

## [The association of affective temperaments and bipolar spectrum psychopathology: An experience sampling study](#)

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Sperry, S.H., Barrantes-Vidal, N. & Kwapil, T.R. (2018). The association of affective temperaments and bipolar spectrum psychopathology: An experience sampling study. *Motivation and Emotion*, 42, 126-136. <https://doi.org/10.1007/s11031-017-9652-4>

**This is a post-peer-review, pre-copyedit version of an article published in *Motivation and Emotion*. The final authenticated version is available online at:**

**<http://dx.doi.org/10.1007/s11031-017-9652-4>**

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### **Abstract:**

Affective temperaments are trait-like expressions of affect that underlie mood psychopathology. Numerous studies have examined affective temperaments in laboratory-based studies; however, few have examined the expression of these temperaments in daily life. The present study examined affective temperaments and their associations with the expression of bipolar spectrum characteristics in daily life using experience sampling methodology. Young adults ( $n = 290$ ) completed the TEMPS-A and were signaled eight times daily for 1 week to complete smartphone surveys assessing affect, cognition, and behavior. Hyperthymic temperament was associated with positive affect, sense of self, and success. In contrast, cyclothymic/irritable temperament was associated with negative affect, impulsivity, negative sense of self, and difficulty concentrating. Those high in cyclothymic/irritable temperament were especially reactive to the experience of stress. Affective temperaments were differentially associated with the expression of bipolar spectrum psychopathology in daily life. The findings offer validation of the TEMPS-A, as well as the adaptive and maladaptive characteristics of hyperthymic and cyclothymic/irritable temperaments.

**Keywords:** Affective temperaments | Bipolar spectrum psychopathology | Experience sampling methodology | Hierarchical linear modeling

### **Article:**

#### **Introduction**

Akiskal and Mallya (1987) operationalized affective temperaments as trait-like expressions of affect that are continuous, can range from adaptive to maladaptive, and underlie mood psychopathology. This model suggests that temperaments can range from healthy affective responding at one end to major mood psychopathology at the other (Vasquez and Gonda 2013) and that extreme elevations in affective temperaments lead to greater risk of developing bipolar

psychopathology (Akiskal et al. 1995; Akiskal and Akiskal 1992; Evans et al. 2005). Evidence suggests that although affective temperaments and normal personality dimensions share many features, they are not redundant, as affective temperaments predict mood psychopathology and impairment over-and-above the effects of normal personality (Kwapil et al. 2013). Furthermore, affective temperaments are proposed to be more directly associated with genetic variation than other behavioral or personality phenotypes, and thus offer a promising endophenotype for mood disorders (Evans et al. 2005; Gonda et al. 2006; Vasquez and Gonda 2013).

Akiskal and Mallya (1987) proposed four distinct affective temperaments—hyperthymic, dysthymic, cyclothymic, and irritable. Hyperthymic is considered the most adaptive temperament and is characterized by increased energy, enthusiasm, sociability, and cheerfulness. However, hyperthymic temperament also has maladaptive expressions such as over-involvement, uninhibited behavior, grandiosity, sensation seeking, and decreased sleep (Akiskal 1992; Akiskal and Akiskal 1992, 2005). Dysthymic (or depressive) temperament is characterized by low energy, introversion, pessimism, self-criticism, excessive worry, and sensitivity to change (see Vasquez and Gonda 2013 for review). Additionally, dysthymic temperament involves guilt or preoccupation about failure, being self-denying, and an excessive desire to please others (Akiskal et al. 2005a). Cyclothymic temperament is characterized by biphasic shifts in negative and positive affect, low and high energy, low and high confidence, and creative thinking or thought disruption (Akiskal et al. 2000). Additionally, those high in cyclothymic temperament often alternate between hypo- and hypersomnia, introverted and extraverted social behaviors, excessive goal-directed behavior (including impulsivity) and anhedonia, and optimism and pessimism regarding achievements (Akiskal et al. 1979; Akiskal and Akiskal 1992). Irritable temperament is characterized by reactivity and sensitivity to negative events, negative affect, moodiness, impulsivity, restlessness, and a tendency to be hyper-critical (Akiskal and Mallya 1987). It has been proposed that irritable temperament is conceptually linked to cyclothymic temperament and shares about half of its variance with cyclothymic temperament (Walsh et al. 2012). These four affective temperaments are measurable via a well validated self-report questionnaire, the Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire (TEMPS-A; Akiskal et al. 2005a, b).

#### Associations with bipolar spectrum psychopathology

Clinical bipolar disorders are characterized by a heterogeneous profile in terms of affective temperaments (Qiu et al. 2017). Bipolar I disorder is associated with elevated cyclothymic and irritable temperaments (Dolenc 2010; Di Florio et al. 2010; Evans et al. 2005; Kesebir et al. 2005; Savitz et al. 2008), as well as dysthymic temperament (Evans et al. 2005; Matsumoto et al. 2005; Mendlowicz et al. 2005; Nowakowska et al. 2005), compared to healthy controls, unaffected siblings (Mahon et al. 2013), and patients with unipolar depression (Goto et al. 2011). In general, research is mixed regarding hyperthymic temperament, with some studies reporting no differences between patients with bipolar disorder and healthy control participants (Evans et al. 2005; Mendlowicz et al. 2005; Nowakowska et al. 2005; Savitz et al. 2008) and other studies reporting elevated hyperthymic temperament scores in bipolar patients relative to healthy control participants (Baldessarini et al. 2016). Additional studies report that those with bipolar disorder have elevated rates of hyperthymic temperament compared to depressed patients (Gassab et al. 2008; Mazzarini et al. 2009). Consistent with conceptualizations of affective temperaments,

cyclothymic and irritable temperaments seem to be most associated with negative outcomes including increased suicidality (Baldessarini et al. 2016), impaired cognitive functioning (Romero et al. 2016), worse clinical features and course of bipolar disorder (Maina et al. 2010; Mechri et al. 2011; Perugi et al. 2012), and worse functional impairment (Nilsson et al. 2012) for those with bipolar disorder. One study suggested that hyperthymic temperament was protective for those with bipolar I and II disorders in terms of decreased rates of suicidal ideation and acts (Baldessarini et al. 2016). Lastly, retrospective studies found that cyclothymic and irritable temperaments were associated with subthreshold symptoms prior to the first affective episode (Özgürda et al. 2009; Zeschel et al. 2015), suggesting that cyclothymic and irritable temperaments may be most relevant for the development of or risk for bipolar spectrum disorders.

A limited number of studies have examined associations of affective temperaments in non-clinical samples experiencing subthreshold affective symptoms. However, this method offers several advantages. The study of non-clinical participants: (a) allow us to examine risk and resilience factors, (b) allows us to consider the expression of affective temperaments relatively independent of the confounding effects of mood disorders such as medication effects, social stigma, and comorbid disorders, and (c) is consistent with dimensional models of affective temperaments. Signoretta et al. (2005) reported associations between dysthymic temperament and social inhibition, and between cyclothymic temperament and increased anxiety, hypersensitivity, eating problems, and aggressive behavior. Morvan et al. (2011) reported that although hyperthymic temperament was associated inversely with depressive symptoms, dysthymic, cyclothymic, and irritable temperaments were positively associated with depression and anxiety. Two studies specifically examined affective temperaments in a non-clinical sample oversampled for subclinical bipolar spectrum psychopathology. Walsh et al. (2012) found that combined cyclothymic/irritable temperament was associated with bipolar disorders (DSM-IV and broader bipolar spectrum diagnoses), borderline personality traits, and functional impairment. Hyperthymic temperament was not associated with bipolar disorders; however, it was associated with subclinical bipolar psychopathology—broader bipolar spectrum disorders, history of hypomania, and interview ratings of hyperthymia. Additionally, all four affective temperaments were associated with trait impulsivity. In a 3-year follow-up of this sample, cyclothymic/irritable temperament continued to predict bipolar disorders, major depressive episodes, and hypomania (DeGeorge et al. 2014). Furthermore, cyclothymic/irritable temperament predicted new cases of broader bipolar spectrum disorders and impaired psychosocial functioning. Hyperthymic temperament continued to predict broader bipolar spectrum disorders and history of hypomania, but was not associated with DSM-IV bipolar or unipolar mood disorders. In fact, hyperthymic temperament was associated with decreased likelihood of depression, consistent with views of hyperthymic temperament as potentially protective. Dysthymic temperament was largely unrelated to measures of psychopathology and impairment in these studies.

### Experience sampling methodology

Previous studies have primarily examined affective temperaments and their correlates in laboratory-based studies. However, laboratory-based studies may not fully capture the dynamic nature of affective temperaments given that they occur in artificial settings and gather

information in brief time windows. Experience sampling methodology (ESM) is a daily diary method that examines momentary expression of psychological and personality phenomena in real-world settings (e.g., Myin-Germeys et al. 2003). ESM assesses affect, cognition, and behavior in daily life, thus enhancing ecological validity, minimizing retrospective bias, and allowing for the examination of context of experiences (Mehl and Conner 2012; Oorschot et al. 2009). To our knowledge, only one previous study used ESM to examine the association of affective temperaments and experiences in daily life. Walsh et al. (2013) assessed daily life experiences in 138 university undergraduates oversampled for bipolar spectrum psychopathology. They found that hyperthymic temperament was associated with adaptive characteristics in daily life including positive affect, evaluating one's current situation as positive, doing exciting activities, confidence, and a desire to spend time with others. However, it was also associated with racing thoughts, difficulty concentrating and restlessness. Cyclothymic/irritable temperament was associated with a broad range of negative characteristics including negative affect, decreased positive affect, stress, difficulty concentrating, and impulsivity. Dysthymic temperament was generally unrelated with affect, but was associated with difficulty concentrating, uncertainty, and feeling socially rejected. Furthermore, the association between feeling like one's situation was stressful and negative affect was stronger for those high in cyclothymic/irritable temperament compared to those who endorsed lower rates of the temperament.

## Goals and hypotheses

The goal of the present study was to examine the associations between affective temperaments and bipolar spectrum psychopathology in daily life. Specifically, the study aimed to replicate and extend Walsh et al.'s (2013) findings by examining the association of affective temperaments with affect, cognition, sense of self, social functioning, and behavior consistent with bipolar spectrum psychopathology in a non-clinically ascertained sample of young adults oversampled for elevated bipolar spectrum traits. Note that we also aimed to extend Walsh et al.'s findings by including additional items examining impulsivity, emotional lability, and interpersonal reactions.

We examined three types of effects. Direct effects examined the association of affective temperaments with experiences in daily life (e.g., irritability). Cross-level interactions examined the extent to which affective temperaments moderated the association of experiences in daily life (e.g., stress and impulsivity). Finally, we examined whether affective temperaments were associated with variability of experiences in daily life (e.g., stress). In terms of direct effects, we predicted that hyperthymic temperament would be associated with adaptive or positive characteristics in daily life including: positive affect, evaluating one's situation as positive, doing many and exciting things, self-confidence, and positive aspects of social functioning, as well as impulsive behaviors. We predicted that cyclothymic/irritable temperament would be characterized by maladaptive or negative characteristics in daily life including: decreased positive affect, increased negative affect, concentration difficulties, decreased sense of self, social rejection, and impulsivity. We predicted that dysthymic temperament would be relatively unassociated with most measures in daily life given Walsh et al.'s (2013) findings. However, we expected that it would be associated with decreased positive affect and increased negative affect, given the conceptualization of it involving worry, pessimism, and anhedonia. In terms of cross-level interactions, we expected that those high in cyclothymic/irritable temperament would be

especially sensitive and reactive to negative situations; therefore, we hypothesized that those high in cyclothymic/irritable temperament would be more likely to experience negative affect, impulsivity, feeling like one's emotions are out of control, racing thoughts, and difficulty concentrating when evaluating their situation as stressful compared to those who were low in the temperament. Given that cyclothymic/irritable temperament is specifically conceptualized as involving affective lability and biphasic shifts in affect, cognition, and behavior, we hypothesized that the temperament would be associated with increased variability in positive and negative affect, feeling like one's emotions were out of control, and stress over-and-above the other affective temperaments.

## Methods

### Participants

This study was approved by the UNC-Greensboro Institutional Review Board and all participants provided informed consent. Participants taking general psychology courses enrolled in the study via two methods. Unselected students volunteered by an online sign-up portal for course credit. In addition, participants who completed departmental mass screening sessions who scored at least 1.5 standard deviations above the mean on the Hypomanic Personality Scale (HPS; Eckblad and Chapman 1986) were invited to participate to ensure adequate representation of people with bipolar spectrum psychopathology. These enrollment methods follow procedures outlined in Walsh et al. (2013). Usable ESM data was available for 290 of the 382 participants who initially enrolled in the study (73% female, mean age = 18.9 years, SD = 2.8). The final sample was 50% Caucasian, 34% African American, 7% Asian, 5% Hispanic, 1% Native American, and 2% other. Participants were dropped due to invalid questionnaires ( $n = 16$ ), missing self-report measures ( $n = 8$ ), or problematic ESM protocols ( $n = 68$ ). Participants received course credit for serving in the study regardless of recruitment method. In addition, participants who completed at least 70% of the ESM questionnaires were entered into drawings for \$100 gift cards.

### Procedures and methods

Participants attended an information session during which they downloaded the ESM smartphone app, completed a demographic questionnaire, HPS, and TEMPS-A, and were trained on ESM procedures. Research assistants explained the ESM procedures and participants completed a practice survey.

Participants completed a 50-item version of the TEMPS-A to assess affective temperaments. The TEMPS-A has good internal consistency (Cronbach alpha = .76–.88) and test–retest reliability ( $r = .58 – .70$ ) for the four subscales (Akiskal et al. 2005a). Participants completed the HPS, which consists of 48 true-false items and has good internal consistency reliability (Cronbach alpha = .87; Eckblad and Chapman 1986). The HPS was intermixed with a 13-item infrequency scale (Chapman and Chapman 1983) used to screen invalid responders (participants who endorsed more than two infrequency items were dropped from the study). Both the TEMPS-A and the HPS inquire about trait-like experiences and instruct participants to indicate what they are typically like.

The ESM questionnaire assessed experiences relevant to bipolar spectrum psychopathology. Specifically, items tapped positive, negative, and irritable affect, feeling energetic, racing thoughts and disrupted cognitions, grandiosity, social functioning, and impulsive behaviors. Participants completed ESM surveys on their personal smartphones using either the Qualtrics system or using a smartphone application, “MetricWire” (Trafford 2015). For 7 days, participants were signaled eight times daily between noon and midnight at stratified random intervals (randomized within eight, 90-min blocks). The same items were used at every assessment. Participants had 5 min to respond to the signal and the questionnaires required approximately 2 min to complete. Responses were time-stamped and automatically uploaded to secure cloud-based servers.

### Statistical Analyses

ESM data have a hierarchical structure in which ratings in daily life (level 1 data) are nested within participants (level 2 data). Hierarchical linear modeling is recommended for ESM data as it provides a more appropriate method of analyzing nested data than conventional unilevel analyses (Nezlek 2012), because it allows for simultaneous modeling of error terms at multiple levels. Level 1 predictors were group mean centered and level 2 predictors were grand mean centered. Direct effects assessed whether the level 2 predictors (TEMPS-A scores) predicted level 1 criteria (ESM ratings). Cross-level interactions, or slopes-as-outcomes, tested whether level 2 predictors were associated with the slope of the level 1 predictor and criterion (e.g., whether affective temperaments predicted the association of situation stressful and negative affect in the moment). Affective temperament scores were simultaneously entered in all analyses. In order to examine variability in affect and stress, *within-person variance* of ESM items or indices assessing negative affect, irritability, happiness, and emotions out of control was calculated (Eid and Diener 1999).

### Results

Consistent with previous research (DeGeorge et al. 2014; Walsh et al. 2012, 2013) standardized cyclothymic and irritable temperaments scores were averaged to compute a cyclothymic/irritable temperament index. On average, participants completed 37.0 ESM questionnaires (SD = 11.9), consistent with previous published studies in our lab (e.g., Walsh et al. 2013). Affective temperaments were unassociated with number of completed ESM questionnaires. Descriptive statistics for the TEMPS-A are presented in Table 1.

**Table 1.** TEMPS-A descriptive statistics and intercorrelations

TEMPS-A	Mean (SD)	Alpha	Pearson correlations		
			H	D	C/I
Hyperthymic (H)	8.43 (3.27)	0.81	–		
Dysthymic (D)	5.59 (1.96)	0.60	–0.40***	–	
Cyclothymic/irritable (C/I)	6.22 (3.22)	0.88	–0.13*	0.30***	–

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Associations of the TEMPS-A affective temperaments with affect and thoughts in daily life are presented in Table 2. Hyperthymic temperament was associated with happiness, energy, and evaluating one’s situation as positive, whereas cyclothymic/irritable temperament was associated

with increased negative affect, irritability, feeling like one's emotions are out of control, and evaluating one's situation as stressful and not as positive. Cyclothymic/irritable temperament was the only temperament associated with trouble concentrating and racing thoughts. Dysthymic temperament was generally unrelated to affect and cognitions, but was associated with decreased energy.

**Table 2.** Associations of affect and cognitions with affective temperaments in daily life

Level 1 criterion	Level 2 predictors ( <i>df</i> = 288)		
	Hyperthymic	Dysthymic	Cyclo/Irr
Affect			
Happy	0.28 (0.07)***	- 0.10 (0.07)	- 0.12 (0.07)
Energetic	0.30 (0.06)***	- 0.15 (0.07)*	0.10 (0.07)
Dysphoria index	- 0.09 (0.06)	0.06 (0.06)	0.38 (0.07)***
Irritability index	- 0.04 (0.06)	- 0.02 (0.06)	0.47 (0.07)***
Emotions out of control	0.05 (0.06)	0.01 (0.06)	0.45 (0.07)***
Current situation is positive	0.15 (0.07)*	- 0.08 (0.07)	- 0.19 (0.07)**
Current situation is stressful	- 0.07 (0.08)	0.07 (0.08)	0.33 (0.09)***
Cognitions			
Trouble concentrating	- 0.04 (0.07)	0.06 (0.07)	0.42 (0.07)***
Thoughts racing	0.10 (0.07)	0.10 (0.08)	0.46 (0.08)***

Raw multilevel regression coefficients indicating the relation of the level 2 predictors (TEMPS) and the level 1 (daily life experience) criteria and standard error

\**p* < .05, \*\**p* < .01, \*\*\**p* < .001

**Table 3.** Associations of sense of self and social interactions with affective temperaments in daily life

Level 1 criterion	Level 2 predictors ( <i>df</i> = 288)		
	Hyperthymic	Dysthymic	Cyclo/Irr
Sense of self in the world			
Confident	0.40 (0.07)***	- 0.30 (0.07)***	0.02 (0.07)
Center of attention	0.18 (0.05)***	- 0.19 (0.06)**	0.24 (0.06)***
Successful in current activity	0.15 (0.07)*	0.03 (0.07)	- 0.20 (0.08)**
Uncertain	- 0.08 (0.06)	- 0.01 (0.06)	0.40 (0.07)***
Bored	- 0.14 (0.06)*	- 0.05 (0.06)	0.24 (0.06)***
Lonely	- 0.16 (0.07)*	0.03 (0.06)	0.39 (0.07)***
Social interactions			
Alone at signal	- 0.02 (0.01)	0.02 (0.01)	0.01 (0.01)
When alone: alone b/c not wanted	- 0.10 (0.07)	- 0.04 (0.06)	0.25 (0.08)**
When with others: close to other(s)	0.04 (0.08)	- 0.14 (0.07)	- 0.02 (0.08)
Cared for by others	0.24 (0.08)**	- 0.12 (0.07)	- 0.11 (0.08)
Criticized by others	0.02 (0.05)	- 0.04 (0.05)	0.30 (0.06)***

Raw multilevel regression coefficients indicating the relation of the level 2 predictors (TEMPS) and the level 1 (daily life experience) criteria and standard error

\**p* < .05, \*\**p* < .01, \*\*\**p* < .001

Associations of affective temperaments with sense of self and social functioning are presented in Table 3. Hyperthymic temperament was again associated with positive aspects of daily life including increased confidence, feeling like the center of attention, feeling successful in one's activity, feeling cared for by others, and decreased boredom and loneliness. In contrast,

cyclothymic/irritable temperament was associated with feeling unsuccessful, uncertain, bored, lonely, and like the center of attention yet socially rejected. Dysthymic temperament was inversely associated with confidence and feeling like the center of attention.

Associations of affective temperaments with behaviors in daily life are presented in Table 4. Hyperthymic temperament was associated with doing something exciting and doing many things, whereas cyclothymic/irritable temperament was associated with doing many things but unassociated with doing exciting things. Six items assessed different aspects of impulsivity and an overall impulsivity index was computed. Hyperthymic temperament was unassociated with the overall impulsivity index. It was positively associated with “Since the last beep I said or did things I wish I hadn’t”, but inversely associated with “right now there is something I should be doing that I am not.” So, in terms of impulsive behaviors, hyperthymic temperament was more associated with acts of commission rather than omission. Dysthymic temperament was inversely associated with doing something troublesome, doing something risky, and acting without thinking. In contrast, cyclothymic/irritable temperament was positively associated with all of the impulsivity items and the overall index.

**Table 4.** Associations of behaviors and impulsivity with affective temperaments in daily life

Level 1 criterion	Level 2 predictors ( <i>df</i> = 288)		
	Hyperthymic	Dysthymic	Cyclo/Irr
Doing something exciting	0.22 (0.06)***	- 0.01 (0.06)	0.11 (0.06)
Doing many things	0.19 (0.06)**	0.04 (0.07)	0.26 (0.08)**
Impulsivity index	0.07 (0.04)	- 0.10 (0.05)*	0.31 (0.05)***
Doing something that could get me into trouble	0.07 (0.04)	- 0.10 (0.05)*	0.27 (0.05)***
Doing something that I may regret later	0.03 (0.04)	- 0.08 (0.05)	0.25 (0.05)***
There is something I should be doing that I’m not	- 0.20 (0.08)*	- 0.02 (0.08)	0.41 (0.08)***
Since the last beep, said or did things I wish I hadn’t	0.09 (0.05)*	- 0.08 (0.05)	0.32 (0.06)***
Since the last beep, did something risky	0.09 (0.05)	- 0.11 (0.05)*	0.34 (0.06)***
Since the last beep, acted without thinking	0.09 (0.05)	- 0.11 (0.05)*	0.38 (0.06)***

Raw multilevel regression coefficients indicating the relation of the level 2 predictors (TEMPS) and the level 1 (daily life experience) criteria and standard error

\**p* < .05, \*\**p* < .01, \*\*\**p* < .001

**Table 5.** Cross-level interactions examining context in the moment

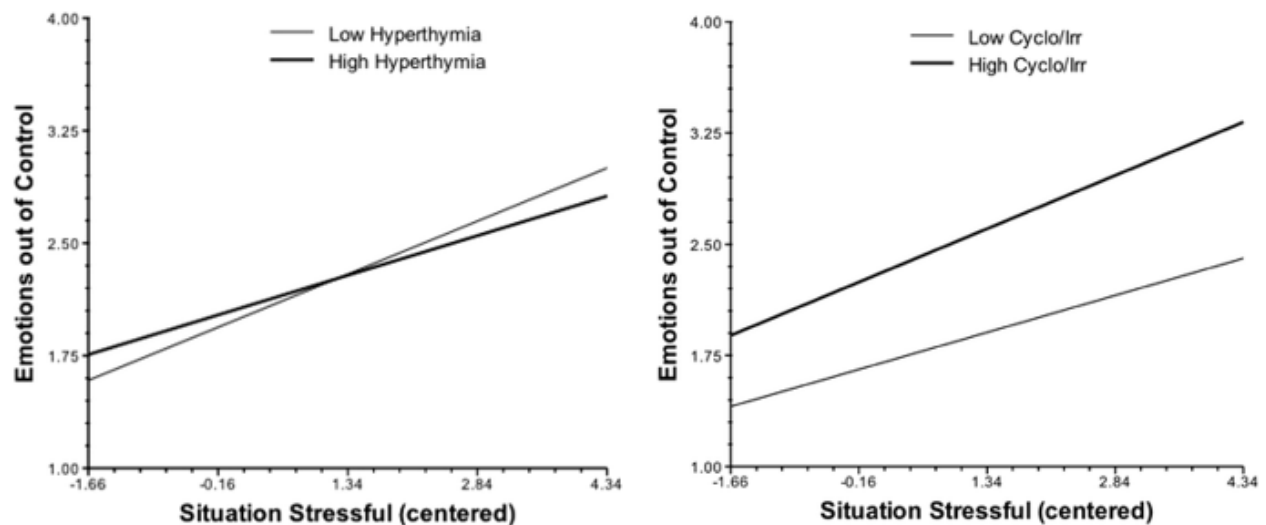
Level 1 criterion	Level 1 predictor	$\gamma_{10}$ ( <i>df</i> = 288)	Level 2 predictor <sup>a</sup>		
			Hyperthymic $\gamma_{11}$ ( <i>df</i> = 287)	Dysthymic $\gamma_{12}$ ( <i>df</i> = 287)	Cyclo/Irr $\gamma_{13}$ ( <i>df</i> = 287)
Irritability index	Situation stressful	0.37 (0.01)***	- 0.03 (0.01)	- 0.01 (0.01)	0.03 (0.02)
Dysphoria index	Situation stressful	0.27 (0.01)***	- 0.05 (0.01)***	0.02 (0.01)	0.03 (0.01)
Emotions out of control	Situation stressful	0.21 (0.01)***	- 0.04 (0.01)**	0.01 (0.01)	0.06 (0.02)***
Thoughts racing	Situation stressful	0.28 (0.01)***	- 0.02 (0.01)	- 0.00 (0.01)	0.01 (0.02)
Trouble concentrating	Situation stressful	0.30 (0.01)***	- 0.05 (0.02)**	0.01 (0.02)	- 0.01 (0.02)
Impulsivity index	Situation Stressful	0.10 (0.01)***	0.01 (0.01)	- 0.03 (0.01)*	0.01 (0.01)
Impulsivity index	Emotions out of control	0.18 (0.01)***	0.01 (0.01)	- 0.05 (0.02)**	- 0.01 (0.02)

<sup>a</sup>Cross-level interaction of the association of the Level-2 variable with the slope of the Level-1 predictor and criterion

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



Cross-level interactions examined the extent to which affective temperaments were especially reactive to context; specifically, when situations were stressful and when people reported feeling their emotions were out of control (Table 5). When in stressful situations, those high in hyperthymic temperament were less likely to report negative affect, feeling like one's emotions were out of control, and trouble concentrating compared to those low in hyperthymic temperament. In contrast, when in stressful situations, those high in cyclothymic/irritable temperament reported feeling like their emotions were out of control more-so than those low in cyclothymic/irritable temperament (Fig. 1). When feeling stressed or that their emotions were out of control, those high in dysthymic temperament were less likely to engage in impulsivity compared to those low in dysthymic temperament.



**Figure 1.** Cross-level interactions of stress and emotions for hyperthymic and cyclothymic/irritable temperaments. Note that temperament variables were continuous. For purposes of the figures, high and low temperaments indicate the upper and lower quartiles respectively

Linear regression was used to test if affective temperaments significantly predicted variability in participants' ratings of negative affect, irritability, happiness, and emotions out of control. Cyclothymic/irritable, dysthymic, and hyperthymic temperaments were entered simultaneously in the analyses. Cyclothymic/irritable temperament significantly predicted increased variability in irritability ( $\beta = 0.26, p < .001$ ), negative affect ( $\beta = 0.30, p < .001$ ), happiness ( $\beta = 0.22, p < .001$ ), and feeling like their emotions were out of control ( $\beta = 0.30, p < .001$ ) over-and-above variance accounted for by the other temperaments. Hyperthymic and dysthymic temperaments did not significantly predict variability in any of these ESM measures.

## Discussion

Akiskal and Mallya's (1987) theoretical framework posits that affective temperaments are unique constructs, distinct from normal personality, that underlie and contribute to the development of bipolar mood psychopathology. Previous research has validated self-report measures of hyperthymic, dysthymic, cyclothymic, and irritable temperaments in laboratory-based studies in clinical bipolar populations (e.g., Di Florio et al. 2010). However, the

association of affective temperaments and bipolar spectrum psychopathology in daily life in non-clinical samples is not yet well characterized. The present study examined the daily life expression of affective temperaments by measuring affective, cognitive, and behavioral correlates of bipolar spectrum psychopathology using ESM in a non-clinically ascertained sample oversampled for bipolar spectrum traits. The present study replicated and extended the previous findings by Walsh et al. (2013).

Consistent with Walsh et al. (2013), hyperthymic temperament was associated with increased happiness, energy, confidence, engagement in positive and exciting things, success, and feeling cared for in daily life. These findings are consistent with views that hyperthymic temperament is associated with adaptive characteristics including increased energy, sociability, and cheerfulness (Akiskal and Mallya 1987; Akiskal 1992; Akiskal and Akiskal 1992, 2005). Additionally, hyperthymic temperament was associated with doing many things at once and doing things one wished they had not. These findings support the notion that hyperthymic temperament may include some maladaptive characteristics including being overly involved or engaging in uninhibited behavior and sensation seeking (Akiskal and Mallya 1987; Akiskal 1992; Akiskal and Akiskal 1992, 2005). However, the overall profile of hyperthymic temperament in daily life was positive, suggesting that hyperthymic temperament is generally more adaptive than maladaptive. Alternatively, this could also reflect that the hyperthymic subscale of the TEMPS-A primarily taps adaptive characteristics and does not adequately tap the potentially maladaptive aspects of the temperament. For example, the questions on this subscale focus on positive aspects such as being upbeat, feeling confident, and being socially capable, but not on maladaptive expressions of hyperthymic temperaments such as being overinvolved in activities, meddlesome, boastful, and uninhibited. Thus, questions remain about the extent to which hyperthymic temperament is associated with development and expression of bipolar disorders, under what circumstances hyperthymic temperament becomes pathological, and the extent to which the TEMPS-A subscale captures this pathological component of hyperthymic temperament.

Consistent with both conceptual models and empirical findings (e.g., Akiskal et al. 1979; DeGeorge et al. 2014; Walsh et al. 2012, 2013), we combined cyclothymic and irritable temperaments. In contrast to hyperthymic temperament, cyclothymic/irritable temperament was characterized by negative affect and stress, difficulty with thoughts, decreased sense of self and success, feelings of social rejection, and extensive impulsive thoughts and behaviors in daily life. Furthermore, cyclothymic/irritable temperament moderated the association of stress in the moment with feeling like one's emotions are out of control, consistent with our hypothesis that those high in cyclothymic/irritable temperament would be more reactive to stress. However, contrary to previous findings (Maremmani et al. 2011; Walsh et al. 2012), cyclothymic/irritable temperament did not moderate the association of stress in the moment with more general negative affect. This may be in part due to the fact that in previous studies, negative affect was measured specifically as anger or agitation. In this study, we included the emotions frustrated and irritable, which in terms of intensity may be milder than anger and agitation. Although there was not a cross-level interaction, those high in cyclothymic/irritable temperament were more likely to experience stress, and were more likely to report heightened negative affect. Additionally, we were surprised that cyclothymic/irritable temperament did not moderate the association of stress in the moment with impulsivity. Note that people high in cyclothymic/irritable temperament experienced elevated impulsivity and experienced impulsivity

in response to stress—it is just that the slope of irritability and stress did not differ across levels of the temperament. Overall, these findings are consistent with views that cyclothymic/irritable temperament is most strongly associated with pathological and problematic outcomes including bipolar diagnoses, major depressive episodes, poor psychosocial functioning, and borderline personality symptoms (DeGeorge et al. 2014; Walsh et al. 2012). Furthermore, the results build on previous research to suggest that even on a momentary basis, cyclothymic/irritable temperament is associated with a host of negative affective, cognitive, and behavioral outcomes and that individuals high in cyclothymic/irritable temperament are especially reactive to stress.

Although both hyperthymic and cyclothymic/irritable temperaments were associated with patterns of unusually elevated mood, cyclothymic/irritable temperament was differentiated from hyperthymic temperament in that it significantly predicted variability in mood. Specifically, cyclothymic/irritable temperament was associated with variability in irritability, negative affect, happiness, and feeling like one's emotions were out of control in daily life. This is consistent with previous findings that suggest that those high in cyclothymic/irritable temperament experience significantly more mood lability both prior to and concurrent with bipolar I disorder (Özgürda et al. 2009). Taken together, these findings could suggest that variability in mood, rather than elevations in negative or positive affect in the moment, may reflect the more pathological component of cyclothymic/irritable temperament.

Dysthymic temperament was largely unrelated to affect, cognition, sense of self, or behavior in daily life. It was associated with decreased energy and confidence in the moment, which is consistent with conceptualizations of dysthymic individuals as being low in energy and high in self-criticism (Vasquez and Gonda 2013); however, it was not associated with social isolation (introversion) or social rejection which was proposed as a core feature of dysthymic temperament by Akiskal et al. (2005a) and supported by Walsh et al. (2013). Furthermore, it was not associated with dysphoria (sadness/anxiety), which was expected given that it is presumed to characterize individuals high in pessimism, worry, and guilt (Vasquez and Gonda 2013). Dysthymic temperament was negatively associated with impulsivity whereby individuals high in dysthymia reporting decreased troublesome and risky behaviors and were less likely to act without thinking. Theoretically, this may reflect that those high in dysthymic temperament are less reactive and more lethargic. Thus, these findings may suggest that dysthymic temperament is most associated with general lethargy and decreased self-esteem rather than worry, pessimism, and introversion.

Given that affective temperaments seem to be differentially associated with bipolar spectrum characteristics in daily life and that hyperthymic and cyclothymic/irritable temperaments each capture unique adaptive and maladaptive aspects of bipolar spectrum psychopathology, it is surprising that mainstream nosology has not yet incorporated hyperthymic and cyclothymic/irritable temperaments into our thinking about risk or protective traits that underlie the development of bipolar spectrum psychopathology. This may be due in part to debates about the extent to which hyperthymic temperament is associated with bipolar disorders. For instance, studies have reported similar rates of hyperthymic temperament in bipolar disorder compared to healthy comparison subjects (Evans et al. 2005; Mendlowicz et al. 2005; Nowakowska et al. 2005; Savitz et al. 2008) and increased rates of hyperthymic temperament in bipolar disorder compared to healthy controls (Baldessarini et al. 2016; Kesebir et al. 2005) and depressed

patients (Gassab et al. 2008; Mazzarini et al. 2009). Studies have also reported that hyperthymic temperament was not associated with DSM bipolar disorders but was associated with subclinical bipolar psychopathology as measured by broad bipolar diagnoses, history of hypomania, and interview ratings of hyperthymia (DeGeorge et al. 2014; Walsh et al. 2012). Yet, genetic studies seem to suggest that hyperthymic temperament, more so than other temperaments, differentiates unaffected siblings from controls (Evans et al. 2005) and produced a genome-wide significant locus for those with bipolar disorder (Greenwood et al. 2012). It may be that by the time people transition into clinical bipolar disorders, the adaptive characteristics of hyperthymic temperament are no longer present. Alternatively, it could be hypothesized that hyperthymic temperament is partially protective, whereby individuals at risk for the development of bipolar psychopathology manifest the more adaptive characteristics of hyperthymic temperament on a day-to-day basis. This is in line with recent findings which suggest that for those with bipolar I and II disorders, being high in hyperthymic temperament was protective against both suicidal ideation and acts compared to those with high cyclothymic and dysthymic temperaments (Baldessarini et al. 2016).

In contrast, cyclothymic/irritable temperament seems to be most associated with risk for the development of and worse outcomes related to bipolar spectrum psychopathology. In a retrospective study of people with bipolar disorder, Zeschel et al. (2015) found that those who were high in cyclothymic and irritable temperament experienced more subthreshold symptoms prior to the onset of their first manic or hypomanic episode and higher levels of concurrent subthreshold and clinical symptoms of mania or hypomania. Likewise, Özgürda et al. (2009) found higher rates of cyclothymic and irritable temperament in patients with bipolar I disorder who reported mood lability prior to their first affective episode. Thus, for individuals at risk for bipolar disorder, being high on cyclothymic/irritable temperament may be indicative of mood instability prior to the onset of the disorder. Furthermore, cyclothymic temperament in conjunction with bipolar disorder may result in worse outcomes. Baldessarini et al. (2016) found that suicidal ideation and acts were strongly associated with cyclothymic temperament for those with bipolar I and II disorders.

## Limitations

The present study had several limitations. The dysthymic temperament subscale had relatively poor reliability (coefficient alpha of 0.60). This was consistent with Kwapil et al. (2013) who reported coefficient alpha for the subscale of 0.54 in a sample of 522 young adults and Walsh et al. (2012) who reported a value of 0.62 in 145 young adults. Note that these values are at the low end or below the range of reliabilities reported for the 110-item version and 39-item version of the TEMPS-A by Elias et al. (2017). The dysthymic temperament subscale also lacked a clear pattern of associations with daily life experiences—especially with negative affect or social rejection, suggesting that it may lack adequate construct validity. A review of the nine dysthymic temperament items on the TEMPS-A indicates that the subscale primarily taps inadequacy, dependency, and social anxiety. These items appear consistent with many of the criteria for depressive personality disorder in DSM-IV (4th ed., American Psychiatric Association 1994), although interestingly they lack the prominent depressive cognitions that are present in this diagnosis. This leads to several concerns about the items in the dysthymic subscale. On a conceptual level, they seem to omit the depressive or dysphoric component of the temperament.

On a psychometric level, it is likely that this subscale has too few items that are measuring too many different characteristics. Conceptually, dysthymic temperament is an important component of affective temperaments and the personality and psychopathology literature. Thus, it may be that the reconsideration of the dysthymic construct and subscale is warranted in the TEMPS-A.

The present study used an undergraduate student sample, which may limit the generalizability to non-college student samples, as well as older adult samples. Consistent with the use of college students, the present sample was predominantly female (73%) which could have affected our results. Previous studies have reported stable gender differences in affective temperaments with men scoring significantly higher on hyperthymic and irritable temperaments than women and women scoring higher on cyclothymic and dysthymic temperaments than men (see Vasquez et al. 2012 for review). Thus, higher rates of cyclothymic and dysthymic temperaments may have been present in a predominantly female sample.

## Conclusions

This study provided evidence for the relevance and differentiation of affective temperaments in daily life by examining affect, cognition, and behavior related to bipolar spectrum psychopathology. Overall, hyperthymic temperament represented largely adaptive characteristics in daily life whereas cyclothymic/irritable temperament represented primarily negative or maladaptive characteristics in daily life even in a non-clinically ascertained sample. Affective temperaments appear to provide promising constructs for understanding etiology, development, and expression of mood psychopathology. Ambulatory assessment methods offer useful tools for exploring dynamic constructs such as affective temperaments and for investigating the extent to which affective temperaments are related to bipolar spectrum psychopathology. Finally, such methods may also provide useful intervention tools for patients suffering from mood disorders.

**Acknowledgements:** We thank Alyssa Bathery, Menghan Luo, Lindsey Grupp, and Christina King for their proof reading and comments on the manuscript.

**Funding:** This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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