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An experimental task to measure proactive aggression under incentive condition: A Reward-Interference Task

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ABSTRACT

Proactive aggression refers to attaining personal goals or gains through aggressive means with prior deliberation and moral disengagement, and it can occur without provocation and with a low-level of anger arousal. The current study introduces a new task, a Reward-Interference Task (RIT), to induce and measure proactive aggression in the laboratory under incentive conditions and develops a task-related questionnaire (Interference/Non-interference Motivation Questionnaire, INIMQ) through four experiments. The findings reveal that instrumental motivation toward incentives and moral motivation (moral disengagement and moral inhibition) were the main motivations for participants to attack opponents during the RIT. The validity and reliability of the INIMQ were acceptable, and the RIT had good internal consistency, adequate convergence, and discriminant validity. The present results show that the RIT is a valid tool for inducing and measuring proactive aggressive behavior under incentive conditions.

1. Introduction

Aggression is any behavior that causes physical or psychological harm to another individual (Anderson & Bushman, 2002). Aggressive behavior can pose a threat to individual health, human collaboration, social economy, and safety (Blair, 2013; Brugman et al., 2017; Carroll & McCarthy, 2018). Aggression is a heterogeneous concept and can be divided into different categories, for example, verbal, physical and indirect aggression (Björkqvist, Lagerspetz, & Kaukiainen, 1992; Crick & Bigbee, 1998). Another widely accepted classification is proactive and reactive aggression, based on motivation (Dambacher et al., 2015; Dodge & Coie, 1987; Dodge, Lochman, Harnish, Bates, & Pettit, 1997; Wrangham, 2018). Previous studies have suggested that proactive and reactive aggression have different cognitive, physiological, and neurobiological mechanisms and etiologies (Dambacher et al., 2015; Hubbard, McAuliffe, Morrow, & Romano, 2010; Nelson & Trainor, 2007; Wrangham, 2018).

Proactive aggression refers to obtaining personal goals or gains through aggressive means with prior deliberation and moral disengagement and it can occur without provocation and with a low-level of emotional arousal (Babcock, Tharp, Sharp, Heppner, & Stanford, 2014; Smeijers, Brugman, von Borries, Verkes, & Bulten, 2018). The core goal of proactive aggression is obtaining self-interest rather than harming the target (Anderson & Bushman, 2002). Stalking, bullying, and premeditated crimes are typical forms of proactive aggression (Wrangham, 2018).

According to previous studies and theories regarding proactive aggression (Bussey, Fitzpatrick, & Raman, 2014; Hyde, Shaw, & Moilanen, 2010; Paciello, Fida, Tramontano, Lupinetti, & Caprara, 2008; Perren & Gutzwiller-Helfenfinger, 2012), a proactive aggression task should meet four demands. First, the aggressive behavior in a proactive aggression task must be driven by an instrumental motivation to obtain an incentive (personal goals or gains). The difference between proactive and reactive aggression is found in the difference in motivation (Poulin & Boivin, 2000; Raine et al., 2006). Specifically, proactive aggression is driven by an instrumental motivation (Vitaro & Brendgen, 2005). In contrast, reactive aggression is driven by provocation-related motivations. In other words, instrumental motivation is the key feature of proactive aggression. Thus, instrumental motivation is the most important index on which to judge whether aggressive behavior in an experimental task constitutes proactive aggression.

Second, aggressive behavior in a proactive aggression task should refer to moral motivations including moral inhibition and disinhibition. According to the definition of aggression (Anderson & Bushman, 2002), aggression refers to harming others, thus the moral system, especially moral emotions (e.g., guilt and empathy) tend to inhibit the behaviors of harming others for personal interests (Crockett, Siegel, Kurth-Nelson, & Dayan, 2017; Tangney, Stuewig, & Mashek, 2007) unless it seems to

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be legitimate or reasonable (such as aggression for justice). Although both proactive aggression and reactive aggression should involve moral motivation, the moral motivation in proactive aggression must be salient and conscious, while that in reactive aggression may be ambiguous or implicit. Because proactive aggression is emphasized as being premeditated or deliberated beforehand (Dodge et al., 1997; Hecht & Latzman, 2018), the occurrence of moral motivation in the decision making process of proactive aggression should be inevitable and clear. In other words, proactive aggression must involve moral inhibition and disinhibition. Moral inhibition is an avoidance motivation to prohibit proactive aggression, while moral disinhibition is a kind of approach motivation to approve harmful behaviors for personal gains. In order to carry out proactive aggression, individuals may develop some psychological strategies and/or personality characteristics (such as moral disengagement, psychopathy, low empathy, and low guilt) to relieve or decrease moral inhibition when they need to engage in harmful behaviors (Bussey et al., 2014; Gini, Pozzoli, & Hymel, 2014; Kish-Gephart, Detert, Treviño, Baker, & Martin, 2013; Thornberg & Jungert, 2014). For example, Bandura (1990) held that moral disengagement is an important cognitive basis for individuals to engage in antisocial behaviors such as bullying. Many studies have shown that moral disengagement has an effect on proactive aggression (Gini et al., 2014; Kowalski, Giumetti, Schroeder, & Lattanner, 2014). Specifically, when individuals decide to engage in proactive aggression, they like to deny or weaken their intention to harm others by means of moral disengagement, which helps them to reduce moral restraint. In other words, participants will use the strategies of moral disengagement to rephrase the cause of their aggression. In addition, psychopathy (Bezdjian, Tuvblad, Raine, & Baker, 2011; Raine et al., 2006), low levels of empathy (Euler, Steinlin, & Stadler, 2017), low levels of theory of mind (Austin, Bondu, & Elsner, 2017), and low levels of guilt (Nagy, Pataky, Szklenarik, & Kormendi, 2012) have been found to have a strong positive correlation with proactive aggression. Thus, aggressive behavior in a proactive aggression task is correlated with moral disinhibition strategies and dispositions (e.g., aggressive moral disengagement, psychopathy, low empathy, and low guilt). On the other hand, aggressive behavior in a proactive aggression task is also associated with moral inhibition.

Third, there should be no significant anger arousal in a proactive aggression task. Previous studies (Hubbard et al., 2010; Wrangham, 2018) have pointed out that, contrary to reactive aggression, the anger arousal of proactive aggression is low, because proactive aggression is under unprovoked conditions. In contrast, provoking and anger are necessary for reactive aggression. In other words, low anger arousal is a discernible feature of proactive aggression. Thus, there should be low or no anger arousal during the proactive aggression process.

Fourth, an unprovoked condition is necessary for a proactive aggression task. Proactive aggression occurs with prior non-provocation (Vitaro & Brendgen, 2005). Although aggression under a provoking condition may also refer to proactive aggression to some degree, it mainly reflects reactive aggression (Tedeschi & Quigley, 1996). Thus, a proactive aggression task must be unprovoked.

Most prior studies referring to proactive aggression only use questionnaires to measure proactive aggression (Euler et al., 2017; Hubbard et al., 2010; Mayberry & Espelage, 2007). Only a few scholars have carried out laboratory studies and developed experimental tasks to assess proactive aggressive response under non-provoking conditions. In contrast to the questionnaire, the experimental task has the following advantages. First, the experimental method can be used to explore the causal relationships between variables, which is difficult to achieve with the questionnaire method. Second, the experimental task can be used to explore the mental process of proactive aggression, while the questionnaire method mainly focuses on the trait or behavior model of proactive aggression. Thus, developing an experimental task of proactive aggression is important and necessary for researching proactive aggression.

Tasks measuring proactive aggression can be divided into two categories. The first type could be called non-incentive proactive aggression tasks, which assess the aggressive behaviors under non-provoking conditions but without incentives (Brugman et al., 2017; Dambacher et al., 2015; Sherrill & Bradel, 2017). For example, in two recent studies, the proactive aggression scores were calculated by summing duration and intensity scores for the unprovoked trials in the Taylor Aggression Paradigm (TAP) (Brugman et al., 2017; Dambacher et al., 2015). Similarly, in other studies, aggressive behaviors under the last three unprovoked trials in the Social Orientation Paradigm based on the Point Subtraction Aggression Paradigm (PSAP) (Cherek, 1981; Perach-Barzilay et al., 2013) were considered as proactive aggression (Cherek, 1981; Perach-Barzilay et al., 2013). These tasks are consistent with the salient feature that a proactive aggression task must be unprovoked. However, the defining features of proactive aggression, instrumental and moral motivation, are ambiguous in the non-incentive task. Thus, it may not be typically representative of proactive aggressive behavior. Proactive aggression driven by external rewards should be studied in future experimental study (Schjolden, Stoskhus, & Winberg, 2005).

The second type could be termed incentive proactive aggression tasks, which assess aggressive behaviors under non-provoking conditions and with incentives (Atkins & Stoff, 1993; Helseth, Waschbusch, King, & Willoughby, 2015; Hubbard et al., 2010). In addition to being unprovoked, the task provides a reward as an instrumental goal. For example, in a pinball game (Atkins & Stoff, 1993; Atkins, Stoff, Osborne, & Brown, 1993), participants could block their opponent's performance by pressing the tilt button to win the game, with the number of times the tilt button was pressed considered as an indicator of proactive aggression. Moreover, in a modified Competitive Reaction Time Task, participants were told they would play a game with a stranger of the same age to win points to exchange for prizes. The participant who won would have the opportunity to take some points away from the opponent or send their opponent an instant message, or do both of the above, or do nothing. Proactive aggression occurred in the first few trials in which the participants won (Helseth et al., 2015). The incentive proactive aggression score was the number of instances where points were taken away from the opponent.

Obviously, instrumental motivation is involved in this kind of task, thus it seems to be suitable for use in researching proactive aggression in the laboratory. However, the following shortcomings still exist in current incentive tasks which impede their application. First and foremost, evidence of the validity of these tasks is insufficient or inadequate. In other words, whether these experimental tasks can induce and accurately measure proactive aggressive behavior has not been examined carefully. For example, the aggressive motivation of participants, which can help establish the construct validity of the experimental tasks, was unexamined in (Tedeschi & Quigley, 1996). Second, the experimental operations of some tasks are challenging. For example, the pinball game requires specialized equipment, which may prevent the wide use of the experimental task. Third, the experimental methods of some tasks are not suitable for multiple repetitions, which may have a negative effect on measurement accuracy, nor the application of neuroscience methods, which require multiple signal superpositions. For example, proactive aggressive behaviors can only be measured by several un-provoking trials in most of these tasks.

In summary, existing proactive aggression tasks may not suit the demands of the current proactive aggression research, therefore, it is crucial to develop effective and reliable laboratory-based tasks of proactive aggression to further explore proactive aggressive behavior.

According to the above-mentioned indexes, a new incentive proactive aggression task, named a Reward-Interference Task (RIT), inspired by previous incentive proactive aggression tasks (Atkins & Stoff, 1993) and the TAP, was developed to induce and measure proactive aggressive behaviors in the laboratory.

The RIT asks the participant to take part in a simple auditory

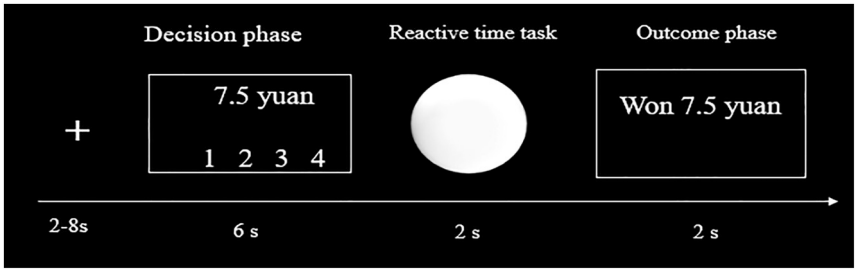

Fig. 1. Time-course for one trial of the Reward-Interference Task.

reaction competition with a virtual opponent. The winner nominally wins money from the game in every trial and the average amount of money won that is used as compensation in the game is paid to the participants at the end of the experiment. During the game, the participants choose a certain noise with which to interfere (or not interfere) with the opponent's performance which may increase opportunities for winning money, while the opponent cannot interfere with the participant's signal tone; this avoids the provoking element. The average or total number of selected noise levels is used as an indicator for measuring proactive aggression. The generation of instrumental and moral motivation in the RIT is obvious, and the aggressive behaviors occurring in the RIT are under an unprovoked condition with no reason for anger.

The present research attempted to develop and test the RIT through four studies. Study 1 explored the motivations of participants in the RIT by interview. Study 2 had two purposes. First, we developed a motivation questionnaire regarding proactive aggression and tested its construct validity. Second, we investigated the discriminant and convergent validity of the RIT. Study 3 further examined the discriminant and convergent validity of the RIT, especially using the motivation questionnaire. Study 4 tested the effect of external rewards on the level of aggressive behavior measured by the RIT to examine the instrumental motivation in the RIT further.

2. Study 1

Study 1 explored the motivation in the RIT by interview. We predicted that the RIT would involve approach motivation (e.g., instrumental motivation and moral disengagement) and avoid motivation (e.g., moral inhibition).

2.1. Method

2.1.1. Participants and procedure

Thirty-seven (13 males, mean age = 19.561 years, SD = 1.261 years), healthy undergraduate students were recruited from our university in China. Two participants, who doubted the opponent was a machine, were removed from the analysis. All participants first completed the RIT, then participated in a post-experiment interview. All participants provided informed written consent and received payment for their participation. The study was approved by our university Brain Imaging Center Institutional Review Board. The experimental protocol was performed in accordance with the standards of the Declaration of Helsinki.

2.2. Measurements

2.2.1. Reward Interference Task (RIT)

To avoid the potential floor effect in the RIT, we designed two features. First, the degree of harm in the RIT was not so severe. Second, we designed an unfair rule by which participants could select a certain level of noise to interfere with his opponent's performance (or not), while their opponent could not select a noise level with which to interfere with the participant's performance. The rule helped participants find excuses for their aggressive behavior (moral disengagement) and engage in more aggressive behaviors.

Participants were asked to complete 30 trials, consisting of 7 filler trials and 23 experimental trials. Four same-gender participants started the experiment at a time. They met each other outside of the laboratory cubicle prior to the experiment and jointly listened to the instructions. There were two roles, role A and role B, in the game. Role A could select a certain level of noise with which to interfere with his opponent's performance (or not) on a 4-point scale (1 = 0 dB, 2 = 70 dB, 3 = 90 dB, 4 = 110 dB), following procedures in previous studies (Brugman et al., 2015; Dambacher et al., 2015; Kramer, Jansma, Tempelmann, & Munte, 2007). Obviously, noise interference in the RIT was optional, not obligatory, and the experimenter did not demand participants to interfere. However, role B could not select a noise with which to interfere with his/her opponent's performance in the competition in sound reaction time. One role A and one role B were matched to complete the task. Participants were told that the role and opponent were randomly assigned by the computer. In fact, all four participants were assigned to role A and played against a computer. Participants were told that they were going to play a competitive reaction-time task against the opponent (role B). Whoever won would gain a corresponding amount of money (5–15 yuan, which was made clear before the competition) in each trial and whoever lost would gain 0 yuan. Participants were told that at the end of the task their game reward would be calculated based on an average of the money they had earned with respect to all trials. Their remuneration consisted of a basic labor fee and the game reward. Thus, the more trials they won, the more bonuses they won.

The process of the experimental and filler trials was as presented in Fig. 1, and Appendix.

2.3. Interviews

To test the motivation in the RIT, we interviewed the thirty-five participants after the RIT. The interviewers were trained by the experimenter. The interview for each participant lasted around 20 min. The interviews aimed to explore why participants chose interference or non-interference during the game, and their feelings during the process of deciding whether to interfere or not. For example, “Please describe in as much detail as you can the process of thinking when making interference choices,” and “Please describe why you chose not to interfere.”

2.4. Data analysis

2.4.1. Descriptive statistics

Descriptive statistics were analyzed using SPSS 22.0 software.

2.4.2. Content analysis for interviews

We used the NVIVO 10.0 software package to transcribe the content of the interviews and help organize and analyze the data. (Bengtsson, 2016; Elo & Kyngas, 2008; Graneheim & Lundman, 2004). First, the interview recordings were transcribed as text and experimenters were

required to be familiar with the content of the interviews via reading through the transcribed text again and again to obtain a sense of the whole. Then three experimenters created nodes for the text, which constituted the units of analysis, independently. The meaning of these nodes was condensed. The condensed meaning units were then labeled and abstracted with code. Next, categories which explain and include the nodes and codes were created. For example, some of the codes representing the motivation to select noise-interference (e.g., want to win more bonuses) formed the category of "instrumental motivation." Revisions were continued and codes that overlapped were combined into a category.

2.4.3. Coding consistency

The three experimenters checked the contents of nodes, the condensed meaning units, and codes one by one. Any inconsistent findings were discussed, re-coded, and classified. Finally, with the findings of the two experimenters and one experimental assistant, we formed a coding table. The number of participants of each code under each category was calculated.

2.5. Results

2.5.1. Descriptive data

The average level of interference selection was 2.13 (SD = 0.85); The Cronbach alpha of the RIT was 0.94 in the current sample. The details of interference selection in the RIT were as Appendix.

2.5.2. Content analysis

We transcribed 72,487 words. The results of the content analysis with respect to the interviews are shown in Tables 1 and 2. Tables 1 and 2 show the reasons for interference and non-interference selection and the number of participants for each reason. The results show that 88.6% of participants reported the reasons for interference focused on instrumental motivations and 61.8% of participants reported the reasons for interference focused on moral disengagement. 76.5% of participants reported the reasons for non-interference selection focused on moral inhibition (guilt and empathy) and 17.6% of participants reported the reasons for non-interference selection focused on lack of instrumental motivation.

2.6. Discussion

The motivation behind the aggressive behavior plays a critical role in the difference between proactive aggression and reactive aggression (Dambacher et al., 2015; Tedeschi & Quigley, 1996), but is too often ignored by researchers of aggressive acts (Tedeschi & Quigley, 1996). In Study 1, we investigated the participants` motivations of interference or non-interference selection in the RIT via the interview. As expected, the findings reveal that motivation for interference selection focused on instrumental motivation and moral motivation, and the motivation for non-interference selection mainly involved moral inhibition.

Table 1
The reasons for interference selection.

Condensed meaning unit (n)	Code (n)	Category (n)
Want to win the reward (25) Want to win the game (18) The temptation of reward (16)	Instrumental motivation (31)	Approach motivation (31)
Interference will not hurt the opponent (7) The right to interfere must be used (12) Have slow responses and have to use interference (8) Meet the experimental requirements (3)	Moral approval (21)	Approach motivation (21)

N = number of people. The number in brackets represents the number of people reporting the cause.

Table 2
The reasons for noninterference selection.

Meaning unit (n)	Code (n)	Category (n)
The weak temptation of reward (6) Let the opponent have the opportunity to win (17) Interference generates the feeling of guilt (12)	*Low instrumental motivation* (6) moral inhibition (26)	Avoid motivation (6)

N = number of people. The number in brackets represents the number of people reporting the cause.

Although the results of the interview content analysis suggested that participants did not admit their harming intention in the RIT and the rules of the RIT permitted participant interference with their opponent, the interference behavior in the RIT was aggression and exhibited the characteristics of proactive aggression. There are several reasons for this. First, proactive aggressors tend to deny their harming intention. Although proactive aggression also refers to harming intention, the core goal of proactive aggression is obtaining self-interest (Anderson & Bushman, 2002) and the feature of immorality in proactive aggression is more obvious. Thus, when individuals decide to engage in proactive aggression, they like to deny or weaken their intention to harm others by means of moral disengagement, which helps them to reduce moral restraint. In other words, participants will use strategies of moral disengagement to rephrase the cause of their aggression, rather than using a straightforward harming intention. Expressions such as "interference will not hurt the opponent", "meet the experimental requirements" should be regarded as moral disengagement, because these explanations are similar to typical expressions associated with moral disengagement. For example, "interference will not hurt the opponent" is similar to the item "teasing someone does not really hurt them", (Bandura, 2002), and "meet the experimental requirements" is similar to the item "employees are never responsible for executing the illegal decisions of their bosses" (Caprara, Fida, Vecchione, Tramontano, & Barbaranelli, 2009). In summary, these expressions reflect the feature of moral motivation (moral disengagement) of proactive aggression, which is obviously different from reactive aggression.

Second, noise interference in the RIT was a kind of active action and caused opponents to feel discomfort. Noise interference in the RIT was an option, not obligatory, and the experiment did not demand participants to interfere. To examine whether the noise did cause discomfort, we recruited 39 participants(19 males, mean age = 20.87, SD = 2.23) to assess the degree of discomfort caused by the selected noises The results showed all the noises made people feel uncomfortable (see Supplement). Additionally, interference caused loss of money for the opponent, which obviously harmed the opponent in terms of interests.

Third, in prior studies (Brugman et al., 2015; Helseth et al., 2015; Hubbard et al., 2010; Moore et al., 2018; Reidy, Zeichner, Miller, & Martinez, 2007), interfering (which was permitted in the experimental task) was consistently regarded as aggressive behavior.

3. Study 2

Study 2 had two goals. First, we sought to develop the task-related questionnaire (Interference/Non-interference Motivation Questionnaire, INIMQ) and test the reliability and construct validity of the questionnaire. Second, we sought to examine the reliability and validity of the RIT. According to the aforementioned standards, the moral disinhibition indexes, such as aggressive moral disengagement (which is assessed by violent attitude), psychopathy, low guilt, anger emotion change during the RIT, and proactive aggression measured by questionnaire, were used as convergent validity indexes. Additionally, since the interference behavior

in the RIT refers to physical aggression, physical aggression measured by a subscale of the Buss-Perry Aggression Questionnaire was also used as a convergent validity index. Furthermore, reactive aggression measured by questionnaire was used as the discriminant validity index.

3.1. Method

3.1.1. Participants

One hundred and forty-seven participants from our university in China were recruited for this experiment. Two of the participants, who believed that their opponent was a machine, were removed. Three participants, who did not understand the instructions about the RIT (Two participants did not respond at the interference selection stage. Another participant thought that the other person could interfere with him as well), were excluded. Finally, 142 participants (mean age = 19.69 years, SD = 1.68 years, 62 men) were included in the further analysis. All participants provided informed written consent and received payment for their participation.

3.1.2. Procedures

Participants first completed the State Anger Scale (SAS) (Forgays, Forgays, & Spielberger, 1997), then took part in the RIT, and subsequently filled out the SAS again and the task-related questionnaire (INIMQ) and other self-reporting measures.

3.2. Measurements

3.2.1. Interference/Non-interference Motivation Questionnaire (INIMQ)

The questionnaire items were formed based on the results of the interviews in Study 1 and a previous study (Anderson & Murphy, 2003). The results of the interviews showed that the reasons for interference/non-interference selection mainly involved instrumental motivations, moral disengagement, and moral inhibition. Accordingly, we compiled the Interference/Non-interference Motivation Questionnaire (INIMQ). The specific steps were as follows. First, three graduate students created the initial items of the questionnaire based on the results of the interviews and a previous study (Anderson & Murphy, 2003). Then they discussed the quality of each item and the dimension which each item belongs to. Ambiguous items were deleted or combined. Next, a psychologist evaluated each item and assessed if it could measure the corresponding dimension. Finally, the items of the INIMQ were formed through repeated discussions. The INIMQ consisted of eighteen items and contained three subscales of instrumental motivation (e.g., “I wanted to win the reward”), moral disengagement (e.g., “In the long run, students who act as B are bound to be compensated.”) and moral inhibition (e.g., “I feel uneasy when I use the privilege of Role A to interfere with Role B"). These subscales contained five, four, and five items, respectively. These items are shown in the appendix B. Responses were on a six-point scale from 1 (absolutely inappropriate) to 6 (absolutely appropriate).

3.2.2. Attitudes toward violence scale

The moral disengagement for aggression was assessed by the Attitude Toward Violence scale, which involves the rationalization and justification of violence (Mills, Kroner, & Forth, 2002). It is a 12-item measure from the subscale of the Measure of Criminal Attitudes and Associates (MCAA) (Mills et al., 2002). In the present study, the scale had adequate internal reliability (α = 0.75).

3.2.3. Psychopathy scales

The Levinson Self-Report Psychopathy Scale (LSRP) (Levenson, Kiehl, & Fitzpatrick, 1995) was used to assess psychopathy. The scale was revised into a Chinese version and showed good reliability and validity (Shou, Sellbom, & Han, 2017). It was scored on a 4-point Likert scale ranging from 1 (very inconsistent) to 4 (very consistent). Higher scores represent a higher level of psychopathy. The total scores of the scale were computed in the current study. The scale showed adequate internal reliability in the current sample (α = 0.75).

3.2.4. Guilt and Shame Proneness scale

The Guilt and Shame Proneness scale is a scenario-based measure used to assess individual differences in guilt proneness and shame proneness (Cohen, Wolf, Panter, & Insko, 2011). The current RIT only referred to guilt, so the guilt-proneness subscales were used as a source of validity information in this study. Guilt proneness is measured by two guilt-proneness subscales (guilt–Negative-Behavior-Evaluation [NBE] which describes feeling bad about the way one acted, and guilt-repair, which describes action intentions and tendencies of compensating or correcting for the transgression). Internal consistency of the NBE subscale (α = 0.81) and guilt-repair subscale was adequate in the current sample (α = 0.76).

3.2.5. State Anger Scale

The State Anger Scale (SAS) is from the State-Trait Anger Expression Inventory (STAXI) (Forgays et al., 1997). The SAS is a 10-item instrument and was used to measure the intensity of feelings of anger experienced by participants on a 4-point Likert scale from 1 (not at all) to 4 (very much). The scale was filled out before and after the experiment. The Cronbach's alpha for the SAS was 0.95 (pre-experiment) and 0.92 (post-experiment). According to a review (Mauss & Robinson, 2009), the self-reporting measure can validly measure feelings currently experienced, thus SAS was used to assess the change in feelings for anger during the RIT.

3.2.6. Reactive-proactive aggression questionnaire (RPQ)

The questionnaire was used to measure reactive and proactive aggression and is a 23-item measure (Raine et al., 2006). It consists of two subscales: reactive aggression subscale and proactive aggression subscale. In the current study, in order to prevent the floor effect of the participants' responses to the items of proactive aggression, participants were asked to rate the possibility of the occurrence of proactive aggressive behaviors on a five-point Likert scale. In the current study, both the reactive aggression subscale (α = 0.83) and proactive aggression subscale (α = 0.88) had good internal consistency.

In addition, we analyzed each item of the proactive aggression subscale and found that some items of the subscale described proactive aggressive behaviors driven by instrumental motivation (e.g., “Hurt others to win game”, “Force to obtain money”,“ Force to manipulate others”, “Yelled to manipulate”). Thus, the scores of instrumental aggression were calculated by averaging the scores of the four items.

3.2.7. Buss-Perry Aggression Questionnaire

Physical aggression was measured by the Physical aggression subscale in the Buss-Perry Aggression Questionnaire (Buss & Perry, 1992). The subscale contains 9 items and its internal consistency was good (α = 0.84) in the current samples.

3.3. Statistical analyses

Descriptive statistics were analyzed using SPSS 22.0 software. To examine the hypothesized factor model of the INIMQ, we conducted confirmatory analysis with Mplus7 using Robust Maximum Likelihood estimation (MLR). Next, to further examine the validity of the INIMQ, we performed Pearson correlation analysis to examine whether the scores of the INIMQ were correlated with the scores of proactive aggression, psychopathy, guilt proneness and attitudes toward violence. Finally, to explore the reliability and validity of the RIT, the coefficient of internal consistency of the RIT and correlation analysis between proactive aggression in the RIT and self-reported measures were computed, and a pair-sample t-test was used to test the change of anger emotion before and after the RIT.

3.4. Results and discussion

3.4.1. Descriptive results

Table A.$_1$ and Table A.$_2$ in the Appendix show the mean scores, SDs, skewness, and kurtosis for responses to items of the INIMQ. And the results show that the distribution of responses to some items was non-normal.

In the RIT, the average level of interference selection was 2.29 (SD = 0.88). The details of interference selection were as Appendix. Cronbach alpha of the RIT was 0.96 in the current sample.

Men (mean = 2.53, *SD* = 0.97) had significantly higher scores than women (mean = 2.11, SD = 0.77) on average proactive aggression scores in the RIT. Age did not have a significant effect on proactive aggression scores in the RIT.

3.4.2. The reliability and validity of the INIMQ

The Cronbach alphas for instrumental motivation, moral disengagement, and moral inhibition in the INIMQ were 0.90, 0.65, and 0.85, respectively.

Confirmatory factor analysis (CFA) showed that the fit indices of measurement models for INIMQ were adequate: X^2/df ratio = 1.47, *SRMR* = 0.07, *RMSEA* = 0.06, *CFI* = 0.95, *TLI* = 0.93 (see Fig. 2). The results indicate that the construct validity of the INIMQ was acceptable (Hu & Bentler, 1999; Kline, 2011).

Pearson correlation analysis showed that moral disengagement scores in the INIMQ were positively associated with proactive aggression scores measured by the RIT, physical aggression, psychopathy and attitudes toward violence. Moral inhibition scores in the INIMQ were positively correlated with guilt NER and guilt repair and negatively correlated with proactive aggression scores measured by the RIT, psychopathy and attitudes toward violence. Instrumental motivation scores in the INIMQ were positively correlated with proactive aggression scores measured by the RIT, moral disengagement scores, proactive aggression of RPQ, psychopathy, and attitudes toward violence, and negatively correlated with moral inhibition scores in the INIMQ (see Table 3). The results further support the construct validity of the INIMQ.

3.4.3. The reliability and validity of the RIT

Proactive aggression scores in the RIT were positively correlated with general aggression, the proactive aggression scores of the RPQ, instrumental aggression (measured by four items of the RPQ, $r = 0.21$, $p < 0.05$), psychopathy and attitudes toward violence, and negatively related with scores of guilt NER and guilt repair (see Table 3). Proactive aggressive behaviors in the RIT did not arouse anger ($t = 0.28$, $p = .78$). The scores were not significantly correlated with the reactive aggression scores of the RPQ ($r = 0.16$, $p > 0.05$) and support the discriminant validity of the RIT.

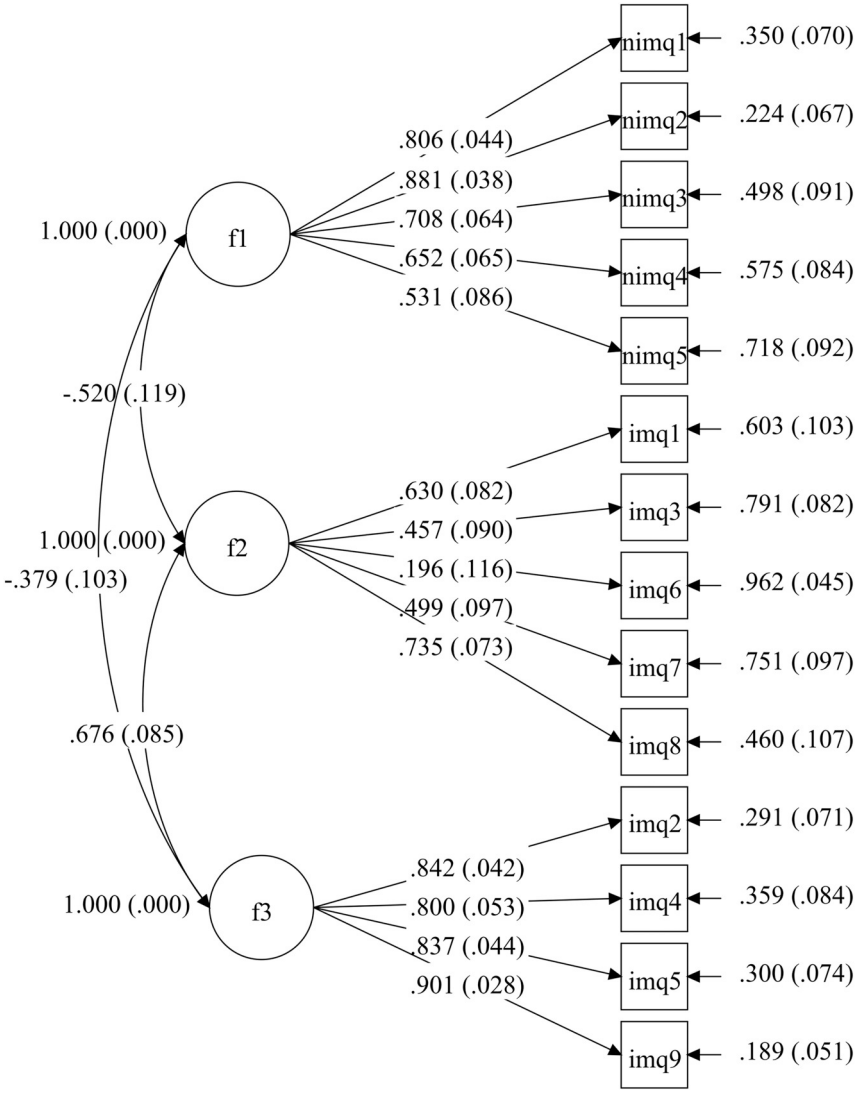

Fig. 2. Three factor model of INIMQ. f1, moral inhibition; f2, moral disengagement; f3, instrumental motivation.

Table 3
Bivariate correlation of proactive aggression in the RIT, IMQ and NIMQ with other individual-difference measures.

Measure	RIT	Instrumental motivation	Moral disengagement	Moral inhibition
Study 2				
Physical aggression	0.17*	0.09	0.18*	−0.07
PA	0.19*	0.17*	17*	−0.16
RA	0.16	31**	0.15	−0.17
Psychopathy	0.31**	26**	0.26**	−0.38**
Attitudes toward violence	0.24**	27**	24**	−0.17*
Guilt NER	−0.25**	−0.08	−0.16	0.29*
Guilt repair	0.19*	0.01	−0.07	0.27**
Instrumental motivation	0.41**	–	–	–
Moral disengagement	0.34**	0.54**	–	–
Moral inhibition	−0.45**	−0.28**	−0.37**	–
Study 3				
Instrumental motivation	0.65**	–	–	–
Moral disengagement	0.44**	0.51**	–	–
Moral inhibition	−0.39**	−0.40**	−0.40**	–
Proactive aggression in TAP	0.33**	0.22	0.28*	−0.31*
Reactive aggression in TAP	0.25*	0.15	0.26*	0.15

Note. RIT, Reward-Interference Task; TAP, Taylor Aggression Paradigm; PA, proactive aggression of Reactive-Proactive questionnaire; RA, reactive aggression of Reactive-Proactive questionnaire.
* $p < 0.05$.
** $p < 0.01$.

3.5. Discussion

Study 2 developed the INIMQ based on the interview and examined the construct validity of the INIMQ. The results show its construct validity was acceptable. In addition, Study 2 preliminarily tested the internal consistency reliability and convergent and discriminant validity of the RIT. The results provide evidence for the reliability and validity of the RIT. In Study 3, the reliability and validity of the RIT were further examined using the INIMQ and laboratory procedure.

4. Study 3

In Study 3, the reliability of the RIT was tested again, using internal consistency coefficients across all trials. We tested the validity of the RIT using the criteria of instrumental motivation, moral disengagement, and moral inhibition from the INIMQ. In addition, the convergent and discriminant validity of the RIT were examined by non-incentive proactive and reactive aggression via laboratory procedure. These validity criteria were derived from the aforementioned standards to assess proactive aggression tasks.

We first sought to test the validity of the RIT by the INIMQ constructed by Study 2, especially using the instrumental motivation, moral disengagement, and moral inhibition subscale. We further tested the convergent and discriminant validity of the RIT by investigating the relationship between the proactive aggression behaviors measured by the RIT and non-incentive proactive and reactive aggression measured by the TAP.

4.1. Method

4.1.1. Participants

Eighty-three (36 males, mean age = 21.63 years, $SD = 1.28$) healthy Chinese undergraduate students participated in this study. All participants first completed the RIT and INIMQ, then completed the TAP. They provided their informed written consent and received payment for their participation. Four participants, who believed that their opponent was machine, were removed from the experiment. Seventy-nine were included in further analysis.

4.2. Measurements

4.2.1. Reward-Interference Task

Participants completed the RIT using the same operation as in Study 1.

4.2.2. Aggressive motivations in the RIT

The INIMQ developed in Study 2 was used to assess the aggressive motivations of participants in the RIT.

4.2.3. Taylor Aggression Paradigm

To measure the aforementioned non-incentive proactive aggressive and reactive aggressive behaviors, an adaptation of the TAP (Taylor, 1967) was used. Together with three same-sex opponents, participants were instructed to complete a competitive reaction-time game. The details of the process were as Appendix.

The first provocation was given in the seventh trial. That is, the first noise that participants received was on the seventh trial, before which participants didn't receive any noise from the opponent under both losing and winning conditions. According to the feature that proactive aggression occurs with prior non-provocation and prior studies (Brugman et al., 2015; Dambacher et al., 2015), we calculated a non-incentive proactive aggression score by summating the duration and intensity scores of the first seven trials. We calculated a reactive aggression score by summating the duration and intensity scores for the last 23 trials.

4.3. Data analysis

We analyzed descriptive statistics of the RIT in SPSS 22.0. Previous studies have found that reactive and proactive aggression measured by the TAP (Dambacher et al., 2015) was correlated with each other. To exclude confusion variables, partial correlation analysis was conducted to test the correlation between incentive proactive aggression measured by the RIT and non-incentive proactive aggression measured by non-provoking trials, and reactive aggression measured by provoking trials in the TAP. We further tested the relationship between proactive aggression in the RIT and instrumental motivation, moral disengagement, and moral inhibition.

4.4. Results and discussion

The results of the descriptive statistics show that the mean average score of proactive aggression in the RIT was 2.46 and SD was 0.85. The effect of gender on proactive aggression in the RIT was not significant. The mean score of proactive aggression in the RIT was 2.57 ($SD = 0.85$) in the male samples. The mean score of proactive aggression in RIT was 2.38 ($SD = 0.85$) in the female samples.

Proactive aggressive behavior in the RIT was positively correlated with instrumental motivation and moral disengagement, and negatively correlated with moral inhibition (see Table 3).

The results of the partial correlation show that the association between incentive proactive aggression in the RIT and non-incentive proactive aggression in the TAP was significant ($r = 0.24$, $p = 0.03$), when reactive aggression was controlled. The correlation between proactive aggression during the RIT and reactive aggression during the TAP was not significant ($r = 0.12$, $p = 0.30$) when the incentive proactive aggression was controlled. These findings provide further evidence for the validity of the RIT.

5. Study 4

As mentioned above, instrumental motivation is the primary standard to assess whether aggressive behavior constitutes proactive aggression or not. Study 3 suggested that instrumental motivation played a key role in aggression in the RIT by showing the significant correlation between the aggressive behaviors in the RIT and the scores in the instrumental motivation subscale of the INIMQ. However, the correlation analysis did not support the effect of instrumental motivation on aggression in the RIT directly. Thus, in this study, the intensity of the incentive was manipulated by the size of the rewards, and we hypothesized that the size of the reward would influence the aggressive behaviors in the RIT.

5.1. Method

5.1.1. Participants and procedure

The design of the study was a within-subject design. A total of 43 healthy participants (23 males, mean age = 19.88 years, SD = 1.09 years) were recruited from our university in China. All participants completed the RIT. Three participants who questioned the existence of the opponent were excluded. Finally, forty participants were included in further analysis. All participants provided informed written consent and received payment for their participation.

5.2. Measurements

5.2.1. Reward-Interference Task

The manipulation was essentially the same as that in Experiment 1, except for the size of the reward. Whoever won was to gain a corresponding amount of money (five levels: 5, 10, 15, 20, 25 yuan) in each trial and whoever lost was to gain 0 yuan. In this study, the levels of 5 yuan and 10 yuan were considered as low-level rewards and the levels of 20 and 25 yuan were considered as high-level rewards. All the other manipulations were the same as in Study 1. The proactive aggression scores were calculated by summing the interference intensity scores across all trials.

5.2.2. Data analysis

We firstly conducted a paired sample *t*-test to explore whether there were any significant differences in RIT aggression under high and low-level reward conditions. We also conducted one-way repeated measure analysis (with post-hoc Bonferroni) to assess the effect of each level of reward on proactive aggression.

5.3. Results and discussion

The results of the paired sample t-test indicate that RIT aggression under the high-level reward condition ($M = 2.19$, $SD = 0.67$) was higher than under the low-level reward condition ($M = 1.94$, $SD = 0.85$), $t = 3.42$, $p < 0.001$. The results of one-way repeated measure analysis were as Appendix (Table $B._1$).

The findings demonstrate that rewards as an important incentive played a key role in aggression in the RIT and participants tended to implement more aggressive behavior with the increase of rewards in the RIT. This is in line with the theoretical perspective regarding proactive aggression (Anderson & Bushman, 2002; Anderson & Murphy, 2003; Tedeschi & Quigley, 1996), and suggests that the convergent validity of the RIT is supported.

6. General discussion

The current research developed a new experimental task, the RIT, to measure proactive aggression and investigated the reliability and validity of the RIT via a combination of quantitative and qualitative analyses. The findings demonstrate that the RIT had good reliability and validity and is a valid experimental task for incentive proactive aggression.

The RIT is an incentive proactive aggression task that is performed in the absence of provoked conditions and retains an incentive to induce proactive aggression. Relative to previous incentive proactive aggression tasks, such as the pinball game and the evaluation of the painting based on laboratory tests, the RIT has distinct advantages. For example, the pinball game requires specialized equipment, while the RIT can be implemented with only a computer. In addition, the proactive aggression scores in most other tasks were only calculated via the first several trials under unprovoked conditions (Helseth et al., 2015). The RIT uses the design of A and B roles to allow the experiment to be repeated multiple times, which makes it possible to explore the neural mechanisms of proactive aggression using event-related design.

Compared with a non-incentive proactive aggression task, the RIT refers to obvious instrumental motivation. The motivation of non-incentive proactive aggression is not investigated, remains vague and may mainly be internal motivation (Tedeschi & Quigley, 1996). Proactive aggression tasks with external motivation are needed (Bobadilla, Wampler, & Taylor, 2012). The non-incentive proactive aggression may mainly reflect the tendency of endogenous proactive aggression, but not the exogenous proactive aggressive response in special situations. Moreover, the aggressive behaviors in the non-incentive proactive aggression task cannot be manipulated. The aggressive behaviors in the RIT are induced by special external motivation (e.g., getting rewards) and can be manipulated by the level of reward, as presented in Study 4. In summary, relative to non-incentive proactive aggression tasks, the RIT is more suitable for measuring and operating exogenous proactive aggressive behaviors.

To examine the motivations of aggressive behaviors in the RIT, we developed the task-related questionnaire (INIMQ) through the results of the content analysis of the interviews after the RIT in Study 1 and the items developed in a previous study (Anderson & Murphy, 2003). The questionnaire, which included the three main subscales of instrumental motivation, moral disengagement, and moral inhibition, was tailored to the RIT. The findings of the present study reveal that the reliability and construct validity of the INIMQ were adequate. Thus, the INIMQ may provide a comprehensive reference for the future application, development, and evaluation of proactive aggression tasks.

As mentioned above, instrumental motivation toward incentives is a defining feature of proactive aggression, thus, instrumental motivation was used as the most important criterion to test the convergent validity of the RIT. The findings indicate that aggressive behavior measured by the RIT was positively correlated with the instrumental motivation measured by the INIMQ in Study 3 and the effect size was high

($r = 0.65$). These results suggest that aggressive behavior in the RIT referred to instrumental motivation toward incentives. To test the effect of the incentive on aggressive behaviors in the RIT further, we manipulated the reward size in Study 4 and found that as rewards increased, aggressive behaviors in the RIT increased. In summary, our results support the hypothesis that the instrumental motivation toward incentives triggers the aggressive behaviors in an RIT.

Moral disengagement is another key factor in assessing a proactive aggression task. Moral standards prevent people from adopting harmful behaviors toward others by a self-sanctioning mechanism (Anderson & Bushman, 2002; Kish-Gephart et al., 2013) when pursuing their specific goals. When people choose a deliberate aggression option for personal goals, aggression selection may be inhibited by their moral system (Anderson & Bushman, 2002; Crockett et al., 2017). Moral disinhibition can reduce the effect of the self-sanctioning mechanism on harmful behavior, which enables individuals to avoid moral sanctions even if they violate their own moral standards, when they pursue their own interests, and enables them to engage in proactive aggression (Bussey et al., 2014; Hyde et al., 2010; Perren & Gutzwiller-Helfenfinger, 2012). In addition, if an individual lacks moral inhibition (e.g., lack of moral emotion) or relieves moral restraint, he will tend to make an aggression decision and engage in aggressive behavior (Cima, Tonnaer, & Lobbestael, 2007; Smeijers et al., 2018). Thus, in this study, we used attitudes toward violence, guilt, and psychopathy as criteria of validity. As expected, aggression in the RIT was related to moral disengagement, attitude toward violence (referring to the rationalization and justification of violence), low moral inhibition, psychopathy, and low guilt. These results are consistent with prior studies that find that proactive aggression is associated with moral disengagement (Bussey et al., 2014; Gini et al., 2014; Thornberg & Jungert, 2014), and suggest that aggressive behaviors in the RIT referred to moral disengagement.

No provoking and low negative emotion arousal are regarded as salient features of proactive aggression, as compared to reactive aggression (Dodge & Coie, 1987; Raine et al., 2006), since reactive aggression is driven by provoking stimulus and negative emotional arousal such as anger and hostility (Castro, Merk, Koops, Veerman, & Bosch, 2005; Little, Henrich, Jones, & Hawley, 2003; McAuliffe, Hubbard, Rubin, Morrow, & Dearing, 2006). Although the RIT did not include the provoking condition, the level of emotional arousal still needed to be tested. Thus, negative emotion arousal was used as a criterion of discriminant validity. In Study 2, we found that there was no significant change in anger emotions during the RIT. These results suggest that the aggressive behaviors in the RIT were not triggered by anger emotion arousal.

In addition, the reactive aggression and non-incentive aggressive behavior measured by the TAP were used as the criteria of discriminant and convergent validity, respectively. The results of Study 3 show that reactive aggression was not, and the non-incentive proactive aggression was moderately, linked to aggressive behaviors in the RIT. These results indicate that aggressive behaviors in the RIT were very different from reactive aggression and related to non-incentive proactive aggression to some degree.

These examinations with respect to the convergent and discriminant validity of the RIT indicate that aggressive behaviors in the RIT had the key features of proactive aggressive behaviors and did not refer to the characteristics of reactive aggression. Therefore, the RIT is an adequate experimental task to induce and assess proactive behavior for incentives.

However, there are some limitations in this study. First, the data in the current study was only collected from young, healthy undergraduate students in China. The participant selection needs to be extended to other populations to further test the effectiveness and validity of the RIT. Additionally, the RIT was developed only among Chinese samples; its reliability and validity should be tested in other samples in other cultures, especially individualistic cultures. On the one hand, we'd like to assume that the results of the RIT with participants from a collectivistic culture can be generalized to an individualistic culture because we can find proactive aggression similar to aggressive behavior in the RIT in both individualistic and collectivistic cultures in many real-life examples, such as hurting others in order to get money or using harmful action to win sports matches. Thus, we argue that aggressive behavior in the RIT should be similar across cultures. On the other hand, proactive aggression refers to moral norms, and the RIT involved social interaction. Aggressive behavior in the RIT seemed to be influenced by some social cultural factors. Thus, the effect of individualistic and collectivistic cultures on aggression in an RIT should be further studied. Second, the ecological validity of the experiment task needs further testing and improvement. For example, future research should use real interaction strategies to make the experimental environment more realistic. Third, the validity of the INIMQ should be examined further. The internal consistency for moral disengagement was not high (0.65), which may be because the strategies of moral disengagement that each participant tended to use in the RIT were different. Moral disengagement refers to several strategies. In an RIT, participants may not use these moral disengagement strategies equally. Some moral disengagement strategies that are not used by some participants may be always used by other participants. Items of the moral disengagement subscale may need to be further revised and the results should be replicated in future study. Fourth, low anger arousal should also be measured by the autonomic nervous system and other anger measurement methods in future study. Fifth, proactive behavior in the RIT was driven by rewards, thus it should be related to the Drive subscale and Reward Responsiveness subscale of the Behavioral Activation Scale (BAS) to some degree. It is a limitation of the present study that the BAS-Drive and BAS-Reward were not used as validity criteria. These criteria should be used in future study.

Ethical statement

The study was approved by 'the Ethics Committee of Southwest University of China.' The experimental protocol was conducted in accordance with the standards of the Declaration of Helsinki. All participants provided informed consent in the current study.

Declaration of Competing Interest

The authors declare no conflicts of interest.

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Appendix A

Study 1

Reward Interference Task (RIT)

Participants were told that the aim of the task was to explore their auditory responses. In order to enable them to concentrate their attention on the current task and respond to the signal tone as quickly as possible, we matched them with an opponent with whom to play the game and their auditory response times in the task were recorded.

Because aggression toward acquaintances or strangers always differs, the four people who took part in the experiment had to be strangers. To ensure that, we emphasized that acquaintances could not participate in the experiment together when recruiting participants. In addition, when the four people arrived at the laboratory, we asked them whether they knew each other. If they knew each other, we would negotiate with some of them and let them participate in the experiment next time.

The process of the experimental trials was as follows. At the beginning of each trial a fix was presented and then role A needed to select non-interference or the level of interference. A white light then appeared on the screen and participants heard a sound signal after 1700 to 5700 ms (randomly). They were instructed to key-click as fast as possible when they heard the sound signal. The light changed from white to red if they lost, and from white to green if they won. Finally, the feedback appeared. The rate of wins and losses was preprogrammed. When participants selected non-interference (level 1), the possibility of winning was 30%. When participants selected levels 2 to 4 (using noise) to interfere with the opponent, the possibility of winning was 50% to 90% (interval, 20%).

The process of the filler trials was the same as the experiment trials except for the interference selection screen and the rate of wins and losses. On the interference selection screen, participants were asked to select a green number from 1 to 4 and were told that the designated number was randomly assigned by the computer, and that the specified number is different each time. The key here will not have any effect on the other. However, they were told that if they pressed the wrong button, even if they won, they would not get the reward for the trial. The possibility of winning was always 50% when participants selected the specified number 1 to 4. Filler trials were inserted into the experimental trials to reduce the possibility of fixing keys. The proactive aggression scores were calculated by meaning selecting noise intensity scores across all experimental trials for each participant.

To ensure that participants would experience the game as a 'real' social interaction, we conducted the following operations. First, if participants' key-press was shorter or longer than two standard deviations of their reaction time to sound in the exercise experiment, they always lost due to reacting before the sound signal or slower than the opponent. This ensured the realism of competing against a human opponent. Second, the experimenter always checked with the "other participants" to see whether they were also ready to start the task before starting the game, and the experimenter reported that they pressed the Q key and started at the same time. A connection screen then appeared to make the participants believe that the players were connecting with each other through a computer network. This connection screen appeared for 12,700 ms. Then, to ensure all participants believed in the existence of the opponent, participants were required to evaluate his/her opponent. If they questioned whether their opponents were actually a computer, they were excluded from further analysis. Two of the participants suspected the existence of a computer opponent and were excluded. Finally, a total of 35 participants were included for further analysis.

In order to make the participants master the experimental rules, prior to the experiment, participants were asked to practice four trials including two filler trials and two experimental trials in random order. Furthermore, we designed some questions to help them understand the rules after the practices (e.g. how do we calculate your compensation?). If they could not answer the question correctly, we would explain the rules again and give them the right answers.

Descriptive data

94.1% of participants made interference choices in at least one trial. The results were similar to those of a previous study (FeldmanHall, Dalgleish, Evans, & Mobbs, 2015), which found all participants selected using shocks to gain money. In the RIT, the average rate of interference selection was 64.4% for all participants. The rate of interference selection of each participant was calculated by dividing the number of interference choices in the experiment by the total number of the experimental trial. The selection rates of 2-level, 3-level, and 4-level interference were 24.7%, 23.7%, and 15.9%, respectively. The skewness of proactive aggression score was 0.49 and the standard deviation was 0.40. The coefficient of kurtosis was −0.80 and the standard deviation was 0.79.

The test of the discomfort caused by noise in the RIT

To examine whether the noise did cause discomfort, we recruited 39 participants(19 males, mean age = 20.87, *SD* = 2.23)to assess the degree of discomfort caused by selected noise on a 7-level scale (1 = Not comfort at all, 2 = Very slight discomfort, 3 = Relatively slight discomfort, 4 = Slight discomfort, 5 = Moderate discomfort, 6 = Stronger discomfort, 7 = Very strong discomfort). The mean level of discomfort was calculated in all participants. The results showed all noise make people feel uncomfortable. The 2-level noise was assessed to bring very slight discomfort (Mean = 1.93, *SD* = 1.19), 3-level noise was assessed to bring slight discomfort(Mean = 4.44, *SD* = 1.67), 4-level noise was assessed to bring stronger discomfort (Mean = 6.48, *SD* = 1.00).

Study 2

Descriptive statistics of items in the INIMQ

Table A.$_1$
Descriptive statistics of items in the interference selection.

Item	M	SD	Skewness	Kurtosis
1	3.66	1.49	−0.24	−1.01
2	3.04	1.54	0.30	−1.03
3	4.30	1.47	1.00	0.26
4	4.04	1.53	−0.57	−0.66
5	3.27	1.60	0.08	−1.17
6	3.29	1.61	0.07	−1.19
7	3.97	1.44	−0.59	−0.51
8	4.43	1.23	−1.16	1.01
9	4.08	1.54	−0.65	−0.56

Table A.$_2$
Descriptive statistics of items in the noninterference selection.

Item	M	SD	Skew.	Kurt.
1	4.39	1.42	−1.08	0.50
2	4.01	1.40	−0.46	−0.50
3	4.46	1.44	−0.85	0.02
4	3.86	1.46	−0.52	−0.58
5	4.04	1.36	−0.65	−0.53
6	4.03	1.36	−0.36	−0.61

Descriptive results of the RIT

80.9% of the participants made interference choices in at least one trial. In the RIT, the average rate of interference selection was 66.2% for all participants; the rate of interference selection of each participant was calculated by dividing the number of interference choices in the experiment by the total number in the experimental trial. The selection rates of 2-level, 3-level and 4-level interference were 24.3%, 20.9%, and 21.0%, respectively. Proactive aggression score of the skewness was 0.22 and the standard deviation was 0.20. The coefficient of kurtosis was −0.65 and the standard deviation was 0.40.

Study 3

Taylor Aggression Paradigm

To measure the aforementioned non-incentive proactive aggressive and reactive aggressive behaviors, an adaptation of the TAP (Taylor, 1967) was used. Together with three same-sex opponents, participants were instructed to complete a competitive reaction-time game. They were told that whoever was slower in reacting to the signal by "1" button press would lose the trial and be punished by the opponent with an aversive noise. The intensity of the punishment could be set by the participants for each trial on a scale from 0 (0 dB noise) to 8 (100 dB noise). The reaction-time task had a feedback phase. During the feedback phase, participants were informed whether they had lost or won and which level of severity and duration of punishment their opponent had selected. At the end of each lost trial, the punishment stimulus was delivered to the participant. The opponent's punishment selection and win or loss trials were preprogrammed. If participants' reaction time was shorter or longer than two standard deviations of their mean reaction time, they always lost.

Study 4

One-way repeated measure analysis

We also conducted one-way repeated measure analysis (with post-hoc Bonferroni) to assess the effect of each level of reward on proactive aggression.

The results of the one-way repeated measure analysis show that the effect of the levels of reward was significant ($F = 9.39$, $P < 0.001$). Pairwise post-hoc comparisons were conducted to test the differences in proactive aggression at each reward level, and Bonferroni was applied for multiple comparisons. The results show that there was lower proactive aggression at the level of 5 yuan than at either 15 yuan ($p = 0.046$), 20 yuan ($p = 0.039$), or 25yuan ($p = 0.004$). There was higher proactive aggression at the level of 25 yuan than at either 5 yuan ($p = 0.004$), 10 yuan ($p = 0.015$), 15 yuan ($p = 0.006$), or 20 yuan ($p = 0.115$). Other pairwise comparisons were not significant. The mean and standard error of proactive aggression at each level of reward are presented in Table B.$_1$.

Table B.$_1$
Mean and stander error proactive aggression under each level of reward.

Reward level	*M*	*SD*
5 yuan	1.87	0.10
10 yuan	2.01	0.12
15 yuan	2.06	0.12
20 yuan	2.14	0.13
25 yuan	2.24	0.14

Note. *M* = mean; *SD* = stander error.

Appendix B. The items of Interference/Non-interference Motivation Questionnaire

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