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8 Not all Perfectionism Cognitions are Multidimensional: Evidence for the Perfectionism
9 Cognitions Inventory-10

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Abstract

The measurement of perfectionistic cognitions has recently caused disagreement among researchers. Flett, Hewitt, Blankstein and Gray (1998) proposed that perfectionistic cognitions are unidimensional. However, after re-examining the factor structure of the instrument used to measure perfectionistic automatic thoughts (Perfectionism Cognitions Inventory, PCI), Stoeber, Kobori, and Tanno (2014a) argued that perfectionistic cognitions are multidimensional. Researchers are now faced with a dilemma; should they adopt a multidimensional approach derived from analysis of the underpinning structure of the instrument or should theory take precedence and the instrument be revised? In considering these two alternatives, in this instance, we advocate the latter strategy. In accord, in the current study we assess the factor structure of the PCI with the intention of creating a unidimensional version of the instrument. In doing so, we provide evidence to support the use of a new shorter version of the PCI. Unlike the original PCI, the PCI-10 has a unidimensional structure that replicates across independent samples. The PCI-10 and the original PCI are also highly correlated. Based on this evidence, we propose that that the PCI-10 provides a short, psychometrically sound, instrument to measure perfectionistic cognitions in the unidimensional manner it was intended.

Key Words: Questionnaire, Survey, Psychometrics

1 Perfectionism has typically been studied as a personality trait. However,
2 perfectionism can also be studied in terms of individual differences in the frequency with
3 which people experience perfectionistic cognitions. Perfectionistic cognitions are automatic
4 ruminative thoughts and images involving the need to be perfect (Flett, Hewitt, Blankstein, &
5 Gray, 1998). As described by Flett et al., perfectionistic cognitions can be understood in
6 context of theories of rumination and as a form of end-state thinking. That is, they are a set of
7 thoughts that occur following failure to reach important goals and when attention shifts
8 towards the self and personal discrepancies (Martin & Tesser, 1989). As such, perfectionistic
9 cognitions are expected to be common among those who seek perfection as, in most
10 circumstances and for most people, perfection is an irrational and impossible goal. In
11 addition, because the themes of perfectionistic cognitions are focused on personal
12 deficiencies, counterfactual thinking, and personal imperatives (i.e., what could have and
13 should have been), they are counter-productive, negatively-valenced, and have a detrimental
14 impact on mental health.

15 In comparison to trait perfectionism, perfectionistic cognitions have received much
16 less attention in research. However, the research that has taken place has been consistent with
17 the theoretical expectations of Flett et al.'s (1998) model. In particular, research has found
18 that more frequent perfectionistic cognitions are related to the experience of negative
19 emotions (e.g., anger and anxiety; Donachie, Hill, & Hall, 2018), more difficulty regulating
20 cognitive-emotion tendencies (e.g., catastrophization, self-blame, reappraisal; Rudolph, Flett,
21 & Hewitt, 2007) and mental health problems (e.g., depressive symptoms; Flett et al., 2012).
22 Notably, research has also found perfectionistic cognitions predict variance in the experience
23 of anxiety, depressive symptoms and burnout symptoms after taking into account trait
24 perfectionism (e.g., Flett et al., 1998; Flett, Hewitt, Whelan, & Martin, 2007; Hill &

1 Appleton, 2011). In other words, perfectionistic cognitions predict the distress people
2 experience independent of their typical perfectionistic behaviour (i.e., trait perfectionism).

3 **Unidimensional versus multidimensional perfectionistic cognitions**

4 A recent debate has arisen that has the potential to alter the way in which
5 perfectionistic cognitions are studied. This debate pertains to whether perfectionistic
6 cognitions are best considered unidimensional or multidimensional. In developing the
7 instrument used to measure perfectionistic cognitions (Perfectionism Cognitions Inventory,
8 PCI), Flett et al. (1998) proposed that perfectionistic cognitions were unidimensional. That is,
9 perfectionistic cognitions are best represented as a single factor capturing the frequency of
10 negative, intrusive and ruminative thoughts that pertain to the need for perfection (with “no
11 underlying causal structure involving two or more components” p.1365). This was primarily
12 because their conceptualisation of perfectionistic cognitions was couched within particular
13 theories of rumination (e.g., Nolen-Hoeksema, 1996; Klinger, 1996; Pyszczynski &
14 Greenberg, 1987). In these theories rumination is typically considered unintentional,
15 unwanted and, in keeping with the Flett et al.’s overarching model, essentially “the
16 dysfunctional residual of a failed discrepancy reduction” (Wanke & Schmid, 1996, p.180)

17 Stoeber and colleagues (Stoeber, Kobori, & Brown, 2014a), though, have more
18 recently argued that Flett et al. (1998) made an error when conceptualising perfectionistic
19 cognitions as unidimensional. This assertion was made for three reasons. First, Stoeber et al.
20 argued that a focus on available literature, experience in counselling perfectionists, and
21 understanding of the perfectionism construct should have led Flett et al. to conclude
22 perfectionistic cognitions were most likely similar to trait perfectionism which is
23 multidimensional. Second, scrutiny of the items of the PCI suggest that it includes at least
24 two broad dimensions. One being perfectionistic strivings (e.g., “My goals are very high”)
25 and the other being perfectionistic concerns (e.g., “No matter how much I do, it’s never

1 enough”). Again, this matches how trait perfectionism can be conceptualised and measured.
2 Third, re-examination of the factor structure of the PCI as presented in the original and
3 subsequent validation work reveals two or three underlying factors when using more rigorous
4 statistical testing (Flett et al., 1998; Flett et al., 2012).

5 With these issues in mind, Stoeber and colleagues proposed the Multidimensional-
6 Perfectionism Cognitions Inventory (MPCI; Kobori, 2006; Kobori & Tanno, 2004; Stoeber,
7 Kobori, & Tanno, 2010)¹. As described by Stoeber et al. (2010), the MPCI is based on the
8 PCI and uses the same instructions and timeframe (“past week”). However, the MPCI differs
9 from the PCI in that the MPCI includes three dimensions and emphasises the experience of
10 both positively and negatively-valanced perfectionistic cognitions. Personal standards capture
11 cognitions about having perfectionistic standards (e.g., “It’s important to set high standards
12 for myself”). Pursuit of perfection capture cognitions about the need to be perfect (e.g., “I
13 must be perfect at any cost”). Finally, concern over mistakes capture cognitions about
14 mistakes (e.g., “I’ll blame myself if I make a mistake”). In support of the use of the MPCI,
15 Stoeber and colleagues provided evidence of the validity and reliability of the instrument.
16 This includes confirmation of its underlying multidimensional structure (e.g., Stoeber et al.,
17 2010).

18 Important for the current study, in developing the MPCI, Stoeber et al. (2014a) also
19 re-examined the dimensionality of the PCI and derived a multidimensional version of the PCI
20 (referred to hereon as the HF-MPCI) so to compare the predictive ability of a
21 multidimensional versus unidimensional approach to perfectionistic cognitions. Regarding

¹ The Multidimensional Perfectionism Inventory (MPCI) was originally developed in Japanese by Kobori (2006; Kobori & Tanno, 2004). An English version (MPCI-E) was later developed by Stoeber, Kobori, and Tanno (2010). In keeping with descriptions elsewhere, we use “MPCI” throughout when referring to both these instruments.

1 the dimensionality of the PCI, it was found to have three factors which were labelled
2 perfectionistic concerns (e.g., “Why can’t things be perfect?”), perfectionistic strivings (e.g.,
3 “My goals are very high”), and perfectionistic demands (e.g., “I should be doing more”).
4 Comparison of the predictive ability of this multidimensional version and the original
5 unidimensional version indicated that the multidimensional version had greater predictive
6 ability in regard to positive affect, negative affect and depressive symptoms. Stoeber et al.
7 concluded that the PCI was multidimensional and that assessing perfectionistic cognitions in
8 multidimensional manner is more advantageous than assessing them in a unidimensional
9 manner.

10 Flett and Hewitt (2014) were unconvinced by the reconceptualization of
11 perfectionistic cognitions as unidimensional. In a response to Stoeber et al. (2014a), they
12 reaffirmed their position that in their model perfectionistic cognitions are unidimensional. In
13 doing so, they questioned the interpretability of the three factors of the HF-MPCI, the
14 appropriateness of the factor labels and the distinctiveness of the factors based on their item
15 content². This stalemate poses researchers with a dilemma. Should those interested in Flett et
16 al.’s (1998) perfectionistic cognitions adopt a multidimensional approach derived from
17 analysis of the underpinning structure of the PCI or should theory take precedence and the
18 instrument be revised? In considering these two alternatives, in this instance, we advocate the
19 latter strategy. We do so for two reasons; (1) exploratory factor analysis is more likely to
20 provide meaningful solutions when theory is used to guide decision making and (2) there has,

² Readers are also directed to Stoeber, Kobori, & Brown (2014b) for a response to Hewitt and Flett (2014) in which the Stoeber and colleagues reiterated their support for considering the PCI in a multidimensional fashion and highlighted the negative consequences of not doing so (viz. suppression).

1 as yet, been no theoretical basis offered for multidimensional perfectionistic cognitions
2 within Flett's et al.'s (1998) model.

3 On these two related issues, although exploratory factor analysis is a technique
4 typically associated with the absence of theory, the importance of theory when available is a
5 common theme in accounts of its use. The argument being that, where possible, researchers
6 should consider relevant theory and previous research when using exploratory factor analysis,
7 and that if the model derived from this analysis is not interpretable or "theoretically sensible"
8 it has little value (Fabrigar, Wegener, MacCallum, & Strahan, 1999, p.281). Whether the
9 underlying latent factors are meaningful is determined by the researcher who needs to
10 consider a range of issue including what is known about the constructs and how they are best
11 operationalised (Henson & Roberts, 2006). It is these things, along with a clear definition of
12 the construct and its attributes, that provide the required conceptual basis to make sense of
13 what is ultimately an exploratory technique (Worthington & Whittaker, 2006). The
14 subjective aspect of interpreting the results of exploratory factor analysis is acknowledged by
15 Stoeber, Kobori, and Brown (2014b) in their reply to Flett and Hewitt (2014). However, still,
16 no theoretical basis for the HF-PCI was been offered. Given that Flett and Hewitt (2014)
17 currently see little place for multidimensional perfectionistic cognitions within their model,
18 and an alternative theoretical basis for multidimensional perfectionistic cognitions has yet to
19 be articulated, the HF-MPCI appears unmerited and supererogatory.

20 **Present study**

21 As the HF-MPCI currently has no theoretical basis in Flett et al.'s (1998) model and
22 there is evidence that the PCI is multidimensional not unidimensional, the purpose of the
23 study was to develop a new unidimensional version of the PCI. In doing so, we tested both
24 the validity of the two factor structures of the PCI proposed by Flett et al. and Stoeber et al
25 (2014a), and explored the underlying factor structure and item content of the PCI.

1 structure by stipulating cross-loadings are zero whereas ESEM allows for non-zero cross-
2 loadings. The result is greater correspondence between exploratory factor analysis and ESEM
3 than with CFA. ESEM is also more appropriate when constructs have complex underlying
4 structures (Marsh et al., 2009). CFA and ESEM were conducted using *Mplus* 8.2 (Muthén &
5 Muthén, 2018) with robust maximum likelihood estimation (MLR) and, for ESEM, TARGET
6 rotation to guide cross-loadings with a target value close to zero (Asparouhov & Muthén,
7 2009). Factor loadings were considered meaningful when $>.30$. Multiple indexes were used
8 to assess model fit in the confirmatory and exploratory-confirmatory analyses: chi-square
9 statistic (χ^2), comparative fit index (CFI), root mean square error of approximation
10 (RMSEA), 90% confidence intervals of the RMSEA, and the standardized root-mean-square
11 residual (SRMR). Conventional criteria were used when interpreting these indexes with
12 values $>.90$ CFI, $<.08$ RMSEA (90% CI $<.05$ to $<.08$) and $<.08$ SRMR providing evidence
13 of adequate model fit (Marsh, Hau, & Wen, 2004).

14 To guide the development of a new unidimensional PCI, we also used exploratory
15 factor analysis (EFA). Common recommendations for this analysis were followed (e.g.,
16 Child, 2006; Tabachnick & Fidell, 2001; Worthington & Whittaker, 2006). Factor structure
17 was first explored using principal components analysis (PCA) and assessed using four
18 common strategies: eigenvalues, screeplot, parallel analysis (with PCA and assessment of
19 95% percentiles) and Velicer's (1976) MAP test (see O'Connor, 2000). This was followed by
20 common factor analysis using principal axis factoring extraction (PAF) with oblique rotation
21 (promax) in which items were constrained to load on the number of retained factors from the
22 PCA. Structure coefficients, pattern coefficients and cross-loading were considered
23 meaningful when $>.30$. These data analyses procedures matched those used by Stoeber et al
24 (2014a).

1 Internal reliability was assessed using Cronbach's α using with recommendations of
2 Cronbach's $\alpha > .70$ indicating adequate reliability.

3 **Results**

4 *Preliminary analysis*

5 Due to missing data from individual responses ($> 5\%$, more than one item), six
6 participants were removed from sample one and five from sample two. Once these values
7 were removed, there were 182 complete cases and 24 cases with incomplete data for sample
8 one and 174 complete cases and 11 cases with incomplete data for sample two. In the cases of
9 incomplete data, the number of missing data due to non-response was one item for both
10 samples. Each missing item was replaced using the mean of each case's available non-
11 missing items (i.e., their own mean score for the compete items on the PCI; Graham,
12 Cumsille, & Elek-Fisk, 2003).

13 *Assessment of previously proposed factor structures*

14 Sample one was first used to test the proposed structures of Flett et al. (1998) and
15 Stoeber et al (2014a). The results of these analyses are provided in Table 1. Flett et al.'s
16 unidimensional structure consisted of 25-items and a single factor. Using CFA, the model
17 provided less than adequate fit. Stoeber et al.'s (2014a) multidimensional structure consisted
18 of 25-items and 3-factors: PCI-concerns (items 16, 1, 3, 11, 18, 22, 24 15, 10, 20), PCI-
19 strivings (items 13, 23, 14, 12, 17, 25 19, 9, 6) and PCI-demands (items 7, 2, 5, 21, 8, 4)³.
20 Using both CFA and ESEM, the model provided less than adequate fit. These analyses were
21 repeated using sample two and provided similar results. Flett et al's (1998) unidimensional
22 structure provided less than adequate fit and so did Stoeber et al.'s (2014a) multidimensional

³ These are based on the loadings of the full set of the 25 items of the PCI reported in Table 1
of Stoeber et al (2014a).

1 structure when assessed using CFA. However, Stoeber et al.'s (2014a) structure provide
2 adequate fit when assessed using ESEM.

3 *Establishing a new unidimensional version of PCI*

4 In deriving a new unidimensional version of the PCI, we first explored the underlying
5 structure of the PCI in sample one. An initial PCA indicated that six eigenvalues were above
6 1 ($\lambda_1 = 8.08$, $\lambda_2 = 2.21$, $\lambda_3 = 1.24$, $\lambda_4 = 1.16$, $\lambda_5 = 1.08$, $\lambda_6 = 1.04$) explaining 32.32%, 8.87%,
7 4.95%, 4.62%, 4.32% and 4.17% of variance. The scree plot suggested a two-component
8 solution. Parallel analysis supported a two-factor solution as only the first and second
9 eigenvalues were above the 95th percentile of the first and second random eigenvalues (λ_1
10 $= 1.82$, $\lambda_2 = 1.68$, $\lambda_3 = 1.57$). Velicer's (1976) MAP test also supported retaining two factors.
11 On this basis, in the PAF the number of factors restricted to two. Following promax rotation
12 fifteen items loaded onto Factor 1 (loadings $>.30$; items 1, 3, 4, 7, 8, 10, 11, 15, 16, 18, 19,
13 20, 22, 24, 25) and eight items loaded onto Factor 2 (loadings $>.30$; items 5, 6, 9, 12, 13, 14,
14 21, 23) with one cross-loading item (item 17) and one non-loading item (item 2). The two
15 factors were highly correlated $r = .60$. The results of these analyses are presented in Table 2.
16 When this factor solution was tested using CFA, this two-factor model provided less than
17 adequate fit: $\chi^2(276) = 618.81$, $p < .001$; $\chi^2/df = 2.23$; RMSEA = .08 [.07, .09]; CFI = .77;
18 TLI = .75; SRMR = .13; BIC = 15085.49. This was also the case when using ESEM which
19 again provided less than adequate fit: $\chi^2(251) = 441.03$, $p < .001$; $\chi^2/df = 1.76$; RMSEA = .06
20 [.05, .07]; CFI = .87; TLI = .85; SRMR = .05; BIC = 15018.32.

21 With the intention of identifying a new unidimensional version of the PCI, we
22 explored this factor solution and alternate factor structures for different possible versions of
23 the PCI. This was guided by, factor loadings, cross-loadings, and item content. It also
24 included reference to the factor solution of Stoeber et al (2014) and the criticisms of Flett and
25 Hewitt (2014) regarding item content. On this basis, we identified that a 10-item version

1 consisting largely of items with higher factor loadings and minimal cross-loadings as the
2 most replicable in regard to providing a single factor solution that was satisfactory in regard
3 to exploratory, confirmatory and exploratory-confirmatory structure. The final EFA with
4 principle axis factoring extraction for this version of the PCI (PCI-10) in samples one and
5 two is provided in Table 3. In regard to CFA, the new model provided adequate fit in sample
6 one. The adequate fit of the model was subsequently tested in sample two which again
7 provided evidence to support the proposed factor structure. The results of these analyses are
8 provided in Table 1.

9 In further support of the use of the PCI-10, it was highly correlated with the full-
10 length version of the PCI in both samples ($r = .94$ and $r = .94$ $p < .001$). The internal
11 reliability of the PCI-10 were also acceptable (Cronbach's $\alpha = .82$ and $\alpha = .87$)⁴.

12 Discussion

13 The purpose of the study was to develop a new unidimensional version of the PCI. In
14 doing so, we tested both the validity of the two factor structures of the PCI proposed by Flett
15 et al. (1998) and Stoeber et al. (2014a), and explored the underlying factor structure and item
16 content of the PCI.

17 Assessment of the previous factor structures of the PCI provided little support for the
18 unidimensional factor structure proposed by Flett et al. (1998). This was the case using
19 confirmatory analyses and when using exploratory analyses. As was found by Stoeber et al.
20 (2014a), then, the PCI appears to include multiple underlying factors rather than a single
21 factor within the 25-item scale. The multidimensional factor proposed by Stoeber et al. fared
22 better but only received mixed support. Stoeber et al.'s factor structure did not provide

⁴ Internal reliabilities for other versions of the instrument were PCI $\alpha = .91/.88$ and PCI-
concerns $\alpha = .86/.84$, PCI-strivings $\alpha = .82/.77$ and PCI-demands $\alpha = .74/.72$ (sample
one/sample two).

1 adequate fit in confirmatory analyses in either sample one or two and did not provide adequate
2 fit in exploratory-confirmatory analyses in sample one. However, it did provide adequate fit
3 in exploratory-confirmatory analyses in sample two. As such, overall, our assessment
4 suggests that the PCI is most likely multidimensional and, in contrasting the HF-MPCI with
5 the PCI, the HF-MPCI more adequately captures the underlying structure of the instrument.

6 Our own exploration of the factor structure also revealed a multidimensional, albeit
7 two-factor, structure. Factor one included all ten items from Stoeber et al.'s (2014a) PCI-
8 concerns with the addition of three PCI-demands items and one PCI-strivings item (PCI-
9 strivings/concerns/demands). Factor two included six PCI-striving items and two PCI-
10 demands items (PCI-strivings/demands). This factor solution provided inadequate fit for the
11 data in confirmatory and exploratory-confirmatory analyses. As such, it did not provide a
12 satisfactory alternative multidimensional structure to the HF-MPCI. With this in mind, our
13 analyses suggest that, in comparing an alternative multidimensional structure, the three-factor
14 structure proposed by Stoeber et al. (2014a) is the most tenable.

15 In seeking to develop a unidimensional version of the PCI, we derived a shorter 10-
16 item instrument. The PCI-10 provided superior fit in comparison to both the PCI and the HF-
17 MPCI when assessed using confirmatory analyses and provided adequate fit more
18 consistently when assessed using exploratory-confirmatory analyses. Importantly, the PCI-10
19 is also demonstrably unidimensional. It therefore offers better alignment with the theoretical
20 framework proposed by Flett et al. (1998) and the notion that perfectionistic cognitions are a
21 distinctive form of ruminative end-state thinking triggered by failure to obtain important
22 goals. These perfectionistic cognitions do not include positive thoughts about the self or
23 performance. Instead, they are characterised solely by a focus on personal deficiencies and
24 inadequacies.

1 In closing it is important to note that the issues discussed in the current paper pertain
2 to the use of the HF-MPCI. That is, the re-conceptualisation and measurement of
3 perfectionistic cognitions in a manner that is inconsistent with the theoretical framework from
4 which they were derived (Flett et al., 1998). It does not pertain to the MPCI (Kobori, 2006;
5 Kobori & Tanno, 2004; Stoeber et al., 2010). Although originally couched within Hewitt and
6 Flett's (1991; Flett et al., 1998) model, as noted by Flett and Hewitt (2014), the MPCI more
7 likely offers a separate and alternative approach. Stoeber et al (2014b) have also subsequently
8 argued that this is the case stating that the approaches should be considered complementary.
9 The merits of the MPCI will need to be considered separately from the issues raised here
10 regarding the HF-MPCI. However, if not couched within Hewitt and Flett's model, the MPCI
11 will also need to find alternative theoretical grounding so researchers and practitioners can
12 better understand multidimensional perfectionistic cognitions and the psychological processes
13 that explain how they arise.

14 **Limitations and future directions**

15 There are several limitations of the current study worthy of consideration. First, the
16 samples were recruited from sport. It is possible that the content of perfectionistic cognitions
17 is to some degree shaped by the context. For example, thoughts concerning mistakes ("I can't
18 stand to make mistakes") may be more salient in some contexts than others such as high-level
19 sport versus social interactions. The PCI-10 will therefore need to be assessed in other
20 contexts so to confirm its psychometric properties outside of sport (e.g., cross-contextual
21 invariance). Adapting the PCI so to consider contextual differences is likely to improve
22 predictive ability of the instrument so may ultimately be desirable. Secondly, a similar issue,
23 the current study we focused only on establishing the factor structure of the PCI-10. Its other
24 psychometric properties such as measurement invariance across different sample
25 characteristics (e.g., gender, age, culture) and test-retest reliability will need to be examined

1 in future research. These, too, are factors that will influence the validity of the PCI-10 and
2 need to be examined in future research (see Stoeber, Kobori, & Tanno, 2013). Thirdly, we
3 have assessed the validity of the PCI-10 in the absence of reference to external variables
4 (divergent, convergent, and incremental validity). The high correlation between the PCI and
5 PCI-10 provides some assurance that the two versions of the instruments will be similar.
6 However, confirming that the PCI-10 encapsulates the core features of perfectionistic
7 cognitions is necessary (e.g., automatic thoughts; Flett et al., 1998).

8 **Summary**

9 As described by Flett et al (1998), perfectionistic cognitions are unidimensional.
10 However, evidence has been provided that the instrument developed to measure the
11 frequency of perfectionistic automatic thoughts, the PCI, is multidimensional (Stoeber et al.,
12 2014a). While there is more work to be undertaken, in the current study we provide evidence
13 that the PCI-10 is a valid and reliable instrument to measure perfectionistic thoughts in the
14 manner that was originally intended.

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References

- 1
2 Appleton, P. R., Hall, H. K., & Hill, A. P. (2011). Examining the influence of the parent-
3 initiated and coach-created motivational climate upon athletes' perfectionistic cognitions.
4 *Journal of Sports Sciences, 29*(7), 661–671.
- 5 Asparouhov, T., & Muthén, B. (2009). Exploratory structural equation modeling. *Structural*
6 *Equation Modeling: A Multidisciplinary Journal, 16*(3), 397–438.
- 7 Child, D. (2006). *The essentials of factor analysis*. (3rd ed.). New York, NY: Continuum
8 International Publishing Group.
- 9 Donachie, T. C., Hill, A. P., & Hall, H. K. (2018). The relationship between
10 multidimensional perfectionism and pre-competition emotions of youth footballers.
11 *Psychology of Sport and Exercise, 37*, 33–42.
- 12 Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the
13 use of exploratory factor analysis in psychological research. *Psychological*
14 *Methods, 4*(3), 272–299.
- 15 Flett, G. L., & Hewitt, P. L. (2014). The multidimensional assessment of perfectionistic
16 automatic thoughts: A commentary on “Examining mutual suppression effects in the
17 assessment of perfectionism cognitions: Evidence supporting multidimensional
18 assessment”. *Assessment, 21*(6), 661–665.
- 19 Flett, G. L., Hewitt, P. L., Blankstein, K. R., & Gray, L. (1998). Psychological distress and
20 the frequency of perfectionistic thinking. *Journal of Personality and Social Psychology,*
21 *75*(5), 1363–1381.
- 22 Flett, G. L., Hewitt, P. L., Demerjian, A., Sturman, E. D., Sherry, S. B., & Cheng, W. (2012).
23 Perfectionistic automatic thoughts and psychological distress in adolescents: An analysis
24 of the Perfectionism Cognitions Inventory. *Journal of Rational-Emotive & Cognitive-*
25 *Behavior Therapy, 30*(2), 91–104.

- 1 Flett, G. L., Hewitt, P. L., Whelan, T., & Martin, T. R. (2007). The Perfectionism Cognitions
2 Inventory: Psychometric properties and associations with distress and deficits in
3 cognitive self-management. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*,
4 25(4), 255–277.
- 5 Graham, J.W., Cumsille, P.E., & Elek-Fisk, E. (2003). Methods for handling missing data. In
6 J.A. Schinka & W.F. Velicer (Eds.), *Research methods in psychology* (pp. 87–112). New
7 York, NY: Wiley.
- 8 Henson, R. K., & Roberts, J. K. (2006). Use of exploratory factor analysis in published
9 research: Common errors and some comment on improved practice. *Educational and*
10 *Psychological Measurement*, 66(3), 393–416.
- 11 Hewitt, P.L. & Flett, G.L. (1991). Perfectionism in the self and social contexts:
12 Conceptualization, assessment and association with psychopathology. *Journal of*
13 *Personality and Social Psychology*, 60, 456–470.
- 14 Hill, A. P., & Appleton, P. R. (2011). The predictive ability of the frequency of
15 perfectionistic cognitions, self-oriented perfectionism, and socially prescribed
16 perfectionism in relation to symptoms of burnout in youth rugby players. *Journal of*
17 *Sports Sciences*, 29(7), 695–703.
- 18 Klinger, E. (1996). The contents of thoughts: Interference as the downside of adaptive normal
19 mechanisms in thought flow. In I. G. Sarason, G. R. Pierce, & B. R. Sarason (Eds.),
20 *Cognitive interference: Theories, methods, and findings* (pp. 3–23). Mahwah, NJ:
21 Erlbaum.
- 22 Kobori, O. (2006). A cognitive model of perfectionism: The relationship of perfectionism
23 personality to psychological adaptation and maladaptation (Unpublished doctoral
24 dissertation). Department of Cognitive and Behavioral Science, University of Tokyo,
25 Tokyo, Japan.

- 1 Kobori, O., & Tanno, Y. (2004). Development of multidimensional perfectionism cognition
2 inventory. *Japanese Journal of Personality, 13*(1), 34–43.
- 3 Marsh, H. W., Hau, K. T., & Wen, Z. (2004). In search of golden rules: Comment on
4 hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in
5 overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling, 11*(3),
6 320–341.
- 7 Marsh, H.W., Muthén, B., Asparouhov, T., Lüdtke, O., Robitzsch, A., Morin, A.J.S., &
8 Trautwein, U. (2009). Exploratory Structural equation modeling, integrating CFA and
9 EFA: Application to students' evaluations of university teaching. *Structural Equation*
10 *Modeling, 16*, 439–476.
- 11 Martin, L. L., & Tesser, A. (1989). Toward a motivational structural theory of ruminative
12 thought. In J. S. Uleman & J. A. Bargh (Eds.), *Unintentional thought* (pp. 306–326).
13 New York, NY: Guilford.
- 14 Muthén, L.K. & Muthén, B.O. (1998–2018) *Mplus User's Guide* (8th ed.). Los Angeles, CA:
15 Muthén & Muthén.
- 16 Nolen-Hoeksema, S. (1996). Chewing the cud and other ruminations. In R. S. Wyer (Ed.),
17 *Advances in Social Cognition, Volume IX: Ruminative Thoughts* (pp. 135–144).
18 Mahwah, NJ: Erlbaum.
- 19 O'Connor, B.P. (2000). SPSS and SAS programs for determining the number of components
20 using parallel analysis and Velicer's MAP test. *Behavior Research Methods,*
21 *Instruments, & Computers, 32*, 396–402.
- 22 Pyszczynski, T., & Greenberg, J. (1987). Self-regulatory perseveration and the depressive
23 self-focusing style: a self-awareness theory of reactive depression. *Psychological*
24 *Bulletin, 102*(1), 122–138.

- 1 Rudolph, S. G., Flett, G. L., & Hewitt, P. L. (2007). Perfectionism and deficits in cognitive
2 emotion regulation. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 25(4),
3 343-357.
- 4 Stoeber, J., Kobori, O., & Brown, A. (2014a). Examining mutual suppression effects in the
5 assessment of perfectionism cognitions: Evidence supporting multidimensional
6 assessment. *Assessment*, 21(6), 647-660.
- 7 Stoeber, J., Kobori, O., & Brown, A. (2014b). Perfectionism cognitions are multidimensional:
8 A reply to Flett and Hewitt (2014). *Assessment*, 21, 666-668.
- 9 Stoeber, J., Kobori, O., & Tanno, Y. (2010). The Multidimensional Perfectionism Cognitions
10 Inventory–English (MPCI–E): Reliability, validity, and relationships with positive and
11 negative affect. *Journal of Personality Assessment*, 92(1), 16-25.
- 12 Stoeber, J., Kobori, O., & Tanno, Y. (2013). Perfectionism and self-conscious emotions in
13 British and Japanese students: Predicting pride and embarrassment after success and
14 failure. *European Journal of Personality*, 27(1), 59-70.
- 15 Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th ed.). Boston, MA:
16 Allyn & Bacon.
- 17 Velicer, W. F. (1976). Determining the number of components from the matrix of partial
18 correlations. *Psychometrika*, 41(3), 321-327.
- 19 Wanke, M., & Schmid, J. (1996). Rumination: When all else Fails. In R. S. Wyer (Ed.),
20 *Advances in Social Cognition, Volume IX: Ruminative Thoughts* (pp. 177-187). Mahwah,
21 NJ: Erlbaum.
- 22 Worthington, R.L., & Whittaker, T.A. (2006). Scale development research: A content
23 analysis and recommendations for best practices. *The Counseling Psychologist*, 34, 806-
24 838.
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1 Table 1

2 *Confirmatory (CFA) and Exploratory-Confirmatory (ESEM) Factor Analyses of Perfectionism Cognitions Inventory*

	χ^2	df	χ^2/df	CFI	TLI	RMSEA [90% CI]	SRMR	BIC
Sample one								
PCI	624.05*	275	2.27	.77	.75	.08 [.07, .09]	.08	15104.96
ESEM: HF-MPCI	399.55*	228	1.75	.89	.85	.05 [.05, .07]	.05	15068.42
CFA: HF-MPCI	537.97*	272	1.98	.82	.81	.07 [.06, .08]	.07	15020.60
PCI-10	71.34*	35	2.04	.94	.92	.07 [.05, .10]	.05	6108.95
Sample two								
PCI	681.80*	275	2.48	.70	.68	.08 [.08, .09]	.09	14740.16
ESEM: HF-MPCI	330.04*	228	1.45	.93	.90	.05 [.03, .06]	.05	14576.79
CFA: HF-MPCI	596.08*	272	2.19	.76	.74	.08 [.07, .08]	.09	14653.94
PCI-10	67.09*	35	1.92	.92	.90	.07 [.04, .09]	.06	6058.08

3 *Note.* PCI-25 = original unidimensional structure proposed by Flett et al. (1998); HF-MPCI = three factor structure of the PCI from Stoeber
4 et al. (2014); PCI-10 = new 10-item unidimensional structure of PCI. Minor discrepancies between the results for Sample 1 and the results
5 reported in Donachie et al (2018) are due to differences in preliminary analyses.

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1 Table 2
 2 *Exploratory Factor Analyses of Perfectionism Cognitions Inventory (Sample 1)*

Pattern coefficients (promax rotation)	F1	F2	h^2
16. Why can't things be perfect?	.80	-.12	.54
3. I should be perfect.	.71	-.06	.46
1. Why can't I be perfect?	.69	-.16	.37
11. People expect me to be perfect.	.68	-.13	.37
22. I can't do this perfectly.	.65	-.01	.41
10. No matter how much I do, it's never good enough.	.62	-.01	.38
19. My work should be flawless.	.59	.19	.51
15. I expect to be perfect.	.59	.13	.46
20. Things are seldom ideal.	.58	-.02	.32
18. It would be great if everything in my life were perfect.	.54	.05	.32
8. I can't stand to make mistakes.	.51	.17	.39
24. Maybe I should lower my goals.	.50	-.13	.19
25. I am too much of a perfectionist.	.48	.08	.28
17. My work has to be superior.	.44	.33	.47
7. I should be doing more.	.41	.16	.28
4. I should never make the same mistake twice.	.39	.14	.23
13. My goals are very high.	-.14	.76	.47
5. I've got to keep working on my goals.	-.16	.67	.35
9. I have to work hard all the time.	-.12	.64	.33
23. I certainly have high standards.	.03	.64	.43
14. I can always do better, even if things are almost perfect.	.12	.55	.31
6. I have to be the best.	.12	.52	.35
21. How well am I doing?	-.01	.50	.24
12. I must be efficient at all times.	.19	.49	.39
2. I need to do better.	.26	.26	.21

3 *Note.* F1 = Factor 1; F2 = Factor 2. $r(F1, F2) = .60, p < .05$; Substantial loadings
 4 ($|loadings| > .30$) are boldfaced.

Table 3

Final Exploratory Factor Analyses of Perfectionism Cognitions Inventory-10 (Sample one and two)

Pattern coefficients (promax rotation)	F1	h^2	F1	h^2
3. I should be perfect.	.65	.42	.75	.56
8. I can't stand to make mistakes.	.66	.43	.49	.24
10. No matter how much I do, it's never good enough.	.60	.36	.57	.33
12. I must be efficient at all times.	.51	.26	.35	.12
15. I expect to be perfect.	.70	.49	.70	.49
16. Why can't things be perfect?	.66	.44	.64	.41
17. My work has to be superior.	.68	.47	.60	.36
19. My work should be flawless.	.72	.52	.67	.46
22. I can't do this perfectly.	.61	.38	.32	.10
25. I am too much of a perfectionist.	.55	.30	.46	.21

1 *Note.* Sample one (n=200) to left. Sample two (n=213) to the right. F1 = Factor 1; Substantial loadings ($|\text{loadings}| > .30$) are boldfaced.

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