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Personality profiles in Eating Disorders: Further evidence of the clinical utility of examining subtypes based on temperament ☆

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ABSTRACT

Despite recent modifications to the DSM-V diagnostic criteria for Eating Disorders (ED; American Psychiatric Association, 2013), sources of variability in the clinical presentation of ED patients remain poorly understood. Consistent with previous research that has used underlying personality dimensions to identify distinct subgroups of ED patients, the present study examined (1) whether we could identify clinically meaningful subgroups of patients based on temperamental factors including Behavioral Inhibition (BIS), Behavioral Activation (BAS) and Effortful Control (EC), and (2) whether the identified subgroups would also differ with respect to ED, Axis-I and Axis-II psychopathology. One hundred and forty five ED inpatients participated in this study. Results of a k-means analysis identified three distinct groups of patients: an Overcontrolled/Inhibited group ($n=53$), an Undercontrolled/Dysregulated group ($n=58$) and a Resilient group ($n=34$). Further, group comparisons revealed that patients in the Undercontrolled/Dysregulated group demonstrated more severe symptoms of bulimia, hostility and Cluster B Personality Disorders compared to the other groups, while patients in the Resilient group demonstrated the least severe psychopathology. These findings have important implications for understanding how individual differences in personality may impact patterns of ED symptoms and co-occurring psychopathology in patients with ED.

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1. Introduction

Eating Disorders (ED) are serious psychiatric conditions that confer a high risk of mortality (Norring and Sohlberg, 1993; Harris and Barraclough, 1997; Keel et al., 2003). There is a substantial variability in the clinical presentation of individuals with EDs (Fairburn et al., 2007; Fairburn and Cooper, 2011), yet sources of this variability remain poorly understood (Fairburn and Cooper, 2007, 2011). The DSM-V diagnostic criteria (American Psychiatric Association, 2013) aim to better capture the observed presentations of ED symptoms through modifications to the previous diagnostic criteria for ED. Some researchers remain concerned, however, that these adjustments will fail to adequately address the substantial heterogeneity in clinical presentations that characterize patients with ED (Fairburn and Cooper, 2011). To the extent that distinct subgroups of ED patients can be reliably identified, it is possible that these groupings could be used to inform assessment, treatment and future diagnostic nosologies.

Consistent with the recent call from the National Institute for Mental Health (NIMH) to decrease the emphasis on discrete, symptom-based diagnostic groups and increase focus on transdiagnostic biological and cognitive processes that underlie psychopathology (Sanislow et al., 2010), the examination of underlying personality dimensions that can classify distinct patient groups can pave the way for new nosologies, which in turn could improve treatment matching and illuminate new avenues for intervention. In this regard, temperament is a promising neurobiological, transdiagnostic process (Muris and Ollendick, 2005; Nigg, 2006; Amodio et al., 2008; Wiersema and Roeyers, 2009) that can be used to understand underlying mechanisms that may drive distinct clinical presentations in ED patients.

Personality features, in particular, have been shown to distinguish ED patients with an Overcontrolled, constricted presentation, who often have primarily restricting symptoms, from those

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with an Undercontrolled, dysregulated presentation, who often exhibit primarily binging and purging symptoms (Westen and Harnden-Fischer, 2001; Espelage et al., 2002; Wonderlich et al., 2005a; Claes et al., 2006b). For example, whereas ED patients with restricting presentations tend to score high on measures of rigidity and obsessive-compulsiveness (Vitousek and Manke, 1994; Anderluh et al., 2003), patients with binging and purging presentations score high on measures of impulsivity, extraversion and affective instability (Strober, 1983; Vitousek and Manke, 1994). Patients with both restricting and binging/purging presentations report high levels of perfectionism and negative affectivity (see Vitousek and Manke, 1994). Further, cluster analytic studies have consistently identified a third, Resilient or high functioning group of ED patients who demonstrate relatively little psychiatric comorbidity and better overall functioning compared to the other groups (Strober, 1983; Goldner et al., 1999; Westen and Harnden-Fischer, 2001; Espelage et al., 2002; Wonderlich et al., 2005a; Claes et al., 2006b), despite displaying a range of ED pathology (e.g., in inpatients, 53.9% of resilient patients had Anorexia Nervosa and 42.1% had Bulimia Nervosa; Claes et al., 2006b; in outpatients, 58% of resilient patients had Bulimia Nervosa and 30% had an Eating Disorder Not Otherwise Specified). These three groups of ED patients have been found to differ with respect to a variety of factors that can impact clinical service delivery, including Axis-I and Axis-II comorbidity, adaptive and interpersonal functioning, impulsivity and childhood trauma histories (Strober, 1983; Goldner et al., 1999; Westen and Harnden-Fischer, 2001; Espelage et al., 2002; Wonderlich et al., 2005a; Claes et al., 2006b). Personality disorders, in particular, have been found to be important for distinguishing different subgroups of ED patients (Espelage et al., 2002; Westen and Harnden-Fischer, 2001). Further, research examining descriptions of ED patients given by their treating clinicians suggested that patients who were described as dysregulated were also reported to have the worst outcome in treatment, compared to patients who were identified as constricted or high functioning (Thompson-Brenner and Westen, 2005). Indeed, patients who were described as dysregulated were reported to achieve recovery from ED symptoms 19 weeks later than patients with a constricted presentation and 41 week later than high functioning patients, providing indirect evidence of the differential treatment needs of these groups.

Despite the strikingly consistent body of evidence that has identified tripartite groupings in ED patients based on personality pathology, to date only a few studies have considered the role of temperament in distinguishing different types of ED patients. In particular, Gray's (1970, 1982) Reinforcement Sensitivity Theory (RST) provides a useful framework for distinguishing various types of psychopathology, but has rarely been applied to Eating Disorders (see Bijttebier et al., 2009 for a review). According to RST, human behavior is governed by two complimentary neurobiological motivation systems: the first, known as the Behavioral Inhibition System (BIS), is responsible for guiding avoidance of behaviors or situations that are likely to result in aversive consequences, while the second system, the Behavioral Activation System (BAS), is responsible for appetitive motivation to approach situations that are likely to result in reward. Previous work shows that ED patients with a primarily restricting presentation tend to score higher than those with a primarily binging/purging presentation on measures of BIS (Claes et al., 2006a, 2010). Results regarding differences in BAS tendencies of ED patients have been mixed: Whereas one study found that binging/purging patients scored higher than restrictive patients on a measure of Fun Seeking, an integral component of the BAS (Beck et al., 2009), another study found that binging/purging and restrictive patients did not significantly differ with respect to BAS (Claes et al., 2010). Further research is necessary, therefore, to clarify how these motivational systems may account for differences in ED symptoms, and whether these differences may also account for differing patterns of psychiatric comorbidity.

Researchers have recently argued that, in addition to considering motivational systems that influence behavior in a reactive manner, a complete understanding of human behavior requires incorporating a consideration of regulatory processes that influence behavior in a top-down or effortful manner (Nigg, 2006; Claes et al., 2009). Specifically, Effortful Control (EC), defined as the ability to regulate behavioral and emotional reactivity, is an important component of top-down regulation. Whereas temperamental tendencies can be observed early in development and have been linked to sub-cortical regions of the brain (Avila, 2001; Fowles, 2006), self-regulation develops later in childhood and is linked with the frontal and prefrontal cortices (Rueda et al., 2005). General clinical research suggests that EC may play an important role in protecting against psychopathology by helping individuals plan and choose adaptive coping responses under circumstances that elicit distress (Rothbart and Sheese, 2006). In this way, EC plays a fundamental role in the development of emotion regulation abilities. In ED patients, however, the relationship between EC and psychopathology may not be so clear-cut. For example, ED patients with a primarily restricting presentation scored higher on a self-report and cognitive measure of top-down control compared to those with a binging/purging presentation (Claes et al., 2010). One possibility is that EC has a curvilinear relationship with resilience – while too little EC results in problems related to impulsivity and poor affect regulation (Muris and Ollendick, 2005), too much EC may also be problematic, especially among those who become highly focused on ineffective coping responses such as extreme calorie restriction. To our knowledge, no extant studies have examined whether EC can be used to identify distinct groups of ED patients.

In sum, examining whether individual differences in temperament can be used to identify distinct subtypes of ED patients has important implications for understanding mechanisms that may account for the complex patterns of co-occurring psychopathology and resilience that are often seen in psychiatric patients, and ED patients in particular. To our knowledge, few studies have combined an examination of reactive temperament, particularly Gray's RST, with an investigation of effortful processes that can modulate reactive tendencies in delineating different groups of ED patients.

1.1. Aims and hypotheses

This study aimed to extend existing research by examining whether motivational and self-regulatory processes could distinguish unique groups of ED patients. Further, we examined whether the groupings identified on the basis of these constructs differed with respect to ED symptoms and associated clinical problems, Axis-I related symptoms and Axis-II psychopathology. Consistent with prior work demonstrating group-based differences in BIS, BAS and EC among ED patients (Claes et al., 2010), as well as a range of studies that have identified tripartite classifications in ED patients (Strober, 1983; Espelage et al., 2002; Westen and Harnden-Fischer, 2001; Goldner et al., 1999; Wonderlich et al., 2005a; Claes et al., 2006b), we expected a three group solution to fit the data, with an Undercontrolled/Dysregulated group (moderate BIS, high BAS, low EC), an Overcontrolled/Inhibited group (high BIS, moderate EC, low BAS) and a Resilient group (low BIS, high EC, low BAS). Further, we expected that these groups would demonstrate reliable differences in their associations with other indices of psychopathology. Specifically, we expected that the Undercontrolled/Dysregulated group would exhibit more externalizing symptoms, as indexed by more binging/purging and bulimia symptoms, problems with hostility and more severe Cluster B

traits on Axis-II (see Wonderlich et al., 2005a; Claes et al., 2006b), compared to the other groups. We expected that the Over-controlled/Inhibited group would exhibit a more internalizing presentation, including greater food restriction, perfectionism, feelings of ineffectiveness, anxiety and depression and more severe Clusters A and C Personality Disorder symptoms on Axis-II (see Espelage et al., 2002; Wonderlich et al., 2005a; Claes et al., 2006b). Finally, we expected that the Resilient group would demonstrate the least severe impairment across measures.

2. Methods

2.1. Participants

Participants included all consecutively admitted female patients to a specialized, inpatient treatment program for Eating Disorders in Belgium over a three-year period ($N=160$, M age=21.70, S.D.=5.86, range=14–43). Eating disorder diagnoses were determined by a structured clinical interview based on DSM-IV-TR criteria (American Psychiatric Association, 2000) administered by trained clinical staff on a multidisciplinary treatment team (psychologists and nurses) who were overseen by the head psychiatrist of the unit. Within this sample, 69 patients met criteria for Anorexia Nervosa, restricting type, 39 met criteria for Anorexia Nervosa, binging/purging type, 28 met criteria for Bulimia Nervosa and 24 met criteria for an Eating Disorder Not Otherwise Specified. The average Body Mass Index of these inpatients was 17.81 (S.D.=4.01, range=10.13–33.90), with 21.9% of the sample very severely underweight (BMI < 15), 12.5% severely underweight (BMI 15–16), 31.9% underweight (BMI 16–18.5), 28.8% normal weight (BMI 18.5–25) and 5% overweight (BMI > 25).

2.2. Measures

2.2.1. Behavioral Inhibition and Activation

The Behavioral Inhibition/Behavioral Activation System Scale (BIS/BAS; Carver and White, 1994; translated into Dutch by Franken et al., 2005) is a 24-item self-report measure that assesses the tendency to act in accordance with approach and avoidance motivations across two primary domains: Behavioral Inhibition (BIS), reflecting sensitivity to punishment, and Behavioral Activation (BAS), reflecting sensitivity to reward. Items are rated on a 4-point Likert scale (1='*very false for me*' to 4='*very true for me*'). Research supports the reliability and validity of this measure in ED populations (Beck et al., 2009). The BIS and BAS total scores demonstrated acceptable internal consistency in the present sample ($\alpha=0.78$ and 0.83, respectively).

2.2.2. Effortful Control

Self-regulatory ability was assessed with the 19-item Effortful Control Scale (ECS) from the short form of the Adult Temperament Questionnaire (Evans and Rothbart, 2007). Participants rated their general ability to exert control over their behavior on a seven-point Likert scale (1='*not at all applicable*' to 7='*completely applicable*'). The ECS assesses control across three subdomains: ability to focus and shift attention; ability to suppress inappropriate behavior; and ability to engage in behavior despite avoidance motivation. Previous research supports the reliability and convergent validity of the ECS in Flemish undergraduate students (Claes et al., 2010). The ECS total score demonstrated acceptable internal consistency in the present sample ($\alpha=0.84$).

2.2.3. Eating disorder related symptoms

The 91-item, second version of the Eating Disorder Inventory (EDI-2; Garner, 1991) yields 11 scales which assess a variety of symptoms associated with EDs, including drive for thinness, bulimia symptoms, body dissatisfaction, feelings of ineffectiveness, perfectionism, interpersonal distrust, poor interoceptive awareness, maturity fears, asceticism, poor impulse regulation and social insecurity. Participants rate items on a 6-point Likert scale from '*never*' to '*always*'. The EDI-2 demonstrates acceptable internal consistency and a stable factor structure across a variety of translations (Podar and Allik, 2009). The subscales of the EDI-2 demonstrated acceptable internal consistencies in this sample (αs=0.76–0.93).

2.2.4. Axis-I related symptoms

The Dutch version of the revised 90-item Symptom Checklist (SCL-90R; original measure, Derogatis, 1994) assesses severity of psychiatric symptoms associated with a variety of Axis-I disorders, including anxiety, depression, obsessive-compulsiveness, phobic anxiety, and psychoticism, as well as other clinical problems such as hostility, interpersonal sensitivity and paranoid ideation, somatic complaints and sleeping problems. Participants rate the extent to which symptoms are present on a Likert-style scale from '*not at all*' (1) to '*extremely*' (5). Previous research supports the internal consistency, test–retest reliability and convergent validity of this measure in adult psychiatric outpatients (Arrindell et al., 2003). The SCL-90 scales demonstrated acceptable internal consistency in the present sample (αs=0.75–0.97).

2.2.5. Axis-II symptoms

The Assessment of DSM-IV Personality Disorders (ADP-IV; Schotte and De Doncker, 1994) is a 94-item Dutch self-report questionnaire used to assess the presence and severity of symptoms related to the 10 personality disorders defined in the DSM-IV-TR (American Psychiatric Association, 2000). Items on the ADP-IV are rated first for the degree to which they apply to the respondent (1='*totally disagree*', 7='*totally agree*'). For items that are rated as relevant at a moderate or higher level (≥ 5), participants also rate the degree to which that trait results in problems or distress for the respondent or others (1='*not at all*', 3='*most certainly*'). Taking the sum of the trait ratings for each relevant criterion derived a dimensional score for severity of symptoms within each personality disorder type. Previous research supports the internal consistency of the ADP-IV (Schotte et al., 1998) as well as the correspondence of its subscales with diagnoses derived from semi-structured diagnostic interviews of Axis-II psychopathology and its ability to discriminate psychiatric inpatients from healthy controls (Schotte et al., 2004). The dimensional scores demonstrated marginally acceptable to acceptable internal consistency in the present sample (αs=0.73–0.90).

2.3. Procedures

Participants who were admitted to the inpatient program were provided with information about ongoing research. Participants who provided written consent to participate completed a package of questionnaires as part of the standard admission procedure in a quiet environment. Questionnaires were completed during the first week of the patients' admission. These research procedures were approved by the internal ethics committee of the hospital.

3. Results

3.1. Clustering solution

To examine the utility of the BISBAS and EC scales in identifying distinct groups of ED patients, we performed a k-means analysis[1] (Sebestyen, 1962; MacQueen, 1967) on the standardized BIS, BAS and EC scale scores (i.e., *z*-scores) with 500 multi-starts (using a maximal number of 500 iterations and the singleton procedure to deal with empty clusters) and comparing solutions with 1–6 clusters. Briefly, the k-means procedure partitions available observations into k clusters such that observations of the same cluster are more similar to each other (i.e., have more similar variable/behavior profiles) than observations belonging to different clusters. The k-means algorithm starts by selecting k (randomly chosen) cluster profiles (also called cluster centroids) and by assigning each observation (in this case, participant) to the cluster for which the (Euclidean) distance between the variable profile of the person and the associated cluster centroid is lowest. Next, based on the obtained partitioning, new cluster centroids are computed (i.e., the mean variable profiles computed across all the observations belonging to the cluster in question) and observations are re-assigned again. This procedure is iterated until an updated partitioning does not differ from the previous one. Because running the k-means algorithm with only a single initial selection of k cluster profiles can produce poorly fitting solutions, we used a multi-start procedure to identify optimally fitting solutions (Steinley, 2003). In particular, the k-means analysis runs multiple (e.g., 500) times, each time with a different set of k initial cluster profiles. For each obtained partitioning, an index of misfit (i.e., sum of squared differences across persons between the original profile and the associated cluster centroid) can be computed to compare the various obtained solutions. The optimal

[1] Due to departures from normality in the BIS variable, we decided to perform a k-means analysis rather than a mixture analysis, as mixture analysis relies more heavily on an assumption of normal (i.e., symmetrical) distributions.

solution can then be found by identifying the clustering which yields the smallest misfit value.

Fifteen participants had missing data on at least one of the clustering variables of interest (BIS, BAS or EC), and were excluded from the analyses, resulting in a final sample of 145. Fig. 1 shows the misfit value of the optimal solution by the number of clusters specified. Examining this graph reveals that the three-cluster solution provides the best compromise between fit and parsimony. In particular, while the misfit values necessarily decrease as the number of clusters increase, the relative decrease in misfit declines when more than three clusters are specified (i.e., adding an extra cluster only implies a small gain in fit, whereas lowering the number of clusters results in a considerable loss in fit). Moreover, for many of the solutions with more than three clusters, the obtained partitioning contains one (or more) cluster(s) with very few observations.

An examination of the centroids of the three clusters (i.e., variable means for each cluster) revealed the following pattern (see Fig. 2, which displays the cluster centroids): the first cluster ($n=53$) was characterized by high BIS scores, low BAS scores and moderate EC scores, and was tentatively labeled the 'Overcontrolled/Inhibited group'. The second cluster ($n=34$) was characterized by very low scores on the BIS, moderate scores on the BAS and high scores on EC; this cluster was tentatively labeled the 'Resilient' group. Finally, the third cluster ($n=58$), tentatively labeled the 'Undercontrolled/Dysregulated' group, was characterized by high scores on the BAS, moderate scores on the BIS and low scores on EC (see Fig. 3, which displays the proportion of participants falling in each group).

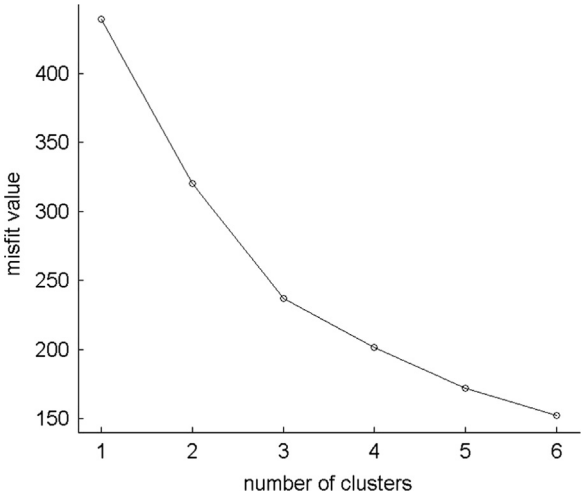


Fig. 1. Scree plot displaying misfit indices across clustering solutions for different number of clusters.

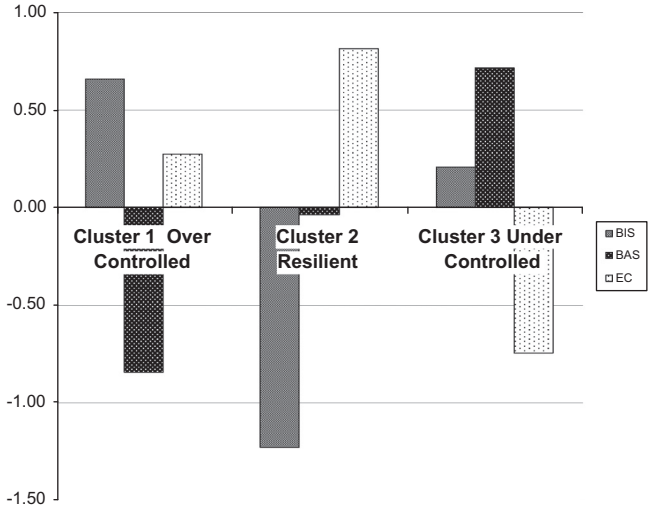


Fig. 2. Personality cluster scores on standardized personality measures.

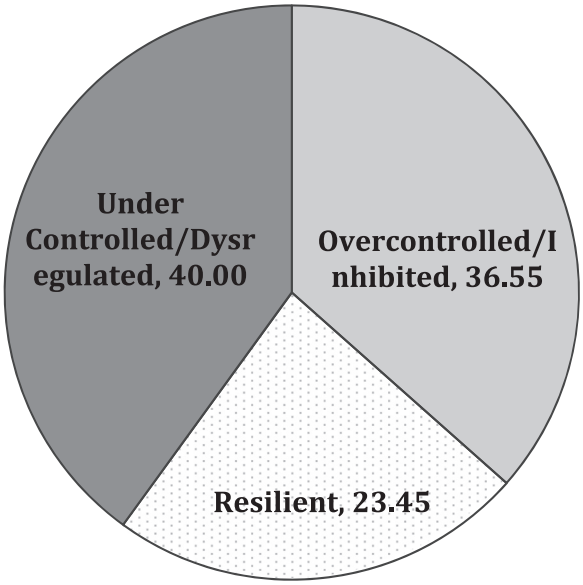


Fig. 3. Percentage of inpatients falling in each of three personality-based typologies.

3.2. Cluster differences on ED psychopathology

A chi-square comparison revealed that the three-cluster solution was able to distinguish between different eating disorder diagnoses ($\chi^2(4)=9.81$, $p=0.04$), such that the greatest portion of patients with restricting Anorexia Nervosa fell in the Overcontrolled/Inhibited group (43.3%), while 31.7% fell in the Undercontrolled/Dysregulated group and 25% fell in the Resilient group. Patients with Bulimia Nervosa and binging/purging Anorexia Nervosa most often belonged to the Undercontrolled/Dysregulated group (54%), while 27% fell in the Overcontrolled/Inhibited group (notably, 76.5% of these patients group binging/purging AN rather than BN; only 11% of patients with BN fell in the Overcontrolled/Inhibited group) and 19% fell in the Resilient group. Patients with a DSM-IV diagnosis of ED-NOS belonged primarily to the Overcontrolled/Inhibited group (45.5%), though a substantial portion fell in the Resilient group (31.8%). The clusters did not differ with respect to Body Mass Index ($F(2, 144)=0.40$, $p=0.67$), nor age at admission ($F(2, 144)=2.42$, $p=0.09$).

MANOVAs comparing the three groups on cognitive and affective aspects of ED pathology, as assessed by the EDI-2, revealed significant differences on all domains assessed ($Fs(2, 141)=5.14–21.70$, $\eta^2s=0.07–0.24$, $ps<0.001–0.007$; see Table 1 and Fig. 4). Consistent with our expectations, the Undercontrolled/Dysregulated group reported more symptoms of bulimia (post-hoc comparison, $ps<0.03$). Further, the Undercontrolled/Dysregulated and Overcontrolled/Inhibited groups reported more severe pathology on virtually every domain assessed compared to the Resilient group (post-hoc comparison, $ps<0.05$), with the exception that the Overcontrolled/Inhibited group did not differ from the Resilient group on bulimia symptoms (post-hoc comparison, $p=0.94$). Inconsistent with our expectations, the Overcontrolled/Inhibited group did not differ from the Undercontrolled/Dysregulated group with respect to perfectionism (post-hoc comparison, $p=0.95$) or feelings of ineffectiveness (post-hoc comparison, $p=0.74$).

Table 1
Means and standard deviations on Eating Disorder Inventory Scales for the three personality clusters.

	Cluster 1 Overcontrolled		Cluster 2 Resilient		Cluster 3 Undercontrolled		*F*	η^2
	M	S.D.	*M*	S.D.	*M*	S.D.		
Impulse regulation	30.19[a]	7.51	23.88[b]	5.80	33.98[c]	8.02	20.94	0.23
Social insecurity	32.48[a]	4.77	25.09[b]	7.15	32.30[a]	5.39	20.79	0.23
Drive for thinness	33.94[a]	7.50	26.03[b]	9.92	32.34[a]	8.43	13.73	0.17
Bulimia	16.10[a]	15.38	15.37[a]	7.39	20.96[b]	9.65	5.62	0.08
Perfectionism	23.77[a]	5.44	19.31[b]	5.81	24.11[a]	5.80	8.30	0.11
Ineffectiveness	44.33[a]	7.38	33.16[b]	10.29	43.14[a]	7.10	21.70	0.24
Body dissatisfaction	43.19[a]	8.80	36.69[b]	11.33	41.95[a]	8.46	5.14	0.07
Interpersonal distrust	27.06[a]	5.69	21.13[b]	6.01	26.70[a]	5.60	12.50	0.15
Interoceptive awareness	36.65[a]	7.24	29.63[b]	7.97	39.16[a]	7.50	16.74	0.20
Maturity fears	29.87[a]	8.54	23.63[b]	7.07	30.21[a]	7.88	8.07	0.11
Asceticism	30.52[a]	6.34	24.44[b]	6.59	31.11[a]	5.88	13.19	0.16

Superscripts denote significant differences among groups.

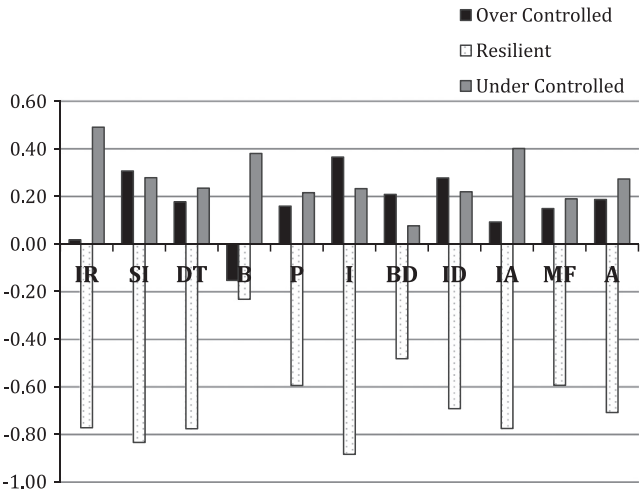


Fig. 4. Eating disorder symptoms exhibited by three subgroups. *Note*. IR: Poor Impulse Regulation, SI: Social Insecurity, DT: Drive for Thinness, B: Bulimia, P: Perfectionism, I: Ineffectiveness, BD: Body Dissatisfaction, ID: Interpersonal Distrust, IA: Interoceptive Awareness, MF: Maturity Fears, A: Asceticism.

3.3. Cluster differences on Axis-I related psychopathology

MANOVAs comparing the three groups on Axis-I related symptoms and other clinical problems assessed by the SCL-90 revealed significant differences on 7 of the 9 domains assessed (*Fs* (2, 145)=0.88–12.69, η^2s=0.01–0.15, *ps* < 0.001–0.44; see Table 2 and Fig. 5). Consistent with our expectations, the Undercontrolled/Dysregulated group reported more hostility than the other two groups (post-hoc comparison, *ps* < 0.01). Inconsistent with our expectations, the Overcontrolled/Inhibited group did not differ from the Undercontrolled/Dysregulated group with respect to internalizing symptoms such as anxiety, agoraphobia or depression (post-hoc comparison, *ps* > 0.80). The Resilient group consistently displayed the lowest scores on most domains assessed (post-hoc comparison, *ps* < 0.05), with the exception of somatization and sleeping problems, for which there were no main effects, and hostility, for which the Resilient and Overcontrolled group did not differ.

3.4. Cluster differences on Axis-II psychopathology

MANOVAs comparing the three groups on Axis-II pathology assessed by the ADP-IV revealed significant differences on all 10 disorders assessed (*Fs*(2, 107)=7.73–23.22, η^2s=0.13–0.31, *ps* ≤ 0.001; see Table 2). Consistent with our expectations, the Undercontrolled/Dysregulated group reported more Cluster B pathology than the other groups, including more severe Antisocial, Histrionic and Narcissistic traits (post-hoc comparison, *ps* < 0.005). Inconsistent with our expectations, the Overcontrolled/Inhibited group did not differ from the Undercontrolled/Dysregulated group with respect to Clusters A or C symptoms (post-hoc comparison, *ps*=0.13–0.99). The Resilient group consistently displayed the lowest scores on all Cluster A and Cluster C disorders (post-hoc comparison, *ps* < 0.02), while the Resilient and Overcontrolled/Inhibited group did not differ with respect to Antisocial, Histrionic and Narcissistic symptoms (post-hoc comparison, *ps* > 0.13).[2]

3.5. Secondary analyses

Given that previous research demonstrates that the Fun Seeking dimension of BAS is most strongly and consistently associated with impulsivity (Carver and White, 1994; Poythress et al., 2008) and may be particularly important in distinguishing ED patients with restricting versus binging/purging presentations (Beck et al., 2009), we repeated the k-means cluster analysis using the standardized score from the BAS Fun Seeking scale instead of the total BAS score, as well as the BIS and EC scores as clustering variables. Consistent with the previous analyses, a three-cluster solution provided the best compromise between parsimony and fit, and similar groups were identified, with the two solutions agreeing on the classification of most participants (88.7% of Overcontrolled, 89.7% of Undercontrolled and 88.2% of Resilient group members were classified into the same group). MANOVAs revealed an identical pattern of results, with the addition that the Overcontrolled/Inhibited group endorsed more Avoidant PD symptoms compared to the Undercontrolled/Dysregulated group (p=0.03). Thus, results are consistent whether a broad measure of approach

[2] Given that this was an inpatient sample with relatively severe psychopathology, we examined whether the three groups differed with respect to medication use. Consistent with our expectation, we found that a greater portion of the participants in the Overcontrolled/Inhibited (n=9; 17%) and Undercontrolled/Dysregulated groups (n=4; 6.9%) were using psychiatric medication (anxiolytics, antidepressants or antipsychotics) at the time of their assessment compared to the Resilient group (n=1; 2.9%), though differences in overall medication use (yes/no; $\chi^2(2)=5.52$, p=0.06) and type of medication used ($\chi^2(6)=8.48$, p=0.21) were not significant. Of the Overcontrolled/Inhibited participants, 4 were using anxiolytics, 4 were using antidepressants and 2 were using antipsychotics at the time of their admission. Of Undercontrolled/Dysregulated participants, 3 were using antidepressants and 1 was prescribed an antipsychotic. We repeated all of the MANOVA analyses including psychiatric medication status (coded 0=no, 1=yes) as a covariate, but the pattern of findings did not change. Results are therefore presented without covariates.

Table 2
Means and standard deviations on Axis-I and Axis-II related pathology for the three personality clusters.

	Cluster 1 Overcontrolled		Cluster 2 Resilient		Cluster 3 Undercontrolled		*F*	η^2
	M	S.D.	*M*	S.D.	*M*	S.D.		
Anxiety	27.42[a]	9.93	21.38[b]	8.36	27.84[a]	8.51	6.29	0.08
Agoraphobia	14.09[a]	6.67	9.73[b]	3.97	13.45[a]	5.47	6.76	0.09
Depression	52.00[a]	12.84	39.03[b]	15.23	50.76[a]	13.25	10.81	0.13
Somatization	28.92[a]	10.04	26.56[b]	9.94	28.98[a]	8.90	0.82	0.01
Obsessive compulsiveness	24.94[a]	7.71	18.76[b]	7.72	26.41[a]	7.52	11.27	0.14
Paranoia/interpersonal sensitivity	47.11[a]	13.36	35.18[b]	13.01	49.64[a]	14.32	12.69	0.15
Hostility	10.11[a]	3.06	9.06[a]	3.27	12.29[b]	4.32	9.58	0.12
Sleeping problems	9.00[a]	3.19	8.50[b]	3.95	9.52[a]	3.74	0.88	0.01
Psychoticism	22.43[a]	6.34	17.62[b]	6.03	24.05[a]	6.95	10.65	0.13
Paranoid PD	22.31[a]	7.35	15.50[b]	6.65	25.28[a]	7.55	15.23	0.23
Schizoid PD	22.72[a]	7.16	16.18[b]	5.03	21.13[a]	7.64	7.73	0.13
Schizotypal PD	26.56[a]	8.29	18.50[b]	6.92	28.80[a]	9.96	12.38	0.19
Antisocial PD	14.21[a]	5.77	14.39[a]	6.93	20.48[b]	7.06	11.08	0.18
Borderline PD	38.87[a]	11.57	27.93[b]	12.55	43.85[a]	11.24	15.44	0.23
Histrionic PD	22.67[a]	6.18	19.11[a]	6.96	28.33[b]	7.82	15.03	0.22
Narcissistic PD	19.51[a]	5.59	17.32[a]	5.96	27.73[b]	8.17	14.79	0.22
Avoidant PD	32.56[a]	8.42	18.96[b]	7.99	28.63[a]	9.29	20.72	0.29
Dependent PD	31.62[a]	8.80	18.89[b]	6.62	31.71[a]	8.86	23.22	0.31
Obsessive compulsive PD	34.08[a]	8.13	24.86[b]	8.53	34.00[a]	8.16	12.81	0.02

Superscripts denote significant differences among groups.

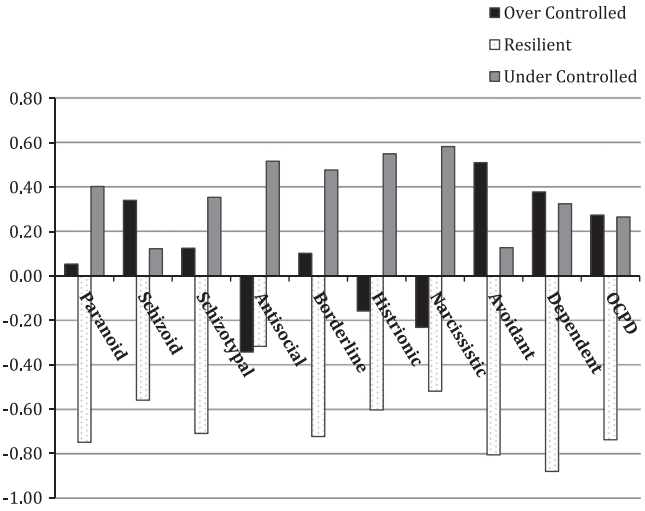


Fig. 5. Personality disorder symptoms exhibited by three subgroups.

motivation, or a more specific measure of impulsivity is used as one of the clustering variables.

4. Discussion

The present study identified distinct groups of ED patients based on measures of reactive temperament and self-regulation, and examined the patterns of co-occurring psychopathology in these groups. Consistent with previous research that has aimed to identify meaningful subgroups of ED patients (Strober, 1983; Goldner et al., 1999; Westen and Harnden-Fischer, 2001; Espelage et al., 2002; Wonderlich et al., 2005a; Claes et al., 2006b), the results of this study identified a tripartite solution as best accounting for the differences among ED patients. Further, although this study was one of the first to examine the combined influence of temperament as conceptualized by Gray's (1982) RST and self-regulation in grouping ED patients, our results were remarkably consistent with previous work that has utilized other personality measures to classify ED patients, including the NEO-FFI (Claes et al., 2006b), the MMPI (Strober, 1983), the MCMI (Espelage et al., 2002) and Q-sort procedures (Westen and Harnden-Fischer, 2001). Specifically, the Overcontrolled/Inhibited group identified in this study, characterized by high BIS, low BAS and moderate EC, is consistent with the constricted, rigid and avoidant groups identified in previous work. The Undercontrolled/Dysregulated group, characterized by high BAS, moderate BIS and low EC, is consistent with the impulsive and borderline groups identified in other studies. Finally, the Resilient group, characterized by high EC, moderate BAS and low BIS is consistent with the high functioning groups that have been identified in other studies. Thus, the present findings add to a growing body of literature that suggests that ED patients can be classified into distinct subgroups, and that these groupings may have important implications for assessment and treatment (Thompson-Brenner and Westen, 2005).

In addition to replicating the tripartite solutions, this study demonstrated that the identified groups of ED patients exhibited different patterns of co-occurring psychopathology. Consistent with our expectations, the Undercontrolled/Dysregulated group showed greater symptoms of bulimia, hostility and Cluster B personality disorders, and were more likely to exhibit a binging and purging, rather than restricting, presentation, compared to the other groups. Further, the Resilient group exhibited the lowest levels of psychopathology across the domains assessed, including ED, Axis-I and Axis-II related symptoms. It should be noted, however, that while this group was low relative to other ED patients, their scores were nonetheless elevated relative to scores that might be expected in healthy populations. Finally, patients in the Overcontrolled/Inhibited group generally reported more severe psychopathology compared to the Resilient group, and differed from the Undercontrolled/Dysregulated patients primarily in that they reported less severe symptoms related to bulimia, hostility and Cluster B traits. In sum, while both the Overcontrolled/Inhibited and the Undercontrolled/Dysregulated groups reported significant internalizing psychopathology relative to other ED inpatients, only the Undercontrolled/Dysregulated group also seems to struggle with considerable externalizing psychopathology.

The identification of these distinct groups may have important implications for clinical service delivery. Specifically, whereas ED patients who have a Resilient profile may require somewhat less intensive services due to lower psychiatric severity and

comorbidity, patients with an Undercontrolled/Dysregulated presentation especially may require more intensive services. Indeed, previous research demonstrates that co-occurring psychopathology is related to a more chronic and severe course in ED patients (Fichter and Quadflieg, 2004). Further, prior research suggests that those patients who were viewed by their clinicians as being highly dysregulated required a much longer duration of treatment to achieve remission, compared to patients who were not viewed as dysregulated (Thompson-Brenner and Westen, 2005). Fortunately, the present study suggests that patients in each group can be identified using brief, self-report measures that could be used in routine intake assessments. Patients who score higher on measures of capacity for top-down control over emotions, and who score lower on measures of avoidance motivation, sensitivity to punishment, neuroticism or negative emotionality are likely to display a number of traits that could promote better outcomes over time. It is important to note, however, that cross-sectional data such as ours do not speak to the direction of the relationships between temperament and resilience, nor do they speak to the longitudinal trajectories. Future research using a prospective approach would be informative in this regard.

This research also points to potentially important individual differences among ED patients that could be used to identify treatments that might be especially helpful in targeting underlying aspects of psychopathology. For example, while Undercontrolled/Dysregulated patients may benefit from interventions aimed at increasing emotion regulation skills and decreasing impulsivity, Overcontrolled/Inhibited patients may benefit from treatments that aim to enhance cognitive and behavioral flexibility. Research suggests that treatments targeting underlying deficits in emotion regulation are efficacious in treating ED patients (for example, Dialectical Behavior Therapy, DBT; see Bankoff et al., 2012 for a review), and emerging evidence supports the feasibility of using a modified DBT protocol focusing on radical openness for constricted patients with Anorexia Nervosa (Lynch et al., 2013).

With regard to unexpected findings, whereas we expected the Overcontrolled/Inhibited group to exhibit more severe internalizing psychopathology, including depression, anxiety, and Cluster C personality disorder symptoms, this study did not find significant differences relative to Undercontrolled/Dysregulated patients. Follow-up analyses suggested that some of these patterns may emerge when a more direct measure of impulsivity is used as one of the clustering variables. One possible explanation for this unexpected finding is that, in addition to greater BIS, the Overcontrolled/Inhibited group also exhibited moderate elevations on self-regulatory control, which has been shown to protect against psychopathology by facilitating emotion regulation (Rothbart and Sheese, 2006). Thus, despite the relatively greater risk that may be associated with high BIS scores, which are often associated with greater negative affectivity and internalizing symptoms (Carver et al., 2000; Slobodskaya, 2007), the Overcontrolled/Inhibited group may be able to compensate for this reactive tendency by employing greater top-down regulation over their emotions and behavior. Another explanation is that the greater use of psychiatric medications at the time of the assessment by the Overcontrolled/Inhibited and Undercontrolled/Dysregulated patients may have attenuated group differences in depression and anxiety (see footnote above); however, it is also important to note that the effectiveness of psychiatric medications in patients who are severely underweight is not well established (Yager et al., 2006). Another possibility is that group differences in anxiety may have been masked by the high portion of individuals with Anorexia Nervosa in this sample, and within the Overcontrolled/Inhibited and Undercontrolled/Dysregulated groups. It is also important to consider that the comparisons in this study were relative to other ED inpatients, who are known to demonstrate high rates of depression and anxiety (Herzog et al., 1992; Braun et al., 1994; Godart et al., 2003; Blinder et al., 2006). It is possible, therefore, that the Overcontrolled/Anxious patients may exhibit greater internalizing symptoms compared to patients without ED or with less severe ED, but not relative to other ED inpatients. Further research is necessary to clarify these possibilities.

Although we believe that this study has a number of important implications for advancing theories and treatment of ED, a number of limitations warrant consideration. First, this study focused exclusively on ED inpatients, and thus it was not possible to directly compare the clinical profiles identified in this study with non-psychiatric controls, patients with other Axis-I disorders or patients with less severe ED symptoms. Although many of our findings were consistent with clustering studies that have been conducted in other ED samples (e.g., outpatients: Espelage et al., 2002; mixed outpatient and community samples: Wonderlich et al., 2005a; clinician ratings: Westen and Harnden-Fischer, 2001; Thompson-Brenner and Westen, 2005), replication in novel samples, particularly those with less severe or less chronic eating disorder symptoms, would strengthen confidence that personality typologies can generalize across patient severity. Additionally, the majority of the patients in this sample were diagnosed with Anorexia Nervosa (either binging/purging or restricting type), consistent with many inpatient ED settings. Again, although our findings were consistent with cluster analytic studies of patients with Bulimia Nervosa (Wonderlich et al., 2005a), further replication in diverse patient groups would strengthen confidence in these findings.

An additional limitation of the present study was that our primary measure of Behavioral Inhibition and Activation (the BISBAS) has not been validated to assess the third component introduced in a revision of Gray's RST, the Flight–Flight–Freeze System (FFFS; Gray, 1987). In Gray's revised theory, BIS is thought to reflect anxiety, while FFFS is thought to reflect fear. It would be interesting to examine the associations of the fear-based FFFS with eating disorder pathology, much of which is conceptually related to anxiety or fear (e.g., fear of weight gain, avoidance of certain foods, rituals and obsessive thoughts). Further, it is possible that the inclusion of this third factor would contribute additional explanatory power to the clustering of ED patients, or would point out further distinctions among the groups. To our knowledge, no existing studies have examined the role of the FFFS in eating disorder pathology (see Bijttebier et al., 2009, for a review). Indeed, many empirical studies have been hampered by the lack of well-validated instruments that can assess all three components of Gray's revised RST. Future work should examine the possible role of FFFS, and Gray's revised theory more general, in differentiating subgroups of ED patients.

This research was conducted prior to the publication of the DSM-V, and thus used DSM-IV-TR criteria for Eating Disorders. An examination of patient subtypes across a range of ED and other diagnostic groups, including using the new DSM-V criteria, will be important for understanding how the differences observed in this study (e.g., for greater Cluster B symptoms in the Undercontrolled/Dysregulated group) map on to differences that may be identified in other patient and non-patient groups. In particular, it would be interesting to examine whether personality and temperament-based typologies can explain changes in profiles of eating disorder symptoms over time. As we have suggested in Section 1, we believe examining trait-level differences in ED patients has the potential to inform future diagnostic nosologies, although much work is still needed in this area before such a possibility could be realized. Findings regarding the ability of personality and temperament dimensions to account for differences in ED diagnoses have been somewhat inconsistent (Espelage et al., 2002), suggesting that other variables may need to be considered, or further refinement of the diagnostic categories may be required.

The reliance on self-report measures to assess temperament and psychiatric symptom severity results in a risk of reporting biases. It is possible, for example, that ED patients who binge and purge perceive themselves as having lower self-regulatory abilities and greater impulsivity, but may not exhibit differences on these constructs when assessed using behavioral paradigms in the laboratory. Although some research suggests that ED patients with different symptom profiles (i.e., binging and purging versus restricting) can be distinguished using cognitive and behavioral measures of regulatory control and impulsivity (i.e., the Stroop task; Claes et al., 2010; the Trail Making and Go-No Go tasks; Claes et al., 2012), behavioral paradigms and observer ratings are necessary to validate these differences. Further, although the measures used to assess psychopathology in this study have good convergence with interview-based diagnoses (Probst et al., 1995; Schotte et al., 2004; Arrindell et al., 2003), future replication should consider of the number of patients within each subgroup who meet diagnostic criteria for other Axis-I and Axis-II disorders, as determined by structured clinical interviews, as this may have important implications for treatment outcomes (Fichter and Quadflieg, 2004; Thompson-Brenner and Westen, 2005).

A final limitation was the cross-sectional nature of this study. As others have noted (Wonderlich et al., 2005b), understanding the impact of personality on eating disorder symptoms requires that researchers employ a variety of methods, including prospective and experimental designs. Without such research, we cannot conclude whether the observed differences in personality, and in co-occurring psychiatric symptoms, function as a precursor or result of ED pathology. Despite these limitations, we believe that the present research provides valuable insight into individual differences in temperament that are associated with distinct clinical presentations in ED inpatients. As such, this research can stimulate further investigation into the impact of such differences on the longitudinal course of ED symptoms and outcomes of ED interventions in this population.

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