

NEUROCOGNITIVE CORRELATES OF PERFECTIONISM: A
MULTIDIMENSIONAL PERSPECTIVE

by

Anthony Robinson, B.S.

A thesis submitted to the Graduate Council of
Texas State University in partial fulfillment
of the requirements for the degree of
Master of Arts
with a Major in Psychological Research
May 2019

Committee Members:

Amitai Abramovitch, Chair

Natalie Ceballos

Joseph Etherton

COPYRIGHT

by

Anthony Robinson

2019

FAIR USE AND AUTHOR'S PERMISSION STATEMENT

Fair Use

This work is protected by the Copyright Laws of the United States (Public Law 94-553, section 107). Consistent with fair use as defined in the Copyright Laws, brief quotations from this material are allowed with proper acknowledgement. Use of this material for financial gain without the author's express written permission is not allowed.

Duplication Permission

As the copyright holder of this work I, Anthony Robinson, authorize duplication of this work, in whole or in part, for educational or scholarly purposes only.

DEDICATION

To Breana— you went to every presentation, you listened to every research idea, you encouraged me to continue working when I felt like giving up, and you supported me in a way that no one ever has. Thank you.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank Dr. Amitai Abramovitch, my thesis chair and mentor, for his guidance and support throughout this project. I would also like to thank the other members of my committee, Dr. Joseph Etherton and Dr. Natalie Ceballos for providing invaluable feedback during the drafting process.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	v
LIST OF TABLES	vii
LIST OF ABBREVIATIONS	viii
ABSTRACT	ix
CHAPTER	
I. INTRODUCTION	1
II. MEASURES OF PERFECTIONISM	4
III. PERFECTIONISM, PSYCHOPATHOLOGY, and NEUROPSYCHOLOGY	10
IV. PURPOSE	16
V. METHODOLOGY	17
VI. RESULTS	28
VII. DISCUSSION	38
REFERENCES	46

LIST OF TABLES

Table	Page
1. Prevalence of DSM disorders in high and low negative perfectionism and perfectionism Subtypes	19
2. Demographic and clinical characteristics of high and low negative perfectionism groups and entire sample.....	28
3. Neuropsychological test performance across low and high negative perfectionism groups while controlling for depression, anxiety, stress, ESIQ, and comorbidity	30
4. Neuropsychological test performance across perfectionism subtypes while controlling for depression, anxiety, stress, and comorbidity	33
5. Pearson correlations between cognitive functions and perfectionism indices	35

LIST OF ABBREVIATIONS

Abbreviation	Description
OCD	Obsessive-Compulsive Disorder
PCI	Perfectionistic Cognitions Inventory
FMPS	Frost Multidimensional Perfectionism Scale
MPS	Multidimensional Perfectionism Scale
SOP	Self-Oriented Perfectionism
OOP	Other-Oriented Perfectionism
SPP	Socially-Prescribed Perfectionism
APS-R	Almost Perfect Scale- Revised
PANPS	Positive and Negative Perfectionism Scale
PI	Perfectionism Inventory
SAD	Social Anxiety Disorder
BCST	Berg Card Sorting Test
AN	Anorexia Nervosa
BN	Bulimia Nervosa
HNP	High Negative Perfectionism
LNP	Low Negative Perfectionism
GAD	Generalized Anxiety Disorder
CBT	Cognitive-Behavioral Therapy

ABSTRACT

At its core, perfectionism revolves around one's self-evaluation in the context of performance outcomes. Although perfectionism has been subject to extensive research, scant literature on its effect on cognitive functioning is available, let alone in non-clinical populations. The aim of the present study is to utilize a comprehensive neuropsychological battery to assess cognitive functions among college students with high and low levels of perfectionism. Participants were 98 college students who were screened for clinical status, completed a neuropsychological battery, and assessed for perfectionism and related symptomatology. Results revealed that the high negative perfectionism group had significantly higher levels of depression and stress compared to the low negative perfectionism group. However, no group differences were found across neuropsychological outcomes. Gradient differences on clinical outcome measures were found when three groups characterized by high adaptive, high maladaptive, and mixed perfectionism were compared. However, no differences were found on neuropsychological tests. These findings suggest that higher levels of negative perfectionism are associated with significant psychopathological burden, however no evidence for an impact on cognitive functions was found. These results are particularly important in the context of the need to identify and treat students struggling with high levels of perfectionism and related psychopathological burden - which can be overlooked given that they present with intact cognitive and academic performance.

I. INTRODUCTION

Perfectionism is a personality trait defined by striving for perfection and setting high standards for performance accompanied by critical self-evaluations and concerns about receiving negative evaluations from others (Flett & Hewitt, 2002). Although historically perfectionism has been understood as a unidimensional construct associated with negative outcomes (Burns, 1980; Hollender, 1965), a controversy regarding perfectionism being a multidimensional trait that encompasses both negative as well as positive/adaptive aspects can be dated to the later 19th century (Stoeber, 2018).

Hamachek (1978) suggested that there were two forms of perfectionism, a positive form termed “normal perfectionism” in which individuals enjoy pursuing perfectionistic strivings; and a negative form termed “neurotic perfectionism” in which individuals suffer from perfectionistic strivings. However, this view was widely criticized at a time in which a unidimensional view dominated the literature (Stoeber & Otto, 2006). The unidimensional view of perfectionism reigned until the early 1990’s when perfectionism was re-conceptualized as a multidimensional construct by two separate research groups. Frost and colleagues (1990) initially defined perfectionism as a multidimensional construct encompassing six facets representing largely maladaptive elements of perfectionism: ‘high personal standards’, ‘excessive concern over mistakes’, ‘doubting of actions’, ‘expectations and evaluation of one’s parents’, and ‘an exaggerated emphasis on organization and order.’ Hewitt and Flett (1991) on the other hand focused on interpersonal aspects suggesting three dimensions, namely ‘self-oriented’, ‘other-oriented’, and ‘socially prescribed’ perfectionism. Shortly after the development of the first multidimensional perfectionism scales, Frost and colleagues (1993) found that all of

the perfectionism subscales load onto two higher-order factors termed positive achievement strivings and maladaptive evaluative concerns. Presently perfectionism is commonly perceived to be a multidimensional construct comprised of both adaptive and maladaptive dimensions, similar to what originally was offered by Hamachek (1978). Indeed, a more recent model of perfectionism highlighting four different profiles: non-perfectionist, adaptive perfectionist, maladaptive perfectionist, and mixed perfectionist (Gaudreau & Thompson, 2010) utilizes the same adaptive/non-adaptive conceptualization. However, the nature of the construct of perfectionism and its sub-constructs is still subject to contemporary debate (Flett & Hewitt, 2006; Stoeber, 2018).

Over the last two decades, perfectionism has been most commonly measured using the Frost Multidimensional Perfectionism Scale (Frost et al., 1990), the Multidimensional Perfectionism Scale (P. L. Hewitt & Flett, 1991), the Almost Perfect Scale-Revised (Slaney, Rice, Mobley, Trippi, & Ashby, 2001), the Positive and Negative Perfectionism Scale (Terry-Short, Owens, Slade, & Dewey, 1995), and more recently, the Perfectionism Inventory (Hill et al., 2004). Each scale measures perfectionism using a unique model that defines perfectionism as either a multidimensional or bi-dimensional construct. Despite the differences among these models, each questionnaire has demonstrated that higher levels of perfectionism were found to be associated with psychopathology. In addition, perfectionism has been associated with negative outcomes ranging from minor headaches to law school drop-out rates since the early 1960s (Burns, 1980; Hollender, 1965) and was understood to be a maladaptive trait even before that. Given that evidence has indicated that psychopathology is linked to decreased cognitive function (Semrud-Clikeman & Goldenring Fine, 2013), numerous disorders and

psychopathological mechanisms have been explored in terms of their association with deficiency in cognitive functions. Consequently, perfectionism is often studied in terms of its relationship with specific DSM disorders such as obsessive-compulsive disorder (OCD) and eating disorders, and cognitive function (Rice & Pence, 2006; Vall & Wade, 2015). However, very little research has examined the relationship between perfectionism and cognitive function in the absence of specific DSM disorders, even though perfectionism is known to be a stable psychological trait (Rice & Aldea, 2006). Thus, further research is needed to fill in this gap in the literature to understand the effects of perfectionism and potential mediating factors on cognitive function in the context of the prevailing theories.

II. MEASURES OF PERFECTIONISM

Unidimensional Measures

Very few unidimensional measures of perfectionism have been established in the literature. Of the few, the most prominent were authored by Burns (1980) and Flett, Hewitt, Blankstein, and Gray (1998). Burns (1980) adapted a portion of the Dysfunctional Attitudes Scale to create a perfectionism scale heavily weighted on personal standard setting and concern over mistakes, measuring an individual's perfectionistic thoughts and beliefs. The second measure, Perfectionistic Cognitions Inventory (Flett et al., 1998), uses a cognitive approach to assess and quantify perfectionism. The authors theorize that perfectionistic individuals are preoccupied cognitively with personal and social standards.

Multidimensional Measures

As a result of increased interest in perfectionism, two multi-dimensional perfectionism scales were developed in the early 1990's, one by Frost and his colleagues, the other by Hewitt and Flett. Despite these scales being created around the same time, they are conceptually different. The Frost Multidimensional Perfectionism Scale (FMPS; Frost et al., 1990) includes six subscales. The first subscale is Concern over Mistakes (CM); this scale measures the tendency to interpret mistakes as failure and a tendency to believe that one will lose respect from others if they fail. The second subscale, Personal Standards (PS), reflects the setting of exceptionally high standards and quantifies the importance placed on them for self-evaluation. The Parental Expectations (PE) subscale measures the tendency to believe that one's parents set high goals for them.

The fourth subscale, Parental Criticism (PC), measures the perception that one's parents are overly critical. The Doubting of Actions (DA) subscale consists of items that reflect the extent to which people doubted their ability to accomplish tasks. Organization, the final subscale, measures the importance placed on order and organization. Frost et al. (1990) recommend omitting the organization subscale when calculating the total score because it has been found to be loosely related to the other subscales.

The second measure, Multidimensional Perfectionism Scale (MPS; P. L. Hewitt & Flett, 1991) is a socio-psychological measure of perfectionism with three subscales: Self-oriented perfectionism (SOP), Other-oriented perfectionism (OOP), and Socially prescribed perfectionism (SPP). The primary difference among the three dimensions is the object to which the perfectionistic behavior is directed or to whom the perfectionistic behavior is attributed. SOP involves self-directed perfectionistic behaviors. The SOP subscale measures behaviors such as setting high standards for evaluating one's own behavior. OOP involves the beliefs and expectations about the capabilities of others. The OOP subscale measures one's tendency to have unrealistic and high standards for others, place importance on other people being perfect and evaluates others' performance. SPP involves the perceived need to attain standards and expectations prescribed by significant others. The SPP subscale measures one's perception that significant others have unrealistic standards for them, evaluates them, and pressures them to be perfect.

Bi-dimensional Measures

More recent research has defined perfectionism as a bi-dimensional construct containing an adaptive and maladaptive domain based on the findings of Frost and

colleagues (1993). The authors found that all of the multidimensional subscales loaded onto two higher order factors which they termed Maladaptive Evaluative Concerns and Positive Striving. As a result, different measures have been created using a theoretical framework based on the bi-dimensional model. The most prominent models include Positive/Achievement Striving vs. Evaluative Concerns, Positive Striving vs. Discrepancy, Positive vs. Negative, and Conscientious vs. Self-Evaluative.

As stated previously, both the FMPS and MPS subscales can be combined to create a Positive Striving (adaptive) factor and an Evaluative Concerns (maladaptive) factor (Frost et al., 1993). The Personal Standards and Organization subscales from the FMPS and the Self-Oriented Perfectionism and Other-Oriented Perfectionism subscales from the MPS load onto the Positive Striving factor. The Concern over Mistakes, Parental Criticism, Parental Expectations, Doubts about Actions subscales from the FMPS and Socially-Prescribed Perfectionism from the MPS load onto the Evaluative Concerns factor. Additionally, The FMPS-Brief (Burgess, Frost, & DiBartolo, 2016) was developed using items from the FMPS to measure Positive Achievement Striving Perfectionism and Evaluative Concerns Perfectionism directly.

The Almost-Perfect Scale-Revised (APS-R; Slaney et al., 2001) is a three-factor measure of perfectionism that contains a Personal Standards (Adaptive) dimension and a Discrepancy (maladaptive) dimension. The three factors include (i) Personal standards, the tendency towards high self-achievement, (ii) Order, the tendency to prefer one's own work, and (iii) Discrepancy, the perception that personal standards are not being met. The Personal standards and Order subscales load onto the adaptive factor while the Discrepancy subscale loads onto the maladaptive factor.

The Positive and Negative Perfectionism Scale (PANPS; Terry-Short et al., 1995) is a two-factor measure of perfectionism based on Skinnerian theory. Positive perfectionism refers to cognitions and behaviors directed at the achievement of goals to obtain a positive consequence while negative perfectionism refers to cognitions and behaviors directed at the achievement of goals to avoid a negative consequence. Therefore, positive perfectionism is driven by the need to achieve and negative perfectionism is driven by avoidance (e.g. avoiding failure). Positive perfectionism comprises the adaptive factor and Negative perfectionism comprises the maladaptive factor.

The perfectionism Inventory (PI; Hill et al., 2004) is a two-factor measure of perfectionism adapted from the FMPS and the MPS consisting of eight subscales. The subscales include Concern over Mistakes, High Standards for Others, Need for Approval, Organization, Perceived Parental Pressure, Planfulness, Rumination, and Striving for Excellence. Concern Over Mistakes refers to the tendency to experience distress or anxiety over making a mistake. High Standards for Others refers to the tendency to hold others to one's own perfectionist ideals. Need for Approval refers to the tendency to seek validation from others and be overly sensitive to criticism. Organization refers to the tendency to be neat and orderly. Perceived Parental Pressure refers to the tendency to feel the need to perform perfectly to obtain approval from one's parents. Planfulness refers to the tendency to plan ahead and deliberate over decisions. Rumination refers to the tendency to obsessively worry about past errors, imperfect performance, or future mistakes. Striving for Excellence refers to the tendency to pursue perfect results and very high standards. Organization, Striving for Excellence, Planfulness, and High Standards

load onto the Conscientious Perfectionism factor while Concern Over Mistakes, Need for Approval, Perceived Parental Pressure, and Rumination load onto the Self-Evaluative Perfectionism factor. In addition, the PI also offers a total perfectionism score.

Perfectionism: Multidimensional vs. Bi-dimensional

Although the multidimensional perfectionism scales developed by Frost and colleagues (1990) and Hewitt and Flett (1991) have been widely used in the literature, there have been many criticisms of the scales. One criticism of the FMPS is that the DA subscale has a substantive overlap with symptoms of Obsessive-Compulsive Disorder (OCD). It has been argued that the DA subscale does not reflect perfectionism but rather symptoms of OCD (Shafran & Mansell, 2001) because the majority of items on the subscale were derived from a measure of OCD symptoms (Limburg, Watson, Hagger, & Egan, 2017). A major criticism of the MPS is that the Other-oriented and Socially-prescribed subscales do not measure perfectionism (Shafran & Mansell, 2001). Additionally, authors have argued that the widespread use of these scales has led to a reduced understanding of the main aspects and clinical relevance of perfectionism (Fairburn, Cooper, & Shafran, 2003). A meta-analysis revealed that the two primary dimensions of perfectionism consistently explained significant amounts of variance within psychopathology, whereas the subscales from different perfectionism scales were unable to explain the variance in most of their meta-regression models, providing more support for the formation of two higher-order factors of perfectionism (Limburg et al., 2017).

Although the conceptualization of perfectionism as bi-dimensional has become the gold standard in the recent literature, it is not without criticism. One of the major criticisms of viewing perfectionism as both adaptive and maladaptive is the clinical implications it has. Flett and Hewitt (2006) argue that if the idea that a healthy form of perfectionism exists is widely accepted, then clinicians may attempt to transform negative perfectionism into positive perfectionism rather than remove perfectionism altogether. Flett and Hewitt posit, the term perfectionist should be reserved only for individuals who hold rigidly to their standards, in any situation, and who constantly place an irrational importance on the attainment of impossibly high standards in multiple domains of life and that it should not be equated with high levels of conscientiousness. Additionally, it has been found that adaptive dimensions of perfectionism are associated with potentially debilitating automatic thoughts (Flett et al., 1998), demonstrating that even “adaptive perfectionism” can be maladaptive.

III. PERFECTIONISM, PSYCHOPATHOLOGY, and NEUROPSYCHOLOGY

Perfectionism and Psychopathology

In the general population, high levels of perfectionism have been associated with psychopathological correlates such as depression (e.g., Mehr & Adams, 2016) and stress (e.g., Ashby, Noble, & Gnilka, 2012). Additionally, perfectionism can interact with specific stressors, increasing the risk for depression (P. L. Hewitt & Flett, 1993). However, self-esteem (Rice, Ashby, & Slaney, 1998), rumination (Nepon, Flett, Hewitt, & Molnar, 2011), and negative social feedback (Nepon et al., 2011) have been found to mediate the relationship between perfectionism, stress, and depression. In addition to stress and depression, perfectionism is also associated with anxiety (e.g., Gnilka, Ashby, & Noble, 2012), including both the somatic aspect as well as its cognitive aspects. These include, worrisome thoughts (e.g., Handley, Egan, Kane, & Rees, 2014), intrusive thoughts (e.g., Flett, Madorsky, Hewitt, & Heisel, 2002), and obsessions (e.g., Tolin, Brady, & Hannan, 2008). It should also be noted, that perfectionism has also been linked to suicidal ideation (e.g., Enns, Cox, Sareen, & Freeman, 2001; Paul L. Hewitt, Flett, & Weber, 1994; Shahnaz, Saffer, & Klonsky, 2018).

In addition to psychopathological correlates, perfectionism is associated with several disorders including Obsessive-Compulsive Disorder (OCD), Anorexia Nervosa (AN), Obsessive-Compulsive Personality Disorder (OCPD) and Social Anxiety Disorder (SAD; Limburg et al., 2017; Shafran & Mansell, 2001). More specifically, individuals diagnosed with OCD have been found to have elevated scores on Total Perfectionism, Concern Over Mistakes, and Doubts About Actions compared to non-psychiatric controls, and have higher Doubts about Actions scores than those diagnosed with Panic

Disorder with Agoraphobia (Frost & Steketee, 1997). With respect to eating disorders, higher scores on both evaluative concerns and achievement striving dimensions among individuals diagnosed with Anorexia Nervosa have been found (Bastiani, Rao, Weltzin, & Kaye, 1995). Similarly, higher scores on both maladaptive and achievement striving dimensions have been found among individuals diagnosed with Bulimia Nervosa (Vohs, Bardone, Joiner, Abramson, & Heatherton, 1999). Interestingly, anxiety has been found to partially mediate the relationship between perfectionism and eating disorders in that anxiety partially accounts for the positive relationship between perfectionism and eating disorders (Egan et al., 2013).

Perfectionism, Psychopathology and Neuropsychology

Psychopathology has been linked to decreased cognitive function across multiple disorders in children and adults (Millan et al., 2012). As a result, perfectionism is often examined in terms of its relationship with neuropsychology in the presence of specific DSM disorders. Numerous studies have attempted to identify the relationship between perfectionism, and cognitive abilities such as set-shifting, in eating disorders. Set-shifting involves the ability to shift attention between mental sets and tasks as a response to either changing goals or stimuli (Tchanturia et al., 2011). In a study conducted by Linder and colleagues (2014) individuals fully recovered from Anorexia Nervosa were compared to non-psychiatric controls on set-shifting ability and perfectionism. The authors found that in the control group, higher manifestations of perfectionism were associated with fewer categories achieved (i.e., number of correct trials), and more perseverations (i.e., the repetition of a particular response) on the on the Berg Card Sorting Test (BCST), and

briefed reaction times for set-shifting (i.e., how quickly a mental set is changed). The opposite effect was found in the Anorexia Nervosa Recovery group; high perfectionism was related to more categories achieved, fewer perseverations on the BCST and longer reaction times for set-shifting. In this study reaction time was calculated by assessing the difference between the reaction time of the first trial with the feedback 'wrong', and the mean reaction time of the three trials before. In addition, the total perfectionism score was used to quantify perfectionism. Another study assessed set shifting in Anorexia patients (AN), Bulimia patients (BN), and non-psychiatric controls (Vall & Wade, 2015). The authors found that higher personal standards perfectionism (adaptive) predicted better performance for all measures of set-shifting other than accuracy, across the AN, BN, and control group. Higher concern over mistakes perfectionism (maladaptive) was associated with better performance accuracy in the BN group only. The results of these studies highlight the differential effects of perfectionism on set-shifting in relation to healthy controls and individuals recovered and suffering from eating disorders. More specifically, these results suggest that perfectionism may impact set-shifting ability either positively or negatively depending on clinical status and the type of perfectionism endorsed.

In addition to eating disorders, perfectionism has been linked to anxiety disorders and OCD for over one hundred years (Frost, Novara, & Rhéaume, 2002). More specifically, perfectionism has been associated with OCD related obsessions in clinical populations (Tolin et al., 2008). Relatedly, these obsessions in OCD have been associated with neuropsychological underperformance (Olley, Malhi, & Sachdev, 2007). Abramovitch and colleagues (2011) have proposed the Executive Overload Model of

OCD accounting for impairments related to obsessional thoughts in OCD. The authors postulate that an overflow of obsessive thoughts, which are associated with hyperactivity of the fronto-striatal system, are a result of a continuous attempt to control automatic processes. In turn, the overflow of obsessive thoughts causes an overload on the executive system. This overload on the executive system consumes cognitive resources, resulting in cognitive impairments. In addition, an awareness of these impairments creates an increased need to over-control the behavior. The attempts to control the behavior result in an increased number of obsessions and cause a further overload on the executive system (Abramovitch et al., 2011). It can be speculated that individuals with increased perfectionism are affected similarly to individuals with OCD.

Perfectionism and Neuropsychology

Given that perfectionism is a trait associated with constant evaluation of performance, it is surprising that research directly examining cognitive functioning in the context of perfectionism is scarce. Furthermore, the burden of psychopathology, cognitive aspects of anxiety related to perfectionism, and most DSM disorders have been associated with a small to moderate degree of deficient performance on most neuropsychological domains (e.g., Abramovitch et al., 2011; Crowe, Matthews, & Walkenhorst, 2007; Doyle et al., 2018; Snyder, Hankin, & Miyake, 2015; Yang, Teng, Liu, Cao, & Shields, 2017). Moreover, the limited research available on perfectionism and cognitive function has been conducted almost exclusively with clinical populations, and little is known about this this association in the general population. For example, Tchanturia and colleagues (2004) examined performance on set shifting tasks in AN and

found that childhood (but not current) perfectionism predicted performance on the Trail Making Test part B (TMB) set shifting task. Slade, Coppel, and Townes (2009) conducted the only study that utilized a comprehensive neuropsychological battery. The authors examined neuropsychological correlates of perfectionism using a bi-dimensional model in a sample of treatment seeking individuals. The authors found that negative perfectionism was negatively correlated with performance on tests of attention assessed by the WAIS Digit symbol and Symbol Search, and with working memory performance, as assessed by the WMS Spatial Span test. Positive correlations were found between negative perfectionism and performance on two set shifting tasks. However, the magnitude of these correlations was small ($r = -.16$ to $-.26$). In contrast, positive perfectionism was positively correlated with performance on tasks of attention and working memory, with correlations of similar magnitude. The authors speculated that negative perfectionism is associated with a central motivational theme in which individuals primarily attempt to avoid making errors, which in turn, negatively affects attention and planning. Additionally, the authors suggest that the opposite motivation (i.e., striving to succeed on tasks) is associated with positive perfectionism (Slade et al., 2009). However, this study utilized a sample of mixed psychiatric and neurologic conditions. Therefore, the effects of the core psychopathology and perfectionism on cognitive function cannot be teased apart. Thus, an evaluation of neurocognitive function associated with perfectionism is needed in non-clinical populations, where perfectionism may not be secondary to the core psychopathology.

In addition, only one study assessed the association between cognitive functions and perfectionism in college students. In this study, Desnoyers and Arpin-Cribbie (2015)

assessed the relationships among self-oriented and socially-prescribed perfectionism, working memory, and attention. The authors found that only socially-prescribed (i.e., maladaptive, negative) perfectionism predicted working memory performance as assessed by a verbal N-back task. However, neither form of perfectionism was found to be associated with attention. No study to date has conducted a comprehensive evaluation of cognitive functions in a non-clinical sample assessing performance difference between high and low perfectionism.

IV. PURPOSE

Given the lack of research on the neuropsychological profile of perfectionism and the limitations of the previously mentioned study, this gap in the literature warrants research that conducts a comprehensive neuropsychological and clinical evaluation in while controlling and assessing mediators and moderators in the general population. The purpose of this study is to assess the cognitive correlates of perfectionism while addressing phenomenology/symptomatology, psychopathology, and other related factors. A secondary goal of the present research is to explore the neuropsychological correlates of different sub-dimensions of perfectionism. The proposed hypotheses are that (1) perfectionism will be associated primarily with reduced processing speed, and with under-performance on tasks of executive function such as Trail making B, and verbal memory tasks such as CVLT-II; and (2) adaptive perfectionism will be associated with intact cognitive functions. Additionally, this study will explore the cognitive and psychological correlates of individuals scoring high in both the adaptive and non-adaptive dimensions.

V. METHODOLOGY

Participants

Participants were recruited as part of a large neuropsychological study conducted at Texas State University. Participants ($n = 98$) were recruited via ads, flyers, and emails. Inclusion criteria were minimum age of 18, intact or corrected vision, and fluency in English. Exclusion criteria included age > 65 , and any history of major neurological conditions (e.g., epilepsy, brain injury). All participants were requested to avoid taking any stimulant medications, or sedatives (e.g., benzodiazepines), or to engage in heavy drinking twenty-four hours prior to the time of assessment. Immediately upon completing the assessment session (that included neuropsychological and clinical assessments) in the lab, one-hundred nine consecutive participants were asked to complete more surveys online for additional reimbursement. These 109 participants were invited to complete additional measures within three months of the completed neuropsychological battery. Individuals who completed the neuropsychological battery more than three months prior to the start of the present study were not invited to participate. Ninety-eight participants who completed the online phase comprised the final sample. The demographic breakdown of the sample can be found in Table 1. The mean age for the entire sample was 21.4 years ($SD=3.2$) and 63.3% of the sample were female. Of the entire sample ($n=98$), 7 participants met criteria for substance abuse disorder (7.1%), 7 for attention deficit/hyperactivity disorder (7.1%), 6 for GAD (6.1%), 4 for Major Depressive Disorder (4.1%), 3 for Social Anxiety Disorder (3.1%), 3 for Bulimia Nervosa (3.1%), 2 for OCD, (2.0%), and 1 participant met criteria for PTSD (1.0%). Prevalence of DSM disorders for specific sub groups can be found in Table 1. All participants signed an

informed consent and were compensated \$40 for participating in the initial in-person session, and \$10 for completing the additional measures related to the present study. This study was approved by the Institutional Review Board in accordance with the declaration of Helsinki.

Table 1. Prevalence of DSM disorders in high and low negative perfectionism and perfectionism subtypes.

	Low Negative Perfectionism (<i>n</i> = 52)	High Negative Perfectionism (<i>n</i> = 46)			Adaptive (<i>n</i> = 24)	Maladaptive (<i>n</i> = 22)	Mixed (<i>n</i> = 24)		
Disorder	%(<i>n</i>)	%(<i>n</i>)	X^2/t	Sig	%(<i>n</i>)	%(<i>n</i>)	%(<i>n</i>)	X^2/F	Sig
Major Depressive Disorder	-	8.7%(4)	4.17	.03*	-	13.6%(3)	4.2%(1)	4.12	.12
Social Anxiety Disorder	1.9%(1)	4.3%(2)	0.48	.48	-	9.1%(2)	-	4.49	.10
Generalized Anxiety Disorder	1.9%(1)	10.9%(5)	3.40	.06	-	9.1%(2)	12.5%(3)	3.01	.22
Post-Traumatic Stress Disorder	1.9%(1)	-	0.89	.34	-	4.5%(1)	8.3%(2)	2.04	.36
Obsessive-Compulsive Disorder	-	4.3%(2)	2.04	.12	-	4.5%(1)	4.2%(1)	1.08	.58
Bulimia Nervosa	-	6.5%(3)	3.50	.06	12.5%(3)	9.4%(2)	4.2%(1)	1.07	.58
Attention-Deficit Hyperactivity Disorder	7.7%(4)	6.5%(3)	0.05	.82	-	4.5%(1)	8.3%(2)	0.47	.79
Substance Abuse Disorder	7.7%(4)	6.5%(3)	0.05	.82					
No Disorder	88.5%(46)	67.4%(31)	6.44	.01*	79.2%(19)	68.2%(15)	66.7%(16)	1.08	.58
Any Disorder	11.5%(6)	32.6%(15)	6.44	.01*	20.8%(5)	31.8%(7)	33.3%(8)	1.08	.58
Average Number of Disorders	.25	.58	1.91	.06	.20	.72	.45	1.91	.15

Note. **p* < .05

Materials

Clinical Measures

1. Mini-International Neuropsychiatric Interview 7.0 (MINI; Sheehan et al., 1998).

The MINI is a valid, reliable and widely used semi-structured diagnostic screening interview. The MINI 7.0 covers primary DSM- 5 disorders and demonstrates good psychometric properties (Sheehan et al., 1998). The presence of a DSM disorder (i.e., yes or no) was used as the outcome measure.

2. Depression, Stress, Anxiety Scale-21 (DASS-21; Lovibond & Lovibond, 1995).

The DASS-21 is a self-report questionnaire that measures severity of depression, anxiety, and stress symptoms. Each item is scored from 0 (“did not apply to me at all over the last week”) to 3 (“applied to me very much or most of the time over the past week”). The DASS-21 demonstrates good to excellent reliability and validity. The internal consistency of the three subscales was found to be good to excellent in non-clinical samples (Cronbach’s $\alpha = .91, .80$, and $.84$ for depression, anxiety, and stress, respectively) (Sinclair et al., 2012), and clinical samples (with α range, $.81- .92$ (Clara, Cox, & Enns, 2001). In the current study, good to excellent reliability was found for the DASS-21 ($\alpha = .91, .83$, and $.88$ for depression, anxiety, and stress, respectively).

3. The State Trait Anxiety Inventory – State short form (STAI-State; Marteau & Bekker, 1992) is a 6 item self-report questionnaire adapted from the State Trait Anxiety Inventory. The STAI-State short form demonstrated good internal

consistency ($\alpha = .82$; Marteau & Bekker, 1992). Similar good reliability was found in the current study ($\alpha = .80$).

4. The Positive and Negative Perfectionism Scale (Terry-Short et al., 1995) is a 40-item questionnaire comprising two-subscales: positive and negative perfectionism. Twenty items form the positive perfectionism subscale and twenty items from the negative perfectionism subscale. The items are rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The positive perfectionism subscale is comprised of questions associated with the positive reinforcement of perfectionistic behavior such as, “*Producing a perfect a performance is a reward in its own right.*” The negative perfectionism subscale is comprised of questions associated with the negative reinforcement of perfectionistic behavior such as, “*I try to avoid the disapproval of others at all costs.*” The scores for each subscale range from 20 to 100. The positive perfectionism subscale and the negative perfectionism subscale demonstrate good to excellent internal consistency in student samples ($\alpha = .87$ to $.94$; Egan, Piek, Dyck, & Kane, 2011). In the present study the both scales were found to have good internal consistency ($\alpha = .88$ for positive and negative perfectionism).

Neuropsychological Measures

A battery of well-validated neuropsychological tests was selected. The following neuropsychological domains and tests were administered:

Executive Functions.

1. The Trail Making Test (TMT; Delis, Kaplan, & Kramer, 2001) is a subtest of the Delis Kaplan Executive Function Systems Battery. The TMT includes two parts, Trail making A and B (TMA and TMB). The TMB measures set-shifting and requires participants to draw a line connecting circled numbers and letters while alternating between numbers and letters in ascending and alphabetical order. The total time in seconds for TMB was used as the outcome measure.
2. The Wisconsin Card Sorting Test (WCST; Loong, 1990)-assesses concept formation, set-shifting, and the ability to utilize environmental feedback for cognitive sets. During the task, a number of stimulus cards are presented to the participant. The participant is told to match the cards, but not how to match. Once the participant selects which pile to place the card, they are given feedback on whether they followed the correct rule. Outcomes of interest were percent preservative errors and the number of categories completed.
3. The Tower of London (TOL; Shallice, 1982) assesses planning ability and problem-solving skills. A computerized version of the Tower of London (Sanzen Neuropsychological Assessment Tests, Colorado Springs, Colorado) was administered. The TOL task requires participants to move beads from a standard initial position to match the ‘goal’ arrangement while following specific rules. The outcome measure of interest for this task was total excess moves beyond the minimum required to complete the model correctly.
4. The Digit Span Task (DS; Wechsler, 2008) is a subtest of the Wechsler Adult Intelligence Scale- IV (WAIS-IV) assessing working memory and specific aspects such as maintenance and manipulation. This test requires participants to repeat a

series of digits and has three conditions: forward, backward, and sequencing. The forward test requires the participant to repeat the digits verbatim, the backward test requires the participant to repeat the digits in reverse order, and the sequencing test requires participants to repeat the digits in ascending order. The outcome measures for this task were total DS Forward, total DS backward, total DS sequencing scores, and a combined sum of all three trials.

5. The Symbol Span test (Wechsler, 2009) is a subtest of the Wechsler Memory Scale-IV (WMS-IV) assessing visual working memory. Participants are briefly shown a series of abstract symbols on a page and then asked to select the symbols they saw in the same order they were previously presented. The outcome measures for this task was the total number of correct trials.
6. Verbal fluency (VF; Delis et al., 2001) measures phonemic fluency (i.e., generating words that begin with a specified letter) and category/semantic fluency (i.e., generating words that belong to a specific category). The outcome measures used were the total number of words for letter fluency and category fluency.
7. The Conners' Continuous Performance Test 3rd Edition (CPT-III; Conners, 2014) is a continuous performance test that assesses response inhibition, attention, and processing speed. The CPT requires participants to press the space bar or click the mouse button when any stimuli other than the target stimuli appears on the screen. Stimuli appear on the screen with different time intervals between each one. The outcome measure of interest in the context of executive function was commission errors as an indicator of response inhibition.

Memory.

1. The California Verbal Learning Test-II (CVLT; Delis et al., 2000) is an auditory list-learning task that requires participants to recall a series of words from a list. Total numbers of words recalled correctly in the short delay and long delay trials, and the cumulative number of words on trials 1-5 were used as outcomes measures in the present study.
2. The Rey-Osterrieth Complex Figure Test (RCFT; Osterrieth, 1944) is a non-verbal memory test. The test includes a copy, immediate, and delayed trials. In this study, the immediate and delayed trials were used as measures of non-verbal memory, using the Meyers & Meyers administration and scoring system (Meyers & Meyers, 1996). For this task, participants are asked to copy an ambiguous figure and then reproduce the figure again from memory.

Processing Speed.

1. The TMA (Delis et al., 2001) is a common measure of processing speed with a graphomotor component. The TMA requires participants to draw a line connecting circled numbers as fast as possible. The total time in seconds for TMA was used as the outcome measure.
2. The CPT-III mean 'go' reaction time was used as an additional outcome measures of interest for processing speed.

Attention.

1. The CPT-III reaction time standard deviation and omission errors were used as outcome measures for attention.

Visuospatial function.

1. The RCFT copy score was used as an indicator for visuospatial function.

Estimated IQ.

1. IQ (ESIQ). IQ was estimated using the Oklahoma Premorbid Intelligence Estimate (OPIE-IV) algorithm for WAIS-IV (Holdnack, Schoenberg, & Lange, 2013). The OPIE-IV algorithm is a psychometrically valid, empirically derived formulae that includes the WAIS-IV Vocabulary and Matrix Reasoning subtest scores, which were administered as part of the present study to estimate levels of intellectual functioning; as well as demographic variables.

Procedure

Research assistants underwent a rigorous 3-month training schedule conducted by a licensed clinical neuropsychologist. Training included hands-on instructional training, multiple mock administrations of the MINI and the neuropsychological battery, examination of video recordings, as well as one-on-one in-person evaluations by the thesis chair. Prior to entering each data point into the database, a dedicated data manager carefully reviewed all outcome measures for all participants upon completion of every session. This process was employed under direct supervision of the thesis chair. Participants were seen individually in a quiet lab room. Each participant completed the MINI clinical interview first, followed by the neuropsychological assessments and the self-report questionnaires which were counterbalanced. Each session took approximately 3.5 hours including a 10-minute break. All computerized test and questionnaires were

taken on identical laptops designated for the study. In addition, online questionnaires were administered via the Qualtrics secured online platform.

Upon completion of the in-person session, 109 consecutive participants were emailed with a request to complete 3 additional surveys. Each participant completed the PANPS and the DASS-21. All Participants signed an electronic informed consent for this portion of the study and were compensated with a \$10 gift card.

Analytic plan

All analyses were conducted using IBM SPSS version 24. To assess overall associations between perfectionism indices and cognitive function, Pearson's correlations were computed. To assess the differences between high and low levels of negative perfectionism, two sub-samples were created using a median split, which has been previously employed as a reliable method to distinguish between high and low perfectionism (e.g., Zuroff et al., 2000). The median split value for the PANPS negative perfectionism score in the present study was 60. Analysis of variance was used to compare the high (HNP) and low negative perfectionism (LNP) groups on continuous clinical and demographic variables, and Pearson's Chi squared test was used for nominal variables. MANCOVA was utilized to assess group differences on neuropsychological tests. In addition, in order to assess the differences between sub-domains of perfectionism, participants were classified as adaptive, maladaptive, or mixed using a median split for those factors based on the PANPS (Median=77 for positive perfectionism). Participants who scored above the median for positive perfectionism and below the median for negative perfectionism were classified as 'Adaptive'. Participants

who scored below the median for positive perfectionism and above the median for negative perfectionism were classified as ‘Maladaptive’. Participants who scored above the median for both positive and negative perfectionism were classified as ‘Mixed’. Participants who scored below the median split for both dimensions were classified as non-perfectionists ($n= 28$) and were excluded from analyses. A MANCOVA was used for the 3-group analysis, with the addition of planned contrasts. Given the high number of comparisons and the risk of familywise inflation of type I errors, a correction for multiple comparisons was employed across comparisons, utilizing the Holm-Bonferroni correction method (Holm, 1979).

VI. RESULTS

Clinical and demographic characteristics of HNP and LNP groups

No significant differences were found between the HNP and LNP groups on demographic variables apart from IQ. Although both groups had a normative and slightly elevated IQ, the HNP group had a higher IQ, compared to the LNP group ($M_{DIFF} = 4.69$ IQ points). In terms of clinical indices, Pearson's Chi-Square revealed that the HNP group higher prevalence of individuals meeting criteria for at least one DSM-Disorder ($p = .014$). Furthermore, univariate analyses revealed that the HNP group exhibited significantly higher scores on the DASS-21 Depression ($p = .01$, and Stress ($p = .02$, see Table 2). These variables including the number of comorbid conditions (see Table 1), were controlled for in subsequent analyses of neuropsychological outcome measures. Notably, although no significant differences were observed on the DASS-21 Anxiety subscale ($p = 0.07$), the effect size found was larger than .2 ($d = 0.40$). According to Sullivan and Feinn (2012) an effect size greater than .2 is not trivial, therefore anxiety scores were controlled for in all subsequent analyses.

Table 2. Demographic and clinical characteristics of high and low negative perfectionism groups and entire sample.

	LNP ($n = 49$)		HNP ($n = 42$)				Entire Sample ($n=98$)	
	Mean/%	SD	Mean/%	SD	$F(1,89)/\chi^2$	Sig	Mean/%	SD
Age (years)	21.06	2.59	21.52	3.26	0.453	.45	21.41	3.20
Education (years)	15.06	1.36	15.21	1.33	0.591	.59	15.16	1.36
%Females	68.6%	-	58.7%	-	0.852	.40	62%	-
GPA	3.24	0.53	3.10	0.49	1.709	.19	3.16	0.52

DASS-21 Depression	6.92	9.10	12.04	11.24	5.732	.01*	13.44	17.02
DASS-21 Anxiety	6.12	8.92	9.62	8.48	3.323	.07	7.42	8.68
DASS-21 Stress	10.48	10.32	16.18	11.10	5.307	.02*	12.58	10.88
STAI- State Anxiety	32.24	10.21	35.39	11.66	1.889	.17	33.64	10.67
Estimated IQ	105.98	10.15	110.67	9.45	5.116	.02*	107.65	10.11
Positive Perfectionism	80.14	9.06	78.22	10.11	2.876	.09	77.78	10.47
Negative Perfectionism	50.76	6.48	70.74	7.67	181.383	<.01**	59.44	12.63

DASS-21, Depression Anxiety Stress Scale 21; STAI, State Trait Anxiety Inventory;
Sig, Significant Difference * note using Fisher's Exact test for binary variables (gender, comorbidity)
IQ Estimation derived from OPIE-IV Equations
Note. * $p < .05$ ** $p < .01$

Neuropsychological test performance – HNP and LNP

A MANCOVA was conducted to compare the HNP and LNP groups on neuropsychological outcome measures while controlling for depression, stress, anxiety, estimated IQ, and comorbidity (see Table 3). Univariate analyses of the 22 neuropsychological outcome measures revealed that the HNP group scored significantly lower only on the DS backward ($p = 0.01$) and phonemic fluency ($p = 0.02$). than the LNP group. However, these comparisons did not survive correction for multiple comparisons and were determined not significant. Effect sizes across tests were small ($d = 0.00 - 0.46$) and 86% of the neuropsychological effect sizes indicated better performance by the HNP group. However, according to scaled scores produced using test norms, both groups performed in the normative range (see supplementary materials). Notably, no group difference was found on GPA.

Table 3. Neuropsychological test performance across low and high negative perfectionism groups while controlling for depression, anxiety, stress, ESIQ, and comorbidity.

	LNP (<i>n</i> = 47)		HNP (<i>n</i> = 43)		F (1,83)	Sig	Cohen's <i>d</i> *
	Mean	SD	Mean	SD			
Executive Functions							
<i>Set shifting</i>							
Trail Making B (sec)	78.85	37.06	75.47	34.62	0.016	.91	- .09
<i>WCST</i>							
Preservative Errors	10.53	6.43	9.33	3.65	0.404	.52	- .22
<i>WCST</i>							
Categories Completed	5.45	1.58	5.72	0.95	0.140	.70	- .20
<i>Planning</i>							
TOL Excess Moves	6.66	6.89	5.60	5.56	0.071	.79	- .16
<i>Working Memory</i>							
DS Forward	10.51	2.24	10.53	2.43	0.059	.80	< - .01
DS Backward	9.17	2.28	8.60	1.92	5.687	.01*	.27
DS Sequencing	9.04	2.17	9.74	2.47	0.912	.34	- .30
DS Total	28.66	4.84	28.88	5.53	0.375	.54	- .04
Symbol Span Total	27.91	7.38	28.33	6.45	0.286	.59	- .06
<i>Fluency</i>							
VF-Letter Total	43.00	9.65	38.91	10.49	5.103	.02*	.40
VF-Category Total	41.62	6.20	42.58	8.66	0.036	.84	- .12
<i>Response Inhibition</i>							
<i>CPT</i>							
Commission Errors	27.96	16.30	27.63	13.95	0.012	.91	- .02
Memory							
<i>Verbal</i>							
CVLT Short Delay Recall	11.87	2.74	11.93	2.39	0.016	.89	- .02

CVLT Trials1-5	53.83	9.62	54.47	8.22	0.145	.70	- .07
CVLT Long Delay Recall	12.21	2.94	12.51	2.26	0.014	.90	- .11
<i>Non- verbal</i>							
RCFT Immediate	24.01	5.29	24.45	6.59	0.006	.94	- .07
RCFT Delayed	23.48	4.63	23.87	6.55	0.005	.94	- .06
Processing Speed							
Trail Making A (sec)	29.72	9.96	25.44	8.44	2.130	.14	- .46
CPT Mean RT (ms)	391.91	52.40	393.21	52.83	0.656	.42	.02
Attention							
CPT Omission Errors	1.45	5.56	0.56	1.09	1.498	.22	- .22
CPT RT SD	96.57	39.56	88.94	39.67	0.039	.84	-.19
Visuospatial							
RCFT Copy	35.21	1.39	35.54	0.91	0.627	.43	- .28

CVLT, California-Verbal Learning Test II; RCFT, Rey-Osterreith Complex Figure Test; DS, Digit Span; WCST, Wisconsin Card Sorting Task; TOL, Tower of London; VF, Verbal Fluency; DF, Design Fluency; CPT, Conner's Continuous Performance Test-III; RT, Reaction time; SD, Standard Deviation

Clinical and demographic characteristics of Perfectionism sub-group

Based on the median split, three groups were created (Adaptive, Maladaptive, and Mixed perfectionism), to reflect the perfectionistic profiles posited by Gaudreau and Thompson (2010). No significant differences were found between the groups on demographic variables (see supplementary materials). Pearson's Chi-Square revealed that the groups did not differ significantly on the number of people who met criteria for at least one DSM-Disorder. The groups differed significantly on the DASS-21 Depression

($p < .001$), DASS-21 Anxiety ($p = .039$), and DASS-21 Stress ($p = .005$; see Figure 1).

Planned contrasts revealed that the Maladaptive group had significantly higher scores on all three DASS-21 subscales (i.e., depression, stress and anxiety) than the Adaptive group ($p = <.001 - .034$).

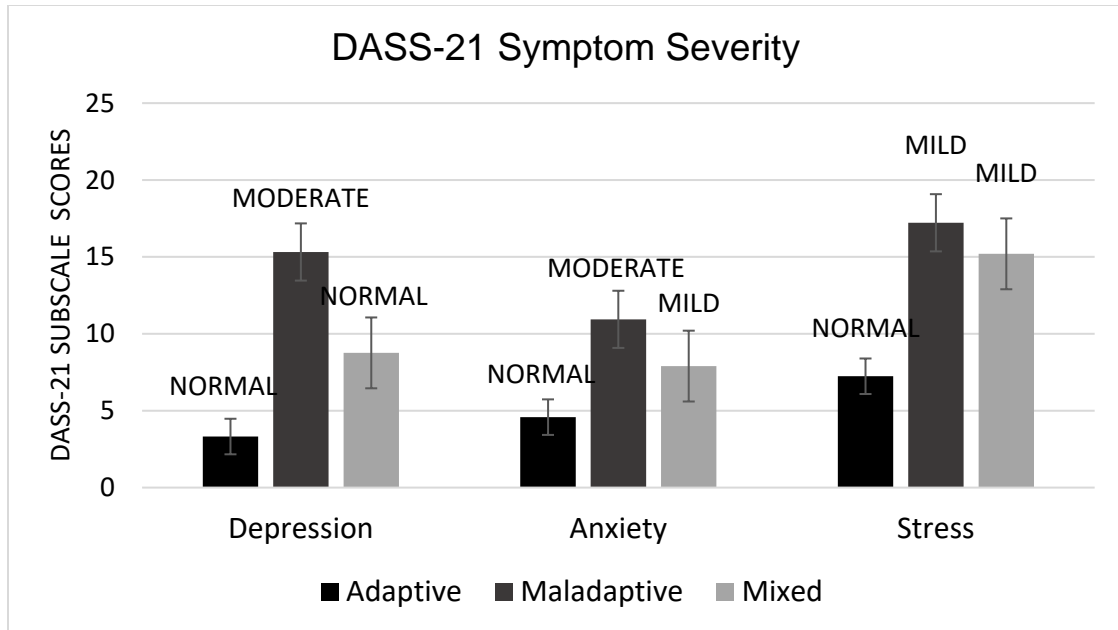


Figure 1. Comparison of DASS-21 symptom severity for the adaptive, maladaptive, and mixed perfectionism groups. Note. Degree of symptom severity categories as defined by the DASS. Error bars represent standard error.

Neuropsychological test performance for Perfectionism sub-groups

A MANCOVA was conducted to compare the three perfectionism sub-groups on the neuropsychological outcome measures while controlling for depression, anxiety, stress, and comorbidity (Table 4). Planned contrasts univariate analyses revealed no significant differences between the groups on any of the neuropsychological outcome measures. Although there were no significant differences between the groups, effect sizes across tests were small to medium ($d = 0.00 - 0.66$). However, the direction of the effect

varied. For example, 36% of the effect sizes indicated worse performance by the Maladaptive group in comparison to the Adaptive group, and 50% of the effect sizes indicated worse performance by the Mixed group in comparison to the Adaptive group. Notably, no group difference was found on GPA.

Table 4. Neuropsychological test performance across perfectionism subtypes while controlling for depression, anxiety, stress, and comorbidity.

	Adaptive (<i>n</i> = 23)		Maladaptive (<i>n</i> = 21)		Mixed (<i>n</i> = 22)		Cohen's <i>d</i> *					
	Mean	SD	Mean	SD	Mean	SD	F (2,59)	Sig	I vs. II	I vs. III	II vs. III	
Executive Functions												
<i>Set-Shifting</i>												
Trail Making B (sec)	73.22	30.27	74.33	39.11	76.55	30.63	0.219	.80	.03	.10	.06	
WCST	10.26	4.48	10.00	4.03	8.68	3.21	1.302	.36	.06	.40	.36	
<i>Preservative Errors</i>												
WCST Categories	5.43	1.72	5.43	1.32	6.00	0.00	1.204	.30	< .01	- .46	- .61	
<i>Planning</i>												
TOL Excess Moves	5.57	6.25	5.76	6.37	5.45	4.81	0.090	.91	.03	- .02	- .05	
<i>Working Memory</i>												
DS Forward Total	10.52	2.39	10.71	2.72	10.53	2.40	0.256	.77	- .07	< .01	.07	
DS Backward Total	9.09	2.55	8.76	1.51	8.45	2.28	0.438	.64	.15	.26	.16	
DS Sequencing Total	9.39	2.57	9.86	2.90	9.64	2.06	1.004	.37	- .17	- .10	.08	
DS Total	29.00	5.19	29.33	5.73	28.45	5.44	0.391	.67	- .06	.10	.15	
Symbol Span Total	27.00	6.46	27.62	7.08	29.00	5.88	0.663	.51	- .09	- .32	- .21	
<i>Fluency</i>												
VF-Letter Total	44.04	9.22	39.62	11.90	38.23	9.17	2.385	.10	.41	.63	.13	
VF-Category Total	42.52	6.45	43.05	9.81	42.14	7.61	0.113	.89	- .06	.05	.10	
<i>Response Inhibition</i>												

CPT Commission Errors	28.87	16.78	30.48	16.33	24.91	10.92	0.332	.71	.09	- .27	- .40
Memory											
<i>Verbal</i>											
CVLT Short Delay Recall	11.87	2.58	12.62	2.03	11.27	2.56	2.618	.08	- .32	.23	.58
CVLT Trials 1-5	53.43	10.39	55.62	8.74	53.36	7.72	1.240	.29	- .22	< .01	.27
CVLT Long Delay Recall	12.00	2.81	12.95	2.57	12.09	1.87	1.825	.17	- .35	- .03	.38
<i>Non- verbal</i>											
RCFT Immediate	23.63	5.92	24.54	7.69	24.36	5.51	0.115	.89	- .13	- .12	.02
RCFT Delayed	22.63	4.65	23.95	7.80	23.79	5.28	0.555	.57	- .20	- .23	.02
Processing Speed											
Trail Making A (sec)	28.61	9.76	25.38	7.92	25.50	9.09	0.674	.51	- .36	- .32	.01
CPT Mean RT (ms)	380.53	50.97	389.02	52.17	397.21	54.37	1.206	.30	.16	.31	.15
Attention											
CPT Omission Errors	0.65	1.22	0.62	1.35	0.50	0.80	0.026	.97	- .02	- .14	- .10
CPT RT SD	90.49	37.30	89.14	42.44	88.75	37.84	0.097	.90	.03	.04	< .01
Visuospatial											
RCFT Copy	35.04	1.63	35.45	1.13	35.63	0.65	2.345	.10	- .29	- .47	- .19

CVLT, California-Verbal Learning Test II; RCFT, Rey-Osterreith Complex Figure Test; DS, Digit Span; WCST, Wisconsin Card Sorting Task; TOL, Tower of London; VF, Verbal Fluency; DF, Design Fluency; CPT, Conner's Continuous Performance Test-III; RT, Reaction time; SD, Standard Deviation

I. Adaptive II. Maladaptive III. Mixed

I vs. II positive effect size reflects better performance by adaptive group in comparison to the Maladaptive group.

I vs. III positive effect size reflects better performance by adaptive group in comparison to the mixed perfectionism group.

II vs III positive effect sizes indicate better performance by the maladaptive group in comparison to the mixed perfectionism group.

Correlations between cognitive functions and perfectionism indices

Demographic information for the entire sample analyses can be found in Table 1. To assess the relationship between cognitive functions and perfectionism, 22 zero order correlations were computed using the entire sample ($n = 98$) separately for positive and negative perfectionism (Table 5). Negative perfectionism was negatively correlated with DS backward scores, [$r(96) = -0.23, p = 0.02$]. However, this correlation did not survive correction for multiple comparisons and was determined not significant. Positive perfectionism was negatively correlated with CPT omission errors, [$r(95) = -0.21, p = 0.03$], where higher ratings of positive perfectionism are associated with less omission errors. This correlation did not survive correction for multiple comparisons and was determined not significant.

Table 5. Pearson correlations between cognitive functions and perfectionism indices.

Variable	Positive Perfectionism	Negative Perfectionism	Fisher z'	N
Executive Functions				
<i>Set shifting</i>				
Trail Making B (sec)	-.01	-.02	.08	98
Preservative Errors	.01	-.10	.92	98
Categories Completed	.03	.07	-.33	98
<i>Planning</i>				
Excess Moves	-.04	-.04	0	95
<i>Working Memory</i>				
DS Forward Total	-.04	-.08	.33	98
DS Backward Total	-.09	-.23*	1.20	98
DS Sequencing Total	.03	.17	-1.18	98
Symbol Span Total	-.05	.10	-1.26	98
<i>Fluency</i>				
Letter Total	.11	-.15	2.20*	98
Category Total	.05	.02	.25	98

<i>Response Inhibition</i>				
Commission Errors	-.02	-.03	0.08	97

Memory

Verbal

CVLT Trials 1-5	<.01	-.06	.56	98
CVLT Short Delay Recall	-.01	-.13	1.04	98
CVLT Long Delay Recall	<.01	-.01	.16	98

Non- verbal

RCFT Immediate	-.05	.01	-.56	98
RCFT Delayed	-.12	-.03	-.81	98

Processing Speed

Trail Making A (sec)	-.07	-.07	0	98
CPT Mean RT	-.17	.03	-1.18	97

Attention

Omission Errors	-.21*	-.05	-1.36	97
Mean RT SD	-.15	-.01	-1.85	97

Visuospatial

RCFT Copy	-.01	.08	-.87	98
-----------	------	-----	------	----

CVLT, California-Verbal Learning Test II; RCFT, Rey-Osterreith Complex Figure Test; DS, Digit Span; WCST, Wisconsin Card Sorting Task; TOL, Tower of London; VF, Verbal Fluency; DF, Design Fluency; CPT, Conner's Continuous Performance Test-III; RT, Reaction time; SD, Standard Deviation

*Significant value did not survive correction for multiplicity

VII. DISCUSSION

This is the first study to assess the neuropsychological correlates of perfectionism while addressing related clinical factors such as severity of psychopathological symptoms and clinical status. Contrary to the proposed hypotheses, results of the comparisons between HNP and LNP groups revealed intact cognitive functions, and no group differences on any neuropsychological outcome measure or on GPA, a secondary performance-related outcome measure. However, the HNP group reported significantly elevated symptom severity (ranging between mild to moderate) of depression and stress and exhibited higher rates of DSM disorders. In contrast, the LNP group exhibited non-clinical levels of depression, stress, and anxiety. Thus, the results indicate that this substantial psychopathological burden does not seem to affect neuropsychological functions, or academic performance. Similar results were found when three groups were created in accordance with contemporary models suggesting an adaptive/positive type of perfectionism that may be conceptually and putatively associated with negative perfectionism (Hamachek, 1978; Hill et al., 2004; Slaney et al., 2001; Terry-Short et al., 1995). These groups, namely, high negative perfectionism, high positive perfectionism, and mixed (high positive as well as high negative perfectionism), exhibited intact neuropsychological performance, and did not differ on task performance, or GPA. However, a gradient of symptom severity was found where the mixed and maladaptive groups indicated significant psychopathological burden, compared to the high adaptive perfectionism group, which exhibited non-clinical levels of anxiety, depression and stress. Thus, with both conceptualizations or ‘perfectionism’ examined, cognitive functions were found to be intact. However, higher negative/maladaptive perfectionism

was associated with substantial psychopathological burden, and low negative/high adaptive perfectionism was not found to be related to clinical/burdensome levels of psychopathology.

Although research on the association between perfectionism and cognitive function in the general population is almost non-existent, our results are generally in accordance with the only study assessing the association between neuropsychological test performance and perfectionism in a non-clinical sample (Desnoyers & Arpin-Cribbie, 2015). The authors of this study found weak correlations with only two outcome measures from two tasks administered (Desnoyers & Arpin-Cribbie, 2015). However, the authors highlighted a major limitation of their study, where insufficient variance and range of perfectionism scores in their study hinders generalizability from their results. Limited research examining cognitive function and perfectionism in clinical samples is characterized by inconsistent results. Moreover, extraction of cogent inferences from the results of these studies regarding perfectionism is threatened by an alternative explanation pertaining to the role of non-perfectionism psychopathological mechanisms that may impact cognitive functions (e.g., Lindner et al., 2014; Tchanturia et al., 2004; Vall & Wade, 2015). Lastly, the only study that utilized a comprehensive neuropsychological battery in the context of perfectionism examined this association in a mixed sample with neurological and psychiatric conditions (Slade et al., 2009) which is subject to the same limitations.

The present study found no association between different domains of perfectionism and cognitive function, and a clear association between types of perfectionism and psychopathological burden. The results testify to a dissociation

between clinically significant psychopathological burden, and cognitive function, even in the context of perfectionism, a construct that inherently revolves around performance and evaluation of the self as a function of outcomes (Burns, 1980). One way to account for this association would be to consider that perfectionism is a facet of anxiety, and one that is associated with frequent negative and worrisome thoughts (Flett et al., 1998). It has been suggested that increased worry and anxiety, as seen in GAD, may be associated with intact performance on cognitive tasks, when the task does not involve high cognitive load or specific threat related stimuli (Eysenck, Derakshan, Santos, & Calvo, 2007). These predictions of Eysenck's Processing Efficiency Theory and Attention Control Theory were verified recently in a study that demonstrated intact performance in sample of young adults with GAD (Leonard & Abramovitch, 2019). Therefore, it can be speculated that in a controlled lab setting where participants focus is limited to a task, in conjunction with a high need to achieve, individuals with high levels of perfectionism may perform normally. Moreover, as opposed to numerous traits, symptoms, and disorders, perfectionism is inherently associated with motivation to perform, and motivation to perform better. This motivation may be present regardless of whether or not it is adaptive on a psychopathological level. Individuals with high perfectionism may be similar to people that are high achieving, in that they are also motivated to perform at a higher level. Thus, as opposed to other primary traits, intact performance in the context of a study or a clinical evaluation may be the rule in the context of perfectionism, which may obscure identification of this burdensome trait in college studies.

Importantly, the present study demonstrates how levels of maladaptive/negative perfectionism are positively associated with symptom severity, and with higher rates of

comorbidity. In contrast, these findings indicate that adaptive perfectionism is associated with less psychopathological burden. In fact, adaptive perfectionism seems to act as a mitigating factor. That is, according to results, elevated negative perfectionism together with elevated adaptive perfectionism results in lower psychopathological burden compared to participants with high negative perfectionism together with low adaptive perfectionism. Indeed, it has been shown that perfectionism is associated with two different drives for achieving success, namely approach (e.g., striving for success) and avoidance (e.g., avoiding failure) (Stoeber, Damian, & Madigan, 2018), which are associated with opposite outcomes in terms of satisfaction and psychological well-being (Elliot, Sheldon, & Church, 1997; Slade & Owens, 1998). It can be speculated that the difference between the groups in terms of symptom severity may be related to their goal orientation. It has also been suggested, however, that contingent self-worth based on performance, a historical hallmark of perfectionism (Burns, 1980), is responsible for the relationship between perfectionism and psychopathology (Dibartolo, Frost, Peicha, Lasota, & Grills, 2004). Therefore, individuals who place a greater emphasis on their standards for performance as a proxy for their self-worth suffer more in terms of psychopathological burden compared to individuals with the more ‘adaptive’ form of perfectionism where self-worth is not associated strongly with the outcome of their performance. The results of the present study support this notion in that endorsing high levels of adaptive perfectionism was not associated with psychological distress. However, as mentioned previously high levels of maladaptive perfectionism was associated with psychopathological burden. Thus, there is a need to critically examine the bi-dimensional model in terms of the motivations and mechanisms underlying adaptive and maladaptive

perfectionism, given that the former is associated with low psychopathological burden and has been termed achievement striving (Frost et al., 1993) - which may not necessarily be a form of perfectionism (Flett & Hewitt, 2006). In fact, it may be the case that adaptive perfectionism is merely a construct assessing self-efficacy, which, when combined with perfectionism, may counterbalance some of the psychopathological burden inherent to negative perfectionism. In other words, it may be the case that perfectionism is inherently related to aversive/negative psychological experience, and self-efficacy is associated with favorable ones, and these two constructs interact. Moreover, Greenspan (2000) posits that a healthy or adaptive form of perfectionism does not exist, and that perfectionism is a burden to most people who experience it. Although there is reason to suspect that adaptive perfectionism may not be perfectionism at all, the real issue may be the perfectionism measures themselves. Blasberg and colleagues (2016) examined the impact of item wording on the content of personality scales and how differences in item wording influence empirical results. The authors modified items of the APS-R personal standards subscale to reflect the extreme nature of perfectionism, rather than simply high standards or striving for excellence (e.g., “high”, “excellence”, and “best” replaced with “perfect”, “perfectly”, “perfectionistic”) and found that the modified version of the APS-R yielded different results than the original. More specifically, the modified version was positively associated with depressive and anxious symptoms, overall negative emotionality, shame, and guilt. In contrast, the original scale was negatively correlated with the same variables. In light of this, future research should also consider item wording when conducting research on perfectionism and when

developing or modifying existing scales to capture adaptive and maladaptive dimensions of perfectionism.

Implications

The results of the current study are particularly important in the context of the need to identify and treat students struggling with high levels of perfectionism and related psychopathological burden. There is a need for counseling centers on college campuses to consider including perfectionism as part of their screenings for psychological maladjustment, given that students who are suffering from psychopathological burden may present with intact cognitive and academic performance. Furthermore, including perfectionism as a screener for maladjustment also has the potential to detect the development of a disorder. Prospective research has found that higher levels of perfectionism predict eating disorders (Lilenfeld, Wonderlich, Riso, Crosby, & Mitchell, 2006) and depression (P. L. Hewitt, Flett, & Ediger, 1996; Rice & Dellwo, 2001), which suggests that it may play a role in the etiology of these disorders. In addition, counseling centers should also consider implementing low intensity, evidence-based interventions targeting perfectionism. Recent studies have shown that both web-based cognitive-behavioral therapy (CBT; Radhu, Daskalakis, Arpin-Cribbie, Irvine, & Ritvo, 2012) and traditional CBT workshop interventions (LaSota, Ross, & Kearney, 2017) for maladaptive perfectionism have been effective for students. However, results from a recent meta-analysis (Smith et al., 2018) provide more support to theoretical accounts suggesting that both types of perfectionism (i.e., adaptive, maladaptive) are part of the premorbid personality of individuals at risk for suicide ideation and attempts. The authors suggest that the relationship between perfectionistic strivings' and suicide ideation also

discredits the notion that such strivings are “healthy, adaptive, or advisable” (Smith et al., 2018). Therefore, identifying, implementing, and disseminating information about effective treatments aimed at reducing perfectionism as a whole is warranted. Moreover, given the contemporary conceptualization of perfectionism as both adaptive and maladaptive, college campuses should consider implementing educational workshops for students highlighting the major differences between the two dimensions as well as the consequences associated with them.

Limitations

This study has a number of strengths, including being the first study to utilize a comprehensive neuropsychological battery to examine the neuropsychology of perfectionism in a young functioning adult sample, employing a psychometrically valid correction for multiple comparisons, and utilizing a large sample, that facilitated covariate analyses. However, this study is not without limitations. First, the perfectionism measure was administered between 1-7 days after completion of the neuropsychological battery. Nevertheless, perfectionism has been demonstrated to be a stable trait up to 1 year (Cox & Enns, 2003; Rice & Aldea, 2006). Second, the sample was comprised of college students. It has been argued that universities are a setting in which perfectionism might be valued and encouraged by a performance-oriented climate (Verner-Filion & Gaudreau, 2010), which may theoretically limit generalizability to other populations. However, it could be argued that assessment of perfectionism in this population provides a wealth of information due to the same exact reason. Indeed, college is a place where individuals ‘exercise’ perfectionism frequently. In addition, as evidenced by our results, perfectionism in itself may entail a substantial psychopathological toll, particularly in

college students. Thus, it can be argued that college students may be a very appropriate population, with clinical and cognitive variance allowing for high resolution information to be extracted.

Conclusion

The present study reveals that elevated levels of negative/maladaptive perfectionism, although associated with substantial psychopathological burden, are not associated with reduced performance across neuropsychological domains. These findings contrast with findings in most DSM disorders, but are in accord with the Attention Control Theory of anxiety and with recent neuropsychological investigations into GAD. However, although negative/maladaptive or positive/adaptive perfectionism were not found to be associated with cognitive dysfunction, the former was found to be associated with substantial psychopathological burden, and the latter, as a mitigating factor for psychopathological symptoms. It can be speculated that adaptive/positive perfectionism may be a form of self-efficacy. Given that no clear cognitive ‘cost’ of perfectionism exists, but significant symptoms of anxiety, depression, and stress, accompany high levels of negative perfectionism, the psychological burden of these functionally intact individuals may be overlooked, especially in academic settings. Future studies should investigate this phenomenon further and potentially examine ways to disseminate information about perfectionism in academic settings and explore low intensity interventions that target this prevailing and burdensome trait.

REFERENCES

- Abramovitch, A., Dar, R., Hermesh, H., & Schweiger, A. (2011). Comparative neuropsychology of adult obsessive-compulsive disorder and attention deficit/hyperactivity disorder: Implications for a novel executive overload model of OCD. *Journal of Neuropsychology*, 6(2), 161. doi:10.1111/j.1748-6653.2011.02021.x
- Ashby, J. S., Noble, C. L., & Gnilka, P. B. (2012). Multidimensional Perfectionism, Depression, and Satisfaction with Life: Differences among Perfectionists and Tests of a Stress-Mediation Model. *Journal of College Counseling*, 15(2), 130-143.
- Bastiani, A. M., Rao, R., Weltzin, T., & Kaye, W. H. (1995). Perfectionism in anorexia nervosa. *International Journal of Eating Disorders*, 17(2), 147-152.
- Blasberg, J. S., Hewitt, P. L., Flett, G. L., Sherry, S. B., & Chen, C. (2016). The Importance of Item Wording: The Distinction Between Measuring High Standards versus Measuring Perfectionism and Why It Matters. *Journal of Psychoeducational Assessment*, 34(7), 702-717.
- Burgess, A. M., Frost, R. O., & DiBartolo, P. M. (2016). Development and Validation of the Frost Multidimensional Perfectionism Scale--Brief. *Journal of Psychoeducational Assessment*, 34(7), 620-633.
- Burns, D. D. (1980). The perfectionist's script for self-defeat, 34.
- Clara, I. P., Cox, B. J., & Enns, M. W. (2001). Confirmatory Factor Analysis of the Depression–Anxiety–Stress Scales in Depressed and Anxious Patients. *Journal of Psychopathology & Behavioral Assessment*, (1), 61.

- Conners, K. (2014). The Conners' Continuous Performance Test 3rd Edition North Tonawanda, NY,: Multi-Health Systems Incorporated.
- Cox, B. J., & Enns, M. W. (2003). Relative stability of dimensions of perfectionism in depression. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, 35(2), 124-132. doi:10.1037/h0087194
- Crowe, S. F., Matthews, C., & Walkenhorst, E. (2007). Relationship between worry, anxiety and thought suppression and the components of working memory in a non-clinical sample. *Australian Psychologist*, 42(3), 170-177. doi:10.1080/00050060601089462
- Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). *Delis-Kaplan Executive Function System. [kit]*: San Antonio, TX : Psychological Corp., c2001.
- Delis, D. C., Kramer, J. H., Kaplan, E., Ober, B. A., Delis, D. C., Kramer, J. H., . . . Ober, B. A. (2000). *California Verbal Learning Test--Second Edition*. San Antonio, TX: Psychological Corporation.
- Desnoyers, A., & Arpin-Cribbie, C. (2015). Examining cognitive performance: Do perfectionism and rumination matter? *Personality and Individual Differences*, 76, 94-98. doi:10.1016/j.paid.2014.11.050
- Dibartolo, P. M., Frost, R. O., Peicha, C., Lasota, M., & Grills, A. E. (2004). Shedding light on the relationship between personal standards and psychopathology: The case for contingent self-worth. *Journal of Rational-Emotive and Cognitive-Behavior Therapy*(4), 237-250.

- Doyle, A. E., Doty, N. D., Willoughby, B. L., O'Donnell, E. H., Wilson, H. K., Colvin, M. K., . . . Faraone, S. V. (2018). Cross-Disorder Cognitive Impairments in Youth Referred for Neuropsychiatric Evaluation. *Journal of the International Neuropsychological Society*, 24(1), 91-103. doi:10.1017/S1355617717000601
- Egan, S., Piek, J., Dyck, M., & Kane, R. (2011). The reliability and validity of the positive and negative perfectionism scale. *Clinical Psychologist*, 15(3), 121-132. doi:10.1111/j.1742-9552.2011.00029.x
- Egan, S., Watson, H. J., Kane, R. T., McEvoy, P., Fursland, A., & Nathan, P. R. (2013). Anxiety as a mediator between perfectionism and eating disorders. *Cognitive therapy and research*, 37(5), 905-913. doi:10.1007/s10608-012-9516-x
- Elliot, A. J., Sheldon, K. M., & Church, M. A. (1997). Avoidance personal goals and subjective well-being. *Personality and Social Psychology Bulletin*, 23(9), 915-927.
- Enns, M. W., Cox, B. J., Sareen, J., & Freeman, P. (2001). Adaptive and maladaptive perfectionism in medical students: A longitudinal investigation. *Medical Education*, 35(11), 1034-1042. doi:10.1046/j.1365-2923.2001.01044.x
- Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: attentional control theory. *Emotion*, 7(2), 336-353. doi:10.1037/1528-3542.7.2.336
- Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. *Behaviour research and therapy*, 41(5), 509-528. doi:10.1016/S0005-7967(02)00088-8

- Flett, G. L., & Hewitt, P. L. (2002). *Perfectionism : theory, research, and treatment*: Washington, DC : American Psychological Association, c2002.
- Flett, G. L., & Hewitt, P. L. (2006). Positive Versus Negative Perfectionism in Psychopathology: A Comment on Slade and Owens's Dual Process Model. *Behavior Modification*, 30(4), 472-495. doi:10.1177/0145445506288026
- Flett, G. L., Hewitt, P. L., Blankstein, K. R., & Gray, L. (1998). Psychological distress and the frequency of perfectionistic thinking. *Journal of Personality and Social Psychology*, 75(5), 1363-1381. doi:10.1037/0022-3514.75.5.1363
- Flett, G. L., Madorsky, D., Hewitt, P. L., & Heisel, M. J. (2002). Perfectionism cognitions, rumination, and psychological distress. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 20(1), 33-47. doi:10.1023/A:1015128904007
- Frost, R. O., Heimberg, R. G., Holt, C. S., Mattia, J. I., & Neubauer, A. L. (1993). A comparison of two measures of perfectionism. *Personality and Individual Differences*(1), 119.
- Frost, R. O., Marten, P., Lahart, C., & Rosenblate, R. (1990). The dimensions of perfectionism. *Cognitive therapy and research*(5), 449.
- Frost, R. O., Novara, C., & Rhéaume, J. (2002). Perfectionism in obsessive compulsive disorder. In R. O. Frost & G. Steketee (Eds.), *Cognitive approaches to obsessions and compulsions: Theory, assessment, and treatment*. (pp. 91-105). Amsterdam: Pergamon/Elsevier Science Inc.
- Frost, R. O., & Steketee, G. (1997). Perfectionism in obsessive-compulsive disorder patients. *Behaviour research and therapy*(4), 291.

- Gaudreau, P., & Thompson, A. (2010). Testing a 2×2 model of dispositional perfectionism. *Personality and Individual Differences*, 48(5), 532-537.
doi:10.1016/j.paid.2009.11.031
- Gnilka, P. B., Ashby, J. S., & Noble, C. M. (2012). Multidimensional Perfectionism and Anxiety: Differences Among Individuals With Perfectionism and Tests of a Coping-Mediation Model. *Journal of Counseling & Development*, 90(4), 427-436.
doi:10.1002/j.1556-6676.2012.00054.x
- Greenspan, T. S. (2000). 'Healthy Perfectionism' is an Oxymoron! *Journal of Secondary Gifted Education*, 11(4), 197. doi:10.4219/jsge-2000-631
- Hamachek, D. E. (1978). Psychodynamics of normal and neurotic perfectionism. *Psychology: A Journal of Human Behavior*, 15(1), 27-33.
- Handley, A. K., Egan, S. J., Kane, R. T., & Rees, C. S. (2014). The relationships between perfectionism, pathological worry and generalised anxiety disorder. *BMC Psychiatry*, 14(1), 1-15. doi:10.1186/1471-244X-14-98
- Hewitt, P. L., & Flett, G. L. (1991). Perfectionism in the self and social contexts: Conceptualizations, assessment, and association with psychopathology. *Journal of Personality and Social Psychology*, 60(3), 456-470.
- Hewitt, P. L., & Flett, G. L. (1993). Dimensions of perfectionism, daily stress, and depression: a test of the specific vulnerability hypothesis. *Journal of abnormal psychology* (1965)(1), 58.
- Hewitt, P. L., Flett, G. L., & Ediger, E. (1996). Perfectionism and depression: Longitudinal assessment of a specific vulnerability hypothesis. *Journal of Abnormal Psychology*, 105(2), 276-280. doi:10.1037/0021-843X.105.2.276

- Hewitt, P. L., Flett, G. L., & Weber, C. (1994). Dimensions of perfectionism and suicide ideation. *Cognitive therapy and research*, 18(5), 439-460.
doi:10.1007/BF02357753
- Hill, R. W., Huelsman, T. J., Furr, R. M., Kibler, J., Vicente, B. B., & Kennedy, C. (2004). A new measure of perfectionism: The Perfectionism Inventory. *Journal of Personality Assessment*, 82, 80-91.
- Holdnack, J. A., Schoenberg, M. R., & Lange, R. T. (2013). Chapter 5: Predicting Premorbid Ability for WAIS–IV, WMS–IV and WASI–II. WAIS-IV, WMS-IV, And ACS, . 217-278. doi:doi:10.1016/B978-0-12-386934-0.00005-5
- Hollender, M. H. (1965). Perfectionism. *Comprehensive Psychiatry*, 6(2), 94-103.
doi:10.1016/S0010-440X(65)80016-5
- Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics. Theory and Applications*, 6(2), 65.
- LaSota, M. T., Ross, E. H., & Kearney, C. A. (2017). A Cognitive-Behavioral-Based Workshop Intervention for Maladaptive Perfectionism. *Journal of Rational - Emotive and Cognitive - Behavior Therapy*, 35(3), 314-328.
- Leonard, K., & Abramovitch, A. (2019). Cognitive functions in young adults with generalized anxiety disorder. *European Psychiatry*, 56, 1-7.
- Lilenfeld, L. R. R., Wonderlich, S., Riso, L. P., Crosby, R., & Mitchell, J. (2006). Eating disorders and personality: A methodological and empirical review. *Clinical Psychology Review*, 26(3), 299-320. doi:10.1016/j.cpr.2005.10.003

- Limburg, K., Watson, H. J., Hagger, M. S., & Egan, S. J. (2017). The relationship between perfectionism and psychopathology: A meta-analysis. *Journal of Clinical Psychology, 73*(10), 1301-1326. doi:10.1002/jclp.22435
- Lindner, S. E., Fichter, M. M., & Quadflieg, N. (2014). Set-Shifting and its Relation to Clinical and Personality Variables in Full Recovery of Anorexia Nervosa. *European Eating Disorders Review, 22*(4), 252-259.
- Loong, J. (1990). *The Wisconsin Card Sorting Test*. . San Luis Obispo, CA: Wang Neuropsychological Laboratory.
- Lovibond, P. F., & Lovibond, S. H. (1995). *Depression Anxiety Stress Scales*. Sydney, Australia: Psychological Foundation of Australia.
- Marteau, T. M., & Bekker, H. (1992). The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). *British journal of clinical psychology*(3), 301.
- Mehr, K. E., & Adams, A. C. (2016). Self-Compassion as a Mediator of Maladaptive Perfectionism and Depressive Symptoms in College Students. *Journal of College Student Psychotherapy, 30*(2), 132-145.
- Meyers, J., & Meyers, K. (1996). *Rey Complex Figure Test and Recognition Trial Manual*. Lutz, FL: Psychological Assessment Resources, Inc.
- Millan, M. J., Agid, Y., Brüne, M., Bullmore, E. T., Carter, C. S., Clayton, N. S., . . . Young, L. J. (2012). Cognitive dysfunction in psychiatric disorders: Characteristics, causes and the quest for improved therapy. *Nature Reviews Drug Discovery, 11*(2), 141-168. doi:10.1038/nrd3628

- Nepon, T., Flett, G. L., Hewitt, P., & Molnar, D. S. (2011). Perfectionism, Negative Social Feedback, and Interpersonal Rumination in Depression and Social Anxiety. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*(4), 297. doi:10.1037/a0025032
- Olley, A., Malhi, G., & Sachdev, P. (2007). Memory and executive functioning in obsessive-compulsive disorder: a selective. *J Affect Disord*, 104(1-3), 15-23.
- Osterrieth, P. A. (1944). Le test de copie d'une figure complex: Contribution a l'etude de la perception et de la memoire. *Archives de Psychologie*, 30, 286-356.
- Radhu, N., Daskalakis, Z. J., Arpin-Cribbie, C. A., Irvine, J., & Ritvo, P. (2012). Evaluating a Web-Based Cognitive-Behavioral Therapy for Maladaptive Perfectionism in University Students. *Journal of American College Health*, 60(5), 357-366.
- Rice, K. G., & Aldea, M. A. (2006). State Dependence and Trait Stability of Perfectionism: A Short-Term Longitudinal Study. *Journal of Counseling Psychology*, 53(2), 205-212.
- Rice, K. G., Ashby, J. S., & Slaney, R. B. (1998). Self-Esteem as a Mediator between Perfectionism and Depression: A Structural Equations Analysis. *Journal of Counseling Psychology*, 45(3), 304-314. doi:10.1037/0022-0167.45.3.304
- Rice, K. G., & Dellwo, J. P. (2001). Within-semester stability and adjustment correlates of the multidimensional perfectionism scale. *Measurement and Evaluation in Counseling and Development*, 34(3), 146-156.

- Rice, K. G., & Pence, S. L., Jr. (2006). Perfectionism and Obsessive-Compulsive Symptoms. *Journal of Psychopathology and Behavioral Assessment*, 28(2), 103-111. doi:10.1007/s10862-006-7488-4
- Sanzen Neuropsychological Assessment Tests. Colorado Springs, Colorado, USA.
- Semrud-Clikeman, M., & Goldenring Fine, J. (2013). Pediatric versus adult psychopathology: Differences in neurological and clinical presentations. In C. A. Noggle & R. S. Dean (Eds.), *The neuropsychology of psychopathology*. (pp. 11-27). New York, NY: Springer Publishing Co.
- Shafran, R., & Mansell, W. (2001). Perfectionism and psychopathology: A review of research and treatment. *Clinical Psychology Review*, 21(6), 879-906. doi:10.1016/S0272-7358(00)00072-6
- Shahnaz, A., Saffer, B. Y., & Klonsky, E. D. (2018). The relationship of perfectionism to suicide ideation and attempts in a large online sample. *Personality and Individual Differences*, 130, 117-121. doi:10.1016/j.paid.2018.04.002
- Shallice, T. (1982). Specific impairments of planning. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, 298(1089), 199-209. doi:10.1098/rstb.1982.0082
- Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., & Dunbar, G. C. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I): The development and validation of a structured diagnostic psychiatric interview. *Journal of Clinical Psychiatry*, 59(20), 22-33.

- Sinclair, S. J., Slavin-Mulford, J. M., Stein, M. B., Renna, M., Blais, M. A., & Siefert, C. J. (2012). Psychometric Evaluation and Normative Data for the Depression, Anxiety, and Stress Scales-21 (DASS-21) in a Nonclinical Sample of U.S. Adults. *Evaluation and the Health Professions*, 35(3), 259-279.
doi:10.1177/0163278711424282
- Slade, P. D., Coppel, D. B., & Townes, B. D. (2009). Neurocognitive correlates of positive and negative perfectionism. *International Journal of Neuroscience*, 119(10), 1741-1754. doi:10.1080/00207450902915212
- Slade, P. D., & Owens, R. G. (1998). A dual process model of perfectionism based on reinforcement theory. *Behavior Modification*, 22(3), 372-390.
doi:10.1177/01454455980223010
- Slaney, R. B., Rice, K. G., Mobley, M., Trippi, J., & Ashby, J. S. (2001). The Revised Almost Perfect Scale. *Measurement & Evaluation in Counseling & Development*, 34(3), 130.
- Smith, M. M., Chen, S., Saklofske, D. H., Sherry, S. B., Mushquash, C., Flett, G. L., & Hewitt, P. L. (2018). The perniciousness of perfectionism: A meta-analytic review of the perfectionism–suicide relationship. *Journal of Personality*, 86(3), 522-542.
doi:10.1111/jopy.12333
- Snyder, H. R., Hankin, B. L., & Miyake, A. (2015). Advancing understanding of executive function impairments and psychopathology: Bridging the gap between clinical and cognitive approaches. *Frontiers in Psychology*, 6(MAR).
doi:10.3389/fpsyg.2015.00328

- Stoeber, J. (2018). The psychology of perfectionism: An introduction. In J. Stoeber (Ed.), *The psychology of perfectionism: Theory, research, applications*. (pp. 3-16). New York, NY: Routledge/Taylor & Francis Group.
- Stoeber, J., Damian, L. E., & Madigan, D. J. (2018). Perfectionism: A motivational perspective. In J. Stoeber (Ed.), *The psychology of perfectionism: Theory, research, applications*. (pp. 19-43). New York, NY: Routledge/Taylor & Francis Group.
- Stoeber, J., & Otto, K. (2006). Positive Conceptions of Perfectionism: Approaches, Evidence, Challenges. *Personality & Social Psychology Review (Lawrence Erlbaum Associates)*, 10(4), 295-319. doi:10.1207/s15327957pspr1004_2
- Sullivan, G., & Feinn, R. (2012). Using Effect Size—or Why the *P* Value Is Not Enough. *Journal of Graduate Medical Education*, 4(3), 279-282.
- Tchanturia, K., Harrison, A., Davies, H., Roberts, M., Oldershaw, A., Nakazato, M., . . . Treasure, J. (2011). Cognitive Flexibility and Clinical Severity in Eating Disorders. *PLoS ONE*, 6(6), 1-5.
- Tchanturia, K., Morris, R. G., Anderluh, M. B., Collier, D. A., Nikolaou, V., & Treasure, J. (2004). Set shifting in anorexia nervosa: An examination before and after weight gain, in full recovery and relationship to childhood and adult OCPD traits. *Journal of Psychiatric Research*, 38(5), 545-552.
doi:10.1016/j.jpsychires.2004.03.001
- Terry-Short, L. A., Owens, R. G., Slade, P. D., & Dewey, M. E. (1995). Positive and negative perfectionism. *Personality and Individual Differences*, 18, 663-668.

- Tolin, D. F., Brady, R. E., & Hannan, S. (2008). Obsessional Beliefs and Symptoms of Obsessive–Compulsive Disorder in a Clinical Sample. *Journal of Psychopathology & Behavioral Assessment*, 30(1), 31-42. doi:10.1007/s10862-007-9076-7
- Vall, E., & Wade, T. D. (2015). Trail Making Task Performance in Inpatients with Anorexia Nervosa and Bulimia Nervosa. *European Eating Disorders Review*, 23(4), 304-311. doi:10.1002/erv.2364
- Verner-Filion, J., & Gaudreau, P. (2010). From perfectionism to academic adjustment: The mediating role of achievement goals. *Personality and Individual Differences*, 49(3), 181-186. doi:10.1016/j.paid.2010.03.029
- Vohs, K., Bardone, A., Joiner, T., Abramson, L., & Heatherton, T. (1999). Perfectionism, Perceived Weight Status, and Self-Esteem Interact to Predict Bulimic Symptoms: A Model of Bulimic Symptom Development. *Journal of Abnormal Psychology*(4), 695.
- Wechsler, D. (2008). *Wechsler Adult Intelligence Scale: Technical and interpretive manual (4th ed.)*. San Antonio, TX: Pearson Assessments.
- Wechsler, D. (2009). *Wechsler Memory Scale—Fourth Edition (WMS–IV) technical and interpretive manual*. San Antonio, TX: Pearson Assessments.
- Yang, Y., Teng, Z., Liu, Y., Cao, S., & Shields, G. S. (2017). The relationships between rumination and core executive functions: A meta-analysis. *Depression and Anxiety*, 34(1), 37-50. doi:10.1002/da.22539

Zuroff, D. C., Blatt, S. J., Sotsky, S. M., Krupnick, J. L., Martin, D. J., Sanislow, C. A., & Simmens, S. (2000). Relation of therapeutic alliance and perfectionism to outcome in brief outpatient Treatment of Depression. *Journal of Consulting and Clinical Psychology*, 68(1), 114.