

NEUROCOGNITIVE CORRELATES OF BODY IMAGE DISTURBANCE

by

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A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Psychology
in the College of Sciences
at the University of Central Florida
Orlando, Florida

Fall Term
2009

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ABSTRACT

Body image, broadly defined as an individual's general experience of his or her physical appearance, is a multidimensional phenomenon that has been found to affect functioning throughout the lifetime. Although some degree of dissatisfaction has been found to be a common aspect of the female experience, research suggests that a disturbance in body image can result in a number of clinical complications, particularly the development of an eating disorder (ED). Despite the relationship between body image and EDs, examinations of the cognitive underpinnings of the relationship between body image disturbance and EDs are relatively few and inconclusive. Research indicates that individuals with an ED diagnosis exhibit cognitive rigidity (deficits in set-shifting ability) and weak central coherence (as demonstrated by performance on measures of information processing style). However, research has not established whether individuals with body image disturbance who do not meet criteria for an ED exhibit comparable performance. The aim of the current study was to determine whether individuals with body image disturbance exhibit similar patterns of neuropsychological functioning. A sample of women with high levels of body image disturbance completed a battery of cognitive tests and outcomes were compared to a group of women with little disturbance and also compared with performance of individuals with diagnosed EDs as cited in previous studies. Overall, the results do not clearly indicate that women with body image disturbance have difficulties with set-shifting tasks and global information processing, however some preliminary patterns did emerge. These preliminary findings extend existing theoretical models of body image and have potential to inform clinical efforts aimed at improving treatment protocols for body image disturbance and EDs by targeting these aspects of neurocognition during treatment.

Dedicated to Reto and my parents for their enduring encouragement, love, and support. Ich liebe dich für immer und ewig.

ACKNOWLEDGMENTS

This project could not have been completed if it were not for the hard work and dedication of my research assistant, Kyle Gerakopoulos. Furthermore, I owe my gratitude to Brittany Stead and Elizabeth Schuster for their availability to assist with occasional experimental duties, edits, and provision of helpful feedback. It is imperative that I recognize Professors Janet Treasure and Kate Tchanturia as well as Drs. Marion Roberts and Carolina Lopez for their assistance in training me on the tasks and inspiring the focus of this research. I am forever indebted to them for their willingness to share the tasks and extend their brilliant ideas from the Institute of Psychiatry “across the pond” to Florida. I want to extend appreciation to my dissertation committee, Dr. Valerie Sims, Dr. Jeffrey Bedwell, Dr. Shawn Lawrence, and –of course – Dr. Stacey Dunn, for their constructive feedback and availability. Particularly, I want to recognize my major professor, Stacey, for her encouragement, patience, and willingness to let me explore ideas outside of the typical realm of our lab. Her flexibility and detail-focus was much appreciated throughout the duration of my graduate school experience. Finally, I wish to thank Diana Orem, Rachael Lunt, Vidya Kamath, and Theresa Marino Carper for their support, advice, and experience during this process.

TABLE OF CONTENTS

LIST OF TABLES	x
CHAPTER ONE: INTRODUCTION.....	1
Set-Shifting Deficits in Eating Disorders	7
Local versus Global Information Processing Style in Eating Disorders.....	9
Extension of Findings to Body Image Disturbance	12
The Current Study.....	13
Current Aims and Hypotheses	14
CHAPTER TWO: METHOD.....	17
Power Analysis	17
Recruitment.....	18
Initial Exclusionary Criteria.....	18
Participants.....	19
Phase 1 Measures- Online Eligibility Screening	22
Human Participants Informed Consent Form	22
Demographic Questionnaire	22
Hospital Anxiety and Depression Scale (HADS).....	22
Brief Symptom Inventory 53 (BSI-53).....	23
Eating Disorder Examination Questionnaire (EDE-Q).....	24
Body Image Disturbance Questionnaire (BIDQ).....	25
Multidimensional Body-Self Relations Questionnaire (MBSRQ)	25
Appearance Schema Inventory-Revised (ASI-R).....	26

Debriefing Form- Phase 1	27
Phase 1 Procedure	27
Phase 2 Measures	28
Informed Consent- Phase 2	28
Eating Disorder Examination (EDE): Screening Interview	29
Vocabulary and Matrix Reasoning subtests of the Wechsler Adult Intelligence Scale- 3 rd Edition (WAIS-III).....	29
Cognitive Tasks	30
Paper Folding Test	30
Wisconsin Card Sorting Test (WCST)	31
Trail Making Task (Trails A and B)	31
Brixton Task.....	32
CatBat Task.....	32
The Rey-Osterrieth Complex Figure Test- copy/recall form (RCFT)	33
Group/Embedded Figure Test (EFT)	34
Debriefing Form- Phase 2	35
Phase 2- Laboratory Procedures	35
CHAPTER THREE: RESULTS	36
Data Screening	36
Set-Shifting Group Comparisons	36
Central Coherence Group Comparisons	37
Correlational Analyses of Body Image and Neurocognitive Variables.....	39

Comparisons with Eating Disordered Groups in the Literature.....	39
Discriminant Validity: Paper Folding Test.....	41
Accounting for Intellectual Ability.....	42
Exploratory Analyses: Anxiety Symptomatology.....	42
Exploratory Analyses: General Psychiatric Symptomatology.....	43
CHAPTER FOUR: DISCUSSION.....	44
Potential Implications.....	50
Limitations.....	52
Future Directions.....	55
Conclusion.....	56
APPENDIX A: HUMAN PARTICIPANTS INFORMED CONSENT FORM.....	63
APPENDIX B: DEMOGRAPHIC INFORMATION QUESTIONNAIRE.....	67
APPENDIX C: HOSPITAL ANXIETY AND DEPRESSION SCALE.....	70
APPENDIX D : BRIEF SYMPTOM INVENTORY.....	73
APPENDIX E: EATING DISORDER EXAMINATION-QUESTIONNAIRE.....	77
APPENDIX F: BODY IMAGE DISTURBANCE QUESTIONNAIRE.....	82
APPENDIX G: MULTIDIMENSIONAL BODY-SELF RELATIONS QUESTIONNAIRE- SELECTED SUBSCALES.....	85
APPENDIX H: APPEARANCE SCHEMA INVENTORY.....	89
APPENDIX I: DEBRIEFING FORM- PHASE 1.....	91
APPENDIX J: HUMAN PARTICIPANTS INFORMED CONSENT FORM- PHASE 2 (Laboratory Procedures).....	93

APPENDIX K: DEBRIEFING FORM- PHASE 2.....	97
APPENDIX L: HUMAN SUBJECTS PERMISSION LETTER	99
REFERENCES	101

LIST OF TABLES

Table 1 Group Means, Standard Deviations, and Comparisons for Measures of Body Image Disturbance	58
Table 2 Group Demographic Means, Standard Deviations, and Comparisons	59
Table 3 Group Set-Shifting Means, Standard Deviations, and Comparisons.....	60
Table 4 Group Central Coherence Means, Standard Deviations, and Comparisons	61
Table 5 Comparison of Effect Sizes for Eating Disordered Samples from Metanalyses to Body Image Disturbed Sample from Current Study	62

CHAPTER ONE: INTRODUCTION

Body image is a complex, multidimensional phenomenon that is difficult to both define and assess. The concept of “body image” has inspired great debate among philosophers, physicians, and psychologists throughout the past 80 years. Historically, it has been most simply conceptualized as “the picture of our own body which we form in our own mind (Schilder, 1935/1950, p.11)” and more recently has mainly come to reflect an individual’s general experience of his or her physical appearance. The accepted definitions of body image generally aim to capture the subjective nature of the body experience in human functioning. A disturbance in body image has a variety of clinical implications that pose threats to quality of life (Butters & Cash, 1987; Noles, Cash, & Winstead, 1985). From a young age, body image affects many facets of everyday life including behavior, emotion, thought, and relationships with others (Cash & Pruzinsky, 2002, p. 3). Due to the complex, inextricable, and intangible nature of body image, disturbance or dissatisfaction can result in a severely diminished quality of life and a myriad of clinical complications (Cash & Pruzinsky, 2002, p. 7).

Research indicates that approximately two-thirds of young adult women from Westernized cultures experience body image dissatisfaction (Moore, 1993; Polivy & Herman, 2002). Following a study conducted in the 1980s, body size dysphoria in normal weight, non-eating-disordered females was found to be so common that it was described as representing a “normative discontent” (Rodin et al., 1985, p. 267). Further research found that less than 10% of women expressed *little* concern regarding their physical appearance (Cash et al., 1986). Such high rates of dissatisfaction are troubling in that research indicates a relationship exists between

levels of subjective body image distress in nonclinical samples and both depression and eating dysfunction in adolescents and adults (McCarthy, 1990; Nolen-Hoeksema & Girgus, 1994; Thompson, Covert, Richards, Johnson, & Cattarin, 1995).

There has been substantial interest in the nature of body image concerns and appearance dissatisfaction in eating disorders (Cash & Deagle, 1997). Research indicates a robust correlational relationship between body image disturbance and eating disorder psychopathology (Rosen, 1990; Thompson, 1990). Longitudinal studies examining such psychopathology, family functioning, and status of physical development suggest that body image dissatisfaction more reliably and consistently predicts eating disturbance than other variables (Attie & Brooks-Gunn, 1989; Cattarin & Thompson, 1994; Garner, Garfinkel, Rockert, & Olmsted, 1987). Although studies employing various methodologies support the notion that body image disturbance often results in the development of disordered eating (Cash & Deagle, 1997; Thompson et al., 1995), findings regarding the exact etiological role of body image disturbance in the development of an eating disorder are currently inconclusive (Leon, Fulkerson, Perry, & Cudeck, 1993; Leon, Fulkerson, Perry, & Early-Zald, 1995).

Within this realm of research, one of the most commonly investigated relationships is between body image disturbance and the development of anorexia nervosa. To meet the diagnostic criteria for the diagnosis of anorexia nervosa (AN) as outlined by the DSM-IV-TR, an individual must experience “disturbance in the way in which one’s body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight” (American Psychiatric Association, 2000, p. 589). Similarly, diagnostic criteria for another commonly researched eating disorder, bulimia nervosa

(BN), necessitates that “self-evaluation is unduly influenced by body shape and weight” (American Psychiatric Association, 2000, p. 594). The literature strongly indicates that there is an association between these eating disorders and body image disturbance, based on studies using both correlational (e.g. Rosen, 1990; Thompson, 1990) and longitudinal methodology (Attie & Brooks-Gunn, 1989; Cattarin & Thompson, 1994).

In the treatment of eating disorders, body image disturbance may be one of the most challenging symptoms to address in recovery because it typically has developed over a long period of time, has an unknown etiology, and is quite resistant to change (Butters & Cash, 1987; Neumark-Sztainer et al., 2006). The presence of body image disturbance is important to address in current treatment methods for other psychiatric conditions, particularly psychotherapeutic treatments based in cognitive therapy, as the presence of body image disturbance diminishes the effectiveness of the treatment (Kazdin, 1983; Miller & Berman, 1983). There have been many attempts to discover what mechanisms contribute to body image disturbance in order to devise more specific treatment protocols, but a clearer understanding of the etiology is needed to more effectively address body image problems both in individuals with and without (at least for the moment) eating disorders.

Given the prevalence of body image dissatisfaction, its relationship to a variety of clinical problems, and the lack of empirically validated treatment options, additional exploration is necessary to further our understanding of this complex aspect of the human experience in ways that directly translate to effective prevention and treatment strategies. Understanding the etiology of body image disturbance and the clinical complications therein is of critical importance due to the prevalence of dissatisfaction in the general population, particularly among young women.

Various theoretical models have been proposed that uniquely account for the etiology of body image disturbance. The theoretical viewpoints include neurocognitive, information-processing, psychodynamic, cognitive-behavioral, sociocultural, and feminist perspectives (Cash & Pruzinsky, 2002, p. 8), each providing an informative lens through which to conceptualize the development of body image. Information-processing and cognitive-behavioral models of body image dissatisfaction in particular have led to significant advances in understanding body image problems as they provide a framework that incorporates cognitive, emotional, social, and individual-based correlates of body image dissatisfaction. A recent review of the work done in this area concluded that there is considerable support for hypotheses indicating that some individuals are more susceptible than others to developing cognitive biases for stimuli that subsequently trigger negative emotions and self-schemas (Williamson, Stewart, White, & York-Crowe, 2004; Williamson, 1996). Indeed, Williamson (1996) suggested that body size estimation itself (in which consistent overestimation is equivocal to disturbance) is the result of a complex bias of judgment influenced by additional biases of memory, perception, and attention. These findings are among those that comprise a current trend in the literature toward identifying cognitive characteristics that make individuals more vulnerable to the development of body image disturbance and the clinical consequences therein.

As part of the increasing number of investigations devoted to further understanding eating disorders, there has been resurgence in the exploration of neurocognitive correlates in an effort to identify potential endophenotypes, which are defined as measurable, heritable traits that parallel unobservable genetic factors related to a particular disease process (Treasure, Tchanturia, & Schmidt, 2005). Studies suggest that there is a genetic basis to cognitive features

such as body dissatisfaction, weight preoccupation, and drive for thinness, as evidenced by findings from adolescent female twins (Keski-Rahkonen et al., 2005; Klump, McGue, & Iacono, 2000; Rutherford, McGuffin, Katz, & Murray, 1993). Endophenotypes advance access to otherwise inaccessible or difficult to retrieve information regarding the more basic components that lead to or are associated with a particular psychiatric diagnosis, allowing for illnesses to be more clearly elucidated in a genetic analysis (Gottesman & Gould, 2003). Research examining certain cognitive features as potential endophenotypes in this domain can help to increase the understanding of the influence of the cognitive processes underlying eating disorders.

Given that some research indicates that genetic factors contribute up to 75% in the development of eating disorder (Treasure & Holland, 1989), examining extrinsic factors related to underlying biological phenomena is critical. In an investigation of female-female twin pairs with at least one individual having a past diagnosis of an eating disorder, 67% of monozygotic twins were concordant for AN as opposed to 0% of dizygotic twins which yielded an overall heritability estimate of 70% for the disorder (Treasure & Holland, 1989). Not only does research strongly suggest the contribution of heredity to the development of AN, but heritability estimates for BN range from 28% to 83% (Bulik & Tozzi, 2004).

Patterns of heritability exist for body dissatisfaction as well, with twin studies suggesting a gender specific genetic linkage to drive for thinness and body dissatisfaction in women (Keski-Rahkonen et al., 2005). Such evidence suggests that the incorporation of research investigating traits thought to be related to underlying genetic processes would contribute to the body of literature that exists for body image. Investigating potential traits related to the presence or

absence of body image disturbance (the actual phenotype) serves to strengthen the case for the existence of certain endophenotypes that may elucidate the organic nature of such disturbance.

Shedding light on potential underlying traits has important implications for provision of optimal treatment as well as understanding onset and prognosis. Currently, there is an effort to incorporate research findings on cognitive styles into clinical practice (Davies & Tchanturia, 2005). For example, cognitive remediation therapy (CRT) has been suggested as a promising intervention to address some of the deficits related to the trends in cognitive functioning that frequently parallel eating disorder symptomatology (Davies & Tchanturia, 2005; Southgate, Tchanturia, & Treasure, 2005). When used in the treatment of other psychiatric disorders like schizophrenia, CRT has been found to effectively teach new cognitive skills integral to daily functioning and is related to positive clinical outcomes (Wykes et al., 2007). This particular therapeutic intervention has been valuable in improving cognitive deficits often seen in AN, is fairly easy to administer, and yields high patient engagement and commitment, making it a viable short-term supplement to other suggested methods for the treatment of eating disorders (Baldock & Tchanturia, 2007; Tchanturia, Davies, & Campbell, 2007).

Research has demonstrated that the use of CRT for acute AN is related to improved neuropsychological performance, particularly for improving cognitive flexibility (Tchanturia et al., 2008). Furthermore, the use of CRT has been related to improved neuropsychological task performance independent of treatment as usual (Tchanturia et al., 2008). It has been suggested that CRT may enhance the effectiveness of Cognitive Behavior therapy when used as a pretreatment during the more acute phase of the illness or as an add-on to Cognitive Behavior therapy (Baldock & Tchanturia, 2007).

Given the increasing interest in cognitive therapies, a considerable amount of research has investigated the presence of certain cognitive traits among individuals with eating disorders. Taken together, it appears that certain neuropsychological profiles related to cognitive flexibility and information-processing style exist among individuals with anorexia nervosa and bulimia nervosa. Given the relationship between body image disturbance and eating disorders, research suggests the possibility that similar cognitive strengths and deficits may exist among individuals with only body image disturbance. That is, individuals with disturbed body image but without the disordered eating and compensatory behaviors necessary to meet full criteria for AN or BN may exhibit cognitive features similar to those individuals who meet full criteria for an eating disorder, indicating that these potential endophenotypes are more specific to body image disturbance than the full manifestation of eating disorder symptomatology. A brief review limited to work that has specifically addressed cognitive flexibility and information-processing style among women diagnosed with eating disorders follows.

Set-Shifting Deficits in Eating Disorders

Set-shifting, a core component of executive functioning, is most commonly defined as the ability to move back and forth between multiple tasks, operations, or mental sets (Miyake et al., 2000). Numerous studies have reported set-shifting deficits in women with both AN and BN, with results strongly suggesting that individuals with AN exhibit significantly more cognitive rigidity than non-psychiatric healthy controls (Ferraro, Wonderlich, & Jolic, 1997; Roberts et al., 2007; Tchanturia, Campbell, Morris, & Treasure, 2005) across a variety of measures. Rigidity has been noted for both traditional cognitive tasks as well as perceptual set-shifting tasks, such as

the Haptic illusion task (Tchanturia, Serpell, Troop, & Treasure, 2001; Tchanturia, Breceelj Anderluh, et al., 2004).

One of the earliest studies to examine this aspect of executive functioning found that participants currently diagnosed with AN as well as those recovering from the disorder exhibited significantly higher perceptual and cognitive set-shifting scores (indicating greater difficulty with set-shifting) than control participants (Tchanturia, Morris, Surguladze, & Treasure, 2002). The results of a later study conducted by the same group indicated that set-shifting impairments exist in recovered patients even following weight restoration (Tchanturia, Morris, et al., 2004), suggesting that this deficit is not related to nutritional status nor is it a temporary consequence of starvation. A recent meta-analysis examining effect sizes across fifteen empirical studies that employed four commonly used neuropsychological measures of set-shifting, confirmed that deficits appeared to be present among individuals with eating disorders (Roberts, Tchanturia, Stahl, Southgate, & Treasure, 2007), although data from individuals with BN was limited. Results from the meta-analysis indicated that the pooled effect sizes varied from small to large across the different tasks surveyed, demonstrating a consistent deficit regardless of illness state (Roberts et al., 2007).

This cognitive deficit has been noted across a variety of studies not only for patients currently diagnosed with an eating disorder and those in recovery, but also among both affected and unaffected sisters as well (Holliday, Tchanturia, Landau, Collier, & Treasure, 2005; Roberts, Tchanturia, Stahl, Southgate, & Treasure, 2007). A study by Holliday and colleagues (2005) indicated that although pairs of sisters discordant for AN exhibited significantly more set-shifting difficulties than unrelated healthy control participants, the sisters did not exhibit differences from

one another. Such findings, along with those examining relationships with disease status, suggest the usefulness of set-shifting as a potential endophenotype for the disorder in that it appears to co-segregate within families, is state-independent, and is more prevalent among unaffected family members than in the general population (Gottesman & Gould, 2003).

It has been suggested that this cognitive rigidity may be a neurocognitive correlate of a variety of psychiatric disorders, including schizophrenia (Snitz, Macdonald, & Carter, 2006) and bipolar disorder (Robinson et al., 2006), and is not specific to eating disorders. The literature additionally postulates that deficits in set-shifting are related to and may be better accounted for by the perfectionism and obsessionality that are often seen in AN (Strober, 1980). Recent research supports a relationship between set-shifting impairments among individuals with AN and traits associated with obsessive compulsive personality disorder (Tchanturia, Morris, et al., 2004). This rigidity and obsessionality may manifest themselves as specific rules and rituals related to food and eating, for instance the categorization of “safe” and “unsafe” foods (Steinglass, Walsh, & Stern, 2006). Regardless of the exact origin, the clinical implications related to set-shifting impairments suggest that understanding the role of this cognitive feature in eating disorder symptomatology is a relevant research pursuit in order to investigate the possible neurodevelopmental origin of eating disorders and to promote the incorporation of cognitive flexibility into treatment for AN.

Local versus Global Information Processing Style in Eating Disorders

Although deficits in set-shifting ability have been implicated as a hallmark cognitive feature associated with eating disorders, it has been suggested that a bias in information

processing style is a cognitive feature with clear clinical implications (Gillberg, Råastam, Wentz, & Gillberg, 2007; Lopez et al., 2008a; Tokley & Kemps, 2007). Information processing styles are typically described as existing on a continuum, wherein one extreme consists of a style that is local and detail-oriented while the opposing end consists of a style that is more global, or focused more on the “big picture.” Individuals who exhibit a more local bias (perform better on tasks requiring focus on details and worse on tasks requiring a global perspective) are often described as having “weak central coherence,” a term that originated from research examining cognitive features of autism spectrum disorders (Frith & Happé, 1994; Happé & Frith, 2006). Individuals exhibiting weak central coherence are said to “miss the forest for the trees;” overlooking the gestalt features of the stimulus for the details.

A recent study by Lopez and colleagues (2008a) indicated that women with AN performed less well than controls on neuropsychological tasks that required global processing and performed better than controls on tasks that necessitated local processing. Participants exhibited evidence of weak central coherence on both visual and verbal (to a lesser extent due to the higher verbal intelligence of AN patients) tests (Lopez et al., 2008a). Interestingly, the findings of the study suggested a relationship between a bias towards local rather than global processing in the visuospatial domain and obsessive-compulsive symptoms, which could detrimentally affect treatment outcome (Crane, Roberts, & Treasure, 2007).

A large scale systematic review by the same group (Lopez, Tchanturia, Stahl, & Treasure, 2008c) based on data from 16 studies employing four separate measures of central coherence indicated the presence of global processing difficulties for individuals with both BN and AN. However, the superiority of local processing could not be conclusively established,

thereby not providing conclusive evidence for the weak central coherence hypothesis. Generally, meta-analyses of the four tasks resulted in moderate effect sizes, indicating overall poorer performance on tests requiring the use of a more global strategy.

As evidenced by recent research, women across the eating disorder spectrum exhibit difficulties in global processing and oftentimes display a preoccupation with detail in processing information, which characterizes a localized, field-independent cognitive style (Gillberg, Gillberg, Råstam, & Johansson, 1996; Lopez, Tchanturia, Stahl, & Treasure, 2008b; Tchanturia, Breceelj Anderluh, et al., 2004; Tokley & Kemps, 2007). Thus, it has been suggested that weak central coherence is a possible risk factor relevant to the formation and prognosis of eating disorders (Lopez et al., 2008c; Tokley & Kemps, 2007) and should be targeted with specific clinical interventions to improve global thinking strategies when appropriate (Davies & Tchanturia, 2005; Tchanturia, Davies, & Campbell, 2007). Despite strong empirical evidence, some of the tasks used to measure central coherence (e.g., Block Design Test) and information processing have not consistently supported the weak central coherence hypothesis (Lopez et al., 2008c). Thus, in order to more conclusively establish meaningful relationships in this area, efforts should be made to comprehensively measure information processing style with a variety of tasks shown to be sensitive specifically to weak central coherence.

Such weak central coherence in AN has been linked to a variety of other neuropsychological deficits, such as poor abstraction and “theory of mind” impairment, that comprehensively could result in the maintenance of eating disorder symptomatology (Tokley & Kemps, 2007; Tchanturia, Happé, et al., 2004). Increasing evidence regarding commonalities between individuals with AN and those with autism spectrum disorders (Gillberg et al., 1996;

Wentz, Gillberg, Gillberg, & Råstam., 1999) may be partially explained by the presence of this cognitive style. Although it is too early to conclude that weak central coherence is an endophenotype of AN or BN, early evidence suggests that an information processing bias is present across the eating disorder spectrum.

Extension of Findings to Body Image Disturbance

Although the evidence strongly suggests the presence of certain cognitive profiles in women with eating disorders, there have been no studies examining the presence of these cognitive correlates among individuals who do not meet full criteria but experience the high body image disturbance component of an eating disorder. Research suggests that the identification of potential endophenotypes will elucidate each of the diagnostic criterion that comprises a diagnosis of AN or BN, aiding in the development of a more comprehensive classification system with an inherently biological and genetic basis (Bulik et al., 2007). The proposed study attempts to dismantle the diagnostic criterion for AN and BN by focusing specifically on Criterion C for the diagnosis of AN and particularly “disturbance in experiencing one’s body weight or shape” and “undue influence of body weight or shape on self-evaluation” (American Psychiatric Association, 2000, p. 589). Similarly, Criterion D for BN necessitates that “self-evaluation is unduly influenced by body shape and weight” (American Psychiatric Association, 2000, p. 594). It is hoped that such a dismantling approach will help to identify neurocognitive factors that may be related to the formation and maintenance of body image disturbance and eating disorders.

The Current Study

The current study investigated how these particular aspects of executive functioning influence cognitive biases that previously have been shown to exist among individuals with eating disorders. A sample of women with high levels of body image disturbance completed a neuropsychological battery measuring cognitive flexibility and information processing style, wherein performance on the measures was compared to the performance of women with minimal body image disturbance. The overall objective of the current study was to identify several possible neurocognitive correlates underlying body image disturbance and dissatisfaction.

Specifically, the study explored relationships between specific aspects of neuropsychological functioning in women with elevated levels of body image disturbance compared to less body image disturbed women as well as compared to women with eating disorders. As previously discussed, recent empirical evidence suggests that individuals with eating disorders encounter more difficulty than healthy controls with cognitive flexibility and global processing (Roberts et al., 2007; Tokley & Kemps, 2007). Investigating whether these patterns exist for individuals who do not meet full criteria for the diagnosis of an eating disorder but do show evidence of body image disturbance will help in further clarifying the nature of these suggested underlying cognitive traits while examining their specificity to certain criteria. Additionally, a greater understanding of these cognitive mechanisms serves to inform research on approaches to treatment for body image disturbance. Particularly, results of the current study suggest that developing treatment options that comprehensively account for the potential influence of cognitive processing deficits underlying body image disturbance is necessary and may even prevent the future development of an eating disorder. As with CRT, clinical efforts to

account for and remediate these cognitive factors have been successful in the preliminary treatment of eating disorders (Davies & Tchanturia, 2005; Southgate, Tchanturia, & Treasure, 2005). If similarities in profiles do exist among individuals with body image disturbance, it could be assumed that such treatment approaches would target cognitive deficits efficaciously in this population as well.

Beyond clinical applicability, results of the current study have the potential to impact the conceptualization of eating disorder symptomatology. Similarities in neurocognitive profiles between those pre-established by the eating disorder literature and those that may be inherent to individuals with high body image dissatisfaction suggest that these neurocognitive endophenotypes may be better accounted for by body image disturbance rather than the full behavioral outcomes (restriction, refusal to gain weight, etc.) that comprise a diagnosis of AN or other more behaviorally-based symptoms of an eating disorder. Differences would suggest that body image dissatisfaction is of disparate neurodevelopmental origins and that the cognitive patterns found in anorexia nervosa may be better accounted for by the biological mechanisms associated with an eating disorder rather than those associated simply with body image disturbance.

Current Aims and Hypotheses

As previously described, there is mounting empirical evidence that particular cognitive traits may parallel biological markers indicative of the potentiality for the development of AN or BN. However, the presence of these factors among individuals with body image disturbance has not yet been established. Given the predictive relationship between such disturbance and the

development of eating disorder psychopathology, treatment incorporating protocols found to be effective in reducing cognitive biases in the treatment of eating disorders can potentially be extended to preventative measures in the treatment of body image disturbance.

The current study aimed to investigate the relationship between cognitive performance and body image disturbance by administering a battery of cognitive tasks to two groups of participants: women with elevated levels of body image disturbance and normal women with no or low levels of body image disturbance, as determined by scores on measures of body image disturbance (one standard deviation below and above the mean score for each measure). The cognitive tasks used in the study were selected based on the findings of past research using the same tasks that suggests women with eating disorders demonstrate distinct profiles on tasks measuring set-shifting ability and central coherence. The following hypotheses were tested:

- 1) Individuals with elevated levels of body image disturbance will perform more poorly overall on measures of cognitive flexibility (WCST, Brixton, CatBat, and Trail Making Task- Trail B) as compared to the performance of women with minimal or no body image disturbance.

- 2) Individuals with high body image disturbance will exhibit a more local and detail-focused information processing bias and weak central coherence, as compared to a more global information processing bias exhibited by women with minimal or no body image disturbance. Individuals with elevated levels of body image disturbance

will perform better on a measure requiring attention to detail (EFT) and more poorly on a measure requiring the global integration of visual information (RCFT).

- 3) Group differences between individuals with high body image disturbance and normal levels of body image disturbance across task performance will be similar to those found for individuals with eating disorders, particularly anorexia nervosa, compared to healthy control women. Effect sizes calculated for the current sample will resemble those cited in the literature for individuals with diagnosed eating disorders.

CHAPTER TWO: METHOD

Power Analysis

In order to obtain an estimate of optimal sample size for the study, a power analysis was conducted. A meta-analysis investigating set-shifting ability in individuals with eating disorders compared to non-psychiatric controls using many of the same cognitive tasks as the current study were identified (Roberts et al., 2007). Pooled standardized effect sizes across the four tasks reported in the meta-analysis ranged between small (Cohen's $d = 0.36$) and large (Cohen's $d = 1.05$), based on Cohen's guidelines (Cohen, 1988). The average pooled effect size across the set-shifting tasks reviewed by the meta-analysis (Cohen's $d = 0.69$) falls in the medium range. Finally, the literature examining central coherence and preoccupation with detail is confined mostly to individuals with eating disorders as there have been no studies conducted investigating individuals with body image disturbance. However, those studies conducted with ED samples (Lopez, Tchanturia, Stahl, & Treasure, 2008c; Tokley & Kemps, 2006) reported effect sizes ranging from moderate (Cohen's $d = 0.50$) to large (Cohen's $d = .98$). An overall mean effect size was then obtained by averaging the effect sizes obtained from previous studies investigating central coherence using measures of information-processing style in individuals with eating disorders compared to healthy controls (Cohen's $d = 0.74$).

Based on the previously discussed studies and Cohen's (1992) recommendations, a power analysis was conducted using G*Power 3 software (Faul, Erdfelder, Lang, & Buchner, 2007), with an alpha of .05 (two-tailed), and an estimated effect size of 0.70, in order to estimate the

sample size needed to achieve a power level of .80. The estimated total sample size (both groups combined) was 52. Based on this estimation, it was proposed that 26 individuals with high levels of body image disturbance and 26 individuals with low levels of body image disturbance would be needed in order to allow for sufficient power to determine group differences and examine relationships between performances on the cognitive tasks in each group. Therefore, the number of participants collected in Phase 2 of the study meets the criteria suggested by the initial power analysis.

Recruitment

The participant pool of psychology students was utilized to recruit a large number of individuals from which to randomly select and match participants for each group in Phase 2. Participants who completed Phase 1 of the study were rewarded one point for the psychology class of their choice.

Initial Exclusionary Criteria

The age range of participants for this study was restricted to females between the ages of 18 and 60. Individuals under the age of 18 and over the age of 60 were excluded as differing levels of cognitive development may diffuse findings and diminish the representativeness of the sample, as indicated by differences in scores on such cognitive measures as the Wisconsin Card Sorting Test (Cinan, 2006) among individuals of different ages. Additionally, because research indicates that young women are most likely to experience body image dissatisfaction (Berscheid et al., 1973; Cash, Winstead, & Janda, 1986; Fallon & Rozin, 1985) participation was limited to women. This restriction ensures continuity in the research

conducted to date on neurocognitive traits in eating disorders (Lee & Shafran, 2004; Lopez et al., 2008c; Roberts et al., 2007).

In addition to age, demographic variables considered during recruitment included ethnicity and highest level of education. Individuals in the less disturbed body image group were invited to participate based on the need to match demographic variables with participants in the high body image disturbance group.

Participants

Construction of the two groups took place in various stages, eventually resulting in the inclusion of 27 participants in the less body image disturbed group and 26 participants in the body image disturbed group- a total of 53 eligible participants for Phase 2 of collection. Accurate construction of groups adhering to the guidelines of the exclusionary criteria was a crucial component of the study to assure the validity of the group comparisons.

The first phase of data collection yielded 978 respondents from which the 2 groups could be constructed. After removing respondents who met the initial exclusion criteria (e.g., the presence of psychopathology, not fluent in English, history of head injury), the pool consisted of 717 respondents. To determine participant eligibility for either of the two groups (body image disturbed or less disturbed body image) as part of Phase 2, a sample mean was calculated for each of the measures of body image. Respondents who had scores on the respective measures that were at least one standard deviation away from the sample mean score for each measure in the direction indicative of disturbance were considered eligible for the body image disturbed group. Respondents who had scores on the same measures that were at least one standard

deviation away from the sample mean score for each measure in the direction indicative of *less* disturbance were considered eligible for the normal body image group. Following this initial grouping, 87 respondents met criteria for inclusion in the body image disturbed group and 373 respondents met criteria for the less disturbed or “normal” body image group.

It is important to note a complication of nomenclature inherent to this population. Given that body image disturbance is likely more prevalent and levels of body dissatisfaction higher among college-aged females (Heatherton, Mahamedi, Striepe, Field, & Keel, 1997), creating a “normal” body image comparison group must take into account that the lack of body image disturbance or dissatisfaction altogether among college-aged females of this generation would actually be abnormal. An attempt was made to create a comparison group with less body image disturbance that would still be reflective of the amount of disturbance seen among individuals of this age group, which resulted in the inclusion of individuals with some degree of dissatisfaction and not entirely free from any body concerns. Therefore, the less disturbed body image group consisted of participants who were one standard deviation away from the mean in the direction of positive body image on each of the measures. Throughout the remainder of this manuscript, the “less disturbed” or “more positive” group will be referred to as the “normal” body image group.

Each respondent eligible for Phase 2 was contacted via email or phone (dependant upon their preference indicated in Phase 1). Participants who did not respond via email after one week were alternatively contacted via telephone in an attempt to set up an appointment for data collection. Of the 460 potential participants who were contacted to participate in the study, 27 individuals from the body image disturbed sample and 27 individuals from the normal body

image sample took part in data collection. Of the 406 respondents not included in Phase 2 collection, 19% declined participation while the remaining 81% failed to respond or could not be contacted (e.g., provided incorrect email address or phone number). There were no significant differences in demographic or grouping variables between the group of 54 responders and those 406 individuals who declined participation or did not respond. Finally, during Phase 2, one participant in the body image disturbed group reported that she had a history of a diagnosed eating disorder and thus her data were not included in the analyses.

Due to the limited number of eligible respondents for Phase 2, individual participant matching was not possible. As a result of the stringent data screening and group construction criteria, the two groups were significantly different across all measures of body image (see Table 1). However, participants in the two groups did not differ significantly across age, years of education, current body mass index, or Full Scale IQ score (see Table 2). There were no statistically significant differences between the groups with respect to race ($\chi^2(5) = 1.56, p = 0.78$). Thus, the groups themselves are matched across potentially confounding demographic variables and comparisons can be made for dependent variables.

The final sample of 53 participants has a mean age of 19.90 ($SD = 2.54$, range = 18-29). The majority of participants reported being heterosexual (95.4%), and they were of the following ethnicities: 60.4% European American, 13.2% Hispanic, 7.6% African American, 2.6% Asian American, 1.9% Bi/Multi-Racial, and 14.4% identified themselves as “other.” The sample current average body mass index (BMI) was 22.61 ($SD = 4.31$), which falls in the “normal” range of BMI as defined by the World Health Organization (WHO, 1997).

Phase 1 Measures- Online Eligibility Screening

Human Participants Informed Consent Form

All participants were required to electronically sign the consent form (Appendix A) via the survey host website prior to participation in Phase 1 of the study. Before signing, participants had the opportunity to read the consent form that included information about the possible inclusion of certain participants in the following phase of research. They were provided with an opportunity to print a copy of the informed consent for their records. No paper forms were created during this phase of research, as all data were stored electronically.

Demographic Questionnaire

Participants were asked to provide demographic information such as ethnicity, highest level of education, and age. This measure (Appendix B) was used to assess such exclusionary criteria as color-blindness, inability to speak English, or significant motor disturbances preventing the use of the dominant hand. Additionally, participants were asked to include contact information in the event that they met the criteria for inclusion in the laboratory phase (Phase 2) of the study.

Hospital Anxiety and Depression Scale (HADS)

The HADS (Zigmond & Snaith, 1983) is a self-report 14-item, 4-point rating scale that measures symptom severity associated with anxiety and depression. This brief measure

(Appendix C) has been found to have good screening properties and is more comprehensive than other instruments utilized to identify the presence of anxiety disorders and depression in both psychiatric patients and the general population (Bjelland, Dahl, Haug, & Neckelmann, 2002). Correlations between the total score of the HADS and other questionnaires and interview-based assessment measures ranged from .67 to .77 (Bjelland et al., 2002). Furthermore, the two individual subscales of the measure have been found to have good concurrent validity with other measures of anxiety and depression, ranging between .49 and .83. Cronbach alphas for the anxiety and depression subscales are .83 and .82 respectively (Bjelland et al., 2002). For the purposes of the current study, this measure was used to exclude potential participants who currently meet criteria for the diagnosis of a severe mood or anxiety disorder (a score of 12 or above on either of the subscales).

Brief Symptom Inventory 53 (BSI-53)

The BSI (Derogatis, 1993) is a 53-item self-report measure that assesses a variety of psychological symptoms encompassing nine symptom dimensions (Somatization, Obsession-Compulsion, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, and Psychoticism) experienced over the past seven days in adolescents and adults. In addition to the symptom dimensions, the measure (Appendix D) consists of three global indices of distress including Global Severity Index (GSI), Positive Symptom Index, and Positive Symptom Total. The measure was normed on four separate samples that include adolescents, adult psychiatric inpatients, adult psychiatric outpatients, and non-patient adults (Derogatis, 1993). The GSI of the BSI-53 suggests the presence of clinically significant symptoms (a GSI T-

score of 63 or above). This measure was developed from the longer SCL-90-R (Derogatis, 1975, 1977) but demonstrates good concurrent validity (.92 - .99) and takes only 8 to 12 minutes to complete (Derogatis, 1993). Several studies report that it has exhibited good internal consistency reliability (.71 – .85) and good test-retest reliability (.68 - .91) across the 9 dimensions. Test-retest reliability ranges from .87 to .90 across the 3 Global Indices. For the purposes of the current study, the score obtained on the GSI from this measure was used to exclude potential participants who currently exhibit or have recently exhibited clinically significant psychological symptoms.

Eating Disorder Examination Questionnaire (EDE-Q)

The EDE-Q (Fairburn & Beglin, 1994) is a 28-item self-report measure based on the Eating Disorder Examination (EDE). The EDE-Q (Appendix E) yields frequency data related to eating disordered behaviors (e.g., binges within the past 28 days) and has four subscales: Restraint, Eating Concern, Weight Concern, and Shape Concern. It has acceptable psychometric properties and has been found to be appropriate for epidemiological studies (Mond, Hay, Rodgers, Owen, & Beumont, 2004). Specifically, correlations between overall score and subscale scores ranged from .68 to .78 with optimal validity coefficients for sensitivity (.83), specificity (.96), and positive predictive value (.56; Mond et al., 2004). For the purposes of the current study, this measure was used to exclude potential participants who reported symptoms consistent with anorexia or bulimia nervosa or a total T score greater than 60. The scale is recommended as a paper-pencil replacement of the self-report version of the investigator-based interview (Celio, Wilfley, Crow, Mitchell, & Walsh, 2004; Fairburn & Cooper, 1993), is utilized

widely (Reas, Grilo, & Masheb, 2006), and is based on normative data for women recently established in a large-scale study (Mond, Hay, Rodgers, & Owen, 2006). Researchers recently noted that the inclusion of examples of what a binge entails (Appendix E) has increased agreement between the EDE-Q and EDE in the case of binge-eating disorder symptoms (Goldfein, Devlin, & Kamenetz, 2005).

Body Image Disturbance Questionnaire (BIDQ)

The BIDQ (Cash, Phillips, Santos, & Hrabosky, 2004) is a 12-item measure that assesses the larger continuum of body image disturbance across scaled items related to aspects of body image dissatisfaction such as appearance-related concerns, mental preoccupation with these concerns, and associated experiences of emotional distress. The measure (Appendix F) has excellent internal consistency (ranging from .80 to .95) and test-retest reliability (.88; Cash & Grasso, 2005). Higher mean scores on the BIDQ suggest greater body image disturbance.

Multidimensional Body-Self Relations Questionnaire (MBSRQ)

The MBSRQ (Cash, Winstead, & Janda, 1985) is a 69-item self-report instrument comprised of 10 subscales that measures one's attitude regarding their physical appearance and physical self (Cash & Pruzinsky, 1990). The MBSRQ (Appendix G) is a commonly used and well-validated self-report inventory for the assessment of body image from an attitudinal perspective (Brown, Cash, & Mikulka, 1990). This measure is widely used in body image research and has good internal consistency (ranging from .73 to .89) and test-retest reliability

across its scales (ranging from .74 to .91; Cash, Winstead, & Janda, 1986). For purposes of the current study, only those subscales directly assessing appearance satisfaction and appraisal of shape were included. The shorter 34-item self-report instrument included the Appearance Evaluation, Appearance Orientation, Overweight Preoccupation, Self-Classified Weight, and the Body Areas Satisfaction Subscales. The Body Area Satisfaction Subscale (BASS) score and the Appearance Evaluation subscale (AE) score were among the dependent variables indicating degree of body image disturbance. The BASS of the MBSRQ was employed to measure the degree of satisfaction (a higher score is indicative of greater satisfaction) across a variety of specific body parts as well as the body as a whole.

Appearance Schema Inventory-Revised (ASI-R)

The ASI-R (Cash, Melnyk, & Hrabosky, 2004) is a 20-item self-report measure comprised of two subscales: Self-Evaluative Salience (12 items) and Motivational Salience (8 items). The measure (Appendix H) uniquely assesses body image investment as part of an individual's cognitive schema, which includes the value, importance, and meaning of appearance and the extent to which an individual engages in behaviors intended to manage appearance. The inventory has good internal consistency (.86), acceptable test-retest reliability (.72), and good concurrent validity with other measures of body image and psychosocial functioning. A higher score on the ASI-R is suggestive of greater body image disturbance.

Debriefing Form- Phase 1

Participants were debriefed fully with information contained in the debriefing form (Appendix I) as to the purposes of the initial online screening phase in which they participated and their possible inclusion in the next phase of research. They were provided with contact information for the investigators. Additionally, they were informed that they did not have to submit their information and would have the opportunity discontinue participation at any point if they did not feel comfortable with the nature of the material covered in the survey.

Phase 1 Procedure

Individuals interested in participation had access to the study as part of the psychology research pool and could freely participate in the online screening in order to assess eligibility for Phase 2 participation. Prior to answering any questions, all participants provided informed consent virtually, with the clear understanding that they could discontinue participation at any point during the study. Participants then were asked to provide basic demographic information including age, race, gender. They were asked about the presence of a prior head injury (wherein the individual received medical attention related to the injury), diagnosed neurological disorder, diagnosed learning disability, color-blindness, inability to speak English, or a diagnosed psychiatric disorder, including past or present substance abuse or dependence. They were asked if they currently are abusing alcohol, prescription medication, or illicit drugs. Participants were asked if they have any first-degree relatives who had been diagnosed with a psychiatric disorder, specifically an eating disorder, obsessive-compulsive disorder, schizophrenia, schizoaffective disorder, or an autistic spectrum disorder. If individuals acknowledged “yes” to any of these

questions or confirmed that they were currently taking psychopharmacological medication, they were not eligible to participate in Phase 2 of the study. Additionally, all participants in this phase completed a brief measure of anxiety (HADS-A), depression (HADS-D), and eating disorder psychopathology (EDE-Q). Furthermore, they completed a brief inventory of psychopathology as part of the screening protocol (BSI-53). If individuals met statistical criteria based on clinical scales (see Measures section) for the presence of a current clinical disorder (including an eating disorder), they were not eligible to participate in Phase 2 of the study. Finally, during this stage, participants completed the three measures of body image (BIDQ, MBSRQ, ASI-R) to assess degree of body image disturbance.

After online collection of Phase 1 and data screening were complete, remaining eligible individuals who were not excluded were sorted into one of two groups based on their responses to the body image assessment tools. All eligible participants were contacted via phone or email to participate in Phase 2, the laboratory portion of the study.

Phase 2 Measures

Informed Consent- Phase 2

All participants were required to provide written consent before participating in the second phase of the study (Appendix J). Prior to securing the signature of the participant and witness (the individual administering the study protocol), consent was explained verbally and participants had the opportunity to read the consent form and ask any questions. Finally, they were provided with a copy of the paperwork for their records.

Eating Disorder Examination (EDE): Screening Interview

The semi-structured Eating Disorder Examination (Fairburn & Cooper, 1993) was administered to all participants in the body image disturbed group to assure that they were not currently meeting full criteria for an eating disorder. This interview is the basis of the EDE-Q (Appendix E), yields the same frequency data related to eating disordered behaviors (e.g., binges within the past 28 days), and consists of 5 subscales. Research has established that each of the five subscales has a satisfactory degree of internal consistency (Cooper, Cooper, & Fairburn, 1989). Individuals currently meeting full criteria for an eating disorder (including AN, BN, binge eating disorder, or eating disorder not otherwise specified) based on responses to the EDE were excluded. In the context of this interview and prior to commencement of data collection, participants were asked if they had ever been diagnosed with an eating disorder in the past. Past history of eating disorder symptomatology also was explored to assure that no participant had ever had (diagnosed or undiagnosed) anorexia nervosa, bulimia nervosa, or binge-eating disorder. Participants with a history of an eating disorder (based on EDE criteria) were excluded because the aim of this investigation was to specifically explore correlates of body image disturbance alone, and therefore including participants with a history of an eating disorder could have confounded the results.

Vocabulary and Matrix Reasoning subtests of the Wechsler Adult Intelligence Scale- 3rd Edition (WAIS-III)

In order to obtain a global estimate of intellectual status for the purpose of comparison between groups, a validated short form of the WAIS-III (Wechsler, 1997) using the Vocabulary and Matrix Reasoning subtests was administered to participants in Phase 2. Research has

supported the use of the Vocabulary and Matrix Reasoning subtests as reasonable estimates of Full Scale IQ (FSIQ) in both normal and clinical samples (Ringe, Saine, Lacritz, Hynan, & Munro Cullum, 2002; Sattler & Ryan, 2001). Using data from the WAIS-III standardization sample, Sattler and Ryan (2001) suggested that a positive correlation exists between FSIQ calculated from the full WAIS-III and FSIQ calculated using only the Vocabulary and Matrix Reasoning subtests ($r = .88$). Correlations between FSIQ and estimates using this dyad of subtests for neuropsychiatric and clinical samples are reportedly similar ($r = .93$; Ringe, Saine, Lacritz, Hynan, & Munro Cullum). IQ estimates were included to ensure that the two groups were generally matched for intellectual ability and to rule out intellectual ability as a potential confound.

Cognitive Tasks

Paper Folding Test

The Paper Folding Test is a measure of spatial visualization (Ekstrom, French, & Harman, 1976). The two-part test is timed and each part takes approximately three minutes to complete. Each item consists of a series of drawings showing a square piece of paper folded up to three times. The final picture in the series includes a dot on the paper indicating where a hole has been punched. Participants must select which of five drawings correctly represents how the paper would appear if it were unfolded. A score is calculated by subtracting one-fourth of the number of incorrect items from the number of correct items. The Paper Folding test has demonstrated good reliability for females ($r = .77$; Shavaliel, 2004). This task was included as a measure of discriminant validity to rule out the possibility that differences between the groups

were non-specific and not reflective of the constructs of interest (cognitive flexibility and information-processing).

Wisconsin Card Sorting Test (WCST)

The WCST (Heaton, 2003) is a commonly administered measure of executive functioning and particularly, set-shifting ability. To complete the task, participants were directed to match each of the stimulus cards with one of four category cards; a single red triangle, two green stars, three yellow crosses, and four blue circles. The sorting rule changes unpredictably throughout the course of the task. The WCST was administered using a computer program and took approximately fifteen minutes to administer to each participant. As is consistent across the literature, the number of perseverative errors was used as the measure of set shifting ability for this task. The number of perseverative errors has been found to have acceptable test-retest reliability (.38; Bird, Papadopoulou, Ricciardelli, Rossor, & Cipolotti, 2004) and more variable construct validity across various clinical populations (Psychological Assessment Resources, 2003).

Trail Making Task (Trails A and B)

Trails A and B (Kravariti, Morris, Rabe-Hesketh, Murray, & Frangou, 2003) is another commonly used measure of executive function and set-shifting ability. As part of the task, participants alternatively link ordered numbers and letters (i.e., 1 - A - 2 - B - 3 - C for Trail B). This task can be administered using pen and paper (Reitan, 1958) and, more recently, a computerized version has become available (which includes an additional alphabetic sequence task). For the purposes of the current study, the paper and pencil version was used. Trail A was

administered prior to completion of Trail B in order to serve as a control trial. Trail A required that participants simply link numbers in numerical order as quickly as they can, (i.e., 1-2-3-4). The format of Trail A is similar to that of Trail B so that the performance on Trail B is not diffused by unfamiliarity with the task format. Time taken to complete Trail B (switching task) and the ratio of time needed to complete Trail A to the amount of time required to complete Trail B are the measures of set shifting ability. Trails A and B took each participant approximately five minutes to complete. Internal consistency reliability for Trails A and B subtests ranged from .72 to .70 (Anastasi & Urbina, 1997) and it is highly correlated with other measures of related constructs (Reynolds, 2002).

Brixton Task

The Brixton Task (Burgess & Shallice, 1997) was the third measure of set-shifting ability. As part of the task, participants were asked to watch a computer screen and predict the movements of a blue circle that changes its location after each of the participant's responses. The pattern of the blue circle's movement frequently changes and the participant has to abandon the old concept and replace it with a new one. The measure takes approximately three minutes to complete. The total number of errors made during the task was used as the measure of set-shifting ability.

CatBat Task

The final measure of set-shifting ability was the CatBat Task (Tchanturia, Morris, Surguladze, & Treasure, 2002), which has been specifically developed to measure deficits among individuals with eating disorders. As part of the protocol, participants were asked to fill in

the missing letters of some words contained in a written short story. In the first part of the story (approximately 15 lines of text) the context requires a 'C' (for CAT) to be filled in the blank, then (approximately halfway into the written text) the context changes and 'B' (for BAT) becomes the most appropriate. The task takes approximately three minutes to complete. The number of perseverative errors ('C' where 'B' is appropriate), the time taken to complete the 'Bat' portion of the story, and the ratio of the time taken to complete the 'Bat' portion to the time taken to complete the 'Cat' portion were the measures of set-shifting ability. Reliability and validity has not been established although this measure is commonly used as part of a neuropsychological battery measuring cognitive flexibility in eating disorders (Tchanturia, Breceļj Anderluh, et al., 2004; Tchanturia, Campbell, Morris, & Treasure, 2005; Tchanturia, Davies, et al., 2008; Tchanturia, Morris, et al., 2004). This task was developed from a measure of set-shifting for non-eating disordered, general neuropsychiatric patients (Eliava, 1964).

The Rey-Osterrieth Complex Figure Test- copy/recall form (RCFT)

The RCFT (Osterrieth, 1944) was among the measures of central coherence. This pen and paper measure allowed exploration of a variety of cognitive processes including visual perceptual organization, planning, non-verbal memory, problem-solving and motor functions. Participants are asked to copy a complex figure from a piece of paper and then asked to recall the figure without previous warning after an interval that varies from 20-30 minutes. Most of the difficulty participants experience when recalling the figure can be explained by the overburdening of working memory during the initial copy phase of the task, which has been tied to a local information processing style demonstrated in the drawing style. Specifically, lower rates of recall often suggest a less coherent drawing style (or detail-focused style; Spreen &

Strauss, 1998; Lezak et al., 2004). Accuracy of the drawing was scored using a method adapted from Osterrieth and colleagues (Osterrieth 1944; Spreen & Strauss, 1998; Lezak et al., 2004), in which the 18 total elements that comprise the drawing are given a quality score from 0 to 2. Drawing style scores were based on the scoring system developed by Booth (2006) and Savage and collaborators (1999), in which scores were based on specific organizational strategies employed across the five main elements. To determine the drawing process's degree of coherence, Booth's (2006) Order of Construction Index (measuring the construction order of the main elements) and Style Index (measuring the continuity of the drawing process) were calculated and an overall Coherence Index was computed by adding the proportion of the total possible scores in both of the sub-indices. A higher score on the Coherence Index indicates a more coherent (global and continuous) drawing style as opposed to a fragmented, locally-processed style (Lopez et al., 2008a). This organizational approach to scoring has shown evidence of high interrater agreement ($r = .80$; Deckersbach et al., 2000).

Group/Embedded Figure Test (EFT)

The EFT (Witkin, Oltman, Raskin, & Karp, 1971) was another measure of local/global information processing style and central coherence. This perceptual task required participants to locate and trace 18 target simple shapes embedded in complex designs while being timed by the experimenter. The participant was asked to indicate when she found the embedded shape, timing was immediately stopped, and the participant was asked to indicate where she found the figure. Scores were recorded in seconds and the mean and total time taken to locate the hidden shapes as well as the total number of errors (time out failures) were calculated as the measures of coherence. Longer mean and total times and more errors indicate a more global processing style

while shorter mean times and fewer time out errors suggest a more local, detail-oriented processing style (Baron-Cohen & Hammer, 1997; Jolliffe & Baron-Cohen, 1997). The task was found to have adequate split-half reliability, adequate internal consistency, and satisfactory construct validity across a sample of adult women (Panek, Funk, & Nelson, 1980).

Debriefing Form- Phase 2

Participants were provided a debriefing form (Appendix K) that specifically informed participants about the general focus of the research project. Participants were provided with contact information for the investigators and other responsible oversight parties (i.e., Department Chair, IRB). Additionally, several clinical resources were listed for participants in case of the unlikely event that they experienced any pervasive negative feelings associated with participation in the study.

Phase 2- Laboratory Procedures

Individuals who agreed to attend the laboratory-based portion of the study participated in a brief semi-structured interview, which included the EDE, to ascertain that they presently met the criteria outlined previously. All participants began by completing the additional informed consent procedures and were then interviewed about past and present eating behaviors. The interview and the subsequent IQ and cognitive testing were administered either by an advanced graduate student in clinical psychology or (less frequently) an upper-level undergraduate student extensively trained to administer the study protocol. The length of the entire laboratory session was between one and two hours. Upon completion, all participants received a debriefing statement and were given the opportunity to receive feedback about their performance.

CHAPTER THREE: RESULTS

Data Screening

Data was analyzed using SPSS software version 17.0. Screening of the variables suggested significant differences between the body image disturbed group and the normal body image group on many of the pertinent dependent variables (DVs) related to neurocognition (see Tables 3-5). All data were screened for violations of the assumption of normality, skewedness and kurtosis, for outliers, and for independence of errors. No violations were noted. Outliers (i.e., scores beyond three times the standard deviation) were not found for any of the DVs.

Set-Shifting Group Comparisons

The first set of analyses tested the hypothesis that, compared to women with normal body image, women with elevated levels of body image disturbance would be more likely to exhibit greater cognitive rigidity, generally experiencing more difficulty on set-shifting tasks requiring cognitive flexibility. A 2 (elevated body image disturbance group, normal body image group) by 7 (Trail B time, Ratio A: B time, Brixton errors, CatBat errors, Bat time, Ratio Bat:Cat time, WCST perseverative errors) MANOVA was performed to investigate group differences in set-shifting ability. To address multiple comparisons, a Bonferroni correction was applied and resulted in a p -value of .007. There was no main effect for group, $F(7, 45) = 1.55, p = .17$ (partial eta squared = .20). However, the effect size was calculated to gauge the overall strength of the relationship between the variables and, using Cohen's descriptions of effect sizes (1988, p. 22), the overall effect size was medium-large. Given this effect size, independent one-way

ANOVAs were conducted as exploratory analyses to examine group differences individually for each of the seven measures of set-shifting ability.

Accordingly, a series of ANOVAs was conducted with body image group as the independent variable and measures of set-shifting ability (Trail B time, Ratio of Trail A time to Trail B time, Brixton errors, CatBat perseverative errors, Bat time, ratio of Bat to Cat time, WCST perseverative errors) as the dependent variables (see Table 3). The ANOVAs indicated significant group differences on the ratio of Bat time to Cat time ($p < .01$; partial eta squared = .17). There were no other significant group differences for any other measures of set-shifting; however, a review of the means indicated that women in the body image disturbance group exhibited a trend toward more difficulty on all of the measures except for the amount of errors on the Brixton (see Table 3).

Central Coherence Group Comparisons

The next set of analyses tested the hypothesis that, compared to women with normal body image, women with elevated levels of body image disturbance would be more likely to experience difficulties with central coherence, exhibiting a bias for detail-oriented processing and generally experiencing more difficulty on tasks requiring global processing and the “big picture” integration of visual stimuli. A 2 (elevated body image disturbance group, normal body image group) by 4 (Central Coherence index score from the copied RCFT, mean time for locating the figures as part of the GEFT, total time taken to locate the GEFT figures, and the number of time out errors on the GEFT) MANOVA was performed to investigate the relationship between body image disturbance and central coherence/information processing style.

To address multiple comparisons, a Bonferroni correction was applied and resulted in a p -value of .01. The main effect for group approached significance, $F(4, 48) = 2.40, p = .06$ (partial eta squared = .17) and the effect size was calculated to gauge the overall strength of the relationship between the variables. Given this large effect size, independent one-way ANOVAs were conducted as exploratory analyses to examine group differences individually for each of the four measures of central coherence.

Accordingly, a series of ANOVAs was conducted with group as the independent variable and measures of central coherence (Central Coherence index score from the copied RCFT, mean time for locating the figures as part of the GEFT, total time taken to locate the GEFT figures, and the number of time out errors on the GEFT) as the dependent variables (see Table 4). The ANOVAs indicated group differences approaching significance for the following individual dependent variables: the total time taken to find the GEFT figures ($p = .05$; partial eta squared = .07) and the number of time out errors accrued throughout the GEFT ($p = .02$, partial eta squared = .11), exhibiting small and medium effect sizes, respectively. These results suggest that women in the body image disturbed group took less time to find the embedded figures and less frequently exceeded the time limits imposed for locating the embedded figures. The other individual indicators of central coherence failed to yield significant differences between groups. However, a review of the means indicated that women in the body image disturbance group exhibited a trend toward a more detailed information-processing style on all of the measures (see Table 4).

Given that a preoccupation with detail could potentially diminish the accuracy of construction of a figure, analyses investigating the accuracy of construction of copying the RCFT

figure as well as the accuracy of delayed reconstruction of the figure were conducted. Two one-way ANOVAs were conducted with group as the independent variable. The first ANOVA, with RCFT copy accuracy as the dependent variable, was significant, $F(1, 52) = 2.22, p < .05$ (partial eta squared = .09). The second ANOVA, with RCFT recall accuracy as the dependent variable, was not significant but did yield a small effect size, $F(1, 52) = .35, p = .56$ (partial eta squared = .01). The results suggest that, although individuals in the body image disturbed group did not have a significantly greater Central Coherence index score on the RCFT, they encountered more problems with accuracy than individuals in the normal body image group while directly copying the figure but not when reconstructing it from memory 20 minutes later.

Correlational Analyses of Body Image and Neurocognitive Variables

To examine whether set-shifting deficits and/or a biased information processing style are linearly related to body image disturbance (as measured by the BIDQ), a multiple correlation analysis across scores within both the body image disturbed and normal body image group was conducted. There were no significant correlations within or across either of the groups between total score on the BIDQ and any of the dependent variables.

Comparisons with Eating Disordered Groups in the Literature

To test the third hypothesis that group differences across task performance for the current sample would be similar to group differences found for women with eating disorders when

compared to control individuals, effect sizes for the individual tasks in the current study were compared qualitatively to those found in meta-analyses or review papers examining findings for set-shifting (Roberts et al., 2007) and information processing (Lopez et al., 2008c) in eating disordered samples. For effect size comparisons reported in the pertinent meta-analyses, the mean difference in scores between the eating disordered samples and the healthy control samples was standardized by calculating Cohen's d , the difference between the two raw means divided by the pooled standard deviation (Rosenberg et al., 2000). Cohen's d effect sizes (Cohen, 1992) are delineated as negligible (≥ -0.15 and > 0.15), small (≥ 0.15 and > 0.40), medium (≥ 0.40 and > 0.75), large (≥ 0.75 and > 1.10), very large, (≥ 1.10 and > 1.45) and huge (≥ 1.45). Table 5 provides the concurrent effect sizes (converted from partial eta squared to Cohen's d) found for the current study for direct qualitative comparison with eating disordered samples.

In the meta-analysis conducted by Roberts et al. (2007), effect sizes illustrating task performance differences between women diagnosed with AN or BN and healthy control women across 16 studies were located for the following measures of set-shifting ability: Trail B time ($d = .36$), Brixton errors ($d = .21$), CatBat perseverative errors ($d = .45$), and WCST perseverative errors ($d = .62$), small, small, medium, and medium respectively. Roberts et al. (2007) noted problems in set-shifting across a number of neuropsychological tasks among individuals diagnosed with an eating disorder and larger effect sizes overall compared to the results of the current study.

In the meta-analysis conducted by Lopez et al. (2008c), effect sizes illustrating task performance differences between women diagnosed with AN or BN and healthy control women across studies were located for only one shared measure of central coherence and information-

processing style: GEFT total time ($d = .32$), a small effect size. The results of the current study for the GEFT total time indicate a larger effect size ($d = .56$) between the body image disturbed group and normal body image group. Two additional measures taken from the RCFT thought to indicate weak central coherence and a more detail-focused information processing style were included in the meta-analysis: the Accuracy index of the Recall RCFT ($d = .49$) and the Order index of the Recall RCFT ($d = .55$), both medium effect sizes. Although these measures were not explicitly included in the hypotheses of the current study, effect sizes for these two additional measures of central coherence were calculated for the sake of comparison and yielded Cohen's $d = .17$ (small effect size) for the Accuracy index of the Recall RCFT and Cohen's $d = .29$ (small effect size) for the Order index of the Recall RCFT.

Effect sizes from the current study more closely paralleled those found when comparing eating disordered and healthy control samples across measures of information processing style (Lopez et al., 2008c). In fact, the effect size found for GEFT total time for the current sample was substantially larger than that found when comparing eating disordered samples to healthy controls. Despite similarities for information processing style, effect sizes found across measures of set-shifting for the current sample were not as large as those in eating disordered/healthy control comparisons.

Discriminant Validity: Paper Folding Test

To assure that group differences are specific to set-shifting and information-processing style and not to a wider neurocognitive deficit that might include other aspects of visual-spatial processing, group differences between the number of errors on the Paper Folding test were

analyzed. In order to most conclusively demonstrate discriminant validity, no significant group differences should be found. A one-way ANOVA was conducted with group as the independent variable and the number of errors on the Paper Folding test as the dependent variable. The results did not reveal a significant difference between the groups, $F(1, 53) = .008, p = .93$ (partial eta squared = .00), indicating that the total mean number of errors made by members of the body image disturbed group ($M = 10.73, SD = 1.88$) did not differ significantly from the total mean number of errors made by members of the normal body image group ($M = 10.51, SD = 1.86$).

Accounting for Intellectual Ability

To assure that group differences in set-shifting and information-processing are not confounded by significant group differences in intellectual ability, a one-way ANOVA was conducted with group as the independent variable and FSIQ as the dependent variable. The results failed to yield significant difference between the groups, $F(1, 53) = 1.49, p = .23$ (partial eta squared = .03), indicating that the mean FSIQ of the body image disturbed group ($M = 106.19, SD = 8.42$) did not differ significantly from the mean FSIQ of the normal body image group ($M = 101.41, SD = 18.13$). Both groups have mean FSIQs firmly within the average range of intellectual ability.

Exploratory Analyses: Anxiety Symptomatology

During the data screening process, it became clear that there were differences between the two body image groups across scores on the HADS-Anxiety (HADS-A) subscale. Following the completion of the analyses of primary interest, analyses exploring differences in reported anxiety symptoms were conducted in order to investigate the statistical significance of these

observed differences. A one-way ANOVA was conducted with group as the independent variable and HADS-A scores as the dependent variable. There was a significant difference between the groups, $F(1, 52) = 19.89, p < .001$ (partial eta squared = .281), indicating that the mean HADS-A score of the body image disturbed group ($M = 8.42, SD = 3.84$) was significantly higher than the mean HADS-A score of the normal body image group ($M = 4.04, SD = 3.31$). It should be noted that a score of eight or above on the HADS-A indicates a potentially clinical level of anxiety, although the type of anxiety is not specified with the HADS-A.

In addition to comparisons of group means, a multiple correlation analysis was conducted to investigate relationships between HADS-A scores and scores across the measures of set shifting and information processing style. No significant correlations were found, indicating the absence of a consistent relationship between degree of anxiety and any measure of neuropsychological functioning.

Exploratory Analyses: General Psychiatric Symptomatology

Given the differences between groups on the HADS-A despite the effort to screen out individuals with clinical levels of psychiatric symptomatology using the BSI-53, mean differences between groups on the Global Severity Index (GSI) of the BSI-53 were investigated. A one-way ANOVA was conducted with group as the independent variable and mean GSI t-scores as the dependent variable. The results indicated a significant difference between the groups, $F(1, 52) = 4.47, p = .04$ (partial eta squared = .08), indicating that the mean GSI t-score of the body image disturbed group ($M = 48.87, SD = 7.04$) was significantly higher than the mean GSI t-score of the normal body image group ($M = 45.34, SD = 5.01$). However, both mean

GSI t-scores were below the cutoff that indicates the presence of clinically significant symptomatology (GSI t-score of 63).

CHAPTER FOUR: DISCUSSION

Based on the results of the current study and previous literature, a clearer picture of specific neurocognitive linkages between body image disturbance alone and full eating disorder psychopathology is beginning to emerge. The current study was based on the specific premise that body image disturbance is an integral criterion for an eating disorder and dismantling such criteria would help to elucidate the developmental pathways inherent to etiology. Given that problems with set-shifting and global information processing are present among individuals diagnosed with eating disorders, a similar presence of these patterns among individuals with body image disturbance (which typically precedes the development of eating pathology) would indicate that body image disturbance alone may better account for these neurocognitive trends. Particularly, because body image disturbance is a uniquely cognitive phenomenon versus the behavioral manifestations (i.e., restriction, bingeing) of eating disorder pathology, it should follow that such aspects of cognitive functioning would be more closely tied to the cognitive component of an eating disorder diagnosis (i.e., body image disturbance). However, the results of the current study suggest that the best understanding of the relationships between these neurocognitive contributions and the pathology they underscore may be reached when each proposed neurocognitive correlate is examined individually.

The first hypothesis proposed differences in set-shifting ability between the body image disturbed group and the normal body image group. Differences between the groups were

statistically non-significant. The effect size for group differences across all of the set-shifting tasks is considered small-medium and may indicate that there is a relationship between body image disturbance and set shifting ability that was not detected by the MANOVA due to small sample sizes (Cohen, 1988; Cohen 1990; Cohen, 1994). A non-significant pattern of more perseverative errors among body image disturbed participants appears upon examination of means but this pattern should be regarded as preliminary and does not conclusively suggest that individuals with body image disturbance had more difficulty with set-shifting than did individuals with normal levels of body image disturbance.

Only one suggested indicator of cognitive rigidity was inconsistent with the other measures- the Brixton task, which uses the number of errors incurred as the measure of set shifting ability. On this test, individuals in the body image disturbed group performed better on average than individuals in the normal body image group, incurring fewer errors over the course of administration. Although unexpected, a review of the literature indicates that such disparate results are not uncommon for this task. In the four studies found that employed the Brixton for measuring differences in set-shifting ability between women with eating disorders and healthy controls (Holliday et al., 2005; Tchanturia et al., 2004a; Tchanturia et al., 2004b), only one identified an effect size that had a confidence interval that did not overlap with zero (Tchanturia et al., 2004c). Researchers have postulated that the Brixton task is particularly sensitive to the severity and course of the illness as the only study to find pronounced set shifting difficulties was among individuals acutely ill with AN (Tchanturia et al., 2004c). Therefore, it follows that individuals with body image disturbance who were specifically selected to participate in the study because of their lack of any mental illness would not show evidence of problems on this

measure. Accordingly, all participants (regardless of group) performed within the moderate average range or above on this measure and showed no incidence of abnormal or impaired performance.

The second hypothesis was based on the idea that individuals with body image disturbance would exhibit the same tendencies in information processing style as individuals with eating disorders. Results indicated a mostly non-significant (after correcting for multiple comparisons) emerging pattern of differences between the groups across the tasks evaluating bias toward a detail-focused information processing style although results were less clear and non-significant for differences in the ability to integrate global information. A pattern toward increased difficulty with global processing and superiority with local processing among individuals with body image disturbance tentatively emerged across a number of the dependent variables. Overall, the pattern of results preliminarily suggests that individuals in the body image disturbance group may exhibit a slightly more piecemeal, localized drawing style when copying the RCFT but found the hidden figures in the GEFT more quickly, with less incidences of timeout errors (exceeding 60 seconds without correctly identifying the hidden figure) compared to individuals in the normal body image group.

These findings tentatively support the weak central coherence account, wherein individuals with body image disturbance experience difficulty seeing the “big picture.” Given that research indicates that such a locally-biased information processing style both decreases the construction accuracy of the initial copy and the accuracy of the recalled information initially encoded in this piecemeal fashion (Spreeen & Strauss, 1998; Lezak et al., 2004), analyses were conducted to explore whether the accuracy of the copied and recalled figures was impacted. The

results of these analyses support previous research suggestive of accuracy issues, in that individuals in the body image disturbed group exhibited significantly more inaccuracy when copying the RCFT figure than individuals with normal body image. Accuracy in recalling the figure after a 20-minute delay was less impaired (and differences between groups were non-significant) although a trend toward greater inaccuracy did exist. Thus, the results suggest that not only are individuals with body image disturbance constructing figures in a more piecemeal fashion, the accuracy of this construction is somewhat diminished, despite a trend toward an increased focus on detail.

The final hypothesis proposed similar group differences between the body image disturbed and the normal body image group of the current study and the groups commonly used throughout the literature to examine set-shifting and information processing style- women diagnosed with eating disorders (BN and AN) and healthy control women. Qualitative comparisons of effect sizes for measures of set-shifting indicated that group differences were more pronounced for eating disordered groups compared to healthy controls, although, with the exception of the Brixton task, they were in the same direction (Roberts et al., 2007). Effect sizes from the current study more closely paralleled those of eating disordered-healthy control samples across measures of information processing style (Lopez et al., 2008c) than across measures of set-shifting. In fact, the effect size found for GEFT total time for the current sample was substantially larger than that found when comparing eating disordered samples to healthy controls. More pronounced differences in the current sample may suggest that individuals with body image disturbance, on average, more quickly identify the hidden shapes of the GEFT than acutely ill eating disordered patients. Overall, the pattern of findings preliminarily suggest that

the difficulties with set-shifting and a bias toward more detail-focused information processing seen in individuals with fully diagnosable eating disorders may also be present among individuals with body image disturbance. However, these non-significant emerging patterns for individuals with body image disturbance are clearly less pronounced, particularly for measures of set-shifting. Substantially more evidence is needed before conclusions can be made.

Evidence indicates that cognitive rigidity, and thereby difficulties on set-shifting tasks, is more closely tied to disease progression and illness severity (Holliday et al., 2005; Roberts et al., 2007) than information processing style. Given that body image disturbance alone is not a mental illness, it follows that deficits across this aspect of executive functioning are more pronounced among individuals suffering from an eating disorder. The potential predictive value of set-shifting difficulties among women with body image disturbance in identifying the progression of disturbance to the eventual adoption of eating disordered behaviors should be investigated. If such predictive value is demonstrated, clinical prevention efforts could be targeted to individuals exhibiting body image disturbance and elevated levels of cognitive rigidity. Furthermore, the possibility that women with high levels of body image disturbance have not yet developed an eating disorder because of the protective merits of cognitive flexibility should be explored. Given the high levels of disturbance and the detail-focused information processing style, what is it that has kept these body image disturbed women from developing eating pathology?

Taken together, differences between groups across measures of both set-shifting and information processing style were almost entirely non-significant and, as such, the meaningfulness of the findings should be regarded as preliminary and interpreted with caution. Most likely, the small sample sizes of the groups reduced the power necessary for finding group

differences. However, the results suggest that women with body image disturbance experience some difficulties integrating visual information and are overly focused on the details of visual stimuli. Such an information processing style may not only impact accuracy, but also may impact the way an individual perceives various stimuli in her everyday life. For instance, a woman who has such a detail focus may experience problems with positive self-appraisal, focusing on unfavorable parts of the body or self, unable to integrate them into her overall appearance (which might be more acceptable to the individual). Of the two neurocognitive traits investigated, this particular neurocognitive correlate- which is related (although not exclusively) to visual processing- is the more pronounced among individuals with body image disturbance. It has been discussed in the scientific literature that body image disturbance is, in part, a perceptual bias (Williamson et al., 2004). However, the underlying neurocognitive contributors to this bias are not completely understood (Williamson, 1996; Williamson et al., 2004) and can perhaps be enhanced by considering the impact of a detail-focused information processing style.

When considering differences across these phenomena for individuals with body image disturbance alone versus individuals with eating disorders, the results suggest that set-shifting may be the more crucial and distinguishing factor. However, beyond indicating trends and relationships, it is impossible to determine causality. Yet, the findings suggest that while women with body image disturbance do show an emerging pattern of slight difficulty with set-shifting, women with eating disorders appear to encounter greater difficulty. This study (and many others to date) do not make it possible to determine whether it is illness progression that impacts set shifting ability or increasing cognitive rigidity (in conjunction with a detail focus) that affects illness onset/progression. However, it is clear that both information processing style and

cognitive rigidity are correlates of eating disorders, and to a slightly lesser extent, body image disturbance.

It is important to note that the importance of investigating body image disturbance is not limited to understanding its complex relationship with eating disorders. Body image disturbance, with its many implications for psychological well being, does not exist purely as one part of the many pieces required for the diagnosis of an eating disorder. Body image disturbance and, to an even greater extent, body dissatisfaction are prevalent experiences among the majority of women in Westernized cultures (Moore, 1993; Polivy & Herman, 2002). Understanding what underlying factors drive body image dissatisfaction and anxiety can serve to inform intervention efforts aimed at minimizing the degree to which such disturbances interfere with daily and optimal functioning, regardless of whether or not eating pathology later develops.

Potential Implications

Despite limited statistical significance, findings from the study have two implications that encompass both the clinical and empirical realms. Clinically, the findings have the potential to improve current psychotherapeutic efforts aimed at treatment of body image problems- an issue that is prevalent not only in eating disordered populations but in the general population as well. The results will be useful for developing interventions aimed at identifying individuals with body image disturbance, in the hope that addressing the neurocognitive correlates of disturbance will prevent the future onset of eating pathology (McCarthy, 1990; Nolen-Hoeksema & Girgus, 1994; Thompson et al., 1995). Furthermore, results help to clarify the existing body of scientific literature that has implicated these cognitive features as endophenotypes of eating disorder

psychopathology while extending empirical linkages regarding the etiology and maintenance of body image disturbance and eating disorder psychopathology.

From a clinical perspective, these results have important implications for the treatment of body image disturbance. Previous findings suggest that CRT may be beneficial in treating eating disordered populations (Davies & Tchanturia, 2005; Southgate, Tchanturia, & Treasure, 2005), while improving cognitive rigidity and enhancing a “big-picture focus (Tchanturia, Davies, Lopez, Schmidt, Treasure, & Wykes, 2008).” This particular therapeutic intervention has been valuable in improving these maladaptive cognitive tendencies, is fairly easy to administer, and yields high patient engagement and commitment, making it a viable short-term supplement to other suggested methods for the treatment of eating disorders (Baldock & Tchanturia, 2007; Tchanturia, Davies, & Campbell, 2007). It has been suggested that CRT may enhance the effectiveness of Cognitive Behavior therapy when used as a pretreatment during the more acute phase of the illness or as an add-on (Baldock & Tchanturia, 2007). The current data indicate that CRT may be useful for treating individuals with severe body image disturbance as well, particularly in an effort to counteract the shared neurocognitive mechanisms that may make an individual more vulnerable to the eventual development of an eating disorder.

The results also clarify the emerging theoretical model of neurocognitive function in eating disorders. Given that the results show very similar, although clearly less pronounced, patterns of neurocognitive functioning among individuals with body image disturbance, it may be better to recognize the role of this uniquely cognitive criterion for an eating disorder diagnosis as the primary (or perhaps original) correlate of cognitive rigidity and weak central coherence. A reconceptualization of the current empirical understanding of the role of these neurocognitive

correlates in the process of eating disorder formation and maintenance will need to account for the potentially preemptive relationship between body image disturbance, set-shifting, and information processing style. Ignoring such a relationship will only confound efforts to uncover the biological and organic underpinnings of these complex disorders.

Limitations

While the current study contributes to the literature in a number of ways, it is important to consider its limitations as well. Perhaps the primary limitation relates to the composition of the sample itself in that individuals in both groups were primarily college students. Thus, the generalizability of the sample is somewhat limited. Furthermore, inherent to this population, body image disturbance is potentially more prevalent and levels of body dissatisfaction higher (Heatherton, Mahamedi, Striepe, Field, & Keel, 1997). Thus, creating a “normal” body image group reflective of this potentiality takes into account that the lack of body image disturbance or dissatisfaction altogether among college-aged females of this generation would actually be abnormal. An attempt was made to create a comparison group that would parallel the amount of disturbance normally seen among individuals of this age group, which resulted in the inclusion of individuals with some degree of dissatisfaction and not entirely free from any body concerns. To address this complication, the “normal” body image group consisted of participants who were one standard deviation away from the mean in the direction of positive body image on each of the measures, with the intention that the sample mean would adequately represent more positive body image in a college female population and reflect what is closer to normative in the general population. However, this potentially minimizes group differences, as it is possible that comparison to a group with absolutely no body image disturbance (although construction of such

a group would be difficult to achieve) would yield larger and more robust effect sizes. It will be important for future investigations to acknowledge this rather unique complication and take it into consideration during recruitment of participants.

The difficulty encountered in constructing an appropriate comparison group also affected sample size. Recruiting “normal body image” participants who were one standard deviation away from the mean in the direction of positive body image (as opposed to individuals with absolutely no body image disturbance) diminishes the likelihood of finding differences between groups. Therefore, it may have been useful to increase the power of the study by increasing the sample size. The power analysis for the current study was based on sample sizes used for comparing healthy controls to eating disordered individuals- a much cleaner (at least theoretically) comparison that may not have required the same level of power. Future studies that wish to recruit a truly “normal” comparison group comprised of participants whose scores on the body image measures are within one standard deviation of the mean may need to consider even larger sample sizes given the additional power needed to differentiate performance across the tasks between two less disparate groups.

It is important to note that the measures selected for the current study were chosen based on their use in previous studies examining the same constructs among individuals with eating disorders (Lopez et al., 2008c; Roberts et al., 2007) in order to facilitate comparisons between samples. Some of the measures included in the battery (particularly those measuring set-shifting) have not been extensively used outside of examinations of neurocognition in eating disorders. Future studies wishing to extend this line of research should include additional extensively employed measures of set-shifting with well-established psychometric properties.

Another important consideration when interpreting the results relates to the levels of anxiety reported among individuals with body image disturbance. Participants in the body image disturbed group had a significantly higher mean score on the HADS-A than the normal body image group. It may be possible that the anxiety is responsible for the group differences seen across measures of set-shifting and information processing style. However, a review of the literature indicates that the presence of comorbid anxiety does not appear to account for incidences of perseveration across measures of cognitive flexibility (Sachs et al., 2004). While this has not yet been established for measures of information processing style, there were no significant correlations between HADS-A scores and any of the dependent variables related to neuropsychological performance. An additional measure of clinical symptomatology was administered during Phase 1 of the study (the BSI-53), which also contained a subscale assessing anxiety symptoms. Any individuals with t-scores on the scale assessing overall psychiatric severity (including clinical levels of anxiety) that exceeded the cutoff indicating the presence of clinically concerning symptoms were not invited to participate in Phase 2. Thus, it is possible that the HADS-A is more sensitive or that the measures differ in their definition of “clinically significant” levels of anxiety. In any case, it is clear that some degree of anxiety is related to body image disturbance in the current study, although the absence of any correlation between anxiety and performance on the tasks strongly suggests that the findings cannot simply be explained by the presence of anxiety. Future research should consider the extent to which generalized or specific anxiety is related to neurocognitive correlates of body image disturbance and decide whether and how to account for its presence.

A last but important limitation relates to the inherently correlational design of the study that does not allow for causal assumptions to be made. As previously discussed, it is impossible to determine whether cognitive rigidity and tendency toward processing detail increases vulnerability to body image disturbance or whether body image disturbance decreases cognitive flexibility and ability to integrate global information. Establishing relationships between body image disturbance and these neurocognitive factors is important progress, but future investigations need to utilize longitudinal designs, structural equation modeling, or possibly experimental manipulation of body image to further elucidate the role of cognitive rigidity and a detail-focused information processing style in the development of body image disturbance.

Future Directions

The findings suggest that some cognitive rigidity and a detail-focused information processing style is related to body image disturbance, suggesting that the relationship between body image disturbance and aspects of executive functioning may be fertile ground for further investigation. Research examining planning, abstract thinking, rule acquisition, and initiation and inhibition has provided interesting findings for individuals with AN and BN (i.e, Mobbs, Van der Linden, d'Acremont, & Perroud, 2008) and similar investigations for body image disturbed samples would help in the construction of more complete models of neuropsychological function in these clinical populations. Future studies directly comparing healthy controls (free from body image disturbance), eating disordered participants, and body image disturbed participants would further clarify the specificity of these particular neurocognitive correlates. Furthermore, utilizing functional neuroimaging techniques to investigate potential activity in the prefrontal cortex

during the completion of set-shifting and information processing tasks by individuals with severe body image disturbance would highlight underlying organic structures responsible for observed performance on the neuropsychological tests.

In the clinical realm, future research should investigate the efficacy of using CRT for the treatment of body image disturbance, either alone or in conjunction with cognitive behavior therapy. Given the promising findings seen in the treatment of eating disordered patients (Baldock & Tchanturia, 2007; Tchanturia, Davies, & Campbell, 2007), clinical trials may be able to determine whether CRT enhances cognitive flexibility and global information processing style among body image disturbed individuals with similar profiles of neuropsychological function. Furthermore, given the frequent co-occurrence of body image disturbance and other psychiatric conditions (particularly depression and anxiety), investigating the impact of CRT as an add-on to therapy when treating clients presenting with diagnostically complex cases may yield informative results. Finally, in treating individuals with eating disorders, particularly those in recovery, it may be important to focus treatment on body image disturbance, the uniquely cognitive symptom of AN and BN, that may ultimately be driving the adoption of maladaptive eating behaviors and compensatory strategies.

Conclusion

The current study adds to the literature by investigating whether aspects of neuropsychological functioning found among eating disordered patients are present among individuals with body image disturbance who have no history of an eating disorder. Body image

disturbance not only is the best predictor of an eating disorder, it also is increasingly prevalent in the general population, particularly among females in Westernized cultures (Moore, 1993; Polivy & Herman, 2002). Therefore, identifying the mechanisms that drive the development of body image disturbance is critically important for preventing eating disorders and treating the millions who suffer the debilitating consequences of extreme unhappiness with one's physical appearance.

The current study suggests a non-significant but emerging pattern toward cognitive rigidity and a bias toward processing visual information in an overly detailed manner among women with body image disturbance. These correlates potentially have direct "real-life" implications in that women with body image disturbance are preoccupied with specific features and details of their bodies that they find unappealing or unacceptable, and may have particular difficulty integrating information or experiences that are discrepant with existing rigid perceptions of how they look. This combination of detailed self-scrutiny and cognitive rigidity can lead to resistance to the cognitive components of widely used cognitive behavior therapy strategies. Overall, a better understanding of all of the variables (neurocognitive and otherwise) contributing to the formation and maintenance of body image disturbance will serve to enhance clinical efforts to combat it and its deleterious effects on overall psychological well-being.

Table 1

Group Means, Standard Deviations, and Comparisons for Measures of Body Image Disturbance

Dependent Variables	<i>M (SD)</i>		Mean Differences	
	Body Image Disturbed Group (<i>n</i> = 26)	Normal Body Image Group (<i>n</i> = 27)	ANOVAs	Effect Size (η^2)
BIDQ t-score	35.14 (9.99)	58.96 (2.64)	$F(1, 52) = 143.19$, $p < .001^{***}$	Large, .73
ASI-R t-score	59.55 (8.00)	43.12 (7.34)	$F(1, 52) = 60.74$, $p < .001^{***}$	Large, .54
MBSRQ				
AE t-score	41.19 (10.19)	52.80 (7.73)	$F(1, 52) = 21.92$, $p < .001^{***}$	Large, .30
BASS t-score	44.42 (9.73)	50.77 (10.58)	$F(1, 52) = 5.16$, $p = .03^*$	Small, .09

Note. Effect sizes based on Cohen's relative size recommendations for partial eta squared; BIDQ=Body Image Disturbance Questionnaire, ASI=Appearance Schema Inventory-Revised, MBSRQ=Multidimensional Body-Self Relations Questionnaire, AE=Appearance Evaluation subscale, BASS=Body Area Satisfaction Subscale; * $p < .05$, ** $p < .01$, *** $p < .001$

Table 2

Group Demographic Means, Standard Deviations, and Comparisons

Dependent Variables	<i>M (SD)</i>		Mean Differences	
	Body Image Disturbed Group (<i>n</i> = 26)	Normal Body Image Group (<i>n</i> = 27)	ANOVAs	Effect Size (η^2)
Age	19.35 (2.61)	20.44 (2.47)	$F(1, 52) = 2.48, p = .12^*$	Small, .05
Education	12.36 (1.3)	12.61 (1.9)	$F(1, 52) = .27, p = .59^*$	Small, .01
BMI	22.95 (3.63)	22.26 (4.99)	$F(1, 52) = .33, p = .56^*$	Small, .01
FSIQ	106.19 (8.42)	101.41 (18.13)	$F(1, 52) = 1.50, p = .23^*$	Small, .03

Note. BMI=Body Mass Index, FSIQ=Full Scale IQ score; Effect sizes based on Cohen's relative size recommendations for partial eta squared; * $p > .05$

Table 3

Group Set-Shifting Means, Standard Deviations, and Comparisons

Dependent Variables	<i>M (SD)</i>		Mean Differences	
	Body Image Disturbed Group (<i>n</i> = 26)	Normal Body Image Group (<i>n</i> = 27)	ANOVAs	Effect Size (η^2)
Trail B time	57.37 (16.32)	55.03 (14.80)	$F(1, 52) = .30, p = .59$	Small, .01
Trail A:B	.55 (.33)	.66 (.54)	$F(1, 52) = .92, p = .34$	Small, .02
Brixton errors	11.69 (4.59)	12.30 (3.24)	$F(1, 52) = .31, p = .58$	Small, .01
CatBat PE	1.04 (1.66)	.67 (2.32)	$F(1, 52) = .45, p = .51$	Small, .01
Bat Time	31.42 (8.62)	27.91 (8.31)	$F(1, 52) = 2.27, p = .14$	Small, .04
Bat:Cat time	1.65 (.48)	1.21 (.49)	$F(1, 52) = 7.88, p = .002^*$	Medium, .17
WCST PE	9.42 (3.73)	8.67 (4.11)	$F(1, 52) = .49, p = .49$	Small, .01

Note. Trail A:B=Ratio of Trail A time to Trail B time, PE=Perseverative errors, WCST PE= Wisconsin Card Sorting Test perseverative errors, Bat:Cat time=Ratio of Bat time to Cat time; Effect sizes based on Cohen's relative size recommendations for partial eta squared; * $p < .05$.

Table 4

Group Central Coherence Means, Standard Deviations, and Comparisons

Dependent Variables	<i>M (SD)</i>		Mean Differences	
	Body Image Disturbed Group (<i>n</i> = 26)	Normal Body Image Group (<i>n</i> = 27)	ANOVAs	Effect Size (η^2)
RCFT CC index	1.18 (.69)	1.43 (.28)	$F(1, 52) = 2.93, p = .09$	Small, .05
GEFT mean	19.35 (1.78)	24.01 (1.75)	$F(1, 52) = 3.49, p = .07$	Small, .06
GEFT Total	348.11 (123.53)	438.91 (196.80)	$F(1, 52) = 4.01, p = .05^*$	Small, .07
GEFT TOE	2.00 (1.55)	3.56 (2.83)	$F(1, 52) = 6.08, p = .02^*$	Medium, .11

Note. RCFT CC index= Rey-Osterrieth Complex Figure Test Central Coherence Index score, GEFT mean= Group Embedded Figures Test mean time for each figure, GEFT Total= Group Embedded Figures Test total time overall, GEFT TOE= Group Embedded Figures Test timeout errors; Effect sizes based on Cohen's relative size recommendations for partial eta squared; * $p < .05$

Table 5

Comparison of Effect Sizes for Eating Disordered Samples from Metanalyses to Body Image Disturbed Sample from Current Study

Dependent Variables	BID-NBI		ED-HC	
	Cohen's <i>d</i>	Relative Size	Cohen's <i>d</i>	Relative Size
Set-Shifting				
Trail B time	.15	Small	.36	Small
Brixton Errors	-.16	Small*	.21	Small*
CatBat Errors	.19	Small	.45	Medium
WCST PE	.19	Small	.62	Medium
Central Coherence				
Recall Acc	.17	Small	.49	Medium
Recall Order	.29	Small	.55	Medium
GEFT total time	.56	Medium	.32	Small

Note. Relative sizes based on Cohen's recommendations for effect sizes calculated using Cohen's *d*; BID=Body image disturbed group, NBI=Normal body image group, ED=Eating disordered samples, HC=Healthy controls, WCST PE= Wisconsin Card Sorting Test perseverative errors, Recall Acc=Recall accuracy; * directional inconsistencies between the samples

APPENDIX A: HUMAN PARTICIPANTS INFORMED CONSENT FORM

HUMAN PARTICIPANTS INFORMED CONSENT FORM

TITLE: Neurocognitive Correlates of Body Image Disturbance

Investigator: Elizabeth Wack, M.S., Doctoral Student
Supervisor: Stacey Tantleff-Dunn, Ph.D., Associate Professor,
Department of Psychology, University of Central Florida, Orlando, FL

CONSENT FORM TO PARTICIPATE IN AN ONLINE STUDY

Introduction

You are being invited to participate in the research as titled above. Your participation is entirely voluntary. You may refuse to participate in this study or withdraw your consent at any time without giving reason and without penalty or loss of benefits to which you are otherwise entitled. You may ask to have your information removed from the research records or destroyed. You will be one of approximately 500 participants in this part of the research study.

Purpose

The purpose of this research is to study the relationship between thinking ability/ perception and how people feel about their bodies. We are also interested in the genetic transmission of these factors. A better understanding of these relationships may provide information that leads to better treatment and ways to prevent eating disorders and other problems related to body dissatisfaction. This survey is part of a larger study and should you meet criteria based on your answers to this survey, you may be invited to participate in a second phase. Should you meet criteria, researchers will contact you (using the contact information you provide during this survey) to invite you to participate in the second phase. If you are concerned or interested in this procedure and your possible participation in the second phase, please contact Elizabeth Wack at betsywack@gmail.com.

Duration and Location

Your participation is anticipated to last between 30 and 40 minutes (although this varies by participant).

Procedures

During this study, the following will occur:

1. You will answer questions about demographic information.
2. You will complete some self-report scales of emotional and psychological experiences.

Exclusions

There are no criteria or characteristics that may make you ineligible to participate in this online study.

Early Withdrawal by You or the Investigator

If, during the course of participating in the study, you decide you do not want to continue to participate (for any reason), please simply discontinue the study by closing the website window. You will not be penalized in any way for early withdrawal, however, you may not receive credit through Sona Systems.

Risks and Discomforts

In rare instances, this study may involve mild emotional discomfort due to personal questions asked about your medical and psychological health. You do not have to answer questions which make you feel uncomfortable and you may stop participation at any time. Should you feel residual discomfort, please contact the UCF Student Counseling Center at (407) 823-2811. There is a slight risk of breach of confidentiality if your information or your identity is obtained by someone other than the investigators, but precautions will be taken to prevent this from happening.

Benefits

You may not receive any personal benefit from participating in this study besides credit given through Sona Systems (if you are completing the study as part of a requirement for a psychology course). However, the information gathered from this research may lead to better treatments for body image disturbance and eating disorders.

Payment and Costs to Participation

You will not incur any costs due to your participation in this study.

New Findings

You will be given any new information gained during the course of this study that might affect your willingness to continue participation in the study.

Confidentiality

Every effort will be taken to protect your identity. The researcher will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. For example, your name will be kept separate from the information you give, and these two things will be stored in different places. Your information will be assigned a code number and the list connecting your name to this number will be kept in a locked file cabinet in the Laboratory for the Study of Eating, Appearance, and Health or in a password protected computer. When the study is done and the data have been analyzed, the list will be destroyed. Your information will be combined with information from other people who took part in this study. When the researcher writes about this study to share what was learned with other researchers, she will write about this combined information. Your name will not be used in any report, so people will not know how you answered or what you did. Additionally, if you do not meet criteria for participation in the second phase of the study, your contact information any identifying information will be discarded. Please note: we may have to notify the proper authorities (without your permission) if you lead us to believe that you are in imminent danger of physically harming yourself or others.

Questions

If you have questions regarding the study, you may call the investigator, Elizabeth Wack, M.S., at 407-823-3872 or email her at betsywack@gmail.com. Additionally, you may contact the study supervisor, Stacey Tantleff-Dunn, Ph.D. at 407-823-5858 or e-mail her at sdunn@mail.ucf.edu.

Consent to Participate

My electronic signature below indicates that I agree with the information described above and voluntarily agree to participate in this study. Any questions I have about this study have been clearly answered.

Authorization and Signatures

I am the Research Participant or am authorized to act on behalf of the Research Participant. My questions have been answered to my satisfaction, and I voluntarily agree to participate in this study. I understand that I will receive a consent debriefing form at the conclusion of my participation.

By clicking the “ENTER” button, I am providing my electronic signature. It certifies that I am at least 18 years of age and consent to participation

ENTER

APPENDIX B: DEMOGRAPHIC INFORMATION QUESTIONNAIRE

DEMOGRAPHIC INFORMATION

1. Name and contact information: _____
2. Age: _____
- 3a. Are you a college student? Yes No
3b. If so, which year are you? First Year Sophomore Junior Senior Other: _____
4. Ethnicity: Hispanic or Latino Not Hispanic or Latino
5. Race: Caucasian African-American Asian-America American Indian/Alaskan Native
Native Hawaiian/Other Pacific Islander Bi-racial Other: _____
6. Sexuality: Heterosexual Bisexual Homosexual/Gay/Lesbian
7. What is your highest completed education level?
Middle school/junior high High school/GED 2-year degree 4-year degree
Post-graduate work Other: _____
8. Height: feet _____ inches _____
9. Current Weight: _____ pounds
10. What do you consider yourself to be?
Right-handed Left-handed Ambidextrous

Please read the following statements and indicate whether ANY of the statements describe you.

11. I am **not** able to speak English fluently.
12. I am color blind.
13. I currently have significant problems with my vision, even when wearing glasses or contacts.
14. I have significant difficulty with moving or feeling the arm or hand that I use for writing.
15. At some point in my life, I got hit in the head so hard that I blacked out for more than 10 minutes.
16. I've experienced one or more seizures after the age of 5.
17. I've been diagnosed with a stroke, brain tumor, or other serious neurological disorder - like Parkinson's disease.
18. I have been diagnosed with a learning disability (like dyslexia).

Yes- ONE OR MORE OF THESE STATEMENTS DESCRIBES ME

No- NONE OF THESE STATEMENTS DESCRIBE ME

The following questions involve potentially sensitive material. If you do not feel comfortable answering the following questions, simply press the I DECLINE TO ANSWER button at the bottom of the following statements. Please read the following statements and indicate whether ANY of the statements describe you.

19. I have been diagnosed with a psychiatric illness (e.g., depression, anxiety, post-traumatic stress disorder).
20. In the past month, I have used alcohol or drugs to the point that it affected my functioning at school, work, or personal relationships.
21. I regularly consume five or more drinks (beer, wine, or liquor) on one occasion.
22. I regularly use illegal drugs (heroin, cocaine, marijuana, etc.).
23. At one point, I got “hooked” on a prescribed medicine or took a lot more of it than I was supposed to.
24. During at least one point in my life, I received inpatient hospitalization for alcohol or drug dependence.
25. I have a first-degree relative (e.g., mother, father, daughter, grandfather) who has been diagnosed with a psychiatric disorder.
26. I have a first-degree relative who has been diagnosed with an eating disorder, obsessive-compulsive disorder, schizophrenia, schizoaffective disorder or an autism spectrum disorder.
27. I have received electroconvulsive therapy in the past six months.
28. I am currently taking psychiatric medication.

Yes- ONE OR MORE OF THESE STATEMENTS DESCRIBES ME

No- NONE OF THESE STATEMENTS DESCRIBE ME

I DECLINE TO ANSWER

29. What is the best way to contact you should you meet criteria to participate in the second phase of the study?

Phone

Email

Either one

I don't want to be contacted at all

APPENDIX C: HOSPITAL ANXIETY AND DEPRESSION SCALE

HOSPITAL ANXIETY AND DEPRESSION SCALE

Clinicians are aware that emotions play an important part in most illnesses. If your clinician knows about these feelings, he or she will be able to help you more.

This questionnaire is designed to help your clinician to know how you feel. Read each item below and click the reply which comes closest to how you have been feeling in the past week.

Don't take too long over your replies, your immediate reaction to each item will probably be more accurate than a long, thought out response.

I feel tense or 'wound up' (*A*)

- 3 Most of the time
- 2 A lot of the time
- 1 From time to time, occasionally
- 0 Not at all

I still enjoy the things I used to enjoy (*D*)

- 0 Definitely as much
- 1 Not quite so much
- 2 Only a little
- 3 Hardly at all

I get a sort of frightened feeling as if something awful is about to happen (*A*)

- 3 Very definitely and quite badly
- 2 Yes, but not too badly
- 1 A little, but it doesn't worry me
- 0 Not at all

I can laugh and see the funny side of things (*D*)

- 0 As much as I always could
- 1 Not quite so much now
- 2 Definitely not so much now
- 3 Not at all

Worrying thoughts go through my mind (*A*)

- 3 A great deal of time
- 2 A lot of the time
- 1 Not too often
- 0 Very little

I feel cheerful (*D*)

- 3 Never
- 2 Not often
- 1 Sometimes
- 0 Most of the time

I can sit at ease and feel relaxed (*A*)

- 0 Definitely
- 1 Usually
- 2 Not often
- 3 Not at all

I feel as if I am slowed down (*D*)

- 3 Nearly all of the time
- 2 Very often
- 1 Sometimes
- 0 Not at all

I get a sort of frightened feeling like butterflies in the stomach (*A*)

- 0 Not at all
- 1 Occasionally
- 2 Quite often
- 3 Very often

I have lost interest in my appearance (*D*)

- 3 Definitely
- 2 I don't take as much care as I should
- 1 I may not take quite as much care
- 0 I take just as much care as ever

I feel restless as if I have to be on the move (*A*)

- 3 Very much indeed
- 2 Quite a lot
- 1 Not very much
- 0 Not at all

I look forward with my enjoyment to things (*D*)

- 0 As much as I ever did
- 1 Rather less than I did
- 2 Definitely less than I used to
- 3 Hardly at all

I get a sudden feeling of panic (*A*)

- 3 Very often indeed
- 2 Quite often
- 1 Not very often
- 0 Not at all

I can enjoy a good book or radio or television programme (*D*)

- 0 Often
- 1 Sometimes
- 2 Not often
- 3 Very seldom

Total
A
D

APPENDIX D : BRIEF SYMPTOM INVENTORY

**BRIEF SYMPTOM INVENTORY
BSI**

Please read the list of problems people sometimes have. Please tell me HOW MUCH THAT PROBLEM HAS DISTRESSED OR BOTHERED YOU DURING THE PAST 7 DAYS INCLUDING TODAY. Please choose the answer that best describes you.

- 0 = Not at all
- 1 = A little bit
- 2 = Moderately
- 3 = Quite a bit
- 4 = Extremely
- R = Refuse to answer

DURING THE PAST 7 DAYS, how much were you distressed by:

- | | | | | | | |
|--|---|---|---|---|---|---|
| 1. Nervousness or shakiness inside | 0 | 1 | 2 | 3 | 4 | R |
| 2. Faintness or dizziness | 0 | 1 | 2 | 3 | 4 | R |
| 3. The idea that someone else can control your thoughts | 0 | 1 | 2 | 3 | 4 | R |
| 4. Feeling others are to blame for most of your troubles | 0 | 1 | 2 | 3 | 4 | R |
| 5. Trouble remembering things | 0 | 1 | 2 | 3 | 4 | R |
| 6. Feeling easily annoyed or irritated | 0 | 1 | 2 | 3 | 4 | R |
| 7. Pains in the heart or chest | 0 | 1 | 2 | 3 | 4 | R |
| 8. Feeling afraid in open spaces | 0 | 1 | 2 | 3 | 4 | R |
| 9. Thoughts of ending your life | 0 | 1 | 2 | 3 | 4 | R |

DURING THE PAST 7 DAYS, how much were you distressed by:

- | | | | | | | |
|--|---|---|---|---|---|---|
| 10. Feeling that most people cannot be trusted | 0 | 1 | 2 | 3 | 4 | R |
| 11. Poor appetite | 0 | 1 | 2 | 3 | 4 | R |
| 12. Suddenly scared for no reason | 0 | 1 | 2 | 3 | 4 | R |
| 13. Temper outbursts that you could not control | 0 | 1 | 2 | 3 | 4 | R |
| 14. Feeling lonely even when you are with people | 0 | 1 | 2 | 3 | 4 | R |
| 15. Feeling blocked in getting things done | 0 | 1 | 2 | 3 | 4 | R |

16. Feeling lonely	0	1	2	3	4	R
17. Feeling blue	0	1	2	3	4	R
18. Feeling no interest in things	0	1	2	3	4	R

DURING THE PAST 7 DAYS, how much were you distressed by:

19. Feeling fearful	0	1	2	3	4	R
20. Your feelings being easily hurt	0	1	2	3	4	R
21. Feeling that people are unfriendly or dislike you	0	1	2	3	4	R
22. Feeling inferior to others	0	1	2	3	4	R
23. Nausea or upset stomach	0	1	2	3	4	R
24. Feeling that you are watched or talked about by others	0	1	2	3	4	R
25. Trouble falling asleep	0	1	2	3	4	R
26. Having to check and double check what you do	0	1	2	3	4	R
27. Difficulty making decisions	0	1	2	3	4	R

DURING THE PAST 7 DAYS, how much were you distressed by:

28. Feeling afraid to travel on buses, subways, or trains	0	1	2	3	4	R
29. Trouble getting your breath	0	1	2	3	4	R
30. Hot or cold spells	0	1	2	3	4	R
31. Having to avoid certain things, places, or activities because they frighten you	0	1	2	3	4	R
32. Your mind going blank	0	1	2	3	4	R
33. Numbness or tingling in parts of your body	0	1	2	3	4	R
34. The idea that you should be punished for your sins	0	1	2	3	4	R
35. Feeling hopeless about the future	0	1	2	3	4	R
36. Trouble concentrating	0	1	2	3	4	R

DURING THE PAST 7 DAYS, how much were you distressed by:

37. Feeling weak in parts of your body	0	1	2	3	4	R
38. Feeling tense or keyed up	0	1	2	3	4	R
39. Thoughts of death or dying	0	1	2	3	4	R
40. Having urges to beat, injure, or harm someone	0	1	2	3	4	R
41. Having urges to break or smash things	0	1	2	3	4	R
42. Feeling very self-conscious with others	0	1	2	3	4	R
43. Feeling uneasy in crowds	0	1	2	3	4	R
44. Never feeling close to another person	0	1	2	3	4	R
45. Spells of terror or panic	0	1	2	3	4	R

DURING THE PAST 7 DAYS, how much were you distressed by:

46. Getting into frequent arguments	0	1	2	3	4	R
47. Feeling nervous when you are left alone	0	1	2	3	4	R
48. Others not giving you proper credit for your achievements	0	1	2	3	4	R
49. Feeling so restless you couldn't sit still	0	1	2	3	4	R
50. Feelings of worthlessness	0	1	2	3	4	R
51. Feeling that people will take advantage of you if you let them	0	1	2	3	4	R
52. Feeling of guilt	0	1	2	3	4	R
53. The idea that something is wrong with your mind	0	1	2	3	4	R

APPENDIX E: EATING DISORDER EXAMINATION-QUESTIONNAIRE

EATING DISORDER EXAMINATION-QUESTIONNAIRE

Instructions: The following questions are concerned with the past four weeks (28 days) only. Please read each question carefully. Please answer all of the questions.

Questions 1 to 12: Please circle the appropriate number on the right. Remember that the questions refer to the past four weeks (28 days) only.

On how many of the past 28 days...	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
1. Have you been deliberately <u>trying</u> to limit the amount of food you eat to influence your shape or weight (whether or not you succeeded)?	0	1	2	3	4	5	6
2. Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?	0	1	2	3	4	5	6
3. Have you <u>tried</u> to exclude from your diet any foods that you like in order to influence your shape or weight?	0	1	2	3	4	5	6
4. Have you <u>tried</u> to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you succeeded)?	0	1	2	3	4	5	6
5. Have you had a definite desire to have an <u>empty</u> stomach with the aim of influencing your shape or weight?	0	1	2	3	4	5	6
6. Have you had a definite desire to have a <u>totally flat</u> stomach?	0	1	2	3	4	5	6
7. Has thinking about <u>food, eating, or calories</u> made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6

8. Has thinking about <u>shape or weight</u> made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
9. Have you had a definite fear of losing control over eating?	0	1	2	3	4	5	6
10. Have you had a definite fear that you might gain weight?	0	1	2	3	4	5	6
11. Have you felt fat?	0	1	2	3	4	5	6
12. Have you had a strong desire to lose weight?	0	1	2	3	4	5	6

Questions 13 to 18: Please fill in the appropriate number in the box on the right. Remember that the questions only refer to the past four weeks (28 days).

Over the past four weeks (28 days) ...

*13. Over the past 28 days, how many times have you eaten what other people would regard as an unusually large amount of food (given the circumstances)?

*14.On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)?

15. Over the past 28 days, on how many DAYS have such episodes of overeating occurred (i.e., you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?

16. Over the past 28 days, on how many times have you made yourself sick (vomit) as a means of controlling your shape or weight?

17. Over the past 28 days, on how many times have you taken laxatives as a means of controlling your shape or weight?

18. Over the past 28 days, on how many times have you exercised in a “driven” or “compulsive” way as a means of controlling your shape, weight, or amount of fat, or to burn off calories?

Questions 19 to 21: Please circle the appropriate number. Please note that for these questions the term “binge eating” is what others would regard as an unusually large amount of food for the circumstances,

accompanied by a sense of having lost control over eating (**Please review description before answering questions**).

19. On how many of the past 28 days, on how many days have you eaten in secret (i.e., furtively)? ...Do not count episodes of binge eating	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
	0	1	2	3	4	5	6
20. On what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? ...Do not count episodes of binge eating	None of the times	A few of the times	Less than half	Half of the times	More than half	Most of the time	Every time
	0	1	2	3	4	5	6
21. Over the past 28 days, how concerned have you been about people seeing you eat? ...Do not count episodes of binge eating	Not at all	Slightly		Moderately		Markedly	
	0	1	2	3	4	5	6

Questions 22 to 28: Please circle the appropriate number. Remember that the questions only refer to the past four weeks (28 days).

Over the past 28 days...							
	Not at all	Slightly	Moderately	Markedly			
22. Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
23. Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
24. How much would it upset you	0	1	2	3	4	5	6

if you had been asked to weight yourself once a week (no more, or less, often) for the next four weeks?							
25. How dissatisfied have you been with your <u>weight</u> ?	0	1	2	3	4	5	6
26. How dissatisfied have you been with your <u>shape</u> ?	0	1	2	3	4	5	6
27. How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in as shop window reflection, while undressing or taking a bath or shower)?	0	1	2	3	4	5	6
28. How uncomfortable have you felt about <u>others</u> seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	0	1	2	3	4	5	6

What is your weight at present? (Please give your best estimate.)

What is your height? (Please give your best estimate.)

Over the past three-to-four months have you missed any menstrual periods?

If so, how many?

Have you been taking the "pill"?.....

APPENDIX F: BODY IMAGE DISTURBANCE QUESTIONNAIRE

Instructions: This questionnaire assesses concerns about physical appearance. Please read each question carefully and circle the answer that best describes your experience. Also write in answers where indicated.

1A. Are you concerned about the appearance of some part(s) of your body, which you consider especially unattractive? (Circle the best answer)

1	2	3	4	5
Not at all concerned	Somewhat concerned	Moderately concerned	Very concerned	Extremely concerned

1B. What are these concerns? What specifically bothers you about the appearance of these body parts?

2A. If you are at least somewhat concerned, do these concerns preoccupy you? That is, you think about them a lot they're hard to stop thinking about? (Circle the best answer)

1	2	3	4	5
Not at all preoccupied	Somewhat preoccupied	Moderately preoccupied	Very preoccupied	Extremely preoccupied

2B. What effect has your preoccupation with your appearance had on your life? (Please describe)

3A. Has your physical "defect" often caused you a lot of distress, torment, or pain? How much? (Circle the best answer)

1	2	3	4	5
No distress	Mild, and not too disturbing	Moderate & disturbing but still manageable	Severe, and very disturbing	Extreme, & disabling

4A. Has your physical "defect" caused you impairment in social, occupational or other important areas of functioning? How much? (Circle the best answer)

1	2	3	4	5
No limitation	Mild interference but overall performance	Moderate, definite interference	Severe, causes substantial impairment	Extreme incapacitating

5A. Has your physical "defect" significantly interfered with your social life? How much? (Circle the best answer)

1	2	3	4	5
Never	Occasionally	Moderately Often	Often	Very Often

5B. If so, how?

6A. Has your physical “defect” significantly interfered with your schoolwork, your job, or your ability to function in your role? How much? (Circle the best answer)

1	2	3	4	5
Never	Occasionally	Moderately Often	Often	Very Often

6B. If so, how?

7A. Do you ever avoid things because of your physical “defect”? How often? (Circle the best answer)

1	2	3	4	5
Never	Occasionally	Moderately Often	Often	Very Often

7B. If so, what do you avoid?

**APPENDIX G: MULTIDIMENSIONAL BODY-SELF RELATIONS
QUESTIONNAIRE- SELECTED SUBSCALES**

THE MBSRQ

INSTRUCTIONS--PLEASE READ CAREFULLY

The following pages contain a series of statements about how people might think, feel, or behave. You are asked to indicate the extent to which each statement pertains to you personally.

In order to complete the questionnaire, read each statement carefully and decide how much it pertains to you personally. Using a scale like the one below, indicate your answer by entering it in the blank space below the statement.

EXAMPLE:

I am usually in a good mood.

In the blank space, enter a:

- 1** if you **definitely disagree** with the statement;
- 2** if you **mostly disagree**;
- 3** if you **neither agree nor disagree**;
- 4** if you **mostly agree**;
- 5** if you **definitely agree** with the statement.

There are no right or wrong answers. Just give the answer that is most accurate for you. Remember, your responses are confidential, so please be completely honest and answer all items.

1. Before going out in public, I always notice how I look.
2. I am careful to buy clothes that will make me look my best.
3. My body is sexually appealing.
4. I constantly worry about being or becoming fat.
5. I like my looks just the way they are.
6. I check my appearance in a mirror whenever I can.
7. Before going out, I usually spend a lot of time getting ready.
8. I am very conscious of even small weight changes in my weight.
9. Most people would consider me good-looking.

10. It is important that I always look good.
11. I use very few grooming products.
12. I like the way I look without my clothes on.
13. I am self-conscious if my grooming isn't right.
14. I usually wear whatever is handy without caring how it looks.
15. I like the way my clothes fit me.
16. I don't care what people think about my appearance.
17. I take special care with my hair grooming.
18. I dislike my physique.
19. I am physically unattractive.
20. I never think about my appearance.
21. I am always trying to improve my physical appearance.
22. I am on a weight-loss diet.

For the remainder of the items use the response scale given with the item, and enter your answer in the space below the item.

23. I have tried to lose weight by fasting or going on crash diets.

1. Never
2. Rarely
3. Sometimes
4. Often
5. Very Often

24. I think I am:

1. Very Underweight
2. Somewhat Underweight
3. Normal Weight
4. Somewhat Overweight

5. Very Overweight

25. From looking at me, most other people would think I am:

1. Very Underweight
2. Somewhat Underweight
3. Normal Weight
4. Somewhat Overweight
5. Very Overweight

26-34. Use this 1-5 scale to indicate how dissatisfied or satisfied you are with each of the following areas or aspects of your body.

- 1 (Very Dissatisfied)
- 2 (Mostly Dissatisfied)
- 3 (Neither Dissatisfied nor Satisfied)
- 4 (Mostly Satisfied)
- 5 (Very Satisfied)

26. Face (facial features, complexion)

27. Hair (color, thickness, texture)

28. Lower torso (buttocks, hips, thighs, legs)

29. Mid torso (waist, stomach)

30. Upper torso (chest or breasts, shoulders, arms)

31. Muscle tone

32. Weight

33. Height

34. Overall Appearance

APPENDIX H: APPEARANCE SCHEMA INVENTORY

Indicate your beliefs about these items using the 1 to 5 scale below.

1= Strongly Disagree	2= Mostly Disagree	3= Neither Disagree nor Agree	4=Mostly Agree	5=Strongly Agree
---------------------------------	-------------------------------	--	---------------------------	-----------------------------

1. What I look like is an important part of who I am.
2. What's wrong with my appearance is one of the first things people will notice about me.
3. One's outward physical appearance is a sign of the character of the inner person.
4. If I could look just as I wish, my life would be much happier.
5. If people know how I *really* look, they would like me less.
6. By controlling my appearance, I can control many of the social and emotional events in my life.
7. My appearance is responsible for much of what has happened to me in my life.
8. I should do whatever I can to always look my best.
9. Aging will make me less attractive.
10. For women: To be feminine, a woman must be as pretty as possible.

For men: To be masculine, a man must be as handsome as possible.
11. The media's messages in our society make it impossible for me to be satisfied with my appearance.
12. The only way I could ever like my looks would be to change what I look like.
13. Attractive people have it all.
14. Homely people have a hard time finding happiness.

APPENDIX I: DEBRIEFING FORM- PHASE 1

Phase 1 Debriefing form

Research conducted by
Elizabeth Wack, M.S. and Stacey Tantleff-Dunn, Ph.D.
University of Central Florida.

Thank you for your participation in this research project. Participation by individuals like you is critical for research and results to be relevant.

Please be aware that you may be contacted by researchers in order to participate in the final phase of the research, which requires you to come to the University of Central Florida for about two hours. During this phase, we will ask you to complete a series of thinking ability and perception tasks. All information you provide will remain strictly confidential. Your name will not be used in any report or presentation. This meeting would last about 2 hours. If the researchers contact you about potential participation in the second phase and you are not interested in participating, please inform them at that time. Otherwise, if you decide to participate in the second phase and at any point are no longer willing to participate, you can discontinue participation at any point, for any reason, without penalty. Should you not meet criteria for participation in the second part of the study, you will not be contacted and the information you provide will remain completely confidential. The information will not be used for any other purposes. If you have questions regarding your possible participation in the second phase of the study, please contact Elizabeth Wack.

If you experience discomfort or negative feelings after participating, you may call Dr. Stacey Tantleff Dunn at the University of Central Florida, Dr. Bob Dipboye, Psychology Department Chair at (407) 823-2216, or the organizations listed below. If you wish to learn the outcome of this study, or if you have any questions, please contact one of the people listed below. Please feel free to print this form for your records.

Thank you for your time. Your participation is very much appreciated.

Dr. Stacey Tantleff Dunn sdunn@mail.ucf.edu 407-823-3578
Elizabeth Wack betsywack@gmail.com 407-823-3872

UCF Counseling Center (for UCF students) 407-823-2811
Community Counseling Clinic (For Community Members) 407-823-2052

**APPENDIX J: HUMAN PARTICIPANTS INFORMED CONSENT FORM-
PHASE 2 (LABORATORY PROCEDURES)**

TITLE: Neurocognitive Correlates of Body Image Disturbance

Investigator: Elizabeth Wack, M.S., Doctoral Student

Supervisor: Stacey Tantleff-Dunn, Ph.D., Associate Professor,
Department of Psychology, University of Central Florida, Orlando, FL

CONSENT FORM TO PARTICIPATE IN AN EXPERIMENTAL STUDY

Introduction

You are being invited to participate in the research as titled above. Your participation is entirely voluntary. You may refuse to participate in this study or withdraw your consent at any time without giving reason and without penalty or loss of benefits to which you are otherwise entitled. You may ask to have your information removed from the research records or destroyed. You will be one of approximately 55 participants in this phase of the research study.

Purpose

The purpose of this research is to study the relationship between thinking ability/ perception and how people feel about their bodies. We are also interested in the genetic transmission of these factors. A better understanding of these relationships may provide information that leads to better treatment and ways to prevent eating disorders and other problems related to body dissatisfaction.

Duration and Location

Your participation is anticipated to last between 1.5 and 2.5 hours (although this varies by participant) and will take place in the Laboratory for the Study of Eating, Appearance, and Health (Rm. 133) in the Psychology Building on the main campus of the University of Central Florida (east Orlando).

Procedures

During this study, the following will occur:

1. You will answer questions about basic demographic information.
2. You will participate in a short interview about psychological and medical history and current psychological symptoms.
3. You will complete some self-report scales of emotional and psychological experiences.
4. You will complete a series of tasks that measure your thinking processes.

Exclusions

There are some criteria or characteristics that may make you ineligible to participate in this study. Each potential participant will be individually evaluated for eligibility through a two step process: 1) the initial internet screen that you've already completed, and 2) an interview and measures during the first part of today's session.

Early Withdrawal by You or the Investigator

If, during the course of participating in the study, you decide you do not want to continue to participate (for any reason), please inform the investigator (Elizabeth Wack) or a member of her research team. You will not be penalized in any way for early withdrawal.

Risks and Discomforts

In rare instances, this study may involve mild emotional discomfort due to personal questions asked during the interview or may become frustrated by difficulty thinking ability tasks. You do not have to answer questions which make you feel uncomfortable and you may stop participation at any time. Should you feel residual discomfort, please contact the UCF Student Counseling Center at (407) 823-2811. There is a slight risk of breach of confidentiality if your information or your identity is obtained by someone other than the investigators, but precautions will be taken to prevent this from happening.

Benefits

You may not receive any personal benefit from participating in this study besides a brief estimate of your intellectual ability (IQ) should you request it. However, the information gathered from this research may lead to better treatments for body image disturbance and eating disorders.

Payment and Costs to Participation

You will not incur any costs due to your participation in this study.

New Findings

You will be given any new information gained during the course of this study that might affect your willingness to continue participation in the study.

Confidentiality

Every effort will be taken to protect your identity. The researcher will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. For example, your name will be kept separate from the information you give, and these two things will be stored in different places. Your information will be assigned a code number and the list connecting your name to this number will be kept in a locked file cabinet in the Laboratory for the Study of Eating, Appearance, and Health or in a password protected computer. When the study is done and the data have been analyzed, the list will be destroyed. Your information will be combined with information from other people who took part in this study. When the researcher writes about this study to share what was learned with other researchers, she will write about this combined information. Your name will not be used in any report, so people will not know how you answered or what you did. Please note: we may have to notify the proper authorities (without your permission) if you lead us to believe that you are in imminent danger of physically harming yourself or others.

Questions

If you have questions regarding the study, you may call the investigator, Elizabeth Wack, M.S., at 407-823-3872 or email her at betsywack@gmail.com . Additionally, you may contact the study supervisor, Stacey Tantleff-Dunn, Ph.D. at 407-823-5858 or e-mail her at sdunn@mail.ucf.edu.

Injury

If you believe you have been injured during participation in this research project, you may file a claim with UCF Environmental Health & Safety, Risk and Insurance Office, P.O. Box 163500, Orlando, FL 32816-3500 (407) 823-6300. The University of Central Florida is an agency of the State of Florida for purposes of sovereign immunity and the university’s and the state’s liability for personal injury or property damage is extremely limited under Florida law. Accordingly, the university’s and the state’s ability to compensate you for any personal injury or property damage suffered during this research project is very limited.

Consent to Participate

My signature below indicates that I agree with the information described above and voluntarily agree to participate in this study. Any questions I have about this study have been clearly answered.

Authorization and Signatures

I am the Research Participant or am authorized to act on behalf of the Research Participant. I have read this Authorization, and I will receive a copy of this Authorization after it is signed.

Signature of Research Participant

Date

Printed Name of Research Participant or

Signature/Printed Name of Person Obtaining Informed Consent

Date

APPENDIX K: DEBRIEFING FORM- PHASE 2

Phase 2 Debriefing form
Research conducted by
Elizabeth Wack, M.S. and Stacey Tantleff-Dunn, Ph.D.
University of Central Florida.

Thank you for your participation in this research project. Participation by individuals like you is critical for research and results to be relevant.

Research indicates that approximately two-thirds of young adult women from Westernized cultures experience body image dissatisfaction (Moore, 1993; Polivy & Herman, 2002). Given the prevalence of body image dissatisfaction, its relationship to a variety of clinical problems and the lack of empirically validated treatment options, additional exploration is necessary to further our understanding of this complex aspect of the human experience in ways that directly translate to effective prevention and treatment strategies. Understanding the etiology of body image disturbance and the clinical complications therein is of critical importance due to the prevalence of dissatisfaction in the general population, particularly among young women. Additionally, given the predictive relationship between such disturbance and the development of eating disorder psychopathology, a better understanding of certain cognitive profiles may help to clarify the nature of the relationship between cognitive processes and the etiology of eating disorder symptomatology. The present study investigates the relationship between cognitive performance, body image, and eating disorders. Once this relationship is better understood, treatment incorporating protocols found to be effective in reducing cognitive biases in the treatment of eating disorders can potentially be extended to preventative measures in the treatment of body image disturbance.

If you experience discomfort or negative feelings after participating, you may call Dr. Stacey Tantleff-Dunn at the University of Central Florida, Dr. Bob Dipboye, Psychology Department Chair at (407) 823-2216, or any of the organizations listed below to receive clinical services. If you wish to learn the outcome of this study, or if you have any questions, please contact one of the people listed below.

Thank you, your participation is very much appreciated.

Dr. Stacey Tantleff Dunn	sdunn@mail.ucf.edu	407-823-3578
Elizabeth Wack	betsywack@gmail.com	407-823-3872
UCF Counseling Center (for UCF students)		407-823-2811
Community Counseling Clinic (For Community Members)		407-823-2052

APPENDIX L: HUMAN SUBJECTS PERMISSION LETTER



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Expedited Initial Review and Approval

From : UCF Institutional Review Board
FWA00000351, Exp. 6/24/11, IRB00001138

To : Elizabeth Wack and Stacey Dunn

Date : September 29, 2008

IRB Number: SBE-08-05814

Study Title: Neurocognitive Correlates of Body Image Disturbance

Dear Researcher:

Your research protocol noted above was approved by **expedited** review by the UCF IRB Vice-chair on 9/29/2008. **The expiration date is 9/25/2009.** Your study was determined to be minimal risk for human subjects and expeditable per federal regulations, 45 CFR 46.110. The category for which this study qualifies as expeditable research is as follows:

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

The IRB has approved a **consent procedure which requires participants to sign consent forms.** Use of the approved, stamped consent document(s) is required. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Subjects or their representatives must receive a copy of the consent form(s).

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

To continue this research beyond the expiration date, a Continuing Review Form must be submitted 2 – 4 weeks prior to the expiration date. Advise the IRB if you receive a subpoena for the release of this information, or if a breach of confidentiality occurs. Also report any unanticipated problems or serious adverse events (within 5 working days). Do not make changes to the protocol methodology or consent form before obtaining IRB approval. Changes can be submitted for IRB review using the Addendum/Modification Request Form. An Addendum/Modification Request Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <http://iris.research.ucf.edu>.

Failure to provide a continuing review report could lead to study suspension, a loss of funding and/or publication possibilities, or reporting of noncompliance to sponsors or funding agencies. The IRB maintains the authority under 45 CFR 46.110(e) to observe or have a third party observe the consent process and the research.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Janice Turchin on 09/29/2008 01:57:24 PM EDT

IRB Coordinator

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