Chapter 4

Rage restrained: Basic motivational states moderate the association between trait anger and state anger/aggression

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Chapter 4

Abstract

People differ in trait anger, or the degree to which they respond with anger to situational provocations. However, high trait anger does not always predict angry feelings and behavior. We hypothesized that high trait anger will only be translated into angry responses when the anger related motivational tendency – approach – is activated, but not when the contrasting motivational tendency – avoidance – is activated. Consistent with this, trait anger was associated with more angry feelings in response to an imagined provocation when participants made arm movements (Experiment 1, $N = 80$) or assumed a body posture (Experiment 2, $N = 68$) favoring approach motivation, but not when participants made arm movements or assumed a body posture favoring avoidance motivation. Trait anger was further associated with more aggression (Experiment 3, $N = 182$) when participants assumed an approach-oriented body posture, but not when participants assumed an avoidance-oriented body posture. The results suggest that the translation of individual differences in trait anger into angry emotion is moderated by basic motivational states.
Introduction

Almost everyone gets angry at least once in a while. However, some people become angry more easily than others. This common observation in everyday life underlies the notion of trait anger, defined as “individual differences in the disposition to perceive a wide range of situations as annoying or frustrating and by the tendency to respond to such situations with elevations in state anger” (Spielberger, 1999, pp. 1). People high in trait anger are prone to react with greater hostility to others, and correspondingly have more conflict-laden interpersonal exchanges, compared to people low in trait anger (Wilkowski & Robinson, 2008). Moreover, high trait-anger people are more likely to engage in substance abuse (Oetting, Deffenbacher, & Donnermeyer, 1998), and are at greater risk for developing coronary heart diseases and elevated blood pressure than low trait-anger people (for meta-analytic reviews see Chida & Steptoe, 2009; Suls, Wan, & Costa, 1995). Consequently, it is important to learn more about the psychological dynamics that underlie trait anger, and particularly, on how we can hinder high trait anger becoming translated into increased levels of state anger and aggression.

Prior research has identified several cognitive processes, such as hostile attribution bias and lapses in cognitive control, that help explain why people high in trait anger are more likely to respond to provocations with anger and hostility (Wilkowski & Robinson, 2008). However, the emotional experience of anger is not just a cognitive state, but is also connected with basic motivational tendencies to engage in approach behavior (Carver & Harmon-Jones, 2009; Harmon-Jones, Harmon-Jones, & Price, 2013). Indeed, people high in trait anger are generally more approach-motivated than their counterparts low in trait anger (Harmon-Jones & Allen, 1998). In the present article, we investigate whether lowering approach motivation may keep high trait-anger people from becoming angry and aggressive, even in situations where they would otherwise be prone to lose their temper.

In what follows, we begin by reviewing the contemporary literature on trait anger. Next, we turn to research linking state anger to basic systems for approach motivation (rather than avoidance). Building on this work, we develop a theoretical rationale for predicting that the relative balance between approach and avoidance motivation moderates the relation between trait anger and state anger. Finally, we present three experiments testing the hypothesis that situationally activating avoidance instead of approach motivation may keep high trait-anger from developing into state anger and aggression.

Trait Anger

People have long recognized the existence of individual differences in anger proneness, as evidenced by everyday expressions such as “hothead,” thin-skinned,” and “grouch”. Scientific research on this topic, however, has been a relatively recent development. Since the 1950s, researchers have begun to systematically investigate individual differences in hostility and anger (for a review, see Spielberger & Sydeman, 1994). Building and extending this early work, Spielberger and associates proposed their
influential state-trait personality theory for anger (Spielberger, 1988; Spielberger Jacobs, Russell, & Crane, 1983). In this conceptualization, state anger is an acute emotional-physiological reaction that ranges from mild irritation to intense fury and rage. Trait anger, on the other hand, refers to a stable personality dimension of anger proneness, or the tendency to experience state anger. People with high trait anger presumably experience angry emotions more frequently and more intensely than people low in trait anger.

To measure trait anger, researchers have developed standardized self-report measures, such as the Trait Anger Scale (Spielberger, 1988), which ask people to rate themselves on items such as "When I get mad, I say nasty things." There are various measures of this kind, which are strongly correlated and probably tap into the same latent construct (e.g., Martin, Watson, & Wan, 2000). The validity of self-report measures of trait anger is supported by numerous empirical studies. For instance, trait anger predicts greater anger-related physiological arousal and more state anger in response to a laboratory provocation (Deffenbacher, Oetting, Lynch, & Morris, 1996). Trait anger is further associated with state anger in everyday life (e.g., Deffenbacher et al., 1996). Finally, trait anger predicts aggressive behavior in laboratory settings (e.g., Bettencourt, Talley, Benjamin, & Valentine, 2006), and in naturalistic settings, where trait anger predicts aggressive driving behavior (e.g., Deffenbacher, Lynch, Oetting, & Yingling, 2001), aggression in the workplace (Douglas & Martinko, 2001), domestic violence (e.g., Barbour, Eckhardt, Davison, & Kassinove, 1998), and child abuse (e.g., Pidgeon & Sanders, 2009).

To understand why people high in trait anger are more easily angered than people low in trait anger, many researchers have adopted a cognitive approach (e.g., Anderson & Bushman, 2002; Crick & Dodge, 1994; Wilkowski & Robinson, 2008). Though cognitive models differ in their particulars, they commonly assume that the way people cognitively process hostile situational input is a major determinant of people's responses to such situations. Indeed, several cognitive processes appear to characterize people high (as opposed to low) in trait anger (Wilkowski & Robinson, 2008). First, people high in trait anger show an interpretation bias, as they tend to interpret situations as more hostile and negative than people low in trait anger (e.g., Wenzel & Lystad, 2005). Second, people high in trait anger have a stronger automatic attentional bias to threat stimuli than people low in trait anger (e.g., Putman, Hermans, & van Honk, 2004). Thus, various cognitive biases may lead high trait-anger people to activate angry cognitions, and presumably pave the way for the arousal of angry feelings.

People high (as opposed to low) in trait anger further appear to be less likely to mobilize effortful control in anger-relevant situations (Wilkowski & Robinson, 2010). For instance, high trait-anger people have been found to display lapses in effortful control when confronted with anger-relevant stimuli (Denny & Siemer, 2012; Wilkowski & Robinson, 2007), because intense emotional arousal tends to disrupt effortful control processes (e.g., Dolcos & McCarthy, 2006). It thus appears that cognitive strategies for anger management are likely to less useful for high trait-anger people than for low trait-anger people. As such, the question arises whether high trait-anger people might be helped by a different approach. Indeed, as we discuss next, recent advances suggest
that motivation is at least as important as cognition in understanding the dynamics of anger (Carver & Harmon-Jones, 2009).

**Motivational Foundations of Anger**

Emotions are not merely cognitive states, but also have important motivational aspects (Darwin, 1872; Frijda, 1988; James, 1890). Among the most basic motivational structures underlying emotion are systems for approach and avoidance motivation (Cacioppo & Berntson, 1994; Carver & Scheier, 1990; Carver & Harmon-Jones, 2009; Elliot & Thrash, 2002; Higgins, 1998; Kuhl & Koole, 2008; Russell, 2003). Approach and avoidance systems are part of a deep biological heritage, and can be observed in rudimentary form in all animal species that have had to fight or flee to ensure their survival (Panksepp, 2004; Stevenson & Rillich, 2012). The approach system is a basic motivational structure that organizes behavior involved in approaching desired incentives (rewards, goals). Its counterpart is the avoidance system, which organizes behavior towards avoiding threats or punishments. When the approach system predominates over the avoidance system, people are in a state of relative approach motivation, which signals that potential rewards outweigh potential punishments in the situation.

Angry feelings are typically accompanied by increased approach motivation (Carver & Harmon-Jones, 2009). For example, people high in approach motivation not only respond with more positive affect to rewards, but also respond with more state anger to frustrations and provocations (Carver, 2004; Harmon-Jones & Peterson, 2008). Likewise, state anger is positively associated with reward sensitivity and negatively with threat sensitivity (Harmon-Jones, 2003a; Smits & Kuppens, 2005), and viewing angry faces elicits approach behavior (Wilkowski & Meier, 2010). Finally, state anger and approach motivation involve similar activations in the left anterior cortex (Hortensius, Schutter, & Harmon-Jones, 2012; Murphy, Nimmo-Smith, & Lawrence, 2003).

Like state anger, trait anger is associated with approach motivation. People high as opposed to low in trait anger are normally characterized by elevated levels of approach motivation (Harmon-Jones & Allen, 1998). However, this does not mean that approach motivation is always heightened among people high in trait anger. For example, the relation between trait anger and approach-related left hemispheric activations only emerges when people were exposed to anger provoking images (e.g., racism), but not when they were exposed to other types of negative pictures (e.g., fearful) (Harmon-Jones, 2007). Moreover, people with high trait anger are faster than people with low trait anger to make approach movements than avoidance movements, but only when they were responding to angry faces with a direct eye gaze, not when they were responding to angry faces with an averted eye gaze, or to happy or neutral faces (Veenstra, Schneider, Bushman, & Koole, 2016).

The aforementioned findings suggest that trait anger is not so much linked to global approach motivation, but rather that trait anger is linked to a more specific tendency to activate approach motivation in anger-relevant situations. This pattern is in line with a situated approach to personality (Mischel & Shoda, 2010, p. 154; see also Mischel & Shoda, 1995), which holds that behaviors related to a certain personality are
not necessarily consistent across situations, but rather are “distinctive but stable patterns of if... then... situation-behavior relations that form contextualized, psychologically meaningful personality signatures (e.g., she does A when X, but B when Y)”. Trait anger may thus be considered a situated motivational trait, that is, as a disposition that manifests itself primarily in contexts that promote approach motivation (Koole & Veenstra, 2015).

If trait anger is indeed a situated motivational trait, then motivational shifts may moderate emotional functioning among high trait-anger people. Specifically, high trait-anger people may only develop angry feelings when the situation affords approach-motivated behavior. By contrast, when the situation does not afford approach-motivated behavior, for instance, when avoidance motivation has become pre-potent, high trait-anger people may no longer display more state anger than low trait-anger people, even in anger-provoking situations. In brief, a situated motivation perspective on trait anger (Koole & Veenstra, 2015) predicts that basic motivations for approach and avoidance should moderate the relation between trait and state anger.

The Present Research and Hypotheses

In the present research, we empirically test this key prediction of a situated motivation perspective on trait anger. Specifically, we investigate how approach and avoidance cues regulate anger and aggression among individuals varying in trait anger. Motivational cues can be conveyed by bodily behaviors that require little, if any, cognitive work, such as pushing or pulling (Cacioppo, Priester, & Berntson, 1993, Rotteveel & Phaf, 2004), or leaning forward or backward (e.g., Harmon-Jones, Gable, & Price, 2011; Price & Harmon-Jones, 2011). We capitalized on the embodied nature of approach and avoidance motivation by using bodily behaviors to induce these situated motivational states, including arm movements (Experiment 1) and seating posture (Experiment 2-3).

In Experiments 1 and 2, we examined the role of situated motivation in anger management responses to an anger-arousing vignette. In Experiment 3, we examined the role of situated motivation in regulating actual aggressive behavior. Across the three experiments, we predicted that activating avoidance motivation (rather than approach motivation) would attenuate the relation between people’s level of trait anger and their level of state anger and aggression. We predicted that high trait anger would predict higher levels of state anger or aggression, when participants were in an approach motivational state. By contrast, we predicted that trait anger and state anger or aggression would be unrelated when participants were in an avoidance motivational state. We tested these predictions for each experiment separately. Moreover, to maximize statistical power, and get an idea of the magnitude of the effects, we also conducted a combined analysis, which is reported at the end of the three experiments.

Experiment 1

In our first experiment, we tested whether attenuating approach tendencies by activating avoidance tendencies can lower state anger in people with relatively higher levels of trait
anger. Basic motivations towards approach and avoidance can be unobtrusively induced by simple arm movements (e.g., Cacioppo, et al., 1993; Rotteveel & Phaf, 2004). Arm flexion is associated with pulling objects closer to the self and activates approach motivation. Arm extension is associated with pushing objects away from the self and activates avoidance motivation. In Experiment 1, we manipulated these arm movements while participants read a vignette about a potentially anger-arousing situation, and imagined themselves in this situation. We predicted that arm movements would interact with trait anger in predicting state anger in response to an anger-provoking vignette. Specifically, for participants who engaged in arm flexion, we expected that higher trait anger would go hand in hand with higher state anger. However, for participants who engaged in arm extension, we predicted no relationship between trait anger and state anger.

Method

Participants and design. Participants were 80 undergraduate students (46 women; $M_{age} = 20.36$, $SD_{age} = 2.48$, range $= 17$-$29$) from the VU University Amsterdam who were paid €3.50 for their voluntary participation. They were randomly assigned to one of two arm movement conditions: (1) push – arm extension (avoidance; $n = 39$), or (2) pull – arm flexion (approach; $n = 41$). Trait anger was assessed using a standardized self-report measure (Spielberger, 1988). The main dependent variable was participants' anger (state) in response to a potentially anger-arousing situation.

Sampling plan. Experiments 1 and 2 were the first studies that tested our prediction that motivational tendencies moderate the trait and state anger relation. We determined the required sample size using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). Due to a lack of previous research on the effects of posture on mood regulation, we assumed a typical effect size of social psychological research (Richard, Bond, & Stokes-Zoota, 2003), which corresponds to a medium effect size ($f^2 = 0.15$; matching with $R^2 = .13$). Based on the present linear multiple regression model with three predictors, a G*Power analysis indicated that for a two-sided test with an alpha of .05, a desired statistical power of .80, a minimum sample size of 77 participants was required.

Procedure and materials. To establish whether motivational effects are influenced by differences in anger prior to the motivation manipulation, participants rated their current level of anger on seven adjectives (e.g., “irritated”, “furious”) using 5-point Likert scales (1 = not at all, 5 = very much), and their current level of negative mood on five adjectives (e.g., “depressed”, “worried”) on a visual analogue scale (1 = not at all to 100 = very much). Both type of adjectives were averaged into two single indices ($M = 1.49$, $SD = 0.49$, Cronbach’s $\alpha = .82$; $M = 36.25$, $SD = 15.97$, Cronbach’s $\alpha = .78$) and originated from Dutch abbreviated version of the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971/1981/1992; Wald & Mellenbergh, 1990).

Next, participants’ motivational orientations were manipulated using different arm movements (Cacioppo et al., 1993; Rotteveel & Phaf, 2004). To activate an avoidance orientation, participants were instructed to press their left hand down on the table. This downward hand pressing leads to a pushing movement and a flexing of extension muscles, which is associated with avoidance behavior. The required hand position was
illustrated by the right panel of the picture in Figure 1. To activate an approach orientation, participants were instructed to press their hand upwards on the bottom side of the table. This upward hand pressing leads to a pulling movement and activation of flexion muscles, which is associated with approach behavior. The required hand position was illustrated by the left panel of the picture in Figure 1. Participants were instructed to keep their hand pressed against the table – while feeling tension in their arm – until they were told otherwise. As a cover story, they were informed that the researchers were interested in the effect of different physical exertions on task performance. Participants were also asked to report the amount of tension they experienced during the arm-movement task.

Figure 1. Pictures of instructed arm movements to activate motivational orientations. The left panel shows a pulling arm movement to activate an approach orientation, and the right panel shows a pushing movement to activate an avoidance orientation.

Participants subsequently read a vignette describing an anger-arousing situation and were asked to imagine experiencing this situation. The vignette methodology has been widely used in emotion research. People’s responses to emotional vignettes generally show a great deal of correspondence with their responses to actual emotion-arousing stimuli (Robinson & Clore, 2001). The vignette was modeled after similar vignettes used in anger research (e.g., Rusting & Nolen-Hoeksema, 1998) and read:

You want to apply for a job opening at your work. To compete with the other colleagues in your department, you each have to write a renewal plan for the department. You’re almost finished when one of your colleagues stands at your desk and asks you a favor. He says he is short on time, and asks if he can use your notes to get an idea of how to approach the assignment. You reluctantly agree, and one week later you find out that your colleague copied everything you wrote, and handed it in as if it were his ideas. Your boss calls the two of you in: he is very angry, and threatens to dismiss you both. Your colleague tries to blame you, and claims that you were the one copying from him. When you
leave your boss’s office, your colleague says you’re a naive loser and it’s easy to take advantage of you.

After reading the vignette, participants rated their state anger on five items asking how angry they would be towards their colleague, how stupid they thought his behavior was, and to what extent they would be inclined to take revenge, punish, and forgive their colleague (1 = definitely not to 11 = very much; M = 8.70, SD = 1.46, Cronbach’s α = .68).

**Trait anger.** We measured individual differences in trait anger with a Dutch version of the Trait Anger Scale (Spielberger, 1988; Spielberger, et al., 1983; for a review, see Wilkowski & Robinson, 2008). We used the abbreviated 10 items version of the scale (e.g., “I’m easily getting angry”) that participants rated on 11-point Likert scales (1 = does not fit to me to 11 = fits perfectly to me). An overall trait anger score was calculated by averaging the items (M = 3.89 SD = 1.16, Cronbach’s α = .82). Finally, participants were thanked, debriefed, and paid for their participation.

**Results**

To test whether the relationship between trait and state anger was moderated by differences in arm movement (i.e., pull/approach vs. push/avoidance), we coded arm movement condition (pull = +1, push = -1), standardized trait anger (Z scores), and computed an interaction term between these variables. We then simultaneously entered these factors into a multiple regression model to predict self-reported state anger, $R^2_{\text{model}} = .187$, $F(3, 76) = 5.84, p = .001$. There was a main effect of trait anger, $\beta = .38$, $t(76) = 3.59, p = .001$, $r = .38$, $R^2 = .145$, such that people high in trait anger reported more state anger. There was no main effect of arm movement, $\beta = -.02$, $t(76) = .19, p = .852$, $R^2 = .000$. More importantly, the analysis yielded the predicted interaction between arm movement and trait anger, $\beta = .21$, $t(76) = 2.05, p = .044$, $R^2 = .052$. This interaction is graphically displayed in Figure 2. Pearson correlations between trait and state anger in the separate arm movement conditions, revealed that trait anger predicted more state anger when participants made a pulling movement (approach), $r = .60, p < .0001$, $R^2 = .360$, but not when participants made a pushing movement (avoidance), $r = .16, p = .340$, $R^2 = .026$. Statistically controlling for pre-existing mood or pre-manipulation state anger did not change the results.

**Discussion**

As expected, activating approach/avoidance motivational states by means of arm movements moderated the relation between trait anger and state anger in Experiment 1. When participants made arm movements consistent with approach motivation, higher trait anger was associated with more state anger in response to an anger-relevant scenario. When participants made arm movements that were consistent with avoidance motivation, there was no significant association between trait anger and state anger. These findings that basic motivational states may moderate the translation of trait anger into state anger.
Figure 2. State anger as a function of trait anger and arm movement (pull – approach versus push – avoidance) (Experiment 1).

Experiment 2

In Experiment 2, we conceptually replicate and extend our findings of Experiment 1. As before, we examined the effects of motivational states on the relation between trait anger and state anger. This time, however, we introduced two methodological changes. A first methodological change was that we used seating postures rather than arm movements to manipulate approach versus avoidance motivation. Specifically, we instructed participants either to lean forward, or to lean back while they were sitting on a chair (Harmon-Jones, et al., 2011). Leaning forward is a bodily movement that people typically make when they are eager to approach something, whereas leaning backward is a bodily movement that people typically make when they are keen on avoiding something. Indeed, prior work has shown that leaning backward reduces approach-motivational responses relative to an active posture such as sitting straight (Harmon-Jones & Peterson, 2009) or leaning forward (Harmon-Jones, et al., 2011).

Second, we added a control condition participants were instructed to sit straight. Prior findings suggest that approach motivation is the default response, at least among Western university students. For instance, studies have found leaning backward reduces approach-motivational responses relative to being upright (Harmon-Jones & Peterson, 2009) or a leaning forward position (Harmon-Jones, et al., 2011). Accordingly, we expected the control/sitting straight condition in Experiment 2 to diverge from the avoidance/leaning backward but not from the approach/leaning forward condition. Specifically, we predicted that we would observe a positive relation between trait and state anger when participants were either leaning forward or sitting straight, but no relation between trait and state anger when participants were leaning backward.
Method

Participants and design. Participants were 68 undergraduate students (41 women, $M_{age} = 20.10$, $SD_{age} = 2.13$, range = 17-27) from the VU University Amsterdam who were paid €3.50 for their voluntary participation. Participants were randomly assigned to one of three seating posture conditions: leaning forward ($n = 23$), sitting straight ($n = 21$) or leaning backward ($n = 24$). The main dependent variable was participants’ state anger in response to an anger-provoking situation. In addition, we measured participants’ individual level of trait anger.

Sampling plan. Based on the present linear multiple regression model, of which we will test the $R^2$ increase of two (trait anger interaction with two motivation-dummy variables) of five predictors, a G*Power (Faul, et al., 2007) analysis indicated that for a two-sided test with a medium effect size ($F = 0.15$; matching with $R^2 = .13$), an alpha of .05, and a desired statistical power of .80, a sample size of 68 participants was required.

Procedure and materials. The equipment, setting, and measures of state anger and trait anger were identical to Experiment 1. This time, however, trait anger was assessed before the motivation manipulation and state anger measurement ($1 =$ definitely not to $7 =$ very much, $M = 3.41$, $SD = 0.89$, Cronbach’s $\alpha = .83$). In addition, we varied seating posture rather than hand movements to manipulate approach versus avoidance motivation (see Harmon-Jones, et al., 2011). Participants were asked to lean forward to activate an approach orientation, and participants were asked to lean back to activate an avoidance orientation. Finally, participants were asked to sit straight in the control condition. The relevant postures were illustrated for participants by respectively the left, middle, and right picture in Figure 3. Participants were instructed to maintain the instructed posture until they were told otherwise. As a cover story, participants were informed that the researchers were interested in the effect of different physical exertions on task performance.

While holding their assigned posture, participants read the anger-relevant vignette story. To insure the generality of our stimulus materials, the background of the vignette was a university- instead of a work-setting, in which another student had plagiarized the participant’s assignment. After reading the vignette, participants rated their angry feelings toward the imagined student that had plagiarized their assignment ($M = 6.18$, $SD = 0.95$, Cronbach’s $\alpha = .72$). Participants were then asked to relax and report the amount of tension they experienced when they were sitting in the instructed position ($1 =$ not at all to $7 =$ very much), to see whether the effects of body position might be due to differences in body tension.

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4 For expositional purposes, the order in which we conducted Experiments 1-3 was different from the order in which the experiments are reported in the present article. We originally conducted Experiment 2 as the first study that tested our prediction that motivational tendencies moderate the trait and state anger relation. For this reason, the state anger measurement slightly deviated from Experiment 1. Experiment 2 also included various exploratory measures. Both the state anger measure as well as the exploratory measures are described in detail in the online supplemental materials.
**Figure 3.** Pictures of instructed seating postures to activate motivational orientations. The left panel shows a leaning forward posture to activate an approach motivational orientation, the middle panel shows a sitting straight posture serving as a control condition, and the right panel shows a leaning backward posture to activate an avoidance motivational orientation.

**Results**

We tested whether the relation between trait and state anger was moderated by differences in seating posture (i.e., leaning forward, sitting straight, and leaning backward). Because the seating posture manipulation consisted of three different conditions, a hierarchical regression analysis was needed to test for significance of the presumed moderating effect of motivation on the trait-state anger relation (see Jaccard & Turrisi, 2003). In the first model, trait anger scores (Z-scores) and two dummy variables for seating posture were entered. Straight seating posture was used as a reference group, which means that the first dummy variable tested the difference between the leaning backward versus the sitting straight condition, and the second dummy variable tested the difference between leaning forward versus the sitting straight condition. In the second model, the product terms between each dummy variable with trait anger were also entered into the model to test the moderation effect of seating posture on the trait-state anger link.

When predicting state anger, the first model explained 16.1% of the variables ($R^2 = .161$, $F(3, 64) = 4.08$, $p = .010$), and showed a main effect of trait anger, such that higher trait anger predicted higher state anger, $\beta = .36$, $t(64) = 3.11$, $p = .003$, $r = .36$, $R^2 = .130$. The main effects of the two dummy variables for seating posture were not significant, $\beta = .21$, $t(64) = 1.53$, $p = .131$, $R^2 = .035$ (leaning backward versus sitting straight), $\beta = .15$, $t(64) = 1.09$, $p = .279$, $R^2 = .018$ (leaning forward versus sitting straight).

Importantly, the second model explained significantly more variance than the first, such that the overall test of the omnibus interaction effect between trait anger and seating posture was significant, $F(2, 62) = 5.53$, $p = .006$, $R^2_{change} = .127$. The significant product term between the first dummy variable (leaning backward versus sitting straight) and trait anger showed that the slopes between trait and state anger differed between the straight posture condition and the leaning backward condition, $\beta = -.49$, $t(64) = -2.72$, $p = .008$, $R^2 = .104$ Pearson correlations between trait and state anger in the separate seating posture conditions, showed that when participants were leaning backward, trait
anger did not predict state anger, $r = -.16$, $p = .470$, $R^2 = .026$. However, when participants were sitting straight, higher trait anger predicted increases of state anger, $r = .57$, $p = .007$, $R^2 = .325$. The product term between the second dummy variable (leaning forward versus sitting straight) and trait anger was not significant, $\beta = -.35$, $t(64) = -1.55$, $p = .127$, $R^2 = .036$. Thus, trait anger was just as strongly related to state anger when participants were leaning forward, $r = .70$, $p < .001$, $R^2 = .490$, as when they were sitting straight (see Figure 4).

There were no significant differences in baseline levels of angry mood (measured by the POMS, $F < 1$), indicating that random assignment to conditions was successful. Moreover, statistically controlling for pre-existing mood or anger differences did not change the results. There was also no significant effect of movement on self-reported tension ($F < 1$), suggesting that all conditions did not differ in levels of physical challenge.

**Figure 4. State anger as a function of trait anger and seating posture (forward – approach, straight – control, back – avoidance) (Experiment 2).**

**Discussion**

The results of Experiment 2 conceptually replicated Experiment 1 with a different motivation induction. Specifically, people with high trait anger showed more state anger than people with low trait anger when they were leaning forward or sitting straight, but not when participants were leaning backward. These findings suggest again that motivational states may moderate whether trait anger becomes translated into state anger. When participants were in an approach state (induced by either leaning forward, or sitting straight), higher trait anger was associated with more state anger in response to a provocative situation. By contrast, when participants were in an avoidance state (induced by leaning backward), there was no association between trait anger and state anger. Finally, in line with the idea that approach motivation represents the default state, the leaning forward condition did not differ from the control (sitting straight) condition in Experiment 2.
Experiment 3

In Experiment 3, we further extended our analysis in three ways. First, we investigated whether situated motivation – manipulated through seating posture as in Experiment 2 – moderates the effects of trait anger in a real social situation. To create this situation, we asked participants to write an essay on the topic of abortion, after which we supplied them with negative comments from a bogus interaction partner. Second, we examined aggressive behavior rather than state anger. To measure aggression, we used a validated paradigm in which participants had to decide how much unpleasant noise they gave to their interaction partner during a subsequent competitive reaction time task with the bogus interaction partner (e.g., Giancola & Parrott, 2008). We predicted that avoidance motivation would attenuate the relation between trait anger and aggression, in the same way that avoidance motivation attenuated the relation between trait anger and state anger in Experiments 1 and 2.

A third extension of Experiment 3 was that we examined not only trait anger, but also other traits that are relevant to anger management and approach motivation, including narcissism, behavioral activation, and behavioral inhibition. Similar to trait anger, both narcissism (Bettencourt, et al., 2006), and behavioral activation (Smits & Kuppens, 2005), have been related to approach motivation, and an increased behavioral aggression in potentially anger-provoking situations. Conversely, behavioral inhibition has been related to avoidance motivation, and a decreased impulse to aggress in potentially anger-provoking situations (Smits & Kuppens, 2005). From this, we would predict that avoidance compared to approach motivation (induced via seating posture) would also attenuate the relation between these alternative traits and aggression.

Method

Participants and design. Participants were 214 American students from The Ohio State University (93 female, 121 male, $M_{age} = 20.25$, $SD_{age} = 2.41$, range = 17-33) who received course credits for their participation. Participants were randomly assigned to one of two seating posture conditions: leaning forward/approach ($n = 108$) versus leaning backward/avoidance ($n = 107$). The main dependent variable was participants’ aggression towards their bogus interaction partner. Individual differences in trait anger

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5 Apart from the motivation manipulation, there was also a video game manipulation in Experiment 3. More specifically, participants played a violent (versus non-violent) video game. In line with previous research (e.g., Anderson et al., 2010), we expected that participants would display more aggression after playing a violent rather than a non-violent video game. Unexpectedly, however, the video game manipulation had no effect on aggression. We suspect that the negative essay feedback overruled the effects of the video game. More specifically, the video game was unrelated to the social situation with the interaction partner and thus less likely to induce aggression during the competitive reaction time task than the negative feedback they received from the interaction partner. The full description of the video game methods and results can be found in the online supplemental materials.
were assessed by a well-validated self-report questionnaire at the beginning of the experiment.

**Exclusion criteria and sampling plan.** Based on a predetermined criterion, we excluded participants who did not believe that the interaction with the bogus partner was real from the dataset. Based on Experiments 1 and 2, we assumed the effect size would fall in between small (.02) and medium (.15), as such we used an effect size of Cohen’s \( f^2 = 0.06 \) (matching with \( R^2 = 0.057 \)). Based on the present linear multiple regression model with three predictors (trait anger, seating posture: leaning forward versus back, and their interaction), a G*Power analysis (Faul, et al., 2007) indicated that for a two-sided test with an alpha of .05, a desired statistical power of .80, a sample size of 186 participants was required.

**Procedure.** Upon arrival, participants provided informed consent and were read instructions by a trained research assistant. Participants were told they would be completing a series of tasks that would help them form an impression of a partner in another room down the hall, whom they would not meet during the experiment. In reality, there was no partner during this experiment. Participants first completed the surveys and demographic questions. Next, an anger provocation was induced by negative feedback on an essay participants had written. Then, the posture manipulation was introduced that was designed to induce approach versus avoidance motivation. While seated in the instructed posture, participants completed a competitive reaction time task that contained the aggression measure. Finally, participants were debriefed and received course credits.

**Materials and measures.**

**Trait anger.** Individual differences in trait anger were measured at the beginning of the experiment, using the Trait Anger Scale (Spielberger, 1988; Spielberger, et al., 1983). The 10 items (e.g., “When I get frustrated, I feel like hitting someone,” and “I feel annoyed when I am not given recognition for doing good work.”) of the Trait Anger Scale were answered on 4-point Likert scales (1 = *not at all applicable to me*, 4 = *very much applicable to me*; \( M = 1.91, SD = 0.48, \) Cronbach’s \( \alpha = .82 \)).

**Narcissism.** The Single Item Narcissism Scale (SINS; Knorath, Meier, & Bushman, 2014) was used to measure participants’ level of narcissism. The SINS consists of one item asking the participant on a 7-point Likert scale (1 = *not very true of me*, 7 = *very true of me*; \( M = 3.20, SD = 1.53 \)): “To what extent do you agree with this statement ‘I am a narcissist.’ (NOTE: The word ‘narcissist’ means egotistical self-focused, vain, etc.).”

**Behavioral activation and inhibition.** Participants completed the behavioral activation and inhibition scale (BAS/BIS Carver & White, 1994) which contains 24 items measuring an individual’s behavioral activation (or approach) system (BAS) as well as their behavioral inhibition (or avoidance) system (BIS). Participants indicated how very true (1) or very false (4) statements such as “When I’m doing well at something I love to keep at it,” and “I feel pretty worried or upset when I think or know somebody is angry with me” were for them. The items of the scales were averaged into a mean level of behavioral activation (Cronbach’s \( \alpha = .96, M = 2.20, SD = 0.82 \)), and behavioral inhibition (Cronbach’s \( \alpha = .70, M = 2.40, SD = 0.56 \)).
**Anger provocation – essay feedback.** The anger provocation consisted of negative feedback on an essay, a well-established method to evoke feelings of anger (e.g., Bremner, Koole, & Bushman, 2011; Bushman & Baumeister, 1998). Upon completing the surveys, participants were given five minutes to write an essay on the topic of abortion. Participants were asked to choose a side, either pro-choice or pro-life. After participants completed their essay, they received an essay on the same topic from their partner, however from an opposite opinion. For example, if a participant wrote a pro-life essay, they received a pro-choice essay from their partner, for evaluation and to help form an impression of the other person. Essays were handwritten by male and female research assistants, and gender of the partner was kept consistent with participant gender. Participants were asked to evaluate their partners’ essay, on a scale from -10 (unacceptable) to +10 (excellent) on six criteria: organization, originality, writing style, clarity of expression, persuasiveness of arguments, and overall quality of the essay. Prior to completing the competitive reaction time task later, participants received ratings for their essay between -10 and -8 from their bogus partner, including a handwritten note “this is the worst essay I have ever read!”

**Motivation manipulation – seating posture.** After the anger induction, participants were randomly assigned to either the leaning forward posture to activate approach motivation, or to a leaning backward posture to activate avoidance motivation. A photograph of the appropriate posture was placed next to the participant’s computer monitor and periodically research assistants would peek into the room to ensure adherence to the posture instruction. If participants were not in the correct posture, the research assistant would tap them on the shoulder and point to the photograph. Notes of compliance were made during data collection.

**Aggression measure - Competitive Reaction Time Task (CRTT).** Upon receiving the bogus feedback from their bogus partner, participants competed in a competitive reaction time task (CRTT) with this partner. The reliability and validity of the CRTT are well established (Giancola & Parrott, 2008). The task requires the participant to try to press a button faster than their partner, linked to the program in another room. The loser is blasted with a loud noise set in duration and decibel intensity chosen by the winner. Prior to each trial, the participant and their ‘partner’ set the duration from 0 to 5 seconds (in 0.5 second intervals) and the level from 60 to 105 decibels. Before starting the CRTT, participants were given samples of low, medium, and maximum decibel levels of the loud noise, which is a combination of sirens, drills, nails on a chalkboard, and other loud sounds. As there was no actual partner, the CRTT set the participant to lose half of the trials randomly. Decibel readings for each computer were standardized prior to experimental testing. The task consists of 25 trials. For each trial, both the chosen duration and intensity was standardized using Z-scores, and then averaged into an overall mean level of aggression for each participant (Cronbach’s $\alpha = .97$, $M = 0.73$, $SD = 0.79$).
Motivation moderates trait anger effects

Results

Manipulation checks. Thirty-three participants (14% of the entire sample) reported doubting the veracity of their interaction partner, and were excluded from the dataset. Thus, a sample of 182 participants remained for statistical analysis.

Trait anger. We tested whether seating posture (leaning forward/approach = +1, leaning backward/avoidance = -1) moderated the relationship between trait anger (Z scores) and aggression with a linear multiple regression analysis. Seating posture, trait anger, and their interaction term were entered into a linear multiple regression model as predictors of mean aggression, i.e., the average of the standardized intension and duration of trial 1-25 of the competitive reaction time task, $R^2_{model} = .231$, $F(3, 176) = 3.31$, $p = .021$. There was a main effect of trait anger, $\beta = .18$, $t(176) = 2.38$, $p = .018$, $r = .19$, $R^2 = .031$, such that people high in trait anger reported more state anger. There was no main effect of seating posture, $\beta = -.02$, $t(176) = -0.20$, $p = .839$, $R^2 = .000$. The interaction between seating posture and trait anger was not significant, $\beta = .13$, $t(176) = 1.74$, $p = .084$, $R^2 = .017$. This interaction is graphically displayed in Figure 5. Although the interaction did not reach significance, the pattern of the data was in the predicted direction. Statistically, mixed effects are likely to be observed in multiple studies when no evidence is withheld, and can provide evidence for the alternative hypothesis, given reasonable levels of statistical power and an adequately controlled low Type 1 error rate (Lakens & Etz, in press). We return to this issue in the combined analysis of Experiments 1-3.

We also conducted Pearson correlations between trait and state anger in the separate posture conditions. As in Experiments 1 and 2, trait anger predicted more state anger when participants were leaning forward (approach), $r = .32$, $p < .002$, $R^2 = .102$, but not when participants were leaning backward (avoidance), $r = .05$, $p = .679$, $R^2 = .003$.

Exploratory personality traits. We tested for the alternative personality trait - narcissism, behavioral activation, and behavioral inhibition- whether seating posture also moderated the relationship between the concerning personality traits and aggression with linear multiple regression analyses. We coded seating posture condition (leaning forward/approach = +1, leaning backward/avoidance = -1), and standardized the personality trait measures (Z scores), and computed an interaction term between these variables. They were then entered into a linear multiple regression model as predictors of mean aggression, i.e., the average of the standardized intension and duration of trial 1-25 of the competitive reaction time task.

As can be seen in Table 1, the interaction between motivation and each personality trait was either statistically significant or approached significance. Further inspecting the correlations in each motivation condition (see Table 1), revealed that an increased level of each personality trait was associated with increased aggression when participants were sitting in an approach related posture, but that this relation was attenuated, or even negative when participants were sitting in an avoidance related posture. Figure 5 visualizes the relations between each motivational personality trait and aggression in the leaning forward versus the leaning backward condition. Finally, as can be seen in the correlation matrix in Table 2, higher levels of trait anger were related to
higher levels of narcissism, however, neither was related to behavioral activation or inhibition. Higher levels of behavioral activation were related to higher levels of behavioral inhibition. Although we should be cautious with over-interpreting these results, given that some of the interactions only approached significance, the pattern of the data suggests that motivation moderated the relation between motivational personality traits and aggression.

**Figure 5.** Moderating effect of seating posture (forward/approach vs. backward/avoidance) on the relation between each personality trait (trait anger, narcissism, behavioral activation, and behavioral inhibition), and total aggression, i.e., average standardized intensity and duration of trial 1-25 (Z-scores).
**Discussion**

The results of Experiment 3 showed that seating posture moderated the relation between trait anger and aggressive behavior in a real social situation. When participants were leaning forward, high trait anger predicted greater aggression. By contrast, when participants were leaning backward, trait anger was unrelated to aggression. Notably, the predicted pattern was only marginally statistically significant, despite the fact that our sample size was more than twice as large as the samples we used in Experiments 1 and 2. This relative weakness of the effect size in Experiment 3 is likely due to the use of a behavioral measure, given that behavioral measures tend to show greater variability than subjective ratings (Baumeister, Vohs, & Funder, 2007).
Despite this caveat, the robustness of the moderating effects of avoidance motivation was confirmed in Experiment 3 in the parallel patterns that were observed for three approach-motivated personality traits other than trait anger: narcissism, high behavioral activation, and low behavioral inhibition. Like trait anger, each of these approach-motivated traits was significantly positively related to aggression when participants were leaning forward, but not when participants were leaning backward. Although the interaction effect only approached statistical significance for narcissism, the consistency of the pattern of effects across personality traits in Experiment 3, supports our situated motivational analysis.

Table 1. Linear multiple regression analyses of the moderating effect of seating posture (forward/approach vs. backward/avoidance) on the relation between each personality trait (trait anger, behavioral inhibition and activation, and narcissism), and mean aggression, i.e., average standardized intensity and duration of trial 1-25.

<table>
<thead>
<tr>
<th>Model</th>
<th>Trait Anger</th>
<th>Posture</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>.13*</td>
<td>0.01</td>
<td>0.09†</td>
</tr>
<tr>
<td>SE B</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>β</td>
<td>.18</td>
<td>.84</td>
<td>.13</td>
</tr>
<tr>
<td>t</td>
<td>2.38</td>
<td>-0.20</td>
<td>1.74</td>
</tr>
<tr>
<td>p</td>
<td>.018</td>
<td>.839</td>
<td>.084</td>
</tr>
<tr>
<td>R²</td>
<td>.031</td>
<td>.000</td>
<td>.017</td>
</tr>
<tr>
<td>M(SD) / r</td>
<td>.19*</td>
<td>0.03(0.72)</td>
<td>0.05(0.71)</td>
</tr>
<tr>
<td>Model</td>
<td>Narcissism</td>
<td>Posture</td>
<td>Interaction</td>
</tr>
<tr>
<td>B</td>
<td>0.09†</td>
<td>-0.00</td>
<td>0.10†</td>
</tr>
<tr>
<td>SE B</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>β</td>
<td>.13</td>
<td>.00</td>
<td>.14</td>
</tr>
<tr>
<td>t</td>
<td>1.76</td>
<td>-0.05</td>
<td>1.94</td>
</tr>
<tr>
<td>p</td>
<td>.080</td>
<td>.958</td>
<td>.055</td>
</tr>
<tr>
<td>R²</td>
<td>.017</td>
<td>.000</td>
<td>.021</td>
</tr>
<tr>
<td>M(SD) / r</td>
<td>.14†</td>
<td>0.03(0.72)</td>
<td>0.05(0.71)</td>
</tr>
<tr>
<td>Model</td>
<td>BAS</td>
<td>Posture</td>
<td>Interaction</td>
</tr>
<tr>
<td>B</td>
<td>0.05</td>
<td>-0.01</td>
<td>0.11*</td>
</tr>
<tr>
<td>SE B</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>β</td>
<td>.06</td>
<td>-.02</td>
<td>.15</td>
</tr>
<tr>
<td>t</td>
<td>0.86</td>
<td>-.27</td>
<td>2.04</td>
</tr>
<tr>
<td>p</td>
<td>.391</td>
<td>.791</td>
<td>.043</td>
</tr>
<tr>
<td>R²</td>
<td>.004</td>
<td>.000</td>
<td>.023</td>
</tr>
<tr>
<td>M(SD) / r</td>
<td>.07</td>
<td>0.03(0.72)</td>
<td>0.05(0.72)</td>
</tr>
</tbody>
</table>

Note: †p < .10, *p < .05, **p < .01, ***p < .001, N = 180, N_{approach} = 92, N_{avoidance} = 88
Motivation moderates trait anger effects

Table 2. Correlations between the personality traits (trait anger, narcissism, behavioral activation and inhibition).

<table>
<thead>
<tr>
<th></th>
<th>Trait Anger</th>
<th>Narcissism</th>
<th>BAS</th>
<th>BIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait Anger</td>
<td>-</td>
<td>.19*</td>
<td>-02</td>
<td>-.13</td>
</tr>
<tr>
<td>Narcissism</td>
<td>-</td>
<td>-</td>
<td>-.09</td>
<td>-.10</td>
</tr>
<tr>
<td>BAS</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.62***</td>
</tr>
<tr>
<td>BIS</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: † p < .10, * p < .05, ** p < .01, *** p < .001, N_{total} = 180, N_{approach} = 92, N_{avoidance} = 88

Combined Results of the Experiments

Although the pattern of the results of Experiment 1-3 was consistent with the expectations, not all predicted interaction effects were statistically significant. Moreover, because no previous research had been done with this specific research question or design, we could only guess the likely effect size. To address these issues, we conducted a combined analysis across Experiments 1-3. The advantage of this combined analysis is that it provided a larger sample (combined N = 328) and therefore greater statistical power. Indeed, with this sample size, we would have 99% chance of detecting a medium effect size (e.g., $f^2 = .15$), and a 55% chance of detecting a small effect size (e.g., $f^2 = .02$; Faul, et al., 2007).

To ensure comparability across studies, we standardized the trait anger, state anger, and aggression scores of each experiment using Z-scores. As outcome variable, we used the standardized trait anger scores of Experiment 1 and 2, and the standardized aggression scores of Experiment 3. Because we used an additional control condition to activate an approach motivational orientation in Experiment 2, but not in Experiment 1 and 3, we combined the approach and control condition of Experiment 2 into a single indicator of approach motivation. Excluding the control condition from Experiment 2 did not change the outcome of the analyses.

First, to compare the effect sizes across studies, we conducted multiple linear regression analyses with trait anger, motivational orientation, and their interaction as predictors of state anger/aggression for each experiment. As can be seen in the overview of result in Table 3, the effect size of the interaction between motivational orientation and trait anger ranged from $R^2 = .017$ to .128, with an average effect size of .066, and standard deviation of .057, indicating that the effect size was in the small (~.01) to medium (~.09) range. In Experiment 3, the interaction between trait anger and motivation was not significant ($p = .084$), which is, given the reality of imperfect power a common occurrence when conducting a programmatic series of studies (e.g., Fabrigar & Wegener, 2016, Nosek & Lakens, 2014, Lakens, 2015). As can be seen in the correlations displayed in Table 4, higher levels of trait anger were related to more state
anger/aggression in all experiments when approach motivation was activated, but not
when avoidance motivation was activated.

Second, to investigate whether the moderating effect of motivation on the
relationship between trait anger and state anger/aggression was consistent across all
studies, we ran an analysis of variance (ANCOVA) with experiment number (1 vs. 2 vs.
3), and motivational orientation (approach/control vs. avoidance) as between subject
factors, standardized trait anger as continuous variable, and standardized state
anger/aggression as dependent variable. An overview of the results can be found in
Table 1 in the supplemental materials.

Table 3. Linear multiple regression analyses of the moderating effect of motivation
(approach (Experiment 1, 3), or approach and control combined (Experiment 2) = +1
versus avoidance = -1) on the relation between trait anger, and state anger (Experiment
1, 2), or aggression (Experiment 3).

<table>
<thead>
<tr>
<th>Experiment 1 – state anger</th>
<th>β</th>
<th>t</th>
<th>df</th>
<th>p</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td></td>
<td></td>
<td></td>
<td>.001</td>
<td>.187</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>.38</td>
<td>3.59</td>
<td>76</td>
<td>.001</td>
<td>.144</td>
</tr>
<tr>
<td>Motivation (arm push – arm pull)</td>
<td>-.02</td>
<td>-0.19</td>
<td>76</td>
<td>.852</td>
<td>.000</td>
</tr>
<tr>
<td>Interaction</td>
<td>.21</td>
<td>2.05</td>
<td>76</td>
<td>.044</td>
<td>.052</td>
</tr>
<tr>
<td>Experiment 2 – state anger</td>
<td>β</td>
<td>t</td>
<td>df</td>
<td>p</td>
<td>R²</td>
</tr>
<tr>
<td>Model</td>
<td></td>
<td></td>
<td></td>
<td>&lt; .001</td>
<td>.254</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>.21</td>
<td>1.65</td>
<td>64</td>
<td>.103</td>
<td>.041</td>
</tr>
<tr>
<td>Motivation (forward/straight – backward)</td>
<td>-.12</td>
<td>-1.11</td>
<td>64</td>
<td>.271</td>
<td>.019</td>
</tr>
<tr>
<td>Interaction</td>
<td>.37</td>
<td>3.06</td>
<td>64</td>
<td>.003</td>
<td>.128</td>
</tr>
<tr>
<td>Experiment 3 – aggression</td>
<td>β</td>
<td>t</td>
<td>df</td>
<td>p</td>
<td>R²</td>
</tr>
<tr>
<td>Model</td>
<td></td>
<td></td>
<td></td>
<td>.021</td>
<td>.053</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>.18</td>
<td>2.38</td>
<td>176</td>
<td>.018</td>
<td>.031</td>
</tr>
<tr>
<td>Motivation (forward – backward)</td>
<td>-.02</td>
<td>-0.20</td>
<td>176</td>
<td>.839</td>
<td>.000</td>
</tr>
<tr>
<td>Interaction</td>
<td>.13</td>
<td>1.74</td>
<td>176</td>
<td>.084</td>
<td>.017</td>
</tr>
</tbody>
</table>
Motivation moderates trait anger effects

Table 4. Correlations between trait anger, and state anger/aggression (Z-scores), in the different motivation conditions (approach/control = +1 versus avoidance = -1), for Experiments 1-3.

<table>
<thead>
<tr>
<th></th>
<th>r</th>
<th>df</th>
<th>p</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experiment 1 – state anger</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach (arm pull)</td>
<td>.60</td>
<td>40</td>
<td>&lt; .0001</td>
<td>.360</td>
</tr>
<tr>
<td>Avoidance (arm push)</td>
<td>.16</td>
<td>38</td>
<td>.340</td>
<td>.026</td>
</tr>
<tr>
<td><strong>Experiment 2 – state anger</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach (lean forward/sit straight)</td>
<td>.60</td>
<td>43</td>
<td>&lt; .0001</td>
<td>.358</td>
</tr>
<tr>
<td>Avoidance (lean back)</td>
<td>-.16</td>
<td>24</td>
<td>.470</td>
<td>.024</td>
</tr>
<tr>
<td><strong>Experiment 3 – aggression</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach (lean forward)</td>
<td>.32</td>
<td>91</td>
<td>.002</td>
<td>.102</td>
</tr>
<tr>
<td>Avoidance (lean back)</td>
<td>.05</td>
<td>87</td>
<td>.679</td>
<td>.002</td>
</tr>
</tbody>
</table>

The three-way interaction between experiment, motivational orientation, and trait anger was non-significant, $F(316) = 2.63, p = .074, \eta^2 = .016$. This meant that our predicted pattern was not qualified by experiment (a lack of heterogeneity across studies). The predicted motivation by trait anger interaction was highly significant, $F(316) = 19.25, p < .0001, \eta^2 = .057$. Overall, trait anger was related to state anger/aggression in the approach ($r(155) = .47, p < .0001, R^2 = .220$), approach-control combined ($r(176) = .47, p < .0001, R^2 = .221$), and control ($r(20) = .57, p < .0001, R^2 = .327$) conditions, however, no relation was present in the avoidance condition ($r(150) = .05, p = .544, R^2 = .003$). Thus, the combined analysis provided support for the notion that basic motivational states moderate whether trait anger becomes translated into anger-related responding.

**General Discussion**

Prior research has shown that trait anger is reliably associated with higher levels of state anger (e.g., Deffenbacher et al., 1996) and aggression (e.g., Bettencourt, et al., 2006). The present research investigated whether this association may be attenuated by situational activation of avoidance motivation. Consistent with this, the present findings show that trait anger predicts state anger (Experiments 1, 2) and aggression (Experiments 3) when participants made approach-oriented gestures or assumed approach-oriented postures. By contrast, the association between trait anger and state anger/aggression was inhibited when participants made avoidance-oriented gestures or assumed avoidance-oriented postures. Situated changes in the balance between approach and avoidance motivation may thus determine whether trait anger becomes translated into state anger and aggression.

Traditionally, researchers have invoked cognitive processes to explain why people high in trait anger are more prone to lose their temper than people low in trait anger.
anger (e.g., Anderson & Bushman, 2002; Wilkowski & Robinson, 2008). However, the motivational gestures and postures that we used to induce motivational states have little, if any, cognitive contents. Consequently, our results suggest that to fully understand how trait anger becomes translated into state anger and aggression, it might be vital to consider the role of basic motivational orientations towards approach and avoidance. In social situations that potentially provoke anger or aggression, people high in trait anger activate markedly more approach motivation than people low in trait anger (Veenstra et al., 2016). Furthermore, situational cues that activate avoidance motivation might down-regulate state anger and aggression among people high in trait anger, which is in line with a situated perspective on emotion regulation (Koole & Veenstra, 2015).

We operationalized motivational orientation in different ways, by varying arm movements, and seating posture. In other recent research, we have observed that ambient darkness, which is associated with avoidance motivation, also attenuates the relationship between anger experience and trait anger (Veenstra, Schneider, & Koole, n.d.). These converging effects suggest that superficially different behaviors, and perceptual experiences may be linked at a deeper level through their theoretical relations with basic motivational systems for approach and avoidance (e.g., Cacioppo, et al., 1993; Cesario, Plaks, Hagiwara, Navarette, & Higgins, 2010; Harmon-Jones, et al., 2011). Anger-related cognitions alone cannot account for these bottom-up effects of the automatic activation of these different motivational physical expressions.

We deliberately chose to use physical, perceptual-motor experiences to manipulate motivational orientation, in order to minimize the odds that our findings were mediated by cognitive inference processes. This supports the view that anger is not solely determined by cognitive states, but also by other emotion components such as motivational tendencies, facial expressions, bodily movements and physiological responding (e.g., Berkowitz, 2010). From an embodied point of view, for example, anger could be viewed from a multi-modal or embodied perspective that contains that human cognition and emotions rely on embodied simulations (e.g., Barsalou, 2008; Niedenthal, 2007). This means that just thinking or talking about emotions leads people to reactivating the physical experience of an emotion. As a consequence, different emotion components can influence each other in both directions, i.e., activating the sensory experience or motivational tendency of an emotion can activate or reinforce emotion related cognitions and behaviors as well.

**Limitations and Future Directions**

The present research inevitably has limitations and thereby leaves many issues for future research. One important direction would be to further integrate our motivational approach to trait anger with cognitive approaches (Wilkowski & Robinson, 2008). In this regard, the behavioral inhibition system seems ideally positioned as a theoretical construct to forge a synthesis between motivational and cognitive approaches. For instance, future research could test the notion that simultaneous activation of approach and avoidance tendencies leads to behavioral inhibition (Corr, 2013; Gray & McNaughton, 2000), as indexed by cognitive control measures, such as inhibitory control (Denny & Siemer, 2012). Likewise, the behavioral inhibition system might be involved in
cognitive conflict adaptation, which appears to be compromised among high trait anger people (see Wilkowski & Robinson, 2010). For instance, future studies could see if cognitive conflict adaptation improves among high trait anger people under conditions of heightened avoidance motivation.

Though our motivational anger management model requires more validation, it could have important practical implications. Our findings indicate that avoidance motivation may put the brakes on the explosive temperament of people high in trait anger. Even when people with high trait anger are unable to leave a situation, they might simply lean back or push down on a table to subdue their anger and aggressive inclinations. Training motivational tendencies has been shown useful in the domain of substance abuse (e.g., Wiers, Eberl, Rinck, Becker, & Lindenmeyer, 2011). Likewise, training motivational tendencies towards provocative stimuli might approve anger management in people with high trait anger as well. We recently followed up on this idea, and indeed found that training avoidance responses towards angry faces may decrease aggression among people with high trait anger (Veenstra, Schneider, & Koole, n.d.).

**Concluding Remarks**

Traditionally, people high on trait anger have been assumed to always respond with more anger and aggression to situational provocations than people low on trait anger. The present research suggests that trait anger may actually be a more dynamic disposition. As it turns out, moment-to-moment shifts in basic motivational states may determine whether trait anger becomes translated into anger and aggression. Indeed, a momentary increase in avoidance motivation may render high trait-anger people no less likely to lose their temper than low-trait anger people. Anger management is thus neither fully predictable from personality, nor from the situation. It is only by jointly considering personality and situation that we can understand when people become more or less angry and aggressive.
Chapter 4 – Supplemental materials

Chapter 4

Supplemental Materials

To foster best scientific practices and increase replicability of our findings, we provide a complete overview of the materials used in the experiment in the present supplemental materials. Additional data or measures that are not further elaborated can be obtained from the first author upon request.

Experiment 2

Experiment 2 was the first study that tested our prediction that motivational tendencies moderate the trait and state anger relation. For this reason, the state anger items slightly deviated from Experiments 1 and 4, and also included some exploratory measures, which are further detailed below.

State anger

The reported results on the state anger scale are based on 2 items: Participants indicating how angry they would be on the person from the vignette, and how angry they felt right now (1 = definitely not to 7 = very much). However, the experiment originally included 4 state anger items. The pattern of results using all 4 items was similar to the one reported in the article, however the main interaction was not significant.

Negative mood

Instead of the single anger subscale of the POMS used in Experiment 1, Experiment 2 included the complete version of the POMS before the motivation manipulation and also after the state anger measure. We conducted a repeated measures ANCOVA with motivation (approach vs. control vs. avoidance) as between-subjects factor, trait anger as continuous predictor and time point of mood measurement (pre vs. post) as within subjects factor. The interaction between trait anger, motivation, and time point of mood measurement was significant, $F(2, 62) = 3.49, p = .037, \eta^2 = .10$. Exploring the correlations between trait anger and the difference between the two mood measurements (post – pre) for both motivation conditions, showed that more trait anger was related to larger decrease in negative mood when participants were leaning backward, $r = -.38, p = .067$; however, trait anger was not related to negative mood changes when participants were sitting straight, $r = .12, p = .614$, or leaning forward, $r = .23, p = .298$.

When we used the anger subscale of the POMS in the reported analysis in the manuscript, there were no significant results. Thus, the observed effects were due to global mood changes rather than changes in state anger. Conducting analyses for all different POMS subscales separately, revealed that the effects on mood only applied to the anxiety subscale. The difference (pre and post) in anxiety could not account for the in the article reported motivation and trait anger interaction effects on state anger.
Motivation moderates trait anger effects

Exploratory measures
For exploratory reasons, Experiment 2 included implicit anger measures as well, i.e., a word stem completion task, and a white noise task. There were no significant results using these implicit measures.

Experiment 3
Experiment 3 included an additional aggression induction. After participants received negative feedback from the bogus interaction partner, half of the participants were randomly assigned to a non-violent video game condition, and the other half to a violent video game condition. The details of the method and the result are elaborated on below. In line with previous research (e.g., Anderson et al., 2010), we expected that participants would display more aggression after playing a violent rather than a non-violent video game. Moreover, we expected that this aggression effect would be especially pronounced among people high (rather than low) in trait anger (e.g., Wilkowski & Robinson, 2008). We also expected that the motivational effect on the relation between trait anger and aggression could be stronger under conditions that promote aggression, such that the attenuating effects of leaning back compared to leaning forward on the trait anger-aggression link would be especially strong under conditions that promote aggression (i.e., after participants played a violent video game).

Method
Aggression manipulation – video games. To manipulate participants’ level of aggression, participants were randomly assigned to one of six video games on a PC, three of which were non-violent and three were violent. Non-violent games included Bloons, Portal, and Little Racers Street. Bloons is considered a tower-defense game, where the player positions different monkeys around the board to pop balloons as they come through paths at varying speeds. The more balloons popped, the higher the score. Portal is a puzzle-platform video game where the player moves through a series of portals using different items to open and close the portals. Little Street Racers is a racing game where the player races other cars on a racetrack. Violent games included Mortal Kombat, Serious Sam 3: BFE, and Road Redemption. Mortal Kombat is a versus street fighting game where the player attempts to punch, kick, and attack another character to move up in the rankings. Serious Sam 3: BFE is a post-apocalyptic survival game where the player has to shoot, stab, or beat monsters to survive and move through the levels. Road Redemption is also a street racing game, but players are expected to shoot and beat other motorcyclists, including police officers, to get ahead on the track.

Participants were given instructions as well as a short demonstration on how to play each game, and played a game for 20 minutes continuously. They were told researchers would be comparing their highest score with their partner’s highest score after the competitive reaction time task. Once finished with the video game, participants were asked to rate the game on 15 engagement related criteria such as “the game was enjoyable/violent/frustrating/enjoyable/etc” on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Data of 5 participants were missing due to a technical
error. The items were averaged into a mean level of engagement in the video game (Cronbach’s α = .84, M = 4.49, SD = 1.03).

Results

Manipulation check. Participants in the violent video game condition reported being more engaged in the game (M = 4.97, SD = 0.88) than participants in the non-violent video game condition (M = 4.01, SD = 0.94), t(176) = 7.00, p < .001, Cohen’s d = 1.04, CI [0.73, 1.34]. On the single item ‘violent’ of the engagement items, the violent video game was also rated as more violent (M = 6.22, SD = 1.29) than the non-violent video game (M = 2.18, SD = 1.35), t(175) = 20.37, p < .001, Cohen’s d = 3.02, CI [2.59, 3.45]. These results indicate that the violent video game was experienced as more engaging as well as more violent than the non-violent video game.

Main analyses. We conducted a 2 (body posture: leaning forward/approach vs. leaning back/avoidance) X 2 (video game type: violent vs. non-violent) ANCOVA with trait anger as continuous predictor, and mean level of aggression as dependent variable, and tested all main and interaction effects. There was a significant main effect of trait anger on aggression, F(1, 172) = 9.07, p = .003, η² = .050. In line with previous research (Spielberger, 1988), participants with higher levels of trait anger, showed also higher levels of aggressive behavior, r = .26, p = .001.

We expected that the effect of posture on the relation between trait anger and aggression would be stronger in the violent video game condition than in the non-violent video game condition, because levels of aggression would be higher when aggression is promoted. Unexpectedly, however, there was no main effect of video game type on behavioral aggression, F(1, 172) = 0.27, p = .607, η² = .002. In addition, there was no predicted interaction effect of video game type and trait anger, F(1, 172) = 0.17, p = .682, η² = .001, and no predicted three-way interaction between trait anger, motivation, and video game type, F(1, 172) = 0.07, p = .794, η² = .000. Moreover, all other remaining main or interaction effects were not significant (all p’s > .373). The absence of these effects suggests that the violent video game was unsuccessful in evoking aggression.

Exploratory measures

For exploratory reasons, Experiment 3 included a questionnaire that measured participants’ general concentration abilities. The Depletion Scale includes 11 items such as “When I’m tired I have difficulties concentrating,” and “It is hard for me to persist with a difficult task.” for which participants indicated their total disagreement (1) to total agreement (7).
Motivation moderates trait anger effects

Table 1. Combined analyses of variance (ANCOVA), with Experiment (Experiment 1 versus 2 versus 3), and motivation (approach/control versus avoidance) as between subject factors, trait anger (Z-scores) as continuous variable, and standardized state anger (Experiment 1, 2), or aggression (Experiment 3) as dependent variable (Z-scores).

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