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Negative Social Evaluative Fears Produce Social Anxiety, Food Intake, and Body Dissatisfaction: Evidence of Similar Mechanisms through Different Pathways

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Abstract

Social anxiety and eating disorders are highly comorbid, suggesting there are shared vulnerabilities that underlie the development of these disorders. Two proposed vulnerabilities are fear of negative evaluation and social appearance anxiety (i.e., fear of negative evaluation regarding one's appearance). In the current experimental study (*N*=160 women) we measured these fears: (a) through a manipulation comparing fear conditions, (b) with trait fears, and (c) state fears. Results indicated that participants in the fear of negative evaluation condition increased food consumption, whereas participants in the social appearance anxiety condition and high in trait social appearance anxiety experienced the highest amounts of body dissatisfaction. Participants in the fear of evaluation and social appearance anxiety conditions experienced elevated social anxiety. These results support the idea that negative evaluation fears are shared vulnerabilities for eating and social anxiety disorders, but that the way these variables exert their effects may lead to disorder specific behaviors.

Keywords

social anxiety; eating disorders; body dissatisfaction; fear of negative evaluation; social appearance anxiety

Eating disorders and anxiety disorders are highly comorbid, with more than 45% of patients with eating disorders (EDs) also meeting criteria for at least one type of anxiety disorder (e.g., Pallister & Waller, 2008). Of all the anxiety disorders, social anxiety disorder (SAD) has the highest prevalence in individuals with EDs (e.g., Godart et al., 2000) and individuals with SAD are also likely to meet criteria for an eating disorder (Becker, DeViva, & Zayfert, 2004). However, it is currently unclear what accounts for this high level of comorbidity. Pallister and Waller (2008) suggest that these two disorders may share vulnerabilities. An accumulation of correlational research studies suggest that two *negative social evaluative fears*, namely *fear of negative evaluation* and *social appearance anxiety*, may be sources of such underlying shared vulnerability (e.g., Gilbert & Meyer, 2005; Levinson et al., 2013).

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Negative Social Evaluative Fears, Social Anxiety, and Disordered Eating

Fear of negative evaluation is the fear that one will be negatively judged and rejected because of that judgment. Social appearance anxiety, in contrast, is the fear that one will be negatively judged specifically on characteristics' of one's appearance (Hart et al., 2008). Researchers have shown that these fears are highly correlated, yet distinct, constructs (Hart et al., 2008; Levinson & Rodebaugh, 2011).

In the social anxiety literature, fear of negative evaluation is understood as a cognitive vulnerability for, or core feature of, social anxiety (Haikal & Hong, 2010; Heimberg, Brozovich, & Rapee, 2012). Heimberg et al. (2012) outline a model in which social anxiety stems from heightened fear of negative evaluation in social situations that have the potential for the individual to be evaluated (e.g., giving a speech). Indeed, multiple studies suggest that individuals high in fear of negative evaluation are likely to feel and exhibit more anxiety when in a social evaluative situation (e.g., Haikal & Hong, 2010). Fear of negative evaluation has also been linked to disordered eating attitudes and behaviors. Cross-sectionally, fear of negative evaluation predicts drive for thinness (Gilbert & Meyer, 2003; Levinson & Rodebaugh, 2012), prospectively predicts increases in bulimic symptoms (Gilbert & Meyer, 2005; Hamann, Wonderlich-Tierney, & Vander Wal, 2009), and increases the amount of variance in bulimia that the dual-pathway model of bulimia is able to predict (Utschig et al., 2010; DeBoer et al., 2013). Overall, research shows that fear of negative evaluation has a clear link with both social anxiety and disordered eating.

Social appearance anxiety (i.e., fear of negative evaluation specifically of one's appearance) is a unique construct that is highly related to social anxiety and disordered eating (Hart et al., 2008; Levinson & Rodebaugh, 2011; Levinson & Rodebaugh, 2012). Individuals with a diagnosis of bulimia nervosa have significantly higher levels of social appearance anxiety than healthy controls (Koskina et al., 2011). In non-clinical samples, social appearance anxiety predicts social anxiety over and above neuroticism, depression, negative affect, extraversion, body dissatisfaction, self-esteem, and trait anxiety (Hart et al., 2008; Levinson & Rodebaugh, 2011). Additionally, social appearance anxiety predicts disordered eating and body dissatisfaction over and above depression, perfectionism, social interaction anxiety, fear of scrutiny, fear of negative evaluation, body mass index (BMI), and fear of positive evaluation (Levinson & Rodebaugh, 2012; Levinson et al., 2013). In fact, social appearance anxiety and fear of negative evaluation were the only two social anxiety constructs that were unique predictors of disordered eating in those studies (Levinson & Rodebaugh, 2012; Levinson et al., 2013). Specifically, social appearance anxiety appears to have a robust relationship with body dissatisfaction, a correlate of disordered eating (Levinson & Rodebaugh, 2012).

Shared Vulnerabilities

The evidence suggests that social appearance anxiety and fear of negative evaluation are important constructs for both social anxiety and disordered eating. Recent research tested these negative social evaluative fears in a single model of comorbidity. Levinson and Rodebaugh (2012) demonstrated that a vulnerability model, in which both social appearance

anxiety and fear of negative evaluation were risk factors for social anxiety and disordered eating, fit the data better than did a model in which these fears were mediators between social anxiety and disordered eating, preliminarily suggesting that these risk factors should be conceptualized as shared vulnerabilities. This vulnerability model was replicated in two additional samples while controlling for perfectionism, negative affect, depression, and BMI (Levinson et al., 2013). However, to the best of our knowledge, social appearance anxiety has not been explicitly manipulated in an experimental design that tests if social appearance anxiety impacts food intake, correlates of disordered eating (such as body dissatisfaction), and social anxiety. Further, fear of negative evaluation and social appearance anxiety have been examined simultaneously in cross-sectional correlational work, but not in an experimental design.

The Current Study

This study is the first to experimentally manipulate fear of negative evaluation and social appearance anxiety, in order to test, beyond self-report alone, if these two negative social evaluative fears produce social anxiety and correlates of disordered eating (e.g., food intake, state body dissatisfaction). We tested if an experimental manipulation of fear of negative evaluation and social appearance anxiety (a modified speech task explained below) impacted food intake, state body dissatisfaction, and social anxiety. We also assessed negative social evaluative fears and tested state levels of negative social evaluative fears as potential mechanisms.

We examined in-vivo eating behaviors: (a) because previous research has shown that in-vivo eating behaviors are highly related to incidence of eating disorders (i.e., dieting) (e.g., Patton, Selzer, Coffey, Carlin, & Wolfe, 1999; Weinstein, Shide, & Rolls, 1997) and (b) to serve as a proxy for disordered eating, given that it has been proposed that disordered eating may consist of entrenched eating habits (Walsh, 2013). Further, recent research has conceptualized eating disorders as disorders of over or under control (Wildes et al., 2011), suggesting that individuals with disordered eating either fail to exhibit self-control or exhibit excessive self-control. Therefore, we conceptualized food intake in the laboratory as a behavioral expression of over or under controlled eating evoked by negative social evaluative fears elicited by the manipulation. Based on prior literature, we expected that the negative social evaluative fears would impact food intake and body dissatisfaction differently.

We specifically hypothesized that fear of negative evaluation would relate to over eating because self-reported trait fear of negative evaluation has been shown to relate to drive for thinness, bulimic symptoms, and negative affect (e.g., Gilbert & Meyer, 2005; Kotov, Watson, Robles, & Schmidt, 2007). Further, in most experimental manipulations of stress, participants exhibit increased (rather than decreased) food intake (Stroud, Kraff, Wilfley, and Salovey, 2000; Laessle and Schulz, 2009). Given that stress may lead to negative affect (e.g., Watson, 1988), which has been shown to result in increased bulimic behaviors (e.g., Goldschmidt et al., 2014; Stice, 2001; Stice & Agras, 1998), we expected fear of negative evaluation to relate to increases in food intake. That is, we expect fear of negative evaluation to increase food intake because: (a) the construct has shown a specific relationship with

bulimic behaviors, which are characterized by periodic, excessive food intake related to both stress and negative affect and (b) the construct may represent a source of stress in general, which has also been shown to increase food intake.

Research suggests that trait social appearance anxiety is robustly related to body dissatisfaction (Levinson & Rodebaugh, 2012; Levinson et al., 2013), but not as strongly related to bulimic symptoms or binge eating (Ostrovsky, Swencionis, Wylie-Rosett, Isasi, 2013). What is less clear based on previous research is how social appearance anxiety should relate to level of food intake: The limited relationship with binge eating might imply that this construct should not increase level of food intake. Indeed, it seems plausible to us that when judgment concerns arise focusing specifically on one's appearance, participants may engage temporarily in particularly high levels of controlled eating because attention is directed toward one's appearance (and therefore higher social appearance anxiety may be related to decreased food intake).

Therefore, we had four main hypotheses stemming from these previous findings. First, fear of negative evaluation (both the experimental condition and trait) would predict increased food intake during the experiment. Second, social appearance anxiety would predict increased body dissatisfaction. Third, both conditions and traits (fear of negative evaluation and social appearance anxiety) would produce increased social anxiety. Fourth, individuals high in trait levels of fear of negative evaluation or social appearance anxiety would be more sensitive to corresponding, trait-relevant state manipulations (e.g., an interaction between trait and condition) and, therefore, to the consequences of them (e.g., body dissatisfaction). Finally, we planned to conduct post-hoc analyses to test the potential mechanisms related to food intake based on the results of the current study. As described below, results of our a priori tests led us to hypothesize, post-hoc, that state fear of negative evaluation would increase food intake, whereas state social appearance anxiety would decrease food intake.

Methods

Participants

Participants were 160 undergraduate women who participated for course credit. College women are an ideal population for this experiment because they are a high risk sample for the development of an eating disorder and are likely to place particular emphasis on their appearance and how it is viewed by others (Taylor et al., 2006). Indeed, participants' disordered eating scores (as measured by the Eating Disorder Inventory-2; Garner, Olmsted, & Polivy, 1983) ranged from very low to very high. Scores ranged from 0 to 19 on Drive for Thinness (M = 4.22, SD = 4.55; 5% scoring at or above the mean of a clinical sample of women with eating disorders from Garner et al., 1983), from 0 to 15 on Bulimia (M = 1.52; SD = 2.60; 5.1% scoring in the clinical range), and from 0 to 27 on Body Dissatisfaction (M = 7.04, SD = 5.84; 10% scoring in the clinical range). Additionally, participants' social anxiety scores (as measured by the Straightforward Social Interaction Anxiety Scale; Mattick & Clarke, 1998; Rodebaugh et al., 2011) ranged from very low (0) to very high (65), with a mean score of 25.00. A total of 32.9 % of participants scored above a 28, which has been suggested as a cut-off score for probable social anxiety disorder (Rodebaugh et al., 2011). Participants were mostly Caucasian (n = 111, 69.4%). Other ethnicities reported were

Asian (*n* = 23, 14.4%), Black (*n* = 9, 5.6%), Hispanic (*n* = 6, 3.8%), multi-racial (*n* = 11, 6.9%), and 1 participant reported ethnicity as not listed. Participants had a median age of 19.01 (*SD* = 1.10) and most participants were in their 1st year of undergraduate school (*M* = 1.70, *median* = 1.00, *SD* = .95).

Self-report Measures

Trait fear of negative evaluation was measured with the Brief Fear of Negative Evaluation Scale—(BFNE; Leary, 1983), which is a 12-item version of the original Fear of Negative Evaluation Scale (Watson & Friend, 1969). The items assess fear of negative evaluation, which has been theorized to be a central component of or vulnerability factor for social anxiety disorder (Heimberg et al., 2012). An example item is *I am usually worried about what kind of impression I am making on someone.* Scores on the BFNE have been shown to correlate with other measures of social anxiety and to have excellent psychometric properties when the four reverse scored items are excluded, as they were here (Rodebaugh et al., 2004). This measure was used to assess *trait* fear of negative evaluation as research has shown that fear of negative evaluation is a genetically based, moderately heritable, trait (Stein, Jang, & Liveslay, 2002). Internal consistency in this sample was excellent (α = .91).

Trait social appearance anxiety was measured with the Social Appearance Anxiety Scale—(SAAS; Hart et al., 2008), which is a 16-item measure developed to assess anxiety about being negatively evaluated by others because of one's overall appearance, including body shape. Research on the psychometric properties of the SAAS scores have demonstrated high test-retest reliability, good internal consistency, good factor validity, incremental validity (e.g., it was a unique predictor of social anxiety above and beyond negative body image indicators), and divergent validity (Hart et al., 2008; Levinson & Rodebaugh, 2011). An example item from the SAAS is *I am concerned people would not like me because of the way I look*. This measure was used to assess *trait* social appearance anxiety. Internal consistency in this sample was excellent (α = .94).

State social anxiety was measured with the Subjective Units of Distress Scale —(SUDS; Wolpe, 1988), which is a behavioral measure often used during exposure treatment and behavioral assessment to measure anxiety. The SUDS scale has been shown to be a valid and reliable measure of state social anxiety (Kaplan, Smith, & Coons, 1995). SUDS ratings can range from 0 (completely calm) to 100 (highest anxiety). Other reference points used in this study include 25 (noticeable, but not bothersome anxiety), 50 (bothersome anxiety), and 75 (very bothersome anxiety). These anchors were based on treatment materials for social anxiety disorder (Hope, Heimberg, Juster, & Turk, 2000). The SUDS scale was used to gain state social anxiety measures before and after the speech manipulation (explained below).

State Body Dissatisfaction was measured with the Eating Disorder Inventory-2—(EDI-2; Garner, Olmsted, & Polivy, 1983), which is a 91-item self-report questionnaire designed to measure psychological features commonly associated with anorexia nervosa and bulimia nervosa. It has been shown to have good internal consistency and good convergent and discriminant validity (Garner et al., 1983) and is frequently used

by clinicians for the assessment of eating disorder symptoms (Brookings & Wilson, 1994). In the current study the 9-item Body Dissatisfaction (BD) subscale was adapted so that the directions ask for the participant to rate the following behaviors "based on how you feel right now." An example item is *I think my stomach is too big.* The BD subscale includes items that assess dissatisfaction with overall body shape as well as the size of specific regions of the body, such as hips, stomach, and thighs. Internal consistency in this sample was excellent (α = .91).

Hunger Measure—Hunger was measured with one item that assesses current hunger level on a seven-point Likert scale ranging from 1 = not at all to 7 = extremely, as used in Oliver, Wardle, and Gibson (2000).

Eating behaviors were measured with pretzels, M & Ms, potato chips, and dried fruit in bowls, which were weighed in grams with an Eat Smart Precision Pro food scale before and after participants were given the opportunity to snack from each bowl, which created a measure of grams of food eaten (Wallis & Hetherington, 2009). We utilized grams of food consumed as has been utilized in previous research with similar manipulations testing the impact of stress on food intake as we sought to be consistent with previous research (e.g., Heatherton, Herman, & Polivy, 1999; Oliver, Wardle, & Gibson, 2000; Oaten, Williams, Jones, & Zadro, 2008). We also report mean levels of food intake in calories.

State social appearance anxiety, state fear of negative evaluation, and state stress was measured with the Manipulation Check Measure—An adapted measure of social appearance anxiety, fear of negative evaluation, and stress was administered at the end of the speech. This measure was adapted from the trait versions of the BFNE and SAAS and from stress subscale of the Depression Anxiety Stress Scale (Lovidbond & Lovibond, 1995). This measure used the same items except that items were reworded to ask about the current time (i.e., how participants were feeling right now). This measure was intended to test if individuals in each condition were experiencing the corresponding state construct (i.e., individuals in the fear of negative evaluation condition should score higher on the state fear of negative evaluation measure than on the social appearance anxiety measure). There are two different sections of this measure. Section 1 asks participants to rate how they are feeling *right now*. This section creates subscales of *general state* fear of negative evaluation (α = .96), social appearance anxiety (α = .91), and stress (α = .91). Section 2 asks participants to rate how they felt during the speech. This section creates subscales of *state* fear of negative evaluation (α = .93) social appearance anxiety (α = .94), and stress (α = .85) *during the speech*.

Procedure

This study was approved by the Washington University IRB. Participants took part in a one session, one and a half hour experiment that was advertised as an experiment about personality and behavior. Participants were asked to eat normally the day before the experiment and to not eat for the hour before their participation. Compliance was verified at the end of the experiment and when data was analyzed without non-compliers (n = 3) there were no substantive changes to results. Participants were consented and completed a short

questionnaire packet consisting of the trait measures listed above. The experimenter explained the SUDS scale and then explained the speech task. Participants were given a list of speech topics upon which they could choose to prepare their speech and were given 2 minutes to prepare the speech. Speech topics were randomly distributed across conditions and did not impact levels of anxiety or body dissatisfaction (*p*s > .90). Speeches were on a range of topics such as hobbies, vacations, and cultural diversity (all topics available at request from the first author). Participants were asked to fill out the Time 1 state measures of anxiety and body dissatisfaction before beginning the speech (but after preparation). Participants then gave a six minute speech in one of three conditions (see below). All participants received the same directions at the end of the speech ("Please stop speaking. Ok, that's the end of the speech. You can sit down now."), and then completed post-speech questionnaires. Questionnaires were provided in all conditions at the same time (i.e., before the speech and after the speech). In the FNE and control conditions (see below), experimenters provided the first questionnaires before the speech, collected them, and left the room. At the end of the speech participants filled out Time 2 state anxiety and body dissatisfaction measures and the manipulation check measure.

Fear of negative evaluation, social appearance anxiety, and control conditions—Participants were randomly assigned to one of three conditions that used a speech task to elicit: (1) fear of negative evaluation (FNE) (*n* = 52), (2) social appearance anxiety (SAA) (*n* = 55), or (3) stress (*n* = 53) associated with speaking (Control). The goal of the manipulation was for participants in the FNE condition to experience high levels of state FNE, whereas participants in the SAA condition should experience high state SAA (and may also experience high state FNE because SAA is a specific form of FNE). Participants in the FNE condition were instructed to treat the audio-recorder as the audience and told that their speech would be audio-recorded and rated later for quality and content of their performance. This speech should theoretically elicit fears of negative evaluation only (and not appearance evaluation) because evaluation was based on audio information only. Experimenters did not sit in with the participants in this condition, to avoid any indication of appearance evaluation.

Participants in the SAA condition were instructed to treat the experimenter and the two cameras as an audience. They were told that their speeches would be rated later specifically on *physical appearance* of the speaker during the speech. This speech should theoretically elicit fears specific to appearance evaluation. Participants in the Control condition were instructed to give a speech but were not told that they would receive any evaluation (nor was the speech recorded – they gave the speech to an empty room). This condition should control for stress and elicit anxiety related to preparing and giving a speech but should not specifically elicit FNE or SAA because there was no observation or recording of the speech.

Eating behavior dependent variable—Pretzels, M & Ms, potato chips, and dried fruit were given to participants in bowls after completion of the Time 2 packet. We gave several types of food to ensure there was food available for all possible food taste preferences. Each bowl was weighed before and after it was left in the room with the participant to assess total grams of food ingested. Participants were also given a bottle of water that was weighed

before and after consumption; however, results using water as a dependent variable are not reported here for conciseness. After the speech the experimenter brought the food into the room and told the participant: "I have to go shut down the equipment and prepare for the last part of the session. It takes a little while for me to get ready, so there are snacks and water to eat and drink and magazines to look at while I am getting ready. I will be back in a few minutes." The experimenter then left the room, and participants were left with the food and water for ten minutes, during which they were permitted to eat and drink as they wished. Participants were also given magazines (brought into the room at the same time as the food) to read while the experimenter was gone.

Post-hoc analyses—Post-hoc structural equation modeling analyses were conducted using Mplus Version 7 (Muthén & Muthén, 1998-2012). We used the Satorra-Bentler chi-square (MLM) estimator, which estimates standard errors and a mean-adjusted chi-square test statistic that are robust to non-normality. Available *n* with complete data for related analyses dropped to 158 because of missing data on questionnaires for 2 participants, which is less than 5% of the sample. Therefore, listwise deletion was used with these cases. Model fit was evaluated using the: (a) comparative fit index (CFI; Bentler, 1990), (b) Tucker-Lewis incremental fit index (TLI; Tucker & Lewis, 1973), (c) root mean square error of approximation (RMSEA; Steiger & Lind, 1980), and (d) standardized root mean square residual (SRMR; Bentler, 1990). The magnitudes of these indices were evaluated with the aid of recommendations by Hu and Bentler (1999). Essentially, for the CFI and TLI, values of .90 and above were considered adequate, whereas values of .95 or above were considered very good; for the RMSEA and SRMR, values of .08 and below were considered adequate and .05 or less very good. For the CFI, TLI, and RMSEA, we used the Swain correction factor for small samples implemented in the RGui to account for the moderate size of the sample (Boomsma & Herzog, 2013). After establishing an acceptable model fit, we tested for mediation. Bootstrapping was used to test for indirect effects. As recommended by Hayes (2009), 5000 draws were implemented.

Results

Descriptive Statistics, Zero-order Correlations, and Transformations

Food intake (measured in grams) was non-normally distributed and therefore was transformed using a square root transformation for analyses. On average participants consumed 32.95 grams or 134 calories (Range 0-539 calories), which, if eaten daily in excess of calories expended would lead to about 14.5 pounds of weight gained per year. There were no significant differences between conditions on hunger level $F(2, 157) = 1.79$, $p = .170$. Condition was dummy coded into 2 variables for use in multiple regression. In the remaining analyses we refer to the first dummy variable (FNE = 1, SAA and control = 0) as group 1 (G1-FNE) and the second dummy variable (SAA = 1, FNE and control = 0) as group 2 (G2-SAA). G1-FNE compares the participants who received the FNE manipulation versus participants who received all other manipulations and G2-SAA compares participants who received the SAA manipulation versus participants who received all other manipulations.

Please see Table 1 for all descriptive statistics and inter-correlations among measures of interest. As can be seen in Table 1, both trait social appearance anxiety and trait fear of negative evaluation were positively correlated with state social anxiety and state body dissatisfaction, but not with grams of food consumed. Please see Table 2 for the means of all variables by condition. As can be seen in this table, participants in the FNE condition ate significantly more food than participants in the other two conditions (SAA and control), whereas participants in the SAA condition experienced higher body dissatisfaction than in the control and FNE condition. Participants in the SAA condition experienced higher state social anxiety than in the FNE and control condition. There were no significant differences by condition in trait FNE or SAA.

Manipulation Check: What State Fears Were Experienced in Each Condition?

Recall that the goal of the manipulation was to evoke state FNE, state SAA, and state stress during the speech. We tested if there were different levels of state fears *during the speech* dependent on condition. A MANOVA across conditions indicated that there was a significant multivariate effect on state stress, SAA, and FNE during the speech, F (3, 155) = 9.753, $p < .001$; Wilk's $\lambda = .71$, partial $\eta^2 = .16$. Follow up pair-wise comparisons indicated that there were significant differences in state FNE between the FNE and control condition, as hypothesized. Also as hypothesized, there were no significant differences in state SAA between the FNE and control condition. In the SAA condition compared to the control condition there were significant differences in both state SAA and state FNE. However, there was no difference in state FNE in the FNE and SAA condition (partially as expected). Please see Table 2 for a list of all means and standard deviations stratified by condition.

Overall, these results indicate that the manipulation successfully increased state SAA and state FNE in each corresponding condition. Participants in the FNE condition experienced increased FNE versus those in the control condition and participants in the SAA condition experienced increased SAA versus those in the control condition. Consistent with the definition of SAA as a specific fear of negative evaluation of appearance, participants in the SAA condition also experienced heightened state FNE (in addition to state SAA) suggesting that manipulating SAA increases both state FNE and state SAA.

Does Fear of Negative Evaluation Increase Food Intake?

To test both the first hypothesis that trait fear of negative evaluation or participants who experienced the FNE condition, and the fourth hypothesis, that an interaction between condition and trait fear of negative evaluation would increase food intake, we utilized multiple regression. Each of the dummy coded condition variables (G1-FNE and G2-SAA), trait fear of negative evaluation (FNE), and the interaction between condition (G1-FNE and G2-SAA) and trait FNE were entered into multiple regression. As hypothesized, there was a significant main effect of G1-FNE, such that G1-FNE was associated with increased food intake relative to the other two conditions (part $r = .16$, $b^* = .19$, $p = .044$). There was no significant main effect of trait FNE (part $r = -.11$, $b^* = -.19$, $p = .168$). There was no significant interaction between trait FNE and condition predicting total food intake (ps > . 238). These results remained unchanged when hunger was included as a covariate and

moderator variable; there was also a main effect of hunger on food intake (part r = .26, b* = .26, p < .001).

Does Social Appearance Anxiety Predict State Body Dissatisfaction?

Next we tested the second and fourth hypotheses that trait social appearance anxiety, G2-SAA, and the interaction between G2-SAA and trait social appearance anxiety would predict state body dissatisfaction after the speech. There was a significant main effect of G2-SAA (part r = .17, b* = .14, p = .039) and trait SAA (part r = .20, b* = .35, p = .011). Both of these main effects were qualified by the hypothesized interaction between trait SAA and G2-SAA (part r = .16, b* = .23, p = .045). As can be seen in Figure 1, participants who were both in G2-SAA and high in trait SAA exhibited the highest levels of state body dissatisfaction.

Do Both FNE and SAA Produce State Social Anxiety?

To test the third and fourth hypotheses we conducted two regression analyses. First we tested if G1-FNE and trait level FNE (and potentially the interaction of G1-FNE and trait FNE) would predict state social anxiety. In accordance with hypothesis, both G1-FNE (part r = .26, b* = .30, p < .001) and trait FNE (part r = .25, b* = .24, p< .001) predicted state social anxiety. The interaction between condition and trait FNE was not significant (p = . 298). Finally, we tested the hypothesis that G2-SAA and trait SAA would predict state social anxiety. In accordance with hypothesis, both G2-SAA (part r = .25, b* = .26, p < . 001) and trait SAA (part r = .16, b* = .30, p = .043) predicted social anxiety. However, the interaction was not significant (p =.323).

Post-hoc analyses: What Increases versus Decreases Food Intake?

Hypotheses—We noted that results were consistent with hypothesis overall, but also noted an interesting paradox in the findings: Although the FNE condition, which led to increased state FNE, led to increased food intake, the SAA condition, which also led to increased state FNE, did not lead to increased food intake. We speculated that state levels of FNE and SAA might carry *opposing* indirect effects of condition or trait levels of FNE and SAA on food intake. That is, we hypothesized, based on the initial findings, that participants might *increase* food intake when they experience increased levels of state FNE, but that when they experience concurrently increased state levels of SAA, they may *decrease* food intake. This hypothesis would explain why participants consumed higher grams of food when FNE was primed and SAA was not (as for participants in G1-FNE), but *not* when FNE and SAA were both primed (as for participants in G2-SAA). It may be that fear of negative evaluation initially increases the urge to eat, but that when one also feels evaluated specifically on one's appearance (in addition to experiencing general fear of negative evaluation), this urge decreases because thoughts are directed toward one's appearance and how to regulate (potentially through decreasing food intake) appearance evaluation concerns.

Model: We tested a model including food intake, state SAA, state FNE, G1-FNE, G2-SAA, trait FNE, and trait SAA. Our primary model did not include any interactions because in multiple regression, there were no significant interactions predicting food intake. We also

tested a fully saturated model that included all of the above variables, in addition to all interactions.

Model fit: Model fit was excellent (df = 2; CFI = 1.00, TLI = 1.00, RMSEA = 0.00, SRMR = .01). When using the Swain correction for small sample size, model fit remained excellent (CFI = 1.00, TLI = 1.00, RMSEA = 0.00). Please see Figure 2 for the hypothesized model and path estimates. We also tested a fully saturated model including all paths and potential interactions, which by definition had perfect fit (df = 0; CFI = 1.00, TLI = 1.00, RMSEA = 0.00, SRMR = 0.00). There were no substantive changes to results when all paths were included (i.e., all main and indirect effects reported in Table 3 and Figure 2 remained significant).

Indirect effects: Testing for Mechanisms: Please see Table 3 for a summary of all indirect effects, confidence intervals, and p-values. As hypothesized, there was a significant indirect effect from G2-SAA to food intake through state SAA such that G2-SAA indirectly decreased food intake through heightened state SAA. Further, there was a significant indirect effect from trait SAA to food intake through state FNE and through state SAA. Notably, the direct effects from state FNE and state SAA on food intake were in opposing directions, such that increases in state FNE *increased* food intake, whereas increases in state SAA *decreased* food intake. In each case increasing state SAA would predict lower food intake: For example, higher trait SAA's tendency to lead to increased state SAA, particularly in the G2-SAA condition, would result in lowered food intake. Finally, there was a marginally significant indirect effect from trait FNE to food intake through state FNE.

Can SAA be manipulated without manipulating FNE?

Given the results of the main four hypotheses tested above, we noted that the experimental manipulation proved unable to manipulate SAA without also manipulating FNE. To investigate this issue further, we conducted a follow up analysis to test to what extent it was possible to experience FNE without SAA and vice versa in these conditions. To do so, we tested the correlation between FNE and SAA across conditions via multiple regression. There was a significant interaction between condition and state fear of negative evaluation predicting state social appearance anxiety (part $r = .33$, $b^* = .28$, $p < .001$). We probed this interaction and determined that in the SAA condition there was a high correlation ($r = .71$) between state social appearance anxiety and fear of negative evaluation. In contrast, in either the FNE or control condition, this correlation was lower ($rs = .32$ and .64 respectively), suggesting that there was a lower correlation between FNE and SAA when experiencing overall evaluation not focused on appearance, but that this correlation was much higher when experiencing appearance evaluation. That is, the results suggest that when appearance is evaluated, the relationship between FNE and SAA is magnified, whereas when FNE is primed for factors other than appearance, the relationship between FNE and SAA is not as strong.

Discussion

Overall, results suggest that both fear of negative evaluation and social appearance anxiety are important negative social evaluative fears in the context of social anxiety, food intake, and body dissatisfaction. We observed three major results: (a) experimental manipulation of fear of negative evaluation increased food intake, (b) experimental manipulation of social appearance anxiety in those participants with a pre-existing tendency toward it increased body dissatisfaction, and (c) both in terms of individual differences *and* experimental manipulations, fear of negative evaluation and social appearance anxiety each independently increased social anxiety.

These results support the idea that the negative social evaluative fears impact social anxiety, body dissatisfaction, and food intake, but in somewhat different ways. Specifically, we found that the pathways through which these mechanisms produce symptoms may differ. For example, individuals who were vulnerable to worrying about negative evaluation regarding their appearance and who then experienced an appearance evaluative condition were likely to experience high state body dissatisfaction. That is, *both* a trait vulnerability and environmental condition increased dissatisfaction about one's body. In contrast, participants experienced heightened social anxiety in either evaluative condition or if they had high levels of the evaluation traits, but the environment did not interact with the trait. In other words, body dissatisfaction may be particularly high when a negative appearance evaluation vulnerability and an environment highly focused on appearance are present, whereas social anxiety may develop when only one of these are present. Further, participants who were told they would be evaluated on their content and performance of their speech, but were not evaluated on their appearance (and therefore were experiencing heightened state fear of negative evaluation but not heightened state social appearance anxiety), increased food intake versus participants in the other two conditions. This effect was not dependent on trait level fear of negative evaluation (e.g., there was no interaction between trait and condition).

State Body Dissatisfaction versus State Social Anxiety

Although preliminary, these results may in part explain why some individuals develop only social anxiety disorder, whereas others develop both social anxiety disorder and an eating disorder. It may be that disordered eating (in addition to social anxiety disorder) develops when both of these variables (trait social appearance anxiety and an appearance evaluative environment) are present, whereas social anxiety disorder may develop when either pathway is present in isolation. For example, individuals may develop social anxiety disorder when one of many conditions exists: An environment that evokes evaluation fears (either fear of negative evaluation or social appearance anxiety) or when the individuals is vulnerable to high levels of the negative evaluation traits. The notion that eating disorders may stem from a combination of trait-like vulnerability and environmental exposure to risk factors idea is consistent with the sociocultural model of bulimia nervosa that suggests that sociocultural factors contribute serious risk for the development of bulimia (Stice, 1994). In this case, an appearance-evaluative environment may be a sociocultural factor impacting body dissatisfaction and a tendency to experience social appearance anxiety may be a

vulnerability that interacts with such an environment. Similarly, this hypothesis is also consistent with theory suggesting that there are multiple risk factors that interact with each other that precede the development of EDs, such as weight concern, low self-esteem, and disturbance in interpersonal relationships (Wilfley, Pike, & Striegel-Moore, 1997) and that critical comments about eating and weight are one of the most potent risk factors for the development of disordered eating and body dissatisfaction (Jacobi et al., 2011).

Body dissatisfaction is a well-established risk factor for eating disorders, especially bulimia nervosa (Attie & Brooks-Gunn, 1989; Killen et al., 1996; Stice & Shaw, 2002) and is sometimes thought of as the prodromal stage of development of an eating disorder (Stice, Ng, & Shaw, 2010). It may be that over an extended period of time individuals who have elevated trait social appearance anxiety and are in highly appearance evaluative environments develop higher body dissatisfaction, which then leads to the development of an eating disorder. To the best of our knowledge, this study is the first empirical demonstration that social appearance anxiety directly leads to state body dissatisfaction (via experimental manipulation of social appearance anxiety). However, more research is needed to test a full model in which social appearance anxiety leads to body dissatisfaction, which then leads to disordered eating over time.

State Negative Social Evaluative Fears

We also provided data further clarifying the relationship between *state* fear of negative evaluation and *state* social appearance anxiety. When considering the results between groups we conceptualized the social appearance anxiety condition as having the highest level of all state negative social evaluative fears overall and the fear of negative evaluation condition as having high levels of fear of negative evaluation, but not high levels of social appearance anxiety. Indeed, post-hoc analyses showed that state fear of negative evaluation and social appearance anxiety were more related in the social appearance anxiety condition than in the fear of negative evaluation or control condition. This finding suggests that when social appearance anxiety is primed, the two states have an increased tendency to move in concert with each other.

These findings are consistent with the definition of social appearance anxiety, which posits that it is a specific form of fear of negative evaluation specific to appearance evaluation. These results help clarify the nature of state social appearance anxiety and its relation with fear of negative evaluation and show that how related the state fears are depends on context. For example, in an appearance evaluative environment state social appearance anxiety and fear of negative evaluation may be highly related, whereas in a non-appearance evaluative condition they may not be as highly associated. If that account is accurate, it suggests that it may be possible to increase fear of negative evaluation without increasing social appearance anxiety, but that in an appearance-evaluative environment, anything that increases either fear of negative evaluation or social appearance anxiety will also tend to increase the other state fear. It must be noted, however, that we did not exhaust all possible manipulations in this study, so it remains possible that other manipulations could, for example, invoke solely social appearance anxiety despite an appearance-evaluative environment: Defining such conditions would be helpful to future research. These findings specifying the nature of the

negative social evaluative fears helped us better understand how state social appearance anxiety and fear of negative evaluation exerted indirect effects from condition and trait-level fears on food intake.

State Fears Impact on Food Intake: Restriction (Over-controlled) versus Increased (Under-controlled) Food Intake

We found that state fear of negative evaluation increased food intake, whereas state social appearance anxiety decreased food intake. These findings may help explain why participants in the fear of negative evaluation condition consumed more food than those in the social appearance anxiety condition: Perhaps evaluation fears *increase* eating only to the extent that one does not feel evaluated on appearance (which may then *decrease* eating because of attempts to regulate fears of appearance evaluation by restraining from food). If an individual is feeling evaluated overall, she may regulate her fears by using food-related habits (e.g., Muraven & Baumeister, 2000; Rieger et al., 2010; Walsh, 2013). However, if she is evaluated specifically on her appearance, she is likely to turn her attention toward her body, feel increased body dissatisfaction, and perhaps prefer to regulate through restriction of food (or through alternative means). These findings are consistent with research on the risk factors of eating disorders, which suggest that concerns related specifically to shape and weight increase the risk for the development of an eating disorder (e.g., Jacobi et al., 2004).

In this case, social appearance anxiety, which is specific to appearance, may cause restrictive eating in the short term and serve as a signal to regulate stress through means other than increased eating (perhaps because attention is focused on one's appearance), whereas general evaluation fears increase eating. However, we expect that when no longer experiencing appearance evaluation this strategy may later be replaced with other maladaptive forms of self-regulation (e.g., bingeing). Thus, it remains perfectly plausible that participants showing over-controlled eating in this study due to social appearance anxiety might later exhibit under-controlled eating when they are no longer in an appearance-evaluative environment (e.g., when alone). For example, over the long-term, over-controlled restriction may lead to under-controlled binge eating as a coping strategy, consistent with findings showing that restraint predicts higher food intake when coupled with stress and anxiety (e.g., Greeno & Wing, 1994).

Limitations

A major limitation of this research is that we used a non-clinical, student sample. However, this limitation is partially offset because undergraduate women are at high risk for the development of an eating disorder (Taylor et al., 2006) and we had clinical levels of disordered eating and social anxiety in our sample. Additionally, we utilized an experimental design to begin to identify specific causal mechanisms. However, it is possible that in a clinical or population-based sample these results would differ. Some researchers have recently argued that it is useful to utilize a normative sample when studying (possibly genetically based) traits and that studying only the extremes of traits limits the breadth of our knowledge for the entire population (Plomin, Haworth, & Davis, 2009). Indeed, there is support for fear of negative evaluation as a genetically based, moderately heritable, trait (Stein, Jang, & Liveslay, 2002). One additional limitation is that participants were not

instructed to eat at a certain time before participation and therefore could have eaten at variable hours before participation, which could have affected food intake. However, hunger levels were distributed equally across conditions and removal of participants who did not follow instructions regarding eating did not alter substantive interpretation. Additionally, participants were not explicitly asked if they had guessed the purpose of the study.

Further, several of our measures were developed specifically for this study, including the manipulation check measure. It would have been ideal to have a measure that has previously shown validity measuring the state fears and that was measured during the speech instead of after. Finally, future researchers may want to consider utilizing different manipulations of these negative social evaluative fears. For example, it could be argued that there would have been better experimental control if we had removed the experimenter from the speech in all conditions, instead of in only the control and fear of negative evaluation conditions. Future research should also test if there are moderators and mediators such as depression, perfectionism, or emotional eating that impact the relationship between food intake and negative social fears. Future research should also manipulate additional constructs, such as guilt, that are known to impact disordered eating to attempt to delineate additional mechanisms that effect social anxiety and disordered eating (Berg et al., 2013).

Implications for a Shared Treatment Model

Overall, these results suggest that negative social evaluative fears are stressors that lead to food intake, social anxiety, and body dissatisfaction. These results support previous research suggesting that social appearance anxiety is highly related to body dissatisfaction, whereas fear of negative evaluation is related to disordered eating correlates such as increased food intake (Levinson & Rodebaugh, 2012). However, we also found that state social appearance anxiety had an impact on food intake (i.e., to decrease food intake). Finally, these results provide support for the idea that social anxiety and disordered eating share vulnerabilities, but that the pathways through which these vulnerabilities arise may be what produces disorder specific behaviors. If research continues to provide support for these shared vulnerabilities, it may be possible to design novel interventions that focus on these risk factors instead of categorical disorders. These interventions may show that it is possible to treat (or ideally prevent) multiple disorders in one protocol. For example, cognitive-behavioral internet based programs have been shown to significantly reduce weight and shape concerns and to decrease the risk of onset of an eating disorder (Taylor et al., 2006). Similarly, it may be possible to develop treatment interventions focused on negative evaluation fears that target both social anxiety and eating disorders in the same protocol.

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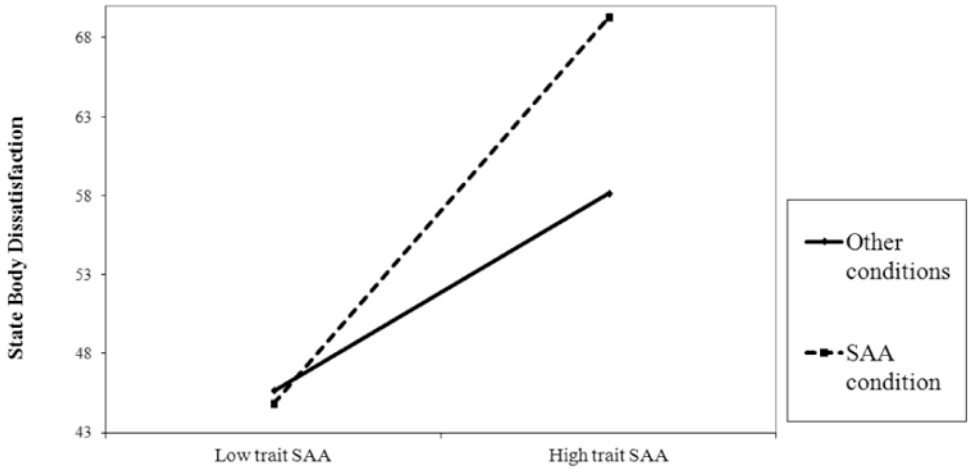

Figure 1.

The interaction between SAA condition and trait SAA predicting state body dissatisfaction.

Note. SAA = Social appearance anxiety, $p = .045$.

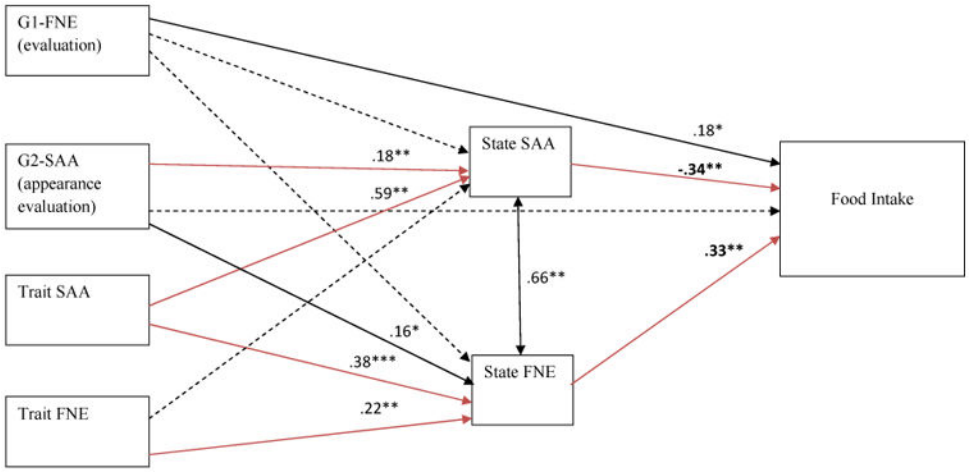

Figure 2.

A Model of Negative Evaluation Fears, Eating, and Body Dissatisfaction.

Note. All effect sizes are direct effects. G1-FNE = participants coded as 1 = FNE condition and 0 = SAA and control condition; G2-SAA = participants coded as 2 = SAA condition and 0 = FNE and control condition. SAA = social appearance anxiety; FNE = fear of negative evaluation, significant paths are bolded, non-significant paths are dashed, pathways through which there are significant indirect effects through state SAA and state FNE are red. Bolded values show that state SAA decreases, whereas state FNE increases food intake. The value between state SAA and food intake is negative showing that high state SAA decreases food intake from the group mean. When the direct paths from trait SAA and trait FNE on food intake are included they are non-significant (when df = 0). *$p < .05$, ** $p < .01$.

Table 1

Descriptive statistics and zero-order correlations between group, trait and state fear of negative evaluation and social appearance anxiety, total grams of food, state social anxiety, and state body dissatisfaction.

	Trait FNE	**Trait SAA**	**Total Grams/ Calories**	**Social Anx**	**State BD**	**S-Stress**	**S-FNE**	**S-SAA**
Mean (SD)	22.49 (7.10)	31.3 (12.83)	32.95 (23.87) 134.65 (101.79)	70.56 (31.29)	54.05 (18.12)	10.97 (4.82)	14.42 (6.19)	12.29 (4.97)
Trait FNE	.91	.59**	-.06	.28**	.44**	.33**	.46**	.49**
Trait SAA		.94	-.10	.42**	.57**	.47**	.53**	.69**
Total Grams			X	-.06	-.06	-.09	.05	-.10
Social Anx				.90	.31**	.62**	.48**	.50**
State BD					.91	.54**	.54**	.66**
S-Stress						.91	.64**	.65**
S-FNE							.96	.79**
S-SAA								.91

Note. Cronbach's alphas are on the diagonal. FNE = fear of negative evaluation; SAA = social appearance anxiety; total grams = total grams of food intake; Social Anx = state social anxiety; BD = body dissatisfaction, grams = total grams of food consumed are non-square root transformed, S = state;

* $p < .05$,

** $p < .001$.

Table 2

Mean Levels (and Standard Deviation) of State and Trait Constructs by Condition

Condition	State Stress (during speech)	State FNE (during speech)	State SAA (during speech)	Total Grams	Calories	State Body Dissatisfaction	State Social Anxiety	Trait FNE	Trait SAA
FNE	5.69	8.12*	3.73	37.69*	152.92*	49.94	68.41	22.16	29.31
	(2.53)	(3.04)	(1.50)	(22.26)	(94.97)	(17.18)	(27.09)	(6.81)	(11.96)
SAA	7.32*^	9.32*	6.80*^	32.02	132.03	59 96*^	82.24*^	23.81	34.38
	(2.99)	(3.82)	(2.97)	(24.51)	(111.04)	(19.99)	(35.08)	(7.41)	(14.89)
Control	5.19	6.89	4.64	29.26	118.43	51.86	60.58	21.40	30.21
	(2.73)	(3.46)	(2.66)	(24.42)	(96.87)	(15.40)	(27.31)	(6.96)	(10.85)

Note. FNE = Fear of Negative Evaluation; SAA = Social Appearance Anxiety

* significantly ($p < .05$) different from control condition,

^ significantly different from the FNE condition.

For total grams means reported are non-square root transformed amounts. Significance tests were computed with transformed variables to improve normality.

Table 3

Summary of Indirect Effects from Trait Social Appearance Anxiety, Trait Fear of Negative Evaluation, G1-FNE, and G1-SAA.

	Estimate	95% Confidence Interval
Effects from G1-FNE to Food Intake		
G1-FNE to state FNE to Food Intake	-.06	-.297 to .174
G1-FNE to state SAA to Food Intake	.07	-.128 to .277
Effects from G2-SAA to Food Intake		
G2-SAA to state FNE to Food Intake	.28	-.041 to .651
G2-SAA to state SAA to Food Intake	-.32	**-.581 to -.054**
Effects from Trait FNE to Food Intake		
Trait FNE to state FNE to Food Intake	.03	*0.00 to .048*
Trait FNE to state SAA to Food Intake	-.01	-.032 to .009
Effects from Trait SAA to Food Intake		
Trait SAA to state FNE to Food Intake	.03	**.007 to .041**
Trait SAA to state SAA to Food Intake	-.04	**-.061 to -.017**

Note. G1-FNE = participants coded as 1 = FNE condition and 0 = SAA and control condition; G2-SAA = participants coded as 2 = SAA condition and 0 = FNE and control condition. FNE = Fear of Negative Evaluation; SAA = Social Appearance Anxiety. Unstandardized estimates are shown. Bolded confidence intervals are $p < .05$; Italicized confidence intervals are $p < .10$.