WORKING PAPER SERIES

Inducing Acute Stress in an Economist's Lab: Selfish Black Lies and Trust under Socio-Evaluative Threat

Karina Held

Working Paper No. 9/2018

OTTO VON GUERICKE
UNIVERSITÄT
MAGDEBURG

FACULTY OF ECONOMICS
AND MANAGEMENT

Impressum (§ 5 TMG)
Herausgeber:
Otto-von-Guericke-Universität Magdeburg
Fakultät für Wirtschaftswissenschaft
Der Dekan

Verantwortlich für diese Ausgabe:
Karina Held
Otto-von-Guericke-Universität Magdeburg
Fakultät für Wirtschaftswissenschaft
Postfach 4120
39016 Magdeburg
Germany

http://www.fww.ovgu.de/femm

Bezug über den Herausgeber
ISSN 1615-4274

Inducing Acute Stress in an Economist's Lab:
Selfish Black Lies and Trust under Socio-Evaluative Threat

Abstract

We propose and validate a task to induce acute socio-evaluative stress in the laboratory. The task features performance-based pay and simultaneously creates a treatment and a control group. Employing this task, we study the influence of acute socio-evaluative stress on the propensity to tell a selfish black lie and to trust messages that can comprise lies. We find that stress significantly reduces the probability to lie at the extensive margin, while it does not influence the intensive margin of lying. Furthermore, we find evidence that socio-evaluative stress significantly reduces the willingness to trust messages that may contain large lies.

JEL Codes

C91, D82, D87

Keywords

Acute Socio-Evaluative Stress, Experiment, Selfish Black Lie, Lying Aversion, Trust

1. Introduction

For many people, lying is costly (Abeler et al. 2014, Fischbacher and Föllmi-Heusi 2013, Gneezy 2005). Yet, lying is omnipresent in the private and the professional domain. Selfish black lies, i.e. deceiving assertions that benefit the liar yet harm the receiver (Erat and Gneezy 2012), especially bear the potential of causing direct economics losses. However, additional, indirect, economic losses may also arise as sensing the possibility of falling victim to a lie may have adverse effects on the propensity to trust and follow messages. This may in turn erode the fundaments of trust-based interactions, even leading to lost business opportunities.

Since selfish black lies can cause efficiency losses, economists have set a focus on studying determinants of lying behavior. So far, characteristics of economic agents (e.g. gender or lying types[1]) and their contractual relations (e.g. incentives for lying[2]) have stood in the center of the analysis. However, the context in which decisions are made may also have a strong impact on behavior. In this study, we focus on acute socio-evaluative stress as the decision-making context. This type of stress is a short-term psychological stress reaction caused by the possibility that another party may judge the decision maker's abilities or actions negatively (Dickerson and Kemeny 2004). Many people are confronted with stressful situations in which their intelligence or competence is evaluated by others. For instance, these could be exams, (job) interviews, public speeches or presentations. The choices made in or right after these situations, e.g. to be honest or to lie, can crucially influence political, economic, or business outcomes.

In fact, stress at the workplace has been shown to adversely influence business outcomes even if it occurs in short bouts, i.e. when stress is acute and not chronic (Hassard et al. 2014, Hoel 2001). When measured, the cost of stress in the workplace usually accounts for an increase in sickness absenteeism, increased turnover rates and reduced productivity. However, these calculations do not control for the impact stress has on the decision quality. Workplace related stress was found to have increased over the last years (Chandola 2010, Hyde 2017) [3]. Therefore, the urge to study interactions of acute stress, the willingness to tell selfish black lies, and the willingness to trust in situations with lying opportunities should not be neglected.

1 Overall, results on gender differences in lying are mixed. While Dreber and Johannesson (2008) and Erat and Gneezy (2012) find that men are significantly more likely than women to tell a selfish black lie, Childs (2012) and Gylfason et al. (2013) find no gender differences in lying. Many papers additionally classify people according to their propensity to lie, i.e. into lying types (e.g. Fischbacher and Föllmi-Heusi (2013) or Hurkens and Kartik (2009).

2 Kajackaite and Gneezy (2017) show that lying behavior is sensitive to incentives. Conrads et al. (2013) show that lying increases under team incentives because individual responsibilities are unclear. Kocher et al. (2017) show that this effect increases when subjects are allowed to communicate. Cappelen et al. (2013) show that lying decreases if the content of the message is personal.

3 Unfortunately, these studies do not differentiate between the type of stressor or acute and chronic stress. Nevertheless, they report increases in stressors connected to acute stress (e.g. inter-personal conflict or work demands) as well as increases in adverse health outcomes (e.g. high blood pressure and cardiovascular risk) associated with episodes of acute stress.

While studying stress, selfish black lies, or trust may already be difficult in the field, accurately measuring their interaction will be even more challenging. We therefore take our research questions to the controlled setting of a laboratory. The laboratory experiment allows us to controllably induce acute socio-evaluative stress in our participants and observe their behavior afterwards. The following chapter introduces the related literature. In chapter 3, we explain why the socio-evaluative stress task psychologists frequently employ may not be appropriate to use in an economist's lab. We therefore introduce a novel stress task and show that it is successful in creating acute socio-evaluative stress in our treatment group while the control group clearly does not show a stress reaction, which we measure with samples of the stress hormone cortisol. Subsequently, we employ our task to study the effect of stress on lying and trusting behavior. We use the game described by Gneezy et al. (2013) to study the willingness to send selfish black lies and to follow messages that can include lies. The lying game involves a first mover who decides on whether and how strong to lie to a second mover whose choice it is to decide on whether to follow the information given by the first mover. This setup will allow us to derive first results on the extensive and intensive margin of lying under acute socio-evaluative stress. Additionally, our results will provide further evidence on trusting behavior under acute stress. The lying game is described in more detail in chapter 4, where we also describe our results.

2. Related Literature

Socio-evaluative stress is an intensely studied subject in psychology and has been shown to significantly influence behavior in diverse contexts. Interestingly, this research has mainly focused on influences on pro-social behavior in the context of non-incentivized moral dilemmas. Youssef et al. (2012) study behavior under socio-evaluative stress. They provide evidence that stressed individuals give significantly less utilitarian responses (maximization of the wellbeing of the involved players) than the unstressed participants if these responses come at the expense of another player. Using anticipatory[4] stress, Starcke et al. (2012) provide further evidence for this finding. Additionally, Singer et al. (2017) show that exposure to socio-evaluative stress has a pro-social effect on everyday moral decision-making. This means that stressed individuals prefer altruistic responses to egoistic ones in moral conflict situations. Although all of these results are based on hypothetical decision situations and do not result in payoff consequences for the participants, they represent a first approach to the question of how acute socio-evaluative stress influences moral decision-making. The results are in line with the dual-process theory of moral judgment (Greene et al. 2004) or system 1 and system 2 in thinking fast and slow (Kahneman 2011). These theories state that both higher cognition and emotional judgement sometimes play a competing role in decision-making. Acute socio-

4 Participants received instructions for a task associated with socio-evaluative stress as well as preparation time but never had to perform the task.

evaluative stress has been shown to affect both of these channels: The stress hormone cortisol influences brain regions integral to emotional decision-making (Dedovic, Rexroth et al. 2009, Kern et al. 2008, Kukolja et al. 2008, Pruessner et al. 2008). Furthermore, acute socio-evaluative stress adversely affects working memory (Kirschbaum et al. 1996, Luethi et al. 2009, Oei et al. 2006), which is a brain system that temporarily stores information, allows the manipulation of said information, and is important for higher cognition (Baddeley 1992). Apparently, stressed individuals rely less on their cognitive judgement when making decisions (Shields et al. 2016). Instead, they tend to rely on their first intuition, which points at the morally correct choice or leads to the application of behavioral heuristics (Buckert et al. 2017).

Following the results of the previous studies, we expect that participants under acute socio-evaluative stress will resort to the morally correct choice of refraining from an obvious lying opportunity. Therefore, we hypothesize that our stressed participants send less selfish black lies than the unstressed participants.

The literature most closely related to our study focuses on the influence of time pressure on decision-making. It should, however, be noted that decision making in our set up is not limited by time pressure. Time pressure may work through diverse channels. For instance, it limits the available time to consider (payoff) consequences. Participants under time pressure might therefore rely on social heuristics (Rand et al. 2014) or their first intuition when making their decisions. Furthermore, some participants might experience feeling pressured as stressful. Note, however, that Dickerson and Kemeny (2004) show that tasks with time pressure do not reliably elicit a significant release of the stress hormone cortisol. Additionally, when time pressure leads to increases in hormonal responses, the data of Buckert et al. (2017) and Steptoe et al. (1993) show that the absolute size of the effect is quite small compared to the effect sizes observed for socio-evaluative stress (e.g. Dickerson and Kemeny 2004). Thus, one should be careful to conjecture that the results provided in the literature on time pressure will automatically apply under socio-evaluative threat.

Capraro (2017), Konrad et al. (2018), and Shalvi et al. (2012) present experimental results for lying under time pressure. However, none of the studies measure stress levels. Shalvi et al. (2012) argue that lying is the initial automatic intuition of people. Deliberation, i.e. time to think about decision consequences, allows people to overcome their automatic self-serving behavioral tendencies. They provide experimental evidence showing that under high time pressure, participants lie significantly more than when provided with ample time to make their decisions. While Konrad et al. (2018) implement a design in which participants have to become aware of the lying opportunity under time pressure, Capraro (2017) ensures that the lying opportunity is clear to the subjects before they make their decisions to lie or to report truthfully. Konrad et al. (2018) show that time pressure has no significant effect on misreporting, but decreases the awareness of the lying opportunity significantly. Thus, for subjects who are aware of the one-shot lying opportunity, the decision to lie does not vary significantly between treatments with and without time pressure. Capraro (2017) provides contradictory evidence from a small stake experiment and shows that for participants who are aware of the lying opportunity, time pressure decreases lying in one-shot interactions. The author argues that the finding is in line with the Social Heuristics Hypothesis (Rand et al. 2014), which claims that people's default strategies correspond to choices that are optimal in their everyday interactions and that have been internalized over time.

The literature further provides evidence for the influence of acute socio-evaluative stress on the willingness to trust, which is related to our study. However, the results are mixed. Steinbeis et al. (2015) and von Dawans et al. (2012) report the results of trust games performed by participants who underwent a task that induces acute socio-evaluative stress. In the trust game, the first mover decides to send some or all of the initial monetary endowment to a second mover. In Steinbeis et al. (2015), the money sent is tripled and the second mover has to decide how much of the tripled amount he or she wants to send back to the first mover. Von Dawans (2012) play a slightly altered version of the game, where the second mover can only decide to return half of the amount and keeping the rest or keeping the entire amount and not returning any. In these games, the first mover's decision is interpreted as the decision to trust. In contrast to our experimental design, decision-making may underlie different psychological pathways, as the second mover can only reap returns higher than the initial endowment if the first mover invested. In the set-up of Steinbeis et al. (2015), this entails sending a signal of trust (entrusted money) to the second mover. In the game that we report in chapter 4, trust can never initiate a reciprocal response by another player.

Von Dawans et al. (2012) show that stressed individuals who act as first movers in a trust game are more pro-social, i.e. more trusting, than the unstressed participants. Steinbeis et al. (2015) argue that this observation results because the participants go through a group version of the stress task, meaning that the design creates potential for social affiliation, which might buffer self-preserving reactions following stress, and therefore leads to the pro-social pattern of trust. The authors expect a self-preserving reaction, because the amygdala shows involvement after the exposure to socio-evaluative stress (Dedovic, Duchesne et al.2009, Rodrigues et al. 2009). This brain region is connected to detecting environmental threats and governing anxious and defensive reactions (Lang et al. 1998). In that vein, Steinbeis et al. (2015) employ a stress task without potential for social affiliation and show that acute socio-evaluative stress leads to decreased levels of trust—especially, if the other player is known to be an outgroup member. Since our participants also undergo an individual stress task, we follow the evidence of Steinbeis et al. (2015) and hypothesize that our treatment group exhibits lower levels of trust than the unstressed control group when it comes to following messages that might contain a lie.

Our main findings concerning the decision to send a selfish black lie and to trust messages can be found in chapter 4. They show that socio-evaluative threat significantly reduces the probability of sending a selfish black lie. However if a member of the stressed treatment group decides to lie, socio-evaluative stress does not alter the aversion to lying at the intensive margin and the size of the lie remains unchanged. For the decision to follow a message, we do not find significant aggregate behavioral differences between the stressed treatment group and the control group. However, we do see that earnings of the players who faced socio-evaluative threat are significantly reduced as these players follow messages that can potentially contain large lies significantly less often than the control group. We conjecture that socio-evaluative stress comes at a cost, as all messages in the game lead to positive expected excess payoffs. Participants who prefer not to follow messages forgo these earnings and cannot regain them during the remainder of the game.

3. The Stress Task

3.1 Experimental Design

Foley and Kirschbaum (2010) show that changes in cortisol best characterize the biological response to acute psychosocial stress. Dickerson and Kemeny (2004) report that tasks elicit cortisol responses if they are uncontrollable and characterized by socio-evaluative threat, where uncontrollability means that an individual is not able to influence the outcome of a situation through a behavioral response (Thompson 1981) and socio-evaluative threat refers to the risk of being judged negatively. In fact, Gruenewald et al. (2004) provide evidence that the component of social evaluation drives cortisol responses in the Trier Social Stress Test (TSST, Kirschbaum et. al. 1993). Psychologists frequently employ this test to induce acute socio-evaluative stress in participants. It has been shown to reliably trigger cortisol responses in both the individual and the group version of the test (TSST-G, von Dawans et al. 2011).

Participants in the TSST have to produce a free speech (a 2-minute mock job interview) in front of a committee who is wearing white laboratory coats and is trained to withhold verbal and nonverbal feedback. The committee is introduced as experts in the evaluation of non-verbal behavior. Participants are further told that a video analysis of their performance will be conducted. Therefore, their free speech is videotaped. However, a performance evaluation is not part of the task and is therefore not carried out. [5]

Het et al. (2009) report how to generate a control group for the TSST. The participants are asked to read a popular scientific text. Afterwards, they have to read out the text simultaneously and in a low voice. Two experimenters are present but are not dressed in lab coats and also do not observe or interrupt the participants. The control group is told that no performance evaluation will take place. Video cameras are not present.

We deliberately avoid the introduction of confederates who serve as the expert panel in the setting as well as giving the participants incorrect information regarding a performance analysis. Following the argument of Jamison et al. (2008), we strongly believe that providing participants with incorrect information

5 Cahlíková and Cingl (2017) present a non-deceptive variant of the TSST that does not control for participants' performance in the free-speech task.

concerning the experiment or the role of the participants therein may influence future expectations and behavior in the lab if participants become aware of the practice.

In our experiment, the participants are divided into two groups of five—the stressed treatment group (*Stress*), and the control group (*Control*). The setup of the lab allowed participants of *Stress* to be seated in a room adjacent to that of participants of *Control*. Participants of *Stress* have five minutes to prepare a two-minute recording, in which they elaborate on their ability to think analytically. This is a skill that is requested in many job descriptions in Germany, where the experiment was conducted. Arguments are recorded with the help of a video software. However, only the resulting soundtrack is used in the experiment, i.e. only the voice recording is available and no visual images. Recordings that do not meet the ideals of a *Stress* participant cannot be re-recorded. Participants of *Control* also have a five-minute time slot to consider what makes a convincing argumentation for analytical thinking. As payoff is performance-dependent in both groups, all participants of the experiment have an incentive to concern themselves with the task during the preparation time.

Each participant of *Control* then evaluates each of the five two-minute recordings on a scale from 0 to 100% (“The person convincingly explained that they possess analytical thinking skills.”). To rule out order effects, each member of *Control* receives the recordings in a different sequence. While performance is not evaluated in the original TSST, we measure performance to control for potential influences on post-task behavior.

In contrast to the original TSST that pays a flat fee to each participant, we incentivize the task based on the results of the performance analysis. Earnings vary for participants of *Stress* with the median rating $\tilde{x}$ given by the members of *Control*, i.e. the higher the median rating, the higher the payoff. Earnings for participants of *Control* vary with the absolute distance between the individual assessment of a *Stress* member and the median rating $|x_i - \tilde{x}_i|$ of that member. The smaller the distance, the higher the payoff. As every *Control* member assesses five different recordings, the sum of five individual payoffs amounts to a *Control* member’s total earnings. In both groups, total earnings range from €1.00 to €10.00 (see Tables 1 and 2).

TABLE 1 EARNINGS – *STRESS*

0% ≤ $\tilde{x}$ ≤ 10%	10% < $\tilde{x}$ ≤ 20%	20% < $\tilde{x}$ ≤ 30%	30% < $\tilde{x}$ ≤ 40%	40% < $\tilde{x}$ ≤ 50%
€1.00	€2.00	€3.00	€4.00	€5.00
50% < $\tilde{x}$ ≤ 60%	60% < $\tilde{x}$ ≤ 70%	70% < $\tilde{x}$ ≤ 80%	80% < $\tilde{x}$ ≤ 90%	90% < $\tilde{x}$ ≤ 100%
€6.00	€7.00	€8.00	€9.00	€10.00

TABLE 2: EARNINGS PER EVALUATION – *CONTROL*

$\|x_i-\tilde{x}_i\|$ > 22.5%- points	20%-points < $\|x_i-\tilde{x}_i\|$ ≤ 22.5%-points	17.5%-points < $\|x_i-\tilde{x}_i\|$ ≤ 20%-points	15%-points < $\|x_i-\tilde{x}_i\|$ ≤ 17.5%-points	12.5%-points < $\|x_i-\tilde{x}_i\|$ ≤ 15%-points

€0.20	*€0.40*	*€0.60*	*€0.80*	*€1.00*
10%-points < $\lvert x_i - \tilde{x}_i \rvert \leq$ 12.5%-points	7.5%-points < $\lvert x_i - \tilde{x}_i \rvert \leq$ 10%-points	5%-points < $\lvert x_i - \tilde{x}_i \rvert \leq$ 7.5%-points	2.5%-points < $\lvert x_i - \tilde{x}_i \rvert$ ≤5%-points	0%-points ≤ $\lvert x_i - \tilde{x}_i \rvert \leq$ 2.5%-points
€1.20	*€1.40*	*€1.60*	*€1.80*	*€2.00*

The original TSST further contains a second task—serially and correctly subtracting a two-digit number from a four-digit number for about 80 seconds. This task adds another element of uncontrollability as participants are called to calculate in front of the committee in a random order. However, we do not to employ this task for several reasons: Our student sample stems from a university that largely offers technical or economics-based subjects. Chances were therefore high that the participants may experience this task as pleasant or familiar. Furthermore, the calculation task induces yet another element of socio-evaluative threat and therefore requires the presence of the expert panel or confederates who correct a subject if a calculation is incorrect. Note that von Dawans et al. (2012) describe a variation of the TSST, in which participants first complete the public-speaking task and then provide their answers for different choice tasks. Afterwards, the subjects complete the mental-arithmetic task and give answers to another set of tasks. The corresponding cortisol response shows that the public-speaking task alone induces a significant increase in cortisol by about 100 percent on average, while the arithmetic task only contributes to a very small additional increase in cortisol.

Apart from inducing acute socio-evaluative stress, participants of *Stress* might experience that their role in the stress task comes with less power. As the type of stress requires that another party might judge the performance of the treatment group negatively, this lack of power cannot be avoided. When considering situations of socio-evaluative threat at the workplace, such as subjective performance evaluations done by managers, co-workers, or customers, the power difference also becomes apparent. In the same vein, our unstressed control group might experience higher power because their evaluations are payoff-relevant for the stressed treatment group. Hence, socio-evaluative stress and power differentials come hand-in-hand and we will therefore not be able to disentangle reactions to acute stress from reactions to power.

The literature suggests that power increases confidence and reassures of currently accessible thoughts. Côté et al. 2011 and DeCelles et al. 2012 show that increases in power result in more antisocial (prosocial) behavior if moral identity is weak (strong). The relationship between power and stress was studied by Sherman et al. (2012). The authors show that the more powerful a leadership position, the lower the levels of the stress hormone cortisol and the lower reports of anxiety. A concept related to power is social status, i.e. increased social rank or wealth (e.g. Piff et al. 2012, Trautmann 2013). The literature on the interplay of social status on prosocial and antisocial behavior shows that the underlying pattern is complex. Piff et al. (2012) provide evidence that higher social status is related to increases in cheating. However, Trautmann et al. (2013) show that low social status individuals agree more that lying in one's own interest can be justified and that lying is not significantly correlated with financial wealth, income, or being a supervisor (i.e. high social status). Further evidence shows that individuals with high social status are more trusting when interacting with a stranger (Korndörfler et al. 2015) and more willing to give to low-income participants (Smeets et al. 2015). While social status is related to power, we do not expect social status to drive our results, as our participants come from a student sample who participate in economic experiments as part of their net income. Furthermore, earnings possibilities are equal between our treatment and control group.

While it may generally be difficult to disentangle the effects of power and acute socio-evaluative stress on behavior, our experimental setup reflects real life situations in which one party has to perform a task that is evaluated by another party. Just like in reality, where performance usually determines payoffs, payoffs in our task are also performance-based. Additionally, our experimental setup comes with the advantage that we can control whether performance under acute socio-evaluative stress influences behavior following the stressor.

3.2 Experimental Procedures

Note that the aim of this first study is to provide evidence that our stress task succeeds in increasing stress levels in the participants of *Stress* compared to those of *Control*. To study lying behavior (see chapter 4), we use a different sample of participants who had no previous experience with our stress task. The data presented in this chapter stems from 26 healthy male[6] subjects aged between 19 and 33 years (mean age of 25.43). Half of the subjects were members of the treatment group, the other half formed the control group. The experiment took place between 3 and 5 p.m. to control for diurnal variations of cortisol (Pruessner et al. 1997). This is important because cortisol levels are highest after awakening and decrease over the course of the day (Kirschbaum and Hellhammer 1989), i.e. the results from experiments scheduled at different times of the day may lead to similar effects in behavior, whereas the cortisol reactivity shows a different pattern. Participants were recruited using hroot (Bock et al. 2014). To avoid the environment of the laboratory stressing participants, only subjects with previous experience in economic lab experiments were invited to take part in the experiment. Before the start of the stress experiment, all participants gave their written consent for the collection and analysis of five saliva samples and the use of the resulting data in this study. Exclusion criteria for the experiment were previous participation in a stress-related experiment, studying psychology, intake of medication known to influence cortisol levels or cortisol responses, smoking

6 Kajantie and Phillips (2006), Kirschbaum et al. (1995), and Kirschbaum et al. (1999) and show that cortisol responses are gender-specific.

more than five cigarettes per day, and reported mental disorder as indicated by the Brief Symptom Inventory-18 (BSI-18, Derogatis 2000). Four of the original 30 participants did not meet these criteria.

After arriving to the lab, participants were informed that the experiment required the collection of five saliva samples per participant. It was pointed out that only cortisol and no other biomarker would be extracted from the samples. The samples were evaluated by Dresden LabService. There are no known risks involved in providing a saliva sample, which is acquired with the help of a Salivette[7] and requires chewing on a cotton swab. The participants were further assured that their data would be stored in a pseudonymized form such that their participation in the study can never be revealed.

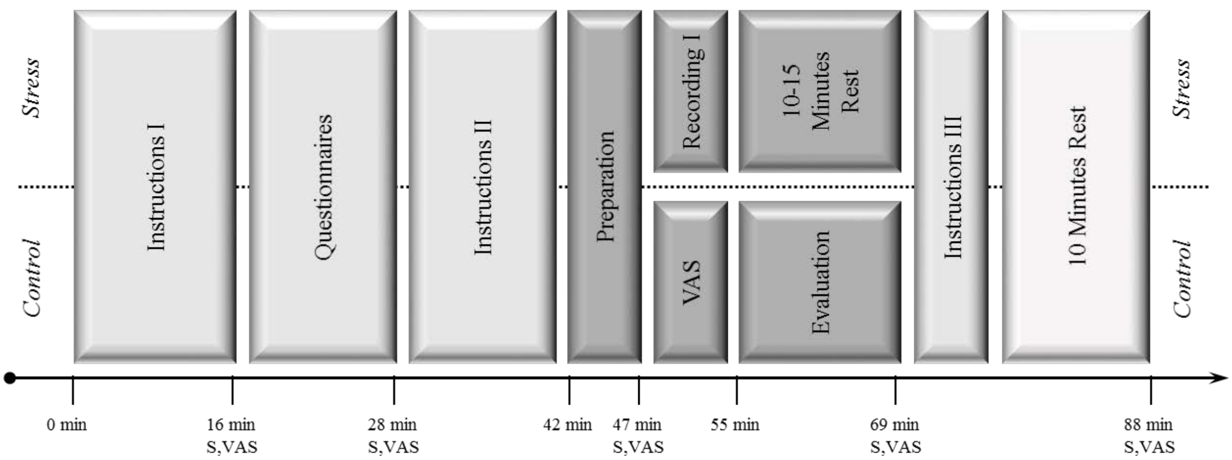

FIGURE 1 STUDY DESIGN INCLUDING AVERAGE DURATION. S = SALIVA SAMPLE, VAS = VISUAL ANALOGUE SCALE.

The experiment was computer-based. Z-Tree (Fischbacher 2007) was used to program the experimental software. The explanation of the data processing, sample collection and evaluation marked the starting point of the experiment and lasted for about 16 minutes (see Figure 1, see Appendix A for the instructions to the stress task). The participants were told that they would receive two additional rounds of instructions during the course of the experiment, and that the following part of the experiment includes the first saliva sample followed by self-reports with the help of several questionnaires. Participants then took a seat at their visually isolated computer workstations and gave their first saliva sample. The seats were assigned by lot. Note that the experiment did not proceed unless all questions were answered individually at the participant's workstation. A battery of nine visual analogue scales (VAS, see Appendix B) were collected after each saliva sample. These self-reports were assessed on a scale from 0-100% and included, for instance, anxiety and stress. Participants received a show-up fee of €5.00.

Providing the first saliva sample and answering the VAS and questionnaires took about 12 minutes on average. The questions included sociodemographic data, drug and alcohol intake. Furthermore, data was collected on short versions of the BIG5 inventory (Rammstedt and John 2007) and the BSI-18 (Spitzer et

7 Salivette® Cortisol by Sarstedt is a small plastic cartridge containing a cotton swab and is designed for cortisol determination from saliva.

al. 2011). Participants gave the second saliva sample after providing their answers, about 28 minutes after arriving to the laboratory. Subsequently, the participants gathered in one room and the second set of instructions was read aloud to them. Participants were not allowed to talk to each other and non-verbal cues were difficult to exchange between treatment groups due to the set-up of the lab and the fact that participants of *Stress* stayed seated at their visually isolated workstations. In the instructions, the participants received information on whether they are part of the treatment or the control group. The group assignment depended on the location of the workstation. Note that all participants received the identical set of instructions irrespective of their role in the experiment. The experiment did not continue until all of the participants' questions were answered at the individual workstations (around 42 minutes into the experiment).

While members of *Control* evaluated the argumentations, *Stress* members rested for 10-15 minutes (on average 14 minutes) to allow salivary cortisol to accumulate. During the resting period, participants sat at their workstations. The use of the computers was not allowed during this time.

After the evaluation (*Control*) and the resting period (*Stress*), participants gave the fourth saliva sample at around 69 minutes into the experiment. Afterwards, the participants gathered again and the last set of instructions was read aloud to them. It announced another 10-minute rest for both types of participants. After this resting period, the participants gave the fifth saliva sample and answered the VAS one last time. Participants received another €5.00 for this part of the experiment. The accumulated earnings were paid out in cash at the end of the experiment. Participants were informed about their earnings from the stress task after the end of the last resting period, i.e. at the end of the entire experiment. Average *Stress* earnings (including the show-up fee) amounted to €16.33 (SD = 1.989), average *Control* earnings were €15.96 (SD = 1.869). A U-Test indicates no statistically significant earnings differences between the two groups.

3.3 Cortisol Response

Dickerson and Kemeny (2004) provide evidence that the peak cortisol response occurs 21–40 min after the onset of an acute psychological stressor. In our setup, the participants received the instructions for the stress task about 39 minutes prior to the collection of the fourth saliva sample. The recording-task started about 20 minutes prior to the collection of the fourth sample. Figure 2 indicates the development of salivary cortisol (in nanomols per liter). The gray bar indicates the stress task. Salivette refers to the saliva samples.

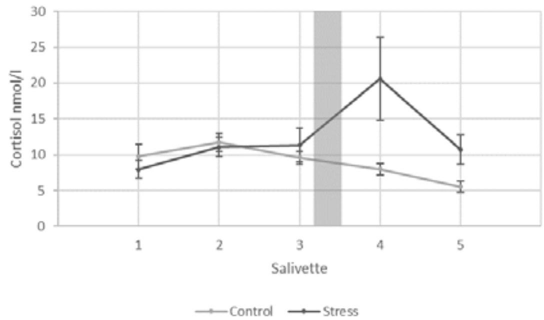

FIGURE 2 MEAN SALIVARY CORTISOL LEVELS AND CORRESPONDING SEM OVER THE COURSE OF THE EXPERIMENT.

U-Tests indicate that there are no statistically significant differences in cortisol levels for the first, second, and third sample across participants of the control and stress condition.[8] Further U-Tests show that differences between the treatment and control group are significant for samples four and five. Using a two-way analysis of variance[9] with repeated measures, we evaluate the cortisol levels measured in samples three to five across the two treatments. Greenhouse-Geisser corrections are applied. The analysis shows that the stress treatment induced a significant increase in cortisol levels, while cortisol levels in the control treatment followed the natural circadian rhythm and decreased over time. The main effect of time is highly significant (F(1.332, 31.97) = 0.007), the treatment effect is marginally significant (F(1, 24) = 0.065), and the interaction of time and treatment is again significant (F(1.332, 31.97) = 0.016).

The successful triggering of a cortisol response following the stress task is further supported by a random effects regression, which additionally allows us to control for further variables (see Table 3). The regression explains cortisol in nmol per liter measured through the five saliva samples. Standard errors are robust and clustered at the participant level. In Model I, the treatment dummy *Stress* is not significant. This is not surprising, as all five saliva samples are included in the analysis, while only two of the samples are taken after the stress task. We further find that cortisol increases significantly from round 1 to round 2—on average by 1.959 nmol/l. This effect is not picked up if cortisol levels between rounds 1 and 2 are compared with the help of a U-Test. The effect is also smaller than the threshold of 2.5 nmol/l (Miller et al. 2013), commonly used to identify a stress reaction. Comparing round 1 and 3 cortisol levels, we do not spot a significant difference. Starting with sample 3, we observe that cortisol begins to decrease. This effect reflects the diurnal rhythm of cortisol in humans. The treatment-time-interaction (Stress x Cortisol Measure) proves to be insignificant for the first three saliva samples. Recall that the actual speaking-task is performed after the third saliva sample is taken. Therefore, the significant treatment-time-interactions for rounds 4 and

8 Participants were not aware of the stress task before giving the first two saliva samples. The third sample was provided shortly after the instructions of the stress task were explained.

9 We use log(cortisol) as the independent variable in the analysis.

5 indicate that our stress intervention was successful in significantly increasing cortisol levels compared to the pre-stress sample 1. This result is in line with the meta-analytic evidence on tasks with elements of socio-evaluative threat and uncontrollability provided by Dickerson and Kemeny (2004). The authors show that for this type of task, cortisol responses are elevated up to 60 minutes after stressor termination.

In Model II, we additionally test the influence of age and performance[10] on the cortisol reaction. Note that performance can only interact with the cortisol response after the third sample is collected, i.e. after the speaking task. Therefore, the model includes sample 4 and 5 data only. We find that our stress intervention has a positive and highly significant influence on cortisol. Cortisol falls significantly from sample 4 to sample 5 (Cortisol Measure 5). As cortisol levels naturally fall during the afternoon, this result is not surprising. Comparing the data from sample 4 and 5 in the stressed group (Stress x Cortisol Measure Stress 5), we find a significant decrease in the level of cortisol. This is also intuitive, as the stress task is performed before sample 4 is collected and the collection of sample 5 is preceded by a stress-free resting period such that the cortisol level has time to decrease. We do not find significant age effects. This is in line with the findings of Kudielka et al. (2004a) who show that socio-evaluative threat results in a significant stress reaction that is independent of the age group. Additionally, we find that performance does not have a significant effect on the cortisol reaction in general. However, there appear to be treatment differences for performance. The interaction effect of performance and stress indicates that the better a stressed treatment group member performs in the task, the smaller this person's cortisol reaction. Nevertheless, the cortisol reaction remains significantly higher for the treatment group than for the control group, even for the highest levels of performance (Wald test, $p < 0.001$).

10 For a member of *Stress*, performance is the median assessment (between 0 and 100 points). For a member of *Control*, performance depends on the absolute difference between the individual assessment of a *Stress* member and the respective player's median assessment. We sum up the differences for each of the five evaluations so that performance in *Control* also varies between 0 and 100 points. Average performance for participants of *Stress* was 60.769 points and for *Control* 58.462 points (SEM *Stress* = 5.036, SEM *Control* = 5.170). This difference is not statistically significant (U-Test: $p = 0.850$).

TABLE 3: CORTISOL RESPONSE

Cortisol nmol/l	Model I			Model II: Cortisol measure ≥ 4		
	Coef.	Robust Std. Err.	P > |z|	Coef.	Robust Std. Err.	P > |z|
Stress	-1.6957	2.2029	0.441	27.0997	10.7233	0.011
Cortisol Measure						
2	1.9592	0.8154	0.016			
3	-0.1738	1.3672	0.899			
4	-1.8107	1.8569	0.329			
5	-4.2462	1.9291	0.028	-2.4354	0.5744	0.000
Stress x Cortisol Measure						
Stress 2	1.1684	1.2868	0.364			
Stress 3	3.5508	2.5009	0.156			
Stress 4	14.4192	5.7619	0.012			
Stress 5	6.9977	2.7315	0.010	-7.4215	4.1115	0.071
Age	0.1321	0.2179	0.544	0.5082	0.5126	0.321
Performance				0.0797	0.0834	0.339
Stress x Performance				-0.2491	0.1314	0.058
Constant	6.3396	5.7164	0.267	-10.0941	17.8100	0.571

RANDOM EFFECTS REGRESSIONS. STANDARD ERRORS ARE CORRECTED FOR CLUSTERING AT THE PARTICIPANT LEVEL. MODEL I: N = 130, R-SQ OVERALL = 0.186, WALD χ^2 = 97.61, P < 0.001.; MODEL II: N = 52, R-SQ OVERALL = 0.270, WALD χ^2 = 26.94, P < 0.001.

4. The propensity to lie and to trust under acute stress

4.1 Experimental Design

To study lying behavior, we use the lying task introduced by Gneezy et al. (2013, see Appendix A for instructions). The participants are divided into two groups of six[11]—first and second movers. In our setup, the groups are assigned randomly and group assignment is independent of the role in the stress task. Our participants were explicitly made aware of this matching protocol. The lying game is played for 18 rounds. During each round, a first mover is randomly and anonymously matched with a second mover, i.e. while each participant knows that he/she interacts repeatedly with the players of the other group, none of the players can build a reputation or identify himself/herself to his/her matching partner. In the same vein, a player never knows whether the current partner belonged to the control or treatment group of the previous stress task. Therefore, behavior cannot be influenced by changes in beliefs about the partner's reaction to stress.

Each pair of players is randomly assigned a number between 1 and 6 (the die roll d). Each number is similarly likely and each pair receives a different number. The first mover sends a message m concerning the die roll to the second mover. This message can be truthful or it can contain a lie. The first mover has an

[11] Depending on the show-up rate of our participants, we added two *Control* members to our stress task, leading to five observations for *Stress* and seven observations for *Control* per session. We also adjusted the lying task so that it could be played with 10 instead of 12 players, if necessary.

incentive to report higher numbers, as his/her payoff increases with the message sent. A first mover's payoff in points is:

$$\pi_{\text{first mover}} = 10 + 2 \cdot m.$$

The second mover has to decide whether to follow the message sent by the first mover. If a second mover follows a correct message, his/her payoff is 10 points. If the second mover follows an incorrect message, i.e. a lie, his/her payoff is 0 points. If the second mover decides not to follow, his/her payoff is 3 points. The second mover's payoff is given as:

$$\pi_{\text{second mover}} = \begin{cases} 10 & \text{if the second mover follows and } m = d \\ 0 & \text{if the second mover follows and } m \neq d \\ 3 & \text{if the second mover does not follow} \end{cases}$$

Irrespective of the die roll, a first mover concerned with individual payoff maximization will always report $m = 6$. However, if lying is morally costly or if the first mover cares about the second mover's payoff, the first mover's decision will not only depend on self-interested payoff maximization but also on the harm that a lie can cause to the second mover.

We use the strategy method, i.e. we have information on the first mover's lying behavior, not only for the die roll, but also for all potential die rolls from 1 to 6. We also have information on the second mover's decision to follow a message for all potential messages 1 to 6. At the end of a round, both types of players receive a payoff table indicating the executed decision including the die roll, the first and the second mover's decision regarding the die roll, as well as first and the second mover's payoff, and a decision and payoff history.

As a first mover's decision to lie may depend on his/her belief whether the second mover will follow the message, we additionally ask the first movers to indicate beliefs about the second mover's decision to follow for every potential message *m*. We incentivize this part of the task by awarding an additional 50 points to those first movers who correctly predict second mover behavior in more than 2/3 of the cases.

We report the results from 146 participants (13 sessions) who performed the stress task described in chapter 3 without providing cortisol samples. None of the subjects participated in the experiment reported in chapter 3. Instead of the final 10-minute resting period, the participants played the lying game, which took on average 15 minutes to complete plus 10 minutes to explain the instructions.[12] Dickerson and Kemeny (2004) show that for our type of stress task, cortisol responses are elevated up to 60 minutes after stressor termination. Nevertheless, the timing of the decision-making tasks usually differs between studies, e.g. in von Dawans et al. (2012) participants provide their answers shortly (about 5 minutes) after their exposure to the stressor. These timing-issues make inter-study comparisons difficult, as the timing can influence the decision-making (Pabst et al. 2013). Therefore, one might argue that our results do not arise

12 We refrained from providing the instructions for the lying game at the very beginning of the entire experiment to rule out that participants design lying strategies while they are still unstressed.

during an acutely stressful event (additionally characterized by an increased heart rate, for instance) but during recovery from acute socio-evaluative stress.

Both types of players in the lying game received the identical set of instructions and gathered in the same room for instructions, i.e. the matchings protocol, the payoff functions and the opportunity to lie were common knowledge for all players in the game. The instructions were read out to all of the participants. Participants were not allowed to talk to each other and non-verbal cues were difficult to exchange due to the set-up of the lab and the fact that participants of *Stress* stayed seated at their visually isolated workstations. The lying game started after all participants' questions were answered at the individual workstations. Questions were answered according to a standard protocol that allowed only explanations of the game but no suggestions on behavior. In total, we provide data from 45 observations for first movers and 40 observations for second movers in *Control*, as well as 30 first movers and 31 second movers[13] in *Stress*. The participants were recruited using hroot (Bock et al. 2014). Members of the recruitment pool who studied psychology or a related field and could potentially be aware of the broad literature on stress research were excluded from recruitment. Participants' age ranged from 18 to 37. The sessions were conducted during different times of the day as Kudielka et al. (2004b) have shown that responses to socio-evaluative stress measured in the morning and afternoon are comparable.

Note that the aim of this study is not to link cortisol levels to behavioral change. Instead, we are interested in behavioral differences induced by acute socio-evaluative stress. Therefore, we refrain from taking saliva samples from the participants of the lying task. Additionally, we also allow both male and female subjects to participate in the study. Even though we did not access cortisol levels for female participants, other studies have shown socio-evaluative stress to arise in females as well (e.g. Kirschbaum et al. 1995). We therefore expect our stress task to induce acute socio-evaluative stress also in our female participants. The evaluation of the self-reported emotional states support this. We find a similar pattern of emotional change between VAS II and VAS III for male and female participants, i.e. before the participants in our stress task know that they have to provide an argument and after this information is available to them (directly before they record the argument). Mean values and corresponding test results for VAS II and III according to treatment and gender can be found in Appendix B.

The experiment was computerized using z-Tree (Fischbacher 2007). Participants received their earnings from the stress task and the lying game at the end of the entire experiment. Each point earned in the lying game was worth €0.04. Note that the participants received feedback on their performance in the stress task after they made all of their decisions in the lying task. Each session (stress task plus lying game) lasted about 82 minutes with average total earnings of €26.41 for first movers and €15.73 for second movers of the lying game (including a 5€ show up payment and the earnings from the stress task). Control group

---

13 A technical difficulty lead to the loss of performance data for four participants who were therefore excluded from the analysis.

performance in the stress task was 61.835 points (SEM = 2.366) and average *Stress* performance was 63.442 points (SEM = 2.586). This difference is not statistically significant.

In Appendix C, we provide a robustness check for our results concerning the decision to lie. As the participants of *Stress* might include information in their recordings that may influence behavior and beliefs of the control group, we design a variant of the stress task in which no such information can be unilaterally exchanged. In the experiment reported in the Appendix, members of *Control* evaluate recordings of another session's stressed treatment group. The results support our findings concerning the willingness to tell a selfish black lie, which we report in the next chapter.

4.2 Results

Decision to tell a selfish black lie—*Extensive margin*

The design of the lying game allows us to study selfish black lies (increasing own payoff and reducing other's payoff) and spiteful black lies (reducing own and other's payoff). With the help of the strategy method, we observe 5,316 truthful messages, 2,416 selfish black lies, and 368 spiteful black lies. Our analysis does not reveal a significant influence of socio-evaluative threat on the propensity of telling a spiteful black lie. We therefore focus on analyzing the propensity of telling a selfish black lie in all of the following analyses and do not include the observations for the spiteful black lies. Including both types of lies into our analyses does not change our findings (see Appendix C for corresponding results).

Figure 3 reports the average probability to send a selfish black lie for first movers over the course of the game and for the die rolls 1-5 (die roll 6 is not depicted, as it is not possible to send a selfish black lie for that number). We observe that 56 percent of the messages sent in *Control* and 74 percent of the messages sent in *Stress* contain the truth. Thus, we find quite a large aversion to lying at the extensive margin in both treatments but also signs for treatment differences in the willingness to report a selfish black lie. Figure 3 provides further support for stress-related differences concerning the decision to send a selfish black lie. Chi-squared tests confirm this result for the overall data set and for each possible die roll (for all tests: $p < 0.001$). Even though the treatment difference does not seem as pronounced during the first round of the game, we observe a lower probability of telling a selfish black lie in our stressed treatment group already during round 1 of the game (chi-squared test, $p = 0.051$).

FIGURE 3 TOP: AVERAGE PROBABILITY OF A SELFISH BLACK LIE OVER THE COURSE OF THE GAME INCLUDING 95% CONFIDENCE BANDS, BOTTOM: AVERAGE PROBABILITY OF A SELFISH BLACK LIE INCLUDING 95% CONFIDENCE INTERVALS—OVERALL AND FOR EACH DIE ROLL.

Table 4 displays the results of three panel probit regressions explaining the binary lying decision of first movers. Model I provides results without variables that are potentially endogenous. It shows that the willingness to report a selfish black lie increases significantly with the round. We find that the lying probability is significantly reduced by about 16 percentage points for subjects in treatment *Stress*. Furthermore, lying decreases significantly the higher the die roll and the older the subject. Both of these effects are also described by Gneezy et al. (2013). Furthermore, the data shows that the probability of sending a selfish black lie does not differ significantly between our male and female participants.

Model II additionally includes the performance in the stress task, the first mover beliefs about second mover behavior and the previous round's lying decision. The results of Model II indicate that the decision to lie does not vary significantly with the round number. Again, the die roll *d* has a significantly negative effect on the decision to lie, i.e. the higher the die roll, the lower the probability of sending a message that does not correspond to the die roll. We further find a significant effect of our stress intervention on the decision to lie: Participants who experienced acute socio-evaluative stress are significantly less likely to send a selfish black lie than the participants in *Control*. The effect size is about 10 percentage points. The results further show that the lying propensity significantly decreases with age. Model II additionally indicates that male and female participants[14] do not differ significantly in their lying probability. We further control for performance in the stress task, as, for instance, participants may be tempted to lie if they performed poorly in the stress task in order to compensate a low payoff from the stress task. We find that the performance effect is close to zero percentage points and insignificant.[15]

Model II further indicates that participants who believe that the second mover will follow the message are significantly less likely to lie (Avg. belief SecMo follows $\in [0,1]$). To control for this effect, we use the average belief calculated for rounds 1-18 to avoid endogeneity problems in the regressions that may arise because the decision on the message may depend on the belief during each round. Additionally, we find that a first mover who indicated a message that did not correspond to the die roll during the previous round, is significantly more likely to lie during the current round (First mover reported m≠d t-1, 1 = lie in t-1, 0 = no lie in t-1).

While the use of the strategy method allows us to study the lying behavior for all possible die rolls, the lying propensity may further be influenced by the decision that was executed during the previous round of the game. Since both types of players in the lying game are informed about the actual die roll, the message sent, the second mover's decision to follow, and the first and second mover's payoffs, we introduce Model III. In this model, we control whether the second mover received a lie during the previous round and whether the second mover followed the message during the previous round. Note that all the effects reported in Model II also prevail in Model III. Again, being a participant of the stressed treatment group significantly decreases the probability of reporting a selfish black lie, by about 10 percentage points. The decision of the second mover to follow the message during the previous round does not affect a first mover's current round lying decision (SecMo followed t-1, 1 = corresponding second mover followed the message in t-1, 0 = corresponding second mover did not follow the message in t-1). However, if the decision executed during the previous round comprised a message that did not correspond to the die roll, a first mover is significantly less likely to send a selfish black lie during the current round (SecMo received lie t-1, 1 = second mover received a lie in t-1, 0 = second mover did not receive a lie in t-1).

Result I: At the extensive margin, participants under socio-evaluative stress are significantly less likely to report a selfish black lie.

14 We do not find a significant gender-stress-interaction in our models.

15 We use the payoff-relevant performance data to control for this effect. This data is available to the participants at the very end of the experiment. To check the robustness of this result, we also run a model including each participant's non-incentivized self-evaluation after the stress task. The effect of this measure on the lying propensity also shows to be insignificant. Note that we also do not find a significant stress-performance-interaction.

TABLE 4: FIRST MOVER'S DECISION TO LIE: EXTENSIVE MARGIN

Lying: First mover reports $m > d$	Model I			Model II			Model III		
	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|
Round	0.0043	0.0018	0.016	0.0018	0.0014	0.183	0.0020	0.0015	0.182
Die roll (d)	-0.0652	0.0101	0.000	-0.0570	0.0053	0.000	-0.0544	0.0052	0.000
Stress	-0.1629	0.0700	0.020	-0.0989	0.0462	0.032	-0.1033	0.0485	0.033
Age	-0.0152	0.0086	0.078	-0.0105	0.0050	0.037	-0.0113	0.0053	0.033
Female	0.0516	0.0723	0.475	0.0239	0.0461	0.605	0.0285	0.0490	0.561
Performance				0.0003	0.0010	0.773	0.0003	0.0011	0.762
Avg. belief SecMo follows				-0.2112	0.0488	0.000	-0.2109	0.0509	0.000
FirstMo reported $m \neq d$ t-1				0.3159	0.0494	0.000	0.3522	0.0487	0.000
SecMo followed t-1							-0.0177	0.0174	0.305
SecMo received lie t-1							-0.0690	0.0182	0.000

RANDOM EFFECTS PANEL PROBIT REGRESSIONS. STANDARD ERRORS ARE CORRECTED FOR CLUSTERING AT THE SUBJECT LEVEL. MODEL I: N = 7,732, PSEUDO R2 = 0.229, LOG PSEUDOLIKELIHOOD = -2307.9216, WALD χ^2 = 146.83, P < 0.001. MODEL II: N = 7,303, PSEUDO R2 = 0.407, LOG PSEUDOLIKELIHOOD = -1655.9238, WALD χ^2 = 303.94, P < 0.001. MODEL III: N = 7,303, PSEUDO R2 = 0.416, LOG PSEUDOLIKELIHOOD = -1630.4813, WALD χ^2 = 393.55, P < 0.001.

First mover beliefs

Different reasons come to mind that may explain the change in the willingness to send a selfish black lie after acute socio-evaluative stress. The change in behavior could result from reduced strategic reasoning (Leder et al. 2013), i.e. stressed participants are not aware of the opportunity to lie. Furthermore, their beliefs concerning second mover behavior could differ from those of *Control*. Another explanation concerns changes in distributional preferences, as acute socio-evaluative stress may influence moral decision-making (Youssef et al. 2012). Note that our instructions were quite clear concerning the lying opportunity. We also answered all questions concerning the game before it started. We therefore neither believe that socio-evaluative stress limited our participants' cognitive resources so that they were not aware of the lying opportunity, nor do we believe that lack of awareness of the opportunity to lie caused behavioral changes.

If acute socio-evaluative stress leads the first mover to believe that the second mover will follow the message sent, first movers could refrain from sending selfish black lies in order to avoid harming the second mover. Thus, a change in beliefs regarding the second mover behavior could explain the effect that we observe. Figure 4 gives a visual representation of the indicated beliefs that the second mover follows a message. In Table 5, we report the corresponding results of three random effects panel probit regressions, with which we explain the dummy variable Belief SecMo follows (1 = first movers expects the second mover to follow a message, 0 = first movers does not expect the second mover to follow a message). Model I indicates that these beliefs do not change significantly after our stress intervention. In fact, the only significant effect we observe is the message sent, i.e. a first mover is less likely to believe that the second mover will follow a message, the higher the message sent.

Model II of table 5 reports the results of a random effects panel regression. The change in model is necessary due to the inclusion of the *Stress*-round interaction term (Ai and Norton 2003). The model additionally considers previous round behavior. Model II indicates that the best predictor for a first mover belief is the first mover's previous round belief (dummy variable Belief SecMo follows t-1). Furthermore, we see that if a first mover observes that the second mover followed the previous round's message, he or she is more likely to believe that the second mover will follow the same message during the current round (dummy variable SecMo followed t-1). We do not find a significant effect of *Stress* on the first mover belief and we also do not find a significant interaction of *Stress* and the round number (Stress x Round).

Recall that the information whether the second mover followed the message is only provided to the first movers for the decision that was executed by the computer. First movers who report the truth are able to observe second mover following behavior for a wider range of messages than first movers who prefer over-reporting the die roll. Since we observe stress-related treatment differences with respect to honesty, participants of *Control* and *Stress* might have different information concerning the second mover behavior. Therefore, Model III reports regression results only for the first round of the lying game when informational differences cannot influence decision-making. Again, we find that first mover beliefs regarding second mover behavior in *Stress* do not differ significantly from those in *Control*. Hence, our analyses indicate that socio-evaluative stress does not alter our first movers' beliefs concerning the second movers' following behavior.

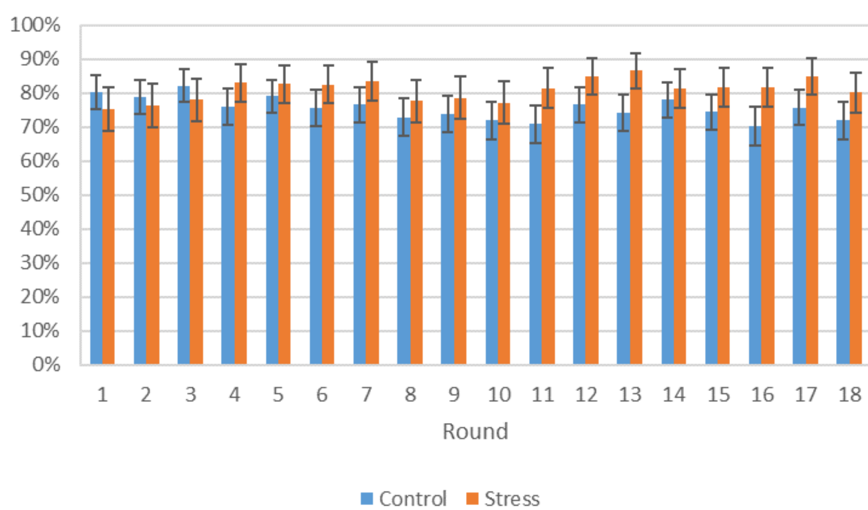

FIGURE 4: FIRST MOVER AVERAGE BELIEF THAT SECOND MOVER FOLLOWS INCLUDING 95% CONFIDENCE INTERVALS.

Although we cannot directly test for this, it appears that socio-evaluative stress alters distributional preferences among our first movers in the lying game. Such changes in distributional preferences could result because participants actively prefer honest responses to dishonest ones. Alternatively, the apparent change in distributional preferences could be due to a reduction in strategic reasoning caused by acute socio-evaluative stress, i.e. participants resort to behavioral heuristics, which results in a less skewed earnings distribution across players. As previous research on non-incentivized decisions in moral dilemma situations has shown (e.g. Singer et al. 2017, Youssef et al. 2012), stressed participants make fewer choices that involve harming other participants. As argued in the literature, this change in behavior can arise because the stress response activates brain regions involved in emotional processing (Arnsten 2009, Ramos and Arnsten 2007), indicating that stressed individuals seem to prefer the intuitive, honest response to the dishonest, individually payoff-maximizing response. In our study, the honest response can reflect other-regarding concerns like inequity aversion (Bolton and Ockenfels 2000, Fehr and Schmidt 1999) or preferences aimed at increasing the payoffs of those worse off in the game (Charness and Rabin 2002, Engelmann and Strobel 2004).

TABLE 5: FIRST MOVER'S BELIEFS CONCERNING SECOND MOVERS' WILLINGNESS TO FOLLOW A MESSAGE

Belief SecMo Follows	Model I			Model II			Model III: Round 1 only		
	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|	Coef.	Robust Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|
Round	-0.0005	0.0017	0.789	-0.0018	0.0016	0.274			
Message sent	-0.0185	0.0074	0.012	-0.0044	0.0029	0.126	-0.0333	0.0129	0.010
Stress	0.0741	0.0617	0.230	0.0129	0.0294	0.660	-0.0284	0.0661	0.668
Age	-0.0018	0.0076	0.815	-0.0021	0.0028	0.459	0.0020	0.0084	0.813
Female	-0.0736	0.0622	0.236	-0.0168	0.0216	0.437	-0.1126	0.0636	0.077
Performance				-0.0003	0.0004	0.457			
Belief SecMo follows t-1				0.6928	0.0384	0.000			
SecMo followed t-1				0.1067	0.0182	0.000			
Stress x round				0.0007	0.0020	0.740			
Constant				0.2610	0.0917	0.004			

STANDARD ERRORS ARE CORRECTED FOR CLUSTERING AT THE SUBJECT LEVEL. MODEL I & III: RANDOM EFFECTS PANEL PROBIT REGRESSIONS. MODEL I: N = 7,732, PSEUDO R2 = 0.017, LOG PSEUDOLIKELIHOOD = -2745.0037, WALD χ^2 = 9.37, P = 0.0952. MODEL II: RANDOM EFFECTS REGRESSION, N = 7,303, R2 OVERALL = 0.521, WALD χ^2 = 790.93, P < 0.001. MODEL III: N = 429, PSEUDO R2 = 0.043, LOG PSEUDOLIKELIHOOD = -188.2840, WALD χ^2 = 9.26, P = 0.055.

Decision to send a selfish black lie—Lying cost

Note that a first mover concerned with efficiency should refrain from lying if the second mover follows, to maximize joint payoffs.[16] If the first mover is solely concerned with his or her own payoff, the first mover should lie to the fullest extent, i.e. always report a 6 irrespective of the payoff consequences for the second mover. Reporting a lie smaller than 6 reflects that lying is morally costly to the first mover. The structure of the data allows us to test whether acute socio-evaluative stress influences this lying cost. We report the

16 A truthfully reported die roll of 1 with the second mover following leads to a total payoff of 22, which equals the payoff from incorrectly reporting a 6 and the second mover following the lie. Thus, a first mover with concerns for efficiency is just indifferent between being truthful and incorrectly reporting a 6 when *d* = 1.

corresponding regression results in Table 6. The dependent variable is the probability of sending the incorrect message of 6 (1 = first movers sends the incorrect message 6, 0 = first movers sends an incorrect message smaller than 6), i.e. we only report data from lies that contain messages higher than the die roll.

Model I results in an insignificant treatment effect of *Stress*. Only the round number and the die roll are positively and significantly related to the probability that the first mover incorrectly reports a message of 6. The results of Model II indicate a significantly positive effect of the die roll, i.e. the higher the number assigned, the higher the probability of incorrectly reporting a 6. Apparently, we observe that the aversion to lie increases with the size of the lie (see also Lundquist et al. 2009). We also see that participants are less likely to send the message 6 if they are under acute socio-evaluative stress. This effect is, however, not statistically significant. We also do not find any significant gender or age related influences. Concerning the performance from the stress task, we find that the higher the performance, the higher the probability of incorrectly reporting a message of 6. Additionally, we find that a first mover who anticipates that the second mover follows the message is significantly less likely to incorrectly report the number 6 (Avg. belief SecMo follows), i.e. tends to report smaller lies. We also find a reluctance to report the largest possible lie in participants who sent an incorrect message during the previous round. Both of these effects can be interpreted as additional evidence for an aversion to lying at the intensive margin.

While evidence for an aversion to lying is abundant in our data set, we also see that it significantly decreases over the course of the game. We further find that participants who reported a 6 during the last round are significantly more likely to also report a 6 during the current round (m = 6 t-1), i.e. their moral cost of acting anti-socially is reduced. In Model III of Table 6, we additionally report the second mover's reaction to the first mover choice from the previous round. Note that the effects that we report in Model II remain unchanged. In fact, the second mover's reaction to the first mover's choice of the previous round does not significantly influence the intensive margin of first mover lying behavior during the current round. Again, we find that the stress treatment does not have a significant effect on the decision to send the largest possible lie. While our results from Table 4 showed that stress has a significantly negative influence on the extensive margin of lying, the results of Table 6 indicate that no such effect exists at the intensive margin of lying. That is, when participants decide to report a selfish black lie, socio-evaluative stress does not have a significant influence on the probability of reporting the largest possible lie.

Result II: At the intensive margin, socio-evaluative stress does not significantly influence the aversion to reporting a selfish black lie.

TABLE 6: PLAYER A'S DECISION TO LIE: INTENSIVE MARGIN

Probability of $m = 6$ if $m > d$	Model I						Model II		
	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|
Round	0.0107	0.0037	0.003	0.0056	0.0019	0.003	0.0055	0.0019	0.003
Die roll (d)	0.0288	0.0106	0.007	0.0256	0.0072	0.000	0.0258	0.0072	0.000
Stress	-0.0106	0.1191	0.929	-0.0293	0.0703	0.677	-0.0306	0.0703	0.664
Age	0.0056	0.0108	0.605	0.0033	0.0068	0.628	0.0031	0.0069	0.653
Female	-0.0604	0.1105	0.584	-0.0378	0.0651	0.561	-0.0355	0.0651	0.586
Performance				0.0022	0.0022	0.046	0.0022	0.0011	0.047
Avg. belief SecMo follows				-0.1654	0.0820	0.044	-0.1666	0.0825	0.043
FirstMo reported $m \neq d$ t-1				-0.0927	0.0216	0.000	-0.0872	0.0217	0.000
$m = 6$ t-1				0.1831	0.0505	0.000	0.1858	0.0499	0.000
SecMo followed m t-1							-0.0049	0.0172	0.776
SecMo received lie t-1							-0.0150	0.0213	0.480

RANDOM EFFECTS PANEL PROBIT REGRESSIONS, STANDARD ERRORS ARE CORRECTED FOR CLUSTERING AT THE SUBJECT LEVEL. MODEL I: N = 2,416, PSEUDO R2 = 0.107, LOG PSEUDOLIKELIHOOD = -581.5209, WALD χ^2 = 22.26, P < 0.001. MODEL II: N = 2,325, PSEUDO R2 = 0.200, LOG PSEUDOLIKELIHOOD = -465.8895, WALD χ^2 = 94.68, P < 0.001.MODEL III: N = 2,325, PSEUDO R2 = 0.201, LOG PSEUDOLIKELIHOOD = -465.4925, WALD χ^2 = 104.02, P < 0.001.

Decision to follow potentially harmful messages

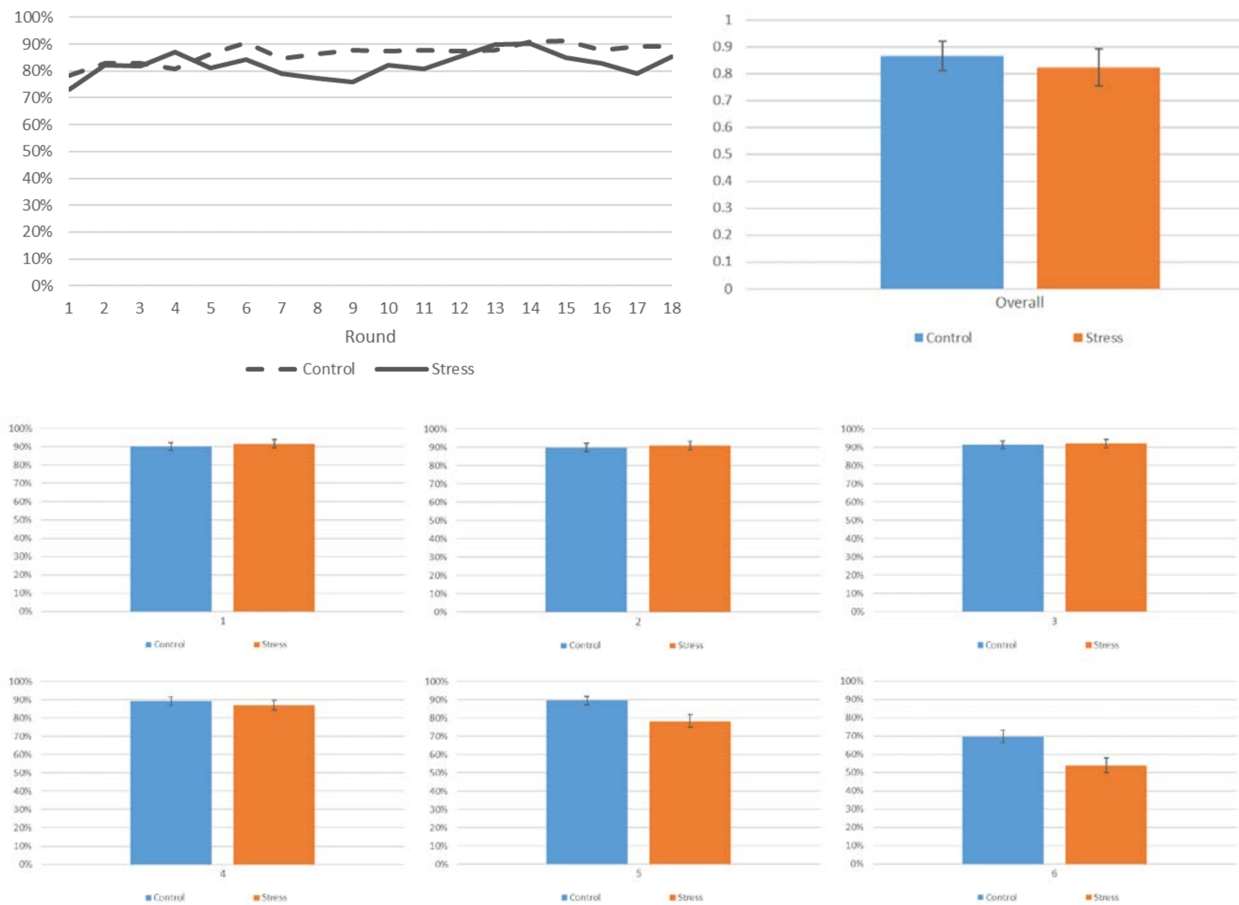

FIGURE 5 TOP: AVERAGE PROBABILITY OF FOLLOWING A MESSAGE, BOTTOM: AVERAGE PROBABILITY OF FOLLOWING INCLUDING 95% CONFIDENCE INTERVALS—FOR EACH MESSAGE.

The decision to follow a message can be interpreted as the decision of the second mover to trust that the first mover will not lie, meaning that the second mover's decision-making environment includes strategic uncertainty. The literature has suggested that decision-making in these situations might be related to risky situations, i.e. situations bearing state uncertainty in which the outcome of one person cannot be due to another person (e.g. Cook and Cooper 2003, Hardin 2002, Karlan 2005). However, the brain seems to implement trusting decisions differently than risky decisions (Aimone et al. 2014, Kosfeld et al. 2005). In this vein, there is evidence that a person's risk attitudes are not tightly connected to the decision to trust (Ben-Ner and Halldorsson 2010, Eckel and Wilson 2005, Houser et al. 2010). Nevertheless, we cannot rule out that this is also the case in our set-up. We are therefore not able to point out potential determinants of trust, which might relate to changes in risk aversion[17], betrayal aversion (e.g. Aimone et al. 2014, Bohnet and Zeckhauser 2004), cognitive reflection (e.g. Corgnet et al. 2016), or even other factors. We leave this question open for future research.

As Figure 5 indicates, the effects of acute stress on the decision of a second mover to follow a message do not seem to differ between treatments at the aggregate level. However, it appears that participants who experienced acute socio-evaluative stress are less likely to follow the messages 5 and 6. Chi-squared tests support this finding: We do not find significant differences in the willingness to follow the message 1-4 between our treatment and control group. For messages 5 and 6, this difference is significant (both $p < 0.001$).

Model I of Table 7 includes the results of a binary response model that explains the second mover's decision to follow the first mover's message (1 = second mover follows, 0 = second mover does not follow). It shows that trust increases significantly over the course of the game. We also see that second movers are significantly less likely to follow the messages 4-6 (variable Message) than they are to follow a message of 1. Stress does not have a significant influence on the decision to follow a message and neither do gender nor age.

Model II additionally includes variables that represent previous round behavior of the second mover, as well as the second mover's performance in the stress task. Most effects of Model I prevail. Model II shows that second movers are significantly less likely to follow the messages 5-6 than they are to follow a message of 1. Second Movers who followed a message during the previous round are significantly more likely to follow the message during the current round (SecMo followed t-1, 1 = second mover followed during the previous round, 0 = second mover did not follow during the previous round). Additionally, the model indicates that second movers who received a lie during the previous round are significantly less likely to follow

[17] Cahlíková and Cingl (2017) and Kandasamy et al. (2014) show that stressed individuals exhibit a larger aversion to risk.

a message during the current round (SecMo received lie t-1, 1 = second mover received a lie during the previous round, 0 = second mover did not receive a lie during the previous round).

Result III: On average, socio-evaluative stress does not significantly influence the willingness to follow a message.

Model III of Table 7 allows us to check for treatment differences in trust regarding different messages as suggested by Figure 5. The results indicate that the willingness to follow a message no longer increases over the course of the game. Unstressed participants are similarly likely to follow messages 2-5 as they are to follow a message of 1. However, a message of 6 is significantly less likely to be followed than a message of 1. Again, the treatment effect of our socio-evaluative stress intervention does not prove to be significant. As expected, treatment differences arise in the willingness to follow messages 5 and 6. We observe that participants in *Stress* are significantly less likely to follow messages 5 and 6 than they are to follow a message of 1. The other effects remain comparable to those reported in Model II.

Result IV: Participants under socio-evaluative stress are significantly less likely to follow high messages.

Contrary to our initial hypothesis, socio-evaluative stress does not have an effect on the aggregate level of trust. However, we do find that stressed participants are significantly less likely to follow high messages, i.e. messages that can potentially include large lies. This lack of trust leads to missed payoff opportunities in those cases where the high message equals the die roll. Therefore, second movers who underwent the socio-evaluative stress task earn significantly less in the lying game than the unstressed second movers. This difference is statistically significant at p = 0.002 (U-Test).

In fact, following comes with a positive expected excess payoff for the second mover. The expected excess payoff is summarized in Table 8. The table reports the probability p with which each potential message is true. The expected excess payoff from following a message is given as $10 \cdot p - 3$. Note that excess expected payoff is significantly larger than 0 points for all potential messages. Since stressed first movers tend to lie less than unstressed first movers, the expected excess payoff when interacting with a stressed first mover is even higher.

Table 7: Second Mover's decision to Follow

Trust: Second mover follows	Model I			Model II			Model III		
	Coef. (Marginal Probabilities)	Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Std. Err.	P > |z|	Coef.	Std. Err.	P > |z|
Round	0.0050	0.0011	0.000	0.0023	0.0009	0.014	0.0011	0.0010	0.266
Message									
2	-0.0043	0.0073	0.555	-0.0046	0.0056	0.408	-0.0088	0.0076	0.247
3	0.0077	0.0060	0.204	0.0087	0.0062	0.163	0.0045	0.0073	0.543
4	-0.0240	0.0111	0.030	-0.0116	0.0107	0.277	-0.0044	0.0122	0.717
5	-0.0601	0.0141	0.000	-0.0227	0.0115	0.048	0.0014	0.0099	0.884
6	-0.2819	0.0267	0.000	-0.1319	0.0142	0.000	-0.1088	0.0185	0.000
Stress	-0.0047	0.0173	0.786	0.0070	0.0111	0.530	0.0270	0.0186	0.147
Age	0.0017	0.0021	0.407	-0.0007	0.0016	0.678	-0.0007	0.0016	0.651
Female	0.0152	0.0178	0.394	0.0036	0.0134	0.788	0.0063	0.0139	0.647
Performance				-0.0005	0.0004	0.238	-0.0004	0.0004	0.357
SecMo followed t-1				0.4525	0.0286	0.000	0.4963	0.0276	0.000
SecMo received lie t-1				-0.1069	0.0126	0.000	-0.1081	0.0139	0.000
Message x Stress									
2							0.0088	0.0111	0.430
3							0.0041	0.0117	0.727
4							-0.0147	0.0200	0.461
5							-0.0542	0.0223	0.015
6							-0.0871	0.0281	0.002
Constant							0.5142	0.0515	0.000

Model I and II: Random effects Panel Probit regressions. Model III: Random effects regression. Standard errors corrected for clustering at the subject level. Model I: N = 7,668, Pseudo R2 = 0.096, Log Pseudolikelihood = -2837.2466, Wald χ^2 = 253.98, p < 0.001. Model II: N = 7,242, Pseudo R2 = 0.344, Log Pseudolikelihood = -1888.516, Wald χ^2 = 652.66, p < 0.001. Model III: N = 7,242, R2 overall = 0.371, Wald χ^2 = 1403.74, p < 0.001.

Table 8: Expected Excess payoff from Following

Message	Probability that the message is true (p)			Expected excess payoff from following a message		
	Overall	Stressed first movers	Unstressed first movers	Overall	Stressed first movers	Unstressed first movers
1	86.76%	87.43%	86.20%	5.68	5.74	5.62
2	85.78%	89.45%	82.66%	5.58	5.94	5.27
3	84.10%	88.64%	80.75%	5.41	5.86	5.07
4	79.31%	84.37%	75.73%	4.93	5.44	4.57
5	77.73%	76.82%	78.53%	4.77	4.68	4.85
6	43.22%	56.11%	36.61%	1.32	2.61	0.66

5. Conclusions

We propose a task to induce acute socio-evaluative stress in an economist's lab. Our task is non-deceptive, features performance-based pay, simultaneously creates a treatment and control group, does not require an expert panel, and allows us to control for the influence of the performance in the stress task on future behavior. We show that our task is successful in inducing acute stress.

Employing our stress task, we study the influence of acute socio-evaluative stress on the propensity to tell a selfish black lie (increasing own payoff at the expense of another player) and to trust messages that could potentially contain a lie. This study is the first to provide evidence on lying with monetary consequences after acute socio-evaluative stress. Our findings concerning the extensive margin of lying are in line with the results from hypothetical choices in moral dilemmas showing that acutely stressed individuals avoid harming others (e.g. Singer et al. 2017, Youssef et al. 2012). We show that individuals under acute socio-evaluative stress are significantly less likely to tell a selfish black lie. The participants of our stressed treatment group reduce lying at the extensive margin and show a significantly increased aversion to lying compared to our control group. Concerning the intensive margin of lying, we do not find stress-related treatment differences. We further show that the decrease in the probability to lie at the extensive margin is not driven by a change in a player's beliefs regarding the other players' trusting behavior. Instead, it appears to be due to a change in distributional preferences. Our participants who underwent the social-stress intervention make choices that are in line with heightened concerns for inequality aversion or maximin preferences, whereas the control group makes choices that are more often characterized by preferences for efficiency, which correspond to self-interested payoff maximization in the lying game that we consider.

Concerning the decision to trust a message that potentially contains a lie, we find no aggregate effects of acute socio-evaluative stress on behavior. However, we do find that participants who underwent the stress task are significantly less likely to trust messages that can potentially include large lies. This reluctance to trust leads to missed payoff opportunities that are reflected in the earnings of the participants, as excess expected payoff from trusting a message is positive and substantial for all types of messages.

Our findings suggest that acute socio-evaluative stress does not increase direct economic losses caused by lying behavior in business relationships. In fact, we would even expect these losses to decrease as the probability of telling a selfish black lie decreases under acute socio-evaluative stress. However, we do find support that an indirect cost may be imposed, as the reduction in trust can lead to missed business opportunities. This may be especially problematic in relationships that are trust-based and characterized by incomplete contracts.

Note that the take-away from this study should not be to increase acutely stressful situations at the workplace to keep deceptive behavior at bay. In fact, there is evidence of the adverse health effects of acute stress (e.g. Brotman et al. 2007, Steptoe et al. 2007) that can lead to reduced business outcomes (e.g. Burton et al. 1999, Goetzel et al. 2004). Instead, managerial implications refer to the fact that people under acute socio-evaluative stress may differ in what they think is ethically acceptable behavior and when they doubt the truthfulness of messages. Therefore, decision-making rights and monitoring efforts might have to be allocated carefully. In order to optimally do so, future research should focus on whether people adjust their lying and trusting decisions under reoccurring acute socio-evaluative stress, i.e. whether reoccurring acute socio-evaluative stress robustly influences decision-making, or whether people learn to cope with it.

References

Abeler, J., Becker, A., & Falk, A. (2014). Representative evidence on lying costs. Journal of Public Economics, 113, 96–104.

Ai, C. & Norton, E. C. (2003). Interaction terms in logit and probit models. Economics Letters 80, 123–129.

Aimone, J. A., Houser, D., & Weber, B. (2014). Neural signatures of betrayal aversion: an fMRI study of trust. Proceedings of the Royal Society B, 281:20132127.

Arnsten, A. F. (2009). Stress signaling pathways that impair prefrontal cortex structure and function. Nature Reviews Neuroscience, 10 (6), 410–422.

Baddeley, A. (1992). Working memory. Science, 255(5044), 556–559.

Ben-Ner, A. & Halldorsson, F. (2010). Trusting and trustworthiness: What are they, how to measure them, and what affects them. Journal of Economic Psychology, 31, 64–79.

Bock, O., Baetge, I., & Nicklisch, A. (2014): hroot: Hamburg registration and organization online tool. European Economic Review, 71, 117–120.

Bohnet, I. & Zeckhauser, R. (2004). Trust, risk and betrayal. Journal of Economic Behavior & Organization, 55, 467–484.

Bolton, G. E. & Ockenfels, A. (2000). ERC: A theory of equity, reciprocity, and competition. American Economic Review, 90(1), 166–193.

Brotman, D. J., Golden, S. H., & Wittstein, I. S. (2007). The cardiovascular toll of stress. Lancet, 370(9592), 1089–1100.

Buckert, M., Oechssler, J., & Schwieren, C. (2017). Imitation under stress. Journal of Economic Behavior & Organization, 139, 252–266.

Burton, W. N., Conti, D. J., Chen, C.-Y., Schultz, A. B., & Edington, D. W. (1999). The role of health risk factors and disease on worker productivity. Journal of Occupational and Environmental Medicine, 41(10), 863–877.

Cappelen, A. W., Sørensen, E. Ø., & Tungodden, B. (2013). When do we lie? Journal of Economic Behavior and Organization, 93, 258–265.

Cahlíková, J. & Cingl, L. (2017). Risk preferences under acute stress. Experimental Economics, 20(1), 209–236.

Capraro, V. (2017). Does the truth come naturally? Time pressure increases honesty in one-shot deception games. Economics Letters, 158, 54–57.

Chandola, T. (2010). Stress at work. The British Academy, London.

Charness, G. & Rabin, M. (2002). Understanding social preferences with simple tests. Quarterly Journal of Economics, 117(3), 817–869.

Childs, J. (2012). Gender differences in lying. Economics Letters, 114(2), 147–149.

Conrads, J., Irlenbusch, B., Rilke, R. M., & Walkowitz, G. (2013). Lying and team incentives. Journal of Economic Psychology, 34, 1–7.

Cook, K. S. & Cooper, R. M. (2003). Experimental studies of cooperation, trust, and social exchange. In: Ostrom, E., Walker, J. (Eds.), Trust and Reciprocity. Russell Sage, New York, 209–244.

Côté, S., Kraus, M. W., Cheng, B. H., Oveis, C., van der Löwe, I., Lian, H., & Keltner, D. (2011). Social power facilitates the effect of prosocial orientation on empathic accuracy. Journal of Personality and Social Psychology, 101(2), 217–232.

Corgnet, B., Espín, A. M., Hernán-González, R., Kujal, P. & Rassenti, S. (2016). To trust, or not to trust: Cognitive reflection in trust games. Journal of Behavioral and Experimental Economics, 64, 20–27.

DeCelles, K. A., DeRue, S. D., Margolis, J. D., & Ceranic, T. L. (2012). Does power corrupt or enable? When and why power facilitates self-interested behavior. Journal of Applied Psychology, 97(3), 681–689.

Dedovic, K., Duchesne, A., Andrews, J., Engert, V., & Pruessner, J. C. (2009). The brain and the stress axis: The neural correlates of cortisol regulation in response to stress. NeuroImage, 47, 864–871

Dedovic, K., Rexroth, M.,Wolff, E., Duchesne, A., Scherling, C., Beaudry, T., Lue, S. D., Lord, C., Engert, V., & Pruessner, J. C. (2009). Neural correlates of processing stressful information: An event-related fMRI study. Brain Research, 1293, 49–60.

Derogatis, L. R. (2000). BSI-18. Brief symptom inventory-18. Administration, scoring, and procedures manual. Minneapolis, MN: NCS Pearson, INC.

Dickerson, S. S. & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. Psychological Bulletin, 130(3), 355–391.

Dreber, A. & Johannesson, M. (2008). Gender differences in deception. Economics Letters, 99, 197–199.

Eckel, C. C. & Wilson, R. K. (2004). Is trust a risky decision? Journal of Economic Behavior & Organization, 55, 447–465.

Engelmann, D. & Strobel, M. (2004). Inequality aversion, efficiency, and maximin preferences in simple distribution experiments. American Economic Review, 94(4), 857-869.

Erat, S. & Gneezy, U. (2012). White lies. Management Science, 58(4), 723–733.

Fehr, E. & Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. Quarterly Journal of Economics, 114(3), 817–868.

Fischbacher, U. (2007). z-Tree: Zurich toolbox for ready-made economic experiments. Experimental Economics, 10(2), 171–178.

Fischbacher, U. & Föllmi-Heusi, F. (2013). Lies in disguise – An experimental study on cheating. Journal of the European Economic Association, 11(39), 525–547.

Foley, P. & Kirschbaum, C. (2010). Human hypothalamus–pituitary–adrenal axis responses to acute psychosocial stress in laboratory settings. Neuroscience and Biobehavioral Reviews, 35(1), 91–96.

Gneezy, U. (2005). Deception: The role of consequences. American Economic Review, 95(1), 384–394.

Gneezy, U., Rockenbach, B., & Serra-Garcia, M. (2013). Measuring lying aversion. Journal of Economic Behavior and Organization, 93, 292–300.

Goetzel, R. Z., Long, S. R., Ozminkowski, R. J., Hawkins, K., Wang, S., & Lynch, W. (2004). Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting U.S. employers. Journal of Occupational and Environmental Medicine, 46(4), 398–412.

Greene, J. D., Nystrom, L. E., Engell, A. D., Darley, J. M., & Cohen, J. D. (2004). The neural bases of cognitive conflict and control in moral judgement. Neuron, 44, 389–400.

Gruenewald, T. L., Kemeny, M. E., Aziz, N., & Fahey, J. L. (2004). Acute threat to the social self: Shame, social self-esteem, and cortisol activity. Psychosomatic Medicine, 66(6), 915–924.

Gylfason, H. F., Arnardottir, A. A., & Kristinsson, K. (2013). More on gender differences in lying. Economics Letters, 119(1), 94–96.

Hardin, R. (2002). Trust and Trustworthiness. Russell Sage, New York.

Hassard, J., Teoh, K., Cox, T., Dewe, P., Cosmar, M., Gründler, R., Flemming, D., Cosemans, B., & Van den Broek, K. (2014). Calculating the cost of work-related stress and psychological risks. Commissioned by the European Agency for Safety and Health at Work.

Het, S., Rohleder, N., Schoofs, D., Kirschbaum, C., & Wolf, O. T. (2009). Neuroendocrine and psychometric evaluation of a placebo version of the 'Trier Social Stress Test'. Psychoneuroendocrinology, 34(7), 1075–1086.

Hoel, H., Sparks, K., & Cooper, C. L. (2001). The Cost of violence/stress at work and the benefits of a violence/stress-free working environment. Report Commissioned by the International Labour Organization (ILO) Geneva.

Houser, D., Schunk, D. & Winter, J. (2010). Distinguishing trust from risk: An anatomy of the investment game. Journal of Economic Behavior & Organization, 74, 72–81.

Hurkens, S. & Kartik, N. (2009). Would I lie to you? On social preferences and lying aversion. Experimental Economics, 12(2), 180–192.

Hyde, S. (2017). Income and health outcomes. Monthly Labor Review, U.S. Bureau of Labor Statistics.

Jamison, J., Karlan, D., & Schechter, L. (2008). To deceive or not to deceive: The effect of deception on behavior in future laboratory experiments. Journal of Economic Behavior and Organization, 68(3–4), 477–488.

Kahneman, D. (2011). Thinking, fast and slow. New York: Farrar, Straus and Giroux.

Kajackaite, A., & Gneezy, U. (2017). Incentives and cheating. Games and Economic Behavior, 102, 433–444.

Kandasamy, N., Hardy, B., Page, L., Schaffner, M., Graggaber, J., Powlson, A. S., Fletcher, P. C., Gurnell, M., & Coates, J. (2014). Cortisol shifts financial risk preferences. Proceedings of the National Academy of Sciences of the United States of America, 111(9), 3608–13.

Kajantie, E., & Phillips, D. I. (2006). The effects of sex and hormonal status on the physiological response to acute psychosocial stress. Psychoneuroendocrinology, 31(2), 151–178.

Karlan, D. S. (2005). Using experimental economics to measure social capital and predict financial decisions. American Economic Review, 95(5), 1688–1699.

Kern, S., Oakes, T. R., Stone, C. K., McAuliff, E. M., Kirschbaum, C., & Davidson, R. J. (2008). Glucose metabolic changes in the prefrontal cortex are associated with HPA axis response to a psychosocial stressor. Psychoneuroendocrinology, 33 (4), 517–529.

Kirschbaum, C. & Hellhammer, D. (1989). Salivary cortisol in psychobiological research: An overview. Neuropsychobiology, 22(3), 150–169.

Kirschbaum, C., Klauer, T., Filipp, S.-H., & Hellhammer, D. H. (1995). Sex-specific effects of social support on cortisol and subjective responses to acute psychological stress. Psychosomatic Medicine, 57(1), 23–31.

Kirschbaum, C., Kudielka, B. M., Gaab, J., Schommer, N. C., & Hellhammer, D. H. (1999). Impact of gender, menstrual cycle phase, and oral contraceptives on the activity of the hypothalamus-pituitary-adrenal axis. Psychosomatic Medicine, 61(2), 154–162.

Kirschbaum, C., Pirke, K. M., & Hellhammer, D. H. (1993). The ‘Trier Social Stress Test’ – a tool for investigating psychobiological stress responses in a laboratory setting. Neuropsychobiology, 28, 76–81.

Kirschbaum, C., Wolf, O. T., May, M., Wippich, W., & Hellhammer, D. H. (1996). Stress- and treatment-induced elevations of cortisol levels associated with impaired declarative memory in healthy adults. Life Sciences, 58(17), 1475–1483.

Kocher, M. G., Schudy, S., & Spantig, L. (2017). I lie? We lie! Why? Experimental evidence on a dishonesty shift in groups. Management Science, Articles in Advance, https://doi.org/10.1287/mnsc.2017.2800

Konrad, K., Lohse, T., & Simon, S. A. (2018). Deception under time pressure: Conscious decision or a problem of awareness? Journal of Economic Behavior & Organization, 146, 31-42.

Korndörfer, M., Egloff, B., & Schmukle, S. C. (2015). A large scale test of the effect of social class on prosocial behavior. PLoS ONE 10(7):e0133193. doi:10.1371/journal.pone.0133193.

Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. Nature, 435, 673–676.

Kudielka, B. M, Buske-Kirschbaum, A., Hellhammer, D. H, & Kirschbaum, C. (2004a). HPA axis responses to laboratory psychosocial stress in healthy elderly adults, younger adults, and children: impact of age and gender. Psychoneuroendocrinology, 29(1), Pages 83–98.

Kudielka, B. M., Schommer, N. C., Hellhammer, D. H., & Kirschbaum, C. (2004b). Acute HPA axis responses, heart rate, and mood changes to psychosocial stress (TSST) in humans at different times of day. Psychoneuroendocrinology, 29(8), 983–992.

Kukolja, J., Schläpfer, T. E., Keysers, C., Klingmüller, D., Maier, W., Fink, G. R., & Hurlemann, R. (2008). Modeling a negative response bias in the human amygdala by noradrenergic–glucocorticoid interactions. Journal of Neuroscience, 28(48), 12868–12876.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1998). Emotion, Motivation, and Anxiety: Brain Mechanisms and Psychophysiology. Biological Psychiatry, 44, 1248–1263.

Leder, J., Häusser, J. A., & Mojzisch, A. (2013). Stress and strategic decision-making in the beauty contest game. Psychoneuroendocrinology, 38(9), 1503-1511.

Luethi, M., Meier, B., & Sandi, C. (2009). Stress effects on working memory, explicit memory, and implicit memory for neutral and emotional stimuli in healthy men. Frontiers in Behavioral Neuroscience, 2, https://doi.org/10.3389/neuro.08.005.2008.

Lundquist, T., Ellingsen, T., Gribbe, E., & Johannesson, M. (2009). The aversion to lying. Journal of Economic Behavior and Organization, 70, 81–92.

Miller, R., Plessow, F., Kirschbaum, C., & Stalder, T. (2013). Classification criteria for distinguishing cortisol responders from nonresponders to psychosocial stress: evaluation of salivary cortisol pulse detection in panel designs. Psychosomatic Medicine, 75(9), 832-40.

Oei, N. Y. L., Everaerd, W. T. A. M., Elzinga, B. M., van Well, S., & Bermond, B. (2006). Psychosocial stress impairs working memory at high loads: An association with cortisol levels and memory retrieval. Stress, 9(3), 133–141.

Pabst, S., Brand, M., & Wolf, O. T. (2013). Stress and decision making: A few minutes make all the difference. Behavioural Brain Research, 250, 39–45.

Piff, P. K., Stancato, D. M., Côté, S., Mendoza-Denton, R., & Keltner, D. (2012). Higher social class predicts increased unethical behavior. Proceedings of the National Academy of Sciences, 109(11), 4086–4091.

Pruessner, J. C., Dedovic, K., Khalili-Mahani, N., Engert, V., Pruessner, M., Buss, C., Renwick, R., Dagher, A., Meaney, M. J., & Lupien, S. (2008). Deactivation of the limbic system during acute psychosocial stress: Evidence from positron emission tomography and functional magnetic resonance imaging studies. Biological Psychiatry, 63, 234–240.

Pruessner, J. C., Wolf, O. T., Hellhammer, D. H., Buske-Kirschbaum, A., von Auer, K., Jobst, S., Kaspers, F., & Kirschbaum, C. (1997). Free cortisol levels after awakening: A reliable biological marker for the assessment of adrenocortical activity. Life Sciences, 61(26), 2539–2549.

Rammstedt, B. & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. Journal of Research in Personality, 41(1), 203–212.

Ramos, B. P. & Arnsten, A. F. (2007). Adrenergic pharmacology and cognition: Focus on the prefrontal cortex. Pharmacology & Therapeutics, 113, 523–536.

Rand, D. G., Peysakhovich, A., Kraft-Todd, G. T., Newman, G. E., Wurzbacher, O., Nowak, M. A., & Greene, J. D. (2014). Social heuristics shape intuitive cooperation. Nature Communications, 5, Article number: 3677.

Rodrigues, S. M., LeDoux, J. E., & Sapolsky, R. M. (2009). The Influence of Stress Hormones on Fear Circuitry. Annual Review of Neuroscience, 32, 289–313.

Shalvi, S., Eldar, O., & Bereby-Meyer, Y. (2012). Honesty requires time (and lack of justifications). Psychological Science, 23(10), 1264–1270.

Sherman, G. D., Lee, J. J., Cuddy, A. J. C., Renshon, J., Oveis, C., Gross, J. J., & Lerner, J. S. (2012). Leadership is associated with lower levels of stress. Proceedings of the National Academy of Sciences, 109, 17903–17907.

Shields, G. S., Sazma, M. A., & Yonelinas, A. P. (2016). The effects of acute stress on core executive functions: A meta-analysis and comparison with cortisol. Neuroscience and Biobehavioral Reviews, 68, 651–668.

Singer, N., Sommer, M., Döhnel, K., Zänkert, S., Wüst, S., & Kudielka, B. M. (2017). Acute psychosocial stress and everyday moral decision-making in young healthy men: The impact of cortisol. Hormones and Behavior, 93, 72–81.

Smeets, P., Bauer, R., & Gneezy, U. (2015). Giving behavior of millionaires. Proceedings of the National Academy of Sciences, 112(34), 10641–10644.

Spitzer, C., Hammer, S., Löwe, B., Grabe, H. J., Barnow, S., Rose, M., Wingenfeld, K., Freyberger, H. J., & Franke, G. H. (2011). Die Kurzform des Brief Symptom Inventory (BSI-18): Erste Befunde zu den psychometrischen Kennwerten der deutschen Version. Fortschritte der Neurologie Psychiatrie 2011, 79(9), 517–523.

Starcke, K., Ludwig, A.-C., & Brand, M. (2012). Anticipatory stress interferes with utilitarian moral judgment. Judgment and Decision Making, 7(1), January 2012, pp. 61–68.

Steinbeis, N., Engert, V., Linz, R. & Singer, T. (2015). The effects of stress and affiliation on social decision-making: Investigating the tend-and-befriend pattern. Psychoneuroendocrinology, 62, 138–148.

Steptoe, A., Hamer, M., & Chida, Y. (2007). The effects of acute psychological stress on circulating inflammatory factors in humans: A review and meta-analysis. Brain, Behavior, and Immunity, 2187), 901–912.

Steptoe, A., Fieldman, G., Evans, O., & Perry, L. (1993). Control over work pace, job strain and cardiovascular responses in middle-aged men. Journal of Hypertension, 11(7), 751–759.

Thompson, S. C. (1981). Will it hurt less if I can control it? A complex answer to a simple question. Psychological Bulletin, 90(1), 89–101.

Trautmann, S. T., van de Kuilen, G., & Zeckhauser, R. J. (2013). Social class and (un)ethical behavior: A framework, with evidence from a large population sample. Perspectives on Psychological Science, 8(5), 487–497.

Von Dawans, B., Fischbacher, U., Kirschbaum, C., Fehr, E., & Heinrichs, M. (2012). The Social dimension of stress reactivity: Acute stress increases prosocial behavior in humans. Psychological Science 23(6), 651–660.

Von Dawans, B., Kirschbaum, C., & Heinrichs, M. (2011). The Trier Social Stress Test for groups (TSST-G): A new research tool for controlled simultaneous social stress exposure in a group format. Psychoneuroendocrinology, Volume 36(4), 514–522.

Youssef, F. F., Dookeeram, K., Basdeo, V., Francis, E., Doman, M., Mamed, D., Maloo, S., Degannes, J., Dobo, L., Ditshotlo, P., & Legall, G. (2012). Stress alters personal moral decision making. Psychoneuroendocrinology, 37(4), 491–498.

Appendix A - Instructions

Stress task—Instructions: Part 1

The experimental software will ask you questions concerning yourself, your character, and your emotional state. Most of these can easily be answered by clicking on the answer with your computer mouse. Please answer quickly without taking too long to think—there are no right or wrong answers. Please read the instructions for each question as these concern different time frames (e.g. during the last month, during the last seven days, today).

Please note that your data will be stored in a pseudonymized format, i.e. your name is not stored together with your data. Instead of your name, a number is assigned. Third parties will not be able to find out that you participated in this study. The data analysis will also be carried out anonymously.

There will be a 10-minute break during the experiment. The software will let you know when. You will receive €5.00 for your participation in this study. You can earn further payoffs during the course of the experiment. The experiment consists of two parts—A and B. You receive the corresponding instructions before the start of each part.

In case anything is unclear to you, we are happy to come by your workstation to answer your questions.

Stress task—Instructions: Part 2

Part A of the experiment differs depending on the room you are located in. If you are in the room with the experimenter's computer terminal, you belong to group 1. If you are in the other room, you belong to group 2.

Group 1:

Job descriptions often include requests for analytical thinking skills. Please imagine that you are applying for a position or a traineeship. Your task is to record a 2-minute video, in which you explain to what degree you possess skills in analytical thinking. Before you start recording, you have 5 minutes to prepare your argumentation. Pens and paper are available at your workstation.

The software will let you know when you should put on your headset. Please position the microphone directly in front of your mouth and make sure the microphone is turned on.

As soon as the video application is loaded, immediately click the button "start recording" at the bottom right corner of your screen. The timer lets you know when the 2 minutes recording time are up. You may not repeat a recording.

After the recording time for your video is over, the corresponding <u>soundtrack</u> is made available to the members of group 2. Each member of group 2 listens to each argumentation and evaluates its persuasiveness. The argumentation will be evaluated according to the criterion: "The person convincingly explained that they possess analytical thinking skills."

The members of group 2 evaluate on a scale from 0% (not convincing at all) to 100% (very convincing). The better your evaluation as a group 1 member, the higher your payoff, which is derived from your median evaluation, i.e. each participant of group 2 evaluates your analytical thinking skills. The median is defined as:

$$Median\ \tilde{x} = \begin{cases} x_{\frac{n+1}{2}} & \text{for an even number } n \text{ of group 2 participants} \\ 1/2\left(x_{\frac{n}{2}} + x_{\frac{n}{2}+1}\right) & \text{for an uneven number } n \text{ of group 2 participants} \end{cases}$$

Your payoff is derived from the following table:

$0\% \leq \tilde{x} \leq 10\%$	$10\% < \tilde{x} \leq 20\%$	$20\% < \tilde{x} \leq 30\%$	$30\% < \tilde{x} \leq 40\%$	$40\% < \tilde{x} \leq 50\%$
€1.00	€2.00	€3.00	€4.00	€5.00

$50\% < \tilde{x} \leq 60\%$	$60\% < \tilde{x} \leq 70\%$	$70\% < \tilde{x} \leq 80\%$	$80\% < \tilde{x} \leq 90\%$	$90\% < \tilde{x} \leq 100\%$
€6.00	€7.00	€8.00	€9.00	€10.00

Example: You are not convincing in arguing you possess analytical thinking skills, and the median of your evaluation is 4%. You then receive a payoff of €1.00. If you are very convincing and the median of your analytical thinking skills is higher than 90%, you receive €10.00 during this part of the experiment.

Please do not state your name in the recording. Use the entire 2 minutes available for recording. You may not record for longer than that because the recording automatically stops after the 2 minutes are over. Should you be done with your argumentation before the 2 minutes are over, the software will continue to record. Please continue your argument instead of letting the time pass by.

Please note that participants of group 2 are also asked whether you tried to positively influence your payoff through ways that are not intended in the experiment. Group 2 participants are therefore asked to indicate whether "The person intentionally tried to influence me, so that I give a better evaluation." If the majority (more than half) of the group 2 participants answer yes to this question, you will not receive a payoff from this part of the experiment, i.e. please do not send any private messages, collusive arrangements, or the like.

After the entire experiment is over, you get to know your median evaluation. You receive your earnings in cash at the end of the experiment. Your total payoff includes your participation payment of €5.00 plus your earnings from part A and B of the experiment.

Total payoff = €5.00 + Payoff Part A + Payoff Part B

Group 2

As a group 2 member, you also have 5 minutes of preparation time, during which you consider what makes a convincing presentation of analytical thinking skills. Pens and paper are available at your work-station.

You receive the recordings of group 1, listen to them, and assess them on a scale from 0% (not convincing at all) to 100% (very convincing). The order in which you receive the recordings differs across group 2 participants, i.e. the recording that one participant hears first, second, third... will be available to a different participant in a different order. After you evaluated one of the recordings, you cannot go back to adjust your evaluation. Please evaluate the recordings quickly, as the experiment is delayed otherwise.

Assessments are made according to the following criterion: “The person intentionally tried to influence me, so that I give a better evaluation,” “The person convincingly explained that they possess analytical thinking skills,” “The person effectively used the 2 minutes available for recording.”

Your payoffs are based on your assessment in the category “analytical thinking.” You assess a total of i=5 participants from group 1. For every group 1 participant, a group median is calculated from the different assessments (see above). Your payoff is derived from the absolute value of the difference between your assessment of a group 1 participant and the respective participant’s group median: $|x_i - \widetilde{x_i}|$

Example: You indicated that participant 2 of group 1 convinced you of his/her analytical thinking skills at a rate of 54%. The group median (including your own assessment) is 81%. The absolute difference between your assessment and the group median is 27 percentage points.

The closer your individual assessment is to the median group assessment, the higher your payoff. Your payoff can be derived from the following table:

0%-points $\leq |x_i - \widetilde{x_i}| \leq 2.5\%$-points	2.5%-points $< |x_i - \widetilde{x_i}| \leq 5\%$-points	5%-points $< |x_i - \widetilde{x_i}| \leq 7.5\%$-points	7.5%-points $< |x_i - \widetilde{x_i}| \leq 10\%$-points	10%-points $< |x_i - \widetilde{x_i}| \leq 12.5\%$-points
€2.00	*€1.80*	*€1.60*	*€1.40*	*€1.20*

12.5%-points $< |x_i - \widetilde{x_i}| \leq 15\%$-points	15%-points $< |x_i - \widetilde{x_i}| \leq 17.5\%$-points	17.5%-points $< |x_i - \widetilde{x_i}| \leq 20\%$-points	20%-points $< |x_i - \widetilde{x_i}| \leq 22.5\%$-points	$|x_i - \widetilde{x_i}| > 22.5\%$-points
€1.00	*€0.80*	*€0.60*	*€0.40*	*€0.20*

Example: If your assessment of person 3 in the category “analytical thinking” is farther than 25 percentage points from the median assessment, you receive €0.20. If your assessment differs by a maximum of 2.5 percentage points from the group median, you receive €2.00.

Since you assess five persons from group 1, you can earn a maximum of €10.00 during this part of the experiment.

After the entire experiment is finished, you get to know the deviation of your five assessments from the five group medians. You receive your earnings in cash at the end of the experiment. Your total earnings amount to the participation payment of €5.00 plus your payoffs from part A and part B of the experiment.

Total payoff = €5.00 + payoff part A + payoff part B

<u>Lying game—Instructions</u>

Part B of the experiment

General information

- You are evenly split into two groups: participants of group A and participants of group B. The assignment of the groups is completely independent of the group assignment during the last part of the experiment. Only you know the group you belong to. The other participants are not informed about your group.
- The experiment lasts for 18 rounds. Your group remains unchanged during the entire time.
- During each round, the computer randomly matches pairs that consist of one group A participant and one group B participant. Overall, every group A participant will be matched with the same group B participant at least three times (and vice versa).
- The computer randomly assigns a number between 1 and 6 to each pair. Each number is similarly likely. During each round, no number will be assigned more than once.
- In each pair, participant A sends participant B a message concerning the assigned number. Participant B does not see the actual number, but only the message participant A sent concerning the number. Participant B has to decide whether to follow participant A's message. Further information is provided below.

Decisions

- For every number that can possibly be assigned to the pair, participant A indicates the message he/she wants to send to participant B. This message can include every integer between (and including) 1 and 6. The message does not have to equal the assigned number.
- Furthermore, participant A indicates whether he/she believes that participant B follows the message 1, 2, 3, 4, 5 or 6.

The assigned number is:	*1*	*2*	*3*	*4*	*5*	*6*
Your message to participant B: *The assigned number is:*	_	_	_	_	_	_

Assume that you send the following message to B...	*1*	*2*	*3*	*4*	*5*	*6*
Do you believe that B will follow the message?	o *Yes* o *No*	o *Yes* o *No*	o *Yes* o *No*	o *Yes* o *No*	o *Yes* o *No*	o *Yes* o *No*

- Before participant B receives the message, he/she has to indicate for all potential messages whether he/she follows:

Message from participant A	*Your decision*
"The assigned number is 1"	*Follow* ◯ ◯ *Do not follow*
"The assigned number is 2"	*Follow* ◯ ◯ *Do not follow*
"The assigned number is 3"	*Follow* ◯ ◯ *Do not follow*
"The assigned number is 4"	*Follow* ◯ ◯ *Do not follow*
"The assigned number is 5"	*Follow* ◯ ◯ *Do not follow*
"The assigned number is 6"	*Follow* ◯ ◯ *Do not follow*

- According to the actually assigned number, the message from participant A is sent to participant B and the corresponding participant B decision is executed.

Payoffs

Participant A:

- Participant A receives a payoff of 10 points plus twice the message sent (i.e. 12 points if participant A sends the message that the assigned number is 1, 14 points if participant A sends the message that the assigned number is 2, etc.): $\pi_A = 10 + 2 \times \text{Message}$
- If, in more than 2/3 of the cases, participant A correctly estimates whether participant B follows the message, participant A receives an additional 50 points at the end of the experiment.

Participant B:

- If participant B follows the message sent by participant A, participant B receives a payoff of 10 points if the message equals the assigned number. Otherwise, participant B earns 0 points.
- If participant B does not follow the message, participant B receives 3 points:

$$\pi_B = \begin{cases} 10 & \text{B follows the message and the message equals the assigned number} \\ 0 & \text{B follows the message and the message does not equal the assigned number} \\ 3 & \text{B does not follow the meassage} \end{cases}$$

Information

- At the end of each round, you will be informed about your pair's results: you see the assigned number, the message participant A sent to participant B, B's decision to follow, the payoff of participant A and participant B.
- You also see a table that contains the information mentioned above for all previous rounds.

Earnings

- At the end of this part of the experiment, your points are converted into Euros at a rate of €1.00 per 25 points. Your payoff will be paid out to you in cash together with your previous earnings at the end of the experiment (participation payment plus payoff from part A):

Total payoff = €5,00 + payoff part A + payoff part B

Appendix B – Visual analogue scales (VAS)

Please indicate how you are feeling right now. Use the sliders to indicate to what degree you agree with the following statements. [Answers range from 0 to 100 percent]

- I am agitated
- I am scared
- I am happy
- I feel challenged
- I feel stressed
- I am proud of myself
- I feel in control of the situation
- I feel ashamed
- I am amused

TABLE 9: VAS II AND VAS III MEANS

VAS	Stress task only		Stress task and lying game			
	VAS II Males	VAS III Males	VAS II Males	VAS III Males	VAS II Females	VAS III Females
I am agitated	10.308 (3.280)	28.077*** (6.981)	15.086 (3.867)	34.343*** (4.328)	14.944 (3.063)	46.972*** (4.713)
I am scared	3.538 (2.018)	15.385*** (5.773)	9.829 (3.081)	18.057*** (4.033)	2.528 (1.150)	26.722*** (4.730)
I am happy	61.308 (6.798)	41.692** (6.820)	68.514 (4.729)	44.029*** (5.444)	60.972 (4.163)	34.333*** (4.795)
I feel challenged	8.462 (2.544)	54.000 *** (8.680)	26.457 (4.817)	65.057*** (4.795)	37.000 (5.023)	65.222*** (4.427)
I feel stressed	8.231 (2.744)	31.538*** (8.005)	15.257 (3.747)	41.714*** (4.985)	19.778 (4.545)	50.139*** (5.008)
I am proud of myself	52.077 (5.917)	47.923 (8.220)	58.000 (5.464)	46.514* (5.975)	44.250 (4.673)	30.444*** (4.659)
I feel in control of the situation	69.308 (7.587)	52.308** (7.330)	71.229 (4.903)	55.857*** (4.863)	55.444 (4.819)	38.056*** (4.112)
I feel ashamed	4.308 (2.747)	13.231* (5.323)	3.657 (2.069)	13.514*** (3.314)	2.333 (1.761)	22.944*** (5.032)
I am amused	27.538 (6.668)	29.769 (8.328)	40.543 (5.578)	30.829*** (4.834)	17.833 (4.281)	8.944** (2.098)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; SIGNIFICANT DIFFERENCES REFER TO INTRAGROUP VAS II – VAS III COMPARISONS BASED ON WILCOXON SIGNED-RANK TESTS. ALL ANSWERS WERE GIVEN ON A SCALE OF 0 - 100%.

Appendix C – Robustness checks

Regression results for pooled data including selfish black lies and spiteful black lies

TABLE 10: FIRST MOVER'S DECISION TO LIE: EXTENSIVE MARGIN-SELFISH BLACK LIES AND SPITEFUL BLACK LIES

Lying: First mover reports $m > d$	Model I			Model II			Model III		
	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|
Round	0.0036	0.0018	0.046	0.0011	0.0015	0.472	0.0013	0.0016	0.420
Die roll (*d*)	-0.0505	0.0083	0.000	-0.0389	0.0045	0.000	-0.0359	0.0043	0.000
Stress	-0.1619	0.0720	0.024	-0.1057	0.0496	0.033	-0.1122	0.0523	0.032
Age	-0.0167	0.0088	0.058	-0.0113	0.0054	0.036	-0.0122	0.0058	0.034
Female	0.0737	0.0752	0.327	0.0506	0.0505	0.317	0.0546	0.0540	0.312
Performance				0.0002	0.0011	0.870	0.0002	0.0012	0.828
Avg. belief SecMo follows				-0.1914	0.0501	0.000	-0.1891	0.0525	0.000
FirstMo reported $m \neq d$ t-1				0.3632	0.0500	0.000	0.3963	0.0481	0.000
SecMo followed m t-1							-0.0085	0.0191	0.654
SecMo received lie t-1							-0.0783	0.0219	0.000

RANDOM EFFECTS PANEL PROBIT REGRESSIONS. STANDARD ERRORS ARE CORRECTED FOR CLUSTERING AT THE SUBJECT LEVEL. MODEL I: N = 8,100, PSEUDO R2 = 0.133, LOG PSEUDOLIKELIHOOD = -2799.0008, WALD χ^2 = 74.70, P < 0.001. MODEL II: N = 7,650, PSEUDO R2 = 0.330, LOG PSEUDOLIKELIHOOD = -2017.4634, WALD χ^2 = 191.71, P < 0.001. MODEL III: N = 7,650, PSEUDO R2 = 0.340, LOG PSEUDOLIKELIHOOD = -1988.0646, WALD χ^2 = 266.60, P < 0.001.

Delayed evaluation treatment

The results reported below are based on data from a slightly altered form of the stress task. Performance evaluations were delayed to a later session, i.e. *Control* members did not evaluate the present *Stress* members. Hence, we could rule out that *Control* members had information regarding the present *Stress* members that could affect beliefs regarding other player's behavior in the lying game, social preferences, or the sense of group identity. The analysis is based on decisions from 14 stressed first movers and 16 unstressed first movers. The instructions and experimental procedures were identical to those described above, except for the fact that participants were made aware that *Control* members evaluate members of *Stress* who recorded their arguments in a previous session of the experiment. The corresponding part in the instructions was: [For *Stress*] "The members of group 2 who are present today will not evaluate your argument. The evaluations will be obtained after today's experiment. You will receive your payoff from this part of the experiment at a later point in time together with the median assessment of your argument. Directly after today's experiment, you will receive the participation payment of 5.00 Euros plus your payoff from part B of the experiment." [For *Control*] "You will then receive the recordings from members of group 1 who recorded their arguments in another experiment. You will not hear the arguments from the members of group 1 who are present today. [...] You will receive your payoff from this part of the experiment at a later point in time together with an overview of your performance. Directly after today's experiment, you will receive the participation payment of 5.00 Euros plus your payoff from part B of the experiment." The results from this additional treatment support our findings reported in chapter 4, i.e. stressed first movers are significantly less likely to send a selfish black lie than unstressed first movers.

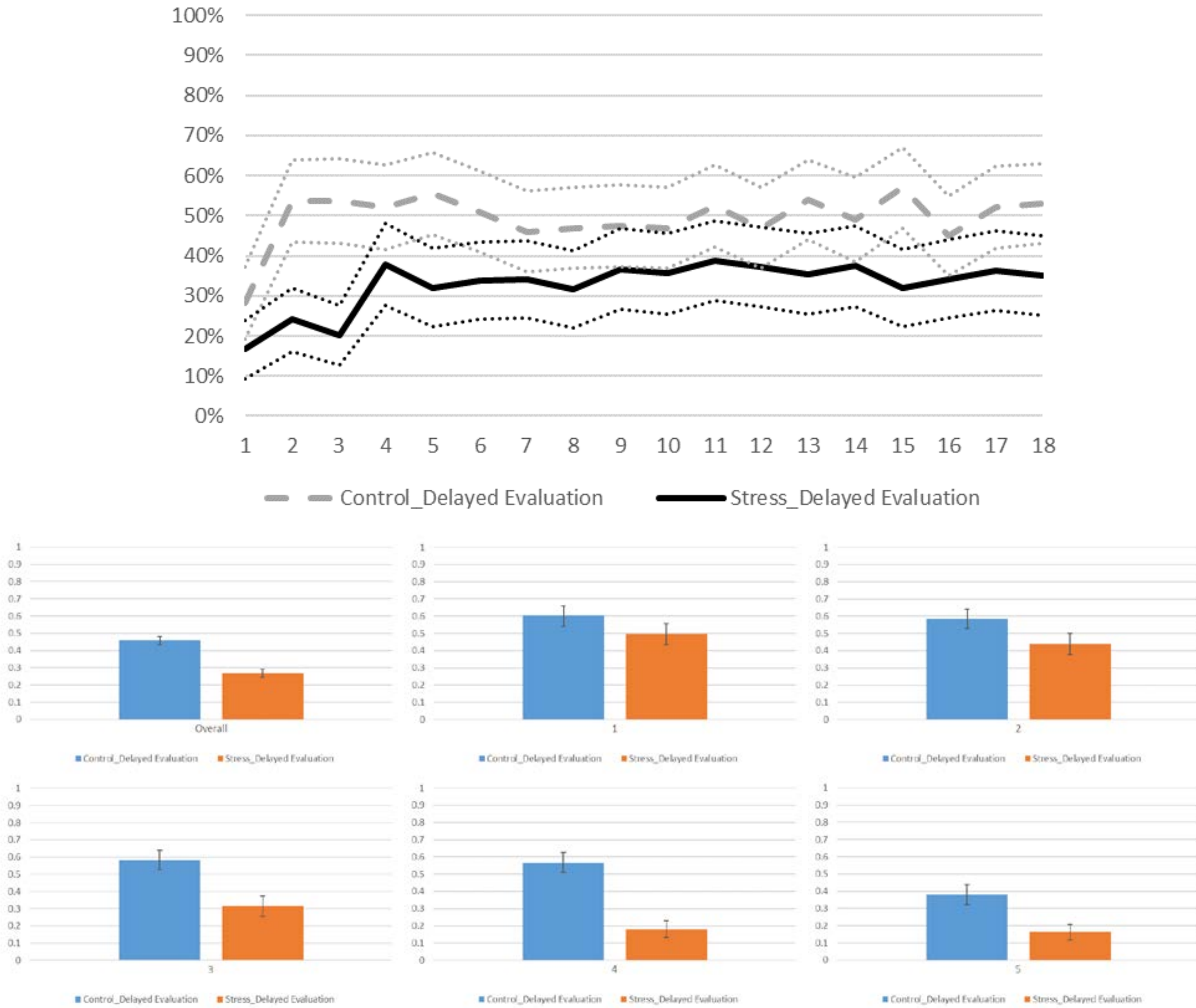

FIGURE 6: TOP: AVERAGE PROBABILITY OF TELLING A SELFISH BLACK LIE INCLUDING 95% CONFIDENCE BANDS, BOTTOM: AVERAGE PROBABILITY OF SENDING A SELFISH BLACK LIE INCLUDING 95% CONFIDENCE INTERVALS—OVERALL AND FOR EACH DIE ROLL.

TABLE 10: FIRST MOVER'S DECISION TO LIE: EXTENSIVE MARGIN-SELFISH BLACK LIES AND SPITEFUL BLACK LIES – DELAYED EVALUATION TREATMENT

Lying: First mover reports $m \neq d$	Model I: Selfish black lies			Model II: All types of lies		
	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|	Coef. (Marginal Probabilities)	Robust Std. Err.	P > |z|
Round	0.0042	0.0022	0.060	0.0027	0.0020	0.183
Die roll (*d*)	-0.0893	0.0123	0.000	-0.0781	0.0125	0.000
Stress	-0.1079	0.0328	0.001	-0.1305	0.0328	0.000
Age	-0.0047	0.0091	0.601	-0.0034	0.0094	0.720
Female	0.1254	0.0770	0.103	0.1807	0.0723	0.012

RANDOM EFFECTS PANEL PROBIT REGRESSIONS. STANDARD ERRORS ARE CORRECTED FOR CLUSTERING AT THE SUBJECT LEVEL. MODEL I: N = 3,151, PSEUDO R2 = 0.221, LOG PSEUDOLIKELIHOOD = -1291.7162, WALD χ^2 = 154.32, P < 0.001. MODEL II: N = 3,240, PSEUDO R2 = 0.181, LOG PSEUDOLIKELIHOOD = -1458.5744, WALD χ^2 = 194.03, P < 0.001.

Otto von Guericke University Magdeburg
Faculty of Economics and Management
P.O. Box 4120 | 39016 Magdeburg | Germany

Tel.: +49 (0) 3 91 / 67-1 85 84
Fax: +49 (0) 3 91 / 67-1 21 20

www.fww.ovgu.de/femm

ISSN 1615-4274