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Honesty is predicted by moral values and economic incentives but is unaffected by acute stress

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ABSTRACT

Being truthful in financial decision-making often implies giving up higher monetary rewards associated with acting dishonestly. Is this trade-off affected by acute stress? We ran an experimental study to answer this question. Using three separate tasks to measure honesty, we examined whether decision-making in this context is influenced by a) the intrinsic value that subjects assign to honesty, b) the size of earnings achievable dishonestly, and c) by being acutely stressed (vs. in a neutral state) when making these decisions. Our main results show that subjects' stated preference for honesty in general, the magnitude of financial rewards, and their interaction predict honest decision-making. However, their effects are immune to acute stress, which did not significantly alter honest decision-making. This finding is important when one considers that many financial decisions are taken by stressed managers and that there are significant costs associated with implementing ethical policies within corporations.

1. Introduction

Honesty and stress are two factors which have been shown to meaningfully, but heterogeneously, impact individuals' economic and financial decision-making (Gibson et al., 2013; Starcke and Brand, 2012). This heterogeneity in honest behavior is driven by both internal and external factors. The strongest internal factor is a person's protected value for honesty. Protected values (PV) are moral values perceived as 'sacred' and thus non-tradeable for monetary benefits (Bénabou and Tirole, 2011). People who display higher protected value for honesty, as measured using a self-reported scale (Tanner et al., 2009), are less willing to lie regardless of the context associated with acting dishonestly. These individuals thus display strong trade-off resistance, having internalized the value of being honest, and habitually choose honesty. Contrarily, those who show weaker moral preferences for honesty are unsurprisingly more willing to make cost-benefit analyses when it comes to acting truthfully; they lie more frequently and require increased cognitive control to behave honestly.

Noteworthy external factors that influence honesty include the size of economic incentives, people are more likely to lie for larger personal gains (Balasubramanian et al., 2017; Kajackaite and Gneezy, 2017, although see e.g. Abeler et al., 2019) and observability, people tend to lie less when they think they might get caught (Augustin et al., 2019; Kajackaite and Gneezy, 2017). Additionally, honesty can be influenced by situational factors such as social norms and ethical codes of conduct in the working environment (Lombard and Gibson Brandon, 2023), which can reinforce or weaken intrinsic motivations for honesty.

The very nature of financial situations in which honesty is required, that is, situations in which one could lie and get away with it, makes them typically difficult to monitor externally. Thus, upholding honesty often relies on professionals'—such as CEOs or traders—willingness to self-monitor and resist the temptation of cheating to increase personal gains. Surprisingly, however, one major environmental factor often associated with high-intensity financial jobs has not yet been examined: the impact of acute stress on people's decision-making.

The literature on acute stress has shown that it tends to impact decisions by affecting two main factors: firstly, it increases the salience of immediate rewards, thereby making them more desirable, and secondly, it decreases one's ability to exert cognitive control, resulting in more habitual actions (Duckworth et al., 2013; Maier et al., 2015; Porcelli et al., 2012; Schwabe and Wolf, 2011). Based on the existing literature, we conjecture that acute stress could influence honesty in two ways: in

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situations where dishonesty leads to higher rewards, a stressed individual may be more sensitive to said rewards and thus more tempted to lie. Concomitantly, acute stress could impair the decision maker's cognitive control, pushing the individual towards more habitual behavior. In this way, stress should augment the effect of protected values for honesty and thereby impact people differently depending on these values. Individuals with a high protected value for honesty are habitually honest and generally able to resist the temptations of economic rewards associated with cheating, no matter how salient (see Section 2 for details). Contrarily, those with a lower protected value for honesty are generally more tempted to lie for higher rewards and when stressed may lack the cognitive control to inhibit this behavior.

In this paper, we investigate the interplay between stress, protected values for honesty, and economic incentives and their effects on honest decision-making. In a pre-registered,[1] between-subjects laboratory experiment, we first stress subjects using a cognitive stressor (see Section 4), and then present them with three different honesty tasks to control for observability and framing effects (see Section 4 for details).

In line with the previous literature, our results show that honesty decreases as economic incentives increase, that individuals with higher protected values scores are significantly more honest, and that there is a significant interaction between economic incentives and protected values: subjects with higher protected values responded less to economic rewards associated with the cheating option. We do not, however, find evidence for any significant interactions of acute stress with the effects of protected values and economic incentives on honesty. Employing Bayesian model comparison analyses, we show that the models without the stress effect are much better at explaining subjects' behavior than those including stress, providing compelling evidence for the inference that stress does not impact honest decision-making.

The finding that stress does not affect honesty, in the context of our experimental setting, can have important insight for policymakers and professionals working in highly stressful environments, such as CEOs, traders, or risk managers. Indeed, knowing that in times of elevated acute stress people will continue to behave with the same levels of honesty without the need for special measures and additional monitoring provides reassurance that resources can be used to motivate professionals into internalizing honesty as a protected value. To this point, a field study conducted with employees from a large bank by Lombard and Gibson Brandon (2023) has shown that wealth managers' protected values for honesty were a highly significant predictor of their ethical behavior when it came to respecting the bank's Code of Conduct clients' interests principle.

Our findings further contribute to the behavioral finance literature by providing information on moral decision-making under acute stress, a phenomenon that is particularly relevant in financial decision-making, yet remains largely unexplored. Additionally, they contribute to decision making research more generally by providing insight that can be implemented in real-world, high-pressure scenarios, and to neuroscience and physiology literature by providing a multi-metric measure of the stress response which contributes to our understanding of this complex phenomenon.

2. Literature review

The efficient functioning of modern societies greatly depends on honesty, which has led governments and institutions to introduce formal instruments, including laws and ethical codes of conduct, to ensure it. Notwithstanding, dishonest behavior is routinely observed: briberies (Ghatak and Iyengar, 2014), falsification of data (Rhodes, 2016), manipulation of financial records (Dichev et al., 2016; Staiger and Sykes, 2010), and insider trading (Augustin et al., 2019; Davis et al., 2020) have continuously been in the headlines, with deleterious economic and societal consequences. Corruption alone costs countries in the European Union as much as 132 billion USD annually, while in developing countries this number soars to 1.26 trillion USD (Fleming, 2019). On the brighter side, there are also numerous examples of people who incur great personal costs to stand by the truth, such as whistle-blowers reporting companies' wrongdoings (Lee and Xiao, 2018), journalists revealing economic crimes (Lal Bhasin, 2013), and citizens demanding political accountability by denouncing corruption (Voltmer, 2009).

Due to the nature of situations in which honesty is required and the significant costs continuous external monitoring would entail, financial and societal institutions frequently require individuals to self-monitor and rely on intrinsic values to resist the temptation of cheating. Considering the costs associated with mitigating the externalities induced by stress, knowing whether honesty is affected by it is of crucial importance. Should stress increase dishonesty, reducing the factors inducing stress in the workplace would have the double positive effect of increasing the workers well-being and decreasing the costs resulting from immoral behavior. On the other hand, if stress does not impact honesty, to mitigate the costs associated with immoral behavior, a firm seeking to increase truthfulness could instead allocate resources to promote strategies that lead to the increased internalization of honesty values among its employees.

The need for self-monitoring has led to studies on the intuitiveness of honesty, however their findings are thus far inconclusive. Reasoning that intuitive responses are expressed more rapidly, some studies show that subjects are more honest when under pressure to respond quickly (Capraro et al., 2019; Lohse et al., 2018), while others find more lying in similar situations (Gunia et al., 2013; Shalvi et al., 2012). These results are part of a larger debate in the psychology and neuroscience literature regarding the cognitive processes underlying honesty, namely, whether honesty is an act of 'Will', the 'active resistance of temptation' requiring cognitive processes of control, or 'Grace', an automatic process arising from the absence of temptation (Greene and Paxton, 2009), with evidence for both hypotheses (Bargh and Chartrand, 1999; Haidt, 2001; McClure, 2004; Metcalfe and Mischel, 1999).

This has led to a focus on theories in economics and finance stating that honesty may vary depending on an individual's own deontological characteristics. The perception of honesty as a PV is not ubiquitous, and, while western societies purportedly favor honesty overall, people vary in the extent to which they perceive dishonesty as reprehensible, as well as what kind of decisions/actions they consider dishonest. This variation can be measured using the protected value for honesty scale (with continuous values ranging from 0 to 6) developed by Tanner et al. (2009). In an experiment focusing on earnings management, Gibson et al. (2013) show that a subject cast in the role of a CEO who scores highly on the PV for honesty scale will refrain from mismanaging the earnings of a company to get a higher variable remuneration. Contrarily, subjects who display lower PV scores for honesty do not show the same emotional aversion to dishonest actions, are more willing to make cost-benefit analyses, and trade in their honesty for monetary gains if the price is right. Likewise, it has been shown (Gibson et al., 2021), that individuals with low PV for honesty also respond more to social norms and are thus prone to temptations to mimic dishonest behaviors in professional environments contaminated by ethically questionable practices.

Neuroimaging studies using functional magnetic resonance imaging (fMRI) have shown that the cognitive processes underlying honest/dishonest choices also differ depending on subjective valuations of honesty. In tasks where cheating led to higher rewards, when generally dishonest people (determined using number of trials cheated on) acted honestly they took longer to respond and showed additional control-related activation in the brain (Speer et al., 2020). In contrast, generally honest individuals (again determined using cheat count) showed no additional activation in control regions and took no longer to respond

[1] Pre-registered at: https://osf.io/n6yk2/?view_only=657064518c9a4737bb516e14dea4f674

when behaving honestly (Greene and Paxton, 2009), but did so in the rare instances when they chose to cheat (Speer et al., 2020). Additionally, a causal link was shown between cognitive control and honesty using transcranial direct current stimulation, a method which allows researchers to increase activations in specific brain regions. When activation in a key region of the control network was increased (the right dorsolateral prefrontal cortex), it reduced cheating for rewards (Maréchal et al., 2017), implying that increasing individuals' self-control increased their ability to behave honestly. Taken together, these findings indicate that honesty depends on the trade-off between sensitivity to potential rewards and the subjective cost of lying (PV), and while people with higher PVs for honesty tend be consistently honest, honesty requires self-control when one's PV for honesty is on the lower end of the PV scale.

The aforementioned research studied honest behavior in controlled environments where individuals experienced little arousal or discomfort when making decisions. However, neutral, stress-free environments do not reflect the professional conditions in which many in the financial industry make decisions. Factors such as high competition and performance pressure contribute to the elevated stress levels endemic to multiple professions (Lundberg and Frankenhaeuser, 1999; Michie, 2002; Mirmohammadi et al., 2014), levels which have been exacerbated by the widespread increase in stress caused by the COVID-19 pandemic (Demirbas and Kutlu, 2021; Robillard et al., 2020), with 43% of employees reporting experiencing daily stress at work (Gallup, 2021). This is especially true for employees in the finance industry, who, according to a recent study, were twice as likely as those in human services to report stress (Vogazianos et al., 2019). Furthermore, perhaps unsurprisingly, there is evidence that investors' anxiety levels are directly impacted by daily fluctuations in stock prices, often exacerbated by geopolitical turbulences, resulting in frequent bouts of acute stress (Engelberg and Parsons, 2016).

The acute stress response is an adaptive mechanism which evolved to allow animals to respond to threatening situations by prioritizing resources—cognitive and biological—that the organism may need to resolve the stressor. This change in biological resource allocation is frequently accompanied by suboptimal, if not deleterious, subjective effects such as feelings of uncontrollability and helplessness in the face of a given threat, which can lead to impaired decision-making (Henderson et al., 2012; Lazarus et al., 1985). Due to the complexity and multi-componential nature of the stress response systems—namely, emotional, cognitive, and biophysiological—which are often correlated, but vary independently (Campbell and Ehlert, 2012; Lupien et al., 2007; Nater and Rohleder, 2009), psychological and neuroscientific studies investigating the role of stress typically use a combination of subjective self-report questionnaires with biophysiological measurements of stress.

Based on the broad existing psychology and neuroscience literature (for reviews see Porcelli and Delgado, 2017; Starcke and Brand, 2012), we know that acute stress can affect decision-making through altering at least two mechanisms: a) by enhancing sensitivity to immediate rewards and b) by decreasing the ability to exert cognitive control (Duckworth et al., 2013; Porcelli et al., 2012; Schwabe and Wolf, 2011). These effects are underlain by changes in brain regions associated with deliberate cognitive control, valuation, and reward processing (Arnsten, 2009; Lewis et al., 2014; McEwen and Morrison, 2013).

Specifically, acute stress tends to enhance sensitivity to immediate rewards in brain areas related to reward processing (the ventral striatum) and increase functional connectivity between this region and one responsible for subjective valuation (the ventromedial prefrontal cortex or vmPFC). This means that under acute stress, the cognitive process which determines the value of different choices is weighing those that are immediately rewarding more highly than usual, biasing decisions. Concomitantly, stress has been shown to decrease functional connectivity between brain regions important for cognitive control (the aforementioned dlPFC) and the same valuation center (vmPFC), resulting in behaviors that prioritize immediately rewarding options, regardless of possible deleterious long-term effects (Maier et al., 2015). These effects are reflected in several behaviors such as an increased propensity to take risks (Gathmann et al., 2014; Oberlechner and Nimgade, 2005; Porcelli and Delgado, 2017, 2009), financial impulsivity (Lempert et al., 2012), impaired self-control (Maier et al., 2015), habitual rather than goal directed-response patterns (Schwabe and Wolf, 2009), and even changes in moral judgments (Starcke et al., 2016). However, these findings are not ubiquitous, and some studies have found no effect of acute stress itself on altruistic (Starcke et al., 2011) or prosocial behavior (Nitschke et al., 2022) nor on economic decision making (Veszteg et al., 2021).

Despite the large body of neuroscientific and psychological literature studying the effects of acute stress on complex human behaviors and the current understanding of the mechanisms that drive honesty (Dai et al., 2018; Dogan et al., 2016; Greene and Paxton, 2009; Maréchal et al., 2017; Shalvi et al., 2012), one fundamental question remains unanswered: Is the propensity to act honestly affected by stress? Specifically, how does acute psychological stress influence decision-makers in subsequent situations where they face a trade-off between increasing their self-interest (through cheating) and doing what is appropriate from a moral standpoint (being honest)?

Understanding how acute stress affects financial decision-making in the presence of benefits associated with unethical behavior is of crucial importance given the many stressful situations with important economic implications that high executives and traders in the financial industry face daily. For instance, an investor, who experiences a spike in anxiety and a drop in well-being following stock price decline (Engelberg and Parsons, 2016) may be motivated to lie to avoid further repercussions or a CEO, who may have to make a decision requiring honesty—e.g. reporting the company's accounts truthfully—following a stressful meeting with an important client may be tempted to inflate numbers.

The studies that come closest to addressing this question are those that impose a time pressure on honesty decisions (Capraro et al., 2019; Gunia et al., 2013; Lohse et al., 2018; Shalvi et al., 2012), however their findings are contradictory and not specific to stress, as time pressure both adds stress and requires a certain level of rapid cognitive processing, which may confound effects. In our novel experimental approach to examine the specific effects of stress on decision-making, including one task focusing on decision-making in a financial context, subjects were stressed, but allowed all the time necessary to make their decision.

3. Testable hypotheses

Based on the combined literature on the relationship between stress and honesty, we can make several predictions. Firstly, in the absence of stress, people's protected values (PV) for honesty have been shown to influence their honesty decisions (Gibson et al., 2013; Dogan et al., 2016) while increased economic incentives (up to a certain magnitude), incentivize dishonesty (Balasubramanian et al., 2017b). In addition, those with high PV for honesty include honesty in their internal reward system, which makes them more trade-off resistant and less susceptible to increased rewards (Tanner et al., 2009, Gibson et al., 2016), meaning that for people with high PV for honesty, increasing economic incentives should have little effect, as they are reluctant to exchanging their protected value (honesty) for monetary rewards. To replicate these findings, and ensure that our experiment is suitable to examine the effect of stress on these mechanisms, we test the following three hypotheses (without stress):

H1. . Protected values will have a positive effect on honesty, those with higher protected values will be more honest.

H2. . Rewards will have a negative effect on honesty, so that higher rewards lead to more dishonesty.

H3. . There will be an interaction between protected values and rewards; higher protected values will reduce the effects of rewards on honesty.[2]

Next, due to the complex nature of the stress response, we perform manipulation checks to ensure that our stress induction was successful at eliciting acute stress.[3]

Finally, we examine our novel question: how does acute stress impact honest decision-making? Based on the existing literature, we hypothesize that in situations where dishonesty leads to higher rewards, stress will impact honest choices by affecting reward perception saliency and the role of protected values. First, considering that stress increases sensitivity to immediate rewards (Lempert et al., 2012), after an acute stressor, a person may be more inclined to dishonesty as rewards increase due to an increased appetite for the personal gain obtainable through lying. Therefore, stress may increase the effect of economic incentives on dishonesty.

Secondly, acute stress has also been shown to impair cognitive control, inducing decision-makers to rely primarily on their habitual responses (e.g. Maier et al., 2015; Porcelli and Delgado, 2017). This push towards habitual responses may influence the effect of PV, as the protected value for honesty scale measures stable traits. For people with higher PV values for honesty their habitual response should be the honest choice, thus their moral buffer against dishonesty should also be enhanced (or maintained in the case of ceiling effects) by stress as this pushes them towards their habitually honest responses. Contrarily, a person holding a lower protected value for honesty, is expected to lie more frequently when stressed due to the reduced cognitive control needed to override their dishonest tendencies, which could result in more lying.

As we hypothesize that acute stress will have opposite direct effects on honesty depending on people's PV scores, it is plausible that they will cancel each other out and, as a result, do not predict a main effect of stress.

Lastly, we expect stress to affect the tradeoff between PV and rewards, which should be captured by a three-way interaction between stress, PV, and reward levels. For those with higher levels of PV for honesty, one could conjecture that as stress increases both the perceived value of rewards and the tendency toward habitual behavior, honest people should experience enhanced competition under stress between the goal of obtaining the more salient rewards and the drive to remain habitually honest. However, people who score highly on PV for honesty are more intrinsically motivated and tend not to consider tradeoffs between honesty and external monetary rewards. Thus, it is likely that there will be little to no detectable change for people with high PV for honesty under stress. Meanwhile, those with lower PV scores for honesty would lack both the moral buffering against the increased temptation of rewards made more salient by stress and temporarily have reduced cognitive control needed to implement honesty, and we can expect an increase in their dishonesty under stress. In extreme cases, that is, those with very high and very low PV for honesty, we may have people who are consistently honest in all situations and people who consistently lie in all situations respectively, as shown in previous studies without stress (e.g. Maréchal et al., 2017). In summary, we hypothesize that the three-way interaction will result in those with higher PV for honesty choosing honesty consistently—perhaps even increasingly depending on ceiling effects—regardless of rewards, while those with lower PV scores would lie more under stress, especially for enhanced rewards.

To test whether stress affects honesty by interacting with PV and economic incentives, our alternative novel hypothesis is that:

H4. Acute stress will augment the effects of both protected values and rewards so that, following acute stress:

a. Lower protected values will result in more dishonesty compared to controls.
b. Higher rewards will lead to more dishonesty compared to controls.
c. The interaction between protected values and rewards will be amplified compared to controls; primarily for those with lower protected values who will lie even more for higher rewards under stress.[4]

Furthermore, as stated, there may be ceiling/floor effects for those with very high/low PV scores.

There is also evidence to suggest that stress may not affect honest behavior. As mentioned, previous studies on stress and economic decision making have not always identified significant impact of acute stress and there are contradictory results from time pressure studies on honest behavior. Moreover, as we propose that acute stress would influence honesty through its interaction with reward saliency and PV, if the roles of PV and rewards are already sufficiently strong in determining (dis) honest behavior, then one would not observe a meaningful additional effect of acute stress. In line with the this, recent studies have reported no effects of acute stress on a number of behaviors in economic and prosocial contexts (Nitschke et al., 2022; Veszteg et al., 2021). In this case our findings should support the null hypothesis of no impact of stress on honesty for H4, which would be:

Null H4: Acute stress will not significantly augment the effects of protected values or rewards so that, following acute stress:

a. Lower protected values will not result in more dishonesty compared to controls.
b. Higher rewards will not lead to more dishonesty compared to controls.
c. The interaction between protected values and rewards will remain unchanged compared to controls.

As there is a reasonable possibility of obtaining a null result, in addition to testing our hypotheses using frequentist statistics, we will run Bayesian model comparison analyses (Wagenmakers, 2007) to examine if our data support the null hypothesis (see Section 5). In this way, evidence for a null finding will also be an informative result suggesting that decisions to behave honestly are not likely to be impacted by acute stress but solely depend on PVs, the size of the reward obtainable through cheating, and on their interaction.

4. Materials and methods

To test our hypotheses, we conducted a between-subjects laboratory experiment (pre-registered online on Open Science Framework – OSF[5]) where individuals were stressed using a cognitive stressor (the Montreal Imaging Stress Task or MIST, details in Section 4.2) and then asked to make decisions on three different honesty tasks. Stress was induced in half of the subjects who were randomly assigned to the stress condition. We designed the experiment to account for both the immediately activated sympathetic nervous system (SNS) changes, which begin with the stressor and require approximately ten minutes to recover from (Starcke and Brand, 2012), and the slower acting hormonal changes in the hypothalamus pituitary adrenal (HPA) axis, which generally peak 15–25 min after the onset of a stressor. Thus, rather than having one long stressor at the beginning followed by the task, which would possibly allow the SNS response to recover, the stressor was presented at

[2] H1–3 correspond to H2–4 in the original pre-registration. H3 has been slightly reworded in this paper for clarification.

[3] Pre-registered as H1 in the pre-registration.

[4] H5 corresponds to H4 in the pre-registration. The wording has been expanded on slightly to increase understanding.

[5] https://osf.io/n6yk2/?view_only=657064518c9a4737bb516e14dea4f674

three separate time points (see Fig. 1 and details in Section 4.1), each followed by a block containing decision tasks.

The tasks were presented in pseudo-randomized orders across task blocks, with the requirements that 1) the honesty tasks were presented in Blocks 2 and 3 to allow for the time required by the hormonal stress response to stress and 2) that the scenario tasks were not presented back-to-back due to their similarity (details in Section 4.3). Stress measures were collected either continuously throughout the experiment, or immediately following the stressor (see Section 4.2). Additionally, subjects did not know when the next stressor would commence and were thus in a continuous state of stress expectation. Previous studies have also shown that not all subjects necessarily experience stress following a stressor (Campbell and Ehlert, 2012; Vaessen et al., 2021), thus we pre-registered models using both stress condition and subjective stress ratings as the variables coding stress. After the final task block, subjects had a short break and then filled out a series of questionnaires before the debrief.[6]

4.1. Subjects

208 healthy adults fluent in French (131 women, mean age 23 (min/max: 18/43)) were recruited for our study via flyers posted around the University of Geneva campuses and emails to a list of people who had previously expressed interest in participating in behavioral studies. The sample size required to detect a potential effect of stress, protected values, and reward magnitude on honest behavior was determined using a power analysis (implemented with the software G*Power 3 (Faul et al., 2007)). Given that our study involved stress-induction, our exclusion criteria included pregnancy, smoking, drug use, and active allergies (which can influence hormonal measures), a history of psychiatric, psychological, or neurological disorders (which could cause a more severe reaction to the stress induction), and left-handed subjects (as we recorded physiological measures via electrodes attached to the left hand). Finally, we did not recruit psychology students to avoid potential knowledge biases. Subjects were also instructed to abstain from caffeine or alcohol 24 h prior to the experiment and to refrain from physical exercise, food, and beverages in the hours preceding it, as these too can influence stress metrics. Four subjects were excluded from the study due to technical problems with the E-prime program, leaving a total of 204 subjects. This study was approved by Canton Geneva's research ethics committee (Commission Cantonale d'Ethique de la Recherche, CCER) and written informed consent was obtained from all subjects. The experiment was performed in accordance with relevant guidelines and regulations and all subject data was anonymized using subject IDs. The entire experiment lasted approximately 90 min (see Fig. 1).

4.2. Stress induction and measurement

Moderate psychological stress was induced using an adaptation of the Montreal Imaging Stress Task (MIST) (Dedovic et al., 2005), a computer-based protocol combining timed arithmetic problems (cognitive and performance-related stress) and experimenter feedback (social stress). The task, in which subjects were presented with a series of arithmetic problems with varying levels of difficulty, was designed to adapt to their response speed and accuracy by adjusting the allotted time so that the average accuracy was always between 40% and 50% no matter how fast or good at arithmetic a subject was. To compound this performance stress, their accuracy was constantly displayed on screen and compared to the 80–90% accuracy expected of them. As an additional social stressor, an experimenter dressed in a lab coat stood directly behind subjects throughout the task taking notes and giving them pre-scripted feedback on their performance at specific time points (see Appendix 1 for full description). After a three-minute training session, the MIST was divided into three four-minute blocks (immediately preceding T1, T2, and T3, see Fig. 1) followed by three seven-minute task blocks to ensure that decision-making took place when the SNS stress response was engaged. The control group was also required to answer arithmetic questions, but their performance was not timed nor evaluated, and they did not have the added social stress of being watched by an experimenter while performing the task.

Acute stress triggers a multi-modal response which can result in immediate activation of the sympathetic nervous system (SNS, otherwise known as the fight or flight response), subjective feelings of stress and anxiety, and hormonal changes in the slower acting hypothalamus pituitary adrenal (HPA) axis, which typically responds to social stressors and takes 15–25 min to peak. Importantly, people react differently to stress, and not all stressors activate all modals of the response (Vaessen et al., 2021). To capture this complexity, we used nine metrics to quantify the subjective, physiological, and hormonal changes potentially induced by stress.

Subjects' subjective experience was measured using a self-report Stress Rating Questionnaire (SRQ) (Edwards et al., 2015) consisting of five 7-point scales to measure stress (e.g. Calm-Nervous, Relaxed--Stressed. See Appendix 1 for full list) and one control measure (Sad--Happy) which measured low arousal negative emotions.

Physiological measures were taken using electrodermal activity (EDA) and photo plethysmogram (PPG) sensors attached to subjects' left (non-dominant) hands using the BIOPAC MP160 system and the accompanying AcqKnowledge software (by BIOPAC®). EDA is a physiological measure of sweat on the skin which is typically affected by the activation of the SNS stress response. Stress can cause both tonic EDA increases (that is, more overall sweating of the skin) and increases in phasic EDA activity (more frequent and stronger shorter bursts of sweat) As these three measures can vary independently, we derived three separate measures from the EDA signal: tonic mean, phasic frequency, and phasic amplitude mean (see Appendix 2 for pre-processing procedure and data exclusion). The PPG sensor was used to capture cardiac activity. From the PPG signal we derived mean heart rate (BPM, expected to increase with stress), pulse photoplethysmographic amplitude (PPGa, expected to decrease with stress as the blood vessels contract), and root mean square of successive difference (RMSSD), a measure of heart rate variability that often decreases with stress.

Lastly, we used saliva samples to measure cortisol, a hormonal marker of HPA axis arousal, and alpha amylase, an enzyme which increases with the SNS stress response. The saliva samples and SRQ responses were taken at four time points: at baseline and following each subsequent stress induction (T0-T3).

The experiment took place between one and 5 pm to control for cortisol's circadian rhythm (Elverson and Wilson, 2005). Salivary cortisol was used to capture the HPA stress response, while the other, faster acting measures captured varying aspects of the SNS response.

4.3. Tasks

The task blocks (see Fig. 1) included three honesty tasks and three cognitive tasks to measure impulsivity (Frederick, 2005), risk-taking (Ellsberg, 1961), and generosity (Camerer, 2003; Maréchal et al., 2017) (see Appendix 1 for details). The honesty tasks were presented in task blocks two and three to allow time for the potential cortisol response to the stress induction to manifest. To ensure that subjects felt comfortable expressing their true preferences, all tasks were performed by subjects at private computer stations where neither the experimenter nor other subjects could observe their decisions.

As honesty decisions are greatly influenced by framing effects (Kajackaite and Gneezy, 2017) we elected to use three different tasks (a total of 20 choices per subject) to allow us to examine honesty in different contexts. Two of the honesty tasks were scenario tasks, allowing for the priming of different identities. The CEO task (Gibson

[6] Note that a glossary with acronyms and unfamiliar terms is also provided at the end of the manuscript.

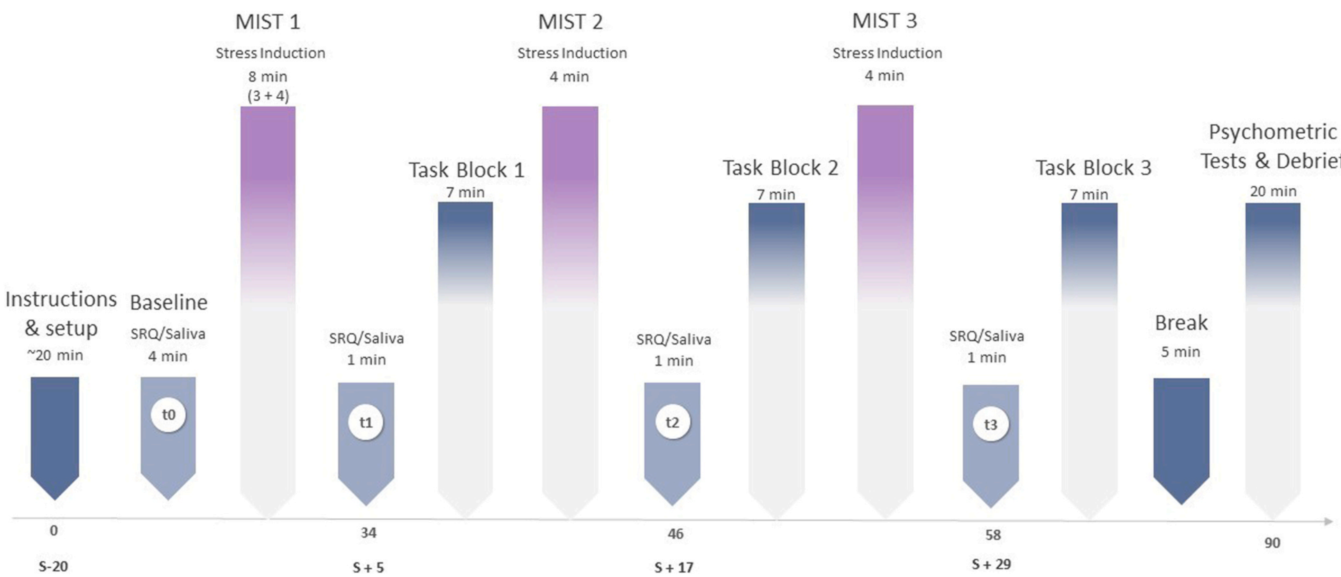

Fig. 1. Experiment timeline. After the baseline stress measures (t0), subjects underwent the Montreal Imaging Stress Task (MIST), divided into three blocks (labelled MIST 1–3). The stressor was interspersed by three task blocks in which three honesty tasks and three cognitive tasks were presented in a semi-randomized order (two per block, see Section 4.3). Salivary and subjective stress measures were taken at t1-t3, immediately following the stressor and physiological stress measures were recorded throughout the experiment.

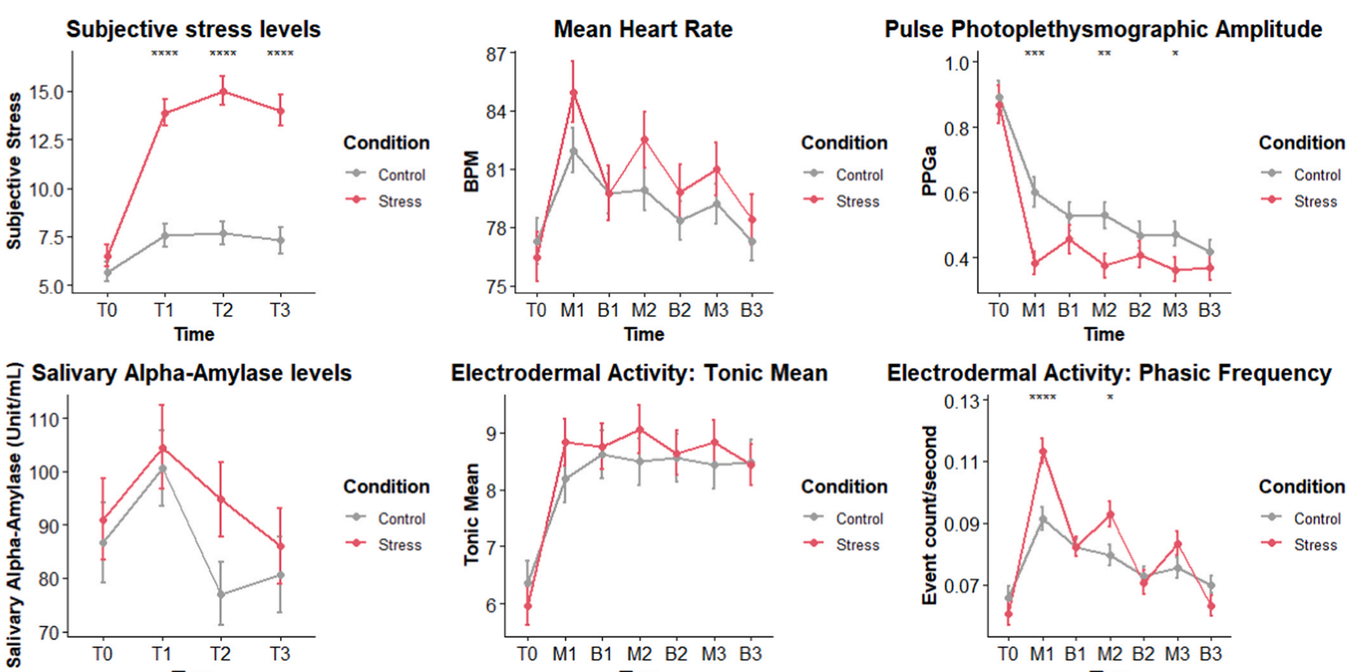

Fig. 2. Changes in stress response and standard error means (SEM) throughout the experiment. M = MIST, B = Block, T = Time directly following the MIST task of the same number. Significance markers: * = $p \leq 0.05$, ** = $p \leq 0.01$, *** = $p \leq 0.001$. Note that both the mean heart rate and the tonic electrodermal activity of subjects in the stress group show a significantly higher increase from baseline for all three MIST periods compared to the control group (see Table 1), although there is not a significant difference between absolute values due to lower baseline measures for the stress condition.

et al., 2013) allowed us to test the impact of stress on honesty in a financial decision-making context where there were incentives to cheat. Subjects were presented with a scenario in which they are the CEO of a company and had to decide on whether to misreport earnings per share for rewards varying within-subjects from 0 to 3.2 CHF[7] (in increments of.8) over five randomized trials. Importantly, they were explicitly told that this misreporting would be legally permitted from an accounting perspective, which specifies the choice as possibly immoral (depending on one's values) but not illegal (Kajackaite and Gneezy, 2017). The second scenario task, the student task, was designed specifically for this study to investigate framing effects. It is structurally identical to the CEO task, with the same number of trials and the same varying economic incentives for dishonesty. However, in this task, subjects were told to imagine themselves in the role of a student who has an after-hours job at the library and has the possibility to misreport the number of hours they

[7] 1 CHF = ~ 1.15 USD

worked for extra pay. As with the CEO task, they were told that this misreporting is legally permitted. The full script for both tasks can be found in Appendix 1.

In the coin toss task (Greene and Paxton, 2009), subjects had to predict the outcome of a coin toss and were rewarded with 3 CHF for each correct prediction. Ten trials were presented to each subject. This task used the same principles as the die roll task in previous studies (Fischbacher and Föllmi-Heusi, 2013; Hao and Houser, 2017; Kajackaite and Gneezy, 2017), however the coin toss framework was chosen so that they would have a 1 in 2 chance of a correct prediction rather than a 1 in 6 chance. Importantly, subjects made the prediction mentally before viewing the coin toss, but only reported it afterwards, allowing them to cheat without the risk of being caught reporting false predictions. While this task only enabled us to measure honesty indirectly using group statistics, it allowed subjects to lie without the experimenters' direct knowledge of their choice (it is possible, though highly unlikely, to make ten correct predictions). Thus, subjects who might be hesitant to lie explicitly, or who withheld from lying for fear that the experimenter would know and be disappointed, would be more at liberty to do so in this task. Indeed, certainty that deceit is unobservable has been shown to increase lying in previous studies (Hao and Houser, 2017; Kajackaite and Gneezy, 2017).

As lying cannot be measured directly in the coin task, but relies on calculated probabilities, we required additional trials (ten instead of the five for the other honesty tasks) and kept the economic incentive constant across trials to increase statistical power. The theoretical probabilities of the success rates reported were calculated for each subject based on a 50% chance of predicting the correct outcome for each trial. These probabilities were used as a measure for dishonesty; the lower the probability that the number of correct predictions reported occurred naturally, the higher the likelihood that subjects were being dishonest.

In addition, as we were interested in how framing influences morality judgements of subjects' choices, perception questions about the honesty tasks were answered by subjects after each task, e,g how dishonest/manipulative they perceived the decision to lie (see Appendix 1 for full list). These were intended for use in exploratory analyses into the possible causes of framing effects.

The cognitive tasks were included both to mask the main goal of the experiment and to provide measures for additional mechanisms through which stress could be impacting honesty, specifically, through generosity, risk aversion or impulsivity. Some studies have shown impacts of stress on these tasks (e.g. Starcke and Brand, 2012, but see also Nitschke et al., 2022; Veszteg et al., 2021 who found no effects), and if subjects in our study also became, for example more impulsive or less generous when stressed, these could be moderators for the effects of stress on honesty. These tasks were used in exploratory analyses which investigated both how they were influenced by stress and how they correlated with honesty.

4.4. Payment

Subjects were paid a fixed show-up fee of 30 CHF[8] (at a rate of 20 CHF/hour, which is the standard compensation for experiments at the University of Geneva based on local salaries) plus a bonus comprised of the winnings of one randomly selected trial from each of the decision making tasks, that is the three honesty tasks, the risk-taking task, and the donation task (mean bonus 13.05 CHF, min/max 4.8/20). This method, shown to be as effective as a pay-all approach (Charness et al., 2016), not only controlled for wealth effects, but also incentivized subjects to remain focused and maximize their winnings on every trial, as they all had the potential of being selected. Moreover, as the highest bonus could still be achieved through full honesty, bonuses did not directly reflect the amount of lying, only the probability associated with it. This benefited subjects who were tempted to lie but were worried about saving face in front of the experimenter, as high rewards could also have been obtained honestly.

4.5. Psychometric questionnaires

The extent to which subjects held truthfulness as a protected value was measured using a well-established, nine-item questionnaire (Tanner et al., 2009) consisting of two, highly-correlated sections that estimate protected values on the importance of honesty from direct and indirect perspectives. The first five items (the indirect measure) assess emotional reactions to violations of honesty as dishonest acts committed by a hypothetical other are judged, while the last four (the direct measure) investigate the individual's own willingness to make a cost-benefit analysis where honesty is concerned, examining which features of protected values (e.g. incommensurability, trade-off resilience, unwillingness to sacrifice) they attribute to honesty (the direct measure). Overall PV score was the mean value calculated from all nine questions and ranged from 0 to 6 on a continuous scale. As pre-registered, we looked at correlations between the overall PV score and its two subscales in our study and found very high correlations between the overall PV score and both the direct scale (Pearson's correlation = 0.78) and the indirect scale (Pearson's correlation = 0.85). As the correlations were so high, we used only the overall PV score in our models as it is the most complete.

As chronic stress and anxiety can contribute to how people perceive and are influenced by acute stress, the STAI-Trait questionnaire (Gauthier and Bouchard, 1993; Spielberger et al., 1983), a well-tested measure of trait anxiety, and the COVID-19 Student Stress Questionnaire (Zurlo et al., 2020), chosen as data was collected during the first year of the COVID-19 pandemic, were included to use as control variables in our models. Three other psychometric tests were also included because of their potential impact on honesty. the Domain-Specific Risk-Taking Scale (DOSPERT Blais and Weber, 2006), which assesses risk-taking in five separate domains (ethical, health and safety, financial, social, and recreational), was chosen as risk aversion can reduce honesty through potential fear of getting caught. The Machiavellianism test (MACH-IV) (Christie, 1970; Loas et al., 2007), which tests for tendencies to manipulate and exploit others, was chosen as lying and/or cheating is one practical way in which these tendencies can be manifested. Finally the Triple-Dominance Measure of Social Values (Van Lange et al., 2007), which classifies people into three social value orientations (prosocial, individualistic, and competitive) was included as lying/cheating usually impacts others, so one's social values may influence these decisions.

To ensure that the experimental and control group were homogeneous, we also collected subjects' demographic information, including socio-economic status, level of education, knowledge of economics, profession/major, and sleeping habits. All questionnaires were presented online in randomized orders using PsyToolkit (Stoet, 2017, 2010) at the end of the experiment, so as not to influence subjects' choices. Demographic and psychometric data were included in the original models as random effects to ensure that our variables of interest had effects that were not already explained by these factors. The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) scores were used to determine which variables were kept as random effects in the final logistic regression model.

5. Results

5.1. Stress response manipulation check

Before testing our main hypotheses, we performed manipulation checks to ensure that our stress induction was successful. Repeated measures ANOVAs showed significant within-subjects changes for all nine stress response measures. T-tests (or Wilcoxon sum rank tests when normality assumptions were violated) were then used to compare the

[8] Approximately $34.50

deltas (differences compared to baseline) between the stress and control conditions. To be conservative, two-tailed tests are reported in Table 1.[9] These tests revealed that our stress manipulation was successful; subjects in the stress condition reported feeling significantly more stressed than those in the control condition on the Stress Rating Questionnaire (SRQ). In addition, they showed increased BPM and decreased PPGa when compared to baseline, as well as higher tonic EDA and phasic EDA frequency (see Fig. 1 and Table 1). Taken together, these results provide evidence for a significantly higher SNS stress response in the stress condition compared to the control condition. There was not a significant difference in changes from baseline between conditions for EDA phasic amplitude and RMSSD, although as expected both measures showed a significant increase and decrease from baseline (respectively) in response to the stressor. Salivary alpha-amylase (sAA) also didn't show a significant difference in increases from baseline between conditions, although differences in absolute values at T2 trended towards being higher in the stress condition ($p = .06$).

We did not see an HPA stress response. Salivary cortisol showed a small decline for both groups, as can be expected from normal circadian rhythms, although the control condition decreased slightly, but significantly less than the stress group. However, as advice in the literature for distinguishing stress responders from non-responders using cortisol recommends using a minimum 1.5 nmol/L increase criterion (Miller et al., 2013), and we saw a decrease from baseline for both groups at all time points, with the maximum difference between group means at 1.29 nmol/L, we can consider the difference in decrease rates between the two groups to be negligible.

Lastly, we ran MANOVA tests to ensure that our stress induction was also successful when controlling for having nine variables to measure the stress response. As expected, we found no significant differences between groups at baseline ($Eta^2 = 0.03$, $p = 0.77$), but we did find significant differences with large effect sizes[10] at T1 ($Eta^2 = 0.36$, $p < 0.001$), T2 ($Eta^2 = 0.36$, $p < 0.001$), and T3 ($Eta^2 = 0.28$, $p < 0.001$).

In short, while a stress response was not recorded in all measures, as is common given its complexity (see for instance Campbell and Ehlert, 2012; Vaessen et al., 2021; von Dawans et al., 2021, 2018), the stress manipulation was successful, triggering a significant subjective and SNS response captured by five different measures, with an additional trend towards significant differences in sAA.

5.2. Descriptive results

Before proceeding with the hypotheses testing, we examined whether the randomization used to assign subjects to the experimental and control group was effective. T-tests showed that subjects did not significantly differ between conditions on any demographic or psychometric measures (see Appendix 2), nor in their protected values for honesty. Table 2 provides descriptive statistics for subjects' PV scores as well as their results on the different tasks. Their performance on the cognitive reflection (CRT), risk-taking, and honesty tasks were similar between conditions (see Table 2). The only significant difference between conditions was in the donation task, with those in the stress condition donating slightly more than those in the control condition (see Section 5.4 for additional analyses).

5.3. Hypotheses testing

We used three different honesty tasks to test our hypotheses on how stress condition, protected values (PV), and the economic cost of truthfulness (ECOST, can also be thought of as the economic incentive for lying) would affect honesty. This enabled us to examine the effects of framing and observability on choices and perceptions of the tasks. The CEO task was used to test honesty in a financial decision-making context by asking subjects to put themselves in the CEO's position and consider misreporting data for real monetary rewards. However, as our subjects were mostly students, we also wished to investigate how they would make decisions in a context that is closer to their own experiences, which is why we added the student task. This task is structurally equivalent to the CEO task, entailing the same number of trials (five) and real life ECOST, that is, the actual extra money per trial they would make if they chose the dishonest option (from 0 to 3.2 CHF). However, in this task subjects were asked to make choices in the function of a part-time student job. Finally, the coin toss task, framed as a prediction task, allowed us to measure honesty in contexts where individuals know with certainty that their dishonesty cannot be known by others, as their mental prediction is not recorded. As shown in Fig. 3 (panel A, also in Table 2), subjects lied in about half of the CEO task trials (mean score.48) and in over 60% of student task trials. In the coin toss task (Fig. 3, panel B, also in Table 2), subjects reported an average prediction accuracy of 69%, higher than the average 50% which would be expected if all answers were honest.

5.3.1. CEO and student tasks

The effects of the stress condition, PV, and ECOST on honesty in the CEO and student tasks were modelled using mixed-effects logistic regressions (with the glmer function from the lme4 package in R, a tool for testing generalized linear models with mixed effects).

We first tested whether our experiment setting replicated previous findings on the effects of protected values, economic incentives, and their interactions, outlined in H1-3. The equation (Eq. 1) below nests how these first three hypotheses affected honesty choices for each individual *i* for choice C in trial *t*:

$$C_{(i,t)} = \beta 0 + \beta 1 PV + \beta 2 ECOST + \beta 3 PV{*}ECOST + n_i + v_t \quad (1)$$

.

PV and ECOST were coded as continuous variables standardized with the mean at 0 (PV range −3.17 to 2.47, ECOST range −1.41 to +1.41), choice (C) was coded as a binary variable where 0 = dishonest, 1= honest. Additionally, we included n_i, an error term for time-invariant unobserved subject characteristics and v_t, a time-specific error term, as subjects made five decisions per task, each with varying rewards. According to the predictions in H1-3, we would expect a positive significant main effect of PV (captured by β1 in our model), the main effect of ECOST (captured by β2 in our model) is expected to be negative and significant, and the interaction between these two factors (captured by β3) to be positive and significant.

To control for the potential effects of experimental, demographic, and psychometric factors that were not the focus of this study, the order in which tasks were presented, as well as other demographic and psychometric variables were systematically included in the model and AIC/BIC scores were compared. The best model included the MACH-IV scores, the DOSPERT: Ethical scale, and the average donation given in the donation task as random variables in the CEO task and the MACH-IV scores and task order for the student task. As detailed in the methods section, the MACH-IV score provides measures of manipulation tendencies, while the DOSPERT-Ethical scale provides a measure of people's willingness to take risks related to ethical decisions. By including these in the models, we ensure that the effects of PV and ECOST we measure cannot be explained away by these factors.

The coefficients for the models with PV, ECOST, and their interaction are outlined in the 'No Stress' columns in Table 3 (column 2 = CEO task and 4 = Student task). As expected, and in line with previous studies (Gibson et al., 2013), our findings show a significant positive direct effect of PV on honesty – i.e. the higher people's protected values for honesty, the more honest their choices –and a significant negative direct effect of ECOST – i.e. the higher the reward the less honest their

[9] The pre-registered 1-tailed tests can be found in Appendix 6

[10] Eta^2 is a measure of the effect of the independent variable. 0.01 indicates a small effect. 0.06 indicates a medium effect. 0.14 indicates a large effect.

Table 1
Analysis of Stress Response During/Immediately Following Stress Induction.

Stress measure	Baseline/T0		MIST1/T1 Δ		MIST2/T2 Δ		MIST3/T3 Δ	
	Mean(se)	Effect Size	Mean(se)	Effect Size	Mean(se)	Effect Size	Mean(se)	Effect Size
Stress Rating Questionnaire								
Control	5.67 (0.50)	0.07	1.89 (0.44)	*0.46****	2 (0.47)	*0.48****	1.62 (0.61)	*0.39****
Stress	6.52 (0.56)		7.36 (0.60)		8.5 (0.69)		7.49 (0.80)	
Salivary Alpha Amylase (unit/ML)								
Control	76.00 (5.40)	0.06	25.00 (5.40)	0.06	-3.44(4.08)	0.08	6.59 (6.40)	0.06
Stress	82.60 (5.60)		15.40 (5.05)		4.63(4.70)		0.86 (6.40)	
Salivary Cortisol (nmol/L)								
Control	4.35 (0.24)	0.05	-0.44 (0.13)	*0.23***	-0.73 (0.20)	0.06	-0.28 (.28)	*0.24****
Stress	4.72 (0.28)		-0.94 (0.11)		-1.02 (0.17)		-1.49 (.23)	
Heart Rate: BPM								
Control	77.30 (1.20)	0.05	4.13 (0.47)	*0.27****	2.37 (0.43)	*0.21***	1.34 (0.58)	0.12*
Stress	76.50 (1.30)		8.54 (0.86)		5.36 (0.73)		3.19 (0.64)	
PPGa								
Control	0.89 (0.05)	0.04	-0.3 (0.04)	*0.23***	-0.37 (0.04)	0.15*	-0.41 (0.04)	0.12
Stress	0.87 (0.06)		-0.49 (0.05)		-0.49 (0.05)		-0.5 (0.05)	
Heart Rate: RMSSD								
Control	44.30 (2.10)	0.07	-5.34 (1.20)	0.05	-1.73 (1.40)	0.03	-1.82 (1.40)	0.02
Stress	48.8 (2.60)		-3.67 (1.90)		-2.37 (1.90)		-0.48 (1.90)	
EDA: Tonic Mean								
Control	6.37 (0.38)	0.03	1.82 (0.14)	*0.28****	2.12 (0.18)	*0.20***	2.06 (0.23)	0.14*
Stress	5.96 (0.35)		2.86 (0.18)		3.10 (0.23)		2.86 (0.25)	
EDA: Phasic Frequency (Event Count/Second)								
Control	0.07 (0.00)	0.08	0.03 (0.00)	*0.32****	0.00 (0.00)	*0.25****	0.01 (0.00)	0.15*
Stress	0.06 (0.00)		0.05 (0.00)		0.03 (0.00)		0.02 (0.00)	
EDA: Phasic Amplitude								
Control	0.17 (0.02)	0.03	0.09 (0.02)	0.08	0.08 (0.02)	0.00	0.07 (0.02)	0.03
Stress	0.16 (0.02)		0.1 (0.02)		0.08 (0.02)		0.08 (0.02)	

Table 1: The nine stress measures divided by condition. Baseline values are given in columns 2–3 followed by the changes in stress measures (deltasΔ) following/during stress inductions (MIST/T1-3, columns 4–9). Se = standard error, effect sizes show Wilcoxon effect sizes for condition). Significance markers (* = $p \leq 0.05$, ** = $p \leq 0.01$, *** = $p \leq 0.001$) indicate where the stress condition is significantly different from the control condition (determined using two-tailed Student's T-test or Wilcoxon rank-sum test when normality assumption was violated). All measures were expected to increase under stress, except for PPGa and RMSSD, which were expected to decrease.

choices—supporting hypotheses one and two. Additionally, the PV-ECOST interaction had a significant positive effect on honesty, supporting hypothesis three anticipating that high protected values increase individuals' trade-off resistance to rewards.

While there is not yet a reliable method for calculating effect sizes for binomial logistic regressions, we examined changes in the probability of an honest choice based on the coefficients. In the student scenario, when both ECOST and PV were at their mean value, the probability of an honest response was only 4.5%, however, an increase of 1 SD in PV raised the probability of an honest response to 77 % when ECOST remained unchanged, and to 48.6% when ECOST also increased by 1 SD (see Fig. 3 for plot with all predicted probabilities). In the CEO task, subjects were more honest when both PV and ECOST were at the mean value (more on this difference in Section 5.3), with a 34.5% probability of acting honestly. A 1 SD increase in PV again increased the probability of honesty to 79.7 % when ECOST remained unchanged, and to 43.9 % when ECOST was also increased by 1 SD. Fig. 3 depicts the interaction effects on predicted probabilities.

To test hypotheses four, we included the stress interaction in the aforementioned model with PV and ECOST. The model tested was:

$$C_{(i,t)} = \beta 0 + \beta 1PV + \beta 2ECOST + \beta 3PV*ECOST + \beta 4SC + \beta 5SC*PV + \beta 6SC*ECOST + \beta 7SC*PV*ECOST + n_i + v_t \quad (2)$$

.

with SC dummy-coded to represent stress condition (0 = no stress, 1 = stress). Again, we would expect β1 to be positive and significant, β2 to be negative and significant, and β3 to be positive and significant according to H1-3. Additionally, based on H4a-c, we would expect β5 to be positive and significant, β6 to be negative and significant, and β7 to be negative and significant. As our hypotheses pertained specifically to interaction effects, we have no prediction for β4.

Contrary to hypothesis 4, predicting that acute stress would increase the joint effects of PV and ECOST, we did not find significant interaction effects with PV and ECOST. Additionally, PV, ECOST, and their interaction continued to be significant when stress was included. Model coefficients for the models including stress can be found in the 'Stress' columns in Table 3 (column 3 for the CEO task and 5 for the student task).

As we did not find a significant result for our main hypotheses (H4a-c) on the role of stress, we used Bayesian methods to investigate, through model comparison, whether there was evidence for the null hypothesis. Unlike frequentist null hypothesis significance testing, Bayesian hypothesis testing compares at least two hypotheses (in our case, the null hypothesis and the alternative hypothesis for H4), and rather than returning p-values for rejecting the null hypothesis, provides Bayes factors which indicate the likelihood of one model being correct relative to the other. This allows us to test, based on the data, what the likelihood is that the model without stress is a better fit than the model with stress. Bayes factors calculated using the BIC approximation of the Bayes factor (Wagenmakers, 2007) provide extreme evidence ($BF_{01} = 420969.7$ for CEO task, 220117 for student task) for the models without stress (No Stress) compared to the models with it (Stress, see Table 3).

Lastly, we used the Matthews Correlation Coefficient (MCC) to gauge the models' predictive power. The MCC compares data predicted by a model to the actual data observed to determine how close the model predictions are to the actual data. MCC scores range from −1, total disagreement between predict and observed data, through 0, the data doesn't match at all, to 1, the data predicted by the model matches the observed data perfectly. Scores of.922 for the CEO task and.933 for the student task show that the models including only PV, ECOST, and their interaction (No Stress) were highly effective at predicting subjects' choices. The MCC score did not change when stress was added to the model. Based on all these findings, we can conclude that stress did not significantly impact honest choices nor alter the effects of PV or of

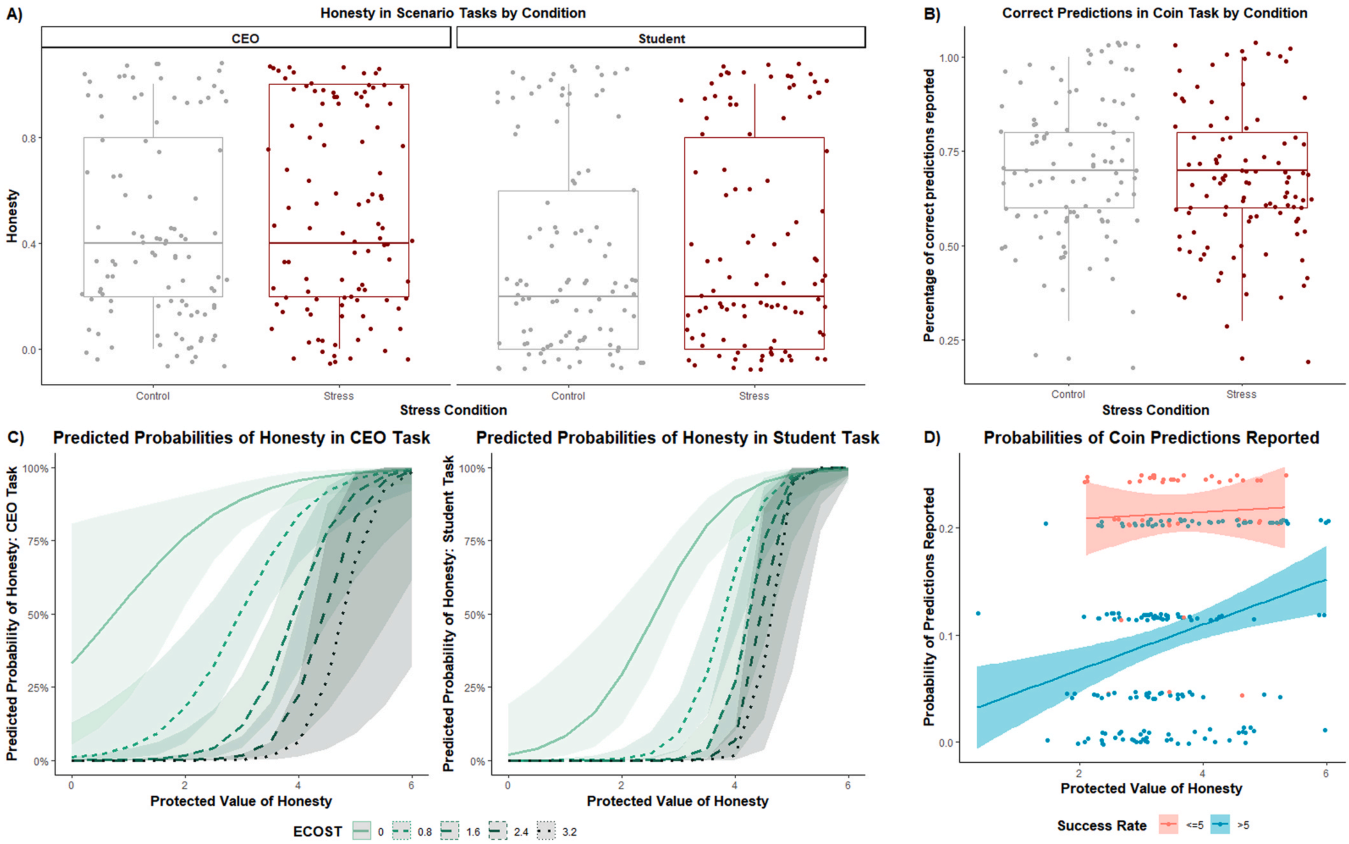

Fig. 3. A) Honesty rates for the scenario tasks divided by conditions. The rates range from 0 = complete dishonesty to 1 = complete honesty. B) Correct predictions for the coin toss task by condition ranging from 0 = all incorrect predictions to 1 = all correct predictions. Given that this is a game of chance with a 50/50 chance of the coin landing on heads or tails, we would expect mean values for correct predictions to be clustered around 0.5 for honest subjects. C) For the two scenario tasks (CEO and student), plots depict predicted probabilities (and standard error of the mean) for honesty based on model with protected values for honesty, the economic cost of lying (ECOST), and their interaction. The Y axis shows predicted probability of an honest response for differing values of PV and ECOST. D) Effects of protected values on the theoretical probability of correct coin predictions reported in the coin toss task, divided by whether the success rate reported was above or below average.

ECOST or of their joint interaction on honest choices.

5.3.2. *Coin toss task*

For the coin toss task, as honesty rates could not be observed directly (cf. Section 4.3), we calculated the theoretical probabilities of success rates reported based on a 50% chance of predicting the correct outcome for each trial (using the density distribution function dbinom in R). These probabilities ranged from.001 (or.1%, rare outcomes such as 0/10 or 10/10 correct predictions) to.246 (or 24.6%, 5/10 correct predictions). As the probability of obtaining very low and very high success rates were identical, given that they are equidistant from 50%, we used an additional factor, direction, to differentiate whether responses were above 50%, that is a higher prediction accuracy than chance (coded as 1) or 50% and below, that is a lower prediction accuracy than expected (0). As we did not expect people to lie to obtain worse results than they would by responding honestly, we only expected correlations between rare outcomes that led to greater gains (coded as 1 in the direction factor). As expected, there was a negative effect for direction, that is responses were more theoretically improbable when they increased the chances of gains, but not losses, implying dishonesty for economic gain (see Fig. 3, panel D). The effect of PV (H1) was then modeled using mixed-effects logistic regressions (the lmer function in R). This task did not include an ECOST variable as rewards did not vary across trials. Thus, the full model for each individual *i* for the probability of the outcome reported (PO, ranging from.001 extremely improbable to.246 highly probable) was:

$$PO_{(i)} = \beta 0 + \beta 1PV + \beta 2D + \beta 3PV{*}D + n_i \quad (3)$$

.

PV was coded as a continuous variable standardized with the mean at 0 (PV range −3.17 to 2.47) and D was a dummy-coded variable representing whether the outcomes reported were above 50% (1) or 50% and below (0). Additionally, we included n_i, an error term for time-invariant unobserved subject characteristics. According to H1, we would expect β1 to be positive and significant, β2 to be negative and significant, and β3 to be positive and significant.

As with the models for the CEO and stress tasks, task order and demographic and psychometric measures were included in the model as random effects (using the lmer function from the lme4 package) and AIC/BIC scores were compared to determine which variables to include. The best model did not include any random effects. As predicted, our findings show a positive effect of PV on the probabilities reported—the higher people's protected value for honesty the more probable their success rates— meaning it is more likely that their responses were honest, supporting hypothesis one in this task as well. Model coefficients and effect sizes can be found in the 'No Stress' columns of Table 4 and model visualization plot in Fig. 3. While the interaction between PV and direction was not significant, we retained it in the final model to preserve the innate data clustering which allows us to interpret direction slopes separately (see Fig. 3).

We then tested the effects of stress condition and its interaction with PV on honesty (H4a) with the model:

Table 2
Descriptive statistics for all subjects and divided control and stress groups.

	All subjects	Control	Stress	p-value
Number of subjects	204	102	102	
Protected Value Honesty (0–6)	3.52 (1.01)	3.45 (0.93)	3.58 (1.08)	0.38
CEO task (0/1)	0.48 (0.37)	0.44 (0.37)	0.52 (0.38)	0.16
Student task (0/1)	0.39 (0.39)	0.37 (0.38)	0.42 (0.39)	0.35
Coin toss task (0/1)	0.69 (0.19)	0.71 (0.19)	0.67 (0.18)	0.11
Average money donated (0–3 CHF)	1.48 (1.22)	1.28 (1.14)	1.68 (1.27)	0.02*
Risk-taking: Money invested: Ambiguous lottery (0–2 CHF)	1.07 (0.68)	1.07 (0.68)	1.07 (0.68)	1
Risk-taking: Money invested: Risky lottery (0–2 CHF)	1.09 (0.65)	1.14 (0.68)	1.04 (0.62)	0.25
CRT correct (0–3)	0.56 (0.75)	0.62 (0.83)	0.50 (0.66)	0.26
CRT confidence of correct responses (0–3)	1.83 (0.73)	1.92 (0.68)	1.75 (0.77)	0.09

Table 2: Mean and standard deviation (in brackets) for behavioral results and protected values for all subjects stratified by condition. P-values indicate significance of differences between the control and stress conditions. The range of responses for each variable is given in brackets in the first column. For the CEO and student tasks 0 = dishonest, 1 = honest. For the coin toss task, 0 = no accurate predictions, 1 = 10 accurate predictions, so higher means = lower probability of honesty. For the donation and risk-taking tasks, the values correspond directly to money (CHF). For the CRT task, it is the number of correct responses.

Table 3
Logistic Regression Coefficient Table: Student and CEO Tasks.

	CEO Task		Student Task	
	No Stress	Stress	No Stress	Stress
Intercept	-0.63 (0.51)	-1.20 (0.69)	*-3.06 (0.71)****	-3.27 (0.96)***
PV	*2.01 (0.59)***	*1.80 (0.75)***	*4.19 (0.78)****	3.34 (0.98)***
ECOST	*-2.44 (0.36)****	*-2.67 (0.49)****	*-3.17 (0.53)****	-3.10 (0.32)***
PV*ECOST	0.83 (0.36)*	0.66 (0.47)*	*1.94 (0.53)****	1.49 (0.61)*
Stress Condition		1.02 (0.85)		0.35 (1.12)
Stress Condition*PV		0.36 (0.47)		1.45 (1.13)
Stress Condition*ECOST		0.41 (0.54)		-0.20 (0.73)
Stress Condition*PV*ECOST		0.27 (0.56)		0.76 (0.73)
AIC	873.00	879.30	749.80	755.10
BIC	917.20	943.10	789.10	814.10
MCC	0.92	0.92	0.933	0.933
Bayes Factor$_{01}$	420969.70		220117.00	

Table 3: Logistic regression coefficient table (and standard errors) for the CEO and student tasks for models with and without stress as a predictor variable on data from all subjects (n=204). Significance markers: * = $p \leq 0.05$, ** = $p \leq 0.01$, *** = $p \leq 0.001$. Besides the stress condition variable and all interactions being non-significant, AIC and BIC scores for both tasks are lower for the models without stress compared to the models with stress, indicating better fit. Bayes factors also provide extreme support for the No Stress model (model without stress) compared to full model including stress. The Mathew's Correlation Coefficient (MCC, scores from −1 to 1) show that the outcomes predicted by the model match the observed outcomes very well and are not improved by adding stress condition to the model.

$$PO_{(i)} = \beta 0 + \beta 1PV + \beta 2D + \beta 3PV*D + \beta 4SC + \beta 5SC*PV + \beta 6SC*D + \beta 7SC*PV*D + n_i \quad (4)$$

.

with SC dummy-coded to represent stress condition (0 = no stress, 1 = stress). We would expect β1 to be positive and significant, β2 to be negative and significant, and β3 to be positive and significant, based on H1. Additionally, according to H4a, we would expect β5 to be positive and significant, β6 to be negative and significant, and β7 to be positive and significant. Once again, as our hypotheses pertained specifically to interaction effects, we have no prediction for β4.

As with the two scenario honesty tasks, there was no effect of the stress condition or the interaction of stress condition with PV (H4a), while the effects of PV and Direction continued to be significant (see Table 4, No Stress columns). We once again used Bayesian hypothesis testing to examine the likelihood of the model without stress fitting the data compared to the model with stress. Bayes factor analysis showed extreme evidence (BF_{01} = 8637.7) for the model without stress compared to the one including it and adjusted R-squared values show that adding stress to the model does not increase its fit (see Table 4). Based on these findings, we can once again conclude that stress did not impact honesty in this task either. It is important to note that a lower model fit for the coin toss task is likely due to the random noise inherent in the measurement, that is, it is expected that not all improbable scores were obtained dishonestly and not all probable scores were obtained honestly.

5.3.3. Subjective stress levels

Since it is possible that not all subjects in the stress condition were stressed, and conversely that some subjects in the control condition were, we ran the same models listed above, substituting the stress condition with subjective stress ratings (SRQ), as pre-registered. Overall, the results from the subjective stress analyses mirror those of the stress condition analyses[11] and Bayes factor analysis showed extreme evidence for the models without stress compared to the models including it (BF_{01} = 16925.61 for CEO task, 466987.5 for student task, and 4067.74 for coin task, see Appendix 5 for full table). This further confirms our finding that stress, whether induced or subjectively experienced, did not have a significant impact on honest decision-making.

5.4. Additional analyses

5.4.1. Donation average

To explore additional factors which may impact honesty, we included results from the cognitive tasks as covariates in our models (both with and without stress condition) and found that, in addition to PV and ECOST, the average amount donated was a significant predictor of honesty in the coin toss task ($t = 2.6$, $p < .01$) and the CEO task (main effect: $t = 2.72$, $p = .01$, Donation average*ECOST: $t = 2.56$, $p = .05$), but not in the student task ($t = 1.37$, $p = .17$). While there was a significant correlation between PV and donation average, this correlation was relatively low (Pearson correlation =.294, $t = 4.368$. p = <.001) and did not result in high multi-collinearity when both factors were included in the model, indicating that donation average captures an additional, omitted factor, such as generosity or altruism, which displays a positive correlation with preferences for honesty (Logistic regression tables available on request).

[11] The only indication that subjective stress may have impacted honest decision making comes from one significant three-way interaction (ECOST*PV*-STRESS) in the CEO task. However, further inspection of the two-way interactions and main effects all indicate that this interaction is most likely driven by ECOST and PV, as none of the variables involving stress reveal any further significant result.

Table 4
Logistic Regression Comparison Table: Coin Toss Task.

	Coin Toss Task			
	No Stress		Stress	
	Coefficients	Partial eta^2	Coefficients	Partial eta^2
Intercept	*0.20 (0.05)****		0.16 (0.07)*	
PV	*0.00 (0.01)****	0.050	*0.01 (0.02)****	0.05
Direction1	*-0.18 (0.05)****	0.270	*-0.14 (0.07)****	0.27
PV*Direction1	0.02 (0.01)	0.010	0.01 (0.02)	0.01
Stress Condition			0.08 (0.09)	0.01
Stress Condition*PV				<0.01
Stress Condition*Direction1			-0.08 (0.1)	<0.01
Stress Condition*PV*Direction1			0.02 (0.03)	<0.01
AIC	-484.60		-479.70	
BIC	-468.00		-449.80	
Adjusted R-squared	0.32		0.32	
BF01	8637.70			

Table 4: Logistic regression coefficients (and standard errors) and effect sizes for the coin task for models with and without stress as a predictor variable on data from all subjects (n = 204). Significance markers: * = p ≤ 0.05, ** = p ≤ 0.01, *** = p ≤ 0.001. Besides the stress condition variable and all interactions being non-significant, AIC and BIC scores for both tasks are lower for the models without stress compared to the models with stress, indicating better fit. Bayes factors also provide extreme support for the No Stress model (model without stress) compared to full model including stress. Partial eta^2, a measure of effect size scores (0.01 = a small effect. 0.06 = a medium effect. 0.14 = a large effect), show a small effect for PV and a strong effect for direction.

5.4.2. Framing effects

Our study included two tasks with similar structures and reward schemes (the CEO and student tasks) in which the subjects were given different roles to examine possible framing effects that would allow subjects to justify lying more in some situations than in others. A Pearson's correlation showed a significant moderate correlation between lying on the two tasks (0.381, t = 5.87, df = 202, p-value = <0.001), however, subjects were significantly more dishonest in the student task than in the CEO task (t = 2.32, p =.02).

To explore what might be driving this effect, we analyzed subjects' perceptions of choices in the two tasks. Table 5 shows their opinions of both honest and dishonest decisions for each task on five different criteria. While subjects did not differ significantly in how they viewed the honesty levels of honest/dishonest choices, they perceived both the honest and dishonest choices for the student task as significantly less harmful to others, indicating that they viewed their choices on this task as less socially impactful. Additionally, they perceived honest decisions in the student task as significantly less long-term oriented, and dishonest choices as less manipulative. Previous studies (e.g. Gneezy, 2005) have found that people lie less when it impacts others negatively, so subjects' perception of the student task as being less manipulative and affecting others less may explain why they were more willing to lie in this task. This perspective may also explain why donation average, an altruistic, other-related action, was only a significant additional predictor in the CEO task, which was seen as more socially impactful.

Table 5
Perceptions of decisions in honesty tasks.

	Honest Choice		Dishonest Choice	
	CEO	Student	CEO	Student
Honest	4.34 (1.12)	4.19 (1.29)	2.10 (1.21)	2.14 (1.25)
Not Hurting Others	3.72 (1.42)	4.06 (1.24)*	2.39 (1.33)	*2.86 (1.52)***
Long-term Oriented	3.93 (1.25)	3.67 (1.42).	2.48 (1.37)	2.74 (1.45).
Not Manipulative	4.16 (1.23)	4.13 (1.23)	2.21 (1.25)	2.49 (1.31)*
Related to Personal Gains	2.76 (1.27)	2.99 (1.35).	4.08 (1.22)	4.06 (1.25)

Table 5: Mean and SD for perceptions of CEO and student tasks for data from all subjects (n = 204). Views on both the honest and dishonest choice were collected on a scale ranging from 1 to 5. Significance markers indicate differences between tasks:. = p ≤ 0.10, * = p ≤ 0.05, ** = p ≤ 0.01, *** = p ≤ 0.001.

6. Discussion

In this study, we examined whether stress impacts honest decision-making by inducing acute stress and analyzing people's decisions on three separate honesty tasks. Our manipulation check showed that the stress induction was successful in robustly triggering the SNS stress response and inducing a high level of psychological stress: evidenced in group level differences in self-report measures (psychological measure), mean heart rate, PPGa, tonic EDA, and phasic EDA frequency (physiological measures), and a tendency in sAA (hormonal measure). While there was not a significant difference between conditions in stress indicators for all nine stress measures, the stress response is complex and multi-faceted and it is not uncommon in the existing literature to report correlations between stress measures that are low or nonexistent (Campbell and Ehlert, 2012; Vaessen et al., 2021), especially for mild psychological stress.

Our results on the honesty tasks replicate previous research findings and provide strong confirmatory evidence that both protected values for honesty and economic incentives (measured by ECOST) are significant predictors of honesty decisions, even under acute stress, and that higher PV makes people trade-off resilient to increasing rewards associated with cheating. Additionally, by introducing a new scenario (the student task) and comparing it to a previously tested scenario (the CEO task), we were able to not only confirm the effects of PV and ECOST in a different hypothetical context, but also explore how the framing influenced perceptions of the task and honesty levels.

Specifically, while decisions on both tasks were perceived similarly with respect to their levels of honesty, the student task was viewed as less socially impactful, which may explain increased dishonesty in this task. However, this observation must be taken with caution as the framing impact of students may have different implications on honest choices in an experiment on earnings management conducted with actual CEOs. It would thus be worthwhile to extend the CEO task focused experiment under stress to a field study with real professionals to contrast the levels of honesty obtained from framing with those that apply in a competitive finance setting.

Of interest, the best model for both scenario tasks included the MACH-IV scores as a random variable. As specified in the methods section, the MACH-IV score provides a measure of Machiavellianism or manipulation tendencies, and while it was not the focus of our study, our findings indicate both that this variable continues to be important, and that PV is still a significant predictor of honesty when the MACH-IV scores were included in the model. Additionally, the best model for the CEO task, but not the student task, also included a measure of willingness to take risks in the ethical domain (the DOSPERT: Ethical scale). This may be because the student task was seen as less harmful to others and manipulative than the CEO task, which may be important criteria for determining how unethical a choice is, but further research is needed to determine whether this is the case.

Our main focus was to examine whether acute stress impacted trade-offs between qualitatively different values: moral motives on one hand (honesty) and financial motives on the other hand. Contrary to our novel predictions (cf. H4), there was no significant interaction between acute stress and PV or ECOST and their impact on honest choices. This contrasts with findings on within-category trade-offs, as in the case of financial rewards that are immediately available vs. delayed (Delaney et al., 2014) or in the case of food choices comparing taste and healthiness (Maier et al., 2015), where an effect of stress on valuation was shown, but is in line with recent findings showing that acute stress in the lab does not impact financial and prosocial decision-making (Nitschke et al., 2022; Veszteg et al., 2021).

There are several possible explanations for this outcome. One plausible reason is that PV, ECOST, and their interaction already have very strong explanatory power in the case of honest decision-making, so that augmenting them through stress has no significant impact on the outcome. A further explanation may lie in the type of acute stress induced. In our design, the honesty decisions were not directly linked to the stressor, that is, decisions made in the honesty task did not influence the intensity or duration of the stressor. It may be that if the stressor is directly linked to the honesty decision, so that lying potentially reduces the cause of stress, it may be more impactful than when it is unrelated to subsequent decisions. Moreover, our study focused on acute stress rather than chronic stress, which has been shown to affect physiology and behavior differently, especially with regards to reward sensitivity (e.g. Ironside et al., 2018). These questions are beyond the scope of the present study but provide interesting topics for future research.

Our findings pertain more to everyday situations in which a stressor could affect an unrelated subsequent decision, for instance: in the professional sphere, a CEO may be deciding whether to report the company's accounts truthfully following a stressful meeting with a big client, an investor experiencing a spike in anxiety following stock price declines may be motivated to lie to a client, an employee could be reporting—and perhaps inflating—their personal expenses after a stressful health scare, or an individual might be filling out their tax forms after a stressful argument with their boss. Another potential reason we have not considered explicitly is that some subjects may perceive honesty itself as an identity-affirming reward. Thus, if stress increases the saliency of all potential rewards—not just monetary ones—stress may have made some subjects more honest through this mechanism. Whether this view of honesty as enhancing subjects' "self-identity" correlates highly, and is thus already accounted for, by the protected values for honesty scale remains to be tested. Additionally, the role of contextual factors such as social norms was not explored, and it would be interesting to study contagion effects and examine whether stressed people with different levels of PV for honesty respond differently to corrupt environments and negative peer pressure. Another explanation, in particular for the CEO task, may lie in the fact that stress only matters when the economic stakes are significantly higher than those provided on average in laboratory experiments, although this concern is mitigated considering the robust effect of ECOST in our experiment.

While we found no significant effect of stress on honesty, our additional analysis did find a significant positive effect of stress on donations, consistent with a recent study which found that stress increased altruism in younger adults (Sparrow et al., 2019). Having observed that stress impacted donations, we then analyzed if there was a relation between behavior in the donation task and decisions to be honest. This analysis revealed that donation average was an additional correlate for honesty on two of the three honesty tasks, however adding this variable to the main model did not negate the results showing that PV and ECOST are important drivers of decisions to act honestly. Taken together these results suggest that there may be an additional omitted variable that could not be captured with our approach. One possibility is that, in our design, dishonesty also represented the selfish choice, so that honest decisions could be influenced by people's attitudes on both honesty (related to justice) and altruism (related to care), two distinct, often conflicting values (Khalil, 2004). It is likely that higher donation averages, a behavioral measure of altruism, were not necessarily predictive of more honest choices, but of more altruistic, other-serving ones, which overlapped in our study. This may also explain why donation average had no significant effect on the student task, in which subjects perceived dishonesty as less manipulative and harmful to others.

To conclude, the finding that protected values for honesty and reward magnitude continue to accurately explain honest/dishonest decisions under acute stress is relevant to researchers and practitioners in a wide range of settings. Given that daily stress is experienced by 43% of employees (Gallup, 2021), it is reassuring to find evidence that honest decision-making remains stable under acute psychological stress, and can still be reliably predicted considering people's protected values for honesty and the rewards at stake. Although this does not detract from the many other deleterious effects of stress on human health and well-being., these results are useful for informing policy and resource allocation, as they indicate no additional need for monitoring honesty decisions during short periods of increased stress. Moreover, as protected value scores are confirmed to be a robust predictor of honest decision-making, even in times of stress, human resources' managers who prioritize moral integrity may find this a valuable tool to be used during their hiring process to curb the costs of dishonest decision-making and even of fraud in the corporate world.

CRediT authorship contribution statement

Sooter Nina: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing. **Ugazio Giuseppe:** Conceptualization, Funding acquisition, Investigation, Methodology, Supervision, Writing – review & editing. **Gibson Brandon Rajna:** Conceptualization, Funding acquisition, Methodology, Resources, Supervision, Writing – review & editing.

Declaration of Competing Interest

For the manuscript titled '*Honesty is predicted by moral values and economic incentives but is unaffected by acute stress*' the authors listed above declare no conflict of interest.

Data Availability

Anonymized data and code available at: https://osf.io/n6yk2/?view_only=657064518c9a4737bb516e14dea4f674.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jbef.2024.100899.

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Glossary

AIC: The Akaike information criterion is a mathematical method for evaluating how well a model fits the data that generated it. Statistically, it is used to compare different models and determine which best fits the data, that is, which explains the greatest amount of variation using the fewest number of independent variables. AIC scores are used for relative comparisons, the lower the score the better.
ANOVA: The analysis of variance is a statistical test used to compare variances between the means of different groups.
BIC: The Bayesian information criterion is a mathematical method for evaluating how well a model fits the data that generated it. Statistically, it is used to compare different models and determine which best fits the data, that is which explains the greatest amount of variation using the fewest number of independent variables. BIC scores are used for relative comparisons, the lower the score the better. Compared to the AIC, the BIC values parsimony more highly, that is it penalizes models more for additional independent variables.
BPM: Beats per minute, a measure of heart rate frequency.
DOSPERT: The Domain-Specific Risk-Taking scale is a well-established psychometric scale to measure an individual's propensity to take risks. The test provides a general risk-taking score, as well as separate scores for five different domains: financial decisions, health/safety, recreational, ethical, and social.
ECOST: The economic cost of truthfulness or economic reward for dishonesty. In our task, this cost ranged from 0 (no economic difference between honest and dishonest choices) and 3.2 CHF, in increments of 0.8 CHF.
EDA: Electrodermal activity is a measure of sweat gland activity measured using a small electric current. Increases in EDA represent the activation of the sympathetic nervous system (see below) and correlate with arousal.
HPA: The hypothalamic-pituitary-adrenal axis is how the endocrine system adjusts the hormonal balance in response to stress through stimulating the adrenal gland to release additional cortisol. This is a more delayed stress response—generally peaking between 15 and 25 min following the onset of the acute stressor—and is especially sensitive to social stressors.
MACH-IV: A psychometric test of Machiavelianism measured using twenty statements taken from Niccolò Machiavelli's writings.
MANOVA: The multivariate analysis of variance is a statistical test used to compare multivariate group means for two or more dependent variables. It is typically accompanied by significance tests which examine the dependent variables separately.
MCC: Mathew's Correlation Coefficient is a statistical tool used for model evaluation. It compares the values predicted by the model to the actual values observed and provides a score ranging from -1 to 1, where -1 indicates total disagreement between prediction and observation, 0 indicates no agreement or predictions that are no better than chance, and 1 indicates perfect agreement between prediction outcomes and observed outcomes.
MIST: The Montreal Imagine Stress Test is an acute stressor consisting of a series of arithmetic problems with varying levels of difficulty and adaptive time limits so that the average accuracy is always between 40% and 50%. Performance stress is compounded using a bar at the top of the screen indicating both subject accuracy and the 80–90% the accuracy expected of them. As an additional social stressor, an experimenter dressed in a lab coat stands directly behind subjects throughout the task taking notes and giving them pre-scripted feedback on their performance.
PPG: A photoplethysmogram or PPG is an optical technique to detect blood volume

changes using non-invasive measurements from the skin's surface. A variety of measures can be derived from the PPG signal such as heart rate frequency, heart rate variability, and pulse rate amplitude.

PV: A protected value is a moral value that an individual perceives as "protected" or "sacred" and would not consider exchanging for monetary benefits. People who hold honesty as a protected value should therefore be trade-off resistant and thus not willing to lie for economic rewards.

RMSSD: The Root Mean Square of Successive Differences is a measure of heart rate variability which tends to decrease with stress. It is obtained by calculating the time difference between heart beats, squaring the values, averaging the results, and calculating the square root of the total.

SNS: The sympathetic nervous system or SNS is the branch of the autonomic nervous system activated in dangerous or stressful situations, popularly known as the fight or flight response. Key physiological changes triggered by the SNS response include an increase in heart rate, an enlargement of pupils, a slowing of the digestive tract and redirecting of blood flow to muscles needed for escape, and increased electrodermal activity or sweating.

SRQ: The stress rating questionnaire is a subjective measure of acute stress consisting of five 7-point scales: Calm-Nervous, Tense-Comfortable, Unconcerned-Worried, Peaceful-Anxious, Relaxed-Stressed.

STAI-T: The State-Trait Anxiety Inventory-Trait is a well-established, 20-item psychometric test for measuring trait anxiety or general anxiety tendencies.

SVO: Social value orientation or SVO is an individual's preference for resource allocation determined by how they allocate resources between themselves and another. The Triple-Dominance Measure used in this study consists of nine choices and classified subjects into three categories: individualistic, with a preference for allocations that benefit themselves above all, cooperative/prosocial, those looking for win-win allocations that maximize both their own and other's earnings, and competitive, those focused on minimizing other's earnings, even at a cost to themselves.