratory (directly in front of the entrance door). Please go there with the completed report sheet and show it silently to Observers as soon as your cubicle number is called by the experimenter. This ensures that each participant informs Observers individually without other participants knowing her/his rank. A two-column table will be displayed on the Observers' computer screens, assigning each personal code the corresponding rank in Part 1. Each Observer will silently compare your report sheet with the information in the table and stamp it. Afterwards, please return to your cubicle in silence. Part 2 of the experiment will begin as soon as all participants have informed Observers of their rank.

The Different Participants in the Experiment

At the beginning of the experiment, each participant randomly drew a chip with a number indicating his cubicle number. The cubicle numbers have the following additional meaning: The participants who have randomly drawn cubicle numbers 1 and 2 have the role of "Observers" described above. Since the chips with even numbers were reserved for female participants and the chips with odd numbers for male participants, there is always one male Observer and one female Observer. These will introduce themselves to you shortly before the actual experiment begins by standing up and saying "I am one of the two Observers". Observers—just like all other participants—will receive this printed explanation of the rules of the experiment, which you are reading, for information about the experiment.

All other participants in the experiment with cabin numbers 3 or higher solve the picture puzzles described above. Each participant is randomly assigned to one of two groups: Group A or Group B. Throughout the whole experiment, all participants of both groups will solve exactly the same 48 picture puzzles, 24 in Part 1 and 24 in Part 2. The further task in part 2 of the experiment is also exactly the same for both groups. Only the order in which the picture puzzles are processed differs between group A and B. The group membership has no further meaning. In Parts 1 and 2 you belong to the same group.

Part 2 of the Experiment

Part 2 of the experiment is very similar to Part 1. First you work on 24 more picture puzzles following the same rules (30 seconds time per puzzle, 1 point for correct answers, 0 points otherwise, etc.). After you have completed remaining 24 picture puzzles in Part 2, you will receive a private feedback on your preliminary rank in Part 2 on the computer screen, indicating how well you have done in the 48 picture puzzles in Parts 1 and 2. The feedback again has the following form: "X% of the participants of the reference group have a higher rank than you". The reference group is again the 413 participants of a previous lab experiment here in the DICE Lab of the HHU from 2014, who have solved the same 48 picture puzzles as you. In addition, the rank you had in Part 1 of the experiment is displayed as a reminder.

The only difference to Part 1 is that you have one more task, which is also used to calculate your final rank in Part 2. You will then receive a private feedback on your final rank in Part 2, which is calculated based on the 48 picture puzzles in Parts 1 and 2 and your score in the further task in Part 2. Details of the further task and how exactly it is included in the calculation of the final rank in Part 2 will be explained on the computer screen during the course of the experiment. For calculation of your final rank the same reference group is used again as for your rank in Part 1 and the preliminary rank in Part 2. The detailed explanations of the further task in Part 2 are given only to the participants, but not to the two Observers.

Just like at the end of Part 1, you still have to inform the two Observers about your performance, i.e., your final rank, in Part 2. Please use the report sheet which is available in your cubicle. In addition, under "Rank 2", please enter legibly in the sentence "__ % of the participants of the reference group have a higher rank than me", which you have received as feedback on your final rank on the computer screen. Please go to two Observers with the completed report sheet and show it to them in silence as soon as your cubicle number is called up by an experimenter. This again ensures that each participant informs Observers individually without the other participants knowing her/his rank. A table with four columns is now displayed to Observers on your computer screen, which assigns to each personal code the corresponding rank in Part 1, the final rank and the difference in rank between the rank in Part 1 and the final rank.

The observers will, also in silence, compare your report sheet with the information in the table and stamp it. Afterwards, please return to your cabin in silence.

End and Payment of the Experiment

After Part 2 of today's experiment, there will be some more screens with questions before we proceed to the payment of €12. We will call you individually by cubicle number for payment. If you have any questions now, please raise your hand out of the cubicle. Experiment supervisor will then come to your seat to answer your questions. Do not ask questions out loud!

D.2. German (original)

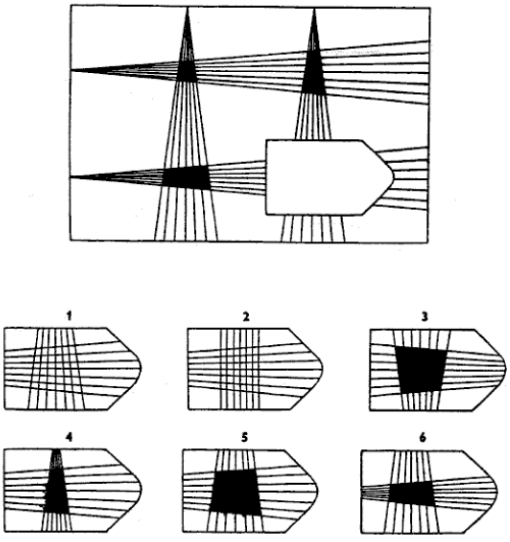
Allgemeine Erklärungen

Wir begrüßen Sie herzlich zu diesem wirtschaftswissenschaftlichen Experiment. Lesen Sie die folgenden Erklärungen bitte gründlich durch! Wenn Sie Fragen haben, strecken Sie bitte Ihre Hand aus der Kabine – wir kommen dann zu Ihrem Platz. Während des Experiments ist es nicht erlaubt, mit den anderen Experimentteilnehmern zu sprechen, Mobiltelefone zu benutzen oder andere Programme auf dem Computer zu starten. Die Nichtbeachtung dieser Regeln führt zum Ausschluss aus dem Experiment und von allen Zahlungen. Für die Teilnahme an diesem Experiment erhalten Sie pauschal 12 Euro, die Sie am Ende dieses Experiments bar ausbezahlt bekommen. Auf den nächsten Seiten beschreiben wir den genauen Ablauf des Experiments.

Teil 1 des Experiments

In Teil 1 und 2 bearbeiten Sie jeweils 24 Aufgaben, die oft verwendet werden, um die sogenannte fluide Intelligenz eines Menschen zu bestimmen. Die fluide Intelligenz ist ein wichtiger Bestandteil der allgemeinen Intelligenz des Menschen. Oft werden solche oder ähnliche Aufgaben auch im Rahmen von Einstellungsverfahren von Unternehmen verwendet. Jede Aufgabe entspricht einem Bilderrätsel. Hier sehen Sie ein Beispiel:

Jedes Bilderrätsel zeigt in seinem oberen Teil ein Muster in einem Kasten, in dem unten rechts ein "Puzzlestück" ausgelassen ist. Ihre Aufgabe ist es, eines der unterhalb des Kastens aufgeführten Puzzlestücke auszuwählen, das die leere, untere rechte Ecke des Musters im Kasten logisch passend füllt. Bitte geben Sie dazu die Nummer des Puzzlestücks, das Ihrer Meinung nach am besten passt, auf dem Bildschirm ein. Die Nummer eines Puzzlestücks steht



oberhalb jedes Puzzlestücks. Es gibt immer genau ein am besten passendes Puzzlestück.

Für die Bearbeitung eines Bilderrätsels haben Sie jeweils 30 Sekunden Zeit. Für jedes richtig beantwortete Bilderrätsel erhalten Sie einen Punkt. Wie dies bei Intelligenztests üblich ist, werden richtige Antworten nicht extra bezahlt. Sie erhalten 0 Punkte für jedes falsch beantwortete Bilderrätsel oder falls Sie innerhalb der 30 Sekunden keine Eingabe zum Ihrer Meinung nach am besten passenden Puzzlestück machen. Nachdem Sie alle 24 Bilderrätsel in Teil 1 bearbeitet haben, erhalten Sie auf dem Computerbildschirm zunächst ein privates Feedback zu Ihrem Rang, der angibt, wie gut Sie bei den Bilderrätseln abgeschnitten haben. Das Feedback hat die folgende Form: "X % der Teilnehmer in der Vergleichsgruppe haben einen höheren Rang als Sie in Teil 1". Die Vergleichsgruppe sind dabei 413 Teilnehmer an einem vorherigen Laborexperiment hier im DICE Lab der HHU aus dem Jahr 2014, die dieselben Bilderrätsel bearbeitet haben, wie Sie es im Laufe dieses Experiments tun. Das Feedback "9 % der Teilnehmer in der Vergleichsgruppe haben einen höheren Rang als Sie in Teil 1" bedeutet also, dass 9 % besser abschneiden als Sie (d.h. einen höheren Anteil der gesamten 48 Bilderrätsel aus Teil 1 und 2 korrekt gelöst haben als Sie) und 90 % schlechter (d.h. einen niedrigen Anteil an Bilderrätseln korrekt gelöst haben als Sie). Sie gehören also zu den 10 % der Besten beim Beantworten der Bilderrätsel, die konzipiert wurden, um die individuelle fluide Intelligenz zu messen. Das Feedback "83 % der Teilnehmer in der Vergleichsgruppe haben einen höheren Rang als Sie in Teil 1" bedeutet, dass 83 % besser abschneiden als Sie und 16 % schlechter. Sie gehören also zu den 17 % der Schlechtesten beim Beantworten der Bilderrätsel.

Bevor Teil 2 des Experiments beginnt, müssen Sie noch zwei sogenannte "Beobachter" über Ihr Abschneiden im Experiment informieren. Bitte verwenden Sie dazu das DIN-A4-Blatt, das in Ihrer Kabine bereitliegt. Ihre Kabinennummer ist bereits eingetragen. Bitte tragen Sie unter "Rang 1" gut leserlich die Zahl in den Satz ein "__ % der Teilnehmer in der Vergleichsgruppe haben einen höheren Rang als ich in Teil 1", die Sie als Feedback auf dem Computerbildschirm erhalten haben. Tragen Sie bitte Ihren persönlichen Code, der ebenfalls auf dem Bildschirm angezeigt wird, daneben in das freie Feld ein: "Mein persönlicher Code ist __". Die Beobachter sitzen in den Kabinen mit Nummer 1 und 2 im Labor (direkt gegenüber der Eingangstür). Bitte gehen Sie mit dem ausgefüllten DIN-A4-Blatt dorthin und zeigen es schweigend den Beobachtern, sobald Ihre Kabinennummer vom Experimentator aufgerufen wird. So wird sichergestellt, dass jeder Teilnehmer die Beobachter einzeln informiert, ohne dass die anderen Teilnehmer seinen Rang erfahren. Den Beobachtern wird auf ihrem Computerbildschirm eine Tabelle mit zwei Spalten angezeigt, die jedem persönlichen Code den entsprechenden Rang in Teil 1 zuordnet. Beide Beobachter werden, ebenfalls schweigend, Ihr DIN-A4-Blatt mit den Angaben in ihrer Tabelle vergleichen und jeweils abstempeln. Bitte begeben Sie sich dann schweigend wieder zurück in Ihre Kabine. Teil 2 des Experiments beginnt, sobald alle Teilnehmer die Beobachter über ihren Rang informiert haben.

Die verschiedenen Teilnehmer am Experiment

Zu Beginn des Experiments hat jeder Teilnehmer zufällig einen Chip mit einer Zahl gezogen, die seine Kabinennummer angibt. Die Kabinennummern haben folgende weitere Bedeutung: Die Teilnehmer, die zufällig die Kabinennummern 1 und 2 gezogen haben, haben die Rolle der oben beschriebenen "Beobachter". Da die Chips mit den geraden Zahlen für die Frauen und die Chips mit den ungeraden Zahlen für die Männer reserviert waren, gibt es immer jeweils einen männlichen Beobachter und eine weibliche Beobachterin. Diese werden sich vor Beginn des eigentlichen Experiments kurz bei Ihnen vorstellen, in dem sie aufstehen und sagen "Ich bin eine/r der beiden Beobachter". Die Beobachter erhalten—genau wie die anderen Teilnehmer—diese ausgedruckte Erklärung der Regeln des Experiments, die Sie gerade lesen, zur Information über das Experiment.

Alle anderen Teilnehmer am Experiment mit den Kabinennummern 3 oder höher lösen die oben beschriebenen Bilderrätsel. Dabei wird jeder Teilnehmer zufällig einer von zwei Gruppen zugelost: Gruppe A oder Gruppe B. Im Laufe des gesamten Experiments bearbeiten alle Teilnehmer beider Gruppen exakt dieselben 48 Bilderrätsel, jeweils 24 in Teil 1 und 24 in Teil 2. Auch die weitere Aufgabe in Teil 2 des Experiments ist exakt dieselbe für beide Gruppen. Nur die Reihenfolge, in der die Bilderrätsel bearbeitet werden, unterscheidet sich zwischen Gruppe A und B. Eine weitere Bedeutung hat die Gruppenzugehörigkeit nicht. In Teil 1 und 2 gehören Sie zu derselben Gruppe.

Teil 2 des Experiments

Teil 2 des Experiments ist Teil 1 sehr ähnlich. Zunächst bearbeiten Sie 24 weitere Bilderrätsel nach denselben Regeln (30 Sekunden Zeit pro Rätsel, 1 Punkt für richtige Antworten, 0 Punkte sonst etc.). Nachdem Sie die weiteren 24 Bilderrätsel in Teil 2 bearbeitet haben, erhalten Sie auf dem Computerbildschirm zunächst ein privates Feedback zu Ihrem vorläufigen Rang in Teil 2, der angibt, wie gut Sie bei den insgesamt 48 Bilderrätseln in Teil 1 und 2 abgeschnitten haben. Das Feedback hat wieder die folgende Form: "X % der Teilnehmer in der Vergleichsgruppe haben einen höheren Rang als Sie." Die Vergleichsgruppe sind dabei wieder die 413 Teilnehmer an einem vorherigen Laborexperiment hier im DICE Lab der HHU aus dem Jahr 2014, die dieselben 48 Bilderrätsel bearbeitet haben wie Sie. Außerdem wird zur Erinnerung angezeigt, welchen Rang Sie in Teil 1 des Experiments hatten.

Der einzige Unterschied zu Teil 1 ist, dass Sie eine weitere Aufgabe haben, die auch in die Berechnung Ihres finalen Rangs in Teil 2 einfließt. Anschließend erhalten Sie ein privates Feedback zu Ihrem finalen Rang in Teil 2, der auf Grundlage der 48 Bilderrätsel in Teil 1 und 2 und Ihrem Abschneiden in der weiteren Aufgabe in Teil 2 berechnet wird. Details zur weiteren Aufgabe und wie genau sie in die Berechnung des finalen Rangs in Teil 2 einfließt, werden im Verlauf des Experiments auf dem Computerbildschirm erklärt. Zur Berechnung Ihres finalen Rangs wird wieder dieselbe Vergleichsgruppe herangezogen wie für Ihren Rang in Teil 1 und den vorläufigen Rang in Teil 2. Die detaillierten Erklärungen zur weiteren Aufgabe in Teil 2 erhalten nur die Teilnehmer, aber nicht die beiden Beobachter.

Genau wie zum Abschluss von Teil 1 müssen Sie noch die zwei Beobachter über Ihr Abschneiden, also Ihren finalen Rang, in Teil 2 informieren. Bitte verwenden Sie dazu wieder das DIN-A4-Blatt, das in Ihrer Kabine bereitliegt. Bitte tragen Sie nun zusätzlich unter "Rang 2" gut leserlich die Zahl in den Satz ein "__ % der Teilnehmer in der Vergleichsgruppe haben einen höheren Rang als ich", die Sie als Feedback über Ihren finalen Rang auf dem Computerbildschirm erhalten haben. Bitte gehen Sie mit dem ausgefüllten DIN-A4-Blatt zu den beiden Beobachtern und zeigen es ihnen schweigend, sobald Ihre Kabinennummer von einem Experimentator aufgerufen wird. So wird wieder sichergestellt, dass jeder Teilnehmer die Beobachter einzeln informiert, ohne dass die anderen Teilnehmer seinen Rang erfahren. Den Beobachtern wird auf ihrem Computerbildschirm nun eine Tabelle mit vier Spalten angezeigt, die jedem persönlichen Code den entsprechenden Rang in Teil 1, den finalen Rang sowie die Rangdifferenz zwischen Rang in Teil 1 und dem finalen Rang zuordnet.

Die Beobachter werden, ebenfalls schweigend, Ihr DIN-A4-Blatt mit den Angaben in ihrer Tabelle vergleichen und abstempeln. Bitte begeben Sie sich dann schweigend wieder zurück in Ihre Kabine.

Ende und Auszahlung des Experiments

Nach Teil 2 des heutigen Experiments folgen dann noch einige Bildschirme mit Fragen u. Ä., bevor wir zur Auszahlung der 12 Euro kommen. Wir werden Sie einzeln nach Kabinennummer zur Auszahlung aufrufen.

Falls Sie jetzt Fragen haben, halten Sie bitte die Hand aus der Kabine. Ein Leiter des Experiments wird dann an Ihren Platz kommen, um Ihre Fragen zu beantworten. Stellen Sie Fragen keinesfalls laut!

D.3. Additional Instructions on the Computer Screen: Die Roll Task

D.3.1. English. There is a die in your cubicle. Please roll the die twice in your cubicle.

Please enter the numbers between 1 and 6 which you rolled on the first and second die rolls on the computer screen. The first number you rolled is added to the number of correctly solved picture puzzles of each participant of the reference group. The second die roll is added to your own number of correctly solved picture puzzles. Your total output is equal to the number of correctly solved picture puzzles in Parts 1 and 2 of the 48 picture puzzles plus the number of points you entered for the second die roll. Your total output is used to calculate your final rank. Your total output is compared with the total output of the peer group. The total output of a participant in the comparison group is equal to the number of correctly solved picture puzzles out of the 48 picture puzzles plus the number of points you entered for the first die roll. Your final rank will be shown to Observers and you will report it to the Observers at the end.

You may, of course, roll the die more often, for example to check that the die is working properly. If you have thrown more than twice, the other throws after the first two do not have any special meaning.

D.3.2. German (original). In Ihrer Kabine liegt ein Würfel bereit. Bitte würfeln Sie zwei Mal in Ihrer Kabine.

Bitte geben Sie dann auf dem Computerbildschirm ein, welche Augenzahl zwischen 1 und 6 Sie beim ersten und zweiten Wurf gewürfelt haben. Die erste gewürfelte Augenzahl wird zur Anzahl der korrekt gelösten Bilderrätsel jedes Teilnehmers in der Vergleichsgruppe dazu gezählt. Die zweite gewürfelte Augenzahl wird zur Anzahl der von Ihnen korrekt gelösten Bilderrätsel dazu gezählt. Ihre entstehende Gesamtleistung entspricht also der Anzahl der von Ihnen korrekt gelösten Bilderrätsel in Teil 1 und 2 von den insgesamt 48 Bilderrätseln plus der von Ihnen eingegebenen Augenzahl vom zweiten Würfelwurf. Ihre Gesamtleistung wird verwendet, um Ihren finalen Rang zu berechnen. Dabei wird Ihre Gesamtleistung mit der Gesamtleistung der Vergleichsgruppe verglichen. Die Gesamtleistung eines Teilnehmers der Vergleichsgruppe entspricht der Anzahl der von ihm / ihr korrekt gelösten Bilderrätsel von den insgesamt 48 Bilderrätseln plus die von Ihnen eingegebene Augenzahl vom ersten Würfelwurf. Ihr finaler Rang wird den Beobachtern angezeigt und Sie werden ihn den Beobachtern abschließend berichten.

Natürlich können Sie gerne auch häufiger würfeln, z.B. um festzustellen, dass der Würfel richtig funktioniert. Falls Sie häufiger als zwei Mal gewürfelt haben, haben die weiteren Würfe nach den ersten beiden keine besondere Bedeutung.

Appendix E: Questionnaire

E.1. English

Please fill out the following questionnaire now before we proceed to the payment. Please enter the following personal data. If you want to enter decimal numbers, please use a dot (.) instead of a comma (,).

- Age
- Gender (male/female)
- Final grade point average at high school (Abiturnote) (1.0–6.0)
- Last math grade (1.0–6.0)
- Last German grade (1.0–6.0)
- Field of study/job
- How much money do you have available each month (after deducting fixed costs such as rent, insurance, etc.)?
- How much money do you spend each month (after deducting fixed costs such as rent, insurance, etc.)?
- In how many economic science experiments have you (approximately) already participated?
- On a scale of 0 to 10, how would you rate your willingness to take risks? 0 means not willing to take risks at all and 10 means completely willing to take risks.
- How important is the opinion that others hold about you to you? Please answer on a scale of 0 to 10, where 0 is not important at all and 10 is extremely important.
- Have you ever solved similar tasks as the picture puzzles before? (Yes/No)
- If so, how long ago approximately? Please indicate the approximate number of months.

Below, please answer a few more questions about lotteries in which you can earn or lose money in addition to the €12 if you decide to accept the lotteries.

Listed below are 6 different lotteries. For each of the 6 lotteries you can choose whether to accept or decline the lottery. If you choose to decline a lottery, your payout will not change. If you accept a lottery, you will realize either an additional gain or an additional loss based on the €12.

At the end of the experiment, one of the 6 lotteries is randomly selected. So you should make each lottery decision as if it was your only decision. The selected lottery is then drawn to determine whether the additional gain or loss will be realized.

Lottery 1: With 50% probability you lose €2 and with 50% probability you win €6. (accept / reject)
Lottery 2: With 50% probability you lose €3 and with 50% probability you win €6. (accept / reject)

Lottery 3: With 50% probability you lose €4 and with 50% probability you win €6. (accept / reject)
Lottery 4: With 50% probability you lose €5 and with 50% probability you win €6. (accept / reject)
Lottery 5: With 50% probability you lose €6 and with 50% probability you win €6. (accept / reject)
Lottery 6: With 50% probability you lose €7 and with 50% probability you win €6. (accept / reject)

E.2. German (original)

Füllen Sie nun bitte die folgenden Fragen aus, bevor wir zur Auszahlung kommen. Bitte geben Sie die folgenden Daten zu Ihrer Person an. Wenn Sie Kommazahlen eingeben möchten, nutzen Sie bitte einen Punkt (.) statt eines Kommas (,).

- Alter
- Geschlecht (männlich/weiblich)
- Abiturdurchschnittsnote (1.0-6.0)
- Letzte Mathenote (1.0-6.0)
- Letzte Deutschnote (1.0-6.0)
- Studienfach/Tätigkeit
- Wie viel Geld haben Sie monatlich (nach Abzug von Fixkosten wie Miete, Versicherungen etc.) zur Verfügung?
- Wie viel Geld geben Sie monatlich aus (nach Abzug von Fixkosten wie Miete, Versicherungen etc.)?
- An wie vielen wirtschaftswissenschaftlichen Experimenten haben Sie (ungefähr) bereits teilgenommen?
- Wie schätzen Sie Ihre Risikobereitschaft auf einer Skala von 0 bis 10 ein? Dabei bedeutet 0 überhaupt nicht risikobereit und 10 vollkommen risikofreudig.
- Wie wichtig ist Ihnen die Meinung, die andere über Sie haben? Bitte antworten Sie auf einer Skala 0 bis 10. Dabei ist 0 überhaupt nicht wichtig und 10 extrem wichtig.
- Haben Sie schon einmal ähnliche Aufgaben wie die Bilderrätsel gelöst? (Ja/Nein)
- Falls ja, wie lange ist das ungefähr her? Bitte geben Sie die ungefähre Zahl der Monate an.

Im Folgenden beantworten Sie bitte noch ein paar Fragen zu Lotterien, bei denen Sie noch einmal zusätzlich zu den €12 Geld verdienen oder auch verlieren können, falls Sie sich entscheiden, die Lotterien zu akzeptieren.

Unten sind 6 verschiedene Lotterien aufgelistet. Sie können für jede der 6 Lotterien wählen, ob Sie die Lotterie akzeptieren oder ablehnen möchten. Falls Sie eine Lotterie ablehnen, bleibt Ihre Auszahlung unverändert. Falls Sie eine Lotterie akzeptieren, werden Sie ausgehend von den €12 entweder einen zusätzlichen Gewinn oder einen zusätzlichen Verlust realisieren.

Am Ende des Experiments wird zufällig eine der 6 Lotterien ausgewählt. Sie sollten also jede Lotterieentscheidung so fallen, als wäre es Ihre einzige Entscheidung. Die ausgewählte Lotterie wird anschließend ausgelost, damit feststeht, ob sich der zusätzliche Gewinn oder Verlust realisiert.

Lotterie 1: Mit 50% Wahrscheinlichkeit verlieren Sie €2 und mit 50% Wahrscheinlichkeit gewinnen Sie €6. (akzeptieren / ablehnen)
Lotterie 2: Mit 50% Wahrscheinlichkeit verlieren Sie €3 und mit 50% Wahrscheinlichkeit gewinnen Sie €6. (akzeptieren / ablehnen)
Lotterie 3: Mit 50% Wahrscheinlichkeit verlieren Sie €4 und mit 50% Wahrscheinlichkeit gewinnen Sie €6. (akzeptieren / ablehnen)
Lotterie 4: Mit 50% Wahrscheinlichkeit verlieren Sie €5 und mit 50% Wahrscheinlichkeit gewinnen Sie €6. (akzeptieren / ablehnen)
Lotterie 5: Mit 50% Wahrscheinlichkeit verlieren Sie €6 und mit 50% Wahrscheinlichkeit gewinnen Sie €6. (akzeptieren / ablehnen)
Lotterie 6: Mit 50% Wahrscheinlichkeit verlieren Sie €7 und mit 50% Wahrscheinlichkeit gewinnen Sie €6. (akzeptieren / ablehnen)