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It depends: Perfectionism as a moderator of experimentally induced stress

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ABSTRACT

Specific diathesis stress models assume that perfectionistic strivings (PS) and perfectionistic concerns (PC) are differentially associated with stress responses. The present study expanded existing research by investigating the incremental validity of interactive effects of PS and PC beyond their main effects on affective and endocrine (cortisol) stress responses. We also applied an experimental between-subjects design to standardize and systematically vary situational demand. We divided 84 participants between two experimental conditions (high vs. low situational demand). Moderated regression analyses on the affective stress response revealed a significant three-way interaction of PS, PC, and situational demand. This result affirms that the effects of PS, PC, and situational demand must not be interpreted independently of each other. For the endocrine stress response, the analyses revealed only a main effect of situational demand but no main or interactive effects of PS and PC.

1. Introduction

According to the latest representative population surveys, more than 80% of the German population suffer from stress (Techniker Krankenkasse, 2009), and approximately 22% of Americans report experiencing extreme stress (APA, 2011). As a consequence, increases in a wide range of physical (e.g., cardiovascular and respiratory diseases) and mental health problems (e.g., affective and anxiety disorders) have been observed (see Everly & Lating, 2013, for an overview).

1.1. Diathesis stress models

To deal with the problems that are associated with the experience of stress, it is essential to understand the processes that mediate or moderate the effects of potential stressors on psychological and physiological outcome variables. Diathesis stress models are primarily concerned with this issue. These models assume that potential stressors result in affective and physiological stress responses only if an individual is vulnerable to a stressor in a given situation (Lazarus, 2006). Broader dimensions of personality such as extraversion and neuroticism (Bolger & Zuckerman, 1995; Hemenover & Dienstbier, 1996) and lower order personality traits such as dependency and self-criticism (Zuroff, Mongrain, & Santor, 2004) have been identified as vulnerability factors.

1.2. Perfectionism

One important vulnerability factor in socio-evaluative achievement situations is perfectionism (Dunkley, Zuroff, & Blankstein, 2003; Flett, Hewitt, & Dyck, 1989). Perfectionism is defined as setting and striving for exceedingly high standards combined with a critical evaluation of one's own behavior and concerns about the consequences of not living up to those standards (see Stoeber & Otto, 2006, for an overview). The different facets that comprise the construct of perfectionism can be represented by two broader dimensions. The first dimension—perfectionistic concerns (PC)—has consistently been found to be associated with negative psychosocial adjustment (e.g., DiBartolo, Li, & Frost, 2008; Flett & Hewitt, 2002). By contrast, the second dimension—perfectionistic strivings (PS)—is associated with some positive psychological and performance outcomes (e.g., Frost, Marten, Lahart, & Rosenblate, 1990; Gilman & Ashby, 2003).

Perfectionism-specific diathesis stress models view PC as a core vulnerability factor. Empirical evidence has confirmed this assumption (e.g., Blankstein, Lumley, & Crawford, 2007; Chang & Rand, 2000) although studies on perfectionism-specific diathesis stress models have applied different measures of PS and PC and

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thus somewhat different conceptualizations of the two dimensions. By contrast, empirical findings for PS as a vulnerability factor have not been as consistent. Whereas some studies have confirmed PS as a vulnerability factor (Hewitt, Flett, & Ediger, 1996), others have found no effects (Chang, Watkins, & Banks, 2004; Dunkley et al., 2003), whilst others found that PS acts as a resiliency factor (Enns, Cox, & Clara, 2005).

The present study investigated two possible explanations for these inconsistent results: First, inconsistencies concerning PS as a diathesis factor might be—at least partially—explained by the correlation and interaction of PS and PC. Stoeber and Otto (2006) addressed effects of an often-found substantial correlation between PS and PC; thus, this overlap has resulted in inflated correlations between PS and negative outcome variables. Depending on whether or not this overlap is statistically controlled for, the direction and significance of the effects of PS might differ markedly. Furthermore, Gaudreau and Thompson (2010) postulate that beyond statistically controlled main effects, potential interactive effects should be analyzed. Based on the combination of high/low scores on PS with high/low scores on PC, Gaudreau and Thompson extracted four types of perfectionism and found evidence for different levels of psychological adjustment for the different combinations (e.g., Douilliez & Lefèvre, 2011; Gaudreau & Verner-Filion, 2012). Taken together, inconsistent results concerning perfectionism-specific diathesis stress models might be attributable to differences in statistical approaches implied by different assumptions about the interplay of PS and PC. Hierarchical moderated regression analyses allow to control shared variance and test for main effects and interaction effects. Therefore, we applied this approach to test and compare different models of the interaction between PC and PS.

Second, with only a few exceptions (Altstötter-Gleich, Gerstenberg, & Brand, 2012; Wirtz et al., 2007), stress has mostly been assessed with self-report measures of daily hassles, stressful life events, or stress questionnaires, resulting in shared method variance and response biases. Additionally, this approach does not permit situation-specific aspects to be separated from personality-specific aspects of the individual stress response. To investigate the moderating effects of personality on stress responses postulated by diathesis stress models, it is important that each participant objectively experiences the same situation. Therefore, we choose a well-established paradigm to induce achievement-related stress: the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993). Wirtz et al. (2007) implemented the TSST to examine the relations between PC and stress responses. We extended her research by including PS and examining perfectionism-specific effects not only in the highly demanding TSST but also in a less demanding placebo condition (see description below).

Our third aim was to examine the incremental validity of perfectionism beyond the variance explained by the higher order trait neuroticism, which has been found to be strongly associated with PC (e.g., Stumpf & Parker, 2000). Also, empirical evidence has questioned the incremental validity of PC beyond neuroticism as a vulnerability factor (see Enns et al., 2005).

Based on these restrictions of previous research on perfectionism-specific diathesis stress models, we aimed to:

1) Test perfectionism as a vulnerability factor under two experimentally controlled conditions, characterized by high vs. low situational demand.
2) Evaluate the incremental validity of interaction effects beyond the main effects of PS and PC.
3) Evaluate the incremental validity of perfectionism as a vulnerability factor beyond neuroticism.

2. Method

2.1. Participants

Participants were 84 students (21 men; 63 women; M_{age} = 23.94, SD_{age} = 4.81) with a variety of majors at the University of Koblenz-Landau (Germany). They were offered the opportunity to participate in a lottery to win cinema and book vouchers.

2.2. Design and procedure

In order to control for baseline group differences, participants completed a perfectionism questionnaire before the actual testing session. Using a between-subjects design, participants were matched according to their PS and PC scores between highly demanding (TSST, n = 42) and less demanding (placebo TSST, n = 41) experimental conditions. The two groups were comparable in age, gender, and their field of study. Individual experimental sessions took about 90 min. The experimental manipulation of situational demand followed the standard protocol of the TSST (Kirschbaum et al., 1993) and its placebo version (Het, Rohleder, Schoofs, Kirschbaum, & Wolf, 2009).

The TSST consists of a period of preparation time (5 min), a simulated job interview (5 min), and a highly demanding arithmetic task (5 min) in front of a two-person committee, a video-camera, and a microphone. This procedure is quite effective at activating the Hypothalamus Pituitary Adrenal (HPA) axis and the sympathetic nervous system (Kirschbaum et al., 1993) and was thus implemented as the highly demanding condition. The Placebo TSST consists of a period of preparation time (5 min), a talk about a recent leisure experience (5 min), and a less demanding arithmetic task (5 min) while alone in the experimental room. This procedure does not activate the HPA axis and has been shown to successfully provide a less demanding control condition (Het et al., 2009).

Immediately before the experimental manipulation, baseline values for HPA and affective stress responses were assessed (t_1). The post (stressor) measures of HPA and affective stress response were assessed directly after the manipulation (t_2). The HPA response was additionally assessed 15 and 30 min after the experimental manipulation. These additional measurements served to control for the slow activation of our specific indicator of HPA response and its convalescence (e.g., Schoofs, Preuss, & Wolf, 2008). At the end of each testing session, participants were fully debriefed.

2.3. Measures

2.3.1. Perfectionism

PS and PC were measured by the Personal Standards and Concern over Mistakes subscales of the Frost Multidimensional Perfectionism Scale (MPS-F; Frost et al., 1990; German version: Altstötter-Gleich & Bergemann, 2006). Items are scored on a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The seven Personal Standards items capture the tendency to set very high standards for performance. By contrast, the nine Concern over Mistakes items cover a tendency to react negatively to mistakes, to interpret mistakes as equivalent to failure, and to believe that one will lose the respect of others following failure. These two subscales are considered to be reliable and valid indicators of PS and PC (Frost, Heimberg, Holt, Mattia, & Neubauer, 1993). Internal consistencies from our study are presented in Table 1.

2.3.2. Neuroticism

Neuroticism was assessed via the corresponding subscale of the short version of the Big Five Inventory (BFI-K; Rammstedt & John,

Table 1
Descriptive statistics and correlations for self-report measures.

	(1)	(2)	(3)	(4)	(5)
(1) Perfectionistic strivings	–				
(2) Perfectionistic concerns	.56**	–			
(3) Neuroticism	.03	.32**	–		
(4) Rest vs. unrest (t_1)	.08	−.08	−.38**	–	
(5) Rest vs. unrest (t_2)	.17	−.11	−.66**	.37**	–
#	7	9	4	8	8
α	.83	.86	.84	.89	.95
M Placebo TSST	3.68	2.43	3.24	3.83	3.81
TSST	3.68	2.40	3.92	3.56	2.67
SD Placebo TSST	0.92	0.84	1.12	0.78	0.90
TSST	0.84	0.86	1.18	0.83	0.94

Note. $N = 83$; t_1 = baseline measure; t_2 = post (stress) measure; # = number of items; α = internal consistency (Cronbach's alpha); TSST = Trier Social Stress Test.
** $p < .01$.

2005). The four items are measured on a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The BFI-K is an economic, reliable, and valid instrument for assessing the core aspects of the Big Five (Rammstedt & John, 2005).

2.3.3. Stress response

Following common practice in empirical stress research (e.g., Starcke & Brand, 2012), we assessed the stress response directly with HPA response indicators and indirectly with self-reports of perceived bodily reactions such as affective arousal.

As an indicator of the *HPA response*, salivary free cortisol concentration (CORT) samples were assessed using Salivette sampling devices (manufactured by Sarstedt, Nümbrecht, Germany). Cortisol concentrations were measured using a commercially available immunoassay with chemiluminescence-detection (IBL-Hamburg, Germany). Inter- and intra-assay coefficients of variation were below 10%. CORT is a valid indicator of the HPA axis activity that mediates the slow endocrine stress response. One participant had to be excluded from data analysis due to the permanent intake of medication.

In accordance with previous TSST studies (e.g., Kirschbaum, Kudielka, Gaab, Schommer, & Hellhammer, 1999), *affective arousal*[1] was measured by the subscale rest vs. unrest (RU) of the Multidimensional Mood State Questionnaire (MDBF; Steyer, Schwenkmezger, Notz, & Eid, 1997). The eight adjectives describe the perception of inner tension and restlessness and are rated for current mood on a 5-point intensity scale ranging from 1 (*not at all*) to 5 (*very much*). The scales of the MDBF are considered reliable, valid, and highly sensitive to change (Steyer et al., 1997).

2.4. Statistical analyses

The data were checked for multivariate outliers according to Tabachnick and Fidell (2007). No participant exceeded the critical Mahalanobis distance, $\chi^2(5) = 20.52$, $p < .001$.

To examine the hypothesized relations between experimental condition, PS, and PC on the one hand and HPA and affective arousal on the other hand, we conducted two sets of analyses: To test whether our experimental manipulation was successful at differentially affecting the HPA response over time, we conducted a repeated-measures analysis of variance (ANOVA) with time of measurement as a within-subjects factor and experimental condition as a between-subjects factor. To determine whether PS, PC, and their interaction were related to affective and HPA responses and how these relations differed by experimental condition, multiple moderated regression analyses were conducted for CORT and RU. Before calculating cross-product vectors representing two- and three-way interactions, we centered PS and PC. Experimental condition was effect coded −1 for the placebo condition and +1 for the TSST condition (see Aiken & West, 1991). In an autoregressive hierarchical model (Model 1), we first regressed each dependent variable measured after the experimental manipulation (t_2) on its baseline counterpart (t_1) to control for the variance of each variable at the baseline measurement. Afterwards, we added all independent variables, two-way interactions, and the three-way interaction to the regression equation. Significant interactions were subsequently analyzed in more detail by conducting simple slopes tests at values of 1 *SD* above (high) and 1 *SD* below (low) the means of PS and PC for the TSST and the placebo condition separately (Cohen, Cohen, West, & Aiken, 2003). To explore the incremental validity of perfectionism beyond neuroticism, we included this variable and its interaction with the experimental condition in the final step (Model 2).

3. Results

Internal consistencies, descriptive statistics, and correlations for all self-report measures are presented in Table 1. The two experimental groups did not differ substantially with regard to PS, PC, neuroticism, and RU, and Cronbach's alpha was satisfactory for all measures.

3.1. Manipulation check

CORT was assessed to control for the differential effects of the two experimental conditions (placebo vs. TSST) on participants' HPA response. The means of CORT in the two experimental conditions across the four times of measurement are illustrated in Fig. 1. Along with significant main effects of experimental condition and time, the two-way interaction involving experimental condition and time was significant, $F(1.87, 151.54) = 8.93$, $p < .001$, $\eta^2 = .10$. As expected, there was a significant cortisol response to the TSST but not to the placebo condition.

3.2. Affective arousal

Concerning post-stressor RU_{t2}, the regression analysis (Table 2) revealed significant main effects of experimental condition, PS, and PC. These main effects were qualified by a significant three-way interaction of PS, PC, and experimental condition.

The results of the simple slope analysis for this interaction are shown in Fig. 2. High PS led to rest in both experimental conditions ($b = -.11$, $p = .61$) but only if it was combined with low PC. In the same way, high PC led to unrest in both experimental conditions

[1] Additionally, affective pleasantness (Kluger & DeNisi, 1996) was assessed by the MDBF subscale Good versus Bad Mood. As the results for affective pleasantness equated those for arousal, only the results for arousal are reported.

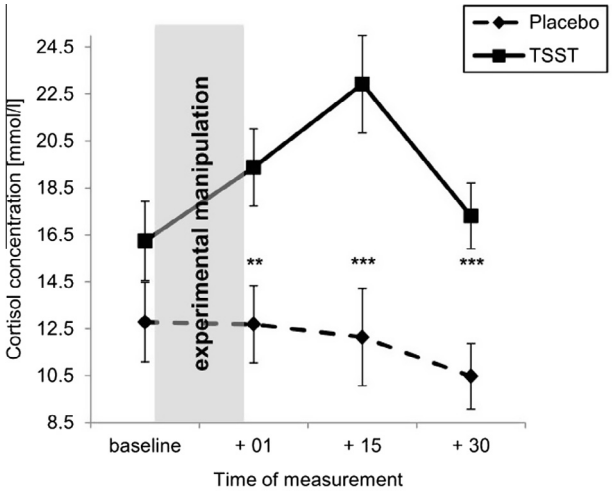

Fig. 1. Salivary free cortisol concentration [mmol/l] as a function of time of measurement and experimental condition. Data are presented as mean ± S.E.M. $^{**}p < .01$. $^{***}p < .001$.

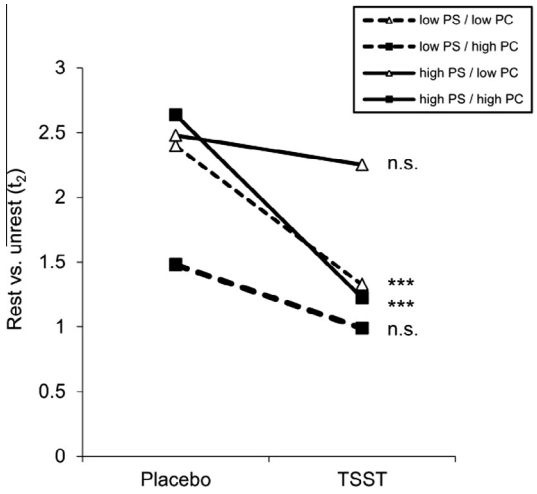

Fig. 2. Predicted values for post-stressor RU_{t2} from Model 1 in Table 2 at 1 *SD* above (high) and 1 *SD* (below) the means of perfectionistic strivings (PS) and perfectionistic concerns (PC) in the two experimental conditions (Placebo TSST vs. TSST). Higher values indicate more rest. $^{***}p < .001$.

($b = -.24$, $p = .41$) but only if it was combined with low PS. If high PS went along with high PC, it was associated with rest only in a situation with a lower demand (placebo), but it was associated with unrest in a situation with higher demand (TSST; $b = -.71$, $p < .001$). However, this slope was not significantly different from the estimated slope for a combination of low PS and low PC ($b = -.54$, $p < .01$).

Adding neuroticism in Model 2 revealed that the main effect of PC was no longer significant, but the PS, PC, and experimental condition interaction explained an additional 3% of the variance in the dependent variable.

3.3. HPA response

Except for a significant effect of the experimental condition, the moderated regression analyses revealed no main or interaction effects of PS and PC for the HPA stress response.

4. Discussion

We investigated the effects of perfectionism as a moderator in a diathesis stress model. We extended previous research by examining perfectionism as a vulnerability factor under experimentally controlled conditions, which were characterized by varying degrees of situational demand. We also evaluated the incremental validity of interactive effects beyond the main effects of PS and PC and beyond neuroticism as a vulnerability factor.

The well-documented effectiveness of the TSST protocol in eliciting substantial stress responses (Dickerson & Kemeny, 2004) was confirmed in our study. Our analyses revealed significant HPA and self-reported stress responses to the TSST but not to its placebo version. More importantly, the dimensions of perfectionism were found to be influential moderating factors with respect to post-stressor RU_{t2}, even when the effects of neuroticism were controlled.

Table 2
Multiple moderated regression analysis testing the relation of experimental condition, perfectionistic strivings, perfectionistic concerns, neuroticism, and post-stressor RU_{t2}.

Parameter	Model 1			Model 2		
	b	*t*(74)	*β*	*b*	*t*(70)	*β*
Intercept	1.85***	4.31		2.57***	6.90	
RU_{t1}	0.36**	3.23	0.28**	0.17†	1.74	0.13†
Condition	−0.40***	−3.89	−0.37***	−0.28**	−3.26	−0.26**
PS	0.34**	2.71	0.28**	0.23*	2.22	0.19*
PC	−0.31*	−2.20	−0.25*	−0.05	−0.43	−0.04
PS × condition	−0.01	−0.09	−0.01	0.02	0.21	0.02
PC × condition	−0.09	−0.63	−0.07	−0.14	−1.16	−0.11
PS × PC	0.07	0.55	0.05	0.06	0.58	0.04
PS × PC × condition	−0.30*	−2.49	−0.26*	−0.27**	−2.73	−0.23**
Neuroticism				−0.46***	−6.29	−0.51***
Neuroticism × condition				0.02	0.23	0.02
R^2	0.50***			0.68***		
F	9.27***			15.27***		
$\Delta R^2_{PS \times PC \times condition}$	0.04*			0.03**		
$\Delta F_{PS \times PC \times condition}$	6.21*			7.45**		

Note. $N = 83$; t_1 = baseline measure; RU = rest vs. unrest; condition = experimental condition (−1 = Placebo TSST; 1 = TSST); PS = perfectionistic strivings; PC = perfectionistic concerns.
† $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

We found a significant PS, PC, and experimental condition interaction that has at least two implications. The first implication is that the effects of each dimension of perfectionism must not be interpreted independently. Our results support Gaudreau and Thompson (2010)) demand to distinguish between a combination of low PS and low PC on the one hand and of low PS and high PC on the other hand. According to their 2×2 model, a combination of low PS and low PC should be considered a "naturally occurring control [...] condition to which other subtypes of perfectionism can be readily compared" (Gaudreau & Verner-Filion, 2012, p. 31). In our study, this combination was associated with an affective reaction that "naturally" answers the situational demand: less rest in the demanding TSST than in the less demanding placebo condition. Also, as predicted by the model, the combination of high PS and low PC was "best" in that it led to sustained rest in both experimental conditions, whilst a combination of high PC and low PS was "worst" in that it led to unrest in both experimental conditions.

Depending on situational demand, the results for the combination of high PS and high PC additionally confirmed the 2×2-model buffer hypothesis. Generally, the buffer hypothesis implies that individual effects on distress are moderated by resiliency factors (e.g., Dunkley, Blankstein, Halsall., Williams, & Winkworth, 2000). Gaudreau and Verner-Filion (2012) assigned this idea to the 2×2 model, predicting that PS can buffer the negative consequences of PC. Our results confirmed this assumption in the placebo condition as a combination of high PS and high PC was related to more rest compared to a combination of low PS and high PC.

In the TSST condition, no buffering effect was observed. This leads to the second implication of the PS, PC, and experimental condition interaction, suggesting that the effects of PS and PC must not be interpreted independent of situational demand. As predicted by the theory of situational strength (see Meyer & Dalal, 2009), our results show that the buffering effect of PS occurs only as long as the situational demand is low; therefore the situation is ambiguous and open for a personality-driven interpretation. When situational demand is high, the buffering effect of PS gets lost as a "strong" situation leaves little room for personality-dependent interpretations.

The experimental approach is a fruitful attempt to generate comparable "strong" and "weak" situations for all participants, thereby separating objective characteristics of the situation from its personality-driven evaluation. For example, Roberts and DelVecchio (2000, p. 5) summarize that there are at least four types of person-environment transactions that lead to stabilized correlations between the characteristics of a person and his/her experienced environment. The lack of control of objective situational characteristics might additionally account for the contradictory findings of some of the previous studies on the perfectionism-specific diathesis stress model.

No moderating effects of PS or PC were found for the HPA stress response. Given the effects of perfectionism on perceived arousal, this means that although the HPA response to the experimental manipulation was not affected by interindividual differences in PS and PC, the self-reported affective stress response was a function not only of the situation but also of perfectionism. Similar results have been found for other traits such as neuroticism (see Schneider, 2004; Schommer, Kudielka, Hellhammer, & Kirschbaum, 1999), but the fact that the PS, PC, and experimental condition interaction remained significant after controlling for neuroticism excludes the possibility that the effect of perfectionism can be attributed to its correlations with neuroticism.

Nevertheless, further studies should check the effect under stricter conditions. Readers who are familiar with the assessment of HPA response via salivary free cortisol may have taken notice of the fact that our sample – comparable to other TSST-studies concerning sample size (see Dickerson & Kemeny, 2004 for an overview) – consisted of about 75% female participants. Female gender, especially the intake of oral contraceptives, has been found to be associated with attenuated salivary cortisol reactivity to stress (Kirschbaum et al., 1999). We attempted to implement an even distribution of gender across the two experimental conditions and used salivary cortisol primarily as a manipulation check. However, in an entirely male sample, perfectionism-specific effects on HPA response cannot be ruled out (e.g., Starcke & Brand, 2012).

Despite these limitations, our results might account for some inconsistencies in existing research and provide new and significant implications for future research on perfectionism-specific diathesis stress models. The first implication is that in order to understand the factors that render a "perfectionist" vulnerable to stress responses, one has to assess the main and interactive effects of the two dimensions of perfectionism. The second implication is that these effects of perfectionism must not be interpreted independently from situational demand. This observation is well known from the person-by-situation interaction literature (e.g., Meyer & Dalal, 2009) but is widely neglected in studies on perfectionism-specific diathesis stress models (e.g., in the studies reported by Enns et al., 2005; Wirtz et al., 2007).

As we showed that perfectionism is an important moderator in the stress process, future studies should look into the processes that mediate the relation between perfectionism, situational demand, and the stress response. Identifying modifiable process variables is a first step toward therapeutic applications. Interesting mediators might be cognitive appraisal or coping processes as proposed by the transactional stress model (see Lazarus, 2006).

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