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Assessing Emotional Reactivity: Psychometric Properties of the Perth Emotional Reactivity Scale and the Development of a Short Form

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Abstract

The Perth Emotional Reactivity Scale (PERS) is a 30-item self-report measure of trait levels of emotional reactivity. In this paper, we examine the psychometric properties of the PERS subscale and composite scores in an adult community sample (*N* = 428), and develop an 18-item short form of the measure (PERS-S). The PERS and PERS-S are designed to assess the typical *ease of activation*, *intensity*, and *duration* of one's emotional responses, and do so for *positive* and *negative* emotions separately. Our confirmatory factor analyses supported that the PERS and PERS-S both had the same theoretically congruent factor structure, and that all subscale and composite scores displayed high internal consistency reliability. Correlations with scores from established measures of psychopathology and emotion regulation also supported the validity of PERS and PERS-S scores. Our data therefore suggest that the PERS-S subscale and composite scores retain the psychometric strengths of their longer PERS counterparts. We conclude that both forms of the measure have good utility. Clinical and research applications are discussed.

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Emotions can be positively or negatively valenced (e.g., happiness or sadness), and manifest as responses across three channels of the emotion system: the experiential (e.g., feeling of anger), physiological (e.g., increased heart-rate), and behavioural channels (e.g., urge to attack; Gross, 2014; Evers et al., 2014).

Many authors agree that people can differ with respect to the typical time-course of their emotional responses (e.g., Davidson, 1998; Becerra et al., 2017; Gruber, Harvey, & Purcell, 2011; Mauss, Cook, Cheng, & Gross, 2007). People may differ with respect to: (1) how easily an emotional response is *activated* in them, that is, the threshold for how strong a stimulus is required to elicit an arousal response and how quickly arousal levels rise to peak amplitude; (2) how *intense* the emotional response is, that is, the peak amplitude that levels of arousal reach; and (3) the *duration* of the emotional response, that is, how long arousal levels take to return to baseline. These three aspects of the emotional response (activation, intensity, and duration) are commonly conceptualised together as a construct termed *emotional reactivity*[3] (Becerra & Campitelli, 2013; Davidson, 1998).

The emotional reactivity construct is of significant interest to psychiatry, as many models of psychopathology posit that abnormal levels of reactivity are a key transdiagnostic risk factor (e.g., Gross & Jazaieri, 2014; Linehan, 1993; Rottenberg & Johnson, 2007). Psychotherapeutic treatment approaches, consequently, often attempt to normalise levels of reactivity through the training of emotion regulation skills (e.g., Barlow et al., 2010; Linehan, 1993), and the assessment of emotional reactivity therefore becomes important.

Emotional reactivity can be assessed in laboratory settings via psychophysiological

[3] Sometimes the emotional reactivity construct is also called *affective style* (e.g., Davidson, 1998) or *emotional vulnerability* (e.g., Sauer & Baer, 2010).

methods (i.e., presenting an emotion inducing stimulus and tracking participants' heart-rate or skin-conductance; Mauss et al., 2005), however such methods are too impractical for some clinical or research purposes. Authors have consequently developed a number of self-report questionnaires, and of these, we think our Perth Emotional Reactivity Scale (PERS; Becerra & Campitelli, 2013; Becerra et al., 2017) is conceptually the most comprehensive (for a review, see Becerra & Campitelli, 2013). In this paper, we examine the psychometric properties of the PERS subscale and composite scores and develop a short form of the measure.

The PERS is a 30-item self-report questionnaire that measures trait levels of emotional reactivity. It is designed to assess the *activation*, *intensity*, and *duration* components of the construct, and do so for *positive* and *negative* emotions separately. Correspondingly, the PERS has six subscales, each with five items: *Positive-activation* (e.g., "I tend to get happy very easily"), *Positive-intensity* (e.g., "When I am joyful, I tend to feel it very deeply"), *Positive-duration* (e.g., "When I'm happy, the feeling stays with me for quite a while"), *Negative-activation* (e.g., "I tend to get upset very easily"), *Negative-intensity* (e.g., "Normally, when I'm unhappy I feel it very strongly"), and *Negative-duration* (e.g., "Once in a negative mood, it's hard to snap out of it"). Scores from the three subscales of each valence are also designed to be combined into a *General positive reactivity* composite and a *General negative reactivity* composite, which indicate overall levels of reactivity for emotions of that valence. Each item is comprised of a statement that respondents answer on a 5-point Likert scale, ranging from 1 (very unlike me) to 5 (very like me), according to how much they agree it is characteristic of them on a typical day.

To date, the psychometric properties of PERS scores have only been examined in one study (Becerra et al., 2017). In a nonclinical sample comprised of 183 adults, exploratory and confirmatory factor analyses found that the PERS had a theoretically congruent factor structure, consisting of six first-order factors (the six intended subscales) subsumed within two valence specific second-order factors (the two intended composites). All subscale and composite scores had high internal consistency reliability, and correlations with other self-report measures supported concurrent validity. High levels of negative reactivity and low levels of positive reactivity, as measured by the PERS, were significantly associated with depression, anxiety, and stress symptoms, and emotion regulation difficulties. The PERS *General negative reactivity* composite also correlated strongly with scores from another self-report measure of negative reactivity (Emotion Reactivity Scale; Nock et al., 2008).

Purpose of this Study

Whilst the abovementioned results are promising for the utility of the PERS, further research is required. The size of the sample in Becerra et al. (2017) was modest, and comprised mostly young university-educated adults. Further work is needed to examine the psychometric properties of PERS scores in larger and more diverse samples. Additionally, whilst the length of the PERS is not excessive, some clinicians and researchers may desire a shorter measure for time-pressured settings, such as work where emotional reactivity is just one of many constructs of interest and a large battery of tests must be administered. This study therefore had two purposes; (1) to examine the factor structure, concurrent validity, and internal consistency reliability of scores from the 30-item PERS in a large community sample; and (2) to develop an 18-item short form called the Perth Emotional Reactivity Scale-Short Form (PERS-S).

Method

Participants and Procedure

Our sample was comprised of 428 English speaking adults (259 females) from the general community.[4] Participants were aged between 18 and 83 (*M* = 47.62, *SD* = 16.77) and were living in Australia at the time of the study. The distribution of educational attainment within our sample was, roughly, similar to that of the Australian adult population as a whole (Australian Bureau of Statistics, 2016). Most of the sample (66.4%) had not completed a university degree. For 36% of participants, their highest level of completed education was a technical diploma, for 30.4% it was high school, and for 0.2% it was primary school. Less than one quarter (21.5%) of the sample was currently studying at university. Participants were recruited via three sources: an online survey recruiting company (Qualtrics panels), an advertisement placed on a social media website, or an advertisement placed on a university website (i.e., Blackboard software) that enrolled undergraduate students visit to download content for their course. Participants completed the PERS as part of a battery of psychological questionnaires in an online anonymous survey.

Materials

The PERS was administered only in its 30-item form. Data for the 18-item PERS-S were obtained by extracting answers from the relevant items of the PERS. The battery also included a measure of psychiatric symptoms and two measures of emotion regulation.

Perth Emotional Reactivity Scale. The PERS (Becerra et al., 2017) is a 30-item self-report measure of trait levels of emotional reactivity. Six subscale scores and two composite scores can be derived from the measure. Higher scores indicate higher levels of reactivity.

Perth Emotional Reactivity Scale-Short Form. We propose the PERS-S here as an 18-item short form of the PERS. It consists of the same six subscales as the PERS, but each subscale has three items instead of five. A minimum of three items is typically needed to derive a reliable latent factor score (e.g., Little, Lindenberger, & Nesselroade, 1999;

[4] Some additional participants (*n* = 47) also completed the survey. However, their data were excluded during quality screening because they failed at least one of three attention check questions (where participants were asked to select a specific point on the Likert-scale) and/or completed the survey impossibly quickly (i.e., at a rate of < 2 seconds per question), suggesting inattentive responding.

Raubenheimer, 2004), hence we considered this the shortest length we could make the PERS-S whilst still maintaining its capacity to assess emotional reactivity at the subscale level. We selected items 1, 19, 25 (*Positive-activation*), 11, 17, 23 (*Positive-intensity*), 3, 9, 15 (*Positive-duration*), 2, 8, 26 (*Negative-activation*), 6, 18, 30 (*Negative-intensity*), and 4, 16 and 22 (*Negative-duration*) from the PERS to form the PERS-S. These 18 items were selected based on three criteria. Firstly, to maintain the breadth of the construct, we wanted all six subscales to be evenly represented (i.e., have three items each). Secondly, we examined the factor loadings from confirmatory factor analyses (CFAs) in this study and Becerra et al.'s (2017) study, and selected those items that had the highest (or at least close to the highest) loadings on their intended factor. Thirdly, we attempted to maximise the goodness-of-fit of our theoretically informed factor structure by eliminating those PERS items which, in CFAs in this study and Becerra et al.'s (2017) study, had the most pronounced correlations between their error terms. Throughout this paper, we refer to the items of the PERS and PERS-S based on their position within the PERS (e.g., item 5 of the PERS-S is referred to as item 11, as this is its position within the PERS). In Appendix A we provide a list of the PERS-S items, noting their respective order when presented in the PERS-S as compared to the PERS. Both forms of the questionnaire are freely available for use and are provided in Appendix A.

Depression Anxiety Stress Scales-21. The Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond, 1995) is a 21-item self-report measure of *Depression*, *Anxiety*, and *Stress* symptoms experienced in the past week. All items can be combined into a *Total scale* score representing overall psychological distress. Items are scored on a 4-point Likert scale, with higher scores indicate more severe symptomatology.

Emotion Regulation Questionnaire. The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) is a 10-item self-report measure of two emotion regulation strategies, *Cognitive reappraisal* and *Expressive suppression*. Items are answered on a 7-point Likert scale, with higher scores indicating more usage of that strategy. High *Expressive suppression* scores and low *Cognitive reappraisal* scores suggest emotion regulation difficulties (Gross & John, 2003).

Difficulties in Emotion Regulation Scale. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36-item self-report measure of difficulties regulating negative emotions and alexithymia. Items correspond to six subscales: *Strategies*, *Impulse*, *Goals*, *Non-acceptance*, *Clarity*, and *Awareness*. Items are answered on a 5-point Likert scale, with higher scores indicating more difficulties. Gratz and Roemer (2004) consider all six subscales to measure facets of emotion regulation, and sum all items into a *Total scale* score. We and some other authors, however, disagree with the inclusion of alexithymia components (i.e., the *Clarity* and *Awareness* subscales) within the definition of emotion regulation (e.g., Gross, 2014; John & Eng, 2014; Preece et al., 2017), and psychometrically these alexithymia subscales do not load on the same higher-order factor as the other DERS subscales (e.g., Zelkowitz & Cole, 2016). Consequently, in addition to the traditional *Total scale* score, we derive and prioritise two further composite scores; a *Regulation composite* score comprised of the *Strategies*, *Impulse*, *Goals* and *Non-acceptance* subscales, and an *Alexithymia composite* score comprised of the *Clarity* and *Awareness* subscales (see also Preece et al., 2017).

Analysis

LISREL 8.80 was used to perform CFAs, SPSS 24 was used for all other analyses. All PERS items were reasonably normally distributed (maximum skewness = -1.11, maximum kurtosis = 2.23).

Factor structure. The factor structure of the PERS or PERS-S was examined via a series of CFAs using maximum likelihood estimation (ML) based on a Pearson covariance matrix. Following the recommendations of Curran, West and Finch (1996), we calculated and reported results for both *normal theory ML* and Satorra and Bentler's (1994) *robust ML* (RML). RML uses a scaled χ^2 statistic (S-Bχ^2) and performs better than ML when the data are not perfectly normally distributed (Curran et al., 1996; Han, Burns, Weed, Hatchett, & Kurokawa, 2009). For both forms of the questionnaire, four models of increasing complexity were examined (see Figure 4.1): a 1-factor model; a 2-factor correlated model comprised of two valence specific first-order factors; a 6-factor correlated model comprised of the six intended subscales as first-order factors; and a 6-factor higher-order model where these six first-order factors were specified to load on two valence specific second-order factors. Model goodness-of-fit was evaluated via the χ^2 statistic (and S-Bχ^2) and three fit indexes: the comparative fit index (CFI), the normed fit index (NFI), and the root mean square error of approximation (RMSEA). A non-significant ($p > .05$) χ^2 statistic suggests excellent fit, however in large sample sizes χ^2 is highly sensitive to small deviations from the model in the data, and often rejects models that are parsimonious and a reasonable approximation of the data (see Browne & Cudeck, 1992; Schumacker & Lomax, 2004); hence we relied primarily on CFI, NFI and RMSEA here. CFI and NFI values $\geq .90$ were judged to indicate acceptable fit, as were RMSEA values $\leq .08$ (Bentler & Bonnet, 1980; Browne & Cudeck, 1992; Kline, 2005; Marsh, Hau, & Wen, 2004). To directly compare the fit of the models the Akaike information criterion (AIC) and χ^2 (and S-Bχ^2) difference tests were also used. AIC penalises model complexity and lower AIC values indicate better fit (Byrne, 2013).

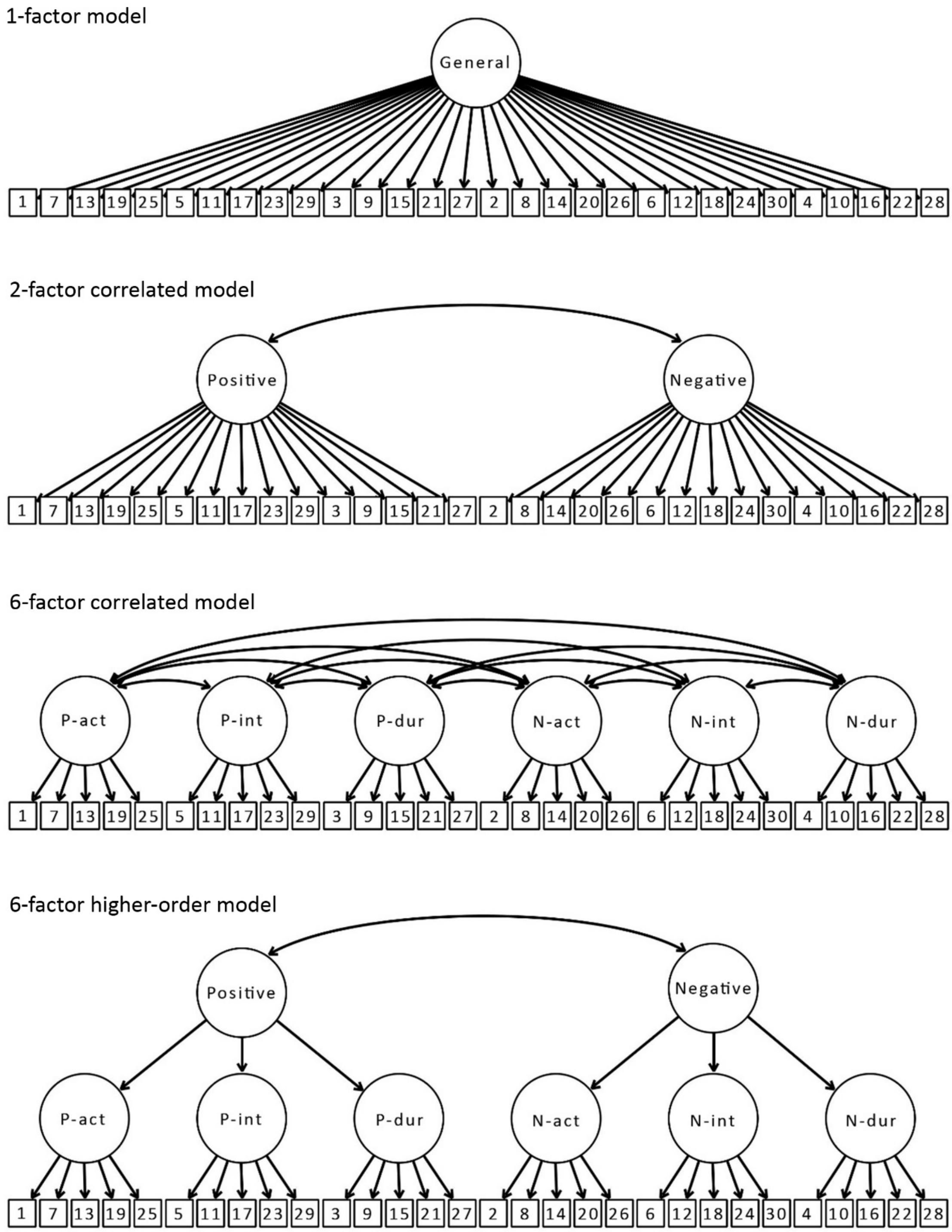

Figure 4.1. The assessed confirmatory factor analysis models for the Perth Emotional Reactivity Scale. Each model was also assessed for the Perth Emotional Reactivity Scale-Short Form (PERS-S) by including only the 18 items of the PERS-S. Ellipses indicate latent factors, squares indicate item numbers, item error terms are not displayed. P-act = Positive-activation, P-int = Positive-intensity, P-dur = Positive-duration, N-act = Negative-activation, N-int = Negative-intensity, N-dur = Negative-duration, Positive = General positive reactivity, Negative = General negative reactivity.

Concurrent validity. Pearson correlations between PERS or PERS-S scores and DASS-21, ERQ and DERS scores were calculated. Because depressive and anxiety disorders are characterised by high levels of negative affect (American Psychiatric Association, 2013), it was expected that high negative reactivity and low positive reactivity would be associated with significantly higher levels of depression, anxiety and stress symptoms, and more emotion regulation difficulties (Gross & Jazaieri, 2014).

Internal consistency reliability. Cronbach's alpha reliability coefficients were calculated for each of the subscale and composite scores. Reliability coefficients ≥.70 were considered acceptable, ≥.80 were considered good, and ≥.90 excellent (Groth-Marnat, 2009).

Results

Descriptive statistics are reported in Table 4.1.

Table 4.1

Descriptive Statistics and Cronbach's Alpha (α) Internal Reliability Coefficients for the PERS, PERS-S, DASS-21, ERQ and DERS

	Total sample (n = 428)			Females (n = 259)		Males (n = 169)	
Measure/scale	*M*	*SD*	*α*	*M*	*SD*	*M*	*SD*
PERS							
General negative reactivity	44.10	13.29	.94	44.81	13.17	43.01	13.43
Negative-activation	14.40	4.83	.85	14.61	4.72	14.08	4.98
Negative-intensity	15.57	4.59	.85	15.82	4.59	15.18	4.58
Negative-duration	14.14	4.97	.88	14.38	4.96	13.76	5.00
General positive reactivity	52.15	9.10	.92	53.29	9.07	50.39	8.89
Positive-activation	17.50	3.74	.79	17.94	3.77	16.83	3.59
Positive-intensity	15.74	3.07	.84	16.03	3.10	15.30	2.97
Positive-duration	18.90	3.67	.86	19.32	3.61	18.26	3.71
PERS-S							
General negative reactivity	26.54	8.14	.91	27.08	8.06	25.70	8.20
Negative-activation	8.68	2.10	.76	8.85	2.96	8.43	3.04
Negative-intensity	9.13	2.93	.81	9.34	2.93	8.80	2.92
Negative-duration	8.73	3.13	.85	8.89	3.11	8.47	3.16
General positive reactivity	33.20	6.88	.92	34.07	6.76	31.86	6.88
Positive-activation	11.11	2.50	.79	11.43	2.47	10.63	2.48
Positive-intensity	10.79	2.52	.82	11.05	2.52	10.38	2.48
Positive-duration	11.29	2.61	.83	11.58	2.53	10.86	2.68
DASS-21							
Total scale	13.58	12.93	.96	13.54	12.60	13.64	13.44
Depression	4.49	5.24	.94	4.25	5.02	4.86	5.54
Anxiety	3.57	4.12	.86	3.66	4.16	3.44	4.06
Stress	5.52	4.81	.90	5.63	4.81	5.35	4.83
ERQ							
Cognitive reappraisal	29.49	6.61	.89	30.13	6.47	28.51	6.46
Expressive suppression	15.03	5.42	.81	13.97	5.33	16.65	5.15
DERS							
Total scale	75.30	12.35	.94	74.92	21.21	75.87	21.60
Regulation composite	50.08	18.01	.96	50.69	18.19	49.14	17.75
Alexithymia composite	25.22	7.59	.87	24.23	7.35	26.73	7.73
Non-acceptance	13.04	5.67	.90	13.19	5.71	12.80	5.61
Goals	13.56	4.98	.89	13.87	5.06	13.09	4.83
Impulse	11.49	5.09	.89	11.72	5.27	11.14	4.81
Strategies	11.98	5.35	.92	11.90	5.41	12.11	5.25
Clarity	9.93	3.62	.82	9.77	3.50	10.17	3.79
Awareness	15.29	5.09	.85	14.46	4.96	16.56	5.05

Note. PERS = Perth Emotional Reactivity Scale, PERS-S = Perth Emotional Reactivity Scale-Short Form, DASS-21 = Depression Anxiety Stress Scales-21, ERQ = Emotion Regulation Questionnaire, DERS = Difficulties in Emotion Regulation Scale.

Factor Structure

For both forms of the questionnaire, all fit indexes and χ^2 or S-Bχ^2 difference tests (*p*s < .001) suggested that the 6-factor correlated model and 6-factor higher-order model were the best solutions (for fit index values, factor loadings, and factor intercorrelations, see Tables 4.2, 4.3 and 4.4, respectively). This pattern of results was similar across ML and RML analyses, so we summarise only the RML results here. The 6-factor correlated model was an excellent fit to the data according to S-Bχ^2, CFI, NFI, and RMSEA; all items loaded well (>.40) on their intended factor, and the three first-order factors within each valence domain were strongly positively correlated. For both forms of the questionnaire, AIC and S-Bχ^2 difference tests (*p*s < .001) indicated that the 6-factor higher-order model was slightly worse fitting than the 6-factor correlated model,[5] but the 6-factor higher-order model was still an excellent fit to the data according to CFI, NFI, and RSMEA. Indeed, all first-order factors loaded strongly (factor loadings >.40) on their valence specific second-order factor. These valence specific second-order factors were negatively correlated (PERS estimated $r = -.47$, $p < .001$; PERS-S estimated $r = -.53$, $p < .001$), thus emphasising the importance of the valence distinction. Because we think deriving these higher-order factor scores makes theoretical sense (i.e., it is consistent with contemporary theorising that the activation, intensity and duration aspects of emotional reactivity form separable parts of a common latent construct; Davidson, 1998) and increases the utility of these questionnaires, the 6-factor higher-order model was, on balance, our preferred solution in this data-set. The PERS and PERS-S therefore displayed the same theoretically congruent factor structure.

[5] All χ^2 and S-B χ^2 difference tests between the examined models were statistically significant (p <.001), indicating that the 6-factor correlated model was better fitting than the 6-factor higher-order model, which was in turn better fitting than the 2-factor correlated model, which was in turn better fitting than the 1-factor model.

Table 4.2

PERS and PERS-S, Goodness-of-Fit Values for the Tested Confirmatory Factor Analysis Models (Maximum Likelihood Estimation and Robust Maximum Likelihood Estimation)

Model	χ^2 or S-Bχ^2 (*df*)	*p*	CFI	NFI	RMSEA (90% CI)	AIC
PERS						
ML						
1-factor model	3619.807 (405)	<.001	.875	.862	.228 (.224-.232)	9538.730
2-factor correlated model	1577.709 (404)	<.001	.954	.940	.0912 (.0870-.0955)	1961.081
6-factor correlated model	1190.054 (390)	<.001	.969	.955	.0729 (.0685-.0774)	1424.995
6-factor higher-order model	1301.982 (400)	<.001	.965	.950	.0770 (.0726-.0813)	1541.965
RML						
1-factor model	3077.519 (405)	<.001	.896	.883	.1240 (.1200-.1280)	3197.519
2-factor correlated model	559.270 (404)	<.001	.994	.979	.0300 (.0237-.0358)	681.270
6-factor correlated model	388.601 (390)	.510	1.00	.985	.0000 (.0000-.0171)	538.601
6-factor higher-order model	436.865 (400)	.099	.999	.983	.0147 (.0000-.0232)	566.865
PERS-S						
ML						
1-factor model	1836.717 (135)	<.001	.851	.842	.264 (.257-.271)	4221.675
2-factor correlated model	622.758 (134)	<.001	.957	.946	.100 (.0928-.107)	780.632
6-factor correlated model	343.812 (120)	<.001	.976	.963	.0759 (.0666-.0853)	446.501
6-factor higher-order model	450.686 (130)	<.001	.972	.961	.0788 (.0713-.0865)	557.090
RML						
1-factor model	1464.995 (135)	<.001	.884	.874	.1520 (.1450-.1590)	1536.995
2-factor correlated model	242.674 (134)	<.001	.991	.979	.0436 (.0347-.0523)	316.674
6-factor correlated model	126.374 (120)	.327	.999	.989	.0112 (.0000-.0270)	228.374
6-factor higher-order model	166.923 (130)	.016	.997	.986	.0258 (.0118-.0366)	248.923

Note. ML = maximum likelihood estimation, RML = robust maximum likelihood estimation, CFI = comparative fit index, NFI = normed fit index, RMSEA = root mean square error of approximation, AIC = Akaike information criterion, CI = confidence interval. To statistically test the fit of a higher-order model, four first-order factors are normally required per second-order factor (so that the second-order portion of the model is overidentified; Chen et al., 2005). However, our higher-order models included only three first-order factors per second-order factor; following the recommendations of Meganck et al. (2008) we hence gained additional degrees of freedom by specifying an additional equality constraint among the loadings for each second-order factor.

Table 4.3

PERS and PERS-S, Estimated Factor Intercorrelations from Confirmatory Factor Analyses of the 6-Factor Correlated Model (Robust Maximum Likelihood Estimation)

Factor	F1	F2	F3	F4	F5	F6
F1 Positive-activation	-	.89	.92	-.37	-.36	-.49
F2 Positive-intensity	.90	-	.80	-.32	-.20	-.39
F3 Positive-duration	.91	.78	-	-.58	-.52	-.60
F4 Negative-activation	-.34	-.33	-.54	-	.86	.89
F5 Negative-intensity	-.30	-.19	-.50	.90	-	.86
F6 Negative-duration	-.45	-.37	-.58	.90	.90	-

Note. All correlations were statistically significant, $p < .05$. Correlations below the diagonal are for the PERS, those above the diagonal are for the PERS-S.

Table 4.4

PERS and PERS-S, Completely Standardised Item Factor Loadings from Confirmatory Factor Analyses of the 6-Factor Higher-Order Model (Robust Maximum Likelihood Estimation)

Factor/item	PERS	PERS-S
General positive reactivity (second-order factor)		
Positive-activation (first-order factor)	.988[a]	.975[a]
1 - I tend to get happy very easily	.769	.776
7 - My emotions go automatically from neutral to positive	.402	-
13 - I tend to get enthusiastic about things very quickly	.588	-
19 - I feel good about positive things in an instant	.775	.761
25 - I react to good news very quickly	.704	.687
Positive-intensity (first-order factor)	.873[a]	.863[a]
5 - I think I experience happiness more intensely than my friends	.676	-
11 - When I am joyful, I tend to feel it very deeply	.755	.758
17 - I experience positive mood very strongly	.873	.880
23 - When I'm enthusiastic about something, I feel it very powerfully	.674	.682
29 - I experience positive feelings more deeply than my relatives and friends	.586	-
Positive-duration (first-order factor)	.929[a]	.952[a]
3 - When I'm happy, the feeling stays with me for quite a while	.846	.844
9 - When I'm feeling positive, I can stay like that for a good part of the day	.839	.832
15 - I can remain enthusiastic for quite a while	.790	.801
21 - I stay happy for a while if I receive pleasant news	.701	-
27 - If someone pays me a compliment, it improves my mood for a long time	.452	-
General negative reactivity (second-order factor)		
Negative-activation (first-order factor)	.948[a]	.951[a]
2 - I tend to get upset very easily	.738	.718
8 - I tend to get disappointed very easily	.737	.729
14 - I tend to get frustrated very easily	.771	-
20 - My emotions go from neutral to negative very quickly	.740	-
26 - I tend to get pessimistic about negative things very quickly	.704	.717
Negative-intensity (first-order factor)	.941[a]	.898[a]
6 - If I'm upset, I feel it more intensely than everyone else	.662	.664
12 - I experience the feeling of frustration very deeply	.731	-
18 - Normally, when I'm unhappy I feel it very strongly	.756	.774
24 - When I'm angry I feel it very powerfully	.661	-
30 - My negative feelings feel very intense	.835	.863
Negative-duration (first-order factor)	.954[a]	.953[a]
4 - When I'm upset, it takes me quite a while to snap out of it	.765	.759
10 - It takes me longer than other people to get over an anger episode	.725	-
16 - It's hard for me to recover from frustration	.794	.775
22 - Once in a negative mood, it's hard to snap out of it	.833	.859
28 - When annoyed about something, it ruins my entire day	.718	-

Note. [a]Loading of first-order factor on valence-specific second-order factor. All loadings were statistically significant, $p < .001$. Results from second-order exploratory factor analyses of the PERS and PERS-S subscales are also provided in Appendix B material.

Concurrent Validity

Correlations with DASS-21, ERQ and DERS scores supported the validity of PERS and PERS-S scores. A table displaying all Pearson correlations is provided in Appendix B. As predicted, high scores on the *General negative reactivity* composite were significantly associated (*p*s < .05) with higher levels of *Depression* (PERS $r = .61$; PERS-S $r = .62$), *Anxiety* (PERS $r = .52$; PERS-S $r = .51$), and *Stress* (PERS $r = .64$; PERS-S $r = .62$) on the DASS-21, and higher levels of emotion regulation difficulties on the DERS *Regulation composite* (PERS $r = .74$; PERS-S $r = .72$). People with higher levels of negative reactivity also reported using significantly more *Expressive suppression* (PERS $r = .13$; PERS-S $r = .11$) and less *Cognitive reappraisal* (PERS $r = -.30$; PERS-S $r = -.30$) on the ERQ. Conversely, high scores on the *General positive reactivity* composite were significantly associated with lower levels of *Depression* (PERS $r = -.39$; PERS-S $r = -.46$), *Anxiety* (PERS $r = -.23$; PERS-S $r = -.31$), and *Stress* (PERS $r = -.27$; PERS-S $r = -.34$) on the DASS-21, and lower levels of emotion regulation difficulties on the DERS *Regulation composite* (PERS $r = -.23$; PERS-S $r = -.33$). People with higher levels of positive reactivity also reported using significantly less *Expressive suppression* (PERS $r = -.25$; PERS-S $r = -.27$) and more *Cognitive reappraisal* (PERS $r = .43$; PERS-S $r = .45$) on the ERQ. PERS scores also correlated highly with their corresponding subscale or composite in the PERS-S (*r*s ranging from .80 to .98, all *p*s < .001), suggesting that scores from the two forms were reasonably comparable.[6]

Internal Consistency Reliability

Reliability coefficients for the PERS were excellent at the composite score level and acceptable to good at the subscale score level. Reliability coefficients for the PERS-S were, generally, slightly lower than those of the PERS, but were still excellent at the composite score level and acceptable to good at the subscale score level (see Table 4.1).

Discussion

Our purpose was to examine the psychometric properties of PERS scores and introduce a short form of the measure. Overall, PERS and PERS-S scores were similar in their psychometric performance and both forms appeared to be valid measures of emotional reactivity.

Consistent with the original factor analytic examination of the PERS (Becerra et al., 2017), the PERS and PERS-S both had a theoretically congruent factor structure in our larger community sample. Our CFAs indicated that the structure of the PERS and PERS-S was well represented by six first-order factors (the intended subscales) subsumed within two valence-specific second-order factors (the intended composites). All subscale and composite scores demonstrated high internal consistency reliability. The PERS-S subscale and composite scores therefore appeared to retain the key strengths of their longer PERS counterparts; allowing the activation, intensity, and duration components of the construct to be robustly assessed in a valence-specific manner.

Scores from both forms of the measure also correlated in expected ways with scores from measures of psychopathology and emotion regulation. High levels of negative

[6] Compared to the PERS *Positive-intensity* subscale, the PERS-S version tended to correlate slightly more strongly with some of the psychopathology and emotion regulation measures (see Appendix B). Nonetheless, the two versions of the subscale still correlated highly with each other (r = .80), and loaded similarly on the second-order "General positive reactivity" factor (loadings = .87 or .86) in CFAs, suggesting that they were reasonably comparable.

reactivity, and low levels of positive reactivity, were significantly associated with emotion regulation difficulties and depression, anxiety and stress symptoms. This is consistent with contemporary theorising that negative emotions of greater intensity are likely to be more difficult to regulate, and poor emotion regulation skills (i.e., difficulty down-regulating negative emotions and up-regulating positive emotions when attempting to fulfil typical hedonic motivations) will often contribute to an emotional profile characterised by high negative reactivity and low positive reactivity (Gross & Barrett, 2011; Gross & Jazaieri, 2014). In our community data-set, high positive reactivity was therefore generally aligned with good psychological well-being. In clinical data-sets, however, we expect that high PERS or PERS-S positive reactivity scores may also sometimes be indicative of underlying psychopathology, particularly in patients who experience manic episodes (Henry et al., 2008).

Contemporary models of psychopathology consistently highlight the importance of abnormal emotional reactivity (e.g., Gross & Jazaieri, 2014; Rottenberg & Johnson, 2007), and in this context, we expect that future use of the PERS or PERS-S in clinical samples will be helpful in further establishing the typical reactivity profiles of various diagnostic categories. In clinical cases where abnormal levels of reactivity are indicated, treatment programs that focus on improving emotion regulation skills are likely to be beneficial (e.g., Barlow et al., 2010). Because our data suggest that PERS scores have slightly higher reliability than PERS-S scores, we think the longer form will be preferable for examiners wanting to maximise reliability for important clinical decisions, however, based on the available evidence, we expect the short form will be sufficient for most research purposes.

Overall then, we think our study makes a useful contribution, however several limitations should be noted. Firstly, our findings apply only to adults from the general community, so the psychometric performance of PERS and PERS-S scores in clinical and adolescent samples still needs to be tested. Secondly, because we selected the 18 PERS-S items based on their statistical performance in this sample and Becerra et al.'s (2017) sample, to some extent this will have capitalised on the specific characteristics of these samples and optimised performance around these data-sets. We also did not administer the PERS-S as a separate instrument, but instead derived its scores from responses on the PERS, which will have inflated the degree of similarity we observed between the PERS and PERS-S. Future work is needed to test the replicability of our results when the PERS-S is administered independently to other samples. Thirdly, we examined concurrent validity only in terms of correlations with other self-report questionnaires; a natural progression for future studies would be to also investigate how PERS and PERS-S scores relate to laboratory-based or behavioural markers of emotional reactivity. Fourthly, PERS and PERS-S scores are intended to measure trait levels of reactivity, but we did not examine their test-retest reliability. Future work should investigate the extent to which PERS and PERS-S scores are consistent over time.

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Table 1B

Pearson Bivariate Correlations Between Scores on the PERS/PERS-S and the DASS-21, ERQ and DERS

Measure/subscale	PERS/PERS-S							
	General negative reactivity	Negative-activation	Negative-intensity	Negative-duration	General positive reactivity	Positive-activation	Positive-intensity	Positive-duration
DASS-21								
Total scale	.65/.64	.59/.57	.60/.57	.62/.60	-.33/-.41	-.30/-.39	-.05/-.23	-.47/-.49
Depression	.61/.62	.56/.54	.55/.54	.59/.57	-.39/-.46	-.35/-.43	-.12/.-29	-.50/-.52
Anxiety	.52/.51	.48/.47	.48/.45	.49/.46	-.23/-.31	-.21/-.28	.01/-.17	-.36/-.38
Stress	.64/.62	.58/.54	.60/.55	.61/.59	-.27/-.34	-.24/-.33	-.01/-.17	-.42/-.43
ERQ								
Cognitive reappraisal	-.30/-.30	-.30/-.30	-.23/-.23	-.30/-.28	.43/.45	.40/.42	.27/.37	.44/.42
Expressive suppression	.13/.11	.12/.09	.05/.04	.18/.17	-.25/-.27	-.25/-.26	-.17/-.24	-.23/-.24
DERS								
Total scale	.71/.70	.64/.60	.63/.61	.70/.66	-.32/-.43	-.29/-.37	-.00/-.27	-.48/-.52
Regulation composite	.74/.72	.64/.61	.68/.66	.71/.68	-.23/-33	-.21/-.29	.079/-.16	-.41/-.45
Alexithymia composite	.25/.24	.14/.25	.28/.14	.27/.26	-.35/-.42	-.31/-.37	-.19/-.37	-.40/-.41
Non-acceptance	.56/.54	.49/.44	.54/.51	.53/.51	-.14/-.23	-.14/-.20	.07/-.10	-.27/-.30
Goals	.57/.56	.48/.46	.54/.52	.55/.53	-.14/-.23	-.15/-.20	.10/-.09	-.27/-.32
Impulse	.65/.65	.57/.56	.62/.59	.62/.58	-.17/-.27	-.15/-.21	.11/-.11	-.37/-.34
Strategies	.73/.73	.64/.63	.64/.64	.73/.69	-.32/-.42	-.29/-.37	-.00/-.25	-.48/-.53
Awareness	.09/.08	.13/.12	-.01/-.02	.12/.11	-.33/-.36	-.28/-.33	-.23/-.34	-.33/-.32
Clarity	.40/.40	.39/.37	.31/.32	.42/.39	-.28/-.38	-.24/-.31	-.09/-.29	-.38/-.41

Note. Correlations in front of '/' are for the PERS, those after '/' are for the PERS-S. Correlations ±.10 or greater are statistically significant, p<.05. PERS = Perth Emotional Reactivity Scale, PERS-S = Perth Emotional Reactivity Scale-Short Form, DASS-21 = Depression Anxiety Stress Scales-21, ERQ = Emotion Regulation Questionnaire, DERS = Difficulties in Emotion Regulation Scale.

Table 2B

Factor Loadings from Second-Order Exploratory Factor Analyses of the PERS or PERS-S Subscale Scores

Subscales	PERS		PERS-S	
	Factor 1 "General negative reactivity"	Factor 2 "General positive reactivity"	Factor 1 "General negative reactivity"	Factor 2 "General positive reactivity"
Positive-activation	-.110	**.884**	.011	**.872**
Positive-intensity	.209	**.749**	-.107	**.864**
Positive-duration	-.335	**.719**	.236	**.763**
Negative-activation	**.850**	-.034	**-.826**	-.013
Negative-intensity	**.911**	.075	**-.864**	.065
Negative-duration	**.886**	-.060	**-.822**	-.089

Note. Factor loadings ≥.40 are in boldface. EFAs (principal axis factoring) were conducted using direct oblimin rotation. Two factors with eigenvalues >1 were extracted for the PERS and PERS-S, which we name "General negative reactivity" and "General positive reactivity". These two factors accounted for 82.86% of the variance in PERS subscale scores and 82.02% of the variance in PERS-S subscale scores.