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"Kill the familiar effect": the impact of anger on deceptive behavior

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Abstract

Emotions can change individuals' perceptions of social distance and, consequently, their deceptive behavior. Anger is a highly destructive emotion; however, its effects on social distance and deception are unclear. This study adopted a 2 (emotion: anger, neutral) × 3 (social distance: friend, stranger, acquaintance) × 2 (task type: baseline, win–win deception) mixed experimental design to investigate the effects of anger on deceptive behavior when facing others at different social distances. The results showed that individuals in a neutral emotional state tended to engage in deceptive behaviors that benefited both parties when facing strangers, friends, and acquaintances, implying mutual gain. However, in a negative emotional state (i.e., anger), individuals showed a reduced tendency to benefit themselves. The study discovered a phenomenon termed the "kill the familiar effect." When individuals are in a state of anger, they make decisions that are more harmful to the interests of acquaintances compared with those of strangers or friends. This suggests that anger results in a heavier cognitive load, and uncertainty about acquaintance relationships moderates the cognitive processes in the deception decisions of angry individuals. This study's results regarding the effects of emotions on deceptive behavior have practical implications for various interpersonal interactions, conflict resolution strategies, and decision-making processes. The study is limited by its focus on a specific set of emotions and social distances; thus, further research in this area is warranted.

Keywords Anger · Social distance · Deceptive behavior · Win–win · Familiarity bias

Introduction

Deception is the intentional act of misleading others through verbal or nonverbal behavior, including providing false information or withholding relevant information (De Paulo et al., 2003). Based on economic outcomes, deception is generally categorized into three types: altruistic deception (benefitting others), self-detrimental and other-benefitting deception (incurring losses to oneself for the benefit of others), and self-benefitting deception (both the deceiver and others gain; Lu et al., 2019). Common deception is self-serving decision-making in which individuals are more likely to lie when the benefits to themselves outweigh the harm to others; however, when individuals perceive that the harm to others would outweigh the benefits to themselves, they are more likely to choose honesty. Previous research has found that the closer the relationship between individuals, the more altruistic the behavior they exhibit. Individuals tend to engage in less altruistic behaviors when dealing with strangers than they do when dealing with those with whom they have close relationships (Garrett et al., 2016).

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Individuals are also more more susceptible to deception in their social network than they are to deception from strangers (Hermann & Ostermaier, 2018).

Individuals often experience emotions such as anxiety, tension, and anger during the deception process because of changes in external circumstances and psychological pressure (Gaspar et al., 2021). These emotions can influence individual deception decisions by either increasing or decreasing deceptive behaviors (Methasani et al., 2017). Emotions can also influence individuals' perceptions of their social distance from others, especially negative emotions such as anger (Hareli & Rafaeli, 2008). However, there is no conclusive evidence from existing deception research on the role of anger in social distancing decisions.

Effect of anger on deceptive behavior

People may engage in deceptive behavior for various reasons, including enhancing their self-esteem, making others feel better, or impressing others to gain popularity (Gylfason et al., 2013). Starek and Keating (1991) posited that deceptive behavior is motivated by the need for personal gain. In the context of economic interactions and negotiations, studies have found that positive emotions such as happiness and excitement increase an individual's perception of gains and foster closer social distance, leading to more prosocial behaviors. In contrast, when individuals experience anger, they tend to be more guarded, maintain greater social distance, and engage in more deceptive behavior to benefit themselves (Gino & Pierce, 2009). Seiffert-Brockmann and Thummes (2017) suggested that both positive and negative emotions can lead to varying degrees of deceptive behavior. They found that, compared to a neutral emotional state, both positive and negative emotional groups engaged in more instances of deception; however, deception levels did not significantly differ between groups experiencing negative emotions (e.g., sadness or fear) and those experiencing positive emotions (e.g., happiness). In contrast, Yip and Schweitzer (2016) found that individuals who experienced anger engaged in more deception than those who experienced sadness or fear. This may be attributed to heightened arousal under anger conditions, which makes it more difficult for deceivers to control their deceptive behavior.

In a previous study on unethical deception, experiments were conducted in which participants were induced to feel anger through autobiographical memory recall; the results indicated that anger increased participants' deceptive behavior (Motro et al., 2018). This may be explained by the idea that anger prompts individuals to rely more on intuitive processing, leading to more irrational deceptive behavior. Other researchers have found that anger can enhance malicious creativity and provoke aggressive behaviors with harmful consequences (Hao et al., 2020). Additionally, anger reduces individuals' empathy toward others and amplifies their self-interest, thus facilitating deception (Yip & Schweitzer, 2015). Several studies have suggested that anger is associated with impulsive decision-making.

Association between social distance and deceptive behavior

When individuals' deceptive behavior is associated with personal benefits, the level of deception may vary depending on their social distance from others (Bornemann et al., 2016). Research has found that, in situations where both oneself and others can benefit, most individuals are more inclined to engage in behaviors that are self-sacrificing and beneficial to others (Erat & Gneezy, 2012). People appear more willing to share items or resources with individuals with whom they maintain closer social distance (intimate individuals). However, when interacting with individuals with whom they have greater social distance (strangers), they engage in less self-sacrificing behavior (Garrett et al., 2016). Swol et al. (2012) found that people are more likely to deceive strangers than friends, especially when both individuals benefit from deception. Conversely, Garrett et al. (2016) found that, even when interacting with friends, individuals engage in deception that benefits both parties. This suggests that when deceptive behavior is mutually beneficial, regardless of social distance, individuals are more likely to engage in deceptive behavior. Qi et al. (2023) also found that when deception does not harm the deceiver's own interests, individuals are willing to engage in deception that benefits others regardless of social distance.

Association between anger and perceived social distance

Previous studies have found that an individual's emotional experience may be more intense when an event is objectively closer, indicating a relationship between increased emotional intensity and decreased objective distance (Metcalfe & Mischel, 1999). Perceived social distance is built upon and influenced by objective distance (Ramachandran & Hirstein, 1997). Therefore, it can be inferred that different emotional experiences affect perceived social distance. This inference has been supported by Van Boven et al. (2010), who showed that individuals describing positive or negative events to others in a positive emotional state experienced closer perceived social distance than those in a neutral emotional state. Moreover, when individuals describe events in a high-emotion-arousing social role (e.g., dancing in front of an audience) rather than a low-emotion-arousing role (e.g., being an audience member), they also perceive closer social

distance. They also found that when individuals attribute their emotional experiences to specific events or objects, the effect of emotional intensity on perceived social distance may be reduced and, in some cases, reversed. Lerner et al. (2003) investigated attitudes toward different safety measures to find the effects of anger and fear on perceived risk and social distance and reported that, among the study's participants, anger could lead to an increased perception of risk and greater social distance. However, Zhang et al. (2020) found that anger reduces individuals' trust in others but does not affect their perceptions of social distance from others, possibly because in scenarios that involve economic interests, individuals must suppress anger to maintain good interpersonal relationships and gain benefits. Furthermore, deceptive decision-making is easily influenced by social distance (Hermann & Ostermaier, 2018; Swol et al., 2012). In China's collectivist culture, which focuses on human relations, win–win deception can serve as a social lubricant for interpersonal interactions, and people are likely to consider the feelings and interests of others (Wang et al., 2011). In this context, individuals have a greater need to control their deceptive behavior when experiencing anger to maintain good interpersonal relationships. Therefore, exploring the deceptive behaviors individuals exhibit toward others at different social distances when experiencing anger may not only help explain the reasons for the inconsistent findings of previous studies in this field and deepen the understanding of this social phenomenon but also further clarify the characteristics of interpersonal deceptive decision-making.

Deceptive behavior serves a practical and adaptive social purpose, as individuals may use deception to satisfy their emotional and practical needs. Among these factors, the combined effects of anger and social distance are crucial in the field of deceptive behavior research. Previous studies have mostly focused on either emotion or social distance, finding that the degree to which anger affects deceptive behavior can vary and that the acceptability of deceptive behavior also varies depending on social distance. Although some studies have explored the role of different social distances in self- and other-benefitting deceptive behaviors, few have examined the combined effect of anger and social distance on deceptive behavior. Thus, the underlying reasons for deceptive behavior under the joint effect of these two factors remains unclear.

The present study used an interactive estimation of the canned coins task (Garrett et al., 2016), which offers a potential economic reward, to examine how anger influences individuals' deceptive behaviors toward different socially distant others. The novelty of the task is that participants were required to estimate the number of coins for different socially distant others and provided the opportunity to make voluntary self-benefitting versus other-benefitting deceptive decisions. This allowed for a more realistic observation of participants' deceptive decision-making tendencies and cognitive processes toward different socially distant others. This task also ensured that we could observe how social distance regulates the trade-off between the self and others in deception decision-making (Hu et al., 2015). Thus, this study investigated the effects of anger on deceptive behavior toward different targets with varying levels of social distance. We predicted that in a neutral emotional state, participants would show more beneficial deception toward friends, acquaintances, and strangers, whereas in a negative emotional state (i.e., anger), participants would show less beneficial deception toward acquaintances and strangers compared to socially closer others (i.e., friends).

Methods

Participants

Sample size estimation was conducted using G*Power 3.1.9.2 (Faul et al., 2007). A mixed-design analysis of variance (ANOVA) with a 2 (emotion: anger, neutral) × 3 (social distance: friend, stranger, acquaintance) × 2 (task type: baseline, win–win deception) design was used as the statistical test. Parameters were set with an effect size (f) of 0.25, Type I error probability (α err prob) of 0.05, and a power (1 − β err prob) of 0.80 (Cunningham & McCrum-Gardner, 2007). The minimum sample size was found to be 36, and 50 students from the Northwest Normal University School of Psychology were recruited for this experiment (23 men, 27 women, M_{age} = 24 years, SD = 2.21 years). Of these, 35 had Master's degrees and 15 had Bachelor's degrees. Participants were randomly assigned to either the anger (15 men, 10 women) or neutral (8 men, 17 women) group.

This study's measures and hypotheses were preregistered at the Open Science Framework (see https://osf.io/24znh), along with study materials and data (see https://osf.io/exfhv/). To meet the requirements of the experiment, each participant was asked to bring a same-gender friend and acquaintance to the laboratory before the experiment. They were then paired with another unfamiliar assistant to complete the "coin estimation" task. Prior to the experiment, all participants were informed that they would receive a certain amount of money as compensation if they completed the task, which consisted of a $10 payoff. and additional rewards. The additional rewards were based on the coin value the participant estimated during the experiment and were exchanged at a ratio of 5:1 and paid in addition to the $10 payoff. Participants' friends and acquaintances were asked to sit in a separate room next door and complete a simple coin-judgment task during the experiment.

All participants were in good physical health, had no history of mental illness or other organic brain disorder, were right-handed, had never participated in similar psychological experiments, and had normal or corrected-to-normal vision. This study was approved by the Ethics Committee of Northwest Normal University. All participants provided signed informed consent prior to the experiment.

Tasks and tools

Emotional arousal

Research shows that memory tends to be better during emotional events compared with non-emotional events, memories of emotional events are more vivid and harder to forget, and memories can be induced through memory recall (Brewer et al., 1980; Li et al., 2020). The emotion-induction procedure involved a self-narrative memory recall task (Brewer et al., 1980). Participants in the anger group were instructed to vividly recall a recent event (within the past three days) that made them feel angry and write it down on a piece of paper. Participants in the neutral group were asked to complete a control task that involved recalling their detailed schedule from the previous day.

Emotional arousal assessment scale

Participants' emotional states were assessed using the Positive and Negative Affect Schedule (PANAS), which consists of 20 descriptive adjectives to evaluate 10 different emotional states (Bradley & Lang, 1994; Watson et al., 1988). This scale has good internal consistency, with a Cronbach's alpha of 0.87. Participants rated their experienced emotions using a 5-point Likert scale, with "1" indicating very slight or no emotion and "5" indicating an extremely strong emotion. Additionally, the participants' levels of pleasure and arousal were assessed using the Self-Assessment Manikin (SAM) scale (Bradley & Lang, 1994). Participants rated their emotional pleasure (ranging from 1 = very unpleasant to 9 = very pleasant) and arousal levels (ranging from 1 = very calm to 9 = very excited) on a 9-point scale. The SAM has good internal consistency, with a Cronbach's alpha of 0.96.

Manipulation scale for social distance

All manipulations of social distance were performed based on existing research (Aron et al., 1992; Zhang et al., 2020, 2022; Zhong et al., 2015). In the "Guess the Canned Coins" task, social distance was manipulated by presenting the names of the task objects (i.e., friends, acquaintances, strangers). The level of intimacy between the participants and others was assessed using the Inclusion of Others in the Self Scale (IOS; Aron et al., 1992). This scale has good internal consistency, with a Cronbach's alpha of 0.93.

To manipulate the effects of varying levels of social distance and control for differences in gender and number of words in name, social distance was categorized into three levels (i.e., friends, acquaintances, and strangers), and the names of the three types of target others were used as the priming stimuli for social distance, and the number of words of the names of the three target others of the same gender was the same number of words. Participants were asked to rate their familiarity with the name stimuli. The participants determined the level of intimacy between themselves and others based on the overlap of seven pairs of circles presented with parallel arrows. The two circles represented the self and the other, and the overlap between the circles gradually increased from one to seven. Participants selected a pair of circles with a higher score to indicate a higher level of intimacy with another person. In this experiment, each participant selected both a friend and an acquaintance in advance and brought them to the laboratory. Participants were informed that "friends" referred to "close friends of the same gender who have been in frequent and stable relationships for more than three years," and "acquaintances" referred to "classmates or peers of the same sex who have been casual acquaintances for more than three years", whereas the stranger was a same-gender stranger from the laboratory whom participants had not met before (Zhang et al., 2022). Scores between 5 and 7 indicated close social distance (e.g., friends), scores between 3 and 4 indicated moderate social distance (e.g., acquaintances), and scores between 1 and 2 indicated distant social distance (e.g., strangers; Aron et al., 1992). Upon completion of the scale, participants were asked to write down another person's name. To avoid interference with the experimental task, the participants completed this scale after they finished the formal experiment.

Interpersonal trust scale

Some researchers have found a relationship between an individual's level of interpersonal trust and their decision to deceive. Individuals with higher levels of interpersonal trust are more likely to exhibit truth bias (Carter & Weber, 2010). Therefore, we included the Interpersonal Trust Scale (ITS) as a covariate in our analysis to account for individual differences.

The ITS was used to assess an individual's level of interpersonal trust in different situations (Rotter, 1967). This scale has good internal consistency, with a Cronbach's alpha of 0.76. It consists of 25 items rated on a 5-point Likert scale, ranging from "completely disagree" (1 point) to

"completely agree" (5 points). Thirteen items were reverse scored (Items 1, 2, 3, 4, 5, 7, 9, 10, 11, 13, 15, 19, and 24). Therefore, the sum of the scores for all 25 items represented the total score on this scale, reflecting the participant's overall level of interpersonal trust. Higher scores indicated higher levels of interpersonal trust. To prevent interference with the experimental task, participants completed the scale before the emotion-induction procedure.

Manipulation and measurement of deceptive behavior

To successfully deceive others, individuals must balance several key cognitive processes, including response conflict monitoring, inhibitory control, and task switching (Hu et al., 2015; Liang et al., 2021). Coin-guessing tasks are commonly used in deception studies (Hu et al., 2015; Zhang et al., 2020). Garrett et al. (2016) adapted egoistic deception in their study of the physiological mechanisms. The experimental task had two roles: a suggester and an estimator. Referring to Garrett et al. (2016), the coin estimation tasks and processes in this study involved participants collaborating with friends, acquaintances, or strangers, and were presented online. Two roles were needed in this task: the estimator (participant) and the submitter (friend, acquaintance, or stranger). The participants were given 3 s to observe a high-resolution image of a glass jar containing several coins. All the stimuli were presented on a white background (RGB: 255, 255, and 255) with an image resolution of 543 × 727 pixels.

Participants were required to send their estimates of the number of coins in a glass jar to their friends, acquaintances, or strangers. They were informed that the submitter on the other side would only have one second to view a similar but lower-resolution image of the glass jar. When the submitters received the estimator's suggestion regarding the number of coins in the jar, they submitted an estimate of the number of coins on behalf of both parties. If the coin estimate provided by the participant in the Win–Win condition was higher than that in the baseline condition, it indicated that the participant engaged in some level of Win–Win deception. The glass jar images were captured using a Logitech C922PRO camera before the experiment, with 20 images featuring jars with varying numbers of coins (ranging from 15 to 65 actual coins). All images were edited using Adobe Photoshop CS4 with the square area centered to present the jar and avoid any unrelated features interfering with the experiment.

The calculation rule for the deception score was as follows: coin estimate under Win–Win condition – coin estimate under baseline condition. A higher deception score indicated that both parties benefited more.

Experimental design

The study employed a 2 (emotion: anger, neutral) × 3 (social distance: friend, stranger, acquaintance) × 2 (task type: baseline, win–win deception) mixed experimental design. Emotion served as a between-subject variable, whereas social distance and task type were within-subject variables. The dependent variables included the participants' deception scores (based on the estimated number of coins), average response times for each condition, and accuracy in the baseline condition (absolute difference between the estimated value and actual number of coins in the jar).

Procedure

Phase 1: Participant recruitment and training.

Participants were instructed in advance to invite a friend and an acquaintance of the same gender to participate. A research assistant the participant had never met before played the role of a stranger. Participants were led to believe the following:

1. The experiment was an online coin estimation task in which the participant was shown a clear image of a jar filled with coins, whereas another person (friend, acquaintance, or stranger) was shown a blurry image of the same jar.
2. Rewards were contingent on the task, and the other person's rewards were based solely on the accuracy of their submissions (i.e., how close their estimates were to the actual number of coins in the jar).
3. As an estimator, participants were required to provide an estimate of the number of coins in the jar and submit their suggestions to another person (a friend, acquaintance, or stranger). That person would act as a submitter and represent the participant by submitting the final estimated coin count.
4. Monetary rewards did not accumulate, and the amount received was based on the reward rules and coin estimates submitted by the submitter in a random trial. The rewards were converted to a 5:1 ratio based on the submitted coin estimates.
5. At no point during the experiment would the amount that could be earned or the experimental outcomes be revealed to the other person.

Participants and submitters were trained separately in different rooms. After the training, the participants (estimators) were privately informed that they could submit coin values ranging from 0 to 100 and that the range of coins in the jar would always be between 15 and 65, a value that the friend, acquaintance, or stranger (submitter) was unaware

of. Participants were also told that submitters would earn rewards based on their judgment of coin count accuracy.

Phase 2: Pre-experiment assessment.

The participants were invited to a quiet laboratory room, while their acquaintances, friends, and strangers were placed in separate rooms to participate in the experiment (in reality, they only completed a simple coin-judgment task). Only the participants completed the pre-test SAM, PANAS, and ITS. Afterward, they completed the emotion-inducing task before retaking the SAM and PANAS.

Phase 3: Presentation of task stimuli and observation of response metrics.

Next, all participants completed the Glass Jar Coin Estimation Task, which was presented on a 15.6-inch LCD computer monitor using E-prime 3.0. The experiment was divided into two blocks, each containing 60 experimental trials and 6 practice trials, for a total of 126 trials. The presentation order was balanced between participants for the blocks and trials. First, the computer displayed the names of the individuals with whom the participant would complete the task. Participants then entered the glass jar coin-judgment experiment. Each trial began with a blank screen presented for 800 ms. Subsequently, a transparent glass jar containing several coins was presented on the screen and the participant had 3 s to observe it. The screen then prompted participants to estimate the total amount of money in the glass jar by sliding the mouse to select the suggested number of coins. Finally, the screen displayed the value provided by the submitter regarding the suggested number of coins. The instructions given to the participants differed between the baseline block and the self- and other-benefit blocks.

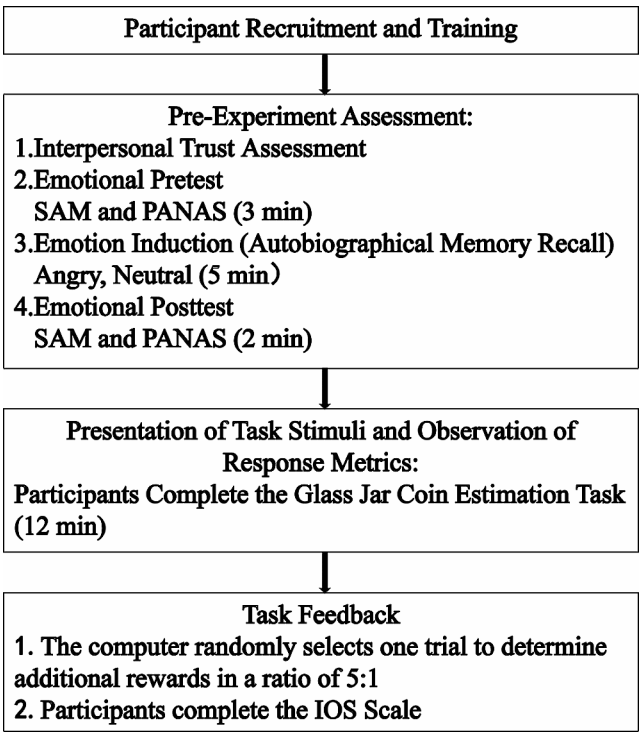

Fig. 1 Experimental flowchart

In the baseline block, the participants were informed that the rewards they and the submitter would receive were based on the accuracy of the submitter's estimation of the money in the jar. The more accurate the estimate, the higher the rewards for both parties. Therefore, in the baseline task, participants needed to make their coin value judgments as accurately as possible. In the self- versus other-benefit block, participants and submitters received rewards based on the submitter's overestimation of the money in the jar (i.e., if it exceeded the actual coin value in the jar). The higher the estimate, the greater would be the reward for both parties. Fig 1 shows a flowchart of the experiment.

Phase 4: Task feedback.

After the experiment was concluded, the computer randomly selected one trial for each stage. The participants received rewards based on the rules and the estimates submitted in the selected trials. Additionally, the participants were required to complete a social distance scale questionnaire. The task diagram is shown in Fig. 2.

Data analysis

Emotionally induced operant test

To test the effects of emotion induction, a paired-sample t-test was conducted to measure participants' emotions before and after the induction task.

Operational testing of social distance

To assess the effectiveness of the social distance manipulation, an ANOVA was conducted on IOS scores, followed by post hoc multiple comparisons.

Deception magnitude scores

To assess participants' deception levels, with emotion as the independent variable and deception score as the dependent variable, a repeated-measures ANOVA was conducted using SPSS 24.0. The experiment consisted of a 2 (emotion: anger, neutral) × 3 (social distance: friend, stranger, acquaintance) × 2 (task type: baseline, win–win deception) factorial design. Participants' interpersonal trust levels were included in the analysis as covariates. To examine whether significant differences existed in deception scores between specific conditions, post hoc t-tests were performed (deception scores = estimated cost value in the win–win condition × estimated cost value in the baseline task). A higher deception score indicated that both parties had benefited more.

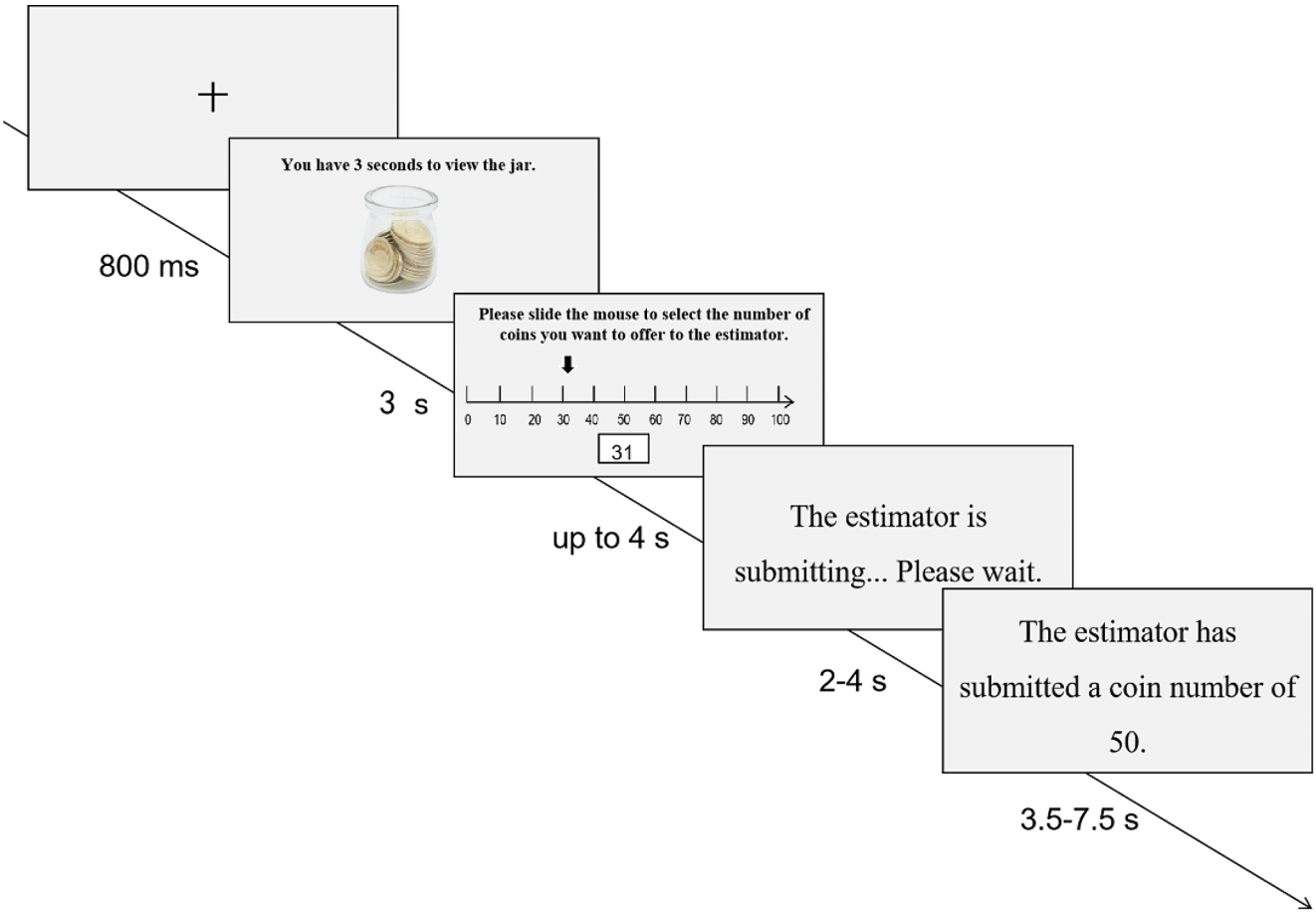

Fig. 2 Task diagram

Reaction time analysis

To analyze participants' average reaction time in judging the number of coins with emotion as the independent variable, SPSS 24.0 was used to conduct a repeated-measures ANOVA with a 2 (emotion: anger, neutral) × 3 (social distance: friend, stranger, acquaintance) × 2 (task type: baseline, win–win deception) design.

Accuracy in baseline condition

To assess the participants' accuracy in the baseline condition, we calculated the absolute differences (i.e., errors) between the participants' estimates and the actual amount in the displayed jar for each trial. With emotion as the independent variable and absolute errors in estimating coin values under the baseline condition as the dependent variable, we used SPSS 24.0 to conduct a repeated-measures ANOVA with a 2 (emotion: anger, neutral) × 3 (social distance: friend, stranger, acquaintance) × 2 (task type: baseline, win–win deception) design to examine the effect of different emotional states and social distances on the accuracy of participants' estimates in the baseline condition.

Results

Emotionally induced operant test

To assess the effectiveness of the autobiographical memory emotion induction, paired-sample *t*-tests were conducted on the pre- and post-test measures of emotion in both groups (Table 1). The results revealed that in the anger group, emotional arousal and anger post-test levels were significantly higher than the corresponding pre-test levels, and pleasure intensity in the post-test was also significantly higher. In the neutral emotion group, no significant differences were found between the pre- and post-test measures of emotions. These findings suggest that the emotion induction was effective.

Table 1 Descriptive statistics (M ± SD) and differential test results for the emotional manipulation test

N	Groups	Pre-test	Post-test	t (24)
25	Anger group			
	Pleasure	5.84 ± 1.37	3.08 ± 0.86	9.70***
	Arousal	5.20 ± 1.08	6.24 ± 1.33	− 3.72**
	Anger	2.06 ± 0.67	3.09 ± 0.60	− 8.06***
25	Neutral group			
	Pleasure	5.80 ± 1.47	5.12 ± 1.17	1.68
	Arousal	5.40 ± 1.35	5.36 ± 0.99	0.14
	Anger	1.86 ± 0.67	1.82 ± 0.66	1.69

*$p < 0.05$ indicates significance at the 0.05 level; **$p < 0.01$ indicates significance at the 0.01 level; ***$p < 0.001$ indicates significance at the 0.001 level. The same applies hereafter

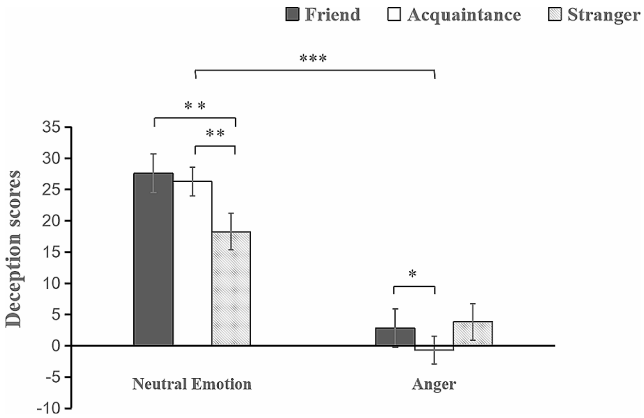

Fig. 3 Deception scores in different emotion conditions

Operational testing of social distance

The main effect of social distance was significant, $F(2, 147) = 1070.16$, $p = 0.000$, $\eta^2_p = 0.94$. Post hoc multiple comparisons revealed that, compared to the IOS scores with the names of strangers ($M = 1.22 \pm 0.42$), IOS scores with the names of friends ($M = 6 \pm 0.61$) were significantly higher, $t(49) = 45.89$, Cohen's $d = 12.98$, $p = 0.000$. IOS scores with the names of acquaintances ($M = 3.36 \pm 0.48$) were also significantly higher, $t(49) = 23.67$, Cohen's $d = 6.70$, $p = 0.000$. Additionally, IOS scores for friends' names were significantly higher than those for acquaintances' names, $t(49) = 26.94$, Cohen's $d = 7.62$, $p = 0.000$. This indicates the effectiveness of the social distance manipulation.

Effects of anger and social distance on deceptive behavior

The experimental results revealed several significant findings. A significant main effect of emotion valence was observed, $F(1, 48) = 44.068$, $p = 0.000$, $\eta^2_p = 0.484$. However, the main effect of social distance was insignificant, $F(2, 46) = 0.031$, $p = 0.879$. The interaction between social distance and interpersonal trust was also insignificant, $F(2, 46) = 7.714$, $p = 0.909$. However, the interaction between emotion valence and social distance was significant, $F(2, 46) = 6.214$, $p = 0.004$, $\eta^2_p = 0.213$. Further simple effects analysis revealed that, in the neutral condition, participants showed significant differences in deception scores among friends, acquaintances, and strangers, $F(2, 46) = 4.617$, $p = 0.015$, $\eta^2_p = 0.167$. In the anger condition, significant differences were observed in deception scores between friends and acquaintances, $F(2, 46) = 4.371$, $p = 0.018$, $\eta^2_p = 0.160$ (Fig. 3). Post hoc multiple comparisons (LSD) indicated that, in the neutral condition, participants' deception scores toward friends ($M = 27.55 \pm 3.05$) were significantly higher than those toward strangers ($M = 18.25 \pm 2.93$, 95% CI [12.35, 24.14]), $t(24) = 2.295$, $p = 0.031$, Cohen's $d = 0.459$. Deception scores toward acquaintances ($M = 26.24 \pm 2.25$, 95% CI [21.71, 30.77]) were also significantly higher than those toward strangers, $t(24) = 2.404$, $p = 0.024$, Cohen's $d = 0.481$. In the anger condition, participants' deception scores toward friends ($M = 2.80 \pm 3.05$, 95% CI [− 3.34, − 8.94]) were significantly higher than those toward acquaintances ($M = -0.75 \pm 2.25$, 95% CI [− 5.28, 3.78]), $t(24) = 2.923$, Cohen's $d = 0.584$, $p = 0.007$, 95% CI [− 3.34, 8.94]. Deception scores toward strangers ($M = 3.81 \pm 2.93$, 95% CI [− 2.09, 9.70]) were also significantly higher than those toward acquaintances, $t(24) = 2.686$, Cohen's $d = 0.537$, $p = 0.013$.

Reaction time analysis

The main effect of emotion was significant, $F(1,48) = 5.966$, $p = 0.018$, $\eta^2_p = 0.111$, with participants in the neutral group ($M = 2105.93 \pm 114.59$, 95% CI [1875.53, 2336.33]) estimating significantly longer reaction times across all conditions compared to those in the anger group ($M = 1710.11 \pm 114.59$, 95% CI [1479.71, 1940.51]). The main effect of social distance was significant, $F(2,47) = 3.817$, $p = 0.029$, $\eta^2_p = 0.140$, indicating significant differences in coin estimation times across different social distance conditions. The main effect of task type was insignificant, $F(1,48) = 3.095$, $p = 0.085$. A significant interaction was observed between social distance and task type, $F(2,47) = 3.634$, $p = 0.034$, $\eta^2_p = 0.134$. Further simple effects analysis revealed that when participants completed the task with a friend, their average reaction time in the baseline condition ($M = 1980.95 \pm 101.40$, 95% CI [1771.20, 2225.62]) was significantly slower than that in the win–win condition ($M = 1680.19 \pm 72.12$, 95% CI [2027.84, 3.78]), $F(1,48) = 6.427$, $p = 0.015$, $\eta^2_p = 0.118$. When participants completed the task with a stranger, their average reaction time in the baseline condition ($M = 2013.41 \pm 120.47$, 95% CI [1771.20, 2255.62]) was significantly faster than that in the win–win condition ($M = 1922.32 \pm 93.06$, 95% CI

[1791.94, 2263.74]), $F(1,48) = 8.670$, $p = 0.005$, $\eta^2_p = 0.153$. No significant three-way interaction was observed among emotion, social distance, and task type, $F(2,47) = 1.270$, $p = 0.285$ (Fig. 4).

Accuracy in baseline condition

The experimental results showed no significant main effect of emotion, $F(1, 48) = 2.649$, $p = 0.110$. The main effect of social distance was insignificant, $F(2, 47) = 2.199$, $p = 0.122$. The interaction between social distance and emotion was also insignificant, $F(2, 47) = 0.069$, $p = 0.933$.

Discussion

The present study found that, compared with the anger group, the neutral group exhibited a higher deception level when facing strangers, friends, and acquaintances, engaging in mutually beneficial deceptive behaviors. In contrast, the anger group provided fewer recommended coin values than the neutral emotion group, resulting in lower deception scores. Furthermore, participants in the anger group were more likely to harm the interests of acquaintances than those of strangers and friends.

Anger reduces perceived benefits

Based on this study's comprehensive findings, in a win–win situation, individuals experiencing anger exhibited lower perceived gains and engaged in more self- and other-harming deceptive behaviors. A possible reason for this is that individuals experiencing anger are more prone to underestimate potential economic losses, thereby reducing their perceived gains (Lerner & Keltner, 2001). This implies that anger may lead to greater uncertainty and potential economic losses in decision-making. In this study, anger led individuals to exhibit lower perceived gains in win–win situations. From an information processing perspective, high-arousal emotions can limit an individual's ability to consciously process external information, increasing the likelihood they will make impulsive decisions (Pennycook et al., 2018; Van der Leer & McKay, 2017). As a high-arousal emotion, anger can cause individuals to focus more on surface-level information and hinder deep-level conscious information processing, thereby reducing their perceptions of gains. In addition, anger can lead to scattered thinking and affect the efficiency of working memory (Van Dillen & Koole, 2007). This may result in individuals being unable to concentrate on potential gains, and thus not fully perceiving the related opportunities or advantages.

Anger elicits unethical decision-making

Deceptive decision-making follows a cost-benefit analysis. Kajackaite and Gneezy (2017) compared the intrinsic costs and motivations for lying and found that once the incentive for deception outweighs the psychological pressure of the cost of lying, individuals tend to shift from telling the truth to lying. The economic benefits of deceptive behavior

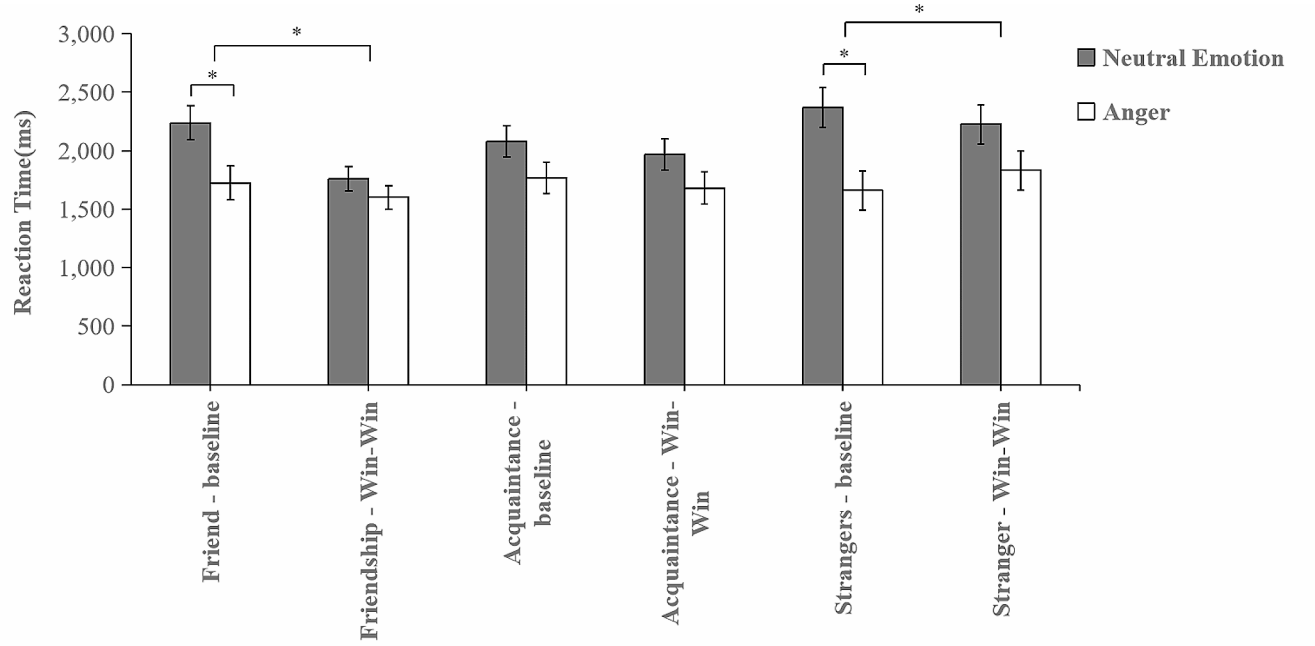

Fig. 4 Reaction time for participants to estimate the number of coins

can predictably influence deception in interpersonal interactions. When the benefits of deception increase, more people opt to engage in deceptive behavior; however, individuals with higher self-control can better resist temptation and regulate their behavior. This suggests that self-control is a crucial component of the deception process. Research has found that anger depletes individuals' self-control, resulting in more deceptive behavior (Ren et al., 2018). In this study, individuals were primarily motivated to deceive for personal gain, and we did not impose the psychological pressure associated with punishment. When the incentive for gain exceeds the psychological pressure associated with the potential costs of deception, individuals are more likely to spontaneously engage in deception. Additionally, we observed that individuals in a state of anger made decisions more rapidly, aligning with information dual-processing theory. When experiencing anger, individuals tend to focus more on surface-level information and are unable to engage in deep-level conscious processing, leading to more impulsive decision-making (Pennycook et al., 2018; Van der Leer & McKay, 2017) and shorter response times. Furthermore, we found that anger emotion led to unethical decision-making, resulting in more deceptive behavior that is detrimental to both parties. This aligns with the findings of Dunn and Schweitzer (2005), who suggested that anger may decrease trust in others. When people feel angry, they are more likely to adopt a self-serving attitude and may be less willing to cooperate or share benefits. This lack of trust and cooperation can lead to missed opportunities for potential gains.

Acquaintance relationship uncertainty moderates cognitive processes in deception decisions of angry individuals

In the context of economic interactions, we found that individuals with in a neutral emotional state made deceptive decisions that benefited both parties for friends, acquaintances, and strangers, with greater benefits observed for friends and acquaintances than strangers. This finding aligns with those of Wiltermuth (2011) and Garrett et al. (2016), suggesting that when deceptive behavior is mutually beneficial for both the deceiver and the deceived, individuals are more likely to engage in deception regardless of the level of social distance. Furthermore, we made an interesting discovery of the "kill the familiar effect." As hypothesized, the experience of anger significantly reduced individuals' performance in terms of benefits. However, individuals made certain "loss–gain" decisions when dealing with acquaintances compared to friends and strangers. According to kin selection theory, individuals tend to engage in more prosocial behaviors such as empathy, assistance, trust, and cooperation toward those with whom they have close social ties and are more willing to interact and share resources with them (Chen et al., 2017; Ostaszewski & Osiński, 2015). Conversely, when dealing with individuals at greater social distances (strangers), they are less inclined to share resources. Individuals also tend to maintain a stronger psychological defense when facing individuals at a moderate social distance (acquaintances) and consider the consequences more extensively when making deceptive decisions. The uncertainty inherent in such relationships influences deceptive decisions. The findings of this study are consistent with those of previous studies. Early studies on interpersonal relationships in China suggested that acquaintances often occupied an intermediate position. When the emotional affinity component increases even slightly, individuals may develop closer relationships with acquaintances. However, the opposite may occur when emotional affinity decreases, potentially leading to a more distant relationship akin to that of strangers (Hu, 2005). Additionally, a study on Chinese interpersonal emotional biases in explicit and implicit judgments found that people tend to maintain a positive emotional bias toward themselves while showing a negative emotional bias toward strangers. However, emotional biases toward acquaintances typically exhibit vague and uncertain characteristics (Yuan & Guo, 2017). Consequently, acquaintances occupy a position in interpersonal interactions characterized by high instability and ambiguity. This helps explain why individuals are more likely to harm the interests of acquaintances when experiencing anger, shedding light on why victims of fraudulent schemes often have some degree of familiarity with the perpetrators.

Limitations and future directions

This study's main findings suggest that anger plays a significant role in interpersonal deceptive behavior. Specifically, this study indicates that anger may lead individuals to perceive fewer benefits and increase the likelihood of engaging in deceptive behavior, especially in situations involving acquaintances. The findings reveal the mechanisms through which anger influences deceptive decisions, including reduced perceived benefits, the induction of unethical decisions, and the effects on different levels of social distance, such as the "kill the familiar effect". However, this study also has some limitations. First, the participants may have been influenced by cultural, socioeconomic, or other individual differences. Therefore, the applicability of the results to other cultural contexts or different samples may be limited. Second, this study focused primarily on a specific type of situation, namely, economic interactions. However, deceptive behavior in real life may be influenced by more factors such as social norms and moral values. Therefore, further research is required to determine the applicability

of these results to different contexts. Finally, this study did not focus on any emotions other than anger and provides evidence only for the conditions under which anger affects deceptive behavior as related to social distance. Future research could examine whether these conditions can be generalized to other emotional contexts. For example, future studies should examine whether discrete emotions such as anger (high certainty and associated approach motivation) and fear (low certainty and associated avoidance motivation) have different effects on deceptive behavior.

Future research should investigate the influence of anger on deceptive behavior in different cultural contexts and socioeconomic backgrounds to validate this study's findings. Additionally, social distance and perceived deception reflect a complex psychological process. Future research could use triangulation methods that integrate diaries and field notes to increase the validity and depth of the findings. Furthermore, using neuroscientific methods to study the neural mechanisms of anger in decision-making and deceptive behavior would provide deeper insights into the interaction between emotions and cognition. Finally, interventions targeting unethical decisions triggered by anger should be developed to help individuals better manage their emotions and make decisions that align with their moral and social interests.

Conclusion

The present study examined the effects of anger on individuals' deceptive behaviors with others at different social distances and found that when deception was mutually beneficial, individuals in a neutral emotional state engaged in deceptive behaviors that benefited both parties, regardless of social distance. Notably, we found a "familiarity killing effect," in which individuals in a state of anger showed significantly less mutually beneficial deceptive behavior, and even engaged in some deception that resulted in losses for familiar individuals. In addition, the findings showed that individuals in a state of anger made decisions more quickly; however, this did not affect their accuracy in judging the number of coins. This suggests that higher levels of anger affect the cognitive processes of individuals, as they will pay more attention to surface information, which hinders the processing of deeper conscious information. This study theoretically enriches the research on factors that influence deceptive behavior and provides evidence and explanations for the influence of anger on deceptive behavior and the potential mechanism underlying this relationship. Practically, the findings of this study support the idea that social distance can effectively regulate individuals' deceptive behavior. Furthermore, the findings emphasize that the uncertainty of acquaintance relationships moderates the deception decisions of angry individuals, which is inspiring for both individuals and society.

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Data availability The data presented in this study are available on request from the corresponding author. The data that support the findings of this study are openly available in [Figshare] at [https://doi.org/10.17605/OSF.IO/24ZNH].

Declarations

Conflict of interest The authors declare no conflicts of interest.

Ethical approval Before the experiment, all participants gave informed written consent in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki), and the study protocol was approved by the Ethics Board of Northwest Normal University (ERB No. 2023078, dated on 07/08/2023).

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