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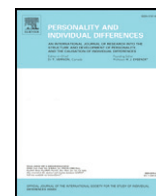
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Short Communication

Individual differences in the motivational direction of anger


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ABSTRACT

This study investigated individual differences in the motivational direction of anger. One-hundred thirty undergraduates completed the behavioral inhibition/activation system (BIS/BAS) scales, followed by a diary study wherein they rated their positive and negative affect (PA/NA) daily for seven days. We examined the within-person relations between anger and two classes of emotion—those associated with approach motivation (PA) and those associated with avoidance motivation (fear). We also examined individual differences in these relations and whether BIS/BAS sensitivities were differentially associated with these individual differences. Multi-level analyses revealed considerable and significant between-person variability in within-person relations. Approximately 95% of participants had a β for the relation between anger and PA ranging from -0.52 to 0.36 and approximately 95% of participants had a β for the relation between anger and fear ranging from -0.32 to 0.80 . Whereas moderating effects of BIS on the relations between anger and fear were relatively robust, moderating effects of BAS on the relations between anger and PA were inconsistent. Our findings reveal that some individuals experience anger as approach-related, whereas others, particularly those with high BIS sensitivity, experience anger as avoidance-related. Thus, the motivational direction of anger depends upon individual differences, particularly BIS sensitivity.

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1. Introduction

Dimensional theories of emotion posit that emotional experiences can be understood in terms of various continua. For example, according to the *valence theory*, two dimensions, termed positive and negative affect (PA/NA), best account for the correlations among self-reported judgments of emotional experiences (Watson, 2009). In recent years, however, researchers found that anger and fear—both negative in valence—were not very similar in terms of their neurobiological correlates (e.g., Carver & Harmon-Jones, 2009). Such evidence ultimately led to the *motivational direction theory*. According to this theory, PA and NA alone are insufficient to account for the variability between emotional experiences. To better account for the variability between emotional experiences, the motivational direction of an emotional experience, or the degree to which an emotion is associated with approach or avoidance motivational tendencies, should also be considered. Although PA, NA, and motivational direction share commonalities (e.g., most negative emotional experiences are avoidance-related), the valence and motivational direction theories differ with regard to their predictions about the motivational direction of anger. According to the valence theory, anger is similar to other negative emotions (e.g., anxiety and fear) and should be associated with avoidance tendencies. By

contrast, according to the motivational direction theory, anger is similar to arousing positive emotions (e.g., pride and enthusiasm) and should be associated with approach tendencies (e.g., Mneimne, Wellington, Walton, & Powers, 2015). The aim of this study was to test these hypotheses.

One commonality of most previous studies investigating the motivational direction of anger is the use of between-person approaches (e.g., Carver & Harmon-Jones, 2009). Aside from between-person approaches, researchers can also investigate the motivational direction of anger using within-person approaches. In contrast to between-person approaches that reveal variability between people in general or on a given occasion, within-person approaches reveal variability within people over time (Cattell, 1952). This study used such an approach to examine the motivational direction of anger. In particular, because most positive emotions are approach-related and fear-relevant emotions are avoidance-related (e.g., Carver & Harmon-Jones, 2009), we examined the day-to-day covariation between anger and these two types of emotions in order to evaluate anger's motivational direction. This within-person approach reveals how anger changes from day-to-day. According to the valence theory, we would expect anger to covary daily with avoidance-related negative emotions. By contrast, according to the motivational direction theory, we would expect anger to covary daily with approach-related positive emotions.

No studies have used such a within-person approach to investigate the motivational direction of anger. A few studies, however, have

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investigated the within-person factor structure of mood. Early studies utilized P-technique factor analysis, which is a factor analysis of one individual's repeated assessments over time (Cattell, 1952). These studies found that on days when peoples' anger increased in intensity, their other negative emotions also increased in intensity, while their positive emotions decreased in intensity (Lebo & Nesselroade, 1978; Zevon & Tellegen, 1982). Subsequent studies used chain-p factor analysis (Cattell & Sheier, 1961), in which each participant's repeated assessments are first centered within-person, removing information about mean levels. The resulting variables are therefore deviations from each person's mean on a given occasion. These deviations are then subjected to factor analysis across participants (i.e., occasions are "chained" together) rather than on an individual basis as in P-technique. Using chain-p factor analysis, recent studies revealed that on days when peoples' anger increased in intensity, their other negative emotions increased in intensity, and their positive emotions decreased in intensity (Watson, 2009). Thus, previous studies using within-person approaches similar to the one used in this study all found evidence supporting the valence theory.

Two limitations of P-technique and chain-p factor analysis are that these approaches can neither quantify individual differences in within-person relations nor determine whether individual differences occurred because of chance. However, given that individual differences in the motivational direction of anger may be one reason for the mixed findings in the literature (e.g., Carver & Harmon-Jones, 2009; Watson, 2009), it is important to use a statistical method capable of quantifying and evaluating the significance of individual differences. Thus, we used within-person multi-level modeling (WP-MLM; West, Ryu, Kwok, & Cham, 2011). Unlike P-technique and chain-p factor analysis, WP-MLM allows researchers to quantify and evaluate the significance of individual differences in within-person relations.

Researchers have demonstrated individual differences in the motivational direction of anger. For example, in developing the second edition of the State-Trait Anger Expression Inventory, Spielberger (1999) found that whereas some individuals reported a trait-like tendency to express their anger, other individuals reported a trait-like tendency to inhibit their anger. Similarly, some participants responded to unfair feedback on a test with self-reported anger toward the experimenters, whereas other participants responded to the same unfair feedback with self-reported anger toward themselves (Jäncke, 1996). Thus, we predicted that we would also find individual differences in the within-person relations between anger and other emotional experiences. Specifically, we predicted that anger and PA would covary positively for some individuals, but negatively for others; we also predicted that anger and fear would covary positively for some individuals, but negatively for others.

To examine these individual differences, we used the behavioral activation and inhibition system (BIS/BAS) scales (Carver & White, 1994). The BIS/BAS scales assess trait-like sensitivities of the BIS and BAS, which are considered neurobiological systems that mediate aversive and appetitive motivational processes, respectively (Gray, 1987). For example, trait BIS sensitivity has been associated positively with trait anger inhibition and higher right-than-left prefrontal cortical activity, which are associated with avoidance motivation; by contrast, trait BAS sensitivity has been associated positively with trait anger expression and higher left-than-right prefrontal cortical activity, which are associated with approach motivation (e.g., Shackman, McMenamin, Maxwell, Greischar, & Davidson, 2009; Smits & Kuppens, 2005). Thus, we predicted that people with high trait BAS sensitivity would exhibit positive relations between anger and PA, whereas people with high trait BIS sensitivity would exhibit positive relations between anger and fear. That is, individuals with high trait BAS sensitivity would experience anger as approach-related, whereas individuals with high trait BIS sensitivity would experience anger as avoidance-related.

2. Method

2.1. Participants

Participants included 148 undergraduates recruited from psychology courses at a university in the Northeastern United States. Eighteen participants without valid diary data were excluded, yielding a final sample of 130 participants. The mean age of these participants was 19.8 years ($SD = 4.37$), 75% were Female, and 86.4% were Caucasian. Descriptive statistics by sex are presented in Table 1.

2.2. Measures and procedure

2.2.1. BIS/BAS scales

The BIS/BAS scales (Carver & White, 1994) include 20 items measuring trait-like sensitivities of the BIS and BAS and four fillers. Ratings are made on a 5-point Likert-type scale (0 = quite untrue of you to 4 = quite true of you). Both the BAS scale ($\alpha = 0.85$) and the BIS scale ($\alpha = 0.81$) exhibited high internal consistency. Participants completed the BIS/BAS scales during a laboratory session prior to the diary portion of the study.

2.2.2. Positive and negative affect scale (PANAS)

The 20-item PANAS (Watson, Clark, & Tellegen, 1988) was used to assess current affect. Items are rated on a 5-point Likert-type scale (i.e., 1 = very slightly or not at all to 5 = extremely). Reports were excluded if they were completed in under 3 min (surveys included a total of 151 items) or > 12 h late, or all items were given the same response (Conner, Tennen, Fleeson, & Barrett, 2009). The average valid completion rate was 74.9% (682/910 reports). Participants completed the PANAS at the end of each day for 7 days via Qualtrics (Kutz, 2016).

Fit indices from an exploratory multi-level factor analysis with geomin rotation in Mplus revealed the best fit for a three-factor structure at the within-person level (Table 2). Using factor loadings > 0.35 (Table 3), we computed scales for PA (all ten items; $\alpha = 0.77$), fear-relevant NA (i.e., afraid, guilty, scared, ashamed, nervous, $\alpha = 0.69$), and

Table 1
Descriptive statistics by sex.

	Male ($n = 31$)	Female ($n = 99$)	p
1. Mean age (SD)	20.2 (5.2)	19.7 (4.1)	0.58
2. # Caucasians (%)	27 (87.1)	86 (86.9)	0.97
3. Mean BAS-total (SD)	41.1 (4.8)	40.8 (5.4)	0.77
4. Mean BAS-drive (SD)	11.2 (2.1)	10.9 (2.6)	0.50
5. Mean BAS-fun seeking (SD)	12.2 (1.9)	11.9 (2.4)	0.61
6. Mean BAS-RR (SD)	17.6 (2.2)	17.8 (1.9)	0.60
7. Mean BIS (SD)	17.4 (3.9)	22.0 (3.5)	0.00
8. Mean fear (SD)	1.3 (0.5)	1.4 (0.5)	0.72
9. Mean anger (SD)	1.4 (0.4)	1.6 (0.6)	0.02
10. Mean positive affect (SD)	2.3 (0.7)	2.1 (0.7)	0.11

Note. BAS = behavioral activation sensitivity; BIS = behavioral inhibition sensitivity; RR = reward responsiveness; SD = standard deviation. Equal variances were assumed for all significance tests, except for those corresponding to mean anger, for which the assumption of equal variances was violated as per Levene's test ($p = 0.04$), and # Caucasians, which used a chi-square significance test.

Table 2
Results of multi-level factor analysis: fit statistics.

Model	RMSEA	CFI	TLI
2 Between, 2 Within	0.057	0.693	0.613
2 Between, 3 Within	0.049	0.789	0.717
3 Between, 2 Within	0.059	0.692	0.587
3 Between, 3 Within	0.050	0.789	0.699

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation; TLI = Tucker-Lewis Index. Best-fitting model is bolded.

Table 3
Geomin rotated factor loadings for within-person portion of multi-level factor analysis.

	Factor 1 (PA)	Factor 2 (fear)	Factor 3 (anger)
Enthusiastic	0.626*	–0.042	–0.124
Proud	0.539*	–0.072	–0.085
Determined	0.529*	0.059	0.015
Inspired	0.529*	0.033	–0.152*
Excited	0.517*	0.012	–0.243*
Active	0.501*	0.003	0.165*
Interested	0.490*	–0.055	–0.074
Attentive	0.481*	0.106*	0.002
Strong	0.474*	–0.043	0.036
Alert	0.431*	0.144*	0.080
Afraid	–0.059	0.705*	–0.069*
Scared	0.009	0.682*	–0.078
Nervous	0.079*	0.520*	0.045
Guilty	0.020	0.506*	–0.002
Ashamed	–0.067	0.503*	0.016
Upset	–0.005	0.353*	0.374*
Jittery	0.164*	0.298*	0.111*
Distressed	0.002	0.287*	0.469*
Hostile	0.073	–0.014	0.562*
Irritable	–0.038	0.031	0.652*

Note. Factor loadings > 0.35 are bolded; PA = positive affect.

* $p < 0.05$.

anger-relevant NA (i.e., irritable, hostile, distressed, upset, $\alpha = 0.67$). We included “upset” as part of the anger-relevant NA scale, because including it as part of the fear-relevant NA did not change the findings but reduced the internal consistency of the anger-relevant NA scale ($\alpha = 0.59$). Intra-class correlations were 0.40 for anger-relevant NA, 0.52 for fear-relevant NA, and 0.65 for PA. Inter-scale correlations are presented in Table 4.

3. Results and discussion

We conducted multi-level models in which reports at level one were clustered within participants at level two. We centered level 1 predictors (i.e., anger-relevant NA) within-person, controlling for individual differences in mean levels of anger, while including random intercepts and slopes (West et al., 2011). Accordingly, although females had a higher mean level of anger than males (Table 1), we did not expect sex differences in the relations between anger and other emotions or in the moderating effects of BIS/BAS on these relations. Indeed, re-analysis of the data including sex as a main effect and in interaction with anger-relevant NA yielded identical results. Thus, we present the results without sex as a covariate for simplicity.

3.1. Are there individual differences in the motivational direction of anger?

First, we assessed the within-person relations between anger and the other emotions and the between-person variability in these

Table 4
Inter-scale correlations.

	1	2	3	4	5	6	7
1. BAS-total	–						
2. BAS-drive	0.82**	–					
3. BAS-fun seeking	0.76**	0.42**	–				
4. BAS-RR	0.70**	0.39**	0.29**	–			
5. BIS	–0.07	–0.07	–0.27**	0.21*	–		
6. Mean fear	0.15	0.19*	0.10	0.04	0.15	–	
7. Mean anger	0.14	0.26**	–0.01	0.06	0.24**	0.62**	–
8. Mean positive affect	0.20*	0.20*	0.13	0.13	–0.06	0.09	0.04

Note. BAS = behavioral activation sensitivity; BIS = behavioral inhibition sensitivity; RR = reward responsiveness.

* $p < 0.05$.

** $p < 0.01$.

relations. We found a negative relation between anger and PA, $t(81.85) = -2.00$, $\beta = -0.08$, $p = 0.04$. Thus, on days when the typical participant's anger increased in intensity above average levels, their PA decreased slightly in intensity. There was more between-person variability in this relation than would be expected by chance, Wald $z = 2.79$, $SD = 0.22$, $p = 0.005$. Assuming a relatively normal distribution, adding 2 SDs to and subtracting 2 SDs from the aforementioned average standardized beta-weight yielded a range of β 's from -0.52 to 0.36 for approximately 95% of the sample.

We also found a moderately positive relation between anger- and fear-relevant NA, $t(92.87) = 6.11$, $\beta = 0.24$, $p < 0.001$. Thus, when the typical participant's anger increased in intensity above average levels, their fear also increased in intensity. Again, there was more between-person variability in this relation than would be expected by chance, Wald $z = 4.18$, $SD = 0.28$, $p < 0.001$. Assuming a relatively normal distribution, adding 2 SDs to and subtracting 2 SDs from the aforementioned average standardized beta-weight yielded a range of β 's from -0.32 to 0.80 for approximately 95% of the sample.

3.2. Are individual differences in BIS/BAS sensitivities differentially associated with individual differences in the motivational direction of anger?

Next, we examined the moderating effects of BIS/BAS on the within-person relations between anger and the other emotions. Both BIS and BAS were included as main effects and in interaction with anger-relevant NA. Given sex differences in BIS, we included sex as a main effect and in interaction with BIS in the following analyses. There was a trend for BAS to moderate the relations between anger-relevant NA and PA, $t(68.73) = 1.87$, $\beta = 0.08$, $p = 0.06$, but no effect of BIS, $t(71.73) = -1.12$, $\beta = -0.04$, $p = 0.26$. In contrast, BIS moderated the relations between anger- and fear-relevant NA, $t(105.78) = 2.56$, $\beta = 0.11$, $p = 0.01$, but there was no effect of BAS, $t(89.15) = -0.54$, $\beta = -0.02$, $p = 0.58$.

To interpret these interactions, we correlated participants' regression slope estimates with their BIS/BAS scores. Controlling for sex and BAS, there was a moderately positive correlation between BIS and anger-fear slopes, $r(100) = 0.31$, $p < 0.001$. Controlling for sex and BIS, the correlation between BAS and anger-PA slopes was not significant, $r(100) = 0.09$, $p = 0.37$.

3.3. Conclusions

This study used a novel approach to examine the motivational direction of anger. Using WP-MLM, we examined the within-person relations between anger and two classes of emotion—those associated with approach motivation (PA) and those associated with avoidance motivation (fear). We predicted that anger and PA would covary positively for some individuals, but negatively for others; we also predicted that anger and fear would covary positively for some individuals, but negatively for others. We further predicted that individuals with high trait BAS sensitivity would exhibit positive relations between anger and PA, whereas individuals with high trait BIS sensitivity would exhibit positive relations between anger and fear.

Most of our results were consistent with these predictions. We found considerable and significant between-person variability in within-person relations, as evidenced by wide ranges of regression slope estimates spanning both positive and negative values. Notably, for some individuals, on days when their anger increased in intensity, so did their PA. For other individuals, on days when their anger increased in intensity, so did their fear. Whereas moderating effects of BIS on the relations between anger and fear were relatively robust, moderating effects of BAS on the relations between anger and PA were inconsistent.

Together, our findings reveal that whereas some individuals experience anger as approach-related, others, particularly those with high trait BIS sensitivity, experience anger as avoidance-related. Thus, the motivational direction of anger depends upon individual differences,

particularly trait BIS sensitivity. These findings suggest a potential reason for heterogeneity in mental health disorders characterized by maladaptive anger, such as borderline personality disorder.

Our findings also lend support for both the valence and motivational direction theories of emotional experience (Carver & Harmon-Jones, 2009; Watson, 2009). They appear consistent with previous research demonstrating that trait BIS sensitivity correlated positively with trait anger inhibition (Smits & Kuppens, 2005), higher right-than-left prefrontal asymmetry (e.g., Shackman et al., 2009), and better recall of anger-relevant words presented preferentially to right compared to left hemisphere systems (Mneimne et al., 2015). Our findings further suggest that individuals with high trait BIS sensitivity likely feel anger concomitantly with most other negative emotions, and therefore, experience anger as avoidance-related. This process may be mediated partly by higher right-than-left prefrontal activity.

Nevertheless, we cannot rule out the possibility that the between-person variability could be explained partly by the fact that people encountered different events. Therefore, additional work is needed to disentangle the effects of situations and traits on the motivational direction of anger. Moreover, given that our sample was comprised largely of female Caucasians, replications using other samples are also needed. In particular, samples comprised of more equal proportions of males and females are likely to yield more reliable moderating effects of trait BAS sensitivity on the motivational direction of anger.

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