SHORT TITLE: Trait and state emotional reactivity, intensity, and perseveration

Relationships between dispositional and experimentally elicited emotional reactivity, intensity, and perseveration

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Abstract

Background: The Emotional Reactivity Intensity and Perseveration Scale (ERIPS) assesses dimensions of trait emotional reactivity, intensity, and perseveration. We aimed to further validate the ERIPS and determine whether these dimensions of trait emotion predict real-time responses to negatively and positively-valenced stimuli. **Method:** Undergraduate students (*n*=214) completed the ERIPS and viewed a sad and amusing movie clip. Participants provided sadness/amusement ratings at seven time-points pre and post viewing the clips. **Results:** Higher perseveration of trait negative and positive affect was associated with slower reductions in sadness and amusement ratings after viewing the clips. Higher trait positive reactivity was associated with a larger increase in amusement after viewing the amusing clip, and a faster return to baseline amusement levels. Trait negative reactivity and negative intensity were not associated with responses to the sad clip. Trait positive intensity was not associated with responses to the amusing clip. **Conclusion:** Although mixed, findings provide some validation of the ERIPS and indicate that, for reactivity and perseveration at least, trait affect may be associated with variability in state affect. Future research should consider mechanisms accounting for individual differences in emotional reactivity, intensity, and perseveration, as well as their potential utility in furthering understanding of emotional disorders.

Highlights

- We tested if dimensions of trait emotion predict variability in state emotion
- We used movie clips to induce negative (sad) and positive (amusement) emotion
- Trait perseveration predicted slower return to baseline for sadness and amusement
- Trait reactivity predicted a larger increase and faster reduction in amusement
- Trait intensity was not associated with real-time sadness or amusement ratings

1. Introduction

According to Watson and colleagues, individual differences in emotional experience are organised around two dimensions: negative and positive affect (Watson & Tellegen, 1985). Negative affect comprises a range of aversive states, including fear and guilt, while positive affect refers to pleasurable engagement with the environment, including feelings such as excitement and interest (Watson, Clark, & Tellegen, 1988). Due to associations with psychopathology, individual differences in trait negative and positive affect (the stable predisposition towards the experience of negative and positive emotion) have been widely researched. In general, trait negative affect is associated with increased risk of psychopathology and negatively associated with well-being. In contrast, positive affect is associated with increased wellbeing and negatively associated with psychopathology (Watson, Clark, & Carey, 1988).

Trait affect is typically assessed by self-report, including the gold standard Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). However, while the trait version of the PANAS assesses the extent to which individuals experience negative and positive emotions 'in general', it may be insensitive to important differences in patterns of emotional responding. Theoretically, dispositional differences in distinct patterns of emotional responding could contribute variability in 'general' trait affect scores. For example, there are extensive literatures reporting individual differences in emotional reactivity (Nock, Wedig, Holmberg, & Hooley, 2008), the intensity of emotional responses (Larsen & Diener, 1987), and the duration of emotional responses (Verduyn, Delaveau, Rotge, Fossati, & Van Mechelen, 2015). Differences in any or all of these aspects of emotional experience could plausibly contribute to variability in trait affect.

In recognition of the potentially distinct contributions of these aspects of emotional experience to dispositional negative and positive affect, Boyes and colleagues adapted the PANAS and developed the Emotional Reactivity Intensity and Perseveration Scale (Boyes, Carmody, Clarke, & Hasking, 2017; Ripper, Boyes, Clarke, & Hasking, 2018). Using the ERIPS, Boyes et al demonstrated that individual differences in dispositional emotional reactivity (likelihood of experiencing an emotional response to situations or stimuli), intensity (strength of the response), and perseveration (persistence of the response) were independently associated with trait negative and positive affect (Ripper et al., 2018). Reactivity, intensity, and perseveration, were also differentially associated with symptoms of depression, anxiety, and stress, indicating the potential utility of these dimensions in furthering understanding of associations between trait affect and psychopathology (Ripper et al., 2018).

Although both trait negative and positive affect are associated with psychological outcomes (Merz & Roesch, 2011), fluctuations in emotionality are also important in predicting these outcomes (Merz & Roesch, 2011). Additionally, affective states are essential to in-the-moment decision-making and behaviour, and demonstrating that dispositional emotional experience is correlated with real-time emotional responding is important if we wish to use differences in trait affect to predict in-situ experiences and behaviour (Ferrer & Mendes, 2018). For example, individual differences in trait anxiety (a construct closely related to trait negative affect) are reliably associated with state anxiety responses to acute stressors (Barlow, 2002). More specifically, trait anxiety reactivity and perseveration are associated with experimentally elicited state anxiety (Rudaizky & MacLeod, 2014). However, while variability in trait affect is consistently associated with variability in state affect (Merz & Roesch, 2011), whether dispositional differences in emotional reactivity, intensity, and perseveration (assessed by the ERIPS) are associated with fluctuations in state emotion is yet to be investigated.

We aimed to further validate the ERIPS and determine whether trait emotional experience is associated with real-time emotional responding. Emotive movie clips provide a dynamic and multisensory method of inducing both negative and positive emotions in laboratory conditions, that have been well validated (Gross & Levenson, 1995). Critically for the current study, they allow the measurement of emotional reactivity, as well as the intensity and duration of the emotional response. In this study, we used movie clips to induce negative (sadness) and positive (amusement) emotion, asking participants to provide real-time ratings sadness/amusement ratings pre and post viewing the films. In accordance with the ERIPS' conceptualisations of reactivity, intensity, and perseveration (Ripper et al., 2018) we proposed the following hypotheses for both negative and positive affect: Trait reactivity would be associated with greater changes in sadness/amusement pre to immediately post viewing the clips. Trait intensity would be associated with higher peak sadness/amusement ratings. Trait perseveration would be associated with a slower return to baseline levels of sadness/amusement.

2. Method

2.1. Participants

Participants (n = 214) were undergraduate students at an Australian university (M_{age} = 21.33 years, SD = 5.49, 73.8% women). Most participants were born in Australia (68.2%), reported full-time study-loads (91.6%), and were living at home with family (67.3%).

2.2. Materials

2.2.1. Sociodemographic information: We recorded participant gender and age, as well as details regarding study-load and living arrangements.

2.2.2. Emotion Reactivity Intensity and Perseveration Scale: The ERIPS (Ripper et al., 2018) was used to assess individual differences in dispositional emotional reactivity, intensity, and perseveration. The ERIPS uses the 20 adjectives of the PANAS (Watson, Clark, & Tellegen, 1988), however, instructions and response options have been adapted. To assess reactivity, participants 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; 5: extremely likely*). To assess intensity, participants were asked, "When you are experiencing a situation that does make you feel this way, how intense is the feeling compared to how other people feel?" (*1: not at all intense; 5: extremely intense*). To assess perseveration, participants were asked, "When you are experiencing 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 generate indices of positive and negative reactivity, intensity, and perseveration. Internal consistencies ranged between $\alpha = 0.87$ (positive perseveration) and $\alpha = 0.91$ (negative reactivity).

2.2.3. Emotion induction: Two validated movie clips were used to induce negative (sadness: Mufasa's death from the *Lion King*, 126s) and positive (amusement: Dory speaking whale in *Finding Nemo* (105s) emotion (Kalokerinos, Greenaway, & Denson, 2015). Participants watched both clips and presentation order was randomised. State emotion was assessed at seven time-points using visual analogue scales. Participants rated their level of sadness/amusement (*0: not at all; 100: extremely*) immediately before watching the movie clips, immediately after watching the movie-clips, and then at one-minute intervals for five minutes. We used continuous scales with only the poles labelled. Scales were displayed on a computer monitor and participants provided responses on a slider scale.

2.3. Procedure

The Curtin University Human Research Ethics Committee approved the study. Students were awarded course credit for participation. The study information sheet focused on reactions to the film clips and the aim of correlating dispositional and state emotional responses was not communicated to participants. After providing consent, participants completed demographic items and the ERIPS. Participants then watched the movie clips and completed the sadness and amusement ratings. Participants watched the two film clips in immediate succession. A related paper has used this dataset to investigate self-injury-related differences in the experience of negative and positive emotion (Boyes, Wilmot, & Hasking, 2019).

3. Results

Rates of missing data were low (<2% on all variables) and data were missing completely at random, $\chi^2(1302) = 1333.37$, $p = 0.264$. Missing data were imputed using expectation maximisation. Descriptive statistics for the ERIPS subscales, disaggregated by gender, and correlations between ERIPS scores, age, and gender are summarised in Table 1. Relative to men, women reported significantly more trait emotional reactivity, both negative, $F(1, 211) = 12.47$, $p = 0.001$, partial $\eta^2 = 0.06$, and positive, $F(1, 211) = 5.06$, $p = 0.026$, partial $\eta^2 = 0.02$. Additionally, there were negative correlations between age and negative reactivity, intensity, and perseveration. Therefore, we adjusted for gender and age in all analyses. Data are publically accessible (osf.io/6q9e8/)

3.1. Emotional responses to the sad and amusing movie clips

3.1.1. Negative emotion: We tested associations between negatively-valenced ERIPS scores and emotional responses to the sad movie clip in a generalised linear mixed model (GLMM). Participant was included as a random factor. Time (sadness ratings taken

immediately pre, immediately post, and at one-minute intervals after viewing the clip), all the negatively-valenced ERIPS subscales, and the interactions between time and all the negatively-valenced ERIPS subscales were included as fixed factors. Results therefore represent unique associations of each dimension (and their interactions with time) over and above the other dimensions. To adjust for potentially confounding effects of gender and age, these were also included as fixed effects.

Consistent with the aims of the emotion induction, there was a significant main effect of time on sadness ratings, $F(6,1467) = 78.95$, $p < 0.001$. Participants reported a significant spike in sadness ratings immediately after viewing the movie clip, followed by significant incremental decreases in sadness ratings over the next five assessments (all $p < 0.001$, Supplementary Table 1). The main effects of trait negative reactivity, $F(1,1467) = 0.44$, $p = 0.507$, intensity, $F(1,1467) = 0.08$, $p = 0.780$, and perseveration, $F(1,1467) = 0.25$, $p = 0.617$, were not significant; however, there was a significant interaction between trait negative perseveration and time, $F(6,1467) = 2.62$, $p = 0.016$. Although there were no differences in the strength of the emotional response to the sad movie clip, among individuals who reported high levels of perseveration of negative affect (+1SD), sadness ratings remained significantly elevated at the final assessment, $t(1467) = 2.32$, $p = 0.020$. In contrast, among individuals who reported low levels of perseveration of trait negative affect (-1SD), sadness ratings at the final assessment did not differ significantly from the baseline ratings, $t(1467) = 1.42$, $p = 0.157$ (Figure 1 and Table 2).

Table 1. Mean (standard deviation) ERIPS scores and correlations with age and gender

	Men (n = 55)	Women (n = 158)	Negative Reactivity	Negative Intensity	Negative Perseveration	Positive Reactivity	Positive Intensity	Positive Perseveration	Age	Gender
Negative Reactivity	28.04 (7.12)	32.60 (8.61)**	--	0.73***	0.67***	0.27***	-0.03	-0.13	-0.24***	0.24**
Negative Intensity	29.78 (7.10)	30.54 (7.96)		--	0.80***	0.10	0.28***	0.08	-0.16*	0.04
Negative Perseveration	28.20 (6.35)	29.70 (7.87)			--	-0.03	0.13	0.14*	-0.16*	0.09
Positive Reactivity	31.93 (5.95)	34.09 (6.23)*				--	0.56***	0.49***	-0.09	0.15*
Positive Intensity	31.29 (6.70)	29.42 (6.96)					--	0.76***	0.03	-0.12
Positive Perseveration	29.22 (6.58)	28.35 (6.11)						--	0.11	-0.06
Age	21.95 (7.39)	21.12 (4.69)							--	-0.07
Gender	--	--								--

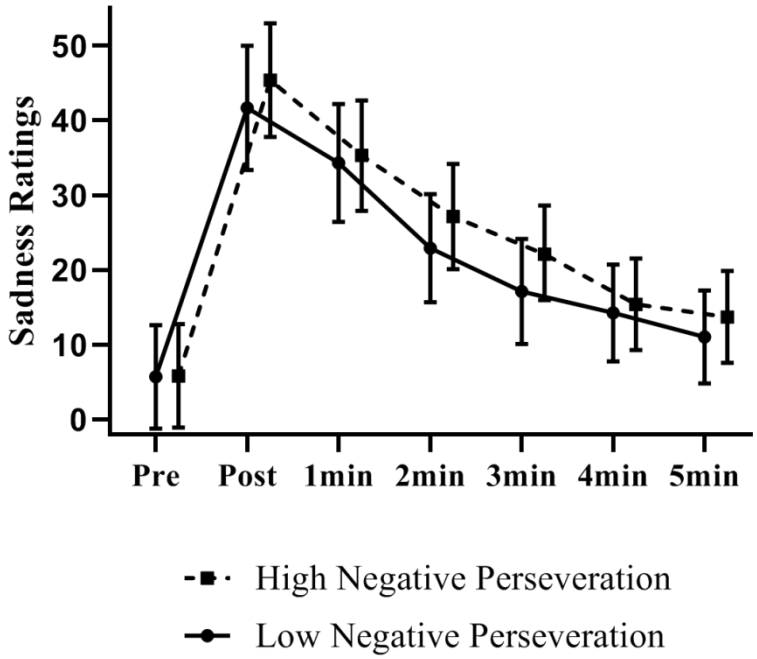
*** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$.

Table 2. Sadness ratings over time at low (-1SD) and high (+1SD) levels of negative emotional perseveration

	Low perseveration of negative emotion			High perseveration of negative emotion		
	Mean (95% CI)	Contrast (previous rating)	*p*	Mean (95% CI)	Contrast (previous rating)	*p*
Pre	5.70 (-1.20 – 12.60)	--	--	5.83 (-1.07 – 12.73)	--	--
Post	41.66 (33.36 – 49.97)	35.96	**< 0.001**	45.39 (37.78 – 53.00)	39.56	**< 0.001**
1 min	34.31 (26.43 – 42.18)	-7.36	**< 0.001**	35.29 (27.91 – 42.66)	-10.10	**< 0.001**
2 min	22.93 (15.71 – 30.15)	-11.38	**< 0.001**	27.16 (20.13 – 34.19)	-8.13	**< 0.001**
3 min	17.11 (10.07 – 24.15)	-5.82	**< 0.001**	22.09 (15.60 – 28.59)	-5.07	**< 0.001**
4 min	14.25 (7.77 – 20.74)	-2.86	**0.002**	15.39 (9.26 – 21.52)	-6.71	**< 0.001**
5 min	11.05 (4.82 – 17.28)	-3.20	**0.001**	13.72 (7.59 – 19.86)	-1.66	0.076

Significant *p* values bolded

Figure 1: Mean sadness ratings (and 95% CIs) over time, at low (-1SD) and high (+1SD) levels of negative perseveration.



3.1.2. Positive emotion: Associations between positively-valenced ERIPS scores and emotional responses to the amusing movie clip were also tested in a GLMM. Participant was again included as a random factor. Time, all the positively-valenced ERIPS subscales, and the interactions between time and all the positive ERIPS subscales were included as fixed factors. Results therefore represent unique associations of each dimension (and their interactions with time) over and above the other dimensions. Again, we adjusted for gender and age in the analysis.

Consistent with the aims of the emotion induction, there was a significant main effect of time on amusement ratings, $F(6,1467) = 63.55$, $p < 0.001$. Participants reported a significant spike in amusement ratings immediately after viewing the movie clip, followed by significant incremental decreases in amusement ratings over the next four assessments (all *p*

< 0.001, Supplementary Table 1). Amusement ratings did not differ significantly between the 4min and 5min assessments, $t(1467) = 0.38$, $p = 0.707$. The main effects of positive reactivity, $F(1,1467) = 1.38$, $p = 0.241$, intensity, $F(1,1467) = 0.01$, $p = 0.926$, and perseveration, $F(1,1467) = 0.72$, $p = 0.397$, were not significant; however, there was a significant interaction between positive reactivity and time, $F(6,1467) = 2.54$, $p = 0.019$. Specifically, relative to individuals who scored low on positive reactivity (-1SD) individuals reporting high levels of positive reactivity (+1SD) reported greater changes in amusement ratings from pre to immediately post viewing the clips, and also demonstrated a steeper gradient in the decline of their amusement ratings over the five post-viewing assessments (Figure 2a and Table 3).

Additionally, there was a significant interaction between trait positive perseveration and time, $F(6,1467) = 2.50$, $p = 0.021$. Although there were no differences in the strength of the emotional response to the sad movie clip, relative to individuals who scored low on positive perseveration (-1SD) individuals reporting high levels of positive perseveration (+1SD) demonstrated a flatter gradient in the decline of their amusement ratings over the five post-viewing assessments (Figure 2b and Table 4). Additionally, at high levels of positive perseveration, amusement ratings remained significantly elevated at the final assessment, $t(1470) = 3.04$, $p = 0.002$. In contrast, at low levels of positive perseveration, by the 4min assessment amusement ratings did not differ significantly from pre-viewing levels, $t(1470) = 1.87$, $p = 0.062$.

Table 3. Amusement ratings over time at low (-1SD) and high (+1SD) levels of positive emotional reactivity

	Low positive emotional reactivity			High positive emotional reactivity		
	Mean (95% CI)	Contrast (previous rating)	*p*	Mean (95% CI)	Contrast (previous rating)	*p*
Pre	19.62 (14.64 – 24.60)	--	--	11.86 (7.01 – 16.71)	--	--
Post	43.71 (37.60 – 49.81)	24.09	**< 0.001**	44.48 (38.89 – 50.06)	32.62	**< 0.001**
1 min	38.19 (32.55 – 43.84)	-5.54	**< 0.001**	36.32 (30.73 – 41.91)	-8.16	**< 0.001**
2 min	32.75 (27.07 – 38.44)	-5.44	**<0.001**	25.68 (19.99 – 31.38)	-10.63	**< 0.001**
3 min	29.82 (24.13 – 35.51)	-2.93	**< 0.001**	19.65 (14.31 – 24.98)	-6.04	**< 0.001**
4 min	25.74 (20.52 – 30.97)	-4.08	**0.001**	16.28 (11.30 – 21.25)	-3.37	**< 0.001**
5 min	25.03 (19.77 – 30.29)	-0.71	0.288	16.59 (11.34 – 21.83)	-0.31	0.787

Significant *p* values bolded

Table 4. Amusement ratings over time at low (-1SD) and high (+1SD) levels of positive emotional perseveration

	Low perseveration of positive emotion			High perseveration of positive emotion		
	Mean (95% CI)	Contrast (previous rating)	*p*	Mean (95% CI)	Contrast (previous rating)	*p*
Pre	13.55 (6.33 – 20.77)	--	--	17.92 (9.77 – 26.07)	--	--
Post	42.30 (33.63 – 50.97)	28.75	**< 0.001**	45.88 (37.67 – 54.08)	27.96	**< 0.001**
1 min	34.81 (26.56 – 43.05)	-7.50	**< 0.001**	39.70 (31.10 – 48.30)	-6.18	**< 0.001**
2 min	26.08 (17.84 – 34.33)	-8.72	**< 0.001**	32.34 (23.44 – 41.25)	-7.36	**< 0.001**
3 min	19.74 (11.91 – 27.58)	-6.34	**< 0.001**	29.71 (20.78 – 38.65)	-2.63	**0.002**
4 min	17.20 (9.56 – 24.84)	-2.54	**0.007**	24.81 (16.33 – 33.28)	-4.91	**< 0.001**
5 min	16.42 (8.64 – 24.20)	-0.79	0.559	25.19 (16.69 – 33.69)	0.38	0.603

Significant *p* values bolded

Figure 2: Mean amusement ratings (and 95% CIs) over time, at low (-1SD) and high (+1SD) levels of positive reactivity and positive perseveration.

Figure 2a

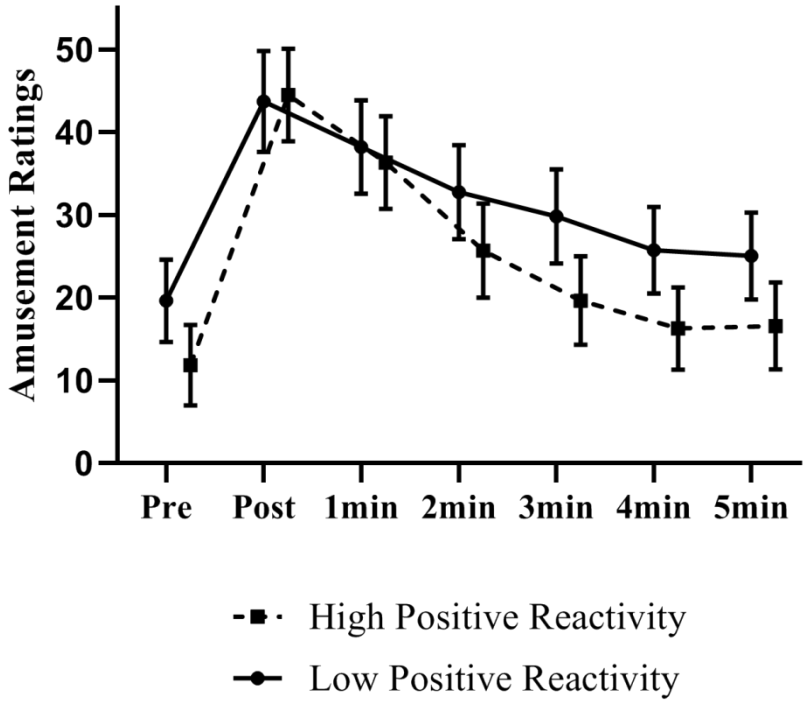
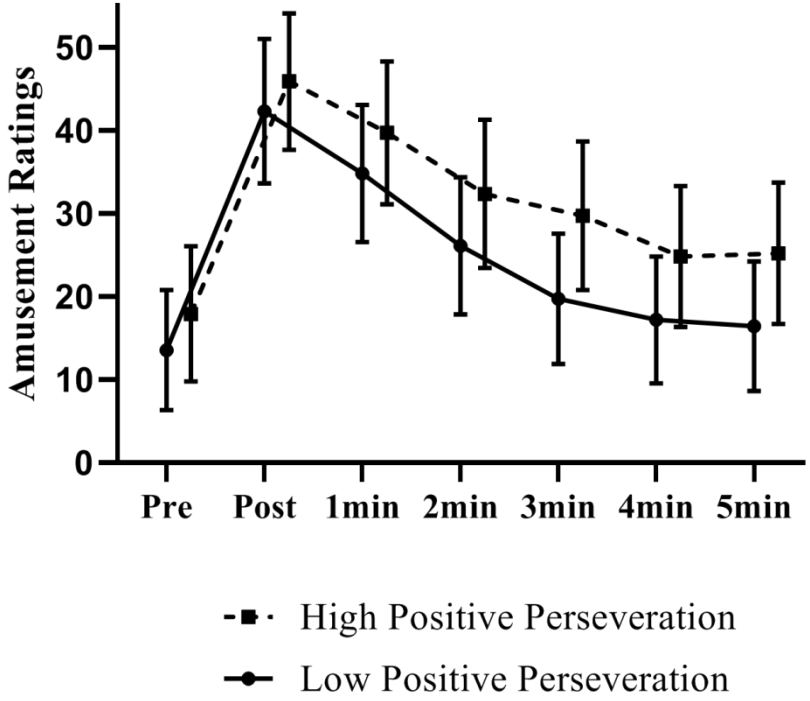


Figure 2b



4. Discussion

We tested whether individual differences in trait emotional reactivity, intensity, and perseveration were associated with real-time emotional responses to negative and positive movie clips. Consistent with previous research, the two movie clips reliably induced sadness and amusement (Kalokerinos et al., 2015); however, associations between ERIPS subscales and state emotional responses to the movie clips were more mixed. Given that the movie clips induced an emotional response characterised by a peak and gradual return to baseline, it is perhaps unsurprising that there were no main effects of trait reactivity, intensity, or perseveration on sadness or amusement ratings. However, interactions between the ERIPS subscales and time provided some evidence that trait emotional experience is associated with state emotional responses captured by the in-the-moment sadness and amusement ratings.

As hypothesised, higher levels of perseveration of trait negative and positive affect were associated with slower reductions in sadness and amusement ratings over time. Additionally, as predicted, trait positive reactivity was associated with a larger increase in amusement in response to the positive movie clip. Trait positive reactivity was also associated with a faster return to baseline amusement levels. Although we had not specifically hypothesised trait reactivity would predict faster returns to baseline, this pattern of responding is consistent with notions of emotional lability and affective variability. Future research investigating whether emotional reactivity, as assessed by the ERIPS, is associated with both the onset and offset of emotional responses may be fruitful.

We did not observe predicted associations between trait negative reactivity and larger increases in sadness in response to the negative movie clip. Additionally, trait emotional intensity was not associated with either peak sadness or amusement ratings. It is possible that unambiguously negative emotional content leaves little room for individual variability, and

more ambiguous stimuli may be needed to capture individual differences in reactivity to emotional stimuli (Boyes & French, 2009, 2012). Consistent with this, as reported above, positive reactivity did interact with time in predicting amusement ratings; however, there was substantially more variability in emotional responses to the amusing movie clip than the sad clip. Additionally, although the film did reliably evoke a sadness response, the manipulation may not have been strong enough to investigate individual differences in emotional intensity. Indeed, at its peak the mean sadness score was below the midpoint of the visual analogue scale. Future research should consider utilising stronger manipulations or using personally-relevant emotional stimuli to induce more intense emotional responses. Relatedly, while it elicited greater variability in emotional responding, the amusing movie clip evoked an even weaker response than the sad clip, and this may also explain why positive intensity was not associated with strength of amusement responses. Future research should seek to induce more intense positive emotions, perhaps through incorporating self-referential statements or reflecting on personally salient positive experiences (Robinson, Grillon, & Sahakian, 2012).

Finally, the fact that the ERIPS measures dimensions of general negative and positive affect while the films elicit specific emotions may also have contributed to the mixed findings. Although films intended to generate discrete emotions (e.g. sadness/amusement) do also generate negative and positive affect (Schaefer, Nils, Sanchez, & Philippot, 2010), future research should use films validated to evoke both specific emotions and general affective responses (Gilman et al., 2017; Schaefer et al., 2010) to test associations between dispositional and state emotional responses.

Taken together, the findings that trait reactivity and perseveration are associated with real-time responses to emotional stimuli are consistent with research demonstrating trait affect is associated with variability in state affect (Merz & Roesch, 2011), and also provide further validation for the ERIPS, at least in terms of trait emotional reactivity and perseveration. While

further research validating the dimensions of trait emotional reactivity, intensity, and perseveration (as assessed by the ERIPS) is clearly needed, articulating mechanisms accounting for differences in these dimensions of emotional experience may prove fruitful moving forward. Perseveration of negative and positive affect are both associated with psychological distress (Boyes et al., 2017; Ripper et al., 2018) and emotional reactivity and affect intensity are strongly linked with dysregulated behaviours such as self-injury and disordered eating (Claes, Smits, & Bijttebier, 2014). Additionally, identifying mechanisms explaining variability in emotional reactivity, intensity, and perseveration may provide potential targets for both treatment and prevention.

For example, rumination (the tendency to experience repetitive intrusive thoughts about negative emotional experiences; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008) is associated with more intense and persistent emotional responses (Thomsen, 2006), and may underpin individual differences in the perseveration of negative affect and associated psychopathology. In contrast, it is possible that 'savouring' (which includes strategies to enhance and maintain positive emotional experiences; Bryant, 1989) may be associated with intensity and perseveration of positive affect, and thereby contribute to mental health and reduce the risk of psychopathology. Similarly, it is plausible that antecedent and response-focused emotion regulation strategies (as described by Gross, 1998) may account for variability in different aspects of emotional experience. For example, antecedent-focused strategies (which influence onset of emotional experiences) may be associated with variability in emotional reactivity while response-focused strategies (that influence the strength and duration of an emotional response) may be associated with both emotional intensity and perseveration (Gross & John, 2003). Testing these predictions may contribute to better understanding individual differences in the experience and regulation of emotion and inform treatment options.

Additionally, future research could also investigate possible relationships between emotional reactivity, intensity, and perseveration and biases in information processing. Attentional biases can favour the processing of either negative or positive information, and these biases are associated with trait negative and positive affect (Grafton, Ang, & MacLeod, 2012; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002). These patterns of biased attention can also be characterised by biases in either (or both) attentional engagement with or disengagement from emotionally-valenced stimuli (Koster, Crombez, Verschuere, & De Houwer, 2006). It is at least plausible that biases in attentional engagement could contribute to greater emotional reactivity, and that biases in the disengagement of attention could contribute to experiencing more intense emotional reactions that persist for longer.

Finally, there may be clinical utility in considering dimensions of emotional reactivity, intensity, and perseveration. For example, negative reactivity may be more strongly linked with disorders characterised by acute symptomatology (e.g. panic disorder; Fava & Morton, 2009) while perseveration of negative affect may be more strongly linked with disorders characterised by prolonged symptomatology (e.g. generalised anxiety disorder; Andrews et al., 2010). Relatedly, emotional lability is a risk factor for the development of bipolar disorder (Akiskal et al., 1995). It is possible that negative and positive reactivity and/or intensity predict depression and mania associated with bipolar disorder, whereas unipolar depression may be characterised more by a general lack of positive affect and perseveration of negative affect. Future research should test these predictions.

Our findings should be considered in the light of two major limitations. First, although movie clips are dynamic and multisensory, there are questions regarding the real-world validity of laboratory-based emotion inductions. Designs that incorporate personally-salient emotional stimuli (Plener, Bubalo, Fladung, Ludolph, & Lulé, 2012), or that can assess dynamic emotional processes with more ecological validity (such as ecological momentary assessment)

are clearly needed to address these concerns. Second, although we assessed state emotion in responses to the movie clips, we only collected self-reported ratings of sadness and amusement on visual analogue scales. Self-reported ratings are limited by respondents' subjective awareness of their emotional experiences and may be influenced by demand characteristics and social desirability. Future research could incorporate psychophysiological assessments to overcome these limitations of self-reported measures of emotional experience.

However, bearing these limitations in mind, although our findings are mixed they provide some further validation for the dimensions of emotional experience assessed by the ERIPS. They also extend previous work by establishing that trait emotional reactivity and perseveration may be associated with individual differences in real-time emotional responses.

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Supplementary Table 1. Sadness and amusement ratings over time in the full sample

	Sadness Ratings			Amusement Ratings		
	Mean (95% CI)	Contrast (previous rating)	*p*	Mean (95% CI)	Contrast (previous rating)	*p*
Pre	5.77 (2.28 – 9.25)	--	--	7.52 (1.83 – 13.21)	--	--
Post	43.53 (39.67 – 47.39)	37.76	**< 0.001**	35.87 (30.31 – 41.44)	28.36	**< 0.001**
1 min	34.80 (31.07 – 38.52)	-8.73	**< 0.001**	29.04 (23.36 – 34.71)	-6.84	**< 0.001**
2 min	25.05 (21.41 – 28.69)	-9.75	**< 0.001**	21.00 (15.37 – 26.63)	-8.04	**< 0.001**
3 min	19.60 (16.12 – 23.09)	-5.44	**< 0.001**	16.51 (10.86 – 22.16)	-4.49	**< 0.001**
4 min	14.82 (11.53 – 18.11)	-4.78	**< 0.001**	12.79 (7.20 – 18.37)	-3.72	**< 0.001**
5 min	12.39 (9.05 – 15.72)	-2.44	**< 0.001**	12.59 (7.01 – 18.16)	0.20	0.707

Note: Significant *p* values are bolded