Anger Has Benefits for Attaining Goals

Heather C. Lench, Noah T. Reed, Tiffany George, Kaitlyn A. Kaiser, and Sophia G. North
Department of Psychological and Brain Sciences, Texas A&M University

Functional accounts of emotion have guided research for decades, with the core assumption that emotions are functional—they improve outcomes for people. Based on functional accounts of emotion, we theorized that anger should improve goal attainment in the presence of challenges. In seven studies, goal attainment was assessed in situations that involved varying levels of challenges to goal attainment. Across studies, anger compared to a neutral condition resulted in behavior that facilitated greater goal attainment on tasks that involved challenges. With a goal to solve difficult puzzles, anger resulted in more puzzles correctly solved (Study 1). With a goal to attain prizes, anger increased cheating rates and numbers of unearned prizes (Study 2). With a goal to do well in a video game, anger increased scores on a game with challenges to be avoided, but not other scores (Study 3). In two studies, examining the consequences of anger in response to the challenging task that was the focus of that anger, anger decreased reaction time with goals to win trials (Study 4), and predicted making the effort to vote in two contentious elections (Study 5). With a goal to protect financial resources, anger increased action taken to prevent loss compared to a physiological arousal condition (Study 6).

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Usually when people are sad, they don't do anything.

They just cry over their condition.

But when they get angry, they bring about a change.
                    —Malcolm X, quoted in G. Breitman (1965)

People often believe that a state of happiness is ideal, and the majority of people consider the pursuit of happiness a major life goal (Diener, 2000). However, recent research has made clear that a mix of emotions, which includes negative states, results in the best outcomes (Cole et al., 2004; Weidman & Kross, 2021). The benefits of emotion have been debated for centuries, and potential benefits are highlighted in a class of theories called functional accounts of emotion, that underlie many hypotheses about emotion. However, there have been few empirical tests of a major assumption underlying these accounts: emotions function to respond to goal challenges. From this perspective, it is not that some emotions are beneficial and some are harmful, but rather specific emotions should result in better outcomes in particular types of situations. In other

words, much like a Swiss army knife that includes different tools to address different needs, different emotions are best suited to solve specific problems (H. C. Lench et al., 2011, 2016). In the present investigation, we focused on the theorized function of the emotion of anger and predicted that anger would improve goal attainment in the presence of challenge.

Functional Accounts of Emotion

According to the functional theories, goal discrepancies represent adaptive challenges that affected reproductive success in evolutionary history, and emotions are coordinated responses that function to resolve those challenges (e.g., Cosmides & Tooby, 2000; H. C. Lench et al., 2015; Mauss et al., 2005; Pinker, 1997). These theories make several assumptions. A first core assumption is that emotions result from a discrepancy between the desired and current status of goals—a difference between what people want and what they have

(Carver, 2004; Frijda, 1987; H. C. Lench et al., 2011). In Berkowitz (1988; 1990) neoassociation model, this is experienced as discomfort. In the majority of accounts that focus on goal-related emotions, this discrepancy is perceived and results from rapid, typically unconscious, evaluations of goal status (Arnold, 1960; Ellsworth & Scherer, 2003; Roseman & Smith, 2001). Accordingly, people experience negative emotions, such as anger, when they perceive that they are not getting what they want, with the particular negative emotion depending on the nature of the discrepancy (Campos et al., 1994). People experience positive goal-related emotions, such as excitement, when they perceive an opportunity to get what they want or when they have gotten what they want. Across multiple studies, people's perceptions of discrepancy predict emotional responses, including the specific emotions that they experience (e.g., Gable & Harmon-Jones, 2008; Moors et al., 2013; Scherer & Meuleman, 2013). In one study of daily emotional experiences, almost 70% of specific emotional experiences could be predicted from people's reports of the perceived goal-relevant events that preceded them (Oatley & Duncan, 1994). Thus, evidence supports the assumption that people's perception of situations predicts the specific emotional responses that they experience.

A second core assumption of functional accounts is that, once elicited, emotions are defined by coordinated changes in cognition, experience, physiology, and behavior (e.g., Ekman, 1992; Frijda, 1987; Izard et al., 1999; Lerner & Keltner, 2001; Mauss et al., 2005; Pinker, 1997; Rottenberg et al., 2007; Tomkins & McCarter, 1964). Consistent with the assumption that these changes are coordinated during emotional experiences, moderate-to-strong correlations occur among cognitive, behavioral, experiential, and physiological responses during sadness, anger, and anxiety (Bonanno & Keltner, 2004; H. C. Lench et al., 2011; Mauss et al., 2005). Further, responses across systems correspond to one another more strongly during emotional experiences than in neutral situations, suggesting that emotion organizes responses (Hsieh et al., 2011; Levenson, 2014). This is not to say that emotions are deterministic, in the sense that a particular goal-discrepancy will always be associated with particular changes across systems. Rather, emotions that result from the perception of particular goal discrepancies, increase the likelihood of particular responses.

The focus of this investigation is on the third core assumption of functional accounts: that emotions function to resolve goal-related challenges, with a specific focus on the emotion of anger. Given the prevalence of the general assumption that emotions are functional and that even negative emotions do something other than make people feel badly, it might come as a surprise that there is scant evidence to support the idea that specific emotions help resolve challenges to goals in nonsocial situations, particularly for specific negative emotions such as anger (Frijda, 1986; Lebel, 2017; H. C. Lench et al., 2016). Certainly, there are hundreds of studies that demonstrate specific emotions cause changes in behavior, cognition, and physiology in ways that *might* be functional, in that one can justify why these changes could potentially be beneficial (see H. C. Lench et al., 2011, for a review). However, studies to date have not further demonstrated that those changes *are* functional, in that people experiencing specific emotions are able to better attain goals within the specified situations (see H. C. Lench et al., 2015, 2016, for reviews).

The Function of Anger

Anger was selected as the target emotion in the current investigation because it is frequently discussed as an emotion that should be regulated or controlled and is hedonically aversive (so much so that people will pay money to avoid experiencing it; Lau et al., 2013). Yet, according to the functional accounts, anger should facilitate goal pursuits in particular situations (Carver, 2004; Frijda, 1986, 1987; H. C. Lench et al., 2011; Levine, 1995; Oatley & Johnson-Laird, 1996; Roseman et al., 1996). The first assumption of functional theories that specify the situations that elicit anger has been well-documented. Anger results when a goal is obstructed and requires attention if it is to be attained or a frustration eliminated (e.g., Berkowitz, 1990; Bodenhausen et al., 2001; Gross & Levenson, 1995; E. Harmon-Jones & Sigelman, 2001; Levine, 1995; Sell, 2011). Some accounts specify that the factor preventing goal attainment must be human to elicit anger, and some focus on perceived injustice by other humans (e.g., Keltner et al., 1993; Roseman, 2018; Sell, 2011; Smith & Ellsworth, 1985). Consistent with these accounts, anger is elicited by films and images that involve social injustice (see H. C. Lench et al., 2011, for a review of elicitations), and appraisals of blame predict anger (Siemer et al., 2007; Smith & Ellsworth, 1985). However, people report experiencing anger during a range of experiences involving obstructed goals that do not include humans, and nonsocial experiences effectively elicit anger (e.g., Averill, 1983; H. C. Lench et al., 2011; Oatley & Duncan, 1994). This includes imaginative tasks, recall, text excerpts, and real life experiences that involve challenges to goals (see review by H. C. Lench et al., 2011). Appraisals that goal attainment is blocked are associated with the prediction of anger in others (Levine, 1995) as well as the experience of anger (Scherer & Ceschi, 1997). Further, studies with infants frequently elicit anger by removing or blocking an attractive toy or video (Buss & Goldsmith, 1998; Stifter & Braungart, 1995). Together, the available evidence suggests that anger is elicited from the perception of a challenge to goals, including but not limited to challenges created by other people (see H. C. Lench et al., 2016, for review).

The second assumption of functional accounts that anger is associated with responses across systems has also been well-documented elsewhere. Generally, anger is associated with coordinated responses that characterize a "readiness for action" (Frijda, 1986; H. C. Lench et al., 2011, 2016; Roseman, 2018; Sell, 2011; Woodman et al., 2009). This activation when there is challenge to a goal is theorized to prompt a focus on achieving the goal until the goal is either achieved or irrevocably lost (Levine & Pizarro, 2004) and anger promotes greater attention to goals and decision making consistent with goals (Khan et al., 2019). In a meta-analysis, experimentally elicited anger was associated with moderate changes ($g = .51$) across all outcomes compared to neutral conditions, in directions consistent with this functional account (H. C. Lench et al., 2011). As with all emotions, this relationship is not deterministic but probabilistic, and individual responses during anger can be affected by a number of moderators (Buck, 2010; Levenson, 2011). For example, the perception of challenge to goals, and resulting anger, increases the likelihood of aggression, but whether this tendency is fulfilled depends on a number of moderators, including learning and attempts to regulate emotion or responses (e.g., Frijda, 1987; Izard, 2007; H. C. Lench et al., 2013; Lerner & Keltner, 2001; Panksepp, 2007). Similarly, anger is associated with activation of the left frontal

cortical region, but this relationship is stronger if people can take action than if they cannot take action (Harmon-Jones, 2003).

The third assumption of functional accounts, that anger functions to support goal attainment in the presence of challenge, is the focus of this investigation. The problem that causes anger is the perception of challenge to goals that are still attainable, and therefore functional accounts predict that anger will result in greater goal attainment in situations that involve challenge. Although many studies have demonstrated that anger changes responses in ways that appear or can be argued to be functional (e.g., see Berkowitz, 1990; Turner, 2007, for informative reviews), studies have infrequently assessed whether those responses are functional (Gould & Lewontin, 1979), and, when studies have assessed functionality, they focused exclusively on social outcomes.

In studies focused on social outcomes, there is evidence that the expression of anger affects the behavior of others in ways that promote goal accomplishment, primarily in that others are more likely to remove themselves as challenges or support the angry person's position (Weidman & Kross, 2021). Sell's recalibration theory (2011) includes that the expression of anger is a mechanism through which individuals recalibrate other people's perception of their own worth and the value placed on their opinions and desires. Consistent with this approach, evidence suggests that others respond with concessions to the expression of anger. In one study on the social consequences of anger, participants paired with another player (actually preprogrammed) who wrote that they were angry or happy about an offer during a negotiation (Van Kleef et al., 2004). Participants facing an angry opponent were more likely to concede. This appears to result because people perceive anger as an implied threat (Sinaceur et al., 2011). Similarly, participants concede to others expressing anger facially and in tone (Côté et al., 2013), and report they are more likely to comply with a verbal request if made by someone expressing anger (Ford & Tamir, 2012). These findings have limited ability to address the function of anger, as they focus exclusively on how other people respond to the expression of anger. Theoretically, the intrapersonal changes associated with anger should also provide benefits that are not completely dependent on responses from others.

Evidence supporting the function of anger in goal attainment in challenging situations outside of social situations is scant. Participants induced to feel angry performed better in a game that involved confrontation (shooting enemies) than participants feeling other emotions (Tamir et al., 2008). In one study, people induced to be angry kicked with more physical force than happy or neutral participants (Woodman et al., 2009), which could perhaps improve outcomes in physical encounters. Frijda (1986) suggested that the furrowed brow and frown common to angry expressions promote a visual focus on particular objects. There is also correlational evidence that greater anger is associated with persistence on difficult tasks and consequently better performance (H. C. Lench & Levine, 2008; Mikulincer, 1988; Schmitt et al., 2019). However, because of the nature of correlational designs, it is also possible that persisting longer elicits more anger. Thus, although the prediction that emotions function to resolve particular problems is core to functional accounts, there is very little attention to this relationship for anger outside of social situations. The focus of this investigation was on the degree to which anger results in greater goal attainment in challenging situations.

Additional Considerations

Multiple recent studies have demonstrated that people vary in their beliefs about the utility of emotions in particular situations and that these beliefs determine whether or not people will intentionally try to use emotions as tools (Kim et al., 2015; Weidman & Kross, 2021). However, for the majority of functional accounts, these beliefs should not matter for whether or not emotions help resolve particular problems. In other words, the theorized impact of specific emotions on goal attainment (i.e., resolving the discrepancy between the desired and current status of goals) should not depend on individuals' attitudes. Once elicited, the changes associated with specific emotions should function to enhance goal attainment in situations characterized by the adaptive challenge, regardless of whether an individual believes that emotion will be useful. Because of these different possibilities, several studies in the present investigation included an assessment of individual beliefs about the utility of anger to examine if these beliefs predicted outcomes.

Another important consideration is that the theorized impact of specific emotions on goal attainment should not be limited to the eliciting situation, and instead should have crossover effects (H. Lench & Levine, 2005; Lerner & Keltner, 2001). Crossover effects have been documented that emotions impact subsequent cognitions unrelated to the situation that elicited the emotion (e.g., Lerner & Keltner, 2001), but relatively little work has focused on crossover effects of emotion on behavior. Of course, emotions in daily life would typically affect cognition and behavior within the same situation that elicited them, but theoretically that need not be the case. People appear to be intuitively aware that emotions can impact their performance in subsequent situations, expressing preferences for stimuli that will elicit specific emotions before they enter particular types of situations (e.g., preferring to watch a video clip that elicits anger before entering a contentious negotiation; Tamir & Ford, 2009). In the present investigation, most studies included an anger evoking task and behavioral responses were measured in a subsequent situation. This combination also permits stronger causal inferences than if emotion was only elicited by and the effects measured on the exact same task.

In order to assess the consequences of anger for goal attainment in the presence of challenges, comparison conditions had to be selected in the experimental studies. A strong comparison, which is frequently included in studies of emotion, is the target state compared to a neutral condition. In the present investigation, we regarded this as the most direct assessment of the effects of anger. However, we also included multiple other conditions for comparison, in order to shed light on the processes influencing this relationship. We selected conditions for comparison that involved states that varied in valence and approach motivation. Some theories of emotion posit that the effects of emotion on behavior are best captured by either valence (positive, negative) or motivation (approach, avoidance), or a combination of both (e.g., see Harmon-Jones, 2003; H. C. Lench et al., 2011; Russell, 1980, for critical reviews of these perspectives). Anger is typically considered a negative, approach-motivated, emotion (Harmon-Jones et al., 2011). Therefore, for comparison, we selected sadness as another negative state that is low approach (Gray et al., 2011), desire as a high-approach positive state (E. Harmon-Jones & Gable, 2009), and amusement as a low-approach positive state (Gable & Harmon-Jones, 2008; although arousal can sometimes be elevated in

amusement, see Haddad & Cakmak, 2017). We also included a physiological arousal condition for comparison to the anger condition in Study 6.

The Present Investigation

Materials for Studies 1, 2, 3, 4, and 6, and preregistered hypotheses for Studies 1–3 and Study 6 are available at https://osf.io/6zg9b/?view_only=b900a120468342fa91f97da6378beb61. Materials for Study 5 are available at https://osf.io/ph4xf/?view_only=7def0c4ac9f84241852fce125a452e4b. Materials that are copyrighted or protected (i.e., International Affective Picture System [IAPS] images, exercise video) are not posted, but detailed information is provided in text. Participants did not consent that their data could be publicly available in aggregate form; authors will follow current APA policy to make data used in a published study available in a timely manner upon request. Supplemental Materials include descriptive statistics for study variables not reported in the main text.

Studies examined whether anger resulted in greater goal attainment in the presence of challenges, including persisting on difficult puzzle tasks (Study 1), cheating to attain prizes (Study 2), physically avoiding objects in a video game (Study 3), signing a petition to avoid financial loss (Study 6). Study 4 examined whether anger elicited by a reaction time task predicted responses on that task, and Study 5 examined whether anger elicited by considering an upcoming election predicted voting behavior in two contentious presidential elections. In all studies, we hypothesized that anger would result in better performance in attaining goals, particularly in situations characterized by challenges to goals. In studies that used an experimental approach, the primary comparison was anger relative to the neutral conditions.

Study 1

Study 1 was designed such that participants' goal was to solve more puzzles. Anger was expected to increase goal attainment (i.e., number of puzzles solved) relative to a neutral state on challenging puzzles. The difficulty of the puzzles in this situation can be overcome with greater persistence in attempting to solve the puzzles, and therefore, we also examined persistence on the task. In addition to comparison to a neutral condition, the effects of anger were compared to the effects of other states that varied in their valence and approach orientation.

Method

Undergraduate students received course credit for their participation (*n* = 233; from the original sample, one participant was removed for failing to understand the task and just reading the puzzles instead of solving them, five for extremely short time on the task, and six for experimenter error or study disruptions that resulted in a loss of data). Power analyses using an effect size of .31 (previously established for behavioral outcomes in studies with similar emotion elicitations [H. C. Lench et al., 2011]), indicated a sample size of 223–263 would yield power of .90−.95. Accordingly, this was the target for participant recruitment.

Participants were randomly assigned to emotion condition (anger, neutral, amusement, desire, sadness). Emotions were elicited through images that forwarded automatically in a slide show consisting of fifteen images displayed for 5 s each (a common emotion elicitation associated with medium-to-large effect sizes; H. C. Lench et al., 2011). Images from the IAPS (Lang, 1995) were chosen that have been shown to elicit amusement, sadness, anger, or neutral emotion in the previous standardization studies (Mikels et al., 2005).[1] The number of IAPS images that elicit anger specifically is relatively small, and therefore, we developed seven images specific to the study population (e.g., insults to the university football team). Images to elicit desire were based on the previous elicitations with dessert images (Gable & Harmon-Jones, 2008). Before viewing the images, participants were told that the images were for a memory task later in the session (to encourage attention to the images and to decrease their awareness of attempts to alter their emotional state), and they rated their emotions before and after on scales from *not at all* (1) to *intensely* (9). The emotion elicitation was effective, as shown in Figure 1, with the target emotion increased in each condition after the elicitation compared to before, and with the target emotion greater in each condition after the elicitation compared to the neutral condition.

Participants then completed four sets of seven anagrams (words to unscramble) that varied in difficulty based on pilot testing (H. C. Lench & Levine, 2008). The first set was the focus of analyses (see preregistered plan) and pilot tested to be difficult (i.e., 50% of pilot student participants solved the anagram correctly with unlimited time in pilot). Participants were told that they would have 20 min to complete a test of verbal intelligence that consisted of jumbled words that they needed to unjumble. This description was intended to clarify that the goal for the task was to solve as many anagrams as possible in a domain of importance to students (appearing intelligent). Each anagram was presented individually on the computer screen, and participants were given a sheet of article on which to write their answers. They were told that they could move on to the next anagram at any time, but that once they moved on they would be unable to go back. The computer program recorded how long participants spent on each anagram.

To explore if any increased goal attainment associated with emotion condition could be accounted for by people's beliefs, participants also rated the utility of different emotions (e.g., "to what

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[1] *Anger:* IAPS 6360, 9180, 9560, 9810; woman with angry face pointing accusingly; man with angry face pointing accusingly; billboard showing "God hates [name of school identity]"; T-shirt showing "I hate [state name]"; major rival football players tackling university football players; statement of "I love football, I hate [name of school identity]"; image insulting school mascot; a young boy being grabbed by a man and looking scared; a man standing on a starving infant; the school logo with graffiti that they "suck!"; an image of two men in diapers with bottles and statement "meanwhile at [school name]". *Neutral:* IAPS 5740, 5870, 6150, 7000, 7001, 7009, 7014, 7025, 7058, 7081, 7130, 7150, 7175, 7185, 7235. *Desire:* IAPS 7350, 7410, 7451; cheesecake with chocolate drizzle; fudge cake with chocolate frosting; lava cake with center showing liquid chocolate; crepes with strawberries; chocolate covered strawberries; chocolate ice cream with raspberries; parfait with toppings; traditional cheesecake with fruit topping; macaroons and small cupcakes; round sponge cake with frosting; boxed truffles; M&M cookies. *Sad:* IAPS 2205, 2520, 2900, 3230, 3300, 9000, 9561; woman with head bowed over casket; military funeral with tombstones; military members with heads down at funeral; pelican covered in oil; person sitting crunched with head down in dark hallway; man and woman hugging in hospital corridor; girl crunched by cement wall with hand to head; starving dog from side. *Amusement:* IAPS 1340, 1810, 1811, 1920, 2344, 2352, 7195, 8600; cute kitten playing with a duck; cute kitten with frog hat; puppy that appears to be smiling; two small dogs cuddled; young child with hair standing on end; laughing girl; laughing infant.

Figure 1

Means (and Standard Errors) for Emotion Intensity for Each Condition Before the Elicitation (Condition Pre) and After the Elicitation (Condition Post), as Well as Scores for the Target Emotion in the Neutral Condition (Neutral Post)
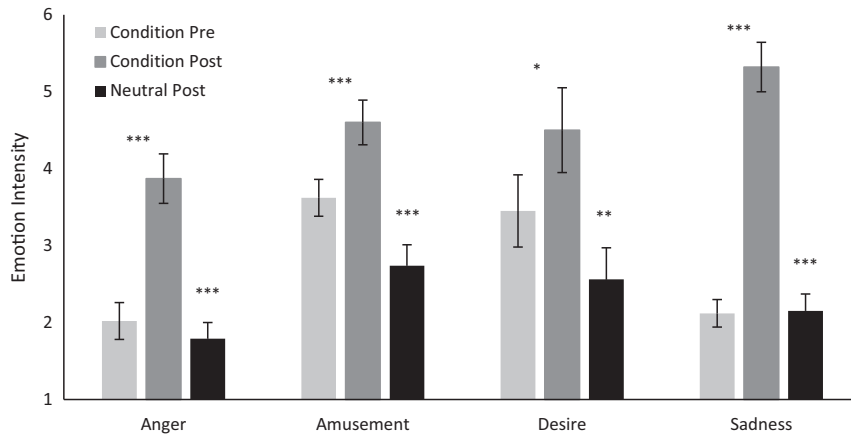
Note. Contrasts are shown comparing the target emotion for each condition before and after the elicitation, as well as the target emotion after the elicitation in each condition compared to the neutral condition.

* *p* < .05.   ** *p* < .01.   *** *p* < .001.

extent would it be useful for you to feel angry while working on a challenging task") on scales ranging from *not at all* (1) to *extremely* (7) (adapted from Tamir et al., 2008). They were then asked what they believed the study was about, debriefed, and thanked for their participation.

Results

As shown in Figure 2, an analysis of variance (ANOVA) revealed that emotion condition affected the number of anagrams correctly solved on the difficult first set, $F(4, 228) = 3.65$, $p = .007$, $\eta_p^2 = .06$. The primary contrast of interest showed that participants in the anger condition solved more anagrams than those in the neutral condition,

$t(90) = 3.82$, $p < .001$, $d = .81$. Compared to the neutral condition, this represents a 39.18% improvement in goal attainment (anagrams solved) when angry. Contrasts revealed that participants in the anger condition also solved more anagrams than those in the amusement condition, $t(93) = 3.11$, $p = .002$, $d = .64$; the desire condition, $t(93) = 2.64$, $p = .010$, $d = .55$; and the sad condition, $t(84) = 2.39$, $p = .019$, $d = .52$. Across all conditions, self-reported anger after the emotion elicitation predicted solving more anagrams on this difficult set ($\beta = .21$, $t = 3.33$, $p = .001$). The improvement in goal attainment was specific to this challenging set, with no difference among conditions in goal attainment on a subsequent easy set of anagrams, $F(4, 228) = 0.96$, $p = .43$. (The sets included this easy set, an impossible set, and a second difficult set. There was a time limit, and

Figure 2

Anger Increased Goal Attainment (Number of Difficult Anagrams Solved)
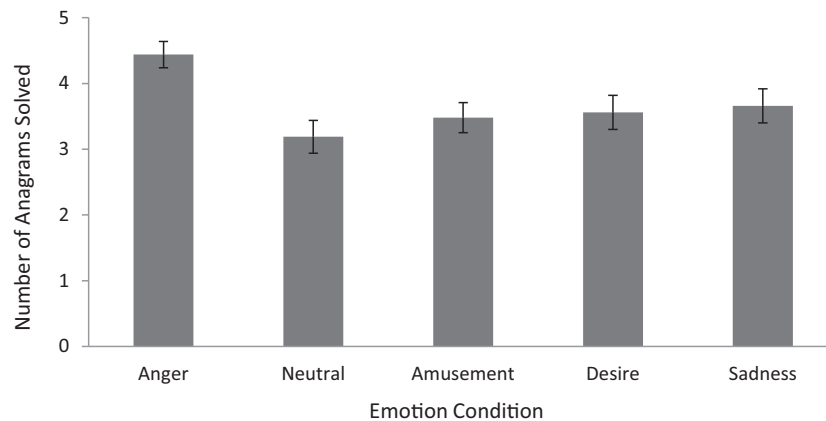
Note. Means (and standard errors) of number of anagrams solved in Study 1 for each emotion condition.

25% of participants did not make it to the second difficult set. Although not the focus of this study based on the preregistered approach, a repeated measure ANOVA with scores on the three solvable sets showed an interaction between condition and set, $F[8, 456] = 2.39$, $p = .016$, $\eta_p^2 = .04$.)

We expected that anger would result in greater goal attainment on this challenging task in part due to greater persistence when encountering difficulty, and anger has correlated with greater persistence in previous studies (e.g., H. C. Lench & Levine, 2008). There was a difference in time spent on the first difficult set of anagrams based on emotion condition, $F(4, 228) = 2.79$, $p = .027$, $\eta_p^2 = .05$. Participants in the anger condition spent more time on the difficult set of anagrams ($M = 53.78$, $SD = 19.87$) compared to participants in the neutral condition ($M = 44.50$, $SD = 19.71$), $t(90) = 2.25$, $p = .027$, $d = .47$. They also spent more time than participants in the amusement condition ($M = 43.95$, $SD = 20.97$), $t(93) = 2.34$, $p = .021$, $d = .49$; the desire condition ($M = 44.17$, $SD = 19.16$), $t(93) = 2.40$, $p = .018$, $d = .50$; and the sad condition ($M = 41.11$, $SD = 15.62$), $t(84) = 3.26$, $p = .002$, $d = .71$.

However, interpretation of this result is complicated by the fact that participants can spend less time on anagrams either because they are giving up in the face of difficulty or they reach the solution relatively quickly. To address the possibility that participants in the anger condition were persisting longer because they were having more difficulty solving anagrams than participants in the other conditions, we conducted a supplemental moderation analysis to determine if emotion condition (anger vs. all other conditions) changed the relationship between persistence and success (using Process Model 1; Hayes, 2018). The results revealed a significant interaction between emotion condition and persistence, $t(229) = 2.03$, $p = .043$. The nature of this interaction was that this relationship was nonsignificantly positive in the anger condition, $t = 1.11$, $p = .270$, whereas participants in the other conditions were less likely to solve anagrams when they persisted, $t = -2.31$, $p = .022$. [Persistence coefficient $= .00001$, $SE = .0000$, 95% CI [.00, .00], $t = -2.31$, $p = .02$; condition coefficient $= -.39$, $SE = .77$, 95% CI [-1.90, 1.12], $t = -.51$, $p = .61$; R^2 change with moderator $= .02$, $F(1, 229) = 4.14$, $p = .04$]. The overall moderation effect and the direction of the relationships suggest that greater persistence in the anger condition was not due to greater difficulty with solving the anagrams, as the relationship was not negative between persistence and reaching a solution, as was the case in all other emotion conditions.

Although not the main focus of the present investigation, participants reported perceived utility of specific emotions in particular types of situations. According to functional accounts, the impact of specific emotions on goal attainment should not depend on individual attitudes. Of course, because this is a null hypothesis, it is difficult to definitively rule out this possibility, although the weight of evidence across studies can be used to support the lack of a relationship. The perceived utility of anger in challenging situations did not correlate with number of anagrams solved in the anger condition, $r(45) = .10$, $p = .522$.

Study 2

Study 2 included a task that has been used in past investigations of cheating behaviors. Participants were notified that they could win prizes based on the number of problems that they solved within a specified period of time. Unlike Study 1, we were not interested in number of problems solved on the task (it was intentionally selected because people perform very poorly on the task and because it motivates cheating behavior). Instead, we were interested in what participants would do after the task to attain the goal of winning prizes. The study was designed such that participants had a chance to misreport the number of problems they solved and goal attainment (i.e., more prizes) could therefore be accomplished through cheating. We do not mean to imply that cheating is good or a way to success, only that it can be an effective way to attain more resources than one would otherwise have access to. In the situation present in Study 2, cheating therefore represents a behavior that can help attain goals. Anger was expected to increase cheating to attain unearned prizes compared to the neutral condition. Additional comparison conditions were included that varied in valence and approach motivation to provide insight into the degree to which these might contribute to any differences.

Method

Undergraduate students received course credit for their participation ($n = 242$; $M_{age} = 18.81$, $SD = 1.56$, 72% female; 64% White/Caucasian, 5% Black/African American, 8% Asian/Pacific Islander, 22% Hispanic/Latinx, 1% multiracial). Power analyses using an effect size of .31 (previously established for behavioral outcomes in studies with similar emotion elicitations [H. C. Lench et al., 2011]), indicated a sample size of 223–263 would yield power of .90−.95. Accordingly, this was the target for participant recruitment. Participants completed the emotion elicitations described in Study 1.

Participants were then told that they would have 5 min to complete a test of reasoning and logic abilities, on which they had to find two three-digit numbers (e.g., 2.32) that equaled 10 when summed in a series of 19 puzzles (they completed an additional initial puzzle as a practice item, for a total of 20). They were further told that they could win university memorabilia for every puzzle task that they solved. This task cannot be completed within 5 min, meaning that all participants were still working when the experimenter stopped them. At the end of the 5 min, the experimenter told participants that they had to set up the next part of the study in another room, and that while the experimenter was gone they should add up the number of puzzles they correctly solved, write that number on a response sheet to be handed in, and throw the sheet with the puzzles away in a recycling bin. A hidden number on the sheet permitted the experimenter to later link the response sheets to the puzzle sheets (in one case, the participant shredded the sheet and it was taped back together). This situation gave participants an opportunity to cheat on the task by reporting that they completed more puzzles than they had (Shu et al., 2012).

At the conclusion of the study, participants completed the exploratory measure of the perceived utility of emotions and debriefing measures described in Study 1 (due to timing constraints, half of participants completed the exploratory measures), and prizes were awarded for reported performance on the puzzle task.

Results

As expected, participants performed poorly on the task (solving an average of 36% of the puzzles), and there were no differences in performance on the task based on emotion condition, $F(4, 227) = 0.14$,

$p = .97$, $\eta^2 = .002$. Overall, 38% of participants cheated on the task by reporting that they completed more puzzles than they actually had; these are lower overall cheating rates than has been documented in other populations with a similar task (e.g., Shu et al., 2012). A logistic regression with whether or not participants cheated as the outcome revealed that anger resulted in higher cheating rates (57%) compared to the neutral condition (27%), $B = 1.28$ $(SE = .44)$, $\beta = .28$, Wald(1) = 8.65, $p = .003$. Contrasts to the additional comparison conditions revealed that participants in the anger condition also cheated more than those in the desire condition (31%), $B = 1.07$ $(SE = .42)$, $\beta = .34$, Wald(1) = 6.57, $p = .010$, and the sadness condition (36%), $B = 0.86$ $(SE = .42)$, $\beta = .43$, Wald(1) = 4.17, $p = .041$, and nonsignificantly more compared to the amusement condition (40%), $B = 0.68$ $(SE = .41)$, $\beta = .51$, Wald(1) = 2.66, $p = .103$. The nonsignificant difference between anger and the amusement condition could potentially indicate shared processes that influenced cheating behavior. It is possible that the shared mechanism could be moral flexibility, which some studies have shown increase with some positive emotions (Vincent et al., 2013), and with a sense of deservingness that accompanies anger (e.g., Claassen, 2016; Feather, 2006). Across all conditions, self-reported anger after the emotion elicitations predicted more cheating, $B = 0.15$ $(SE = .07)$, $\beta = 1.16$, Wald(1) = 4.03, $p = .045$.

As in Study 1, we examined whether the perceived utility of anger correlated with goal attainment in the anger condition and found that the perceived utility of anger in challenging situations did not correlate with cheating behavior, $r(35) = .20$, $p = .25$.

Study 3

Study 3 was designed such that participants' goal was to attain high scores on a skiing video game, with one game that involved challenging play (avoiding flags) and one game that involved only a jump. This situation was selected for Study 3 because the cognitive changes associated with emotion are less relevant to the physical movement required in the games compared to the outcomes in Studies 1 and 2. Therefore, this task provided an opportunity to assess the generalizability of the effects of anger on behaviors that promote goal attainment in challenging situations.

Method

Undergraduate students ($n = 288$) completed the study for partial course credit. From the original sample, a total of 23 participants were removed, eight because the experimenters failed to record their scores, and the remaining for not following instructions (e.g., switching between games, counter to instructions). Power analyses using an effect size of .31 (previously established for behavioral outcomes in studies with similar emotion elicitations [H. C. Lench et al., 2011]), indicated a sample size of 223–263 would yield power of .90−.95. Accordingly, this was the target for participant recruitment.

Participants were introduced to a Nintendo Wii balance board and system and practiced playing each of two skiing games (the avatar was standardized across participants and already set up when participants began the session). One skiing game (ski slalom) involved skiing down a slope while avoiding multiple flags, and scores reflect the total time to finish the course with a penalty for each flag hit. The other skiing game (ski jump) involved a single jump. After practicing the games in counterbalanced order, participants were given an opportunity to ask questions about the games. Each game takes approximately 1 min, with small variation depending on the physical motion of participants on the balance board. They completed the emotion elicitation described in Study 1. Participants then played the two skiing games, in counterbalanced order, a total of three times each before starting the next game type. There were no differences based on counterbalanced task order in scores on the ski slalom game, $t(131) = 0.03$, $p = .97$, or the ski jump game, $t(131) = 0.57$, $p = .57$. To reduce performance anxiety, the experimenter left the room during this time and recorded scores from behind an observational window (leaving participants alone likely increased the number of participants who failed to follow instructions). In the ski slalom game, scores reflect the time to complete the course with a penalty for every flag hit; in the ski jump game, scores reflect the distance jumped. Scores were averaged across the three tries at each game for analyses.

At the conclusion of the study, participants completed the exploratory measure of perceived utility of emotion and debriefing measures described in Study 1

Results

To permit comparison of scores on the two skiing games with different score structures, z-scores were calculated for the score on each game. An ANOVA with condition (anger, neutral, amusement, desire, sad) as the between subject factor and game (slalom, jump) as the repeated measure showed no main effect of condition, $F(4, 283) = 0.92$, $p = .451$, $\eta_p^2 = .013$; no main effect of game, $F(1, 283) = 0.00$, $p = .972$, $\eta_p^2 = .00$; and a significant interaction between condition and game, $F(4, 283) = 3.50$, $p = .008$, $\eta_p^2 = .05$. Follow-up analyses revealed scores on the challenging skiing game (ski slalom) were affected by emotion condition, $F(4, 283) = 4.01$, $p = .004$, $\eta_p^2 = .05$. As shown in Figure 3, contrasts revealed that participants in the anger condition had better (i.e., lower) scores than those in the neutral condition, $t(113) = 3.83$, $p < .001$, $d = .72$. They also scored better than participants in the sadness condition, $t(116) = 3.64$, $p < .001$, $d = .68$, and not significantly better than participants in the desire condition, $t(113) = 1.84$, $p = .069$, $d = .35$. Participants in the anger condition did not score significantly better than those in the amusement condition, $t(112) = 0.64$, $p = .525$, $d = .12$. This pattern could indicate that general physical arousal had a benefit for game scores, as this would be greater in anger, amused, and desire conditions compared to the sad and neutral conditions. On the ski jump game, which was relatively easy, there were no differences in score based on emotion condition, $F(4, 283) = 0.57$, $p = .687$, $\eta_p^2 = .01$.

As in the previous studies, we again examined whether the perceived utility of anger related to goal attainment in the anger condition. The perceived utility of anger did not correlate with scores on the slalom skiing game, $r(47) = .09$, $p = .53$.

Study 4

Study 4 examined the relationship between anger elicited by a challenging task and responses on that task. This situation parallels situations faced in real life—where anger by a challenging situation and affects behavior in that same situation. Studies 1–3 have the methodological advantage of separating the elicitation of anger from the measurement of behavior to overcome challenges, which

Figure 3

Means (and Standard Errors) in Scores on a Challenging Game for Each Emotion Condition
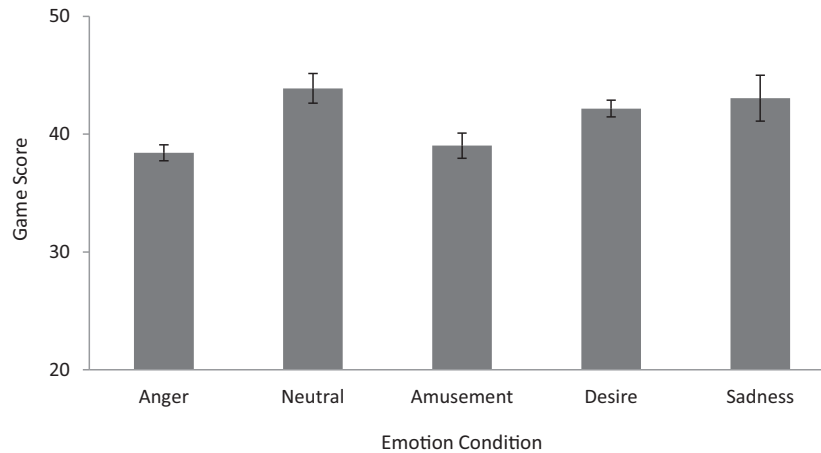
Note. Lower scores indicate better performance.

permits for stronger causal inferences. Study 4 was intended to replicate the pattern of findings in these methodologically stronger studies with a more ecologically valid paradigm where anger is elicited by, and the effects measured on, the same task.

Method

Undergraduate students enrolled in introductory psychology courses ($n = 131$, $M_{age} = 18.58$ years, $SD = 0.89$, 73% female) completed the study for partial course credit. The race/ethnicity of the participants was 69% White, 19% Asian, 5% biracial/multiracial, 3% Arab/Middle Eastern, 2% other, 1% Black/African American, and 1% Native American. Twenty-three participants were missing scores on the initial practice block because of a programming error and are not included in those comparisons. Power analyses using an effect size of .31 (previously established for behavioral outcomes in studies with similar emotion elicitations [H. C. Lench et al., 2011]) and an estimated correlation of .2 among measures, indicated a sample size of 110 would yield power of approximately .95. Accordingly, this was the target for participant recruitment.

To create a situation that both elicited anger and measured responses to that task, participants completed a modified version of the anger incentive delay task used in previous studies to effectively elicit anger (Angus & Harmon-Jones, 2019; derived from the monetary incentive delay task from Knutson et al., 2000). Participants were told that they would play a game where they had to respond within a set time to a target and could win or lose $0.50 on each trial depending on if they responded quickly enough. Participants were told to respond (using the spacebar) to the target on the screen before it disappeared to win the money, and that responding outside of the allotted time interval would result in a loss of money. They were informed they could only press the spacebar once per trial. They then completed four blocks with 20 trials in each block. During each trial, a cue (white circle) appeared for 500 ms, which indicated the trial was beginning. A fixation cross then appeared on the screen for 1,500 ms and then was replaced with the target stimulus in the middle of the screen, which took the form of

four white dots in a row. All participants completed a practice block of five trials to become familiar with the procedure, during which the target stimulus was displayed for 400 ms. The duration of the target stimulus varied between blocks and participants were given feedback about whether they succeeded and would win money (green text) or failed and would lose money (red text). This procedure is illustrated in Figure 4.

All participants completed three blocks after the practice, this included a success block, a success with incentive block, and an anger (challenge) block. On the success block, the response window was set at 400 ms, which meant that participants were highly likely to be able to respond within the window. On the success with incentive block, the response window remained long (500 ms) and participants were told that, if they did well on the next two blocks, their total winnings would be doubled. On the anger block, the response window was shortened (100 ms), which made it challenging to respond to the target before it disappeared. This situation has been shown to evoke the emotion of anger (Angus & Harmon-Jones, 2019).

Before starting the game and after each block, participants completed items from the Discrete Emotions Questionnaire (C. Harmon-Jones et al., 2016) previously used to measure responses to this task. Participants rated how angry, frustrated, calm, excited, and sad they were "right now" on scales from *not at all* (1) to *extremely* (7). Consistent with the prior use of this scale, the frustration and anger items were combined for analysis. At the conclusion of the game, participants reported their demographic information, and then were debriefed and thanked for their participation.

Results

A preliminary analysis confirmed that participants were less successful on the block that was designed to result in failure; a repeated measure ANOVA with number of trials correct (out of 20 possible) revealed differences across blocks, $F(3, 321) = 712.95$, $p < .001$, $\eta_p^2 = .93$. Consistent with the design of the blocks, participants had fewer correct trials on the anger-inducing block ($M = 2.85$,

Figure 4

Example of a Trial With Positive or Negative Monetary Feedback
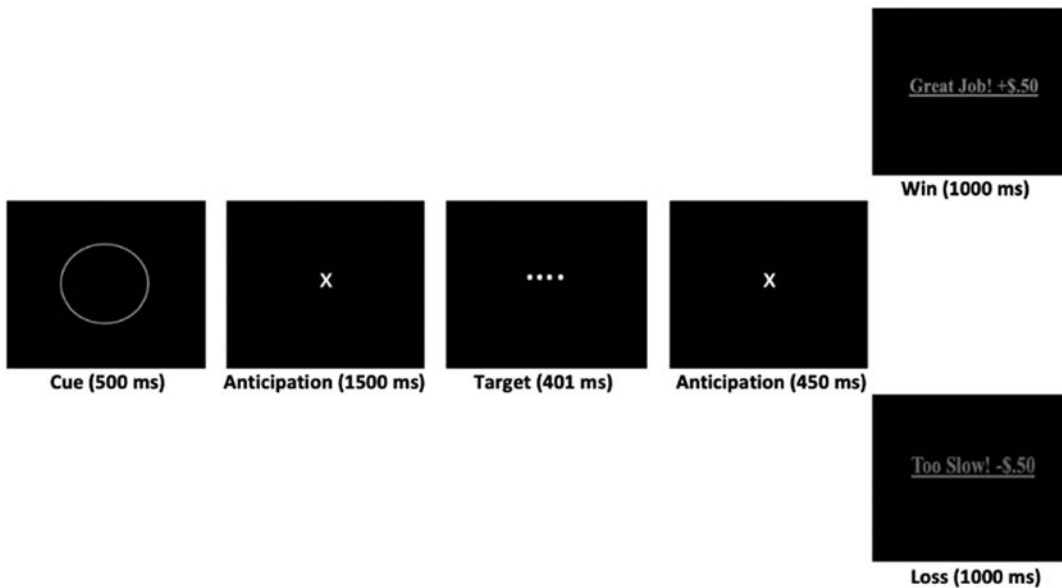
Note. Adapted from "The Anger Incentive Delay Task: A Novel Method for Studying Anger in Neuroscience Research," by D. J. Angus and E. Harmon-Jones, 2019, *Psychophysiology*, *56*(2), Article e13290 (https://doi.org/10.1111/psyp.13290). Copyright 2018 by Society for Psychophysiological Research. Adapted with permission.

$SD = 3.45$) compared to the success block ($M = 18.02$, $SD = 3.93$), $t(130) = 34.14$, $p < .001$, and the success block with an incentive block ($M = 18.70$, $SD = 3.53$), $t(130) = 40.78$, $p < .001$.

In a second preliminary analysis, Table 1 presents the means (and standard deviations) for emotion intensity before starting the trials and after each block. Anger was higher in the anger block than all the other blocks, all ts > 11.11, ps < .001. Participants also reported being less calm in the anger block than other blocks, all ts > 3.59, ps < .001. They tended toward being less excited in the anger block compared to before starting the trials, $t(130) = 1.96$, $p = .05$, and were less excited compared to the practice block, $t(130) = 2.45$, $p = .016$, but their excitement in the anger block did not differ from the success block, $t(130) = 1.03$, $p = .31$, or the success with incentive block, $t(130) = 1.74$, $p = .084$.

A repeated measure ANOVA with average reaction time per trial on each block revealed that speed of response differed across blocks, $F(3, 321) = 63.36$, $p < .001$, $\eta_p^2 = .37$. Shown in Figure 5, contrasts among blocks revealed that participants responded faster in the anger block than in the practice block, $t(107) = 10.35$, $p < .001$.

They also responded faster in the anger block than the success block, $t(130) = 31.27$, $p < .001$, and the success with incentive block, $t(130) = 18.52$, $p < .001$. Reported intensity of anger predicted faster reaction time on the anger block, $r(128) = .21$, $p = .02$. A regression analysis that included reported intensity of anger predicting reaction time on the anger block, controlling for reaction time on the practice block, as well as self-reported sadness, desire, and relaxation, revealed that self-reported anger predicted reaction time with these covariates, $\beta = .23$, $t = 2.32$, $p = .02$.

As another indicator of action to perform well on challenging tasks, participants were also asked at the end of each block if they wanted an opportunity to redo the block after the study was over, which typically works against participants' interest of leaving the study as soon as possible. A repeated measure ANOVA revealed a difference across blocks in the desire to redo the block, $F(3, 390) = 32.25$, $p < .001$, $\eta_p^2 = .20$. Participants were more likely to want to redo the anger block (38.2%) than the practice block (22.1%), $t(130) = 2.81$, $p = .003$; the success block (1.5%), $t(130) = 6.87$, $p < .001$; or the success with incentive block (1.5%), $t(130) = 8.40$,

Table 1

Means (and Standard Deviations) in Intensity of Emotions Before Starting the Blocks and After Each Block

Block	Anger *M* (*SD*)	Calm *M* (*SD*)	Excited *M* (*SD*)	Sad *M* (*SD*)
Pretrials	1.55 (0.87)	5.05 (1.58)	2.78 (1.56)	1.98 (1.31)
After control block	1.81 (1.08)	4.61 (1.77)	2.82 (1.54)	1.76 (1.20)
After success block	1.68 (1.11)	4.76 (1.77)	2.63 (1.67)	1.63 (1.13)
After desire block	1.69 (1.18)	4.62 (1.84)	2.73 (1.75)	1.61 (1.09)
After anger block	3.35 (1.71)	3.95 (1.73)	2.48 (1.58)	1.94 (1.31)

Figure 5
Means (and Standard Errors) in Average Reaction Time Across Blocks
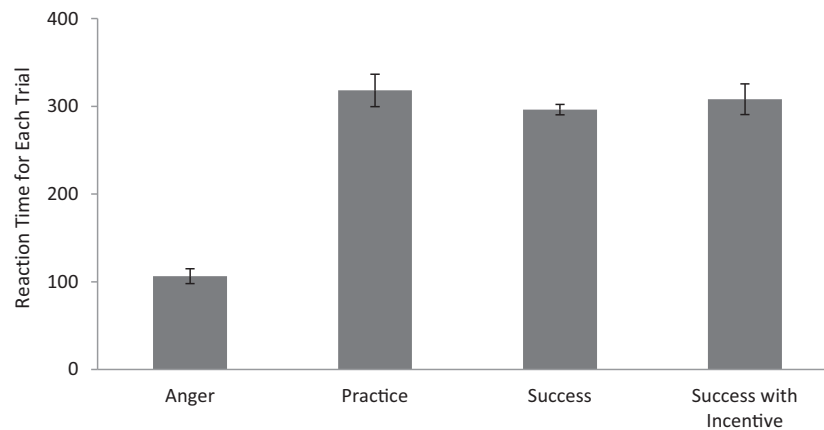
$p < .001$. Further, self-reported intensity of anger predicted a desire to redo the block, $r(131) = .38$, $p < .001$.

Study 5

Study 5 was designed to examine the relationship between anger and behaviors to avoid future negative outcomes. Specifically, eligible voters in two highly contentious elections (the U.S. Presidential elections of 2016 and 2020) reported the anger they felt in anticipating the win of the "other" candidate and reported their voting behavior in the election. This situation was selected because it represents an important real-world behavior that affects goal-related outcomes and because anticipatory emotion related to upcoming events directs behavior (Baumeister et al., 2007; Brown & McConnell, 2011) and elicits emotions in the moment (Loewenstein et al., 2001).

Method

Responses to the 2016 and 2020 U.S. Presidential election were collected as part of a larger investigation on people's ability to forecast their emotions (H. C. Lench, Levine, Perez, Carpenter, Carlson, Bench, & Wan, 2019; H. C. Lench, Levine, Perez, Carpenter, Carlson, & Tibbett, 2019; H. C. Lench et al., 2021; Levine et al., 2020, 2021; https://doi.org/10.17605/OSF.IO/PH4XF, for preregistered sample size); only methods and procedures relevant to the current investigation are reported here. Participants were excluded if they did not report their responses after the election or indicated they were not eligible to vote in the election. The final sample in 2016 was gathered from a large university in Texas, a large university in California, and MTurk, and included 989 participants. In 2016, the sample included 65% women, 24% men, and 1% with other gender identities, with an average age of 28.90 years ($SD = 12.64$; range of 18 to 70 years old), and 56% identified as Democrats, 30% as Republicans, and 15% as neither. Of the 813 of participants who reported voting, 63% voted for Clinton, 29% for Trump, and 8% for another candidate. In 2020, the final sample of 416 participants was gathered from a large university in Texas and a large university in California, and included 78% women, 19% men, and 3% with other gender identities, with an average age of 20.64 years ($SD = 3.35$; range of 18 to 50 years old), and 70% identified as Democrats, 17% as

Republicans, and 14% as neither. Of the 347 participants who reported voting, 83% voted for Biden, 17% for Trump.

Participants completed online surveys weeks before the election and again the week of the election outcome. In 2016, 3 weeks before the election, participants were prompted to

> Suppose it is an evening during the week of November 8th, days after the presidential election, and that Donald Trump/Hillary Clinton won the election and will be the next president of the United States. In general, how will you be feeling at that time?

They reported how angry and scared they would feel on scales ranging from *not at all* (1) to *extremely* (9). In 2020, 2 weeks before the election, participants were given the same prompt for Joe Biden/Donald Trump, except the time frame was given as "the week after the election is announced, days after the presidential election" due to the uncertainty about the time frame to announce a winner.

Participants who completed the Time 1 survey were invited to complete the second survey any time between 5 p.m. and midnight, for 3 days after the election outcome was announced. They reported whether or not they voted in the election, and, if so, who they voted for in the election.

Results

Election 2016

A logistic regression examined the relationship between voting behavior and anger if the nonpreferred candidate won the election. Anger predicted voting in the election, $\beta = 1.19$, Wald(1) = 31.95, $p < .001$. Anger was also higher among those who voted ($M = 6.31$, $SD = 2.64$) than those who did not vote ($M = 5.01$, $SD = 2.68$). The relationship between anger and voting held, $\beta = 1.19$, Wald(1) = 16.59, $p < .001$, after controlling for predicted fear, and fear was not a significant predictor of voting behavior, $\beta = 1.00$, Wald(1) = .001, $p = .97$. To be as conservative as possible in drawing inferences about this relationship, we also ran the logistic regression with anger predicting voting for those who supported Clinton and those who supported Trump separately. The relationship between anger and voting held when examining only those who supported Hillary Clinton, $\beta = 1.44$, Wald(1) = 15.18, $p < .001$, and when examining

only those who supported Donald Trump, $\beta = 1.17$, Wald(1) = 15.18, $p < .001$.

Election 2020

A logistic regression examined the relationship between voting behavior and anger if the nonpreferred candidate won the election. Anger predicted voting in the election, $\beta = 1.33$, Wald(1) = 20.54, $p < .001$. Anger was also higher among those who voted ($M = 6.30$, $SD = 2.73$) than those who did not vote ($M = 3.95$, $SD = 2.84$). The relationship between anger and voting held, $\beta = 1.26$, Wald(1) = 7.99, $p = .005$, after controlling for predicted fear, and fear did not significantly predict voting behavior, $\beta = 1.08$, Wald(1) = 0.91, $p = .34$. To be as conservative as possible in drawing inferences about this relationship, we also ran the logistic regression with anger predicting voting for those who supported Biden and those who supported Trump separately. The relationship held when examining only those who supported Joe Biden, $\beta = 1.34$, Wald(1) = 15.45, $p < .001$, but did not reach significance when examining only those who supported Donald Trump, $\beta = 1.23$, Wald(1) = 2.46, $p = .117$.

Study 6

Study 6 was intended to specifically compare an anger condition to a physiological arousal condition. There were indications in some studies, specifically Study 3, that the benefits for performance in the presence of challenges in the anger condition could be partially attributed to physiological arousal. Study 6 therefore including a physiological arousal condition for direct comparison, and measured responses in a situation unlikely to be impacted by physiological arousal (signing a petition to prevent a tuition increase). To be clear, we do not intend to argue that physiological arousal associated with anger did not contribute to increased performance in the presence of challenges in Study 3. Instead, we argue that physiological arousal is only one component of anger, and that other components can also increase the performance in challenging situations. In some situations, it is likely that physiological arousal contributes to performance; in other situations, cognitive or behavioral responses likely contribute to performance.

Method

Undergraduate students ($n = 126$, $M_{age} = 18.59$, $SD = 0.89$, 65% female; 82% White, 8% Asian, 5% other, 3% Black/African American, 2% biracial/multiracial, and 1% Native American) completed the study for course credit. One participant was removed because they did not complete the majority of trials. After review of Study 4 data indicated little response to the success trials, analyses in Study 6 focused on the anger condition versus a physiological arousal condition, and participant information reflects those conditions. Power analyses showed an actual power of .83 to detect relationships.

Participants completed the modified anger incentive delay task described in Study 4. Instructions for how to play the game were identical to those in Study 4: Participants were told they had to respond within a set time to a target and could win or lose $0.50 depending on how quickly they responded. All of the participants completed the practice and success blocks from Study 4. Participants in the anger condition then completed a third block

during which the target stimulus was displayed for 400 ms (same duration as the practice block), as in Study 4. For the first 12 trials, participants received accurate monetary feedback with regards to their performance. However, the remaining eight blocks were programmed to solely provide negative monetary feedback, which has previously been shown to evoke anger (Angus & Harmon-Jones, 2019).

Participants in the physiological arousal condition were assigned to complete cardio exercise while wearing a wristband heart rate monitor, instead of a third block of the game trials. Participants were instructed to follow along with a workout video, which included various exercises (e.g., jumping jacks, lunges, air squats) as well as modified versions of the exercises if needed. Participants exercised for 10 min while an experimenter monitored their heart rate to ensure that it stayed within the target heart rate zone for moderate cardio (between 64% and 76% of the maximum heart rate for a 20-year-old individual; Centers for Disease Control & Prevention, 2020). All participants maintained a heart rate within this range by the end of the cardio session. Before starting the game and after each block, participants completed the Discrete Emotions Questionnaire described in Study 4 (C. Harmon-Jones et al., 2016).

At the conclusion of the study, participants took part in a task that has previously been used to measure the effects of anger on behavioral responses and was used in the present investigation to assess action to address challenges to goals (Harmon-Jones, 2003). Participants were told that the experimenters had been asked to distribute some information by a student group. This information was a description of a 20% increase in student tuition that was likely to be implemented in the next academic year and the efforts of the group to stop the tuition increase. Along with the information, they saw a Quick Response code that they could scan to sign a petition from a student group trying to prevent the increase and scans of the Quick Response code were recorded.

Results

In a preliminary analysis, anger was higher in the anger condition ($M = 2.86$, $SD = 1.53$) than in the physiological condition ($M = 1.55$, $SD = 0.87$), $t(120) = 5.74$, $p < .001$. Participants in the anger condition did not differ in their calmness ($M = 4.06$, $SD = 1.60$) from the physiological condition ($M = 3.86$, $SD = 1.72$), $t(120) = 0.66$, $p = .51$. Participants in the physiological condition reported greater excitement ($M = 3.05$, $SD = 1.76$) compared to the anger condition ($M = 2.46$, $SD = 1.54$), $t(120) = 1.98$, $p = .05$.

An independent t test comparison revealed that participants were more likely to sign the petition against a tuition increase in the anger condition (89%) than they were in the physiological arousal condition (69%), $t(124) = 2.90$, $p = .004$.

Discussion

Based on functional accounts of emotion, we predicted that anger would result in greater goal attainment in situations involving challenges. Across studies, anger improved goal attainment compared to a neutral condition in a variety of challenging situations. When faced with difficult puzzles, anger resulted in greater goal attainment relative to the neutral condition and greater persistence (Study 1), but this was not the case for easier puzzles. When faced with poor performance that challenged a goal to attain

prizes, anger increased cheating rates to receive more prizes relative to the neutral condition (Study 2). On a video game that was relatively challenging, anger resulted in better scores compared to the neutral condition (Study 3), but this was not the case on a less challenging game. On a task where speed of response related to goal attainment, anger resulted in decreased reaction times and a greater interest in redoing the task to improve scores (Study 4). In two contentious presidential elections, anger if the "other" candidate won predicted voting behavior (Study 5). Anger also resulted in greater willingness to sign a petition to stop a tuition increase compared to a physiological arousal condition (Study 6). Together, these findings demonstrate that anger increases effort toward attaining a desired goal, frequently resulting in greater success. This effect was detected on tasks that involved greater challenge to goal attainment and was not evident on tasks that were relatively easy. These effects were consistently specific to anger, although in some cases, anger and amusement or desire did not differ.

How and When Anger Is Functional

Previous studies have demonstrated that the expression of anger can alter the behavior of others in ways that promote goal attainment in social situations (see Tibbett & Lench, 2015, for a review). For example, participants who interacted with another player (actually a computer program) that stated in writing that they were angry were more likely to capitulate to the player's demands than if happiness or nothing were expressed (van Kleef et al., 2004). In a similar vein, participants were particularly likely to indicate intentions to comply with the demands of an angry person who left a message for them (Ford & Tamir, 2012). The present investigation extended these interpersonal responses to anger expression to examine the degree to which intrapersonal changes associated with anger predicted goal attainment, in situations where goal attainment does not depend on the reactions of others to expressed emotion.

The effects of anger in terms of promoting effort toward goal attainment, and frequently success, were specific to situations that involved challenges to goals. Anger did not appear to relate to goal attainment in situations, where goal attainment was relatively easy to accomplish. This finding is consistent with previous accounts that anger is a motivational response to the experience of greater challenge relative to benefits (Sell's, 2011). This pattern is also consistent with functional accounts of emotion that posit the emotion of anger is a response to the perception of obstacles to goals and organizes responses to overcome obstacles and attain goals (e.g., H. C. Lench et al., 2011, 2016).

Two other findings from the present investigation are informative about the role of anger in goal attainment. First, multiple studies have demonstrated that people's beliefs about emotions affect whether people will use those emotions as tools (e.g., Tamir & Bigman, 2018; Weidman & Kross, 2021). To address this issue, the present investigation included measures of participants' beliefs about emotions in Studies 1–3. Participants' perceptions of the utility of anger did not predict greater goal attainment in these studies. This suggests that the benefits to goal attainment demonstrated with anger were not dependent on beliefs that anger has utility. Second, previous studies have demonstrated that, once elicited, emotions can have crossover effects on subsequent decision making and cognition unrelated to the emotion-evoking event (H. Lench & Levine, 2005; Lerner & Keltner, 2001). The present investigation demonstrates similar crossover effects for behavioral responses and associated outcomes related to success on tasks.

Implications for Emotion Theory

In the present investigation, the degree to which anger resulted in greater goal attainment was compared to the states of sadness, amusement, desire, and physiological arousal. These states were selected as comparison conditions because they vary in valence (sadness and anger are negative, amusement and desire positive), approach orientation (anger and desire are high approach, amusement and sadness are low approach), and physiological arousal. These comparison conditions give insight into the likelihood that effects are specific to the emotion of anger or result from general arousal or other components of emotional experience. Across studies, greater effort and goal attainment was specific to anger, although there were some situations where anger did not differ from other emotion conditions. In two studies, anger and amusement did not differ (in a positive direction but not significant in Study 2; not in Study 3). This pattern of results warrants future investigation to determine the components of amusement and anger that are potentially contributing to outcomes, and if those components are shared or different across outcomes. In Study 3, anger also did not differ from desire, which might again suggest a shared component that related to the specific outcome in the study and warrants future investigation. The pattern of findings marks areas for potential future exploration into the specific cognitive and physiological mechanisms that support the observed behavior changes.

Identifying the function of specific emotions is critical to developing accounts of atypical emotion and psychological disturbance. The view that positive emotion is ideal for mental health and well-being has been prominent in lay and psychological accounts of emotion (e.g., Diener, 2000). People also prefer to use positive emotions as tools more than negative and tend to see negative emotions as undesirable and maladaptive (e.g., Weidman & Kross, 2021). However, evidence suggests that a mix of positive and negative emotions promotes well-being (Cole et al., 2004), and that using negative emotions as tools is particularly effective (Weidman & Kross, 2021). Such findings suggest that models of emotion in psychological disturbance should take into account the potential utility of negative emotions. The medical professions rely on understanding the function of a system to evaluate physical disease and maladaptive processes (Ness & Williams, 1994). In other words, it is necessary to know what a system is supposed to do to evaluate if it is not functioning as it should. An understanding of what is normal for an emotion could similarly support a determination about whether a particular behavioral response to emotion is within a typical range or represents an issue that should be addressed with treatment (Andrews & Thomson, 2009; Ness & Williams, 1994).

Limitations and Future Directions

This investigation examines the functions of anger in nonsocial situations and, as such, it opens a host of questions and issues that should be addressed in future investigations. We highlight some of these questions that are particularly interesting from a theoretical perspective, but acknowledge that there are many more issues and questions that can be raised. The present investigation included multiple methods of eliciting anger and multiple comparison

conditions. However, the experience of anger is complex and future studies should include different emotion elicitations and different comparison conditions. Emotion elicitations were selected that have been successfully used in past elicitations of anger with medium-to-large effect sizes (H. C. Lench et al., 2011). Future studies should expand these elicitations to include those that involve relational goal challenges and insults to people's honor, as these two types of situations have been shown to elicit anger in the past and could have interesting consequences for how people respond.

A limitation of the present investigation is that it focused on the consequences of anger as a coordinated response across systems, without teasing apart the specific contributions of each response to behavioral responses. This methodological choice was intentional to focus on the emotion of anger as the level of analysis, consistent with functional accounts of emotion. However, future research should explore the specific contributions made by each process associated with anger to behavioral responses and success outcomes. This could be done through the inclusion of comparison conditions, as mentioned above, but also by including multiple measures of responses across systems (cognitive, behavioral, physiological) in studies to see the extent to which behavior is predicted by changes in each system and/or co-occurring changes across systems.

Multiple theories of emotions are based on the premise that specific emotions, such as anger, function to resolve particular types of challenges to goals (e.g., Cosmides & Tooby, 2000; H. C. Lench et al., 2015; Mauss et al., 2005; Pinker, 1997). In other words, each emotion functions as a tool that helps in specific types of situations (H. C. Lench et al., 2016). Evidence that emotions result in greater goal attainment in particular types of situations supports the theoretical premise that emotions are functional during goal pursuits. The present investigation focused on anger and examined the consequences of anger for goal attainment in situations that are theoretically relevant to the emotion of anger characterized by challenges to goals. The theoretical and empirical perspective developed in this investigation for the case of anger can be applied to any emotion theorized to be functional during goal pursuits. If emotions function to resolve particular types of challenges to goals, then they should result in better outcomes in those specific situations.

Conclusions

Do emotions help or hurt human reasoning and functioning? We offer a preliminary answer to this age-old question for anger: "it depends." The results of the present investigation support the assertion that anger results in greater goal attainment in situations that involved challenges. This more nuanced perspective on the potential function of emotion, which accounts for the type of situation in which function is examined, can be applied to the study of other emotions and should result in the development of a more comprehensive account of the functions of emotion.

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