

SHORT TITLE: Emotional reactivity and perseverance

Emotional reactivity and perseverance: Independent dimensions of trait positive and negative affectivity and differential associations with psychological distress

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**Abstract**

**Background:** Theoretically, two types of emotional responding could underlie individual differences in trait affect: 1) a disposition reflecting increased probability of experiencing positive or negative emotions (emotional reactivity), and 2) a disposition to experience prolonged emotional reactions once elicited (emotional perseveration). We developed a measure of these dimensions and investigated whether emotional reactivity and perseveration 1) account for unique variance in trait affect, and 2) are differentially associated with symptoms of psychological distress. **Method:** In Study 1, participants (T1:  $n = 90$ ; T2:  $n = 51$ ) completed the Positive and Negative Affect Schedule (PANAS) and the Emotional Reactivity and Perseveration Scale (ERPS, adapted from the PANAS). In study 2, participants ( $n = 228$ ) completed the PANAS, ERPS, and Depression Anxiety Stress Scales. **Results:** Study 1 established the basic psychometric properties of the ERPS and demonstrated that emotional reactivity and perseveration accounted for unique variance in trait positive and negative affect. Study 2 confirmed these findings and established that emotional reactivity and perseveration are differentially associated with depression, anxiety, and stress scores. **Conclusion:** Emotional reactivity and perseveration represent independent dimensions of trait affect. Considering these dimension in future research could further the understanding of both normal emotional responding and emotional vulnerability.

*Keywords:* Positive Affect, Negative Affect, Emotional Reactivity, Emotional Perseveration, Psychological Distress, Depression, Anxiety, Stress

## 1. Introduction

The seminal work of Watson and colleagues proposed that individual differences in emotional experience can be organised around two affective dimensions (Watson, Clark, & Tellegen, 1988; Watson & Clark, 1984; Watson & Tellegen, 1985). Positive affect (PA) is conceptualised as a pleasurable engagement with one's environment, and includes feelings such as joy and contentment. In contrast, negative affect (NA) is a dimension of subjective distress comprising a range of aversive mood states (e.g. irritability, anger, distress; Watson & Clark, 1984; Watson & Tellegen, 1985). From this perspective trait PA refers to the stable predisposition towards the experience of positive emotion, whereas trait NA is a stable predisposition towards negative emotion. Individual differences in trait affect are predictive of both psychological distress and wellbeing. Specifically, PA is positively associated with subjective wellbeing and negatively associated with psychopathology, while NA is associated with affective disorders, including depression and anxiety, and negatively associated with wellbeing (Crawford & Henry, 2004; J. Hu & Gruber, 2008; Lonigan, Phillips, & Hooe, 2003; Watson, Clark, & Carey, 1988). Additionally, NA prospectively predicts symptoms of anxiety and depression, offering further evidence for the role of trait NA as a risk factor for the development of internalising disorders (Lonigan et al., 2003).

Trait PA and NA are typically assessed using the dispositional version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988), which measures the extent to which individuals experience negative and positive emotions "in general". Theoretically, at least two different types of dispositional emotional responding could underlie variation in such trait negative and positive affect scores: 1) a disposition that reflects increased probability of experiencing positive or negative affect in response to situations or stimuli (*emotional reactivity*), and 2) a disposition to experience prolonged emotional reactions once elicited (*emotional perseveration*). Either of these dispositions would increase the amount of time spent experiencing a

given emotion, and should therefore be associated with higher trait negative and positive affectivity scores.

Recently, Rudaizky and colleagues demonstrated that reactivity and perseverance are dissociable dimensions of a construct closely related to NA, trait anxiety (Rudaizky & MacLeod, 2013, 2014; Rudaizky, Page, & MacLeod, 2012). Trait anxiety has traditionally been viewed as a unitary construct and is typically assessed using self-report questionnaires requiring respondents to rate how often they experience specific symptoms (e.g. worry). Rudaizky and colleagues posited that anxiety reactivity and anxiety perseverance could both underlie variation in trait anxiety scores (Rudaizky et al., 2012). They created the Anxiety Reactivity Perseveration Scale (ARPS), adapted from the trait version of the State-Trait Anxiety Inventory, STAI-T (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and demonstrated that these two dimensions independently predict variance in trait anxiety (Rudaizky et al., 2012). However, whether dimensions of emotional reactivity and perseverance underlie individual differences in trait negative and positive emotion more generally remains an open question.

The current research aimed to: 1) develop a measure of the hypothesized dimensions of emotional reactivity and perseverance (for both positive and negative emotion), 2) determine whether the emotional reactivity and perseverance subscales account for unique variance in trait PA and NA, and 3) investigate if individual differences in emotional reactivity and perseverance are differentially associated with symptoms of depression, anxiety, and stress.

## **2. Study 1: The Emotional Reactivity and Perseveration Scale**

Study 1 aimed to establish the basic psychometric properties (structure, internal consistency, and test-retest reliability) of a measure of emotional reactivity and perseverance (adapted from the PANAS – see methods section below for a description) and determine whether the proposed reactivity and perseverance dimensions are independently associated with trait PA and NA.

## 2.1. Method

### 2.1.2. Participants

The baseline (T1) sample comprised 90 adults between 18-52 years of age ( $M = 25.31$ ,  $SD = 5.57$ ). Of these, 29 (32.2%) were male and 61 (67.8%) were female. The majority were current university students ( $n = 75$ , 83.3%). Of the sample 27 (30.0%) reported a prior diagnosis of a mental illness, most commonly a depressive disorder ( $n = 13$ ) or an anxiety disorder ( $n = 10$ ). Participants were re-assessed one week later (T2). Of the 51 (56.7%) participants who completed the T2 assessment, 19 (37.3%) were male and 32 (62.7%) were female. When compared with participants who only completed the T1 assessment, participants who completed both assessments did not differ significantly in terms of age, gender, history of mental health problems, positive and negative affect, or emotional reactivity and perseverance.

### 2.1.3. Measures

*2.1.3.1. Positive and Negative Affect:* Trait affect was measured using the dispositional version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is a 20 item scale measuring both PA (e.g. proud, inspired) and NA (e.g. nervous, distressed). Using a 5 point likert scale (0: *Very slightly*; 4: *Extremely*) respondents rate the extent to which they 'generally' feel each emotion. The PANAS demonstrates good internal consistency for both the PA ( $\alpha = .88$ ) and NA ( $\alpha = .87$ ) subscales (Watson, Clark, & Tellegen, 1988). Internal consistencies were excellent in the current sample ( $\alpha = .89 - .92$ ).

*2.1.3.2. Emotional Reactivity and Perseveration:* Emotional reactivity and perseverance were measured using an adapted version of the PANAS, the Emotional Reactivity and Perseveration Scale (ERPS). The ERPS is a 40-item scale that retains the original 20 emotions of the PANAS; however, the instructions and response options have been adapted to reflect reactivity and perseverance (see Appendix). To assess reactivity, respondents were asked, "When exposed to a

situation that would make the ‘average’ person experience this feeling, how likely is it that you will experience this particular feeling?” (1: *not at all likely*; 4: *extremely likely*). To assess perseverance, participants were asked “When you experience a situation that does make you feel this way, how long is this feeling likely to persist?” (1: *Not at all persistent*; 5: *Extremely persistent*). Relevant items are summed to provide separate indices of positive reactivity, perseverance of positive emotion, negative reactivity, and perseverance of negative emotion.

#### 2.1.4. Procedure

Upon receipt of ethical approval, the study was advertised on an online booking system for undergraduate psychology students interested in participating in research for course credit. Additional recruitment strategies included advertising the study via social media (e.g. Facebook), the posting of advertisements on notice boards, through snowballing and via personal networks. Participants were fully informed as to the nature of the study, and were invited to complete the confidential online survey in their own time. At T1 participants completed the PANAS followed by the ERPS. Only the ERPS was completed at T2 (to assess test-retest reliability of the new measure).

#### 2.2. Results

With the exception of the assessment of test-retest reliability, all analyses were conducted using data collected at T1. Rates of missing data ranged between 0 – 5% and were missing completely at random for both positive and negatively-valenced items [Little’s Tests:  $\chi^2(170) = 191.64, p = .122$ ;  $\chi^2(193) = 179.18, p = .754$ ]. Given low rates of missing data and the fact that data were missing completely at random, missing data were imputed using the expectation maximisation algorithm in SPSS 22.

### 2.2.1. *Principal Components Analyses of the ERPS*

Due to the small sample, principal components analyses were conducted separately for positive and negative items. Given expected correlations between the emotional reactivity and perseverance dimensions an oblique rotation was used. The Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's Test of Sphericity indicated that the sample was adequate for both the positive [KMO = .90; Bartlett's Test:  $\chi^2(190) = 1328.55, p < .001$ ] and negative items [KMO = .91; Bartlett's Test:  $\chi^2(190) = 1846.39, p < .001$ ]. Eigen values ( $\geq 1$ ), visual examination of the scree plots, and parallel analyses (with 1000 samples; Courtney, 2013; O'Connor, 2000), were used to determine the number of components to extract. Items were included if they loaded unambiguously on a component (loadings  $\geq .40$ ), were conceptually coherent (communalities  $\geq .40$ ), and did not cross-load on components. In the initial PCA, four components with eigenvalues greater than one emerged when analysing positive items and three components with eigenvalues greater than one emerged when analysing negative items. However, these components were structurally unclear and included numerous cross-loading items. In contrast, visual examination of the scree plots suggested a clear two component solution (for both positive and negative items). The parallel analyses confirmed that two components be retained for positive items. For negative items, Horn's (1965) parallel analysis suggested a single component while Velicer's (1976) minimum average partial test (MAP) suggested two components. Taken together, the scree plots, the results of the parallel analyses, and the conceptual clarity of components indicated a two component solution for both positive and negative items. This two component solution accounted for 61% of the total variance in positive items, 70% of the total variance in negative items, and mapped directly onto the hypothesized emotional reactivity and perseverance subscales (Table 1). The emotional reactivity and perseverance components were correlated in both the positive ( $r = .57$ ) and negative ( $r = .72$ ) items.

*Table 1: Summary of Principal Component Analyses of the ERPS*

Item	Reactivity Component	Perseveration Component
<b>Positive Items</b>		
Interested (Reactivity)	.75	
Excited (Reactivity)	.72	
Strong (Reactivity)	.65	
Enthusiastic (Reactivity)	.73	
Proud (Reactivity)	.52	
Alert (Reactivity)	.81	
Inspired (Reactivity)	.80	
Determined (Reactivity)	.88	
Attentive (Reactivity)	.83	
Active (Reactivity)	.69	
Interested (Perseveration)		.75
Excited (Perseveration)		.61
Strong (Perseveration)		.86
Enthusiastic (Perseveration)		.71
Proud (Perseveration)		.88
Alert (Perseveration)		.70
Inspired (Perseveration)		.85
Determined (Perseveration)		.65
Attentive (Perseveration)		.72
Active (Perseveration)		.68
<i>Internal Consistency</i>	.92	.93

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<b>Negative Items</b>		
Distressed (Reactivity)	.84	
Upset (Reactivity)	.87	
Guilty (Reactivity)	.88	
Scared (Reactivity)	.86	
Hostile (Reactivity)	.41	
Irritable (Reactivity)	.76	
Ashamed (Reactivity)	.91	
Nervous (Reactivity)	.83	
Jittery (Reactivity)	.47	
Afraid (Reactivity)	.81	
Distressed (Perseveration)		.81
Upset (Perseveration)		.84
Guilty (Perseveration)		.72
Scared (Perseveration)		.64
Hostile (Perseveration)		.80
Irritable (Perseveration)		.78
Ashamed (Perseveration)		.64
Nervous (Perseveration)		.65
Jittery (Perseveration)		.86
Afraid (Perseveration)		.73
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<i>Internal Consistency</i>	.95	.95

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*Note:* Component loadings < .40 are suppressed.

### 2.2.2. Reliability of the ERPS

Internal consistencies of the emotional reactivity and perseverance subscales were estimated using Cronbach's alpha ( $\alpha$ ). Internal consistencies were excellent and ranged between  $\alpha = .92$  and  $\alpha = .95$  (Table 1). One-week test-retest reliabilities were estimated by examining intraclass correlations (using a two-way mixed effects model) between scores on the ERPS in the subsample of participants who completed both assessment sessions ( $n = 51$ ). With the exception of perseverance of negative emotion, mean scores on the ERPS did not differ significantly over the two assessments. Test-retest reliabilities ranged between .61 and .91 (Table 2).

Table 2: Test-retest reliability of the ERPS

	T1 Mean (SD)	T2 Mean (SD)	<i>p</i>	ICC (95% CI)	<i>p</i>
<b>Positive Items</b>					
Reactivity	34.80 (7.46)	33.08 (8.27)	.125	.67 (.42 – .81)	< .001
Perseveration	30.78 (7.39)	29.53 (7.56)	.265	.61 (.32 – .78)	.001
<b>Negative Items</b>					
Reactivity	26.95 (10.70)	25.18 (11.60)	.155	.82 (.68 – .90)	< .001
Perseveration	25.06 (10.95)	23.00 (10.71)	.025	.91 (.84 – .95)	< .001

Note: Significant *p* values are bolded.

### 2.2.3. Associations between emotional reactivity and perseverance and trait affect

Two multivariate linear regressions (controlling for age, gender, and history of mental health problems) were conducted to determine if emotional reactivity and perseverance were independently associated with PA and NA (Table 3). Positive emotional reactivity and perseverance were independently associated with PA. Positive reactivity accounted for a unique

8.4% of the variance in PA and perseveration of positive emotion accounted for a unique 7.3% of the variance in PA. Negative emotional reactivity and perseveration were not associated with PA. The overall model accounted for 61% of the variance in PA [ $R^2 = .61$ ,  $F(7, 80) = 20.82$ ,  $p < .001$ ]. Negative emotional reactivity and perseveration were independently associated with NA. Negative reactivity accounted for a unique 6.3% of the variance in NA and perseveration of negative emotion accounted for a unique 3.2% of the variance in NA. Positive emotional reactivity and perseveration were not associated with NA. The overall model accounted for 61% of the variance in positive affect [ $R^2 = .61$ ,  $F(7, 80) = 20.33$ ,  $p < .001$ ].

### 2.3. Discussion

Study 1 adapted the dispositional version of the PANAS to develop a measure of emotional reactivity and perseveration (ERPS). Principal components analyses identified clear reactivity and perseveration dimensions for both positively and negatively-valenced items. The reactivity and perseveration subscales demonstrated excellent internal consistency and adequate one-week test-retest reliability. Importantly, the reactivity and perseveration subscales accounted for unique variance in PA and NA scores, indicating that reactivity and perseveration represent independent dimensions of trait affect. While previous research has distinguished between *intensity* of emotional experience and *frequency or duration* of emotional experience (Diener, Sandvik, & Pavot, 2009), by confounding frequency and duration, prior research conflates reactivity and perseveration, thereby precluding any conclusions regarding these dimensions in the context of PA and NA. Additionally, existing measures of emotional reactivity (Nock, Wedig, Holmberg, & Hooley, 2008) do not always distinguish between positive and negative emotion (e.g. “I tend to get emotional very easily” and “I experience emotions very strongly”). By contrast, the ERPS conceptually distinguishes between, and independently assesses, dimensions of emotional reactivity and

Table 3: Summary of multivariate associations between emotional reactivity, perseverance, and trait positive and negative affect

	Positive Affect				Negative Affect			
	<i>B</i> (95% CI)	$\beta$	<i>p</i>	Part <i>r</i>	<i>B</i> (95% CI)	$\beta$	<i>p</i>	Part <i>r</i>
<b>Study 1</b>								
Constant	10.28 (1.03 – 19.53)	--	<b>.030</b>	--	12.52 (1.26 – 23.77)	--	<b>.030</b>	--
Age	.06 (-.12 – .24)	.05	.526	.04	-.08 (-.31 – .14)	-.05	.458	-.05
Gender	.86 (-1.39 – 3.10)	.06	.449	.05	-1.77 (-4.50 – .96)	-.09	.201	-.09
Previous mental health problem	-1.11 (-3.46 – 1.23)	-.07	.348	-.06	-.07 (-.292 – 2.79)	-.00	.963	-.00
Positive reactivity	.40 (.21 – .59)	.46	<b>&lt; .001</b>	.29	-.20 (-.42 – .03)	-.18	.090	-.12
Positive perseverance	.36 (.18 – .55)	.40	<b>&lt; .001</b>	.27	.08 (-.14 – .30)	.07	.467	.05
Negative reactivity	-.11 (-.30 – .07)	-.17	.217	-.08	.41 (.19 – .63)	.50	<b>&lt; .001</b>	.25
Negative perseverance	-.02 (-.20 – .16)	-.03	.841	-.01	.29 (.07 – .51)	.35	<b>.011</b>	.18
<b>Study 2</b>								
Constant	14.06 (7.92 – 20.20)	--	<b>&lt; .001</b>	--	13.55 (6.20 – 20.90)	--	<b>&lt; .001</b>	--

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Age	-.13 (-.24 – -.02)	-.10	<b>.022</b>	-.10	.07 (-.07 – .20)	-.06	.330	.05
Gender	-.92 (-2.37 - .53)	-.05	.213	-.05	-.53 (-2.26 – 1.21)	-.03	.549	-.03
Previous mental health problem	.73 (-1.12 – 2.57)	.04	.439	.03	1.82 (-.39 – 4.03)	.10	.105	.09
Positive reactivity	.48 (.35 – .61)	.50	<b>&lt; .001</b>	.30	-.24 (-.40 – -.08)	-.29	<b>.004</b>	-.16
Positive perseverance	.36 (.22 – .50)	.33	<b>&lt; .001</b>	.21	-.09 (-.26 – .08)	-.09	.313	-.06
Negative reactivity	-.22 (-.34 – -.10)	-.26	<b>&lt; .001</b>	-.15	.22 (.08 – .36)	.29	<b>.003</b>	.16
Negative perseverance	-.02 (-.14 – .10)	-.02	.743	-.01	.27 (.13 – .42)	.33	<b>&lt; .001</b>	.20

*Note:* Significant *p* values are bolded.

perseveration in the context of both positive and negative emotion. Additionally, by adapting the PANAS, the ERPS maps directly onto the gold standard measure of PA and NA.

### **3. Study 2: Associations between emotional reactivity and perseverance and symptoms of depression, anxiety, and stress**

Due to the small sample in Study 1, the structure of the ERPS was assessed separately for positive and negative items. Study 2 aimed to address this limitation and replicate the structure of the ERPS using confirmatory techniques to factor analyse all items simultaneously in a larger independent sample. Study 2 also aimed to replicate the internal consistencies of the reactivity and perseverance dimensions, as well as the finding that emotional reactivity and perseverance were independently associated with PA and NA. An additional goal of Study 2 was to examine how emotional reactivity and perseverance are associated with indices of current psychological distress. While there are well-established associations between trait affect and psychological distress reported in the literature (Crawford & Henry, 2004; L. Hu & Bentler, 1998; Lonigan et al., 2003; Watson, Clark, & Carey, 1988), whether these relationships are differentially attributable to underlying individual differences in emotional reactivity and/or perseverance remains to be established. Therefore, Study 2 also investigated if emotional reactivity and perseverance were differentially associated with symptoms of depression, anxiety, and stress.

#### *3.1. Method*

##### *3.1.1. Participants*

The sample comprised 228 adults between 18-52 years of age ( $M = 22.22$ ,  $SD = 5.88$ ). Of these, 66 (28.9%) were male and 161 (70.6%) were female. The majority were current university students ( $n$

= 199, 87.3%). Of the sample 40 (17.5%) reported a prior diagnosis of a mental illness, most commonly a depressive disorder ( $n = 23$ ) or an anxiety disorder ( $n = 16$ ).

### 3.1.2. Measures

3.1.2.1. *Positive and Negative Affect; Emotional Reactivity and Perseveration*: The PANAS, and the ERPS as described in Study 1 were used.

3.1.2.2. *Psychological Distress*: Symptoms of depression, anxiety, and stress were assessed with the 21-item Depression Anxiety and Stress Scales (DASS21; Lovibond & Lovibond, 1995). Respondents indicate on a 4-point Likert scale how much they have experienced the given symptom over the last four weeks (0: *Did not apply to me at all*; 3: *Applied to me very much, or most of the time*). The DASS21 shows good internal consistency and validity in non-clinical samples (Henry & Crawford, 2005). Internal consistencies were excellent in the current sample: depression  $\alpha = .90$ ; anxiety  $\alpha = .82$ ; stress  $\alpha = .90$ .

### 3.1.3. Procedure

Upon receipt of ethical approval, the study was advertised on an online booking system for undergraduate psychology students interested in participating in research for course credit. The study was also advertised on social media for potentially interested participants. Participants were fully informed as to the nature of the study and were invited to complete the confidential online survey in their own time.

## 3.2. Results

### 3.2.1. Confirmation of the structure and internal consistencies of the ERPS

Confirmatory factor analysis was conducted in AMOS 22 using maximum likelihood estimation. Positive emotional reactivity items were constrained to load onto a Positive Reactivity factor and

items measuring perseverance of positive affect were constrained to load onto a Positive Perseveration factor. Negative emotional reactivity items were constrained to load onto a Negative Reactivity factor and items measuring perseverance of negative affect were constrained to load onto a Negative Perseveration factor. The four factors were hypothesized to be correlated. 95% bias corrected confidence intervals for factor loadings were estimated using 1000 bootstrapped re-sampling draws. Correlated error terms were only permitted within each of the four factors, with the exception that error terms for the same emotion were permitted to be correlated across the reactivity and perseverance factors. Model fit was evaluated using the chi-square statistic ( $\chi^2$ ), which should be non-significant. However,  $\chi^2$  is extremely sensitive to sample size so we also report  $\chi^2/\text{degrees of freedom}$  ( $\chi^2/\text{DF}$ ). Values for  $\chi^2/\text{DF}$  near one indicate good model fit and values of three or less indicates acceptable fit. Additionally, root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardised root mean square residual (SRMR) are reported. For RMSEA and SRMR a value of .05 or less indicates good fit and a value of .08 or less indicates acceptable fit. For CFI a value of .95 or greater indicates good fit, a value of .90 or greater indicates adequate fit (Blunch, 2008).

A test of the full hypothesized model indicated that the correlations between Positive Perseveration and Negative Perseveration, Positive Perseveration and Negative Reactivity, and Positive Reactivity and Negative Perseveration were not significant. After removing these non-significant correlations, the four factor model demonstrated adequate model fit:  $\chi^2(708) = 1329.30$ ,  $p < .001$ ;  $\chi^2/\text{DF} = 1.88$ ; RMSEA = .065; SRMR = .069; CFI = .902. Factor loadings and internal consistencies are summarised in Table 4. The correlations between Positive Reactivity and Positive Perseveration ( $r = .40$ ,  $p < .001$ ), Negative Reactivity and Negative Perseveration ( $r = .56$ ,  $p < .001$ ), and Positive Reactivity and Negative Reactivity ( $r = .15$ ,  $p < .001$ ) were all significant. Internal consistencies were excellent for all four factors ( $\alpha = .91$  to  $\alpha = .93$ , Table 4).

Table 4. Standardised factor loadings and bias corrected confidence intervals from the confirmatory factor analysis

	Positive Reactivity	Positive Perseveration	Negative Reactivity	Negative Perseveration
	[95% Bias Corrected CI]			
Interested (Reactivity)	.74 [.65 - .79]			
Excited (Reactivity)	.72 [.62 - .79]			
Strong (Reactivity)	.72 [.64 - .80]			
Enthusiastic (Reactivity)	.73 [.64 - .81]			
Proud (Reactivity)	.77 [.68 - .82]			
Alert (Reactivity)	.75 [.66 - .82]			
Inspired (Reactivity)	.74 [.66 - .81]			
Determined (Reactivity)	.81 [.74 - .86]			
Attentive (Reactivity)	.83 [.76 - .88]			
Active (Reactivity)	.69 [.60 - .76]			
Interested (Perseveration)		.72 [.63 - .79]		
Excited (Perseveration)		.65 [.53 - .74]		
Strong (Perseveration)		.64 [.54 - .73]		

Enthusiastic	.75 [.66 - .82]	
(Perseveration)		
Proud (Perseveration)	.66 [.55 - .75]	
Alert (Perseveration)	.61 [.49 - .71]	
Inspired (Perseveration)	.79 [.71 - .85]	
Determined	.80 [.72 - .85]	
(Perseveration)		
Attentive (Perseveration)	.72 [.60 - .81]	
Active (Perseveration)	.65 [.55 - .73]	
Distressed (Reactivity)		.73 [.64 - .79]
Upset (Reactivity)		.69 [.60 - .76]
Guilty (Reactivity)		.76 [.69 - .83]
Scared (Reactivity)		.80 [.71 - .86]
Hostile (Reactivity)		.56 [.44 - .66]
Irritable (Reactivity)		.69 [.59 - .77]
Ashamed (Reactivity)		.81 [.74 - .87]
Nervous (Reactivity)		.82 [.75 - .87]

Jittery (Reactivity)				.60 [.48 - .71]
Afraid (Reactivity)				.88 [.83 - .91]
Distressed (Perseveration)				.77 [.69 - .82]
Upset (Perseveration)				.72 [.60 - .80]
Guilty (Perseveration)				.67 [.55 - .75]
Scared (Perseveration)				.76 [.68 - .82]
Hostile (Perseveration)				.55 [.43 - .65]
Irritable (Perseveration)				.66 [.55 - .75]
Ashamed (Perseveration)				.78 [.71 - .84]
Nervous (Perseveration)				.76 [.68 - .82]
Jittery (Perseveration)				.61 [.48 - .71]
Afraid (Perseveration)				.77 [.68 - .84]
<i>Internal Consistency</i>	.93	.91	.92	.91

### 3.2.2. *Replication of associations between reactivity, perseverance, and trait affect*

Two multivariate linear regressions (controlling for age, gender, and history of mental health problems) were conducted to determine if emotional reactivity and perseverance were independently associated with PA and NA. The overall models accounted for 66% of variance in PA [ $R^2 = .66$ ,  $F(7, 197) = 53.77$ ,  $p < .001$ ] and 42% of variance in NA, [ $R^2 = .42$ ,  $F(7, 197) = 20.12$ ,  $p < .001$ ]. Positive emotional reactivity and perseverance of positive emotion each contributed unique variance to the prediction of trait PA. Negative emotional reactivity was negatively associated with PA (Table 3). Negative emotional reactivity and perseverance of negative emotion contributed unique variance to the prediction of trait NA. Positive emotional reactivity was inversely associated with NA.

### 3.2.3. *Associations between emotional reactivity, perseverance, and psychological distress*

Having replicated the four dimensions of emotional reactivity and perseverance identified in Study 1, we were then interested in whether these dimensions were differentially related to symptoms of depression, anxiety, and stress. As seen in Table 5, positive reactivity and positive perseverance were negatively correlated with depression, anxiety, and stress scores. Conversely, negative reactivity and negative perseverance were positively related to depression, anxiety, and stress scores. To assess the contributions of emotional reactivity and perseverance to psychological distress, separate multivariate linear regression analyses were conducted for depression, anxiety, and stress scores. Results are summarised in Table 6. The overall models accounted for 35% of the variance in depression [ $R^2 = .35$ ,  $F(7,192) = 14.54$ ,  $p < .001$ ], 24% of the variance in anxiety [ $R^2 = .24$ ,  $F(7,193) = 8.52$ ,  $p < .001$ ], and 30% of the variance in stress [ $R^2 = .30$ ,  $F(7, 192) = 11.75$ ,  $p < .001$ ] scores. After controlling for age, gender, and history of mental health problems, emotional reactivity and perseverance differentially predicted symptoms of psychological distress. Positive emotional reactivity was inversely associated with all psychological distress scores. Perseveration of positive emotion was not independently associated with any of the psychological distress scores.

Negative emotional reactivity was associated with higher anxiety scores but was not associated with depression or stress scores. In contrast, perseveration of negative emotion was associated with higher depression and stress scores but was not associated with anxiety scores.

### 3.3. Discussion

Using an independent sample, Study 2 confirmed the structure of the ERPS, replicated the excellent internal consistencies of the reactivity and perseveration dimensions, and replicated the finding that emotional reactivity and perseveration were independently associated with individual differences in trait PA and NA. However, although the sample size met the minimum guidelines for CFA (Boomsma, 1982), the sample was small and findings should be considered preliminary in nature. Further psychometric work validating the structure of the ERPS is clearly needed.

Additionally, Study 2 indicated differential associations between emotional reactivity and perseveration and symptoms of depression, anxiety, and stress. Specifically, individual differences in the perseveration of negative emotion were associated with depression scores but not anxiety scores. This finding is consistent with the notion that depression in particular may be characterised by an insensitivity to changing emotional context and as such may contribute to sustained negative emotion beyond the immediate emotional context (Rottenberg, Gross, & Gotlib, 2005). In contrast, our results indicate that the tendency to experience acute negative emotional reactions represents an underlying contributor to anxiety, but not necessarily depression. Regarding positive emotion, positive emotional reactivity was negatively associated with depression, anxiety, and stress scores but perseveration of positive emotion was not associated with any symptoms of psychological distress. This finding highlights that repeated reactivity to positive stimuli may be more salient than how long that positive emotion lasts in protecting against symptoms of psychological distress.

Importantly, given the differential associations between individual differences in these

Table 5. Correlations between affect, reactivity and perseverance, depression, anxiety, and stress scores (Study 2)

Variable	Mean (SD)	2	3	4	5	6	7	8	9
1) Positive affect	31.26 (7.83)	-.28***	.70***	.71***	-.24**	-.26***	-.59***	-.25***	-.44***
2) Negative affect	19.89 (7.07)	-	-.32***	-.32***	.6***	.54***	.59***	.68***	.64***
3) Positive reactivity	33.39 (8.16)		-	.74***	.13	-.08	-.49***	-.27***	-.35***
4) Positive perseverance	30.17 (7.18)			-	.07	-.06	-.44***	-.23**	-.32***
5) Negative reactivity	26.89 (9.37)				-	.73***	.23**	.35***	.302***
6) Negative perseverance	26.46 (8.72)					-	.33***	.38***	.41***
7) Depression	11.70 (4.70)						-	.63***	.78***
8) Anxiety	10.77 (3.95)							-	.73***
9) Stress	13.11 (4.73)								-

Note: \*\*  $p < .01$  \*\*\* $p < .001$ .

Table 6: Summary of multivariate associations between emotional reactivity, perseverance, and depression, anxiety, and stress scores (Study 2)

	Depression			Anxiety			Stress		
	<i>B</i> (95% CI)	$\beta$	<i>p</i>	<i>B</i> (95% CI)	$\beta$	<i>p</i>	<i>B</i> (95% CI)	$\beta$	<i>p</i>
Constant	16.82 (11.56 – 22.09)	--	<b>&lt; .001</b>	11.13 (6.46 – 15.80)	--	<b>&lt; .001</b>	13.11 (7.95 – 18.67)	--	<b>&lt; .001</b>
Age	.02 (-.08 – .12)	.03	.637	-.01 (-.10 – .08)	-.02	.764	.07 (-.04 – .17)	.08	.198
Gender	-.10 (-1.34 – 1.14)	.01	.874	-.39 (-1.51 – .72)	-.05	.490	.56 (-.71 – 1.83)	.05	.386
Previous mental health problem	.16 (-1.41 – 1.74)	.01	.841	-.04 (-1.43 – 1.36)	-.00	.961	-.54 (-2.14 – 1.06)	-.04	.504
Positive reactivity	-.23 (-.34 – -.11)	-.39	<b>&lt; .001</b>	-.14 (-.24 – -.04)	-.30	<b>.006</b>	-.16 (-.28 – -.05)	-.28	<b>.006</b>
Positive perseverance	-.09 (-.22 – .03)	-.14	.130	.01 (-.10 – .12)	.02	.858	-.07 (-.19 – .06)	-.10	.283
Negative reactivity	.06 (-.04 – .16)	.12	.232	.11 (.02 – .20)	.27	<b>.015</b>	.05 (-.06 – .16)	.10	.345
Negative perseverance	.11 (.01 – .21)	.21	<b>.009</b>	.08 (-.01 – .17)	.17	.096	.17 (.06 – .28)	.31	<b>.002</b>

Note: Significant *p* values are bolded.

dimensions of emotional experience and psychological distress, it is possible that previous research examining trait PA and NA scores as predictors of psychological outcomes may mask subtle but important distinctions in the relationships between emotional experience and both psychological distress and wellbeing. However, the current findings are preliminary and further research examining the utility of individual differences in emotional reactivity and perseverance in predicting symptoms of psychological distress is clearly needed.

#### **4. General Discussion and Directions for Future Research**

This research establishes the basic psychometric properties of a measure of emotional reactivity and perseverance adapted from the gold standard measure of trait affectivity. Across two independent samples individual differences in emotional reactivity and perseverance accounted for unique variance in trait PA and NA, indicating that reactivity and perseverance represent independent dimensions of trait affectivity. The reactivity and perseverance dimensions were also differentially associated with depression, anxiety, and stress scores, suggesting that the addition of reactivity and perseverance components into measures of trait PA and NA could potentially enhance our capacity to identify salient individual differences in emotional experience that are associated with psychological distress. Considering these dimensions in future research could further the understanding of both normal emotional responding, as well as the understanding of emotional vulnerability in clinical samples.

To this end, a number of future studies examining the role of emotional reactivity and perseverance could be conducted. An obvious avenue for future research could be investigating whether reactivity and perseverance represent independent dimensions of specific negative (e.g. anger, disgust) and positive (e.g. happiness, amusement) emotional states. Additionally, research could also examine reactivity and perseverance dimensions of emotional responding to contrived laboratory stressors. This could assess whether individual differences in trait emotional reactivity

and perseveration predict both immediate responses (self-reported and psychophysiological) to, and sustained emotional responses following, experimentally induced positive and negative emotional states (Gross & Levenson, 1995; Kalokerinos, Greenaway, & Denson, 2015; Rudaizky & MacLeod, 2014). Such research would further validate these dimensions of emotional experience.

Furthermore, individual differences in emotional reactivity and perseveration may provide insights into models of emotion and emotion regulation. For example, it is possible that the likelihood of generating an emotional response might reflect individual differences in emotional reactivity and in antecedent-focused emotion regulation processes. In addition, response-focused emotion regulation processes might modulate both the magnitude and perseveration of an emotional response once elicited (c.f. Gross & John, 2003; Gross & Thompson, 2007). Another construct that warrants investigation is rumination, the tendency to continuously think about and focus attention on emotionally relevant stimuli (Nolen-Hoeksema, 2000). According to the Emotional Cascade Model, rumination is a key contributor to emotional dysregulation, which is conceptualised as heightened sensitivity to emotional stimuli, experiencing emotions extremely intensely, and a slow return to emotional baseline (Selby, Anestis, & Joiner, 2008). Examining potential associations between dimensions of emotional reactivity and perseveration and individual differences in both emotion regulation and rumination could yield novel insights into processes underlying emotional dysregulation.

An interesting alternative research avenue would be to establish whether emotional reactivity and perseveration are reliably associated with distinct patterns of cognition known to underlie emotional vulnerability. Previous research has established that individuals may show a pattern of attentional bias that selectively favours the processing of negative or positive information and, depending on the direction, this bias is associated with trait negative or positive emotion (Grafton, Ang, & MacLeod, 2012; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002). More recently a distinction has been made between biases in attentional engagement (the tendency for attention to be captured by stimuli) and biases in attentional disengagement (the tendency for

attention to be held by the stimuli; Cisler & Olatunji, 2010; Clarke, Hart, & MacLeod, 2014; Koster, Crombez, Verschuere, & De Houwer, 2006). It is plausible that biased attentional engagement might underlie individual differences in emotional reactivity and that difficulties in disengaging attention once captured by a stimulus might underlie individual differences in emotional perseveration.

Additionally, although reactivity and perseveration were differentially associated with psychological distress in Study 2, the non-clinical nature of the sample prohibits conclusions regarding associations between these dimensions and psychopathology. As such, further research examining dimensions of emotional experience in clinical samples would be useful. For example, Rudaizky and colleagues (Rudaizky & MacLeod, 2013; Rudaizky et al., 2012) speculate that the dimensions of anxiety reactivity and perseveration may improve the predictive ability of trait anxiety in evaluating vulnerability to specific anxiety disorders. Specifically, they argue that reactivity may be more strongly associated with disorders characterised by the experience of acute episodes of anxiety (e.g. panic disorder; Fava & Morton, 2009) and that perseveration may be more strongly associated with disorders characterised by more enduring anxiety symptoms (e.g. generalised anxiety disorder; Andrews et al., 2010). There is evidence to suggest that stress reactivity may be associated with the onset of clinical depression (Gotlib, Joormann, Minor, & Hallmayer, 2008; Kendler, Karkowski, & Prescott, 1999) but that additional factors (e.g. patterns of negative thinking and negative self-description) contribute to persistent depression (Teasdale, 1988). Incorporating the dimensions of emotional reactivity and perseveration into research with clinical samples may enhance our understanding of emotional disorders.

Finally, a limitation of the ERPS is that it only provides indices of emotional reactivity and perseveration. Seminal work by Larsen and Diener established that the intensity or magnitude of the emotion is an important aspect of emotional responding, that there are stable individual differences in affect intensity, and that higher levels of affect intensity are associated with psychological distress (Diener et al., 2009; Larsen & Diener, 1987). Adapting the ERPS to additionally measure

individual differences in emotional intensity would provide a single measure of three core dimensions of positive and negative emotion (reactivity, perseveration, and intensity), which map directly onto PA and NA as measured by the PANAS. However, it should be noted that while the current analyses provide preliminary evidence regarding the structure of the ERPS, the sample sizes were small and further psychometric research in both community and clinical samples is clearly needed to validate the structure of the scale (or any future adaptations or extensions).

In conclusion, the current research establishes the basic psychometric properties of a measure of emotional reactivity and perseveration, establishes that individual differences in these dimensions account for unique variance in trait affectivity and are differentially associated with symptoms of psychological distress, and suggests future research on these dimensions that could further the understanding of both normal emotional responding and vulnerability to emotional disorders. Addressing these questions clearly requires more research; however, we believe that the ERPS represents a potentially useful tool that can underpin future work in this area.

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### Appendix: The Emotional Reactivity and Perseveration Scale

You have just completed a questionnaire in which you indicated how often you tend to have certain feelings or emotional experiences. However, individuals differ in the likelihood of experiencing specific feelings and the degree to which these feelings persist across time. In the following questionnaire you will be shown a list of feelings similar to those in the previous questionnaire but you are asked to make the following two different judgements concerning your tendency to experience such feelings. *[This paragraph is included if the ERPS is being used in conjunction with the PANAS]*

#### Emotional Reactivity

This scale consists of a number of words that describe different feelings and emotions. When exposed to a situation that would make the “average” person experience this feeling, how **likely** is it that *you* will experience this particular feeling? Please rate this using the five options provided.

Not at all likely	Slightly likely	Moderately likely	Very likely	Extremely likely
1	2	3	4	5

[Followed by the 20 PANAS feelings/emotions]

#### Emotional Perseveration

This scale consists of a number of words that describe different feelings and emotions. When you experience a situation that does make you feel this way, how long is this feeling likely to **persist**? The longer a feeling lasts the more persistent it is. Please rate this using the five options provided.

Not at all persistent	Slightly persistent	Moderately persistent	Very persistent	Extremely persistent
1	2	3	4	5

[Followed by the 20 PANAS feelings/emotions]