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ORIGINAL ARTICLE

The Influence of Body Dissatisfaction on Set Shifting Ability

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Abstract Set shifting, or the ability to shift back and forth between multiple tasks or mental sets, has been shown to be impaired in individuals with eating disorders. The purpose of this study was to experimentally examine set shifting among acutely body dissatisfied women. Participants included 146 undergraduate women selected for self-reported high or low body shame. Each participant was randomized to one of three still-image induction groups: body dissatisfaction, negative affect, or neutral affect. Immediately following the induction, participants were administered the Wisconsin Card Sorting Test (WCST) to assess set shifting. A 2 (high vs. low body shame) × 3 (induction group condition) ANOVA was conducted on the total number of WCST perseverative errors. The results suggest that for women who feel relatively satisfied with their bodies, thin ideal or negative affective images do not impact set shifting performance. However, for women who experience body shame, acute body dissatisfaction and negative affect may impact executive functioning as demonstrated by set shifting performance. In other words, women who endorse body shame may have difficulty shifting set during moments of increased negative affect, regardless of the general or body-specific nature of the negative affect.

Keywords Set shifting · Cognitive flexibility · Body dissatisfaction · Affect · Anorexia nervosa · Eating disorders

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Introduction

Cognitions play an important role in theories regarding eating disorders. For example, the cognitive theory of anorexia nervosa (AN), first developed by Garner and Bemis (1982) and based on Beck's model of emotional disorders (Beck 1976), posits that maladaptive beliefs attached to the importance and meaning of weight and shape contribute to the development and maintenance of AN. This focus on cognitive content (Ingram and Kendall 1986) provided the foundation of a cognitive-behavioral therapeutic model that emphasizes direct modification of maladaptive expectations and beliefs in those with AN (Garner and Bemis 1982). However, cognitive behavioral therapy (CBT) has yet to be demonstrated effective for the treatment of AN (Bulik et al. 2005; Murphy et al. 2010; Steinhausen 2002; Steinhausen et al. 2003; Zipfel et al. 2000). Given the historically poor treatment prognosis and high mortality rate among individuals diagnosed with AN (Steinhausen 2002), a priority for researchers is to address this treatment limitation and enhance both cognitive theories and treatment for AN.

Some suggest that existing cognitive theories of AN focus too narrowly on cognitive content (Vanderlinden 2008). Broadening the conceptualization to more widely encompass "cognitive operations," or the underlying processes of the cognitive system (Ingram and Kendall 1986),

including neurocognitive deficits such as cognitive inflexibility, might enhance our understanding of cognitions in AN, and subsequently, cognitive treatments. However, fewer studies have investigated neuropsychological impairment in eating disorders than in other psychiatric disorders, and those conducted appear to have limited consensus (Tchanturia et al. 2005).

Research suggests that set shifting, or the neurocognitive ability to shift back and forth between mental sets and perform a new task in light of interference and priming from a previous task, may be significantly impaired in AN and may underlie the rigid, inflexible cognitive style surrounding appearance and food evident in these individuals (Miyake et al. 2000; Roberts et al. 2007). Numerous studies have found set shifting deficits in individuals with AN (for a review see Roberts et al. 2007; Tchanturia et al. 2011), with these deficits persisting to some extent after weight restoration (Danner et al. 2012; Nakazato et al. 2009; Roberts et al. 2010; Tchanturia et al. 2004a, b, 2012). Evidence has also emerged to suggest that set shifting impairment not only persists after recovery but is also evident in first-degree non-AN relatives (Galimberti et al. 2013; Holliday et al. 2005; Roberts et al. 2010). Given these findings, it is possible that impaired set shifting may be a vulnerability factor for AN and may represent an endophenotype of AN (Holliday et al. 2005; Nakazato et al. 2009).

However, it is plausible that the disorder itself may contribute to greater cognitive deficits. Research suggests that poor set shifting ability is associated with the acute stage of AN (Roberts et al. 2010), and may improve upon weight restoration (Tchanturia et al. 2004a, b). Further, two studies examining AN in adolescence found no differences in set shifting ability between adolescents with AN and healthy controls, indicating that set shifting performance may be less impaired in the earlier stages of the disorder (Fitzpatrick et al. 2012; Shott et al. 2012).

Given the mixed findings to date, it is possible that set shifting is a trait that creates vulnerability to AN or that set shifting acts as a sequelae of AN, or both. Even if it is a potential trait characteristic of AN, studies suggest that set shifting may be elastic with the capacity to improve, or worsen, under certain conditions. Although the causal link between set shifting and AN remains inconclusive, what is clear is that set shifting ability appears to be impaired in AN and warrants further investigation.

Although the study of set shifting in the context of eating disorders is relatively recent, a number of studies incorporating diverse methods and measures provide empirical evidence for the relationship between impaired set shifting and negative affect in general [see Ashby et al. (1999) for a review; Frederickson 1998]. Further, a large meta-analysis has demonstrated evidence for the link between negative affect and low cognitive flexibility (Baas et al. 2008). Studies have also demonstrated that individuals higher in trait anxiety demonstrate inefficiencies in switching mental set (Johnson 2009), dysphoric undergraduates demonstrate poorer ability to shift set on the WCST relative to their euthymic peers (Channon 1996), and compared to healthy controls, individuals with major depressive disorder demonstrate set shifting deficits when presented with a modified WCST that uses negative stimuli (e.g., images selected to induce feelings of sadness and fear) (Deveney and Deldin 2006). Furthermore, experimental studies show that upon affective manipulation individuals with even modest increases in positive affect display increased cognitive flexibility and reduced perseveration compared to neutral and negative affect groups (Baumann and Kuhl 2005; Dreisbach and Goschke 2004; Hirt et al. 2008).

Thus, a wide literature has consistently demonstrated that positive affect tends to enhance creativity and fluidity among concepts and increase set shifting ability in both healthy and clinical populations while negative affect tends to hinder set shifting performance and creativity (Hirt et al. 2008). Put another way, affective states can influence individuals' abilities on a trait-like cognitive construct.

Although there is an extensive literature regarding the effects of negative affect on set shifting, research has yet to examine whether a body-centric type of negative affect (i.e., body dissatisfaction) has similar, or potentially stronger, influences on set shifting among individuals concerned with their weight and shape. Body dissatisfaction, or a "negative subjective evaluation of one's physical body" (Stice and Shaw 2002, p. 985) is highly prevalent among women in Western cultures, a robust factor in the development and maintenance of eating disorders, and a hallmark feature of AN (Garner and Garfinkel 1980; Stice and Shaw 2002).

Does body dissatisfaction, conceived of as body-centric negative affect, influence cognitive flexibility in general and set shifting in particular? One might expect that body dissatisfaction-related cognitions and negative affect may inundate cognitive resources to the point that effective set shifting is hampered, as would be suggested by cognitive load theory (Sweller 1988; Sweller and Chandler 1994), and that this effect may be especially strong among those elevated in body dissatisfaction. Indeed, there is evidence that individuals high on body dissatisfaction have a ruminative, perseverative style (Cowdrey and Park 2012; Park et al. 2011; Serpell et al. 1999) making it plausible that these individuals have difficulty shifting set when their body-centric negative affect is activated. However, to date, studies have not yet experimentally examined the effect of body dissatisfaction induction on set shifting ability.

Given that most individuals with AN experience significant negative affect (Hudson et al. 2007; Kaye et al.

2004), and both AN and negative affect appear to be related to set shifting difficulties, it is important to understand the relevant contributions of body dissatisfaction and negative affect on set shifting difficulty among individuals concerned with their weight and shape. Studies examining negative affect and set shifting in AN are limited and present mixed findings. Three studies have found no correlation between depression and set shifting difficulty in AN populations (Roberts et al. 2010; Steinglass et al. 2006; Wilsdon and Wade 2006) and no difference in lifetime depression prevalence or depressive symptom scores between two groups of women with AN classified with either "intact" and "impaired" set shifting (Roberts et al. 2010). These studies suggest that set shifting impairment in those with AN is not necessarily related to the presence of comorbid negative affect. However, a study by Giel et al. (2012) found that set shifting was intact in patients diagnosed with AN sans comorbid depression and also that set shifting impairment was significantly correlated with depressive symptoms but not with BMI or severity of ED symptoms. This study indicates that affect might indeed play a significant role in the set shifting deficits witnessed in those with AN.

The current study examines whether a body-centric negative affect (i.e., body dissatisfaction) contributes to set shifting difficulties above and beyond general negative affect in individuals concerned with their appearance using an experimental design to examine the effects of various affective inductions (a body dissatisfaction condition, a negative affect non-body-related condition, and a neutral condition) on set shifting ability (assessed with the WCST) in a population of susceptible (i.e., body shameful) females. The inclusion of the negative affect group allowed testing whether a body-centric type of negative affect (i.e., body dissatisfaction) would result in differential set shifting consequences relative to more generic negative affect. We hypothesized that body shame and induction condition would interact to predict set shifting ability. In particular, the most pronounced set shifting impairments were expected in individuals reporting high body shame who were randomized to the body dissatisfaction induction condition.

Method

Participants

Female undergraduates ($N = 146$) from a large, public Southeastern university participated in this study. The women were recruited from the Introductory Psychology participant research pool and received course credit for their participation.

The Body Shame subscale of the Objectified Body Consciousness Scale (OBCS-BS; McKinley and Hyde 1996) was administered to the participant pool via a mass online screening in order to select individuals high and low in body shame for participation since prior pilot work with undergraduate females showed that body shame emerged as a strong predictor of subsequent body dissatisfaction ($\beta = .226$, $t(249) = 4.84$, $p < .001$) relative to other predictors such as perfectionism, thin ideal internalization, and body surveillance following a body dissatisfaction induction.

Measures

Body Shame

The Body Shame subscale of the Objectified Body Consciousness Scale (OBCS-BS; McKinley and Hyde 1996) reflects the degree to which the pursuit of unattainable internalized standards of beauty results in experiencing shame about one's body. The eight items are assessed using a 1 (*strongly disagree*) to 7 (*strongly agree*) scale. The OBCS-BS subscale has demonstrated good internal consistency (alpha = .75–.84 for undergraduate women), adequate test–retest reliability ($r = .79$), and adequate construct validity via correlations with measures of body esteem and appearance control (McKinley and Hyde 1996). Example items include, "I would be ashamed for people to know what I really weigh" and "When I can't control my weight I feel like something must be wrong with me." This measure was administered as part of the mass online screening for introductory psychology students, and participants were recruited for participation based on their scores (see 'Participants' section).

Demographics

A brief demographic questionnaire was administered containing items such as age, year in school, race/ethnicity, and self-reported height and weight.

Inductions

For the body dissatisfaction induction condition, a series of 15 still images collected from fashion magazines and fashion websites portraying thin/athletic females was shown. Each image was presented to participants for 15 s. Other researchers have used similar body dissatisfaction paradigms (Groesz et al. 2002; Wade et al. 2009). A pilot study showed that this particular slideshow of female images was shown to induce self-reported body dissatisfaction in females scoring in the top quartile of body shame on the OBCS-BS subscale with pre-induction body

dissatisfaction ($M = 4.88$, SD = 1.48) significantly lower than post-induction body dissatisfaction ($M = 5.45$, SD = 1.51), $t(24) = 3.25$, $p < .01$. Women in the bottom quartile of body shame on the OBCS-BS subscale did not report any differences in body dissatisfaction between pre-induction ($M = 2.75$, SD = 1.03) and post-induction ($M = 2.82$, SD = 1.29), $t(23) = .63$, $p > .05$.

To induce negative affect, a series of 15 images selected from the International Affective Picture System (IAPS; Lang et al. 2008) depicting a town devastated by a recent tornado were shown. Each image was shown for 12 s. The images in the IAPS are well-validated for use in affect induction paradigms. Normed valence scores have been validated for each image with scores ranging from 1 to 10 with higher scores indicating more positive valence. The rankings of the tornado scene negative IAPS images for the current study ranged from 1.95 to 6.47 with an overall average ranking of 3.50 indicating a generally negative set of images. These images were also pilot tested as a collective slideshow and generated appropriate levels of negative affect. *T* tests from piloting revealed that the slideshow of IAPS images depicting storm damage led to a significant increase in negative affect, with participants rating their pre-manipulation levels of negative affect ($M = 13.77$, SD = 3.44) lower than after viewing the images ($M = 18.08$, SD = 5.42), $t(12) = 4.86$, $p < .001$.

For the neutral induction, 15 images from the IAPS, each presented for 12 s, were shown to participants. The still images in the IAPS are well-validated for use in affect induction paradigms and normed valence scores have been validated for each image with scores ranging from 1 to 10 with higher scores indicating more positive valence. The rankings of the neutral IAPS images for the current study ranged from 4.52 to 5.52 with an overall average ranking of 4.95 indicating a neutral set of images. The 15 neutral images used in this induction consisted of items such as a chair, basket, and lamp. Any IAPS image that was traditionally normed as "neutral" but may have been activating for individuals with disordered eating, such as an image of a fork, were excluded. Given the availability of normed data, the neutral images were not pilot tested prior to use in the current study.

Set Shifting

The Wisconsin Card Sorting Test (computerized version IV, Heaton et al. 1993) has been widely used to assess set shifting ability. This task involves sorting 128 cards that vary in the shape on the card (star, circle, square, cross), the color of the shape (red, yellow, green, blue), and the number of shapes on the card (one, two, three, or four). The participant is not given explicit information regarding how to appropriately sort but is asked to sort each card under one of four category cards and is given feedback after each sort regarding the correctness of the sort. After the participant has correctly identified the pattern for a sustained time (e.g., sorting needs to occur by shape), the pattern will unpredictably change (i.e., sorting by shape is no longer correct) and the number of perseverative errors made by the participant (i.e., continuing to sort under the former rule) is used as a measure of set shifting ability with greater number of errors reflecting poorer ability to shift sets.

Affect

The Positive and Negative Affect Schedule (PANAS; Watson et al. 1988) measured the affect experienced by participants. This 20-item scale comprises a positive affect and a negative affect mood scale. For each item participants report on how they feel "at this moment" using a response scale from 1 (*very slightly or not at all*) to 5 (*extremely*). Good reliability has been demonstrated (Positive Affect Scale, alphas ranging from .86 to .90; Negative Affect Scale alphas ranging from .84 to .87). In the current study the Positive Affect Scale had an alpha of .83 and the Negative Affect Scale an alpha of .73.

Body Dissatisfaction

Two items from Eating Disorder Examination-Questionnaire (EDE-Q; Fairburn and Beglin 1994) were used to measure dissatisfaction with weight and shape: "How dissatisfied are you with your weight?" and "How dissatisfied are you with your shape?," with higher scores indicating greater dissatisfaction. One study using the Eating Disorder Examination (EDE 11.5; Cooper and Fairburn 1987), an interview version of the EDE-Q, found these two items to be highly intercorrelated with other measures of weight and shape concern at $p < .01$ with *r*s between .47 and .57 (Goldfein et al. 2000). In addition, two visual analogue scales (VAS) were used to measure dissatisfaction with weight and shape (Heinberg and Thompson 1995) in the online survey: "Please slide the bar to indicate how dissatisfied you feel about your body *weight* right now" and "Please slide the bar to indicate how dissatisfied you feel about your body *shape* right now," with higher scores indicating greater satisfaction. In the current study, the EDE-Q and VAS item pairs were each averaged separately to develop dissatisfaction scores. In the current study, the two EDE-Q items evidenced internal consistency as demonstrated by a strong correlation, $r = .61$, $p < .001$, as did the two VAS items, $r = .63$, $p < .001$.

Eating Disorder Psychopathology

The Eating Attitudes Test-26 (EAT-26; Garner et al. 1982) is a widely used 26-item self-report questionnaire intended

to capture maladaptive eating disorder-related thoughts, feelings, and behaviors. Respondents rate their agreement with the items on a 6-point scale with higher scores indicating greater levels of pathology. The EAT-26 is scored such that the first three responses ("Never," "Rarely," and "Sometimes") are scored as "0" and the later three responses ("Often," "Usually," "Always") are scored as "1," "2," and "3," respectively. A total score at or above 20 is associated with maladaptive eating behaviors and eating disordered symptomology and can be considered a cut-off for a probable eating disorder diagnosis (Garner et al. 1982). The EAT-26 has demonstrated adequate internal consistency (alphas range from .80 to .89 in a clinical sample) and has been shown to be highly correlated with other measures of eating pathology (Berland et al. 1986; Greenleaf and McGreer 2006; Henrickson et al. 2010). In the current study, alpha was .86 indicating adequate reliability.

Procedure

Eligible participants (i.e., female undergraduates scoring in the upper quartile (scores of 3.0 and lower) and lower quartiles (scores of 4.0 and higher) on the body shame screening measure were invited to participate via email recruitment. After providing written informed consent in the laboratory, participants were administered a demographic questionnaire.

Next, each participant viewed the slideshow of images for the induction condition she was randomly assigned (body dissatisfaction, negative, or neutral). The images were viewed full-screen on a computer monitor and each condition contained 15 images with the entire show lasting approximately 4 min. Due to the transient nature of inductions (Martin 1990), participants were administered the WCST immediately after viewing the images.

Following the experimental protocol (i.e., body-related, negative affect, or neutral images and WCST) individuals were administered the two body dissatisfaction items from the EDE-Q (Fairburn and Beglin 1994), the body dissatisfaction VAS items, the PANAS (Watson et al. 1988), and the EAT-26 (Garner et al. 1982) via an online survey in the laboratory. Since participants took the WCST directly after the mood induction, effects of the induction were likely dissipated by the time the questionnaires were administered. Finally, after completing the questionnaires, participants were debriefed about the nature of the study and given the opportunity to ask questions regarding the study. Due to the presentation of thin/athletic female images to women high in body shame, care was taken to provide thorough debriefing including information regarding referral sources and media literacy.

Results

Demographic Data

Participants in the low body shame group had an average age of 18.83 years (SD = 1.11) and an average body mass index (BMI) of 21.89 (SD = 2.37). Those in the high body shame group were 18.96 years old (SD = 1.07) on average with a mean BMI of 23.03 (SD = 3.43). Independent samples t tests determined that there were no differences between the high body shame and low body shame groups in age $t(143) = -.74$, $p = .458$. However, the groups did differ in BMI ($t(143) = -2.27$, $p = .025$) with individuals in the high body shame group reporting a higher average BMI than those in the low body shame group, although both BMIs were in a healthy range. Although the majority of participants were Caucasian non-Hispanic ($N = 96$; 65.8 %), a variety of ethnic and racial backgrounds were represented in this study: African American ($N = 20$; 13.7 %), Hispanic ($N = 11$; 7.5 %), Asian ($N = 9$; 6.2 %), Native American ($N = 1$; 0.7 %), and Eastern European ($N = 1$; 0.7 %), Middle Eastern ($N = 1$; 0.7 %), and multi-racial ($N = 7$; 4.8 %).

Correlational Data

Means, standard deviations, and correlations for all study measures are presented in Table 1. As expected, body shame (OBCS-BS) was significantly correlated with body dissatisfaction (EDE-Q, VAS) and eating pathology (EAT-26). These findings increase our confidence that the OBCS-BS prescreening differentiated the high and low body shame groups as women with distinct perceptions regarding the appearance of their bodies. Consistent with findings indicating a link between set shifting difficulty and eating disorders, set shifting (WCST perseverative error score) was significantly correlated with body dissatisfaction (EDE-Q) and eating pathology (EAT-26). However, set shifting was not correlated with VAS body dissatisfaction items or body shame (OBCS). Negative affect scores (PANAS) were found to be significantly correlated with body shame (OBCS), body dissatisfaction (EDE-Q, VAS), and eating pathology (EAT-26), consistent with extant research linking negative affect with disordered eating. Of note, negative affect (PANAS) was not correlated with set shifting (WCST perseverative error score).

Mood Ratings

A 2 (low vs. high body shame) × 3 (induction group condition) ANOVA was conducted on the total PANAS negative affect score. No interaction effect was found, $F(2, 135) = .136$, $p = .873$, suggesting that in general,

Table 1 Means, standard deviations, and correlations for study variables

Variables	M	SD	1	2	3	4	5	6	7
1. OBCS body shame	3.69	1.40	–						
2. EDE-Q body dissatisfaction	6.93	2.82	.51**	–					
3. VAS body dissatisfaction	10.86	4.00	−.50**	−.75**	–				
4. EAT-26 eating pathology	7.81	8.21	.62**	.38**	−.37**	–			
5. PANAS positive affect	22.28	6.42	−.14	−.17*	.23**	−.04	–		
6. PANAS negative affect	14.09	4.13	.29**	.20*	−.22**	.18*	.09	–	
7. WCST perseverative errors	7.23	4.35	.11	.17*	−.09	.27**	.08	.02	–

OBCS Objectified Body Consciousness Scale, *EDE-Q* Eating Disorder Examination Questionnaire, *VAS* Visual Analogue Scale, *PANAS* positive and negative affect schedules; *WCST* wisconsin card sorting test

* $p < .05$; ** $p < .01$

participants in the six different conditions did not differ in negative affect experiences approximately 20 min after the negative affect induction was administered.

Set Shifting

A 2 (low vs. high body shame) × 3 (induction group condition) ANOVA was conducted on the total number of WCST perseverative errors.[1] There was a significant interaction effect between body shame and induction on set shifting, F (2, 138) = 4.47, p = .013, partial η^2 = .06 demonstrating a medium effect size (Cohen 1988; Richardson 2011) with 6 % of the variance in set shifting ability attributable to the interactive effect. This indicates that the two levels of body shame (high and low) were differentially affected by the inductions (body dissatisfaction, negative, or neutral) in terms of set shifting ability. Given that the high and low body shame groups significantly differed on BMI, the effects of BMI were controlled with a 2 (low vs. high body shame) × 3 (induction group condition) ANCOVA on the total number of WCST perseverative errors with BMI as a covariate. The interaction remained significant F (2, 138) = 4.34, p = .015, partial η^2 = .06. For parsimony, the ANOVA results are presented. See Table 2 for perseverative error means and standard deviations. See Fig. 1 for a graphical representation of the interaction.

To further explore group differences of this interaction effect a Tukey's honestly significant difference (HSD) post hoc test was performed and no significant group differences were found. Alternative approaches were then used to

[1] Two outliers were identified in the low body shame/neutral affect induction combined group upon examination of a normal Q–Q plot; these two participants made 21 and 25 perseverative errors with the remaining participants ranging from 3 to 15 errors with 77 % of individual making eight or fewer perseverative errors. These outliers were removed in all analyses related to the interactive hypothesis; removal of these outliers did not affect the significance of the omnibus F test.

Table 2 Means, standard deviations, and range of perseverative errors for the interaction effect

Induction condition	Body shame condition	
	Low body shame	High body shame
Body dissatisfaction	6.18 (2.22)	9.62 (8.03)
	Range (3.00–12.00) (N = 22)	Range (4.00–36.00) (N = 26)
Negative affect	6.65 (2.83)	6.84 (2.70)
	Range (4.00–15.00) (N = 23)	Range (4.00–15.00) (N = 25)
Neutral affect	8.00 (3.63)	6.23 (2.56)
	Range (4.00–15.00) (N = 18)	Range (3.00–14.00) (N = 30)

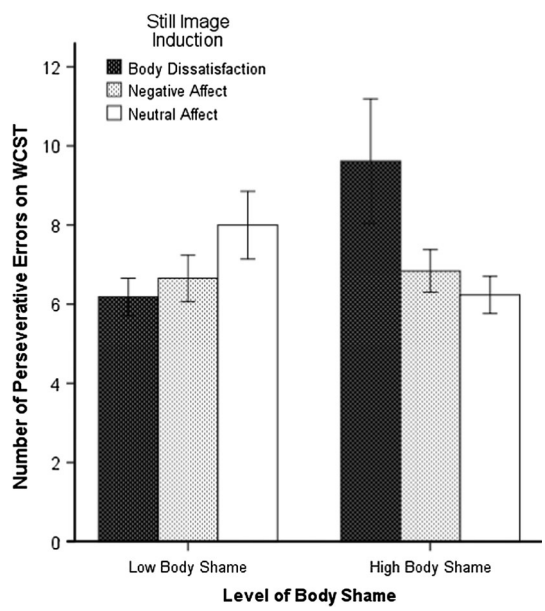

Fig. 1 The interaction between body shame and induction type on perseverative errors. *Error bars* represent ±1 standard error

explore mean differences in a less statistically stringent fashion. Separate one-way ANOVAs with Tukey post hoc tests were performed within each level of body shame. Although the risk of Type I error increases when performing multiple statistical analyses, this series of analyses may also shed light on preliminary findings worthy of future exploration. When investigating only those in the low body shame group, there were no significant group differences F (2, 60) = 2.05, $p = .137$ suggesting that those low in body shame made a similar amount of perseverative errors, regardless of whether they were exposed to the body dissatisfaction, negative affect, or neutral affect inductions. For those in only the high body shame group, there were significant group differences F (2, 78) = 3.46, $p = .036$, partial $\eta^2 = .08$ demonstrating a medium effect size (Cohen 1988; Richardson 2011). Post hoc Tukey's tests showed that those with high body shame who viewed the body dissatisfaction images made significantly more perseverative errors ($M = 9.62$, SD = 8.03) than those in the neutral affect group ($M = 6.23$, SD = 2.56) but not compared to those in the negative affect group ($M = 6.84$, SD = 2.70). No other group differences emerged within the high body shame group.

Discussion

The current study experimentally investigated the combined role of body shame and an induction of acute body dissatisfaction, negative affect, or neutral affect on set shifting ability, a cognitive deficit often observed in individuals with AN. There were no significant differences in set shifting ability across the three induction groups for those in the low body shame group. This suggests that for women who feel relatively satisfied with their bodies, images intended to induce body dissatisfaction or negative affective do not impact cognitive ability as evidenced by WCST set shifting performance.

However, individuals in the high body shame group who viewed the body dissatisfaction images made more perseverative errors than those in the high body shame group who viewed neutral images. Interestingly, within the high body shame group, statistical comparisons indicated that the body dissatisfaction induction group did not make more errors than the high negative affect conditions. Hence, our results suggest that for individuals high on body shame, poorer set shifting performance may be linked to the experience of general negative affect rather than body-centric negative affect. In other words, body dissatisfaction does not appear to contribute to set shifting difficulties above and beyond general negative affect. Statistically, the general experience of negative affect may be just as powerful in inducing a type of cognitive derailment as acute body dissatisfaction in women high in body shame. This finding contradicts some prior research that has found a limited relation between mood and set shifting ability in AN samples (Roberts et al. 2010; Steinglass et al. 2006; Wilsdon and Wade 2006) but aligns with other research showing the link between depressive symptoms and set shifting impairment in women with AN (Giel et al. 2012).

That said, it is interesting to note that the mean perseverative error findings indicate that those in the high body shame/body dissatisfaction group made more perseverative errors than those in the high body shame/negative affect group (see Table 2). In other words, although findings were not statistically significant in the current study, the direction of the effects suggests that body dissatisfaction may induce cognitive rigidity above and beyond negative affect alone. In addition, the number of WCST perseverative errors was significantly correlated with body dissatisfaction and eating pathology measures but not significantly related to the negative affect measure in this study. These findings make theoretical sense given the value and import often placed upon appearance by women who are ashamed of their weight and shape. When such a specific, vulnerable component of self (i.e., appearance) is negatively targeted, the emotional-cognitive impact is likely greater than the impact created by a broader target (general sadness) alone. In other words, both affective and cognitive elements may contribute to declines in cognitive performance when a complex cognitive-affective construct such as body dissatisfaction is activated in individuals with elevated body shame.

The current study has a number of strengths. The study of neurocognitive constructs is limited in the field of eating disorders and few experimental designs with this focus have been implemented; as such, this study contributes to a young body of literature examining cognitive constructs and disordered eating. In addition, the current experimental design was able to discern causal, rather than correlational, relations between body dissatisfaction and set shifting. No prior study has investigated such a relation. Given the rigid thinking style often associated with AN, knowing under what circumstances that rigidity is increased may benefit therapeutic approaches. Another strength is the use of the WCST, a stringent, validated, task-driven measure of set shifting, rather than a self-report measure of cognitive flexibility. Finally, although disadvantageous in some respects, the use of undergraduate women allows for more generalized results across a larger population than investigating set shifting only among those with disordered eating. Body dissatisfaction and negative affect are not uncommon in college women; thus the variables investigated in the current study are relevant to this broader group of individuals.

This study also has limitations. Although the omnibus test was significant, conservative post hoc tests revealed no

pairwise group differences. This result could have emerged because although the omnibus *F* acts as a single test and does not need to control for multiple comparisons, Tukey's HSD reduces the chance of finding a difference among a pair of groups by chance by controlling for multiple comparisons. However, given the relative novelty of experimental work on neurocognitive processes related to eating disorders, the findings from the alternative statistical follow-up warrant attention. That said, differences between the body dissatisfaction and generalized negative affect conditions may not have emerged because the images in the body dissatisfaction condition may have felt too contrived or sterile. For example, making personally relevant comparisons to a peer or celebrity embodying societal notions of a physical ideal may have generated greater dissatisfaction and negative affect surrounding one's body than viewing impersonal images of thin women in the lab. As with most experimental designs, the rigorous internal validity likely reduced external validity. In addition, increasing statistical power by oversampling may have revealed set shifting differences among groups.

The use of a homogenous, non-clinical sample may make our results less generalizable to other populations. Research with more diverse or clinical samples may have yielded different results. An important limitation to note regarding the induction paradigm is the limited range of negative affect elicited by the negative affect induction. The tornado images generally tapped into sadness-related negative affect; however, negative affect can be induced in a variety of other ways (e.g., anger, frustration, embarrassment, boredom, etc.). Additional limitations include the lack of pre-induction assessment of affect and set shifting. The WCST was not administered prior to the induction given significant practice effects of such a measure (Basso et al. 1999). A pre-induction affect assessment would have strengthened the study and will be considered in future experimental paradigms. Similarly, given that inductions (affective or body-oriented) typically do not endure for more than a few minutes, the WCST was administered immediately after the induction rather than testing affect or body dissatisfaction immediately after the induction; thus, the current study did not utilize an induction manipulation check although pilot studies indicated that the induction was effective in generating negative affect. Finally, the current study used pairs of items rather than a validated scale to assess body dissatisfaction. Although these items reduced participant burden and demonstrated a strong correlation with each other, a more complete measure of body dissatisfaction would be useful for future studies examining body dissatisfaction and set shifting.

Finally, it is important to consider the nature of the dependent variable, namely the number of perseverative errors made during the WCST. The current sample of undergraduate women made fewer perseverative errors as a whole than age-matched norms, scoring in the 88th percentile. This above-average performance may indicate that the current sample is more cognitively oriented to successfully completing tasks such as the WCST. Indeed, there is some evidence that individuals with higher intelligence outperform those with lower or average intelligence on the WCST, including perseverative error counts (Arffa 2007; Arffa et al. 1998), although not all studies have found this relation (Boone et al. 1993). Further, one study found that women may outperform men on a variety of WCST subtests, including perseverative errors (Boone et al. 1993). As such, educated, intelligent female undergraduates may be especially adept at the WCST and also more able to cognitively overcome the affective states induced in the current study.

Future Research

Results from the current study generate interesting avenues for future research, particularly related to understanding the contribution of general negative affect (vs. disorder-specific pathology) in the set shifting deficits among women with eating disorders. Experimental designs that employ confederates to induce body dissatisfaction or negative affect in participants might enhance the ability to stimulate more generalizable, genuine, and sustained feelings of body dissatisfaction or sadness. This study indicated that set shifting may indeed be exacerbated under certain conditions in a population with body image concerns. The relative effects of general versus body-centric negative affect on executive functioning should also be examined in clinical samples. The current results also suggest that there may be value in investigating whether modifying a cognitive operation, such as inflexibility, in addition to modifying cognitive content, reduces the risk of developing an eating disorder in individuals with appearance concerns or perhaps improve treatment efficacy for those with eating disorders. Finally, it would be valuable to use more ecologically valid designs to investigate the relation between depression (prolonged negative affect) and set shifting within a population of individuals with body dissatisfaction.

Conclusion

Given the rigid cognitive operations often documented in individuals with AN, better understanding set shifting ability, along with factors such as general negative affect and body dissatisfaction induced negative affect that may impair it, is warranted. The current study found that there was an interactive effect of body shame and induction-type (body dissatisfaction, negative affect, neutral affect), with

those high in body shame who viewed the body dissatisfaction induction making more perseverative errors than those high in body shame who viewed the neutral induction, but not more so than those who viewed the negative affect induction. This suggests that vulnerable individuals (e.g., those high on body shame) may have difficulty shifting set during moments of increased negative affect, whether the affect is triggered by generalized stimuli or stimuli specifically engendering body dissatisfaction.

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Informed Consent Approval for this study was granted by the Institutional Review Board (IRB) at the University of North Carolina at Chapel Hill. All procedures followed were in accordance with the ethical standards of the IRB. Informed consent was obtained prior to study participation.

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