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ORIGINAL ARTICLE

Approach and Avoidance Profiles Distinguish Dimensions of Anxiety and Depression

Jeffrey M. Spielberg · Wendy Heller · Rebecca Levin Silton · Jennifer L. Stewart · Gregory A. Miller

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Abstract Although a substantial body of research has examined the relationship between motivational systems and mood and anxiety disorders, there is disagreement among theorists regarding the nature of these relationships. Discrepancies in the literature may be explained by several factors. Studies of motivational models rarely examine both mood and anxiety disorders simultaneously, making comparisons among them difficult. Furthermore, dimensions of anxiety often are not distinguished, obscuring potential relationships. Finally, although research in this area is beginning to conceptualize individual differences in motivational systems as longstanding temperament phenomena, this notion has not been widely incorporated into motivational models. The present study examined relationships between temperamental differences in approach and avoidance motivational systems and dimensions of anxiety and depression. Results revealed distinct relationships between motivational temperaments and each psychopathology dimension. Present findings implicate individual differences in temperamental motivation as a potential factor in the development and/or maintenance of mood and anxiety disorders.

Keywords Approach · Avoidance · Motivation · Anxiety · Depression

J. M. Spielberg (✉) · W. Heller · R. L. Silton · J. L. Stewart · G. A. Miller
Department of Psychology, University of Illinois at Urbana-Champaign, 603 E. Daniel Street, Champaign, IL 61820, USA
e-mail: jspielb2@illinois.edu

W. Heller · G. A. Miller
Beckman Institute Biomedical Imaging Center, University of Illinois at Urbana-Champaign, Champaign, IL, USA

R. L. Silton
Department of Psychology, Loyola University Chicago, Chicago, IL, USA

J. L. Stewart
Department of Psychiatry, University of California San Diego, San Diego, CA, USA

G. A. Miller
Department of Psychiatry, University of Illinois at Urbana-Champaign, Champaign, IL, USA

G. A. Miller
Zukunftskolleg, University of Konstanz, Constance, Germany

Introduction

A number of theorists have proposed that emotional responses are regulated by two overarching motivational systems, one oriented to potentially desirable outcomes and one oriented to potentially aversive outcomes (for review see Elliot and Covington 2001; Gray 1981, 1990, 1994; Lang et al. 1998).[1] In these models, emotion is thought to mobilize the organism to respond to the shifting demands of the environment, in order to obtain appetitive stimuli or avoid aversive stimuli. Consequently, the responses governed by these motivational systems serve a number of functions, including stimulation of action, recruitment of attention, and social communication (Bradley et al. 2001).

Research has linked emotion to the outcomes of goal-directed behavior, with successful goal attainment engendering positive emotions (e.g., happiness, joy) and failure

[1] Some researchers have suggested additional dimensions important for emotional and motivational processes, such as constraint/impulsivity (Carver 2005).

to attain a desired goal evoking negative emotions (e.g., sadness, anxiety; Higgins 1997, 2001; Idson et al. 2000). These motivational systems have been theorized to be instantiated, in part, in the prefrontal cortex and lateralized, such that left prefrontal cortex is associated with an approach system, involved in obtaining desirable outcomes, and right prefrontal cortex is associated with a withdrawal system, involved in avoiding undesirable outcomes (Davidson 1983).

Motivational systems have been conceptualized as forming the "basic building blocks that underlie the complexity of human behavior" (Carver et al. 2000, p. 741). Consequently, researchers have investigated personality dimensions that characterize the two motivational systems. Elliot and Thrash (2002) proposed that individual differences in the two motivational systems, which they termed approach and avoidance (drawing on Lewin's [1935] terminology), map onto temperament types that form the basis of prominent dimensional characterizations of personality. Specifically, they hypothesized that approach temperament forms the common "basic core" for extraversion, positive emotionality (Watson and Clark 1993), and Gray's (1981, 1990, 1994) behavioral activation system (BAS), whereas avoidance temperament forms the common "basic core" for neuroticism, negative emotionality (Watson and Clark 1993), and Gray's behavioral inhibition system (BIS). As predicted by Elliot and Thrash, submitting extraversion and neuroticism scales (from the NEO Five-Factory Inventory [NEO-FFI], Costa and McCrae 1992), positive and negative temperament scales (from the General Temperament Survey [GTS], Watson and Clark 1993), and scales designed to measure Gray's BAS and BIS (Carver and White 1994) to exploratory factor analysis resulted in a two-factor structure the authors interpreted as representing approach and avoidance temperament.

The relationship between approach and avoidance motivation has been conceptualized inconsistently in the literature, with some suggesting independence (e.g., Gable et al. 2003) and some suggesting an inverse relationship due to mutual inhibition (e.g., Tomarken and Keener 1998). Research suggests that the relationship depends on which level of the systems is examined. For example, the systems appear inversely correlated at the level of behavioral output, whereas they appear to function independently at the level of the evaluation of salient motivational features of a stimulus (Cacioppo et al. 1999). At the level of motivational temperaments, evidence suggests that approach and avoidance are inversely correlated (Elliot and Thrash 2002; Gable et al. 2003), although not to the degree that they would be if they were one bipolar dimension.

Given that approach and avoidance temperament have been theorized to be heritable, present early in life, affective in nature, and stable throughout the lifetime (Buss and Plomin 1984; Clark et al. 1994; Elliot and Thrash 2002), researchers have theorized that they contribute to the development of psychopathology (e.g., Clark et al. 1994). For example, dysfunction in motivational systems has long been considered a key feature of depression (for an early example, see Beck 1967). However, the nature of this dysfunction has been a matter of debate. Specifically, there have been inconsistent findings regarding whether depression is linked to approach or avoidance systems, or both. Davidson posited that depression is "fundamentally associated with a deficit in the approach/appetitive motivational system" (Davidson 1998, p. 320), because the anhedonia that is often characteristic of depression is manifested as a decrease in responsiveness to positive stimuli (Henriques and Davidson 2000; Meehl 1975). Consistent with this hypothesis, research has consistently found a link between depression and decreased approach motivation (e.g., Layne 1980; Layne et al. 1983).

In regard to the avoidance system, researchers have proposed that depression is associated with a bias toward the avoidance motivational system that could result from a decrease in activation of the approach system, an increase in activation of the avoidance system, or both (Henriques and Davidson 2000; Tomarken and Keener 1998). Results in this area have been mixed, with some studies finding increased avoidance motivation (e.g., Layne et al. 1982; Dickson and MacLeod 2004) and some studies finding decreased avoidance motivation in depression (e.g., Henriques and Davidson 2000). These inconsistent findings may reflect differences in comorbid anxiety across studies. One aim of the present study was to resolve these inconsistencies by examining the relationship between depression and avoidance motivation while taking into consideration the presence of comorbid anxiety. Clark and Watson (1991) suggested that depression can be distinguished from anxiety by the presence of anhedonia. Accordingly, the present study used a measure of anhedonia in order to identify the unique relationship between depression and motivational temperaments. Given that the measure of depression utilized in the present study targets anhedonia (hypothesized to be due to decreased approach motivation) and not increased negative affect (which is more likely to reflect increased avoidance motivation), it was hypothesized that anhedonic depression would be unrelated to avoidance motivation.

The relationship between motivational systems and anxiety has received less attention. Davidson (2002) proposed that anxiety disorders are characterized by an "invariant core" (p. 76) of psychological functions he attributed to the avoidance system, such as heightened vigilance for threatening stimuli. However, research indicates anxiety disorders are a heterogeneous category (e.g.,

Brown et al. 1998; Heller and Nitschke 1998; Mineka et al. 1998; Nitschke et al. 1999), making it possible that an increase in the avoidance system is only related to certain anxiety dimensions. Therefore, a second aim of the present study was to determine the consistency of the relationship with avoidance motivation across anxiety dimensions. Two anxiety dimensions were examined: anxious apprehension, characterized by worry and verbal rumination (Andrews and Borkovec 1988; Barlow 1986, 1991), and anxious arousal, characterized by somatic tension and physiological hyperarousal (Watson et al. 1995; Watson et al. 1995).

Anxious apprehension and anxious arousal have been distinguished from each other by both psychometric (e.g., Nitschke et al. 1999) and psychophysiological methods (e.g., Engels et al. 2007). Specifically, these dimensions have been associated with different patterns of hemispheric brain activity, as measured by electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) (Engels et al. 2007; Heller et al. 1997; Nitschke et al. 1999; Spielberg et al. 2010). Anxious apprehension has been associated with relatively greater left prefrontal EEG activity (Nitschke et al. 1999), whereas anxious arousal has been associated with relatively greater right prefrontal and mid-temporal activity (Spielberg et al. 2010). Given that both anxious arousal and the avoidance system have been linked to right-hemisphere activation, this dimension of anxiety seems likely to be associated with an increase in the avoidance system. The association of left prefrontal EEG activity with both anxious apprehension and the approach system suggests that anxious apprehension will be associated with the approach system rather than the avoidance system. However, fMRI research (Engels et al. 2007; Spielberg et al. 2010) indicates that the increase in left prefrontal activity associated with anxious apprehension is due to an increase in activity in Broca's area, thought to reflect verbal rehearsal associated with worry which is likely not associated with the approach system. Therefore, there does not seem to be a strong theoretical basis for associating anxious apprehension with the approach system.

The present study examined these hypotheses in three samples. A large unselected undergraduate sample was utilized in Study 1. Test–retest data were collected for a subsample of participants in order to determine the temporal stability of the measures used as indicators for approach and avoidance temperament. Study 2 utilized a large, unselected undergraduate sample to provide a replication and extension using a questionnaire measuring an additional facet of anhedonic depression. An unselected community sample was used in Study 3 to ascertain whether the relationships observed in the undergraduate samples would generalize to a more diverse sample.

Study 1

Method

Participants

A total of 1,114 undergraduates participated as partial fulfillment of a requirement of an introductory psychology course at the University of Illinois at Urbana-Champaign. Age and gender were available for a subset of the sample ($n = 616$). Of those participants, 227 were male and 389 were female, 17–29 years old ($M = 18.55$, $SD = .96$). Those participants for whom age or gender was not available did not differ significantly ($p < .05$) on any questionnaire measure from those for whom these data were collected.

Procedure

Participants were tested in groups of 30-120 students in a classroom setting where they completed a questionnaire booklet. This booklet contained the Penn State Worry Questionnaire (PSWQ; Meyer et al. 1990; Molina and Borkovec 1994), portions of the Mood and Anxiety Symptom Questionnaire (MASQ; Watson et al. 1995; Watson et al. 1995), the NEO Five-Factor Inventory (Costa and McCrae 1992), the General Temperament Survey (GTS; Watson and Clark 1993), and the Behavioral Inhibition System and Behavioral Activation System scales (BIS/BAS; Carver and White 1994), along with questionnaires not analyzed in the present study.

The 16-item PSWQ was used to assess anxious apprehension. For this questionnaire participants rated how characteristic (1 = not at all, 5 = very typical) each item was of them. This scale consists of items such as "Many situations make me worry."

The Anxious Arousal scale of the MASQ (MASQ-AA) consists of 17 items. Participants completed a subset of the items from the Anhedonic Depression scale (MASQ-AD), because Nitschke, Heller, Imig, McDonald, and Miller (2001) found that the Anhedonic Depression scale was best represented by two facets that correspond to the Loss of Interest (LI) and High Positive Affect (HP) subscales identified by Watson, Clark, et al. (1995). The LI subscale is more closely related to the DSM-IV-TR criteria for a Major Depressive Episode. Therefore, only the 8 items from the LI subscale were used in this study to obtain a measure of anhedonic depression. For both MASQ scales, participants rated how much they experienced each item during the previous week (1 = not at all, 5 = extremely). The MASQ-AA scale consists of items such as "Startled easily," whereas the MASQ-AD-LI scale consists of items such as "Felt like nothing was very enjoyable."

Participants completed the entire 60-item NEO-Five Factor Inventory (NEO-FFI). Two of the five scales were analyzed in the present study, the 12-item Extraversion (NEO-E) and the 12-item Neuroticism (NEO-N) scales. Participants rated how characteristic (1 = strongly disagree, 5 = strongly agree) each statement was of them. The NEO-E scale consists of items such as "I like to have a lot of people around me," whereas the NEO-N scale consists of items such as "I often get angry at the way people treat me."

Participants also completed the 90-item GTS. Two of the three scales were analyzed for the present study, the 28-item Negative Temperament (GTS-NT) and the 27-item Positive Temperament (GTS-PT) scales. Participants indicated whether each statement was characteristic of them (1 = false, 2 = true). The GTS-NT consists of items such as "I have days that I'm very irritable," whereas the GTS-PT consists of items such as "I can make a game out of some things that others consider work."

On the BIS and BAS scales, comprised of 7 and 13 items, respectively, participants rated how characteristic (1 = strongly disagree, 5 = strongly agree) each statement was of them. The BIS scale consists of items such as "Criticism or scolding hurts me quite a bit," whereas the BAS scale consists of items such as "I go out of my way to get things I want."

The BIS, BAS, GTS-PT, GTS-NT, NEO-E, and NEO-N were readministered 1–6 months later to a subsample of participants ($n = 51$) in order to assess the temporal stability of these measures.

Data Analysis

Questionnaire scores were examined for outliers, and scores two standard deviations above/below the mean were assigned the value at two standard deviations. Confirmatory Factor Analysis was used to test the factor structure observed by Elliot and Thrash (2002). In order to set the scales for approach and avoidance temperament, their variances were constrained to be one. Maximum likelihood estimation was used, and correlation matrices were used as input to the CFA. The two latent factors were allowed to covary freely. Three fit indices were examined to assess model fit, the Comparative Fit Index (CFI; Bentler 1990), the Tucker-Lewis Index (TLI, Tucker and Lewis 1973), and the Root Mean Square Error of Approximation (RMSEA, Steiger and Lind 1980). The CFI reflects the extent to which the current model fit is better than a model in which the variables are constrained to be uncorrelated. The TLI is similar to the CFI, with the inclusion of a penalty for model complexity. The RMSEA also accounts for model complexity and reflects the extent to which the model-implied covariance matrix fits the predicted population covariance matrix.

GTS-PT, NEO-E, and BAS scales were initial indicators for approach temperament, and GTS-NT, NEO-N, and BIS scales were initial indicators for avoidance temperament. In order to improve model fit, measurement weight cross-loadings were added. Modification indices were examined in order to select which weights to add. Specifically, the weight associated with the largest critical ratio was added to the model and the fit indices associated with the subsequent model were then examined. Measurement weights were added until the model was associated with excellent fit indices. Specifically, Hu and Bentler (1999) suggested that CFI and TLI values greater than .95 and RMSEA values less than .06 indicate excellent model fit.

Structural equation modeling (SEM) was conducted to estimate the relationships between the latent approach and avoidance temperament variables and the three psychopathology scores, using AMOS (Analysis of Moment Structures) version 18. SEM was used (e.g., as opposed to regression) in order to estimate latent variables for approach and avoidance temperament without the added error of estimating factor scores. In addition, SEM allows the relationships between approach and avoidance temperament and the three psychopathology variables to be estimated simultaneously.

Approach and avoidance temperament latent variables were modeled in the same manner as the final model obtained in the CFA. Maximum likelihood estimation was used, and correlation matrices were used as input. As depicted in Fig. 1, approach and avoidance temperament were exogenous variables predicting PSWQ, MASQ-AA, and MASQ-AD-LI (endogenous variables). The error terms corresponding to the psychopathology variables were allowed to covary (not shown in Fig. 1, for ease of viewing) because of the substantial common variance shared by these constructs that will not necessarily be completely predicted by approach and avoidance temperament.

Additional tests were conducted in order to evaluate potentially distinct relationships between temperament scores and the three psychopathology scores. A series of nested models were created, each testing a pairwise comparison of the standardized regression weights corresponding to two of the psychopathology scores. Each set of nested models compared a model in which all regression weights were allowed to be estimated freely to a model in which two of the standardized regression weights between one of the latent variables and the psychopathology questionnaires were constrained to be equal. For pairs of regression weights differing in sign, one of the endogenous variables was multiplied by -1, causing the weight for that variable to change sign. This was done so that the comparison between weights would reflect the difference in the magnitude of the effects.

Exploratory analyses were conducted to assess potential gender differences, using those participants for whom

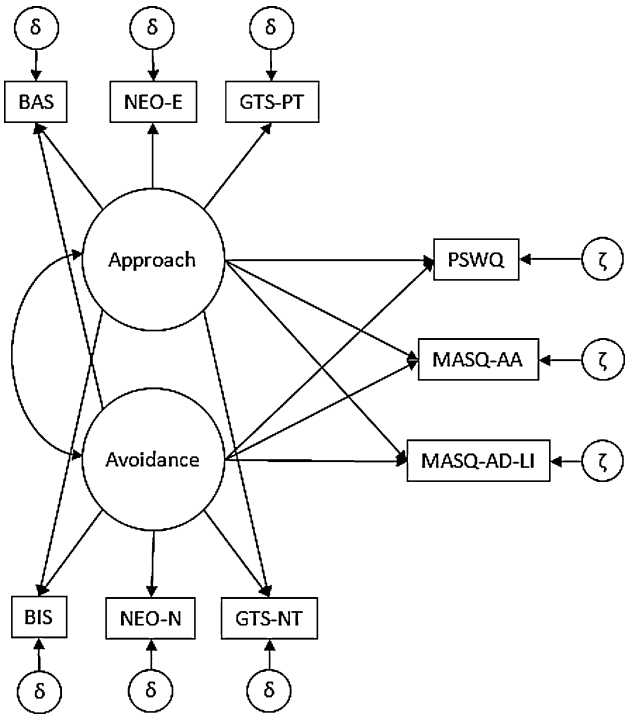

Fig. 1 Structural equation model for Study 1 ($N = 1{,}114$). Latent variables for approach and avoidance temperament predicting PSWQ, MASQ-AA, and MASQ-AD-LI. *BIS* behavioral inhibition system, *BAS* behavioral activation system, *GTS-NT* general temperament survey negative temperament, *GTS-PT* general temperament survey positive temperament, *NEO-N* NEO neuroticism, *NEO-E* NEO extraversion, *PSWQ* Penn State Worry Questionnaire, *MASQ-AA* Mood and Anxiety Symptom Questionnaire Anxious Arousal, *MASQ-AD-LI* Mood and Anxiety Symptom Questionnaire Anhedonic Depression Loss of Interest. The covariance between the error terms are not pictured for conciseness

gender information was collected. These analyses were conducted using multiple-groups analysis following the testing order recommended by Bollen (1989), and the measurement model was tested first. To begin, the measurement weights were tested for consistency across genders, followed by a test of the covariance (with the measurement weights held constant), and a test of the variances (with the measurement weights and covariance held constant). Next, the path model was tested (with the measurement model held constant). First, the regression weights were tested for consistency across genders, followed by a test of the covariances (with the regression weights held constant), and a test of the variances (with the regression weights and covariances held constant).

Results

Means and standard deviations for the nine scales are provided in Table 1. Univariate and multivariate normality were examined. All univariate skew and kurtosis values were 1 or less (absolute value), and multivariate kurtosis was 1.9, indicating that the data were distributed normally.

Confirmatory Factor Analysis

In the final model, BAS, NEO-E, GTS-PT, BIS, and GTS-NT were indicators of the approach latent variable, and BIS, NEO- N, GTS-NT, and BAS were indicators of the avoidance latent variable. This model was successfully estimated and associated with a χ^2_5 value of 21.2, $p = .001$. For the final measurement model, the CFI value was .994, the TLI value was .983, and the RMSEA value was .054 (90% confidence interval = .031 to .078), indicating that the model provided an excellent fit to the data. All measurement weights were significant at $P < .001$. The standardized estimates are provided in Table 2. The latent temperament variables were correlated −.415 ($\chi^2_1 = 131.2$, $P < .001$).

Structural Equation Model

The model was successfully estimated and was associated with a χ^2_{17} value of 225.9, $P < .001$. The CFI value was .965, the TLI value was .926, and the RMSEA value was .097 (90% confidence interval = .085 to .110). These values indicate that the model provided adequate although not excellent fit to the data. All measurement weights were significant at $P < .001$ and the standardized estimates were extremely similar to those found in the CFA.

SEM: Approach Temperament Predicting PSWQ, MASQ-AA, and MASQ-AD-LI

As shown in Table 3, approach temperament positively predicted PSWQ and MASQ-AA, whereas approach temperament negatively predicted MASQ-AD-LI. The magnitude of the γ for MASQ-AD-LI was larger than that for the γ for MASQ-AA, $\chi^2_1 = 7.0$, $P = .008$. The γ for PSWQ was larger than the γ for MASQ-AA, $\chi^2_1 = 108.3$, $P < .001$.

SEM: Avoidance Temperament Predicting PSWQ, MASQ-AA, and MASQ-AD-LI

As reported in Table 3, avoidance temperament positively predicted PSWQ, MASQ-AA, and MASQ-AD-LI. The γ for PSWQ was larger than the γ's for MASQ-AD-LI, $\chi^2_1 = 171.4$, $P < .001$, and MASQ-AA, $\chi^2_1 = 108.3$, $p < .001$.

Given the strong relationship between avoidance temperament and PSWQ, several secondary analyses were conducted to ensure that, although highly related, these

Table 1 Descriptive statistics

Variable	Study 1 ($N = 1{,}114$)		Study 2 ($N = 514$)		Study 3 ($N = 145$)	
	Mean	SD	Mean	SD	Mean	SD
BIS	21.3	3.8	22.4	3.3	21.4	3.3
BAS	40.8	5.1	41.3	4.3	39.3	4.9
GTS-NT	12.8	7.3	13.6	7.1	11.4	6.6
GTS-PT	18.7	5.7	18.5	5.4	19.1	5.4
NEO-N	29.8	8.0	33.7	9.2	32.8	8.7
NEO-E	42.9	6.9	43.6	7.3	40.2	6.6
PSWQ	49.8	13.7	51.3	15.0	47.1	14.6
MASQ-AA	28.6	8.3	28.2	8.5	22.2	3.9
MASQ-AD-LI	18.0	5.6	17.3	5.2	15.1	4.2
MASQ-AD-HP	–	–	35.9	10.8	39.5	9.8

BIS behavioral inhibition system, *BAS* behavioral activation system, *GTS-NT* general temperament survey negative temperament, *GTS-PT* general temperament survey positive temperament, *NEO-N* NEO neuroticism, *NEO-E* NEO extraversion, *PSWQ* Penn State Worry Questionnaire, *MASQ-AA* Mood and Anxiety Symptom Questionnaire Anxious Arousal, *MASQ-AD-LI* Mood and Anxiety Symptom Questionnaire Anhedonic Depression Loss of Interest, *MASQ-AD-HP* Mood and Anxiety Symptom Questionnaire Anhedonic Depression Low Positive Affect

Table 2 Factor loadings

	Study 1 ($N = 1{,}114$)		Study 2 ($N = 514$)		Study 3 ($N = 145$)	
	Avoidance	Approach	Avoidance	Approach	Avoidance	Approach
BIS	.831	.250	.684	.212	.760	.100
BAS	.180	.623	.241	.642	.452	.837
GTS-NT	.909	.126	1.026	.176	.890	.074
GTS-PT	–	.825	–	.810	–	.800
NEO-N	.888	–	.851	–	.922	–
NEO-E	–	.837	–	.848	–	.844

BIS behavioral inhibition system, *BAS* behavioral activation system, *GTS-NT* general temperament survey negative temperament, *GTS-PT* general temperament survey positive temperament, *NEO-N* NEO neuroticism, *NEO-E* NEO extraversion

Table 3 Regression weights

Variable	Study 1 ($N = 1{,}114$)			Study 2 ($N = 514$)			Study 3 ($N = 145$)		
	γ	χ^2	P	γ	χ^2	P	γ	χ^2	P
Exogenous variable: approach temperament									
PSWQ	.298	117.3	<.001	.273	46.9	<.001	.084	1.0	.328
MASQ-AA	.095	7.7	.006	.190	12.5	<.001	.030	.1	.797
MASQ-AD-LI	−.239	61.1	<.001	−.157	11.1	.001	−.128	1.5	.227
MASQ-AD-HP	–	–	–	−.529	126.4	<.001	−.556	30.5	<.001
Exogenous variable: avoidance temperament									
PSWQ	.913	1200.6	<.001	.982	487.9	<.001	.851	78.3	<.001
MASQ-AA	.476	195.4	<.001	.461	76.7	<.001	.300	6.9	.009
MASQ-AD-LI	.525	301.5	<.001	.553	138.2	<.001	.471	20.0	<.001
MASQ-AD-HP	–	–	–	.291	46.1	<.001	.195	4.3	.039

PSWQ Penn State Worry Questionnaire, *MASQ-AA* Mood and Anxiety Symptom Questionnaire Anxious Arousal, *MASQ-AD-LI* Mood and Anxiety Symptom Questionnaire Anhedonic depression loss of interest, *MASQ-AD-HP* Mood and Anxiety Symptom Questionnaire Anhedonic Depression Low Positive Affect

constructs were distinct. Specifically, unused subscales of the GTS and NEO (conscientiousness & agreeableness from the NEO & disinhibition from the GTS), which should have opposite relationships with avoidance temperament and anxious apprehension, were added (individually) to the model with avoidance and PSWQ as predictors. As predicted, these relationships were indeed opposite, with conscientiousness and agreeableness having a negative relationship with avoidance temperament and a positive relationship with PSWQ, and disinhibition having a positive relationship with avoidance and a negative relationship with PSWQ. This indicates that avoidance temperament and worry are separable constructs.

Temporal Stability of Temperament Indicators

As shown in Table 4, all of the temperament dimensions, except BAS, exhibited high stability across time. The BAS correlation between time 1 and time 2 was .567. This may explain the fact that BAS exhibited the smallest primary loading on approach temperament in the CFA, and SEM analyses, since this measure may contain more error variance. Overall, the indicators of approach and avoidance temperament appear to have high temporal stability, at least over the time period sampled.

Exploratory Gender Analyses

The exploratory multiple-groups analyses testing for gender differences did not reveal any significant discrepancy between genders.

Discussion

The strong two-factor structure representing approach and avoidance temperament identified by Elliot and Thrash (2002) was found to provide an excellent fit to the data in the present study in a much larger sample ($N = 1{,}114$ vs. $N = 165$). Importantly, depression and the two anxiety dimensions each evidenced a distinct pattern of relationships with motivational temperaments. Specifically, avoidance temperament was positively related to depression and the two anxiety dimensions, with anxious apprehension exhibiting the strongest relationship. Approach temperament was negatively related to anhedonic depression, positively related to anxious apprehension, and had a small positive relationship with anxious arousal.

Table 4 Temporal stability of temperament indicators ($N = 51$)

Scale	BIS	BAS	GTS-NT	GTS-PT	NEO-N	NEO-E
Correlation of T1 & T2	.81	.57	.83	.83	.80	.86

BIS behavioral inhibition system, *BAS* behavioral activation system, *GTS-NT* general temperament survey negative temperament, *GTS-PT* general temperament survey positive temperament, *NEO-N* NEO neuroticism, *NEO-E* NEO extraversion

The finding that anhedonic depression has a negative relationship with approach temperament supports Davidson's (1998) hypothesis that anhedonic depression is associated with a decrease in the activation of the approach motivational system. Furthermore, only anhedonic depression was associated with lower levels of approach temperament. This finding is consistent with the work of Clark and Watson (1991; Clark et al. 1994; Mineka et al. 1998) proposing that low positive affectivity/extraversion distinguishes depression from anxiety disorders, whereas depression and anxiety disorders share a common core of high negative affectivity/neuroticism. The unexpected positive association between MASQ-AD-LI and avoidance temperament suggests that anhedonia is not due solely to a decrease in approach motivation. This hypothesis is supported by an examination of the factor analysis performed during the development of the MASQ (Watson et al. 1995), which indicates that the MASQ-AD-LI items exhibited high loadings on the General Distress factor hypothesized to be more closely related to avoidance temperament.

Results revealed that avoidance temperament was positively related to both anxiety dimensions. This supports Davidson's (2002) hypothesis that increased activation in the avoidance motivational system forms the core of anxiety disorders. Contrary to prediction, anxious apprehension exhibited a stronger relationship with avoidance temperament than anxious arousal, since the gamma for PSWQ was significantly larger than the gamma for MASQ-AA. Although the hypothesis that anxious arousal, and not anxious apprehension, would be related to avoidance temperament was not supported, present findings support the general hypothesis that avoidance temperament has different relationships with the two anxiety dimensions. The finding that approach temperament positively predicted anxious apprehension was somewhat unexpected, but it is consistent with recent research indicating that comorbid anxious apprehension normalizes the left dorsolateral prefrontal cortex hypoactivation observed in depression (when comorbid with anxious arousal; Engels et al. 2010).

As expected, approach and avoidance temperament exhibited a strong negative correlation. Although the magnitude of the correlation between temperaments was sizable (−.415), it was not so large that they should be considered one bipolar dimension.

These findings help to illuminate the relationship between motivational systems and depression and anxiety. Given that this was the first test of this model (i.e., approach and avoidance temperament latent variables predicting anhedonic depression, anxious arousal, and anxious

apprehension), this study was replicated in an independent sample of unselected undergraduates. An additional subscale of the MASQ-AD, measuring a different facet of anhedonic depression, was also included in order to examine potential differential relationships between the facets.

Study 2

Method

Participants

A total of 514 undergraduates (149 female, 348 male, gender data was not available for 7 participants) participated as partial fulfillment of a requirement of an introductory psychology course at the University of Illinois at Urbana-Champaign. Participants were 18–23 years old ($M = 18.82$ years, SD = .99).

Procedure

Participants were tested in groups of 30–120 students in a classroom setting where they completed a questionnaire booklet. This booklet contained portions of the MASQ, the GTS the PSWQ, the BIS/BAS, and the NEO. The questionnaire formats and testing context were identical to those in Study 1 with the exception that the entire MASQ-AD scale was administered. This added the 14 questions of the High Positive Affect (HP) subscale identified by Watson, Clark, et al. (1995) and Nitschke et al. (2001). The MASQ-AD-HP consists of items such as "Felt cheerful" (reverse keyed).

Analysis Overview

CFA and SEM analyses were conducted using the same indicator variables and methods as used in Study 1, with the addition of MASQ-AD-HP as an endogenous variable, with approach and avoidance temperament as predictors.

Results

Means and standard deviations for the 10 scales are provided in Table 1. Univariate and multivariate normality were examined. All univariate skew and kurtosis values were smaller than 1 (absolute value), and multivariate kurtosis was 3.9, indicating that the data were distributed normally.

Confirmatory Factor Analysis

The model was successfully estimated and associated with a χ^2_5 value of 12.8, $P = .025$. The CFI value was .994, the TLI value was .982, and the RMSEA value was .055 (90% confidence interval = .018 to .093), indicating that the model provided an excellent fit to the data. All measurement weights were significant at $p < .001$. The standardized estimates are provided in Table 2. The temperament latent variables were correlated −.494 ($\chi^2_1 = 80.1$, $P < .001$).

Structural Equation Model

The model was successfully estimated and was associated with a χ^2_{21} value of 123.0, $P < .001$. The CFI value was .963, the TLI value was .920, and the RMSEA value was .097 (90% confidence interval = .081 to .114). These values indicate that the model provided adequate although not excellent fit to the data. All measurement weights were significant at $P < .001$, and the standardized estimates were extremely similar to those found in the CFA.

SEM: Approach Temperament Predicting PSWQ, MASQ-AA, MASQ-AD-LI, and MASQ-AD-HP

As shown in Table 3, approach temperament negatively predicted MASQ-AD-HP and MASQ-AD-LI and positively predicted MASQ-AA and PSWQ. The γ magnitude for MASQ-AD-HP was larger than the γ magnitudes for MASQ-AD-LI, $\chi^2_1 = 45.2$, $P < .001$, PSWQ, $\chi^2_1 = 15.9$, $P < .001$, and MASQ-AA, $\chi^2_1 = 24.0$, $P < .001$.

SEM: Avoidance Temperament Predicting PSWQ, MASQ-AA, MASQ-AD-LI and MASQ-AD-HP

As reported in Table 3, avoidance temperament positively predicted all four psychopathology measures. The γ for PSWQ was larger than the γ's for MASQ-AD-LI, $\chi^2_1 = 58.6$, $P < .001$, MASQ-AD-HP, $\chi^2_1 = 151.5$, $P < .001$, and MASQ-AA, $\chi^2_1 = 72.2$, $P < .001$. The γ for MASQ-AD-LI was larger than the γ for MASQ-AD-HP, $\chi^2_1 = 24.7$, $P < .001$, and marginally larger than the γ for MASQ-AA, $\chi^2_1 = 3.2$, $P = .074$. Finally, the γ for MASQ-AA was larger than the γ for MASQ-AD-HP, $\chi^2_1 = 6.2$, $P = .013$.

Discussion

The pattern of relationships between motivational temperaments and depression and anxiety observed in Study 2 is consistent with the pattern found in Study 1. Similar to Study 1, avoidance temperament was positively related to PSWQ, MASQ-AA, and MASQ-AD-LI, and approach temperament was positively related to both anxiety types and negatively related to MASQ-AD-LI. Additionally, Study 2 found that, similar to MASQ-AD-LI, MASQ-AD-HP was positively related to avoidance temperament and negatively related to approach temperament. Although the relationships between

motivational temperaments and psychopathology types were consistent in direction across studies, there were differences in the magnitude of the relationships with approach temperament, with the greatest difference being that the magnitude of the γ associated with MASQ-AA doubled. This finding indicates that the relationship between approach and MASQ-AA may be unstable, suggesting that approach temperament does not play a consistent role in the etiology and/or maintenance of anxious arousal.

The findings of Study 2 suggest that the two facets of anhedonic depression are differentially related to motivational temperaments, with MASQ-AD-LI having a significantly stronger relationship with avoidance temperament and MASQ-AD-HP having a significantly stronger relationship with approach temperament. The fact that the low positive affect captured by MASQ-AD-HP has a strong relationship with approach temperament is conceptually consistent, given that approach temperament is theorized to be related to the generation of positive affect. Additionally, present results suggest that, although decreased approach does play a part, the loss of interest captured by MASQ-AD-LI is largely driven by increased avoidance temperament.

Overall, the findings of Studies 1 and 2 support the hypothesis that motivational temperaments are highly, and differentially, related to depression and anxiety types. Additionally, the findings of Study 2 suggest that approach and avoidance temperament are differentially related to the two facets of anhedonic depression examined. However, the generalizability of these findings is limited by the use of undergraduate samples. Therefore, Study 2 was replicated (including the use of the MASQ-AD-HP subscale) in a sample of unselected individuals from the community.

Study 3

Method

Participants

A total of 145 participants (79 female, 52 male) were recruited from the community through a newspaper advertisement, a local electronic newsletter advertisement, and a local mental health center. Participants were 19–51 years old ($M = 35.07$, SD $= 9.31$) and passed exclusion criteria for a separate fMRI experiment: left-handedness, history of serious brain injury, abnormal hearing or vision, metal in their body, pregnancy, or non-native English speakers.

Procedure

Participants were tested individually, completing a questionnaire booklet containing portions of the MASQ and the GTS along with several other questionnaires not analyzed in the present study. Participants were also given a questionnaire packet to complete at home containing the PSWQ, the BIS/BAS, and the NEO, along with several other questionnaires not analyzed in the present study.

Analysis Overview

CFA and SEM analyses were conducted as in Study 2. Additionally, a multi-group CFA was conducted in order to explore potential differences in the factor structure between undergraduate and community samples (the Study 2 sample was used as the undergraduate sample). First, a model in which all measurement weights were held constant across groups was compared to a model in which all weights were allowed to vary across groups in order to determine whether the weights differed overall. Next, a series of comparisons was conducted, each of which compared a model in which only one weight was held constant across groups to a model in all weights were allowed to vary across groups in order to determine which weights contributed to differences in factor structure.

Results

Means and standard deviations for the 10 scales are provided in Table 1. Univariate and multivariate normality were examined. All univariate skew and kurtosis values were smaller than 1 (absolute value), and multivariate kurtosis was -.8, indicating that the data were distributed normally.

Confirmatory Factor Analysis

The model was successfully estimated and associated with a χ^2_5 value of 7.8, $P = .169$. The CFI value was .993, the TLI value was .979, and the RMSEA value was .062 (90% confidence interval = .000 to .142), indicating that the model provided an excellent fit to the data. The BIS and GTS-NT measurement weights for the approach latent variable were not significant, $P = .31$ and $P = .31$, respectively. All other measurement weights were significant at $P < .001$. The standardized estimates are provided in Table 2. When the non-significant measurement weights were removed, model fit increased (CFI = .994, TLI = .988, RMSEA = .048). The temperament latent variables were correlated $-.616$ ($\chi^2_1 = 42.8$, $P < .001$).

Structural Equation Model

The model was successfully estimated and was associated with a χ^2_{21} value of 50.2, $P < .001$. The CFI value was .958,

the TLI value was .911, and the RMSEA value was .098 (90% confidence interval = .064 to .133). These values indicate that the model provided adequate although not excellent fit to the data. Similar to the CFA findings, the BIS and GTS-NT measurement weights for the approach latent variable were not significant. All other measurement weights were significant at $P < .001$ and the standardized estimates were extremely similar to those found in the CFA.

SEM: Approach Temperament Predicting PSWQ, MASQ-AA, MASQ-AD-LI, and MASQ-AD-HP

As shown in Table 3, approach temperament negatively predicted MASQ-AD-HP. All other relationships with approach temperament were non-significant. The γ magnitude for MASQ-AD-HP was larger than the γ magnitudes for MASQ-AD-LI, $\chi^2_1 = 12.8$, $P < .001$, PSWQ, $\chi^2_1 = 11.2$, $P = .001$, and MASQ-AA, $\chi^2_1 = 10.7$, $P = .001$.

SEM: Avoidance Temperament Predicting PSWQ, MASQ-AA, MASQ-AD-LI and MASQ-AD-HP

As reported in Table 3, avoidance temperament positively predicted all four psychopathology measures. The γ for PSWQ was larger than the γ's for MASQ-AD-LI, $\chi^2_1 = 9.7$, $P = .002$, MASQ-AD-HP, $\chi^2_1 = 30.5$, $P < .001$, and MASQ-AA, $\chi^2_1 = 15.8$, $P < .001$. The γ for MASQ-AD-LI was larger than the γ for MASQ-AD-HP, $\chi^2_1 = 5.8$, $P = .016$.

Multi-Group CFA Comparison

The comparison of the model in which all measurement weights were held constant across groups to the model in which all weights were allowed to vary was significant, $\chi^2_9 = 18.5$, $P = .030$. For the next set of model comparisons, in which a model with only one weight held constant across groups was compared to a model in which all weights were allowed to vary, the comparison was significant when holding constant the BAS weight for the approach latent variable ($\chi^2_1 = 5.105$, $P = .024$) or the BAS weight for the avoidance latent variable ($\chi^2_1 = 4.433$, $P = .035$). Additionally, the comparison in which the GTS-NT weight for the avoidance latent variable was held constant was marginally significant ($\chi^2_1 = 3.635$, $P = .057$). All other comparisons were non-significant.

Discussion

The pattern of relationships between motivational temperaments and anxiety and depression in Study 3 was largely consistent with the patterns found in Studies 1 and 2. The consistency in findings across the undergraduate and community samples confirms that the observed overall patterns of motivational temperaments are characteristic of depression and anxiety in general rather than specific to an undergraduate population. Higher avoidance temperament was again associated with greater levels of PSWQ, MASQ-AA, MASQ-AD-LI, and MASQ-AD-HP. Additionally, MASQ-AD-HP was again associated with lower levels of approach temperament. Furthermore, the pattern of relationships associated with the MASQ-AD subscales was consistent with that observed in Study 2, supporting the hypothesis that the two facets of depression are differentially related to motivational temperaments.

However, in Study 3 the relationships between approach temperament and PSWQ, MASQ-AA, and MASQ-AD-LI were not significant. This lack of significance may be due to differences in power related to the smaller sample size used in Study 3 (145 vs. 1,114 and 514). However, the magnitude of these relationships decreased in Study 3, although the magnitude of the relationship with MASQ-AD-LI was fairly similar to that found in Study 2. This suggests that the discrepancy in findings is not due solely to reduced power, at least for PSWQ and MASQ-AA.

One potential explanation for the source of this discrepancy can be found by examining the loadings in the measurement model. Specifically, the approach temperament weights for BIS and GTS-NT decreased in magnitude from Study 2 to Study 3 and are no longer significant, and the avoidance temperament weight for BAS doubled in magnitude from Study 2 to Study 3. The primary loadings remained consistent in magnitude, with the exception of the BAS approach loading which increased in magnitude by 25%. A multiple-groups analysis comparing the measurement weights for the Study 2 sample to those from the Study 3 sample indicated the presence of significant differences in the loadings. Follow-up comparisons indicated that this was being driven by differences in the BAS weights for both approach and avoidance and, marginally, the GTS-NT weight for avoidance. Given the differences in average age between the two samples and the fact that BAS exhibited the least temporal stability in Study 1, this finding suggests that BAS is a relatively unstable measure, even over a relatively short time period, and may function differently in different age groups.

General Discussion

The three studies consistently show that anxious apprehension, anxious arousal, and anhedonic depression can be distinguished from one another in their relationship to motivational temperament across undergraduate and community samples. Davidson's (2002) hypothesis that

anxiety is related to avoidance temperament was supported in all three studies. However, anxious apprehension consistently exhibited a stronger relationship with avoidance temperament than anxious arousal. This suggests that, although the etiology and maintenance of both anxiety types may be related to avoidance temperament, this influence is stronger for anxious apprehension. This difference underscores the importance of distinguishing dimensions of anxiety (Engels et al. 2007; Heller et al. 1997, Nitschke et al. 1999, 2001).

In addition, the present study supports Davidson's (1998) hypothesis that anhedonic depression is associated with decreased approach motivation. Results, however, suggest that it is important to distinguish between facets of anhedonic depression. This is evidenced in Studies 2 and 3, wherein approach temperament had a consistently stronger relationship with the low positive affect measured by MASQ-AD-HP, and avoidance temperament had a consistently stronger relationship with the loss of interest measured by MASQ-AD-LI. An examination of the factor analysis performed during the development of the MASQ (Watson et al. 1995) provides one possible explanation for this differential pattern of relationships with motivational temperaments. Specifically, the MASQ-AD-LI items exhibited high loadings on the General Distress factor, whereas the MASQ-AD-HP items did not. This suggests that avoidance temperament is strongly related to general distress, which is a larger component of MASQ-AD-LI than MASQ-AD-HP. Nevertheless, present findings indicate that depression as a construct, in which loss of interest and low positive affect are fundamental facets, is related to both decreased levels of approach temperament and increased levels of avoidance temperament.

In summary, results indicate that anhedonic depression and dimensions of anxiety are both associated with increased avoidance motivation, whereas only anhedonic depression is associated with decreased approach motivation. This suggests that increased avoidance motivation predisposes toward internalizing psychopathology generally, with the level of approach motivation influencing the type of psychopathology that emerges. For example, two individuals can both have high avoidance motivation and both be prone to developing psychopathology, but one individual may have low approach motivation and, as a result, be more prone to develop depression, whereas the other individual has only high avoidance motivation and be more prone to develop anxious apprehension. Individuals very high in avoidance and low in approach may be likely to develop both depression and anxious apprehension.

Present results also support the need to examine the effects of comorbidity in research involving either depression or anxiety. Since depression and anxiety frequently co-occur (Kessler et al. 1994) yet possess different relationships to motivational temperaments, both need to be measured to identify and understand the contributions of each. This also has implications for treatment, in that the nature of the processes that maintain depression and anxiety may differ depending on the presence or absence of comorbid psychopathology.

The results of the present study are consistent with the findings of a recent study that suggested that depression is related to temperamentally low approach motivation. Shankman et al. (2007) found that non-depressed individuals and individuals with late-onset depression (beginning after age 16) exhibited an increase in approach-related left-frontal EEG activity during a gambling task thought to increase approach motivation, whereas individuals with early-onset depression did not. They proposed that low levels of temperamental approach motivation predispose toward early-onset depression. However, they also found that chronicity of depression was unrelated to levels of left-frontal EEG activity during their task and posited that approach motivation may be unrelated to the factors that maintain chronic depression. Given that the present results suggest that increases in avoidance temperament are also related to depression, it may be that approach motivation is related to first onset of depression, whereas avoidance motivation is related to factors that maintain depression chronically. If so, the differential pattern of relationships observed between facets of depression and motivational temperaments indicates that low positive affect is also primarily related to the onset of depression, whereas loss of interest may be more related to the maintenance of depression.

The present study examined continuous dimensions of depression and anxiety, rather than focusing on DSM-IV diagnoses. This strategy was employed for several reasons. First, anxious apprehension and anxious arousal are represented to varying degrees in different anxiety disorders (Heller and Nitschke 1998). Therefore, examining DSM-IV anxiety diagnoses would not provide a clear picture regarding these dimensions. Second, DSM-IV diagnoses are categorical, whereas the present study conceptualizes depression and anxiety as continuous constructs. Third, the present study was aimed at examining relationships between motivational temperaments and depression and anxiety in the general population, rather than just in clinical samples. This aim follows, in part, from findings that depression and anxiety impact function in important ways at levels below those that qualify for a DSM-IV diagnosis (e.g., Judd et al. 2002). This appears to be especially true when symptoms of depression and anxiety are comorbid (Preisig et al. 2001). Examination of the relationship between motivational temperaments and diagnosable DSM-IV mood and anxiety disorders will likely be a

fruitful avenue of investigation but would represent a different aim than that of the present study.

The present studies had several limitations. Only self-report measures were used to assess motivational temperaments and psychopathology. Recent research suggests that other measures of motivational temperaments (e.g., behavioral, physiological) might fail to find increased avoidance temperament in depression (Rottenberg 2008). Specifically, Rottenberg has suggested that, at the level of mood, depression is associated with increased responses to unpleasant stimuli. However, hyporesponsivity is observed when examining short-term reactions to unpleasant stimuli. Thus, the self-report measures of motivational temperament may better reflect longer-term motivational responses, conceptually similar to mood.

In addition, although motivational temperaments are presumed to be longstanding predispositions, the temporal stability of motivational temperaments was assessed over only a relatively short time (1–6 months). Research should examine the stability of these measures over longer time intervals in order to determine whether they truly represent temperament types. Finally, the present research assumes that temperamental motivation, which is hypothesized to be relatively stable and develop early in life, influences the development of anxiety and depression. However, this is not the only potential pattern of influence. It is also possible that psychopathology influences temperamental motivation or that there is bidirectional influence. These possibilities seem more likely when psychopathology develops early in life. Longitudinal research, especially research focusing on childhood, should be conducted to understand the causal relationships between temperament motivation and psychopathology.

Despite these limitations, the present research contributes to the understanding of how motivational factors influence mood and anxiety disorders. Specifically, these studies clarify the relationship between motivation and depression and anxiety by demonstrating how these manifestations of psychopathology are differentially associated with motivational systems. Furthermore, findings support the differentiation between anxious apprehension, anxious arousal, and anhedonic depression and have implications for the implementation of effective treatment interventions. Treatment needs likely differ depending on the presence or absence of each type of psychopathology. For example, treatments that concentrate on changing patterns of approach and avoidance, such as behavioral activation treatment for depression (Martell et al. 2001), could adjust the focus on avoidance strategies depending on the level of anxious apprehension present. In addition, since the present research indicates that the High Positive Affect and Loss of Interest facets of anhedonic depression relate differently to motivational systems, treatment needs may also differ depending on which facet (if any) predominates. Finally, the present studies provide insight into how motivational systems may contribute to the development and maintenance of anxiety and depression.

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