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Motivated to confront:

How experiencing anger affects anchoring bias

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### Abstract

Prior research has asserted that emotions affect anchoring bias in decision making through the emotion's certainty appraisal (Inbar & Gilovich, 2011) or through the emotion's action tendencies (Jung & Young, 2012) but these prior studies investigate the role of each component—appraisal or action tendency—without accounting for potential effects of the other one. The current research investigates whether anger exerts a significant effect on anchoring bias by activating a desire to confront a potential anchor. Importantly, the studies compare the effect of anger versus disgust, emotions that differ in their action tendency but are similar in their certainty appraisal. In Study 1, participants completed an emotion induction task and then a negotiation task where the first offer from the negotiation partner served as a potential anchor. Anger led to more deviation from the anchor compared to disgust or neutral feelings. Subsequent studies provide evidence that the angry participants are less anchored when the anchor value comes from a more confrontable source (someone else versus themselves in Study 2 and an out-group member versus an in-group member in Study 3).

Key words: anger, disgust, anchoring bias, action tendency, anchor source

Motivated to confront:

How experiencing anger affects anchoring bias

Emotions can have a marked effect on decision making, such as risk assessments (Lerner & Keltner, 2001), judgments of guilt in tort cases (Lerner, Goldberg, & Tetlock, 1998), investment decisions (Tsai & Young, 2010), and information selection in social and political issues (Young, Tiedens, Jung, & Tsai, 2011). Much of the research on emotions and decision making demonstrates that emotions from one situation can spill over into subsequent and unrelated decisions (see Han, Lerner, & Keltner, 2007, for a review). In particular, researchers assert that emotional spillover occurs when automatic evaluations about the environment—cognitive appraisals (Lazarus, 1966)—seep into unrelated tasks. After an emotional experience, a decision-maker unwittingly utilizes the appraisal in subsequent tasks. For example, experiencing an emotion associated with appraisals of the environment being uncertain leads to heightened risk estimates in subsequent judgments (Lerner & Keltner, 2001). Similarly, experiencing an emotion associated with individual agency appraisals leads to increased judgments of blame for individuals as opposed to situational blame (Lerner, Goldberg, & Tetlock, 1998).

While cognitive appraisals have been investigated as a mechanism to explain the effect of emotions on decision making, another important component of emotions, action tendencies, has received relatively less attention as a focal mechanism for empirical studies (Young & Zhu, 2018). Action tendencies are the behavioral intentions associated with emotions, like the urge to approach, avoid, or reject (Frijda, 1986; Frijda, Kuipers, & ter Schure, 1989; Fontaine & Scherer, 2013). Emotion scholars who investigate the role of appraisals in emotions also acknowledge that emotion experiences involve changes in motivations (Lerner & Tiedens, 2006; Moors, Ellsworth, Scherer, & Frijda, 2013) and consider action tendencies as embedded in the appraisals (Cryder, Lerner, Gross, & Dahl, 2008). Despite some call for empirical research taking the emotion/feeling is for doing perspective (Fontaine & Scherer, 2013; Zeelenberg, et al., 2008), documenting that emotions affect decision-making by changing behavioral intentions, and not just through cognitive appraisals, is relatively uncharted territory (but see Lerner, Small, & Loewenstein, 2004; Raghunathan & Pham, 1990; Jung & Young, 2012; Young et al., 2011). Emotions are characterized by experiential changes in multiple channels such as physiological responses, cognitive appraisals, motivational goals, and action tendencies (Lazarus, 1991; Roseman et al., 1994). Researchers emphasize that for a full understanding of the role of emotions, we should not look at changes in a single component (Frijda et al., 1989; Kuppens, Van Mechelen, Smits, & De Boeck, 2003; Zeelenberg et al., 2008).

One well-documented decision making bias is anchoring—the tendency to assimilate a judgment to an available, initial reference point (Tversky & Kahneman, 1974). The simple act of considering an initial value can lead to a biased decision because decision-makers often insufficiently adjust away from that value. Some research has demonstrated that emotional experiences have considerable effects on anchoring bias (Bodenhausen, Gabriel, & Lineberger, 2000; Englich & Soder, 2009; Epley & Gilovich, 2006). For example, prior research posited that the certainty appraisal associated with an emotion could make a decision-maker more or less confident about adjusting from a reference point (Inbar & Gilovich, 2011). Specifically, Inbar and Gilovich (2011) found that decision-makers feeling angry—a high-certainty emotion (Smith & Ellsworth, 1985)—were less anchored on a subsequent task than those feeling fearful—a low-certainty emotion (Study 1). Also, participants induced to feel disgust (high-certainty) were less anchored than participants induced to feel sadness (lower-certainty) (Study 2). However, while the emotional comparisons in these studies differed in the focal appraisal dimension—certainty—they also differed on a key motivational dimension—to attack or affiliate (Fontaine & Scherer, 2013). People feeling anger want to attack more than those feeling fear, and although disgust creates a moderate amount of desire to attack, disgust does evoke greater desire to attack than does sadness. It is possible that the desire to attack spurred by anger and disgust made participants relatively more likely to discredit and adjust away from the anchor in the decision task.

In this way, action tendencies and not only cognitive appraisals could have also affected the observed pattern of results.

Prior research on emotions and anchoring that takes a motivational approach also has not adequately accounted for the possible effect of cognitive appraisals. Jung and Young (2012) hypothesized that the desire to attack—an antagonistic action tendency—associated with anger could induce angry participants to deviate more from given anchors compared to sad participants. However, anger and sadness not only differ in action tendencies; they also differ in certainty appraisal, with anger being higher in certainty than sadness (Smith & Ellsworth, 1985).

The present studies attempt to shed more light on the effect of an emotion's action tendency on decisions by investigating two discrete emotions—anger and disgust—that are similar in their negative valence and certainty appraisal but differ in action tendencies. If anger and disgust are found to exert a differential influence on anchoring, it can be attributed to the action tendencies associated with them. In this regard, this research is expected to make two meaningful contributions beyond the existing literature. First, the paper will demonstrate that an emotion's action tendency can influence one's cognition and decision-making above and beyond its appraisal tendency. Other papers have shown that emotions can change our goals and subsequent choices (e.g. Wiltermuth & Tiedens, 2011; Jung & Young, 2011), but this paper is the first to test the role of action tendency controlling for the most relevant dimension of appraisal tendency.

Based on the action tendency account, it is expected that anger leads to more deviation from anchors than disgust, due to its greater association with the desire to attack (“moving against”, Frijda et al., 1989). The angry decision maker is ready to attack and will discredit a potential anchor as a reference point, resulting in less anchoring compared to the disgusted decision maker. A second contribution this paper makes is to draw more attention to action tendencies, an aspect of emotional experiences that contributes to the experience of discrete emotions. Researchers have called for future research to more granularly distinguish the effects of appraisals and action tendencies (Young & Zhu, 2018), and similarly examine between the informational and experiential pathways by which emotions affect decisions (Lerner et al, 2015). The current paper aligns with these calls for more understanding of an emotion’s action tendencies and decision making.

### **Cognitive and motivational approaches to the role of emotion in decision making**

According to a social functionalistic perspective, emotions have evolved to deal with diverse threats in our life. Each emotion activates behavioral responses to promote survival and well-being (Frijda, 1986; Keltner & Gross, 1999; Levenson, 1994; Hutcherson & Gross, 2011). For example, anger triggers aggressive behavior whereas disgust promotes avoidant response. These distinctive action tendencies are so intense and automatic that they exert a substantial impact on how people think and behave.



In addition to offering a more complete view of emotions and decision making, action tendencies may be particularly likely to carry over into subsequent decisions because they are foundational to the experience of emotions (Zeelenberg, 2008). Emotions are portrayed as the coordinating mechanism orchestrating the action of multiple response systems in a unified way toward solving problems (Levenson, 1994). In other words, “Specific appraisals elicit specific emotions, with specific experiential contents. This experiential content is the proximal cause of all that follows, including specific adaptive behavior” (Zeelenberg, 2008). With regard to anger in particular, action readiness is paramount: “the desire to gain revenge on, or to get back at the instigator of anger can almost be taken as a definition of anger” (Averill, 1982). Investigating the moving against action tendency as an alternative mechanism to certainty in affecting anchoring is critical because emotions guide behavior through triggered action tendencies.

Cognitive appraisals and action tendencies are related to one another but they do not perfectly map onto each other. Frijda and colleagues (1989) asked people to recall 32 different emotional experiences and rate them on both appraisal dimensions and action readiness dimensions. They found that appraisal and action readiness dimensions were highly correlated with each other, but each component also made a significant, independent contribution to distinguishing distinct emotions. Also, action tendencies are associated with combinations of appraisals, rather than being matched one to one

(Kuppens et al., 2003). For example, the moving against action tendency of anger arises from a set of appraisals on certainty, responsibility, anticipated efforts, etc. Given this finding, it is necessary to consider both components in order to fully understand emotional experiences. For example, two emotions such as anger and disgust can be similar in their cognitive appraisals and be considerably different in their motivational tendencies. We assert unique action tendencies of emotions can provide explanations above and beyond cognitive appraisal tendencies of emotions. No study to date has directly tested this possibility.

### **Anger and the desire to move against**

Anger and disgust are both negative in valence (Scherer & Fontaine, 2013), are often experienced together as a response to morally offensive behavior, and are even used interchangeably to describe relevant feelings (Nabi, 2002; Marziller & Davey, 2004; Simpson, Carter, Anthony, & Overton, 2006). According to the cognitive appraisal theory of emotion, both anger and disgust are high certainty emotions compared to other negative emotions such as fear and sadness (Smith & Ellsworth, 1985). Despite these similarities, anger is associated with unique action tendencies distinguishing itself from disgust. First, anger promotes approach tendencies while other negative emotions including disgust generally activate avoidant behavior (Harmon-Jones & Allen, 1998; Hutcherson & Gross, 2011). Second, feeling angry increases aggressive, oppositional behavior toward the target (Frijda et al., 1989; Hutcherson & Gross, 2011). For example, someone who is

blocked from achieving a goal becomes angry and wants to approach the block to act aggressively toward it. Prior research has shown that people feeling angry become punitive, even toward others not responsible for their anger (Holmes, 1972; Goldberg, Lerner, & Tetlock, 1999). Also, angry people actively seek out opportunities to argue against others' viewpoints (Young et al., 2011) and choose to perform evaluative tasks when they expect the evaluation will be negative (Wiltermuth & Tiedens, 2011).

Anger and disgust are both characterized by a defensive action tendency that is primarily shared by all negative emotions. However, anger and disgust also differ in two other action tendency factors: anger involves greater intervention and more attack than disgust (Fontaine & Scherer, 2013). Considering their distinct motivational profiles, it is predicted that anger and disgust will differentially influence how people respond to an anchor. Anchoring bias occurs because people rely on the anchor value without sufficient adjustment or search for anchor-inconsistent information (Mussweiler & Strack, 1999; Mochon & Frederick, 2013). Feeling angry and its associated antagonism will make people motivated to argue against and deviate from a potential anchor. Feeling disgust will not result in the same effect on anchoring bias due to its lack of antagonistic drive. As a result, we hypothesize that angry people will be less susceptible to anchoring bias compared to people feeling neutral or disgusted.

A set of three studies was performed to test this hypothesis. Study 1 examined the effects of anger on anchoring bias using a negotiation task.

Study 2 replicates the pattern using a different task. Comparing responses to self-generated and other-provided anchors provided evidence that anger's antagonistic action tendency drives the effect. Study 3 provides a further test of the action tendency explanation by comparing responses to anchors provided by in-group and out-group members.

### **Study 1**

In Study 1, we examined the effect of anger on anchoring in negotiations. In two negotiation scenarios, we predict that anger will lead to more deviation from given offers (less anchoring bias) compared to disgust or neutral feelings. In both scenarios, the first offer served as an anchor value. The participant's counteroffer, more specifically the extent to which their counteroffer deviated from the negotiation partner's first offer, provided a measure of anchoring.

### **Method**

164 individuals participated in this online study at a public, West-coast university in exchange of \$2. Participants read that this online study consisted of two unrelated tasks: a memory task that includes a video and an ostensibly unrelated second study on negotiation. They were randomly assigned to watch one of three video clips known to induce anger, disgust, and neutral feelings (Gross & Levenson, 1995).

Participants then read one of the two scenarios and made their counteroffer in response to the first offer provided by their negotiation partner.. In one scenario, participants took the role of someone in the market

to buy a used car. The scenario said they found one they really liked and wanted to negotiate the lowest possible price. The offer from the car dealer was \$10,500 and their task was to make a counteroffer. In the other scenario, participants imagined that they were negotiating their starting salary in a new job. The recruiter just offered \$41,000 and asked how much they would counter. Later, they answered several questions about the video clip, reported their feelings (i.e., angry, disgusted, neutral) after watching the video for manipulation check, and provided demographic information for data analysis.

## **Results and Discussion**

*Manipulation check.* A one-way ANOVA on each emotion manipulation check item was conducted to check the effectiveness of emotion manipulation. Participants in three emotion conditions significantly differed in self-reported experience of anger,  $F(2, 161) = 76.90, p < .001$ , disgust,  $F(2, 161) = 288.18, p < .001$ , and neutral feelings,  $F(2, 161) = 55.36, p < .001$ . Participants in the Anger Condition ( $M = 5.08, SD = 1.77$ ) felt significantly more angry than participants in the Disgust Condition ( $M = 3.04, SD = 1.94, t(161)=6.74, p<.001$ ) and Neutral Condition ( $M = 1.31, SD = .77, t(161)=12.39, p<.001$ ). Those in the Disgust Condition ( $M = 6.34, SD = 1.16$ ) reported significantly more disgust than those in the Anger Condition ( $M = 5.72, SD = 1.50, t(161)=2.72, p=.007$ ) and Neutral Condition ( $M = 1.33, SD = 0.84, t(161)=22.12, p<.001$ ). And those in the Neutral Condition ( $M = 5.31, SD = 1.77$ ) reported feeling more neutral than those in the Anger

Condition ( $M = 2.66$ ,  $SD = 1.76$ ,  $t(157) = 8.27$ ,  $p < .001$ ) and Disgust Condition ( $M = 2.27$ ,  $SD = 1.37$ ,  $t(157) = 9.71$ ,  $p < .001$ ).

*Anchoring effects.* We standardized participants' negotiation counteroffers for each scenario. In the salary scenario, responding with a higher salary indicates more deviation from the anchor, whereas, in the car scenario, offering a lower price does so. Accordingly, we next reversed the standardized scores for the car scenario so that a higher z-score indicates a larger deviation from the anchor value and therefore less anchoring (Epley & Gilovich, 2006).

A one-way ANOVA on this standardized score revealed a significant difference by emotion conditions,  $F(2, 161) = 3.98$ ,  $p = .02$ , partial  $\eta^2 = .047$ , observed power = .71. Participants in the Anger Condition ( $M = 0.31$ ,  $SD = 0.99$ ) deviated more from the anchor than participants in the Disgust Condition ( $M = -0.18$ ,  $SD = 1.02$ ,  $t(161) = 2.61$ ,  $p = .01$ ) and the Neutral Condition ( $M = -0.12$ ,  $SD = 0.93$ ,  $t(161) = 2.26$ ,  $p = .03$ ). There was no significant difference between the Disgust Condition and the Neutral Condition,  $t(161) = 0.34$ ,  $p = .73$ . The results show that when negotiating to buy a used car or negotiating a starting salary, negotiators experiencing anger deviated more from the first offer provided by their negotiation partner. They made more aggressive offers than those experiencing disgust or neutral feelings.

The observed pattern was as hypothesized: two emotions that are similar in cognitive appraisal but different in action tendency had different

effects on anchoring. Angry individuals deviated more from a given anchor in these negotiation scenarios than disgusted individuals or people feeling neutral emotions.

## **Study 2**

The purpose of Study 2 is to replicate the Study 1 finding with a different task (general knowledge task) and to provide more direct evidence that the desire to confront the anchor drives the effect. One way to test the role of action tendency is to manipulate the source of anchor. In Study 1, participants made decisions with anchor values provided by the experimenters (ostensibly, their negotiation partner). On the other hand, people can generate anchor values on their own in order to use them as relevant and useful benchmarks in decision making. For example, if asked to guess the gestation period of an African elephant, people who do not know the answer often use 9 months (human gestation period) as a reference point and, based on the knowledge that bigger species tend to have a longer gestation period, add more months to arrive at an answer that seems reasonable (Epley & Gilovich, 2001, 2005)

We expect that anger will not have the same impact on anchoring when anchors are self-generated as when anchors are other-provided. Angry people are motivated to attack something or someone else, not themselves nor their own ideas and similarly they will confront externally-provided anchors more than self-generated anchors. We hypothesize that feeling

angry will result in more deviation from anchors when the anchors are externally-provided, not when the anchors are self-generated.

## **Method**

97 university affiliates participated in this online study. The same video clips as in Study 1 were used to induce anger, disgust, and neutral emotions. Participants then took a general knowledge task in which they got four other-provided anchor questions (Jacowitz & Kahneman, 1995) and four self-generated anchor questions (Epley & Gilovich, 2001).<sup>1</sup>

One example of other-provided anchor questions is “What is the height of the tallest redwood (in feet)?” Participants answered an ensuing question first where a pre-selected anchor value was provided as a reference point, such as “Is it higher or lower than 65?” and later gave their final estimate. In this example, the anchor value was provided by the experimenter. In contrast, self-generated anchor questions had a clear reference point most people will come up with easily on their own. One sample question is “How many days does it take Mars to orbit the sun?” To answer this question, most participants used 365 days (the Earth’s orbital period) as a reference point and found their best answer from it. The order of two sets of questions was counterbalanced. To prevent participants from searching for the answer online, the question prompt at the start of the general knowledge questions explicitly asked them not to search the internet or rely on anyone else to find

<sup>1</sup> Four anchoring questions were randomly selected from the original set of questions used by Jacowitz & Kahneman (1995) and Epley & Gilovich (2001) respectively. For the complete set of questions used in Study 2, please see Appendix A.



the answer. After the participants completed all eight questions, they answered the emotion manipulation check items and provided demographic information.

## **Results and Discussion**

*Manipulation check.* A one-way ANOVA on each emotion manipulation check item revealed a significant difference in self-reported experience of anger,  $F(2, 91) = 77.54, p < .001$ , disgust,  $F(2, 91) = 759.99, p < .001$ , and neutral feelings,  $F(2, 91) = 77.23, p < .001$ . Participants in the Anger Condition ( $M = 5.41, SD = 1.72$ ) felt significantly more angry than participants in the Disgust Condition ( $M = 2.65, SD = 1.60, t(91)=7.92, p<.001$ ) and Neutral Condition ( $M = 1.13, SD = .43, t(91)=12.26, p<.001$ ). Those in the Disgust Condition ( $M = 6.71, SD = .59$ ) reported significantly more disgust than those in the Anger Condition ( $M = 6.16, SD = .81, t(91)=3.55, p=.001$ ) and Neutral Condition ( $M = 1.16, SD = .37, t(91)=35.32, p<.001$ ). And those in the Neutral Condition ( $M = 5.65, SD = 1.60$ ) reported feeling more neutral than those in the Anger Condition ( $M = 1.78, SD = 1.18, t(91) = 11.24, p<.001$ ) and Disgust Condition ( $M = 2.10, SD = 1.27, t(91) = 10.24, p<.001$ ).

*Anchoring effects.* After the general knowledge task, participants were asked to recall the anchor value they generated and utilized in answering the self-generated anchor questions. For example, they were asked to report the gestation (pregnancy) period of human and whether they considered the value to answer the question about the elephant's gestation period.

Previously-used selection criteria were applied (Epley & Gilovich, 2001); participants who did not meet both criteria – 1) generate the right anchor value and 2) use the anchor to find an answer – were excluded on an item-by-item basis.<sup>2</sup>

To create a measure of deviation from the anchor, absolute deviation scores between anchors and estimates were first computed by subtracting participants' estimates from anchor values and taking absolute values out of them. That is, regardless of the direction, the farther participants' estimates are from anchor values, the more deviation and the less anchoring they indicate<sup>3</sup>. Next, as anchoring questions involve different measurement units, these absolute deviation scores were standardized and averaged for each anchor source, other-provided versus self-generated (see Epley & Gilovich, 2001, 2004, 2006; Inbar & Gilovich, 2011; Simmons, LeBoeuf, & Nelson, 2010). Thus, this anchoring measure is basically a z-score indicating the amount of deviation from anchors. A positive z-score indicates a greater deviation than average, while a negative z-score indicates a less deviation than average.<sup>4</sup>

<sup>2</sup> Data analysis without applying these two selection criteria did not change the significance of the main findings.

<sup>3</sup> Not all the participants know the correct direction they should take from the anchor value. Depending on whether the participants believe the correct answer is higher or lower than the anchor value, they would deviate in a different direction. To obtain a more consistent and comparable measure of anchoring effect despite this inconsistency in deviating direction, researchers have calculated anchor-estimate gap scores (i.e., adjustment score in Epley & Gilovich, 2001, 2005, 2006; Inbar & Gilovich, 2001; Simmons et al., 2010) by taking absolute difference scores, standardizing, and averaging them across items.

<sup>4</sup> Mean scores of actual responses for each emotion condition in Study 2 and 3 are reported in Appendix B.

A 3 Emotion  $\times$  2 Anchor Source mixed-model ANOVA, where Anchor Source is a within-subjects variable, yielded a significant interaction,  $F(2, 85) = 6.08, p = .003$ , partial  $\eta^2 = .125$ , observed power = .88. Analysis of simple effects showed a significant anchor source effect only for the Anger condition. Participants who felt angry deviated more from other-provided anchors ( $M = 0.28, SD = 0.69$ ), compared to self-generated anchors ( $M = -0.21, SD = 0.53, t(29) = 3.01, p = .005$ ). There was no anchor effect by anchor source in the Disgust Condition,  $t(26) = 1.52, p = .14$ , or in the Neutral Condition,  $t(30) = 0.71, p = .48$  (Figure 1). When evaluating the emotion effects for each anchor source, a significant difference by emotion was observed only for other-provided anchors,  $F(2, 91) = 4.94, p = .009$ . Participants in the Anger Condition deviated more from other-provided anchors than participants in the Disgust or Neutral Condition. This significant difference by emotion condition was not observed with self-generated anchors,  $F(2, 85) = 1.83, p = .17$ . These results confirm our hypothesis that the effects of anger on anchoring will depend on the source of anchor. When the source was someone else, anger made people deviate more from the anchor and consequently weakened its effect on their final estimate compared to when the anchor value was self-generated.

### **Study 3**

Study 2 provided support for the motivational account of the role of anger in affecting the amount of anchoring effect. As hypothesized by the notion that anger provokes someone to be antagonistic toward others and

not the self, anger generated larger anchor-estimate gaps for other-provided anchors and not self-generated anchors. However, a possible alternative explanation for this moderating effect is that the two types of anchoring questions may involve different mental processes: anchoring-and-adjustment and selective accessibility.

Some anchoring occurs when a decision maker fails to adequately adjust from the initial reference point (anchoring-and-adjustment: Tversky & Kahneman, 1974; Simmons, LeBoeuf, & Nelson, 2010). This process characterizes the decision process for self-generated anchors (Epley & Gilovich, 2001, 2006). A second process relies on confirmatory hypothesis testing of the anchor (Mussweiler & Strack, 1999). In this process, the decision maker checks the validity of the anchor and makes a biased search for information consistent with the anchor. The information uncovered by the selective search become more accessible in memory and weighs more heavily on judgments than when the anchor is not present. This selective accessibility affects decision-makers who are considering other-provided anchors (Bodenhausen et al., 2000). In sum, decision-makers engage in adjusting away from a self-generated anchor, whereas other-provided anchors prompt information search.

The fact that anchoring can involve different mental processes might provide a plausible alternative explanation for the Study 2 findings. The debiasing effect of anger in the case of other-provided anchors could be attributed to the type of mental process (hypothesis testing vs. adjustment),

not the source of anchor itself (other vs. self). It is possible that angry participants deviated more from the other-provided anchors not because the anchors were from external targets (vs. oneself), but because the other-provided anchors have been shown to trigger a hypothesis testing process and self-generated anchors do not. That is, when faced with an externally-provided anchor, individuals tend to test the validity of the anchor by searching for anchor-consistent information (Mussweiler & Strack, 1999), leading subsequent judgments to be closer to the anchor than if none had been provided. Because anger influences the search for information (Young et al, 2011), it could be that angry participants searched for anchor-inconsistent information and thus were less anchored by the externally-provided anchor compared to other emotion conditions. In contrast, self-generated anchoring is mediated by a different mental process, anchoring and adjustment, which will not be affected by anger in the same way.

To create a more rigorous test of anchor source effects separate from the process effects, Study 3 uses a different manipulation of anchor source to hold the related mental process constant. All anchors in Study 3 are other-provided, but differ by whether the source is an in-group member or an out-group member. As both in-group and out-group members are others, the selective accessibility model applies to all questions. If angry people react differently to anchor values provided by an in-group member versus an out-group member, it would provide additional evidence for the role of anchor source while holding the type of anchoring process constant. We hypothesize

that anger will lead to more deviation from the anchor only when the anchor value is provided by an out-group member, not when it is given by an in-group member.

## **Method**

149 college students and staffs participated in this online study in exchange of \$2. In this study, three target emotions were manipulated by autobiographical recall method (Keltner, Ellsworth, & Edwards, 1993). Participants were asked to recall and write about an event that caused them to feel anger or disgust in the past, or just describe how they commuted to school that day in the Neutral condition. We employed a different emotion induction method from Study 1 & 2, because the autobiographical recall method is another well-established and frequently used technique (Quigley, Lindquist, & Barrett, 2014). Given that each method has its own limitations, using a different emotion induction technique can be helpful in examining the robustness and generalizability of the findings.

To manipulate the group membership of the anchor provider, school affiliation information was utilized, because for college students, school membership forms an important part of one's self-identity (Wilder & Thompson, 1980). After the recall task for emotion induction, participants were asked to indicate their college membership between their university and a rival school in the local community. As all the participants were recruited from a single university, this question was intended to prime their school identity and make them believe that their rival school students also

participate in this study. Then, they were given 4 other-provided anchor questions (2 items used in Study 2 and 2 newly added items)<sup>5</sup>. Each question indicated who provided the anchor value as a reference point. Participants were told that in two questions, anchors were provided by a student from their university (in-group member), and in the other two questions, anchors were provided by a student from a rival school (out-group member). Their final estimates served as the measure of anchoring effect. Lastly, participants completed emotion manipulation check items and provided demographic information.

As we used the autobiographical recall task for emotion induction, we screened out participants who failed to follow instructions (e.g., described an incident that induced a different emotion from the one requested). As a result, 12 participants were removed and our data analysis was conducted with the final sample of 137 participants.<sup>6</sup>

## **Results and Discussion**

*Manipulation check.* To validate the emotion induction procedure, we asked participants to report their emotions after the anchoring task.

Participants in three emotion conditions significantly differed in self-reported experience of anger,  $F(2, 134) = 35.78, p < .001$ , disgust,  $F(2, 133) = 91.70, p < .001$ , and neutral feelings,  $F(2, 133) = 41.51, p < .001$ . Participants in

<sup>5</sup> Please see Appendix A for items used in Study 3. There are no unreported anchoring questions in our studies.

<sup>6</sup> Out of 149 participants, 5 participants were initially removed because of their failure to follow instructions (3 did not write anything for emotion induction and 2 did not answer any of the anchoring questions) and 7 participants were deleted because they wrote up their experience on a wrong emotion (not the target emotion they were asked to recall and describe).

the Anger Condition ( $M = 4.55$ ,  $SD = 1.97$ ) felt significantly more angry than participants in the Disgust Condition ( $M = 3.70$ ,  $SD = 2.00$ ,  $t(134)=2.29$ ,  $p=.024$ ) and Neutral Condition ( $M = 1.56$ ,  $SD = 1.17$ ,  $t(134)=8.12$ ,  $p<.001$ ). Those in the Disgust Condition ( $M = 5.38$ ,  $SD = 1.28$ ) reported significantly more disgust than those in the Anger Condition ( $M = 3.63$ ,  $SD = 2.00$ ,  $t(133)=5.72$ ,  $p<.001$ ) and Neutral Condition ( $M = 1.42$ ,  $SD = .90$ ,  $t(133)=13.51$ ,  $p<.001$ ). And those in the Neutral Condition ( $M = 6.15$ ,  $SD = 1.29$ ) reported feeling more neutral than those in the Anger Condition ( $M = 3.39$ ,  $SD = 2.11$ ,  $t(133) = 7.52$ ,  $p<.001$ ) and Disgust Condition ( $M = 3.28$ ,  $SD = 1.74$ ,  $t(133) = 8.11$ ,  $p<.001$ ).

*Anchoring effects.* Similar to Study 2, absolute deviation scores were calculated, standardized, and averaged for each anchor source, in-group (their school) and out-group (rival school). A 3 Emotion (Anger, Disgust, Neutral)  $\times$  2 Anchor Source (in-group, out-group) mixed-model ANOVA, where Anchor Source is a within-subjects variable, yielded a significant interaction,  $F(2, 134) = 3.54$ ,  $p = .032$ , partial  $\eta^2 = .05$ , observed power=.65 (Figure 2).

Analysis of simple effects revealed a marginally significant anchor effect for both the Anger and Disgust Condition. That is, participants in the Anger Condition deviated slightly more from an anchor when the anchor was provided by an out-group member ( $M = 0.15$ ,  $SD = 1.05$ ) than when it was provided by an in-group member ( $M = -0.15$ ,  $SD = 0.39$ ), although the magnitude of the effect did not quite reach a conventional level of



significance,  $t(41) = 1.76, p = .086, d = .08$ . When the anchor was provided by an out-group member, angry individuals deviated more from the anchor value and as a result, they were less anchored compared to individuals feeling disgust or neutral. This attenuating effect of anger was not observed when the anchor was provided by an in-group member, which adds more evidence for the action tendency mechanism. The reverse pattern was observed in the Disgust condition: participants in the disgust condition deviated more from an anchor provided by an in-group member ( $M = 0.17, SD = 1.00$ ) than one provided by an out-group member ( $M = -0.10, SD = 0.23, t(46) = 1.83, p = .074, d = .08$ ). In the Neutral condition, no significant difference by anchor source was observed (in-group:  $M = -.047, SD = .58$ , out-group:  $M = -.046, SD = .75, t(47) = .004, p = .997$ ). When examining the difference by emotion conditions for each anchor source, the emotion effects failed to reach significance:  $F(2, 134) = 1.59, p = .21$  (out-group) &  $F(2, 134) = 2.07, p = .13$  (in-group), although the interaction effect of emotion and anchor source displayed a similar pattern to that of Study 2.<sup>7</sup>

To sum up, by manipulating the group membership of anchor provider we obtained a significant interaction effect which is consistent with the results of Study 2. Yet the simple effects were not significant in Study 3. The failure to replicate the simple effects may be attributable to the issue of manipulation strength. Compared to the self-other distinction, in-group vs.

<sup>7</sup> The raw datasets and study materials from all three studies are shared through the following link: [https://osf.io/s9m63/?view\\_only=6695f67997754d379ad504a4cf8ca8d4](https://osf.io/s9m63/?view_only=6695f67997754d379ad504a4cf8ca8d4)

out-group distinction is much subtler in that both in-group and out-group members are considered as “other” as opposed to the self. Also, manipulating anchor source by school affiliation might be effective only for the participants who hold strong group identities associated with their school. Thus, it is not surprising that the emotion effects turned out to be slightly weaker in Study 3 than in Study 2.

### **General Discussion**

The current studies examined the role of anger experiences in anchoring bias. Experiencing anger led to less anchoring than disgust and neutral emotional states in a negotiation task (Study 1). Subsequent studies varied the source of the potential anchor, providing evidence for the role of action tendency as a driving factor. The effect of anger on anchoring bias was observed only when the anchors were provided by a confrontable target—someone else, not the self (Study 2), and by out-group members not by in-group members (Study 3). Anger spurs a tendency to approach, intervene, and attack someone or something. Experiencing anger leads people to seek an external target for acting on the desire to confront, but it does not lead to self-attack or self-criticism. The role of anchor source supports the idea that the motivation to confront drives the effect of anger on anchoring.

This research contributes to the literature on emotion and decision making by offering empirical evidence on how an emotions’ action tendencies affect subsequent decisions. Prior research has primarily focused on the cognitive appraisal component of emotions to understand how

discrete emotions have differential effects on decision making while considering motivational components as embedded in appraisals. Although appraisal tendencies and action tendencies are related (Frijda et al., 1989), they describe different aspects of emotional experiences and thus should be considered in tandem for a better understanding of how emotions affect decision making. Because the two focal emotions—anger and disgust—are similar in certainty appraisal but are distinctive in their action tendencies, these findings provide evidence for the notion that action tendencies associated with emotions exert a unique effect on subsequent decisions. Additionally, although anger and disgust also differ in other appraisal dimensions such as anticipated effort and attention (Smith & Ellsworth, 1985), these appraisal dimensions do not provide theoretical justification for the current findings. In particular, effortful thinking facilitated by incentives and forewarnings leads to more deviation from self-generated anchors (Epley & Gilovich, 2005). As anger is associated with higher anticipated effort and attention than disgust, anger should result in more deviation from self-generated anchors than disgust, but we found the opposite pattern in our studies. The action tendency account best explains the difference between experienced anger and disgust on anchoring.

The notion that emotions affect subsequent decisions by changing one's action tendencies has been asserted in some prior work (e.g. Raganathan & Pham, 1999; Young et al, 2011). However, the majority of empirical research on differential effects of discrete emotions on decision

making theoretically draws on the Appraisal-Tendency Framework (Lerner & Keltner, 2000) when selecting comparison emotions and most findings are explained using cognitive appraisal tendencies. The current research goes beyond prior research on emotions and anchoring because the chosen two emotion conditions allow us to examine the role of action tendency while controlling for the effect of a relevant cognitive appraisal. In this way, the current studies suggest a methodological shift for researchers studying emotions and decision making; researchers should be aware of multiple dimensions by which emotions differ—valence, cognitive appraisal dimensions, and action tendencies—before choosing emotion comparison conditions and interpreting results.

Future studies should examine the unique action tendency of disgust more directly. In a set of three studies, participants feeling disgusted displayed the opposite pattern in response to anchors compared to those feeling angry. Disgusted people deviated more from a self-generated anchor than an other-provided anchor in Study 2, and deviated more from an anchor offered by an in-group member compared to one offered by an out-group member in Study 3. In this research, anger was the focal emotion and disgust was chosen as a comparison state. Yet disgust has its own action tendency property, which is to avoid, expel, or break off contact with the offending entity (Rozin, Haidt, & McCauley, 1993; Haidt, 2003). This desire to expel is known to be particularly stronger with proximal objects compared to distant objects (Han, Lerner, & Zackhauser, 2012). Considering that self-

generated anchors (or anchors provided by an in-group member) are more proximal than other-provided anchors (or anchors provided by an out-group member), the observed patterns could be explained by the unique action tendency of disgust, even though the patterns did not reach acceptable levels of statistical significance. If more research is conducted to investigate the role of disgust and its unique action tendency in a variety of decision-making contexts, it will enrich our understanding on emotion and decision making from an action tendency perspective.

The current studies also lend support to the idea that emotions can benefit decision making, depending on the characteristics of the task. When people heavily rely on a reference point without checking its validity, they are more likely to be anchored by that value and less likely to make accurate estimates or make better decisions. As a way of overcoming anchoring bias, scholars have suggested cognitive strategies such as considering the opposite (Lord, Lepper, & Preston, 1984; Mussweiler, Strack, & Pfeiffer, 2000) or procedural checklists such as re-anchoring with figures generated by other models (Kahneman et al., 2011). The current research suggests that individuals can also use emotional strategies to combat anchoring bias. One component of emotional intelligence (Mayer & Salovey, 1997) is to use emotions for facilitating cognition and behavior. A person with high emotional intelligence can self-induce a particular emotion that boosts performance in the task at hand (Tamir, Mitchell, & Gross, 2008). For example, if an individual is about to engage in a task requiring critical

perspectives on the given data and does not want to be anchored on available reference points, she could think of an event that made her angry. Ruminating on this event would induce an angry state and help push back against the reference point. Knowing that anger affects anchoring bias, decision makers can put themselves in an angry mood to make a better decision by not falling prey on anchoring bias.

While this research showed the significant role of anger in moving against the given anchors, additional analyses revealed that angry participants did not necessarily give more correct estimates than participants feeling disgust or neutral.<sup>8</sup> This finding of relatively similar accuracy might be due to the fact that participants deviated from the anchor values in different directions and sometimes deviated more than necessary. Deviating from anchor values is the very first step toward overcoming anchoring bias, but whether anger can help people make accurate judgment as a result should be further researched to be fully understood.

<sup>8</sup> By computing the absolute difference scores between the participant's estimates and correct answers with general knowledge questions used in Study 2 and 3, we created accuracy measures and examined emotion effects on them. There was no significant difference by emotion conditions in both studies.

Figure 1. Standardized absolute deviation score as a function of emotion and anchor source (self vs. other)

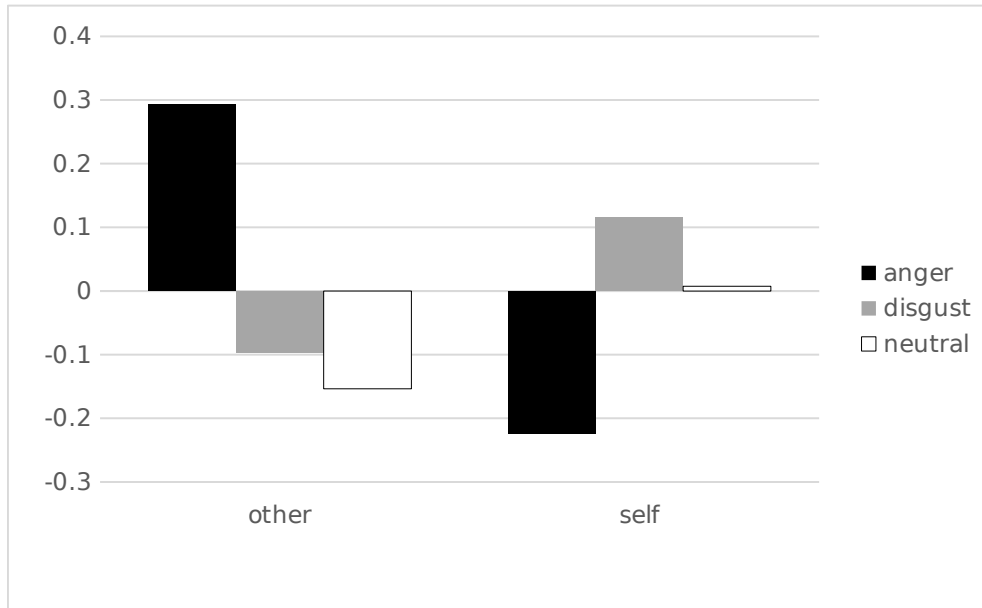
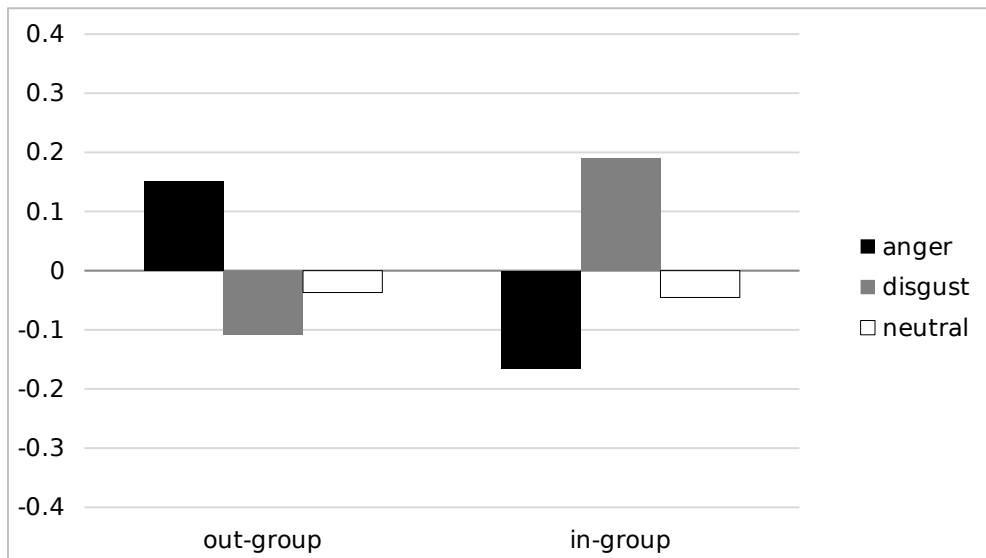


Figure 2. Standardized absolute deviation score as a function of emotion and anchor source (in-group vs. out-group)



Appendix A. Anchoring questions used in Study 2 & 3

	Anchor Source	Questions
Study 2	Other-Provided	What is the length of Mississippi River? (miles) What is the height of tallest redwood? (feet) What is the population of Chicago? (millions) What is the maximum speed of house cat? (mph)
	Self-generated	When was Washington elected president? (year) What is the boiling point of water on Mt. Everest? (°F) How many days does it take Mars to orbit the Sun? What is the gestation period of an African elephant? (months)
Study 3	Other-Provided	What is the height of Mt. Everest? (in feet) What is the height of tallest redwood? (in feet) What is the population of Chicago? (in millions) What is the average number of babies born per day in the United States?



Appendix B. Mean scores of actual responses to each anchoring question by emotion conditions

(1) Study 2

Item	Anchor	Anger	Disgust	Neutral
<b>Other1</b>	2000	2578.45	2088.06	2045.52
<b>Other2</b>	65	162.13	124.65	120.55
<b>Other3</b>	5	9.710	4.977	6.689
<b>Other4</b>	7	13.333	9.306	9.000
<b>Self1</b>	1776	1779.72	1787.75	1782.55
<b>Self2</b>	212	125.76	132.54	111.39
<b>Self3</b>	365	387.05	371.67	314.47
<b>Self4</b>	9	10.68	11.89	11.84

(2) Study 3

Item	Anchor	Anger	Disgust	Neutral
<b>In-group1</b>	2000	10773.33	14536.82	13522.20
<b>In-group2</b>	65	122.21	156.98	138.50
<b>Out-group</b>	5	5.6921	5.0122	5.3955
<b>Out-group2</b>	50000	103717.95	58774.09	67521.74

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