

Self-Critical Perfectionism and Binge Eating Symptoms: A Longitudinal Test of the Intervening Role of Psychological Need Frustration

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Although abundant research has shown that self-critical perfectionism relates to binge eating symptoms, fewer studies have addressed the role of intervening processes that might explain why this is the case. Grounded in self-determination theory, we hypothesized that self-critical perfectionism would relate to an increased risk for binge eating symptoms because it engenders frustration of the psychological needs for autonomy, competence, and relatedness. This hypothesis was tested in a sample of 566 adolescents (72% female; mean age = 13.3 years) using a 3-wave longitudinal study with a 6-month interval. Structural equation modeling analyses showed that self-critical perfectionism related to increases in psychological need frustration which, in turn, predicted increases in binge eating symptoms. Structural relations were found to be equivalent for males and females. Theoretical and clinical implications of these findings are discussed.

Keywords: self-critical perfectionism, psychological needs, binge eating, longitudinal, self-determination theory

Clinical as well as subclinical binge eating symptoms (i.e., uncontrollable eating of a large amount of food in a short period of time) are highly prevalent in adolescent boys and girls (Abebe, Lien, Torgersen, & von Soest, 2012), with studies showing prevalence rates from 1.5% to 4% (Hoek, 2006; Hudson, Hiripi, Pope, & Kessler, 2007). Such high prevalence rates urge scholars to examine risk factors of binge eating so as to prevent the development of full-blown clinical eating disorders. One factor that has consistently been found to increase the risk for binge eating symptomatology is self-critical (SC) perfectionism (e.g., Bardone-Cone et al., 2007). To deepen our understanding of why adolescents high on self-criticism are more prone to develop binge eating problems, we tested the role of psychological need frustration as an explanatory mechanism.

We hypothesized that a self-critical perfectionistic attitude would contribute actively to the frustration of the basic psychological needs for autonomy, relatedness, and competence, as conceived within self-determination theory (Deci & Ryan, 2000). Whereas satisfied psychological needs contribute to psychological well-being, growth, and vitality, the frustration of these same needs elicits ill-being and depletes people's energy resources

(Ryan, Deci, Grolnick, & La Guardia, 2006; Vansteenkiste & Ryan, in press). Because episodes of uncontrollable overeating emerge more easily when people are low on energy and feel drained (Baumeister, Vohs, & Tice, 2007) or occur more frequently following negative emotions (Dingemans, Martijn, Jansen, & van Furth, 2009), need frustration in particular seemed an ideal candidate to account for the link between self-critical perfectionism and binge eating symptoms.

Self-Critical Perfectionism and Binge Eating Symptoms

SC perfectionism is characteristic of individuals who set rigid and unrealistically high standards for themselves. Moreover, self-critical individuals have pervasive doubts about whether their performance is good enough, are highly concerned with making mistakes, and engage in harsh negative self-evaluation when confronted with failure (Blatt, 2004; Frost, Marten, Lahart, & Rosenblate, 1990).

This critical self-evaluative tendency renders individuals vulnerable to a wide range of types of psychopathology, including depressive symptoms (Luyten et al., 2007), anxiety, and eating pathology (Bardone-Cone et al., 2007). As such, perfectionism can be considered a transdiagnostic vulnerability factor for psychopathology (Egan, Wade, & Shafran, 2011). Specifically with regard to eating pathology, studies among patients with eating disorders have consistently shown that currently ill and even patients recovered from an eating disorder display elevated levels of SC perfectionism compared to healthy individuals (e.g., Halmi et al., 2000; Soenens, Vansteenkiste, et al., 2008). Further, longitudinal research in nonclinical samples indicated that SC perfectionism relates to increases in binge eating over time, providing evidence that SC perfectionism constitutes a vulnerability factor for the development of binge eating (Boone, Soenens, & Braet, 2011; Flett & Hewitt, 2005; Mackinnon et al., 2011; Mushquash &

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Sherry, 2013). A recent experimental study even showed that priming SC perfectionism increased the probability of engaging in binge eating during the 24 hr following the prime (Boone, Soenens, Vansteenkiste, & Braet, 2012).

Although these studies show rather convincingly that SC perfectionism relates to binge eating, the exact mechanisms involved in this association are less well documented. This is an intriguing question as, at first sight, the association between SC perfectionism and binge eating seems rather counterintuitive. Indeed, why would SC perfectionism, as a relatively overcontrolled personality dimension involving rigidity and excessive conscientiousness, relate to more undercontrolled and impulsive symptoms such as binge eating? A few longitudinal studies to date have provided insight into this question (Boone et al., 2011; Mackinnon et al., 2011). For instance, Sherry and Hall (2009) tested a model in which SC perfectionism relates to changes in binge eating through the generation of interpersonal discrepancy, depressive affect, dietary restraint, and low interpersonal esteem. Drawing on the sociocultural model, Boone et al. (2011) showed that SC perfectionism predicted increases in bulimic symptoms over a 2-year period through the adoption of the thin ideal.

Some of the explanatory variables in these studies, such as the adoption of the thin ideal and dietary restraint, are rather specific in nature as they are specifically tied to eating-related dynamics. As such, they help to understand why SC perfectionism renders individuals vulnerable for eating pathology in particular. Different from such a specific focus, Sherry and Hall (2009) examined more global mechanisms such as depressive affect and interpersonal discrepancy and esteem. Given that SC perfectionism renders individuals vulnerable to not only eating pathology but also a broad range of manifestations of psychopathology, we believe that a focus on these broader mechanisms is essential. The identification of a more global mechanism may help to capture the broader dynamics involved in perfectionism as a transdiagnostic vulnerability factor (Egan et al., 2011) and may help to provide more insight into the reasons why SC perfectionism leads to multiple disorders (i.e., multifinality; see Nolen-Hoeksema & Watkins, 2011, for an overview).

In this study, we aimed to build on previous work identifying more general underlying mechanisms by relying on an overarching theoretical perspective that has received relatively little attention in the field of eating regulation, that is, self-determination theory (SDT; Deci & Ryan, 2000; Vansteenkiste, Niemiec, & Soenens, 2010). Within SDT it is maintained that the frustration of the psychological needs is implicated in various forms of psychopathology, including eating pathology (Ryan et al., 2006). Frustration of basic psychological needs represents a potential theory-driven and general mechanism that may account for the association between SC perfectionism and binge eating symptoms. Interestingly, processes of psychological needs are assumed to be implicated not only in the development of psychopathology but also in the development of resilience and growth (Ryan & Deci, 2000a). The notion that the very process that leads to vulnerability may also represent a path toward the development of resilience has important practical implications, as it might guide prevention and intervention programs to simultaneously reduce psychopathology and optimize resilience and growth.

Basic Psychological Needs

A central tenet of SDT involves the postulation of a set of basic psychological needs, that is, the needs for autonomy, relatedness, and competence (Deci & Ryan, 2000; Ryan & Deci, 2000b). The need for autonomy refers to the need to experience a sense of volition and choice in one's activities. The need for relatedness reflects the need to feel loved and cared for by significant others. The need for competence reflects the need to feel effective in one's actions and to be able to achieve one's goals. Much as plants need water and sunshine to flower, human beings' psychological needs have to be fulfilled to promote growth and well-being (Ryan, 1995). In line with this claim, research has shown that satisfaction of each of these three needs is related positively to well-being and negatively to ill-being across different cultures and life domains (e.g., Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Ryan & Deci, 2000b; Vansteenkiste, Lens, Soenens, & Luyckx, 2006). More germane to the present research, a number of studies have investigated the link between the needs and eating pathology. For instance, Thøgersen-Ntoumani, Ntoumanis, and Nikitaras (2010) found that need satisfaction was associated negatively with body image concerns, which in turn related positively to unhealthy weight control behaviors. Further, Schüler and Kuster (2011) found that unfulfilled basic needs related positively to binge eating.

Although many studies examined the association between need satisfaction or a lack thereof and people's personal development and well-being, the role of the active blocking or thwarting of these same psychological needs has been studied less. In a number of recent studies (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Sheldon & Gunz, 2009), it has been argued and found that the frustration of the psychological needs—rather than the mere deprivation or lack of fulfillment of them—is particularly important in the etiology of maladaptive outcomes and psychopathology. This claim is grounded in the growing recognition that a lack of experienced need satisfaction does not by definition imply active need frustration. To illustrate, although a teenage girl may have the impression that she has few close friends, it is only when she is actively excluded or rejected by her peers that her need for relatedness is frustrated. In a similar vein, although an adolescent may receive little positive feedback (i.e., low competence satisfaction), his need for competence would only be actively thwarted when he is explicitly criticized by his teacher. As for autonomy, an adolescent may feel that her parents do not actively nurture her interests, yet her autonomy would only be actively thwarted when she feels pressured to act in certain ways. While need satisfaction serves as a nutrient for growth, the presence of need frustration would not only slow down growth but would also even elicit malfunctioning, much as poison leads to a more rapid deterioration of plants than the absence of water (Vansteenkiste & Ryan, in press).

To the best of our knowledge, the separate effects of the absence of need satisfaction and the presence of need frustration in the prediction of eating pathology have been examined in only two recent studies. Bartholomew, Ntoumanis, Ryan, Bosch, and Thøgersen-Ntoumani (2011) showed in a sample of female athletes that need frustration rather than the absence of need satisfaction was related to disordered eating. Further, assessing adoles-

cents' psychological need satisfaction and need frustration on a day-to-day basis, [Verstuyf, Vansteenkiste, Soenens, Boone, and Mouratidis \(2013\)](#) found that need frustration, but not unfulfilled need satisfaction, related to daily fluctuations in participants' binge eating symptoms. Binge eating would be a compensatory yet dysfunctional behavior to handle the negative affect elicited by need frustration ([Vansteenkiste & Ryan, in press](#)). Further, because need frustrating experiences deplete energetic resources, less energy is available to adequately regulate one's eating pattern (e.g., resisting fatty and sugary foods), thereby making one more vulnerable to binge eating ([Baumeister, Muraven, & Tice, 2000](#)).

Self-Critical Perfectionism and Need Frustration

In this study, we consider the possibility that SC perfectionism would increase the odds of frustration of each of the three needs. SC perfectionism would predict increased autonomy frustration because SC perfectionists typically hinge their self-esteem on achievements, thereby leaving little room for flexibility in achieving their intended perfect performance ([Shafran, Cooper, & Fairburn, 2002](#)). Because SC perfectionists can only feel good about themselves when they excel, they constantly pressure themselves to perform better. In line with this reasoning, SC perfectionists have been shown to be driven by a controlled (i.e., pressured) regulation of their behavior ([Mouratidis & Michou, 2011](#); [Vansteenkiste, Smeets, et al., 2010](#)). Rather than acting because they want to, SC perfectionists act out of "mustivation," which is ultimately autonomy frustrating.

Further, there are several reasons why SC perfectionism would engender competence frustration. For instance, SC perfectionists typically strive for unrealistically high, almost utopian standards ([Shafran et al., 2002](#)), which increases the odds of failure ([Blatt, 1995](#)). Moreover, when they fail to live up to their standards, SC perfectionists engage in harsh self-criticism, which further exacerbates their feelings of failure. Even after they perform successfully, positive feelings are often short-lived and standards are reappraised as insufficiently demanding ([Egan et al., 2011](#)). In other words, because SC perfectionists feel like their performance is never good enough, they rarely derive a sense of competence from their achievements ([Frost & Marten, 1990](#); [Hamachek, 1978](#)).

Finally, SC perfectionism has been shown to relate to more interpersonal distance ([Habke & Flynn, 2002](#)), which is indicative of relatedness frustration. Because of their competitive attitude, perfectionists are more likely to see others as opponents and to display a dominant and hostile attitude, for instance, by feeling superior and looking down on others ([Habke & Flynn, 2002](#)). Further, due to their strong focus on self-definition, SC perfectionists tend to neglect the importance of interpersonal relations, leading to a distortion of the quality of interpersonal experiences ([Blatt, 2008](#); [Blatt & Luyten, 2009](#)).

The Present Study

The primary purpose of the present study was to examine whether frustration of the basic psychological needs, as conceived within SDT, represents a meaningful explanatory mechanism in the association between SC perfectionism and binge eating. The present study goes beyond past work in SDT, as most previous studies looked at social-environmental factors (e.g., con-

trolling socialization; [Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011](#)) that might precede need frustration rather than at the role of personality characteristics such as SC perfectionism. Moreover, most of these previous studies in the SDT literature are cross-sectional in nature (e.g., [Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011](#)), while the present work used a longitudinal design.

Using a cross-lagged study design with three waves (separated by 6-month intervals), we examined the intervening role of the basic psychological needs in the relation between SC perfectionism and increases in binge eating symptoms. Specifically, we examined whether SC perfectionism at Time 1 would predict increases in need frustration and decreases in need satisfaction from Time 1 to Time 2 and whether these changes would in turn predict changes in binge eating symptoms from Time 2 to Time 3 or from Time 1 to Time 3. In line with recent research findings pointing to the importance of differentiating need satisfaction from need frustration, we considered both constructs as potential intervening variables. Yet we expected need frustration to be predicted by SC perfectionism and to predict, in turn, increases in binge eating. That is, SC perfectionists would not just experience lower need satisfaction over time, they would increasingly have the feeling that their psychological needs were actively blocked and frustrated, which would make them more vulnerable to engage in binge eating.

Finally, we examined whether the proposed structural model would apply across gender. This was done for two reasons. First, if the model would apply to both boys and girls, this would increase the generalizability and robustness of our findings. Second, although it has been shown that females display somewhat higher levels of binge eating symptoms compared to males ([Striegel-Moore et al., 2009](#)), we expected that the structural associations would be equivalent across gender because the underlying processes involved in the development of binge eating pathology would be similar. Whereas some previous studies provided evidence for such structural equivalence (e.g., [Boone et al., 2011](#)), other studies failed to do so (e.g., [Costanzo, Musante, Friedman, Kern, & Tomlinson, 1999](#)).

Method

Participants and Procedure

Participants were 566 adolescent boys ($N = 165$; 29%) and girls ($N = 401$; 71%) aged between 11 and 15 years ($M = 13.28$ years, $SD = 0.89$) from two secondary schools in Flanders (Belgium). All participants were Caucasian, 79% came from intact families, 20% had divorced parents, and 1% came from a family in which one of the parents had died. Prior to data collection, a passive informed consent was obtained from parents and active assent was obtained from the adolescent. Questionnaires were administered during class and under the supervision of the primary investigator of this study. Adolescents did not receive any incentive for participation in the study. The study procedures have been approved by the local research ethics committee of Ghent University.

Measures

Participants filled out a set of questionnaires at three time points, separated by about 6 months. At all three time points, participants

completed questionnaires regarding SC perfectionism, need satisfaction and frustration, and binge eating symptoms. All measures in the present study were translated from English to Dutch, the participants' mother tongue, according to the guidelines of the International Test Commission (Hambleton, 1994).

Self-critical perfectionism. Participants completed the subscales for Concern over Mistakes (CM; nine items) and Doubts about Actions (DA; four items) from the Frost Multidimensional Perfectionism Scale (F-MPS; Frost et al., 1990). Items were rated on a 5-point Likert scale, rated from 1 (*totally disagree*) to 5 (*totally agree*). The F-MPS has been shown to have good psychometric properties in its original version (Frost et al., 1990) as well as in translated versions, including the Dutch version that was used in this study (Soenens, Luyckx, et al., 2008). As in many previous studies (e.g., Park, Heppner, & Lee, 2010; Soenens, Luyckx, et al., 2008), the items from the CM and DA subscales were combined into a composite score representing SC perfectionism. This approach is justified by previous research showing that items from these subscales consistently load on the same factor, while items tapping into the setting of high standards as such load on a separate factor (e.g., Dunkley, Blankstein, Halsall, Williams, & Winkworth, 2000; Frost & Marten, 1990). In this study, Cronbach's alpha for SC perfectionism was .89, .89, and .92 at T1, T2, and T3, respectively.

Need satisfaction and frustration. Need satisfaction and frustration were measured using the Balanced Measure of Psychological Needs (Sheldon & Hilpert, 2012). The scale contains a balanced number of items tapping into both the satisfaction and frustration of the psychological needs for autonomy, competence, and relatedness. Items were rated on 5-point Likert scale, ranging between 1 (*totally not agree*) and 5 (*totally agree*). Each need was assessed with six items, three of which tapped into need satisfaction and three into need frustration. Because we did not have differential predictions for each of the separate needs, we created, in line with past work (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani), composite scores of need satisfaction and need frustration by averaging their respective items. In the current study, the internal consistency of these composite need satisfaction and need frustration scales were satisfactory, ranging between .78 and .82 across the three waves. These reliability estimates are similar to those reported for the original instrument by Sheldon and Hilpert (2012).

Binge eating symptoms. Binge eating symptoms were measured using the Bulimia subscale of the validated Dutch version (van Strien & Ouwens, 2003) of the Eating Disorder Inventory II (EDI-II; Garner, 1991), which assesses "the tendencies to think about and engage in bouts of uncontrollable overeating" (Garner, 1991, p. 5). One item was not included in the computation of the scale score (i.e., "I have thought of trying to vomit in order to lose weight"), since we were mainly interested in assessing binge eating rather than compensatory bulimic behaviors (e.g., Verstuyf, Vansteenkiste, & Soenens, 2012; Woods, Racine, & Klump, 2010). Participants indicated to what extent they engaged in overeating and experienced loss of control during eating on a 6-point Likert scale ranging from 1 (*never*) to 6 (*always*). The EDI-II is widely used to assess psychological and behavioral characteristics of eating disorders and has been shown to have good psychometric properties (Garner, 1991; van Strien & Ouwens, 2003). Similar to findings obtained in other nonclinical samples (e.g., van Strien &

Ouwens, 2003), only a limited number of adolescents (i.e., 9%) reported at T1 that they had engaged in binge eating at least sometimes (i.e., a score of 3 or higher). In this study, internal consistency for binge eating symptoms was .74 at Wave 1, .80 at Wave 2, and .83 at Wave 3.

Adjusted body mass index (BMI) T1. At baseline, each participant provided self-reports of current weight (kg) and height (m). The body mass index was calculated as weight (in kg)/height (in m)². This study used the adjusted BMI [(actual BMI/percentile 50 of BMI for age and gender) × 100], to allow for comparisons with children of the same age and gender. The 50th percentiles of the BMI for age and gender are based on normative data in a Flemish sample (Roelants & Hauspie, 2004). Seventy-nine percent of the adolescents had normal weight, 15% were classified as underweight, and 6% were overweight.

Data analytic strategy. Missing data analysis was conducted, and descriptive statistics and bivariate correlations were presented. Structural equation modeling (SEM) with latent variables was used to examine the main hypotheses, using Mplus. We used a robust maximum likelihood estimator, and full information maximum likelihood was used to generate unbiased parameter estimates. Following the recommendations of Cole and Maxwell (2003), cross-lagged mediation models were estimated by including autoregressive (stability) effects, cross-sectional covariances, and the hypothesized cross-lagged paths between the constructs across time. In testing the main models we controlled for relevant background variables (age, gender, and adjusted BMI) by allowing paths from the background variables to the latent constructs of all study variables. Multigroup analyses for gender were performed while controlling for age and adjusted BMI. A number of fit indices were used to evaluate the model (Kline, 2005): the chi-squared test, the comparative fit index (CFI), the root-mean-square error of approximation (RMSEA) with 90% confidence intervals (CI), and the standardized root-mean-square residuals (SRMR). As indicators of acceptable fit (Kline, 2005), we used χ^2/df ratio of 2 or below, CFI values of .90 or above, RMSEA values of .06 or below, and SRMR values of .08 or below. For model comparisons, scaled chi-square difference test and Δ CFI values were used when comparing the fit of the constrained model with the fit of the unconstrained model (Cheung & Rensvold, 2002). When the scaled chi-square difference test is significant and the Δ CFI is greater than .01, the models differ significantly from each other. Bootstrap analysis, based on 1,000 samples, was used to estimate bias-corrected standard errors and 95% (BCa 95%) CI for the indirect effect. If zero is not included in the 95% CI for an indirect effect, then the indirect effect is significant at $p < .05$.

Results

Missing Data Analysis

As is often the case with longitudinal data, there was some drop-out during the study, as not all adolescents who participated at Wave 1 participated at Waves 2 and 3. In addition, some adolescents who did not participate at Wave 1 joined the study at Waves 2 and 3. A total of 395 participants participated at all three measurement waves. We also included in the analyses those who participated in two waves ($n = 171$), leading to a total of 566 participants. We deemed it critical to remove participants who had

participated only once ($n = 88$) to reduce biased estimates of the data and to ensure we obtained valid and reliable estimations of the missing data. To examine whether similar findings would be obtained when using all participants in the sample, we also did the main (cross-lagged) analyses as depicted in Figure 1, using all participants. Results showed almost identical results for the critical mediational sequence. Participants with and without missing data were compared using R. J. A. Little's (1988) missing completely at random (MCAR) test. A nonsignificant χ^2 test or a χ^2/df ratio value of 2 or less suggests that missing values can be estimated reliably. Comparison of means and covariances of all variables for participants who participated in at least two measurement waves revealed a χ^2/df ratio of .98. As a result, missing values were estimated using full information maximum likelihood (FIML).

Descriptive Statistics and Preliminary Analyses

Correlations between the manifest study variables are presented in Table 1. It should be noted that because of the large sample size, weak correlation coefficients (for instance correlations of .10) reach significance. All stability coefficients were high, with the highest stability for binge eating symptoms (ranging from .58 to .64). Correlation analyses showed that SC perfectionism at T1 was associated with less need satisfaction and more need frustration and binge eating both within and across waves. Binge eating was associated with less need satisfaction and more need frustration both within and across waves.

A similar pattern emerged when using the separate subscales (i.e., the separate needs) of the need satisfaction and frustration scores rather than the composite scores, with correlations of satisfaction of the three needs with perfectionism and binge eating symptoms ranging from $-.10$ to $-.37$ (all $ps < .05$) and with correlations of frustration of the three needs with perfectionism

and binge eating symptoms ranging from .20 to .67 (all $ps < .001$). Because the associations of the three separate needs with SC perfectionism and binge eating were fairly similar and because of the low reliability of some of the separate need scales, only the composite scores for need frustration and need satisfaction were used in subsequent analyses.

The background variables age and adjusted BMI were associated with several study variables (see Table 1). Further, an analysis of variance revealed that gender had a significant effect on need frustration T1 [$F(1, 540) = 4.21, p < .05, \eta^2 = .01$, Cohen's $d = 0.20$] and binge eating symptoms T2 [$F(1, 487) = 13.51, p < .001, \eta^2 = .02$, Cohen's $d = 0.38$], with boys ($M = 2.51$) reporting higher levels of need frustration T1 compared to girls ($M = 2.39$) and with girls ($M = 1.94$) reporting higher levels of binge eating T2 compared to boys ($M = 1.69$). Because these background variables were related to the study variables, they were taken into account in the primary analyses by allowing structural paths from gender, age, and adjusted BMI to all study variables at all measurement waves. The paths from gender were deleted from the model when testing whether gender moderated the associations.

To examine mean-level change and stability in the study variables, we performed univariate analyses of change and stability using latent growth curve modeling to test the stability of the constructs (Duncan, Duncan, Strycker, Li, & Alpert, 1999). The maximum likelihood estimator was used to obtain FIML estimates. Using latent growth curve modeling, changes in all four study variables across the three time points could be examined. For each variable, two latent factors were modeled: (a) the intercept, reflecting the level of each variable at a fixed measurement point (i.e., T1), and (b) the slope, which describes the rate of change over time (Duncan et al., 1999). The linear slope pattern coefficients for the measures were fixed at 1 and 2 for T2 and T3. Results showed that

Table 1
Means, Standard Deviations, and Correlations Between Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Time 1														
1. Age														
2. Adjusted BMI	.01													
3. Self-critical perfectionism	.17***	-.03												
4. Need satisfaction	-.18***	.02	-.37***											
5. Need frustration	.13**	.08	.55***	-.49***										
6. Binge eating	.19***	.13**	.39***	-.25***	.37***									
Time 2														
7. Self-critical perfectionism	.15**	-.04	.60***	-.30***	.39***	.26***								
8. Need satisfaction	-.13**	.05	-.31***	.54***	-.34***	-.23***	-.38***							
9. Need frustration	.09*	.01	.52***	-.38***	.58***	.29***	.64***	-.47***						
10. Binge eating	.16***	.10*	.42***	-.21***	.27***	.64***	.37***	-.32***	.40***					
Time 3														
11. Self-critical perfectionism	.11***	-.04	.51***	-.26***	.31***	.14**	.58***	-.23***	.41***	.20***				
12. Need satisfaction	-.07	.06	-.28***	.48***	-.36***	-.23***	-.29***	.58***	-.49***	-.24***	-.23***			
13. Need frustration	.10*	-.03	.53***	-.32***	.58***	.33***	.45***	-.37***	.65***	.30***	.58***	-.45***		
14. Binge eating	.14**	.06	.34***	-.24***	.30***	.58***	.34***	-.26***	.40***	.64***	.31***	-.33***	.40***	
Mean	13.28	97.05	1.96	3.93	2.42	1.81	2.02	3.79	2.49	1.86	2.03	3.75	2.44	1.83
SD	0.89	12.61	0.66	0.50	0.66	0.67	0.68	0.58	0.70	0.78	0.73	0.58	0.72	0.82

Note. Test-retest correlations appear in bold. BMI = body mass index.
* $p < .05$. ** $p < .01$. *** $p < .001$.

the slope means of SC perfectionism ($\beta = .04, p < .01$) and need satisfaction ($\beta = -.10, p < .001$) were significant, indicating that there was an average increase in SC perfectionism and a decrease in need satisfaction over time. The slope means of binge eating and need frustration were not significant, indicating that there was no average change in these variables. Furthermore, the slope variance of all variables reached significance, indicating interindividual differences in the rate of change in all constructs.

Primary Analyses

Measurement model information. In the SEM analyses, each latent variable was represented by parcels rather than by individual scale items. Parcels are likely to have a stronger relationship to the latent variable, are less likely to be affected by method effects, and are more likely to meet assumptions of normality (T. D. Little, Cunningham, Shahar, & Widaman, 2002; Marsh, Hau, Balla, & Grayson, 1998). SC perfectionism and binge eating were represented by three parcels (Kline, 2005; T. D. Little et al., 2002; Marsh et al., 1998). In both cases, items were assigned randomly to the parcels. The approach of random assignment is quite common and is recommended in cases where items do not differ strongly in terms of variance or item-total correlation (Kline, 2005; T. D. Little et al., 2002), which was the case in our data. In general, parceling is considered an appropriate approach to create indicators for latent factors when the items represent a largely unidimensional scale. Exploratory factor analyses (principal axis factoring) on the items for SC perfectionism and on the items for binge eating showed a one-factor solution explained most of the variance (accounting for 39% and 34% of the variance in, respectively, SC perfectionism and binge eating at T1), with all items loading substantially on the retained factor ($>.52$ and $>.43$, for SC perfectionism and binge eating, respectively).

Reliability coefficients of the parcels ranged from .80 to .70 for SC perfectionism, and from .43 to .69 for binge eating symptoms. The parcels for binge eating contained only two items, which evidently resulted in a lower reliability. Yet this relatively lower reliability does not represent a problem for the estimation of the underlying latent factor. As long as the parcels are strongly correlated (which was the case), their common variance is sufficiently large to represent a latent factor. Moreover, by estimating a latent factor (which contains only the common variance), error variance caused by low reliability is controlled for. In line with previous studies (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011), scores for the individual needs (i.e., relatedness, competence, and autonomy) were used as indicators for need frustration and need satisfaction at the three measurement points. Reliability estimates of these scores ranged between .51 and .72. The final model involved 12 latent variables and 36 indicators. The three background variables (i.e., age, gender, and adjusted BMI) were represented as manifest variables.

Measurement model. Confirmatory factor analysis was used to test the validity of the measurement model. Two different measurement models were compared to test whether variation occurred in factor loadings across waves. In the first model, for each latent construct, factor loadings were constrained across waves, while freeing intercepts and error variances. The fit of this constrained model was compared to the fit of an unconstrained model in which factor loadings were allowed to vary across waves

(Cole & Maxwell, 2003). The scaled chi-square difference test and the difference in CFI revealed that the constrained model, $\chi^2(508) = 737.19 = 1.45, p < .001$; CFI = .975, and the unconstrained model, $\chi^2(492) = 721.30 = 1.47, p < .001$; CFI = .976, did not significantly differ from each other, indicating that the equality constraints were justified and that our latent variables were measured similarly across waves, scaled $\Delta\chi^2(16) = 16.93, p > .05$; $\Delta\text{CFI} = .001$. All indicators had significant and moderate to strong loadings on the latent factors, ranging from .63 to .91 (all $ps < .001$), suggesting that latent variables were adequately measured by their respective manifest indicators.

Cross-lagged analyses. The cross-lagged mediation model included all possible autoregressive (stability) coefficients, all possible within-time associations between constructs, and all possible cross-lagged paths between constructs. This model yielded a good fit to the data: $\chi^2(604) = 1,004.08, p < .001, \chi^2/df$ ratio = 1.66, RMSEA = .036 (90% CI [.032, .039], CFI = .96, SRMR = .050). In this model, SC perfectionism did not predict changes in need satisfaction. As hypothesized, the cross-lagged path from EC perfectionism T1 to need frustration T2 did reach significance ($\beta = .28, p < .001$), suggesting that SC perfectionism engenders increases in need frustration over time. Unexpectedly, psychological need frustration at T2 did not predict an increase in binge eating symptoms at T3. Further inspection revealed that the non-significance of this association was probably due to high level of stability of binge eating over a 6-month interval. Indeed, the autoregressive paths for binge eating symptoms were $\beta = .71, p < .001$ from T1 to T2, and $\beta = .84, p < .001$ from T2 to T3. To examine whether need frustration would predict changes in binge eating symptoms over a longer period of time (i.e., a 1-year interval rather than a 6-month interval) we estimated an additional model in which we removed binge eating symptoms at T2. This model had a satisfactory fit, $\chi^2(511) = 889.69, p < .001, \chi^2/df$ ratio = 1.74, RMSEA = .038, 90% CI [.034, .042], CFI = .95, SRMR = .051, and is shown in Figure 1. As can be noticed, the cross-time stability in binge eating symptoms over the 1-year interval dropped to .50 and need frustration at T2 was now predictive of increases in binge eating symptoms from T1 to T3, while the initial relation between SC perfectionism at T1 and increases in need frustration at T2 remained significant. In addition to these hypothesized paths, one other unanticipated yet interesting path emerged. Binge eating symptoms at T1 were predictive of decreases in need satisfaction from T1 to T2. Finally, in the adjusted cross-lagged model the standardized indirect effect from SC perfectionism at T1 to binge eating symptoms at T3 through need frustration at T2 was significant ($\beta = .11, p < .01$; BCa CI 95% = [.037, .179]).

Multigroup analysis with gender as a moderator. Before examining whether the model in Figure 1 was invariant across gender, we examined the measurement equivalence across gender by constraining the factor loadings of each latent construct to be equal, while freeing intercepts and error variances. We compared the fit of such a constrained model to the fit of an unconstrained model in which all factor loadings were allowed to vary between male and female participants. Note that, in testing these models, the factor loading of the first indicator of each latent construct was fixed to 1 (so as to identify the scale of the latent variables). In addition, the factor loadings of the second and the third indicators were constrained to be equal over time (so as to ensure that the

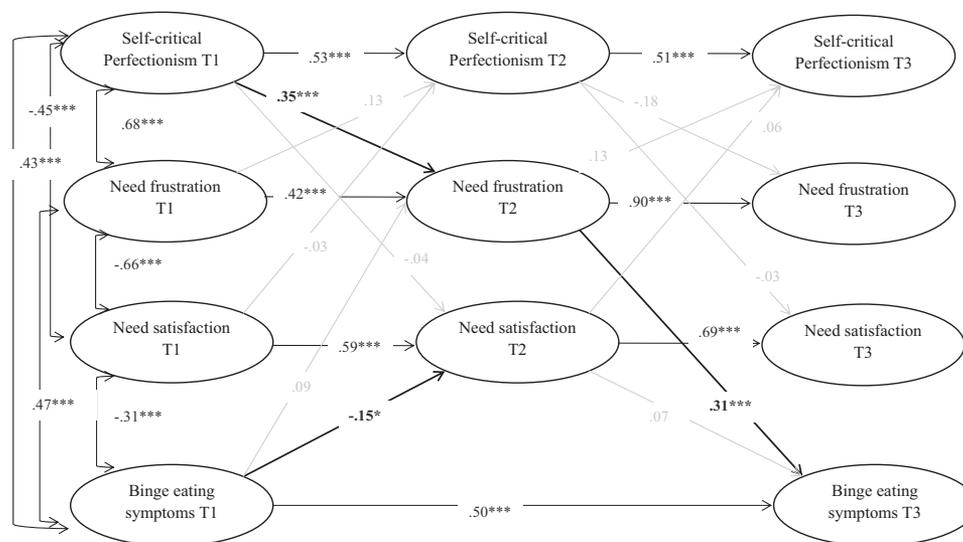


Figure 1. Cross-lagged analyses testing the mediating model. Ovals represent latent variables. Gray paths are nonsignificant ($p > .05$). Black paths are significant ($p < .05$). The double-headed arrow represents a latent correlation. Autoregressive paths are represented by horizontal arrows; cross-lagged paths are represented by diagonal arrows. For reasons of clarity, path coefficients from age, gender, and adjusted BMI to all latent variables, manifest variables, error terms, and latent correlations at Time 2 and Time 3 are not shown. T = time. * $p < .05$. *** $p < .001$.

meaning of the latent variables did not change between waves). The scaled chi-square difference test and the difference in CFI revealed that the constrained model, $\chi^2(856) = 1,185.281 = 1.38$, $p < .001$; CFI = .962, and the unconstrained model, $\chi^2(848) = 1,186.042 = 1.40$, $p < .001$; CFI = .961, did not significantly differ from each other, indicating measurement equivalence across gender, scaled $\Delta\chi^2(8) = 3.21$, $p > .05$; Δ CFI = .001.

Next, a multigroup comparison was performed to investigate potential structural differences between male and female participants for the final model by comparing the fit between the constrained model, in which the structural relations between males and females were not allowed to vary, and the unconstrained model in which the structural relations (including paths from the background variables age and adjusted BMI to the study variables) were set free. The chi-square difference test and the difference in CFI of the final model revealed that the constrained model, $\chi^2(1057) = 1,490.41$, $p < .001$; CFI = .948, and the unconstrained model, $\chi^2(1016) = 1,463.48$, $p < .001$; CFI = .947, did not significantly differ from each other, indicating structural equivalence of the model across gender, scaled $\Delta\chi^2(41) = 30.94$, $p > .05$; Δ CFI = 0.001.

Additionally, we also investigated differences between males and females specifically with regard to the indirect effect only using bias-corrected bootstrapping (1,000). To do so, we started from a model in which all paths were constrained except for the two paths representing the indirect effect. In this model, the indirect paths for males and females were calculated separately ($a1 \times b1 = ab1$ for males; $a2 \times b2 = ab2$ for females). Next, we estimated the difference between these two indirect effects ($ab1 - ab2$) using bias corrected bootstrapping. The bootstrap estimate of the difference between the indirect effect for males and females was .105, and the BCa CIs (95%) did not contain zero [-0.148,

0.358] ($b = .105$), showing that the indirect effect did not differ significantly between males and females.

Discussion

Although the growth-enhancing effects of the satisfaction of people's psychological needs for autonomy, competence, and relatedness are well-documented, it is only more recently that research has started to focus on the effects of need frustration on maladaptive functioning (see Vansteenkiste & Ryan, *in press*, for an overview). In this study, we aimed to add to this line of work by examining whether individuals high in SC perfectionism would be vulnerable to increases in need frustration, which, in turn, would heighten the risk for developing binge eating symptoms.

Self-Critical Perfectionism and Psychological Need Frustration

The correlational findings pointed out that SC perfectionism and binge eating were associated with all three separate needs, such that they were positively associated with need frustration and negatively with need satisfaction. In the path analyses, though, in which the overlap between need satisfaction and need frustration was controlled for, SC perfectionism was found to uniquely predict need frustrating experiences. We speculate on a number of reasons why SC perfectionists actively generate need frustrating experiences. First, SC perfectionists may create their own need-frustrating experiences through the type of activities they choose and the way they regulate them (i.e., proactive mechanism). As SC perfectionists typically strive for unrealistically high standards and stick to those standards rigidly, they are more vulnerable to experiences of failure (i.e., competence frustration) and to display pressured forms of functioning (i.e., autonomy frustration).

Second, SC perfectionists may perceive the social environment in a more biased way (Yiend, Savulich, Coughtrey, & Shafran, 2011), that is, as depriving or even thwarting their psychological needs. For instance, SC perfectionists may be more critical of their own functioning and may evaluate their goal progress more negatively than nonperfectionists (Blatt, 1995). SC perfectionists may also be more sensitive to ego-threatening information, thereby pushing themselves into action. Also, because of their competitive attitude, SC perfectionists might more easily perceive others as opponents they need to outperform, thereby actively thwarting their need for close relationships.

Third, SC perfectionists might not only generate more need frustration or interpret the reality as indicative of need frustrating but also elicit need frustrating responses from the environment (evocative mechanism). For instance, because SC perfectionists strongly focus on their self-definition at the expense of their interpersonal relations (Blatt, 2004), their competitive and sometimes even hostile interpersonal style might elicit rejection from others, thereby leading to stressful relationship experiences. These relational stressors might encourage them to further devalue and neglect the importance of relationships and to increasingly emphasize the importance of achievements to preserve a sense of self-worth. Future research could disentangle these three described mechanisms. Through these three mechanisms, SC perfectionists might get caught in a vicious cycle of self-defeating overstriving in which they put themselves under constant pressure to perform well and to maintain a sense of self-esteem (Shafran et al., 2002).

Psychological Need Frustration and Binge Eating Symptoms

A second key finding of the present study was that the increase in need frustration associated with SC perfectionism in turn predicted an increase in binge eating symptoms, at least when changes in binge eating were modeled over a 1-year interval. Two findings are noteworthy. First, the frustration of the psychological needs rather than their mere deprivation or nonfulfillment could account for the link between SC perfectionism and binge eating. These findings are in line with recent studies (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Verstuyf, Vansteenkiste, & Soenens, 2012) and theorizing (see Vansteenkiste & Ryan, in press, for an overview) suggesting that it is the active frustration of the needs (rather than the absence of their satisfaction) that catalyzes psychopathology. Second, these effects only emerged when considering changes in binge eating across a 1-year interval. The reason for this is that the cross-temporal stability of binge eating was much higher across 6 months than across a 1-year interval. Although replication of these findings is necessary, our data suggest that meaningful change in binge eating symptoms occurs across a relatively longer time interval. Accordingly, the effects of need frustrating experiences only seem to manifest when considering this longer period of time in which substantial change occurs. Possibly, need frustrating experiences also need to be sufficiently accumulated across time and even become chronic for them to translate into malfunctioning.

We suggest at least two mechanisms that might explain why need frustration makes one more vulnerable for episodes of uncontrollable eating. First, accumulating need frustrating experiences might increase the inclination to engage in compensatory

behaviors as a way to experience a derivative sense of satisfaction (Verstuyf, Patrick, Vansteenkiste, & Teixeira, 2012). Indeed, some studies found that binge eating alleviates negative feelings in the short term and helps to suppress extreme emotions (Munsch, Meyer, Quartier, & Wilhelm, 2012). Binge eating might thus be seen as a way to escape from negative self-awareness and from the need frustrating experiences (Heatherton & Baumeister, 1991). Second, need frustrating experiences require energy from an individual, which might cause ego depletion. Because self-regulation relies on limited resources (Baumeister et al., 2000), less energy remains available following need frustration to adaptively regulate emotions and to exert control over eating, such that one will be less able to control eating and to resist fatty and sugary food. The necessity to cope with intensive negative emotions elicited by need frustration and the fact that need frustration itself usurps self-control capacities may explain why one is more vulnerable for episodes of uncontrollable eating in response to need frustration.

Two additional findings emerged. First, gender did not moderate the established relations, showing that SC perfectionism led to increases in binge eating symptoms through increases in need frustration for both males and females. This finding is consistent with previous studies that did not detect structural differences in the relation between perfectionism and binge eating in adolescents (Boone et al., 2011).

Second, we found that binge eating was related to a decrease in experienced need satisfaction but did not increase need frustration over time. Presumably, episodes of binge eating may elicit feelings of incompetence or may prompt feelings of guilt, which could result in low need fulfillment. Note that this particular finding deviates from the diary study by Verstuyf et al. (2013), who reported that, on a day-to-day basis, binge eating covaried with need frustration but not with need satisfaction. Before providing any interpretation, future research may want to replicate the current finding.

Toward a More Encompassing Model of the Relation Between SC Perfectionism and Binge Eating

By examining need frustration as a global mechanism, we aimed to add to previous studies examining either other global (e.g., depressive symptoms, self-esteem, interpersonal discrepancy and esteem; Sherry & Hall, 2009) or more specific mechanisms (e.g., thin ideal internalization and dietary restraint; Boone et al., 2011) involved in the development of binge eating. Both the more global and the more specific approach are of value as they likely provide complementary information. While global mechanisms provide us with insight into the fundamental processes that may underlie the association of SC perfectionism with various psychopathological outcomes, specific mechanisms enhance our understanding of the reasons why a self-critical individual may develop binge eating problems in particular, as they may moderate the association between need frustration and psychopathology. In this regard, the study of global mechanisms has the potential to gain insight into the reason why a single vulnerability factor may give rise to different types of psychopathology and may help to understand the phenomenon of comorbidity in relation to SC perfectionism (i.e., multifinality; Nolen-Hoeksema & Watkins, 2011). Indeed, much as SC perfectionism constitutes a transdiagnostic risk factor for various psychopathological outcomes, need frustration may repre-

sent a transdiagnostic explanatory mechanism to understand how psychopathology unfolds (Ryan et al., 2006; Vansteenkiste & Ryan, in press).

Furthermore, future research might want to assess both specific and more general variables to examine their reciprocal interrelations as a way to evolve toward a more encompassing model. For instance, the adoption of the thin ideal may elicit need frustrating experiences, as one may feel pressured to live up to societally promoted (but not personally endorsed) models of thinness. Conversely, in response to need frustration people may become more likely to search for need substitutes, that is, goals that people engage in to compensate for need frustrating experiences (Deci & Ryan, 2000). When people cling to such need substitutes, they may, for instance, pursue the goal of physical attractiveness and become susceptible to the thin ideal. Ironically, although this goal would be adopted with the intention to overcome need frustration, it is likely to further increase need frustration. Thin ideal internalization indeed has been found to relate to rigid dieting efforts that tend to backfire (Stice & Shaw, 2002).

Prevention and Treatment Implications

Our findings yielded more insight into how SC perfectionism makes one more vulnerable to engage in uncontrollable eating. SC perfectionism seems to actively contribute to the frustration of the psychological needs for autonomy, relatedness, and competence. Given these findings, prevention and intervention programs targeting perfectionism (e.g., Pleva & Wade, 2007; Wilksch, Durbridge, & Wade, 2008) may focus not only on changing and challenging perfectionistic cognitions but also on the awareness and regulation of experiences of need frustration and satisfaction. First, the therapist and patient might discuss need frustrating experiences that are related to the self-critical attitude. When patients become more aware of the self-defeating processes associated with their self-criticism, they may be more able to adequately cope with these experiences. Therefore, it is advisable that therapy also focus on the promotion of the use of an adequate emotion regulation style to deal with need frustrating experiences. One such style of adequate emotion regulation may be an integrative style, where patients develop an active interest in the causes of their experiences of need frustration and the capacity to learn from these experiences in terms of future behavior (Ryan et al., 2006). Second, it may be important to encourage patients to engage in activities that satisfy their needs. A treatment that is growth oriented might be particularly interesting and helpful, as it may broaden the scope of treatment and help one to focus not only on changing the “bad behavior and thinking” but also to focus on and engage in positive behaviors. In treatment, one can help patients to get back in touch with their basic psychological needs. For instance, patients can be stimulated to act more freely and volitionally (e.g., by allowing themselves to do something they really like), to engage in authentic and open relationships (e.g., by reflecting on the value of friendships, enjoying friendships, and not projecting their own standards on others), and get in touch with their own capacities (e.g., knowing their own limits and standards, such that they can set realistic goals for themselves).

Limitations and Research Suggestions

A main strength of this study was the use of a longitudinal design, which allowed us to make inferences about changes over time. However, our study also had some limitations, including the somewhat low reliability of the measures for the individual psychological needs and the self-reported nature of height and weight and the other study variables, which might have inflated the strength of some of the observed associations. Although it is a strength that we included both males and females in our sample, all participants were Caucasian nonclinical adolescents, which limits the generalizability of the findings.

Future researchers may also want to test the model using diary studies or signal- or event-contingent sampling methods, such as ecological momentary assessment (EMA; Shiffman, Stone, & Hufford, 2008). Daily diary studies have shown that perfectionism (Boone, Soenens, Thanasis, et al., 2012), need frustration (Verstuyf et al., 2013), and binge eating (Sherry & Hall, 2009) fluctuate from day to day within individuals and have shown that they influence each other during the course of a day. However, no study has examined the interrelations between these constructs simultaneously at the level of daily fluctuation. Furthermore, EMA would allow researchers to take a more dynamic look at the microprocesses underlying the associations between SC perfectionism, need frustration, and binge eating. Ideally, future longitudinal studies would also include more assessment waves. The inclusion of additional waves would allow researchers to chart different types of change and to use more sophisticated statistical approaches (e.g., latent growth modeling and mixture modeling).

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