Effects of Anger on Malevolent Creativity and Regulatory Strategies

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Abstract

Two experiments were conducted to investigate the influence of anger on malicious creativity performance and its underlying mechanisms, as well as to explore the effect of anger regulation in attenuating malicious creativity performance. Experiment 1 compared differences in individuals' malicious creativity performance under angry, sad, and neutral emotional states, revealing that individuals in an angry state generated a greater number of more novel malicious ideas, with emotional arousal and implicit aggression mediating the effect of anger on malicious creativity performance. Experiment 2 examined how different emotion regulation strategies (cognitive reappraisal and expressive suppression) influence the malicious creativity performance of angry individuals, finding that both the cognitive reappraisal group and the expressive suppression group exhibited lower levels of malicious creativity performance compared to the no-strategy control group, with emotional arousal and implicit aggression mediating the influence of these two emotion regulation strategies on individuals' malicious creativity performance. These results demonstrate that anger promotes individuals' malicious creativity performance by enhancing implicit aggression and emotional arousal, while cognitive reappraisal and expressive suppression strategies can serve as effective approaches for attenuating malicious creativity performance in angry individuals.

Full Text

The Effect of Anger on Malevolent Creativity and Emotion Regulation Strategies

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Abstract

Two experiments investigated the effect of anger on malevolent creativity performance and its underlying mechanisms, as well as the effectiveness of emotion regulation strategies in attenuating this effect. Experiment 1 compared malevolent creativity performance across anger, sadness, and neutral emotion conditions, revealing that angry individuals generated more numerous and novel malevolent ideas. Both emotional arousal and implicit aggression mediated the relationship between anger and malevolent creativity performance. Experiment 2 examined how different emotion regulation strategies (cognitive reappraisal and expressive suppression) influence the malevolent creativity of angry individuals. Results showed that both cognitive reappraisal and expressive suppression groups exhibited lower levels of malevolent creativity compared to the no-strategy control group, with emotional arousal and implicit aggression mediating the effects of these regulation strategies on malevolent creativity performance. These findings indicate that anger enhances malevolent creativity by increasing implicit aggression and emotional arousal, while cognitive reappraisal and expressive suppression represent effective strategies for weakening malevolent creativity in angry individuals.

Keywords: malevolent creativity, anger, emotional arousal, implicit aggression, emotion regulation

1. Introduction

Creativity is typically defined as the capacity to generate ideas and products that are both novel (original, unexpected) and appropriate (useful, constrained by conditions) within a specific context (Runco & Jaeger, 2012). While creativity is often viewed as inherently beneficial to individuals and society, its "dark side" has gained increasing recognition (A. J. Cropley, 2010). Malevolent creativity represents a prominent manifestation of this dark side, referring to creativity intended to deliberately harm other people, property, processes, or symbols (D. H. Cropley et al., 2008; Plucker et al., 2004). Malevolent creativity shares a close relationship with general creativity, as both require individuals to generate novel and useful ideas or problem solutions. Previous research has demonstrated that general creativity positively predicts malevolent creativity (Hao et al., 2016; Hao et al., 2020; Perchtold-Stefan et al., 2020), suggesting that general creativity may serve as a foundation for malevolent creativity. However, malevolent creativity differs in its requirement that the individual' s motivation be directed toward intentional harm, leading to distinct patterns of relationships with certain factors. For instance, research has found that malevolent creativity correlates positively with aggression levels, whereas general creativity shows no such correlation (Hao et al., 2016; Hao et al., 2020).

Manifestations of malevolent creativity are widespread, ranging from novel fraud schemes and money laundering to more severe acts such as murder and terrorist attacks. Identifying the factors that influence malevolent creativity and devel-

oping effective strategies to mitigate its potential societal harm hold significant social importance. Malevolent creativity performance may be affected by factors including unfair situations, emotional intelligence, and motivational orientation (Gill et al., 2013; Gutworth et al., 2016; Hao et al., 2020; Harris et al., 2013), as well as by individuals' emotional states. In particular, anger likely represents a critical factor influencing malevolent creativity. On one hand, malevolent creativity typically requires individuals to intentionally harm others, and such harmful behaviors are frequently triggered by anger (Anderson & Bushman, 2002). On the other hand, prior research indicates that anger can enhance general creativity performance (Russ & Kaugars, 2001; Van Kleef et al., 2010). These findings suggest that anger may be an important factor affecting malevolent creativity, making the investigation of how anger influences malevolent creativity performance an intriguing and novel research topic.

The pathways through which anger influences malevolent creativity can be analyzed from two perspectives: emotional arousal and implicit aggression. First, a meta-analysis (Baas et al., 2008) indicates that low-arousal, approach-oriented negative emotions (e.g., sadness) have no significant effect on general creativity, whereas high-arousal, avoidance-oriented negative emotions (e.g., fear and anxiety) reduce cognitive flexibility and thereby inhibit general creativity. Anger, as a high-arousal, approach-oriented negative emotional state (Baas et al., 2008; Lang, 1995; Russell, 2003), enhances general creativity performance. Researchers propose that anger elevates individuals' cognitive activation (increased arousal), mobilizing more cognitive resources for the current task and consequently promoting general creativity performance. By the same logic, we can speculate that during malevolent creativity tasks, when individuals' anger is induced, the resulting increase in emotional arousal may lead them to allocate more cognitive resources to the task, thereby enhancing malevolent creativity performance. Thus, emotional arousal likely plays an important role in the relationship between anger and malevolent creativity. Second, anger is associated with high aggression levels (Anderson & Bushman, 2002) and can predict individuals' aggressive preferences (Molho et al., 2017). Influenced by social desirability effects, aggression has both priming and implicit characteristics (Richetin & Richardson, 2008). Research by Harris and Reiter-Palmon (2015) demonstrates that high implicit aggression levels significantly predict malevolent creativity performance. Therefore, we can speculate that implicit aggression may also play an important role in the relationship between anger and malevolent creativity performance.

If anger promotes malevolent creativity performance, then regulating anger to weaken individuals' malevolent creativity holds significant social importance. Emotion regulation refers to a series of cognitive processes that adjust or change the occurrence, intensity, and duration of emotional states (Eisenberg et al., 2000; Gross & Thompson, 2007). Cognitive reappraisal and expressive suppression are two of the most commonly used and effective emotion regulation strategies (Webb et al., 2012). The former involves reinterpreting a situation from a different perspective, assigning new meaning to situational stimuli to

alter emotional states (Gross & Thompson, 2007), while the latter involves intentionally suppressing the expression of impending or ongoing emotions (Gross, 1998). Research indicates that both strategies can effectively regulate negative emotions, though their effects differ (Goldin et al., 2008; Ray et al., 2008). We propose that cognitive reappraisal and expressive suppression can also effectively regulate anger and influence angry individuals' malevolent creativity performance.

In summary, this study focuses on investigating the effect of anger on malevolent creativity performance and the attenuating effect of emotion regulation strategies on angry individuals' malevolent creativity. Specifically, we address two research questions: (1) What is the effect of anger on malevolent creativity performance and what are its underlying mechanisms? (2) If anger promotes malevolent creativity performance, can emotion regulation strategies weaken angry individuals' malevolent creativity performance and what are the underlying mechanisms? In Experiment 1, we used autobiographical recall tasks to induce anger and sadness in two groups of participants, with a third neutral emotion control group. Sadness and anger are both associated with unfulfilled goals and are closely linked to promotion-focused self-regulation strategies that concentrate on pursuing or achieving a goal, thus reflecting an approach motivational tendency (Carver, 2006; Higgins, 1997, 2001, 2006). In other words, sadness is a low-arousal, approach-oriented negative emotion, whereas anger is a high-arousal, approach-oriented negative emotion, making sadness an appropriate negative emotion control condition. All three groups completed malevolent and general creativity tasks, along with a word preference task and subjective emotion rating scales to measure implicit aggression and emotional arousal. We compared differences in general and malevolent creativity performance across the three emotion conditions and tested whether anger influences malevolent creativity through implicit aggression and emotional arousal. Experiment 1 hypothesis: (I) Anger will enhance malevolent creativity performance, with both implicit aggression and emotional arousal serving as potential pathways. Experiment 2 first induced anger using autobiographical recall, then required participants to use either cognitive reappraisal or expressive suppression strategies for emotion regulation, with a no-regulation control group. We compared differences in malevolent creativity performance across the three groups during the emotion induction and regulation phases, and tested whether emotion regulation strategies influence angry individuals'malevolent creativity performance through emotional arousal and implicit aggression. Experiment 2 hypothesis: (II) Emotion regulation strategies can effectively weaken angry individuals' malevolent creativity performance, and this weakening effect may occur through both emotional arousal and implicit aggression pathways. To control for potential confounding effects of individual differences in general creative potential, malevolent creative potential, and daily aggression levels, both experiments measured these variables and included them as covariates in data analyses. This research was approved by the Human Research Ethics Committee of East China Normal University (Approval Numbers: HR 084-2018; 281-2019).

2. Experiment 1: The Effect of Anger on General and Malevolent Creativity

2.1 Participants

A total of 102 participants were recruited, including 84 females and 18 males (age: M = 20.51, SD = 2.21). Participants were randomly assigned to anger, sadness, and neutral emotion groups, with gender balanced across groups (28 females and 6 males per group).

2.2 Tasks and Measures

The Alternative Uses Task (AUT) was used to assess general creativity performance. The AUT requires participants to generate as many novel uses as possible for common everyday objects (Runco et al., 2016). For example, "What are some novel uses for a candle?" In this experiment, general creativity performance was evaluated using two indices: fluency and originality (Runco et al., 2016; Runco & Acar, 2012). Fluency refers to the number of valid ideas generated. Originality refers to the novelty of the generated ideas. Raters assigned originality scores based on the frequency of each idea in the experimental sample. Specifically, ideas with frequencies of $ $1%, 1%–5%, or >5% received scores of 2, 1, and 0, respectively (Hao et al., 2017; Runco et al., 2016). The sum of originality scores across all ideas served as each participant' s final originality score.

The Malevolent Creativity Task (MCT) was used to assess malevolent creativity performance. Adapted from realistic presented problems, the MCT requires individuals to generate as many novel and malicious solutions as possible for open-ended real-world problems (Hao et al., 2020). For example, "Xiao Wang has had a crush on someone for a long time, but suddenly a romantic rival appears. Please think of novel ways to damage the rival' s image." This experiment evaluated malevolent creativity performance using three indices: fluency, originality, and harmfulness. Fluency and originality were scored using the same procedure as the AUT. Harmfulness refers to the degree of harm associated with each idea. Five raters independently rated the harmfulness of each idea on a 5-point scale (inter-rater reliability ICC = 0.84). Each idea' s harmfulness score was the mean rating across the five raters, and each participant' s final harmfulness score was the mean harmfulness score across all their ideas.

Implicit aggression was assessed using the word preference task (Zhu et al., 2006). This task consisted of 25 trials, each comprising a probe character and three target characters. The target characters included one that could form an aggressive word with the probe, one that could form a neutral word with the probe, and one distractor character. In each trial, participants received 1 point for selecting the target character that formed an aggressive word with the probe, and 0 points for other selections. Higher total scores indicated higher implicit aggression.

The Self-Assessment Manikin (SAM) was used to assess valence and arousal levels (Bradley & Lang, 1994). Participants rated their emotional valence (1 = "very unhappy" to 9 = "very happy") and arousal (1 = "very calm" to 9 = "very excited") on 9-point scales. The Positive and Negative Affect Schedule (PANAS) was used to assess ten emotional states (Bradley & Lang, 1994; Watson et al., 1988). Participants rated their current emotional state (1 = "not at all" to 9 = "extremely") on 9-point scales.

The Buss-Perry Aggression Questionnaire (BPAQ) assessed daily aggression levels (Buss & Perry, 1992). Participants rated 22 items on 5-point scales (Cronbach's $\alpha = 0.84$ in this experiment), with higher scores indicating greater aggression. The Runco Ideational Behavior Scale (RIBS) assessed everyday creative behavior tendencies (Runco et al., 2001). Participants rated 19 items on 5-point scales (Cronbach' s $\alpha = 0.83$), with higher scores indicating greater general creative potential. The Malevolent Creativity Behavior Scale (MCBS) assessed malevolent creative behavior tendencies (Hao et al., 2016). Participants rated 13 items on 5-point scales (Cronbach' s $\alpha = 0.90$), with higher scores indicating greater malevolent creative potential.

2.3 Procedure

Participants first completed the pre-test SAM and PANAS. Next, participants in the anger and sadness groups completed a 5-minute autobiographical recall task (Brewer et al., 1980) to induce the corresponding emotions, while participants in the neutral emotion group completed a control task (detailed recording of their daily schedule). Following emotion induction, participants completed the post-test SAM and PANAS. They then verbally completed one MCT (10 minutes) and one AUT (5 minutes). Verbal responses were recorded and later transcribed for analysis. Based on previous research designs, the MCT duration was set at 10 minutes and the AUT at 5 minutes (Jiang et al., 2012; Lu et al., 2019). Finally, participants completed the word preference task and the BPAQ, RIBS, and MCBS scales (see Figure 1 [Figure 1: see original paper]).

[Figure 1: see original paper]

2.4 Results

2.4.1 Emotion Induction Manipulation Check To verify the effectiveness of emotion induction, paired-samples t-tests were conducted on pre- and post-test emotion ratings for each group (see Table 1). Results indicated that for the anger group, post-test arousal and anger levels were significantly higher than pre-test levels, while post-test valence was significantly lower. For the sadness group, post-test valence and arousal were significantly lower than pre-test levels, while post-test sadness was significantly higher. The neutral emotion group showed no significant changes. These results confirm successful emotion induction.

2.4.2 Effects of Emotion on Malevolent Creativity (MCT) and General Creativity (AUT) Performance Using emotion group as the independent variable, a one-way multivariate analysis of variance (MANOVA) was conducted on MCT fluency, originality, and harmfulness. Box' s M = 68.30, p < 0.001, indicating non-homogeneous covariance matrices and making MANOVA inappropriate. Therefore, separate one-way ANOVAs were conducted for each MCT index. Results revealed a significant main effect of emotion on MCT performance, F(6, 196) = 6.38, p < 0.0001, p^2 = 0.16. Specifically, emotion showed a significant main effect on MCT fluency, F(2, 99) = 14.80, p < 0.0001, p^2 = 0.23. Post-hoc comparisons (Bonferroni) indicated that the anger group (M = 8.94, SD = 4.77) scored higher than both the sadness group (M = 6.32, SD = 2.40, p = 0.005, Cohen' s d = 0.69) and the neutral emotion group (M = 4.56, SD = 2.23, p < 0.001, Cohen' s d = 1.18), with no significant difference between sadness and neutral groups (p = 0.096) (see Figure 2A). Emotion also showed a significant main effect on MCT originality, F(2, 99) = 15.83, p < 0.0001, p^2 = 0.24. Post-hoc comparisons revealed that the anger group (M = 9.79, SD = 7.73) scored higher than both the sadness group (M = 4.68, SD = 4.08, p < 0.001, Cohen' s d = 0.83) and the neutral emotion group (M = 2.91, SD = 2.43, p < 0.001, Cohen' s d = 1.20), with no difference between sadness and neutral groups (p = 0.504) (see Figure 2B). Finally, emotion showed a significant main effect on MCT harmfulness, F(2, 99) = 4.01, p = 0.021, p^2 = 0.08. Post-hoc comparisons indicated that the anger group (M = 2.91, SD = 0.27) scored higher than both the sadness group (M = 2.65, SD = 0.44, p = 0.051, Cohen' s d = 0.71) and the neutral emotion group (M = 2.65, SD = 0.53, p = 0.044, Cohen' s d = 0.62), with no significant difference between sadness and neutral groups (p = 1.00) (see Figure 2C).

[Figure 2: see original paper]

Using emotion group as the independent variable, a one-way MANOVA was conducted on AUT fluency and originality. Box' s M = 24.05, p < 0.001, indicating that MANOVA was inappropriate. Separate one-way ANOVAs revealed a significant main effect of emotion on AUT performance, F(4, 198) = 3.71, p < 0.0001, p^2 = 0.07. Specifically, emotion showed a significant main effect on AUT fluency, F(2, 99) = 6.43, p = 0.002, p^2 = 0.12. Post-hoc comparisons indicated that the anger group (M = 11.26, SD = 6.20) scored higher than the neutral emotion group (M = 7.26, SD = 3.44, p = 0.002, Cohen' s d = 0.80), with no other significant differences (see Figure 2D). Emotion also showed a significant main effect on AUT originality, F(2, 99) = 7.84, p < 0.001, p^2 = 0.14. Post-hoc comparisons revealed that the anger group (M = 15.29, SD = 8.85) scored higher than both the sadness group (M = 11.21, SD = 5.50, p = 0.042, Cohen' s d = 0.55) and the neutral emotion group (M = 8.91, SD = 5.23, p = 0.001, Cohen' s d = 0.88), with no significant difference between sadness and neutral groups (p = 0.489) (see Figure 2E).

When BPAQ, RIBS, and MCBS scores were included as covariates in ANCOVAs, the main effects of emotion group remained significant: MCT fluency, F(2, 96)

= 13.15, p < 0.001, p^2 = 0.22; MCT originality, F(2, 96) = 13.52, p < 0.001, p^2 = 0.22; MCT harmfulness, F(2, 96) = 3.78, p = 0.026, p^2 = 0.07; AUT fluency, F(2, 96) = 6.33, p = 0.003, p^2 = 0.12; AUT originality, F(2, 96) = 7.94, p = 0.001, p^2 = 0.14.

2.4.3 Mediation Analysis of Implicit Aggression and Emotional Arousal To examine whether emotion influenced implicit aggression (IA), a one-way ANOVA was conducted, revealing a significant main effect of emotion, F(2, 101) = 3.32, p = 0.040. Post-hoc comparisons indicated that the anger group (M = 9.62, SD = 3.27) scored significantly higher than both the sadness group (M = 7.91, SD = 3.21, p = 0.045, Cohen' s d = 0.53) and the neutral emotion group (M = 7.62, SD = 3.85, p = 0.019, Cohen' s d = 0.56).

[Figure 3: see original paper]

To further test whether the effect of anger on malevolent and general creativity performance was mediated by IA, the independent variable was dummy-coded (1 = anger group, 0 = neutral emotion group). Using PROCESS for bootstrap-based mediation analysis (Hayes, 2013; Hayes & Preacher, 2014) with fluency, originality, and MCT harmfulness as dependent variables and IA scores as the mediator (5000 bootstrap samples, 95% confidence intervals), results indicated that anger had a significant direct effect on MCT fluency, b = 3.84, p < 0.001, CI = [2.01, 5.67], and a significant indirect effect through IA, b = 0.54, CI = [0.01, 2.07] (see Figure 3A). For MCT originality, anger showed a significant direct effect, b = 5.83, p < 0.001, CI = [3.08, 8.57], and a significant indirect effect through IA, b = 1.06, CI = [0.12, 3.62] (see Figure 3B). For MCT harmfulness, anger demonstrated a significant direct effect, b = 0.37, p = 0.007, CI = [0.10, 0.64], and a significant indirect effect through IA, b = 0.08, CI = [0.004, 0.236] (see Figure 3C). However, for AUT fluency, while anger showed a significant direct effect, b = 3.49, p = 0.009, CI = [0.91, 6.07], the indirect effect through IA was not significant, b = 0.31, CI = [-0.31, 1.71]. Similarly, for AUT originality, anger had a significant direct effect, b = 5.98, p = 0.002, CI = [2.27, 9.70], but the indirect effect through IA was not significant, b = 0.40, CI = [-0.46, 1.94]. These results demonstrate that IA partially mediates the effect of anger on malevolent creativity performance but does not mediate the effect of anger on general creativity performance.

Mediation analysis of emotional arousal revealed that anger had a significant direct effect on MCT fluency, b = 3.80, p < 0.001, CI = [1.99, 5.62], and a significant indirect effect through arousal, b = 0.58, CI = [0.08, 1.66] (see Figure 4A). For MCT originality, anger showed a significant direct effect, b = 6.08, p < 0.001, CI = [3.26, 8.89], and a significant indirect effect through arousal, b = 0.80, CI = [0.08, 2.41] (see Figure 4B). For MCT harmfulness, anger demonstrated a significant direct effect, b = 0.42, p = 0.004, CI = [0.14, 0.69], but the indirect effect through arousal was not significant, b = 0.03, CI = [-0.03, 0.18]. For AUT fluency, anger had a significant direct effect, b = 2.58, p = 0.032, CI = [0.23, 4.92], and a significant indirect effect through arousal, b

= 1.22, CI = [0.27, 2.62] (see Figure 4C). For AUT originality, anger showed a significant direct effect, b = 4.60, p = 0.008, CI = [1.23, 7.96], and a significant indirect effect through arousal, b = 1.79, CI = [0.42, 3.91] (see Figure 4D). These findings indicate that emotional arousal partially mediates the effects of anger on fluency and originality in both malevolent and general creativity, but does not mediate the effect of anger on malevolent creativity harmfulness.

[Figure 4: see original paper]

We conducted the same mediation analyses for sadness, dummy-coding the independent variable (1 = sadness group, 0 = neutral emotion group) and using IA scores and emotional arousal as mediators for fluency, originality, and MCT harmfulness. No significant mediation effects were found.

The main findings of Experiment 1 are as follows: (1) Anger enhanced both general and malevolent creativity performance; (2) Both emotional arousal and implicit aggression mediated the facilitative effect of anger on malevolent creativity performance; (3) Only emotional arousal mediated the facilitative effect of anger on general creativity performance. These findings address Research Question 1. They not only replicate previous research showing that anger promotes general creativity performance (Baas et al., 2011; Russ & Kaugars, 2001) but also extend our understanding of the relationship between anger and malevolent creativity by demonstrating that anger similarly enhances malevolent creativity performance. Notably, we found that on MCT fluency, the anger group outperformed both sadness and neutral groups, whereas on AUT fluency, only the anger group outperformed the neutral group. Based on the mediation analyses, we speculate that anger elevates implicit aggression, which in turn promotes malevolent creativity performance but not general creativity performance. This additional facilitative effect may further widen the performance gap between angry and sad individuals on malevolent creativity tasks. Moreover, emotional arousal mediated the effects of anger on fluency and originality in both malevolent and general creativity, whereas implicit aggression mediated the effects of anger on all three malevolent creativity indices (fluency, originality, and harmfulness). This suggests that anger influences malevolent and general creativity performance through different pathways, with implicit aggression representing a specific pathway for the effect of anger on malevolent creativity.

3. Experiment 2: The Effect of Anger Regulation Strategies on Attenuating Malevolent Creativity

3.1 Participants

A total of 120 participants were recruited, including 90 females and 30 males (age: M = 20.40, SD = 2.02). Participants were randomly assigned to cognitive reappraisal, expressive suppression, and control groups, with gender balanced across groups (30 females and 10 males per group).

3.2 Tasks and Measures

Two MCTs were used to measure malevolent creativity performance before and after emotion regulation. Pilot testing indicated no significant differences between the two MCTs in difficulty, familiarity, or malevolence (task difficulty: $t(29) = 1.56$, $p = 0.13$; malevolence: $t(29) = 0.95$, $p = 0.35$; familiarity: $t(29) = -0.11$, $p = 0.92$), ensuring task homogeneity. Participants also completed the word preference task, SAM, PANAS, BPAQ (Cronbach' s $\alpha = 0.86$), RIBS (Cronbach' s $\alpha = 0.81$), and MCBS (Cronbach' s $\alpha = 0.86$).

3.3 Procedure

As shown in Figure 5 [Figure 5: see original paper], participants first completed the pre-test SAM and PANAS. Next, they induced anger through an autobiographical recall task. Following emotion induction, participants completed the post-test SAM and PANAS and a pre-regulation MCT (5 minutes). During the emotion regulation phase, participants in the cognitive reappraisal and expressive suppression groups used their respective strategies to regulate anger (3 minutes), while the control group completed a 3-minute copying task (selected from the expository text "A Productive Science–Phenology"). After emotion regulation, participants rated task difficulty, completed another post-test SAM and PANAS, and a post-regulation MCT (5 minutes). Finally, participants completed the word preference task and the BPAQ, RIBS, and MCBS. Specific instructions for emotion regulation strategies are provided in the appendix.

[Figure 5: see original paper]

3.4 Results

3.4.1 Manipulation Checks for Emotion Induction and Regulation A one-way ANOVA on emotion regulation task difficulty ratings revealed no significant main effect of regulation strategy, $F(2, 117) = 0.61$, $p = 0.546$, indicating that cognitive reappraisal ($M = 3.48$, $SD = 1.69$), expressive suppression ($M = 3.85$, $SD = 2.23$), and copying tasks ($M = 3.33$, $SD = 2.57$) did not differ significantly in difficulty.

Emotion induction results confirmed that all three groups successfully induced anger characterized by low valence and high arousal. Emotion regulation results demonstrated that both cognitive reappraisal and expressive suppression effectively increased valence and decreased arousal, successfully regulating anger (see Table 2).

3.4.2 Effects of Emotion Regulation on Malevolent Creativity A two-way repeated-measures ANOVA was conducted with emotion regulation strategy as the between-subjects factor and time (pre- vs. post-regulation) as the within-subjects factor on MCT fluency, originality, and harmfulness.

For fluency, the main effect of time was significant, $F(1, 117) = 5.89$, $p = 0.017$,

$p^2 = 0.05$, with pre-regulation scores (M = 7.03, SD = 3.12) significantly lower than post-regulation scores (M = 7.68, SD = 2.84, p = 0.017, Cohen' s d = 0.22; Bonferroni-corrected). The main effect of regulation strategy was not significant, F(2, 117) = 1.11, p = 0.333, $p^2 = 0.02$, nor was the interaction, F(2, 117) = 1.96, p = 0.145, $p^2 = 0.03$ (see Figure 6A). When BPAQ, RIBS, and MCBS scores were included as covariates, the main effect of time became non-significant, F(1, 114) = 1.31, p = 0.26, $p^2 = 0.01$.

For originality, the main effect of time was not significant, F(1, 117) = 0.02, p = 0.885, $p^2 = 0.00$, nor was the main effect of regulation strategy, F(2, 117) = 2.53, p = 0.084, $p^2 = 0.04$. However, the interaction was significant, F(2, 117) = 3.25, p = 0.042, $p^2 = 0.05$. Simple effects analysis revealed no significant differences among groups at pre-regulation (ps > 0.1). At post-regulation, both the cognitive reappraisal group (M = 7.20, SD = 4.67, p = 0.003, Cohen' s d = 0.66) and expressive suppression group (M = 7.63, SD = 4.71, p = 0.010, Cohen' s d = 0.57) scored significantly lower than the control group (M = 10.45, SD = 5.13), with no other significant differences (ps > 0.1) (see Figure 6B). Separate pre-post comparisons within each group showed no significant differences for the cognitive reappraisal and expressive suppression groups (ps > 0.1), while the control group showed a marginally significant increase from pre- (M = 8.48, SD = 4.27) to post-regulation (M = 10.45, SD = 5.13; p = 0.05, Cohen' s d = 0.42) (see Figure 6B). When covariates were included, the interaction remained significant, F(2, 114) = 3.96, p = 0.022, $p^2 = 0.07$.

For harmfulness, the main effect of time was significant, F(1, 117) = 27.79, p < 0.001, $p^2 = 0.19$, while the main effect of regulation strategy was not, F(2, 117) = 2.35, p = 0.100, $p^2 = 0.04$. The interaction was significant, F(2, 117) = 3.91, p = 0.023, $p^2 = 0.06$. Simple effects analysis revealed no significant differences among groups at pre-regulation (ps > 0.1). At post-regulation, both the cognitive reappraisal group (M = 2.26, SD = 0.36, p < 0.001, Cohen' s d = 0.80) and expressive suppression group (M = 2.26, SD = 0.31, p < 0.001, Cohen' s d = 0.85) scored significantly lower than the control group (M = 2.57, SD = 0.41), with no other significant differences (ps > 0.1) (see Figure 6C). Separate pre-post comparisons showed significant decreases for both the cognitive reappraisal group (pre: M = 2.63, SD = 0.59; post: M = 2.26, SD = 0.31; p < 0.001, Cohen' s d = 0.76) and expressive suppression group (pre: M = 2.72, SD = 0.52; post: M = 2.26, SD = 0.31; p < 0.001, Cohen' s d = 1.07), while the control group showed no significant change (ps > 0.1) (see Figure 6C). When covariates were included, the main effect of time remained significant, F(1, 114) = 8.61, p = 0.004, $p^2 = 0.07$, as did the interaction, F(2, 114) = 4.45, p = 0.014, $p^2 = 0.07$.

In summary, compared to the control group, participants who underwent cognitive reappraisal or expressive suppression showed reduced originality and harmfulness scores on the malevolent creativity task.

[Figure 6: see original paper]

3.4.3 Mediation Analysis of Implicit Aggression To examine whether emotion regulation influenced IA, a one-way ANOVA revealed a significant main effect of regulation strategy, $F(2, 119) = 6.75$, $p = 0.002$. Post-hoc comparisons indicated that the control group ($M = 10.65$, $SD = 3.22$) scored significantly higher than both the cognitive reappraisal group ($M = 8.88$, $SD = 2.45$, $p = 0.005$, Cohen' s $d = 0.62$) and expressive suppression group ($M = 8.55$, $SD = 2.51$, $p = 0.001$, Cohen' s $d = 0.73$), with no significant difference between the two regulation groups ($p = 0.598$).

To test whether the effects of emotion regulation strategies on angry individuals' malevolent creativity performance were mediated by IA, we conducted relative mediation analyses using the MEDIATE plugin (Hayes & Preacher, 2014) with bootstrap bias-corrected nonparametric percentile methods (5000 samples, 95% confidence intervals). Using the control group as reference, the independent variable was dummy-coded and post-regulation MCT fluency, originality, and harmfulness served as dependent variables with IA scores as the mediator. For fluency, cognitive reappraisal showed a non-significant direct effect, b = -0.61, p = 0.390, but a significant indirect effect through IA, b = -0.49, CI = [-1.16, -0.06] (see Figure 7A). Expressive suppression also showed a non-significant direct effect, b = -1.02, p = 0.157, but a significant indirect effect through IA, b = -0.58, CI = [-1.32, -0.10] (see Figure 7B). For originality, cognitive reappraisal showed a significant direct effect, b = -2.34, p = 0.032, and a significant indirect effect through IA, b = -0.91, CI = [-1.98, -0.19] (see Figure 7C). Expressive suppression showed a non-significant direct effect, b = -1.75, p = 0.111, but a significant indirect effect through IA, b = -1.07, CI = [-2.27, -0.28] (see Figure 7D). For harmfulness, cognitive reappraisal showed a significant direct effect, b = -0.22, p = 0.006, and a significant indirect effect through IA, b = -0.08, CI = [-0.15, -0.02] (see Figure 7E). Expressive suppression also showed a significant direct effect, b = -0.21, p = 0.010, and a significant indirect effect through IA, b = -0.10, CI = [-0.18, -0.03] (see Figure 7F). These results demonstrate that IA mediates the effects of both cognitive reappraisal and expressive suppression on malevolent creativity performance.

[Figure 7: see original paper]

3.4.4 Mediation Analysis of Emotional Arousal Mediation analyses of emotional arousal using the same method revealed that for fluency, cognitive reappraisal showed a non-significant direct effect, b = -0.52, p = 0.431, but a significant indirect effect through arousal, b = -0.58, CI = [-1.13, -0.01] (see Figure 8A). Expressive suppression also showed a non-significant direct effect, b = -0.90, p = 0.174, but a significant indirect effect through arousal, b = -0.70, CI = [-1.27, -0.13] (see Figure 8B). For originality, cognitive reappraisal showed a significant direct effect, b = -2.21, p = 0.026, and a significant indirect effect through arousal, b = -1.04, CI = [-1.97, -0.02] (see Figure 8C). Expressive suppression showed a non-significant direct effect, b = -1.57, p = 0.113, but a significant indirect effect through arousal, b = -1.25, CI = [-2.24, -0.21] (see

Figure 8D). For harmfulness, cognitive reappraisal showed a significant direct effect, b = -0.28, p = 0.001, but the indirect effect through arousal was not significant, b = -0.03, CI = [-0.08, 0.003]. Similarly, expressive suppression showed a significant direct effect, b = -0.28, p = 0.001, but the indirect effect through arousal was not significant, b = -0.03, CI = [-0.09, 0.01]. These findings indicate that emotional arousal mediates the effects of both cognitive reappraisal and expressive suppression on fluency and originality of malevolent creativity performance, but not on harmfulness.

[Figure 8: see original paper]

The main findings of Experiment 2 are as follows: After anger induction, (1) both cognitive reappraisal and expressive suppression effectively reduced angry individuals' emotional arousal and implicit aggression levels; (2) both strategies effectively weakened angry individuals' malevolent creativity performance (idea originality and harmfulness); (3) both emotional arousal and implicit aggression mediated the effects of emotion regulation strategies on angry individuals' malevolent creativity performance. These findings address Research Question 2, demonstrating that emotion regulation strategies can effectively weaken the malevolent creativity of angry individuals. Notably, the attenuating effects of emotion regulation strategies were observed for originality and harmfulness but not for fluency, suggesting that these strategies primarily affect the qualitative rather than quantitative aspects of malevolent creativity. In other words, weakening anger may not reduce the number of malicious ideas generated but can decrease their harmfulness and novelty. These findings further confirm the importance of both emotional arousal and implicit aggression as pathways through which anger influences malevolent creativity performance.

4. General Discussion

The present findings demonstrate that anger enhances malevolent creativity performance, while cognitive reappraisal and expressive suppression effectively weaken the malevolent creativity of angry individuals. Both emotional arousal and implicit aggression mediate the facilitative effect of anger on malevolent creativity and the attenuating effect of emotion regulation strategies. Effect size analyses indicate medium to large effects for the main findings, suggesting high reliability of the results.

Both experiments identify implicit aggression and emotional arousal as important pathways through which anger influences malevolent creativity performance. Emotional arousal appears to be a general pathway for the effect of anger on both malevolent and general creativity. This may occur for two reasons. First, creative activities require maintaining a certain level of cognitive activation to increase engagement of the cognitive system, thereby sustaining goal-related attention and effort (Byron et al., 2010; Gilet & Jallais, 2011). Anger, as a high-arousal emotional state, can enhance cognitive activation and mobilize more cognitive resources for the current task, thereby improving cre-

ativity performance. Second, research has found that anger (high arousal) activates broader semantic networks (Gilet & Jallais, 2011), whereas sadness (low arousal) inhibits semantic network activation (Bless et al., 1992; Bolte et al., 2003). Broad semantic activation helps individuals find novel connections between different categories and concepts, thereby promoting the generation of original ideas and enhancing creativity performance (Friedman & Förster, 2010). These two mechanisms may explain why emotional arousal serves as a general pathway for the effect of anger on creativity, including both general and malevolent creativity.

Implicit aggression may represent a specific pathway through which anger influences malevolent creativity performance. Experiment 1 found that implicit aggression mediated the effect of anger on malevolent creativity but not on general creativity. Both experiments found that only implicit aggression mediated the effect of anger on idea harmfulness. Research has shown that anger is closely linked to aggression (Anderson et al., 1996; Berkowitz, 1990; Roseman et al., 1994). On one hand, anger can interfere with higher-order cognitive processes including moral reasoning and judgment (Anderson & Bushman, 2002). On the other hand, anger may provide justification for aggressive behavior, leading individuals to make faulty emotional attributions and thereby increasing aggression levels (Anderson & Bushman, 2002). Thus, anger may disrupt moral judgment and emotional attribution regarding aggressive behavior, inducing high levels of implicit aggression and making individuals more inclined to explore harmful ideas. To successfully achieve harmful goals, individuals then tend to think of more numerous and novel (unexpected) harmful ideas.

The study also found that both cognitive reappraisal and expressive suppression effectively reduced angry individuals' emotional arousal and implicit aggression levels. Mediation analyses revealed that these reductions in emotional arousal and implicit aggression effectively decreased the fluency and originality of angry individuals' malevolent creativity, while reductions in implicit aggression also effectively weakened idea harmfulness. These findings not only demonstrate that cognitive reappraisal and expressive suppression can effectively weaken angry individuals' malevolent creativity performance but also reveal the underlying mechanism: these strategies reduce malevolent creativity by decreasing emotional arousal and implicit aggression levels.

This study has both theoretical and practical significance. Theoretically, it enriches research on factors influencing malevolent creativity and provides evidence and explanations for the effect of anger on malevolent creativity and its underlying mechanisms. Practically, it confirms that cognitive reappraisal and expressive suppression strategies can effectively weaken the malevolent creativity of angry individuals, highlighting the necessity of regulating anger to avoid or reduce the social harm caused by the dark side of creativity.

This study has several limitations. First, to maintain consistent task order across conditions for comparison purposes, Experiment 1 used a fixed task order without counterbalancing. The potential effects of task order on the results

warrant further investigation. Second, considering the accuracy and ecological validity of emotion induction, this study used only autobiographical recall tasks. Future research could employ other induction methods, such as combining visual and auditory materials or using embodied induction through facial expressions and postures. Third, this study examined only the two most common and effective emotion regulation strategies. Future research could include other types of strategies, such as avoidance or attentional distraction, to compare their effectiveness. Finally, the sample had a higher proportion of female participants. Whether gender differences exist in the effects of anger on malevolent creativity performance and its underlying mechanisms requires further investigation.

Main Conclusions

1. Anger enhances both general and malevolent creativity performance.
2. Implicit aggression and emotional arousal are two important pathways through which anger influences malevolent creativity performance, with the implicit aggression pathway being specific to malevolent creativity (relative to general creativity).
3. Cognitive reappraisal and expressive suppression strategies can effectively regulate anger and weaken angry individuals' malevolent creativity performance, with implicit aggression and emotional arousal serving as important mediators in this process.

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Appendix: Experimental Materials

Self-Assessment Manikin (SAM)

1. Please rate your current emotional valence level
2. Please rate your current emotional arousal level

Positive and Negative Affect Schedule (PANAS)

Please rate your current emotional state. Please respond honestly without overthinking, based on your first impression. Circle the appropriate number.

1. How worried do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
2. How disappointed do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
3. How angry do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
4. How calm do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
5. How anxious do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
6. How happy do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
7. How satisfied do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
8. How sad do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
9. How tense do you feel right now?
   - Not at all 1 2 3 4 5 6 7 8 9 Very much
10. How relaxed do you feel right now?
    - Not at all 1 2 3 4 5 6 7 8 9 Very much

Autobiographical Recall Task

Anger Induction: For the next 5 minutes, recall a recent incident that made you feel angry. Try to vividly re-experience that moment, then write in detail about what happened, the surrounding circumstances, and your thoughts at the time.

Sadness Induction: For the next 5 minutes, recall a recent incident that made you feel sad. Try to vividly re-experience that moment, then write in

detail about what happened, the surrounding circumstances, and your thoughts at the time.

Neutral Emotion: For the next 5 minutes, recall a typical day in your recent campus life, then write in detail about your schedule from morning to evening.

Word Preference Task

This is a word association task. Based on your first impression, select one character from the left options to form a word with the character on the right. Mark your choice with a "√" . There are no right or wrong answers.

1. {___} money
2. flow {___}
3. {___} material
4. group {___}
5. hit {___}
6. report {___}
7. decide {___}
8. down {___}
9. draw {___}
10. tie {___}
11. strong {___}
12. {___} fall
13. {___} light
14. rob {___}
15. grab {___}
16. kill {___}
17. flow {___}
18. {___} egg
19. {___} melon
20. lose {___}
21. small {___}
22. release {___}
23. foolish {___}
24. nest {___}
25. defeat {___}

Malevolent Creativity Task (MCT)

Xiao Ming broke the classroom projector. Afraid of being criticized by the school and required to pay compensation, he doesn' t want to be found out. What can Xiao Ming do to frame a classmate without getting caught? Please think of and verbally report various novel framing methods within 10 minutes. The more methods and the more novel, the better!

Experiment 2 Pre-regulation: Xiao Wang has had a crush on someone for a long time, but suddenly a romantic rival appears. Please think of a novel way

for Xiao Wang to damage the rival' s image. What can Xiao Wang do to damage the rival' s image? Please think of and verbally report various novel methods within 5 minutes. The more methods and the more novel, the better!

Experiment 2 Post-regulation: Xiao Li wants to rank at the top of the class in the final exam. Please think of a novel way for Xiao Li to interfere with classmates' studying. What can Xiao Li do to interfere with classmates' studying? Please think of and verbally report various novel methods within 5 minutes. The more methods and the more novel, the better!

Alternative Uses Task (AUT)

Please think of and verbally report novel uses for a candle within 5 minutes. Brief expressions are acceptable. The more ideas and the more novel, the better!

Emotion Regulation Tasks

Cognitive Reappraisal: Cognitive reappraisal is an emotion regulation strategy that involves reinterpreting an emotional experience from a positive perspective. For example, after failing an exam, one might think that one test score doesn' t define them and they can do better next time. Please turn to page 4 and recall the incident that made you angry. Spend 3 minutes using cognitive reappraisal to write in detail about how you would handle the situation if it happened again.

Expressive Suppression: Expressive suppression is an emotion regulation strategy that involves inhibiting the expression of emotional experiences, hiding one' s feelings so others cannot tell. For example, after failing an exam, one might act as if it doesn' t matter and not let others see their sadness. Please turn to page 4 and recall the incident that made you angry. Spend 3 minutes using expressive suppression to write in detail about how you would handle the situation if it happened again.

Control Condition: Please turn to page 4 and recall the incident that made you angry. Spend 3 minutes copying the following text: " 'Wu' mainly refers to living things (animals and plants), while 'hou' is what ancient Chinese people called qi and hou. Over two thousand years ago, ancient Chinese people divided the year' s seasonal changes into so-called twenty-four solar terms, and divided natural phenomena occurring under the influence of cold and heat into seventy-two hou. The use of phenological knowledge to guide agricultural production has developed into a science worldwide, called phenology."

Task Difficulty Rating

Please rate how difficult you found the task you just completed (emotion regulation task). 1 = Very easy, 9 = Very difficult.

Very easy 1 2 3 4 5 6 7 8 9 Very difficult

Buss-Perry Aggression Questionnaire (BPAQ)

This questionnaire asks about your emotional expression. It contains 22 items. After reading each item, please consider how much it describes you and mark the number that best fits you. Your answers may vary depending on time or situation, so please respond based on your typical state. There are no correct answers; please answer honestly without overthinking.

22. I have difficulty controlling my temper.

Runco Ideational Behavior Scale (RIBS)

The following items use a 0-4 scale to indicate how frequently you typically have certain thoughts. Please mark the number that best represents your actual thoughts. Note that the focus is on your thoughts, not what you think you should actually do. This survey is anonymous and your responses will be kept confidential. If you have difficulty with certain items, please select the option closest to your thoughts.

0 = Never
1 = About once a year
2 = About once or twice a month
3 = About once or twice a week
4 = Almost daily, sometimes more than once a day

3. After reading what others have written, I realize there are other perspectives and have my own ideas about the topic.
4. I often can' t sleep at night because many ideas come to mind, keeping me awake.
5. When I make plans (e.g., to eat at a specific restaurant or see a particular movie) and they get disrupted, I can easily find alternatives.
6. When I see clouds, shadows, and similar ambiguous images, I imagine what these shapes and images might be.
7. When writing letters, I have difficulty staying on one topic because I think of many things simultaneously.
8. After listening to songs, I can think of different or better lyrics.

Malevolent Creativity Behavior Scale (MCBS)

Each question below has five frequency options. Please mark the number that best reflects your actual situation based on your personal experience. 1-5 represent from "never" to "always." Each option only reflects objective circumstances, with no value judgment.

1. Never

2. Rarely
3. Sometimes
4. Often
5. Always

Note: Figure translations are in progress. See original paper for figures.