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Analysis of a Multidimensional Model of Body Image Disturbance Using Structural Modeling.

David Hunter Gleaves
Louisiana State University and Agricultural & Mechanical College

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Analysis of a multidimensional model of body image disturbance using structural modeling

Gleaves, David Hunter, Ph.D.

The Louisiana State University and Agricultural and Mechanical Col., 1993
ANALYSIS OF A MULTIDIMENSIONAL MODEL OF BODY IMAGE DISTURBANCE USING STRUCTURAL MODELING

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

The Department of Psychology

by

David H. Gleaves,
B.S., Vanderbilt University, 1986
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Abstract
Although there has been a wealth of recent research on the construct of body image disturbance, it is still a highly controversial and poorly understood phenomenon. Much of previous research has treated body image disturbance as if it were a unidimensional construct. Recently, a multidimensional model was proposed which incorporated the concepts of body size distortion, preference for thinness, body dissatisfaction, and fear of fatness. The purpose of the present investigation was to examine this multidimensional model in an attempt to establish its validity and resolve many of the current controversies regarding body image disturbance. The LISREL 7 program was used to perform a structural modeling analysis of the theoretical model. The multidimensional model was tested against alternate one, two, and three dimensional models. Several specific hypothesized effects regarding the relationships between the underlying dimensions were also tested. A total of 175 women participated in the study, 54 eating disorder patients and 121 undergraduate students. The results supported the hypothesized four dimensional model, relative to alternative models. Body dissatisfaction appeared to be directly affected by both body size distortion and preference for thinness, in addition to actual body size. Fear of fatness was found
to be the best predictor of restrictive eating. The results supported a significant relationship between fear of fatness and body size distortion, although the exact nature of the relationship could not be conclusively determined, probably due to reciprocal causation. The results appeared consistent across the clinical and non-clinical samples. These data help resolve many of the current controversies in the body image literature and illustrate the need to study the construct in a multidimensional context. The results also suggested the need to develop more sound assessment instruments for fear of fatness.
Introduction

Body image has been described as an evaluation of one's size, weight or any other aspect of the body that determines physical appearance (Thompson, 1990). In recent years, there has been a wealth of research published on the topic of a disturbance in body image with eating disordered and non-eating disordered populations. There have been books devoted to the topic (Cash & Pruynsky, 1990; Thompson, 1990) as well as several comprehensive reviews of theoretical and assessment issues (Ben-Tovin & Walker, 1991; Cash & Brown, 1987; Garner & Garfinkel, 1981; Slade, 1985). Despite years of research, body image disturbance is still a poorly understood phenomenon. The purpose of the present investigation was to examine a theoretical model of body image disturbance with the hopes of resolving some of the conflicts in the body image literature and increasing our understanding of the phenomenon.

Body Image Disturbance in Anorexia Nervosa

Body image disturbance has long been thought to be a central psychopathological feature of anorexia nervosa. In the current version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R; APA, 1987) a "disturbance in the way in which one's body weight, size, or shape is experienced" is included as a diagnostic
criteria for the disorder. Hilde Bruch (1962) was one of the first to examine body image disturbance in anorexia. She described the disturbance as being one of three key symptoms necessary for the development of the disorder. She noted that the central pathological feature of anorexia was not the emaciation of body, but rather the body image distortion associated with it and the stubbornness with which the appearance is often defended as normal (Bruch, 1962).

In one of the first attempts to measure body image disturbance, Slade and Russell (1973) found anorexics to overestimate the size of their body to a greater degree than did control subjects. It was also noted that overestimation decreased as the patients gained weight and that the greater degree of overestimation predicted relapse following discharge. Since this study, several other researchers have replicated the findings (see the reviews cited above), although some of the findings have recently been called into question (Hsu & Sobkiewicz, 1991; Penner, Thompson, & Coovert, 1991).

Body Image Disturbance in Bulimia Nervosa

In the 1980s, with the addition of bulimia (American Psychiatric Association, 1980) and then bulimia nervosa (American Psychiatric Association, 1987) to the Diagnostic and Statistical Manual for Mental disorders, much research
has examined body image disturbance associated with these disorders. This research has found that individuals with bulimia nervosa also overestimate body size, relative to non-eating disordered controls (Thompson, Berland, Linton, & Weinsier, 1986; Williamson, Davis, Goreczny, & Blouin, 1989). Bulimia nervosa subjects have also been found to prefer a much smaller ideal body size than same size controls (Williamson et al., 1989). In the current version of the DSM, a "persistent overconcern with body shape and weight" is included as a diagnostic criteria for bulimia nervosa, and several reviews of the disorder have concluded that body image disturbance is a central feature (Fairburn & Garner, 1986; Schlesier-Stroop, 1984).

However, as with anorexia nervosa, recent researchers have questioned the significance of body image disturbance associated with bulimia nervosa (Hsu & Sobkiewicz, 1991).

**Equivalence of the Disturbance in AN and BN**

In a recent study by Williamson, Cubic, and Gleaves (1993), groups of anorexia and bulimia nervosa patients and normal controls were contrasted using the Body Image Assessment, a well validated silhouette measure of body image disturbance. The investigators found that, when controlling for actual body size, there were no statistically significant differences between anorexic and bulimic subjects in terms of perceptions of current or
ideal body sizes. However, both groups chose a larger current body size and a smaller ideal body size, relative to the normal control group. The authors concluded that the disturbance of body image is equivalent in these two clinical groups. Anorexics tend to be much thinner than bulimics, therefore statistical control of actual body size is necessary when contrasting these groups on measures of body image.

**Body Image Disturbance in Normal Populations**

In recent years, many researchers have examined body image disturbance in non-clinical populations. Several large scale studies have led to the description of what has been called a "normative discontent" with body size (Rodin, Silberstein, & Streigel-Moore, 1985). In a large study by Nielsen (1979), 56% of the women surveyed (aged 24-54) reported being on a diet. Cash, Winstead, and Janda (1986) conducted a nationwide survey of 30,000 individuals, and found that only 18% of the men and 7% of the women expressed little concern with their appearance. Women also scored lower than men on an overall physical appearance evaluation with 31% of the women giving an overall negative rating on this attribute. Subjects also gave their subjective weight category which was then compared with an objective category based on established norms. Women consistently overrated themselves, with 47%
of the objectively normal-weight women placing themselves in the overweight category and 40% of the underweight women put themselves in the normal-weight range. Similarly, in a study of teenage girls, Huenemann, Shapiro, Hampton, and Mitchell (1966) found approximately three-quarters expressing a strong desire to lose weight even though only one quarter were objectively classified as overweight.

Non-eating disordered subjects have also been found to overestimate their body size in laboratory experiments (Cash & Brown, 1987; Garner, Garfinkel, & Bonato, 1987; Hsu, 1982; Slade, 1985). Thompson and colleagues found that 95% of their sample of non-eating disordered women overestimated body size, with the greatest overestimation of waist, hips, and thighs (Thompson, 1986; Thompson & Spana, 1988). Overestimation of body size for females has been found to be approximately twice that of males (Thompson & Thompson, 1986).

Rodin and colleagues have noted that the preoccupation with weight and body image have reached such a proportion that they feel it can be considered a normal part of the female experience (Rodin et al. 1984; Silverstein, Peterson, & Perdue, 1986). They view this "normative discontent" as existing on a continuum, with
individuals on the high end of the continuum having a high risk for the development of an eating disorder.

**Correlates of Body Image Disturbance**

In non-eating disordered subjects, a wealth of research has addressed the connection between body image disturbance and eating dysfunction. In most studies to date, measures of appearance related disturbance have been found to correlate highly with indices of eating disturbance in women (Hesse-Biber, Clayton-Mathews, & Downey, 1988; Keeton, Cash, & Brown, 1991; Thompson & Psaltis, 1988). The exception to these findings is that studies that examined body size overestimation have not conclusively found an association with disordered eating (Thompson, 1990).

Other research has examined the relationship between body image disturbance and other psychological constructs such as depression and self-esteem in non-eating disorder populations. Measures of depression have been found to be highly correlated with subjective indices of body dissatisfaction and negative appearance evaluation (Marsella, Shizuru, Brennan, & Kameoka, 1981; Thompson & Psaltis, 1988). Size overestimation has also been found to positively correlate with depression (Taylor & Cooper, 1986) and negatively correlate with self-esteem (Thompson & Thompson, 1986).
Similar findings have occurred in eating disordered populations. Measures of body image disturbance have been found to correlate with low self esteem, depression, low ego strength, external locus of control, anxiety, eating pathology and neuroticism in anorexia nervosa subjects (Garner & Garfinkel, 1981; Thompson, 1990) and measures of body dissatisfaction has been found to correlate highly with measures of affective and personality disturbance in bulimia nervosa subjects (Gleaves, Williamson, & Barker, 1993a). Body dissatisfaction and overestimation has also been found to predict relapse in both anorexia nervosa (Slade & Russell, 1973) and bulimia nervosa (Freeman, Beach, Davis, & Solyom, 1985).

**Current Controversies Regarding Body Image Disturbance**

Though there is a wealth of research on the topic of body image disturbance, there are still many controversies. Meerman, Vandereycken, and Napierski, (1986) concluded that there has been no consistent, comprehensive empirical or theoretical line of inquiry for classification of the body image construct. The current state of the body image research has led at least one group of investigators (Hsu & Sobkiewicz, 1991) to conclude that it may be time for the concept to be abandoned as an etiological determinant for eating disorders.
Cash and colleagues (Cash & Brown, 1987; Keeton, Cash, & Brown, 1990) noted several factors that may have hindered the advancement of knowledge in this area of research. They note that one of the more significant problems has been researchers' frequent use of only one measure of body image, implicitly assuming that the construct is uni-dimensional. To date, the vast majority of research on body image has focused on body size distortion or overestimation, the perceptual aspect of the disturbance (Hsu & Sobkiewicz, 1991; Keeton et al., 1990).

Hsu and Sobkiewicz (1991) noted that the term overestimation of body size has often been used interchangeably with that of a disturbance of body image.

In contrast with much of the earlier research, Garner and Garfinkel (1981) noted two ways in which body image disturbance may be manifested. The first that they noted was body size distortion, which refers to a perceptual disturbance. The second was body dissatisfaction, or an affective dimension which refers to how an individual feels about his/her body, which can range from complete satisfaction to total disparagement. Since Garner and Garfinkel's report, a wealth of research has been conducted supporting the distinction between perceptual and affective dimensions of body image disturbance (Rosen, 1992; Thompson, 1990).
One unresolved issue has been the lack of convergence between perceptual measures and subjective indices of dissatisfaction. Generally, the correlations between the two have been found to be low and non-significant (Cash & Brown, 1987; Cash & Green, 1986; Fabian & Thompson, 1989; Thompson, 1992). Further, size estimation levels have not been found to be as predictive of eating disturbance as have dissatisfaction levels. Low correlations with clinically meaningful psychological variables have prompted several researchers to question the usefulness of the perceptual accuracy aspect of body image disturbance (Coovert et al., 1988; Penner et al., 1990; Thompson, 1992).

A problem with the previous investigations on the predictive power of body size distortion is the failure to examine the effects in the context of other body image variables. When attempting to predict body dissatisfaction or eating disturbance from body size distortion, it is essential to account for the effect of actual body size. An example can help illustrate this point. Consider a woman with a very small body size who has a distorted perception and sees herself as moderately larger than she actually is. Assuming that body dissatisfaction is correlated with actual body size (a consistent finding in body image research), a woman with a
much larger actual body size who did not overestimate her body size would report an equal or greater degree of body dissatisfaction than the smaller woman. Thus size distortion would appear to be uncorrelated with dissatisfaction. However, if the two women had the same body size, the one who distorted the most would see herself as the largest and report the greatest body dissatisfaction. Unconverted size estimates, which conceptually represent a linear combination of actual body size and perceptual accuracy, have consistently been found to be associated with body dissatisfaction (Ben-Tovin, Walker, Murray, & Chin, 1990; Coover et al., 1988; Williamson, Gleaves, Watkins, & Schlundt, 1993). Thus, when actual body size is controlled for, the effect of body size distortion becomes more clear and meaningful.

Another variable that should be considered when evaluating body dissatisfaction is an individual’s ideal body size. Returning to an example, if two women had the same actual body size and the same degree of body size distortion, but one had an extremely small ideal body size, then she would most likely report the greatest degree of body size dissatisfaction. The importance of the effect of ideal body size was supported by the finding that differences between estimates of current and ideal body size have been found to be better predictors of body
dissatisfaction than estimates of current body size alone or indices of actual body size (Williamson et al., in press). However, what has not been established is that perceptions of ideal size represent a different underlying dimension than body size distortion. That is, it is possible that women who choose a small ideal body size do so simply because of body size distortion (i.e. a small body size is perceived as being larger than it really is). If this were the case, then measures of ideal body size and body size distortion would actually be measuring the same underlying dimension. Thus, it is unclear if perceptions of an ideal body size represent a separate perceptual dimension.

Another unresolved issue is the role of fear of fatness in the overall construct of body image disturbance. Many of the earliest writers in the area of eating disorders described fear of fatness as being at the core of the psychopathology of the eating disorders (Crisp, 1967; Russell, 1970; Wilson, 1987). However, the construct seems to have been ignored in much of the body image research. More recently, researchers have the significance of fear of fatness as a determinant of the eating disorders. While Hsu and Sobkiewicz (1991) suggest that the construct be studied instead of body image disturbance, others have examined the way in which fear of
fatness may influence the other dimensions of body image disturbance. Activation of fear of fatness has been found to lead to increases in body size distortion and body dissatisfaction (McKenzie, Williamson, & Cubic, 1993). Thus, fear of fatness appears to be an important determinant of body image variables that should be included in the study of body image. How fear of fatness fits in a comprehensive model of body image disturbance has not been established, however.

Hsu's recommendation to abandon the concept of body image disturbance was based on the contention that overestimation of body size does not significantly explain body disparagement or eating problems characteristic of eating disorders. He concluded that overestimation has not facilitated our understanding of the psychopathology of the eating disorders. However, as noted above, this failure to predict other relevant clinical variables may be more due to the failure to study the phenomenon in a multidimensional context. Hsu suggesting that fear of fatness, pursuit of thinness, and body disparagement may be stronger predictors of disturbed eating patterns. In making this argument, Hsu appears to equate the terms body size distortion and body image disturbance. He failed to acknowledge that other researchers (e.g., Williamson et al., 1990) have provided theoretical models which include
the concepts of fear of fatness, body size overestimation, pursuit of thinness, and body disparagement within a broader multi-dimensional conceptualization of body image disturbance.

To summarize, it is suggested here that much of the confusion regarding the concept of body image disturbance may be largely due to the way in which the disturbance has previously been defined, conceptualized, and studied, particularly the failure to study the construct in a multidimensional context. Thus, instead of abandoning the concept altogether, it is suggested that body image be further studied as a multidimensional construct which may resolve some of the controversies and conflicting findings of earlier studies.

A Model for Body Image Disturbance

Williamson and colleagues (Williamson et al., 1990) have proposed a multidimensional model of body image disturbance. The model is comprised of four dimensions: fear of fatness, body size overestimation or distortion, preference for thinness, and body size dissatisfaction. The model proposed that a person's body dissatisfaction is a function of both body size overestimation and preference for thinness along with a person's actual body size. The model further proposes that fear of fatness functions as a moderator variable that determines an individuals body
size distortion and preference for thinness. The degree of a person's body dissatisfaction is thus determined by the degree of distortion, preference for thinness, fear of weight gain, and his/her actual body size. While the individual components have been generally described in the earlier discussion of previous research, they will each be described in more detail below.

**Body Size Distortion.** This dimension is generally conceptualized as the overestimation of actual body size. That is, individuals estimate that various body areas (or whole body) are larger than they actually are. Body size distortion is referenced to in the diagnostic criteria for anorexia nervosa as a "Disturbance in the way in which one's body weight, size, or shape is experienced, e.g., the person claims to "feel fat" even when emaciated, believes than one area of the body is "too fat" even when obviously underweight" (APA, 1987, p. 67). As noted, this construct has been addressed in most of previous research on body image. Techniques for assessing body size distortion usually require a subject to indicate their perception of body size which is then compared to a measurement of actual size (Ruff & Barrios, 1986) or to estimates of size based on normative data (Williamson, Davis, Goreczny, Bennett, & Gleaves, 1989). Both bulimics and anorexics have been found to exhibit body size
distortion relative to non-eating disordered samples (Williamson, Davis, Goreczny, & Blouin, 1989; Williamson, Cubic, & Gleaves, 1993).

Preference for Thinness. A dimension that has received less attention in the scientific literature is preference for thinness. It may be conceptualized as an individual's ideal body size which is used as a standard or ideal for judging satisfaction with current body size (Williamson et al., 1990). This concept is generally measured by having subjects rate an ideal body size or body shape. Anorexics and bulimics have been found to choose a smaller ideal body size and to score higher on attitudinal measures of drive for thinness (Garner, Olmsted, & Polivy, 1986; Williamson, Davis, Goreczny, & Blouin, 1989; Williamson et al., 1993; Williamson, Kelley, Davis, Ruggiero, & Blouin, 1985) when compared to control subjects.

Body Dissatisfaction. Body dissatisfaction, or body size dissatisfaction is an affective construct and is usually defined just as the name implies: a dissatisfaction with one's body, body size, or, possibly more importantly, dissatisfaction with one's perception of body size. Body size dissatisfaction may be measured by self report measures (Garner, Olmsted, Polivy, & Garfinkel, 1983), or by having individuals rate their
degree of satisfaction with their body as a whole or with individual body parts (Slade et al., 1990).

Eating disorder subjects have been found to report greater body dissatisfaction than controls, even when controlling for actual body size (Williamson et al., 1989, 1993). However, as described above, body dissatisfaction is also extremely prevalent in non-eating disordered populations. Body dissatisfaction has also been found to be highly correlated with dieting behavior in bulimia nervosa (Gleaves, Williamson, & Barker, 1993a) suggesting that body dissatisfaction may be a motivational variable for dieting. This relationship has also been suggested by Thompson (1990) and Rosen (1992).

Fear of Fatness. Fatness has been noted as a characteristic fear in eating disorder patients, and some have likened the eating disorders to a weight phobia or a morbid fear of fatness (Crisp, 1974, Morgan & Russell, 1975). The concept was first measured and examined empirically by Goldfarb, Dykens and Gerrard (1985). They developed an instrument for measuring fear of fatness and found that they could clearly discriminate between anorexic subjects and randomly selected female college students and could also differentiate between bulimics, repeat dieters, and non-dieting women. The mechanism
whereby fear of fatness leads to aberrant eating behavior was not examined.

Williamson et al. (1990) suggested that fear of fatness may indirectly affect body dissatisfaction by increasing judgements of actual size. Similar hypothesized effects have been discussed by Rosen (1992) and Slade (1982). This effect is based on an anxiety based conceptualization of eating disorders and body image disturbance and is consistent with cognitive research with anxiety disorders, where attentional biases for threatening stimuli unique to the concerns of specific anxiety disorders have been found (Foa & Kozack, 1986; MacLeod & Mathews, 1991; MacLeod, Mathews, & Tata, 1986; Mathews, Richards, & Eysenck, 1989). This line of research suggests that, if a person is unduly concerned about a particular domain of content, then attentional or perceptual biases are likely to develop (Williamson, Gleaves, & Lawson, 1991). Such biased perceptions have been observed for food related concerns among women with eating disorders (Gleaves, Williamson, & Barker, 1993b; Williamson et al. 1991). If fatness is seen as a feared stimulus or condition, then individuals with such a fear may demonstrate hypervigilance and overestimate signs of danger (i.e. their own current degree of fatness). Thus,
body size distortion would be an effect of fear of fatness.

Some previous research has supported the effects of fear of fatness on body size distortion. Consumption of a test meal (which is thought to activate fear of fatness), has been found to lead to significantly increased body size distortion for both anorexia nervosa (Crisp & Kalucy, 1974) and bulimia nervosa patients (Lohr & Barrios, 1988; McKenzie, Williamson, & Cubic, 1993). Williamson et al. (1990) also hypothesized that fear of fatness might similarly affect preference for thinness. However, the findings by McKenzie et al. (1993) did not support this hypothesis, and the authors concluded that preference for thinness may represent a more stable, trait-like construct.

The model proposed by Williamson et al. (1990) makes several predictions regarding body image measures. It predicts that the dimensions of body image disturbance are distinct though intercorrelated constructs. The model also predicts that an individual’s body dissatisfaction would be explained as a linear function of her actual body size, body size distortion, preference for thinness and fear of fatness. The model further suggests that restrictive eating could be explained as a linear function of body dissatisfaction. The present investigation was
designed to examine this multi-dimensional model using the structural modeling methodology described below in an attempt to establish the model's validity and help answer some of the remaining unresolved issues that have been presented.

**LISREL**

The term LISREL stands for linear structural relations. LISREL is a specific program for structural equation modeling developed by Joreskog and Sorbom (1989). The name LISREL has become synonymous with the technique, and they are often used interchangeably. The technique is also often referred to as causal modeling, or analysis of covariance structures. Structural equation modeling can be viewed as the product of the merging of two statistical approaches: confirmatory factor analysis and path analysis (Shatford & Evans, 1986). The approach has an advantage over path analysis because it allows for errors in the measurement of some variables, without assuming that any one variable is perfect (Shatford & Evans, 1986).

The basic objective of structural modeling is to provide a means of estimating the relationships among the underlying constructs of a hypothetical model. The technique generally uses maximum likelihood estimation to estimate the parameters of the model and attempts to establish the validity of the hypothesis of no differences
between the data and the model. Specifically, it compares the observed data covariance matrix with the matrix implied by the model to determine if the two are significantly different.

In using structural modeling, the various measures (referred to as indicator variables) are hypothesized to assess different constructs (referred to as latent variables). The relationship of the indicator variables to the latent variables comprises the measurement model. The structural model is the hypothesized causal pattern of the latent variables. LISREL allows for an evaluation of the measurement properties of the indicator variables. It takes into account equation errors, measurement errors, correlated measurement errors and can accommodate models with reciprocal causation (Hayduk, 1989; Shatford & Evans, 1986). Because of these capabilities, it has a clear superiority over path analysis (Bollen, 1989).

In line with the path analysis methodology, there are two kinds of latent variables in a structural equation model: exogenous, which may be thought of as independent variables or causes, and endogenous variables, which may be thought of as dependent variables or effects.

After LISREL computes the maximum likelihood estimates of the model parameters, several indices are provided to determine the fit of the model. The adequacy
of the measurement model can be determined by examining squared multiple correlations for each variable and the coefficient of determination for all of the observed variables jointly. These values range from zero to one with values close to one representing good models. The coefficient of determination is an indicator of how well the observed variables, in combination, serve as measuring instruments for all the latent variables jointly. It is a generalized indicator of reliability for the entire measurement model (Byrne, 1989).

The program also provides several indices of how well the data fit the model. Both the overall fit and the fit of individual components are examined. It is generally accepted that several indices should be examined to determine the overall fit of a model (Hayduk, 1989). Several of these indices are provided by or are easily derived from the LISREL program. The $X^2$ statistic tests the fit between the restricted hypothesized model and the sample data. A significant $X^2$ indicates a discrepancy between the model and the data. The goodness-of-fit index (GFI) is the ratio of model explained covariance to total covariance and ranges from 0.0 to 1.0. It is based on total sum of squares. The adjusted goodness-of-fit index (AGFI) is based on mean squares and, thus, adjusts for degrees of freedom. Although there are presently no well
established rules as to how high the GFI and AGFI need to be, Cuttance (1987) has suggested that models with an AGFI of less than .8 be regarded as inadequate and that most acceptable models appear to have an AGFI of greater than .90. The root mean square residual (RMR) indicates the average discrepancy between the elements of the sample and implied covariance matrices.

Several indices based on ratios of the model $X^2$ to that of the null model are often also used. These include the Tucker-Lewis index (TLI), the Bentler-Bonett index (BBI), and Bentler’s comparative fit index (CFI). Of more than 30 indices tested by Marsh, Balla, and McDonald (1988), the TLI was the only widely used index found to be relatively independent of sample size. Bentler (1990) reported similar efficiency for the CFI. General "rules of thumb" are that the values of the TLI, BBI, and CFI should not be less than .90 (Bentler, 1990; Bentler & Bonett, 1980).

Goodness-of-fit of the individual model parameters can be determined by examining t-values, standardized residuals, and modification indices. T-values suggest whether or not a parameter is significantly different from zero. Non-significant parameters can be considered unimportant to the model and can be fixed to zero (Byrne, 1989) although this should only be done if it is
theoretically justified to do so (Hayduk, 1987). Standardized (or normalized) residuals represent the discrepancy between the sample and the hypothesized covariance matrices. Specifically, they are the number of standard deviations the observed residuals are from the zero residuals that would exist if the model were a perfect fit (Byrne, 1989). Values greater than two are generally regarded as being statistically significant.

The program also points out what modifications in the individual parameters of the model can be made to improve the fit. Modification indices represent the expected drop in $X^2$ if a fixed parameter were freely estimated. A large drop in the chi-square relative to the degrees of freedom suggests improvement in the fit of the model. These modification indices can be a guide to improving the model. It is important to note that these changes should only be made if they are theoretically justified (Lomax, 1986) and that the procedure is no longer a confirmatory analysis after data based modifications are made.

**Rationale and Aims of the Present Investigation**

The purpose of the present investigation was to apply the structural modeling methodology and LISREL program to examine a proposed multidimensional model of body image disturbance. This analysis examined how well the data fit
the theoretical model, and indicated where problems with measurement occurred.

Hypotheses

Based on previous research and the model described above, five specific hypotheses were formulated. The first two hypotheses addressed the measurement model and the third, fourth, and fifth addressed causal paths of the structural model. In the structural modeling methodology, it is important to test models against alternative models (Hayduk, 1987). Thus, theoretical alternative hypotheses, where meaningful, were also tested.

Hypothesis 1. It was predicted that the measures of body image disturbance, as a whole, could be discriminated from a related construct (restrictive eating). This prediction was made to establish the validity of the construct of body image disturbance. The logical alternative to this hypothesis was that body image disturbance could not be discriminated from restrictive eating. Additional hypotheses were to be tested only if the data supported this initial prediction.

Hypothesis 2. It was predicted that the observed variables of body image disturbance would be found to measure four separate, but correlated, underlying dimensions: fear of fatness, body size distortion, preference for thinness, and body dissatisfaction. This
hypothesis was to be contrasted with two alternate hypotheses: A) that body image disturbance is a unidimensional construct, as it has been often treated in previous research; and B) that body image disturbance is a two dimensional construct as described by Garner and Garfinkel (1981) with underlying perceptual and affective dimensions.

Hypothesis 3. It was also predicted that both body size distortion and preference for thinness would be found to significantly affect overall body dissatisfaction, above and beyond the effect of actual body size. This hypothesis was supported by the recent finding by Williamson, Gleaves, Watkins, and Schlundt (1993) that measures of current and ideal body size both explained significant amounts of variance in overall body dissatisfaction. According to the current model, current body size was conceptualized as an estimate of actual body size plus an estimate of body size distortion. This hypothesis was to be tested only if the data had already been found to support hypotheses 1 and 2. The alternative to these hypothesized effects was that either body size distortion or preference for thinness did not directly affect body dissatisfaction and that body dissatisfaction increases only as a function of actual body size.
Hypothesis 4. It was further predicted that fear of fatness would be found to directly affect body size distortion. This effect was hypothesized by Williamson (1990), and the rationale was described in detail above. The body image literature has not provided a viable alternative to this hypothesis. In such a situation, Hayduk (1987) recommended creating a meaningful alternative. The hypothesis that was created and tested was that the reverse relationship existed between body size distortion and fear of fatness. That is, that body size distortion, along with actual body size, directly affected fear of fatness. This prediction was a viable alternative hypothesis because, if an individual overestimated her body size, this overestimation could lead to an increase in fear of fatness. Thus, in this alternative model, both of the affective dimensions (fear of fatness and body dissatisfaction) were conceptualized as being the effects of the perceptual dimensions. In this alternate model, fear of fatness would then directly affect restrictive behaviors, as opposed to the indirect effect from the hypothesized model.

Hypothesis 5. Finally, it was predicted that body dissatisfaction would be found to directly affect restrictive eating. This hypothesis was included largely to demonstrate the significance of body image disturbance
to eating behavior. The hypothesis follows from simple logic (people diet because they are unhappy with their bodies), longitudinal studies that have found body dissatisfaction to be the best predictor of the development of eating problems (Attie & Brooks-Gunn, 1989; Garner, Garfinkel, Rockert, & Olmsted, 1987; Striegel-Moore, Silberstein, Frensch, & Rodin, 1989), and recent structural modeling analyses supporting a strong relationship between body dissatisfaction and restrictive behaviors (Gleaves & Eberenz, 1993; Gleaves, Williamson, & Barker, 1993a). No alternative was tested regarding this hypothesis. The hypothesized structural model and the alternative model with the reverse relationship between fear of fatness and body size distortion are presented in Figure 1.
Hypothesized Structural Model

Alternative Structural Model

Figure 1. Hypothesized and Alternative Structural Models
Method

Subjects

A total of 175 women, ages 14 to 42 (mean = 21.1) participated as subjects in this study. Only women with a body mass index of less than 30 were included because some of the indicators were not validated on samples with a greater body mass. Both clinical (eating disorder) and non-clinical subjects were included in order to have an adequate amount of variability in the indicator variables, and because research has suggested that body image disturbance is present and a significant problem in both clinical and non-clinical populations.

Eating disorder subjects were 54 women who presented for treatment at one of two psychiatric hospitals (n = 9 and n = 38), or were undergraduate students who were recruited as normals, but were found to meet the diagnostic criteria for an eating disorder (n = 7). Clinical subjects were diagnosed, based on a structured interview, as meeting the DSM-III-R criteria for bulimia nervosa (n = 23), anorexia nervosa (n = 14), both anorexia and bulimia nervosa (n = 2) or eating disorder not otherwise specified (n = 15). One of the hospitals was located in Baton Rouge, LA and the other hospital was located in Philadelphia, PA. Subjects from the Philadelphia location were paid $5.00 for their participation. Subjects from the two locations were
contrasted on the proposed indicators for the study using a multivariate analysis of variance (MANOVA). The test was non-significant $F(13,40) = 1.9, p > .05$, as were all of the univariate comparisons. The different diagnostic groups were also contrasted using analysis of variance. While there was a significant effect for body mass index, $F(2,51) = 18.31, p < .001$, with the anorexia nervosa patients being significantly smaller than the bulimia nervosa or atypical patients, a MANOVA with the remainder of the body image indicators was non-significant, $F(20,82) = 1.44, p > .05$, suggesting that all clinical subjects were similar on these variables.

Non-eating disorder subjects were 121 women contacted through undergraduate courses in psychology and were offered extra credit for their participation. For this study, efforts were not made to screen out eating disorder symptomatology, as the goal was to attain a broad sampling of the population with a broad range of body image disturbance. As noted above, seven undergraduate students that were found to meet the diagnostic criteria for an eating disorder were included as eating disorder subjects. These subjects were given referral information regarding treatment.

For descriptive purposes, clinical and non-clinical subjects were contrasted using a MANOVA with the proposed
indicators as dependent variables. The multivariate effect was highly significant, $F(13,161) = 24.70, p < .001$. Subject characteristics and univariate comparisons of clinical and non-clinical subjects are presented in Table 1. As can be seen, clinical subjects scored significantly higher than non-clinicals on each of the indicator variables except BMI and the measures of ideal body size, where they scored significantly lower.

**Assessment Instruments**

The Body Image Assessment Procedure (BIA; Williamson, Davis, Bennett, Goreczny, & Gleaves, 1989).

The BIA is a simple method for assessing body image disturbance. The procedure involves selection of a silhouette of a female body frame which most closely resembles the subject’s perception of her current (CBS) and ideal (IBS) body sizes. A discrepancy score (CBS-IBS) is also calculated. The procedure is simple to use and economical in time for administration. It has been found to differentiate bulimia nervosa patients from normals and bulimic binge-eaters (Davis, Williamson, Goreczny, & Bennett, 1989). Test-retest reliability has been found to be .90 for CBS and .71 for IBS. High CBS scores and low IBS scores have been found to correlate with elevated
Table 1
Sample Characteristics and Univariate Comparisons on Indicator Variables

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Clinical</th>
<th>Non-Clinical</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
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<tr>
<td>BMI</td>
<td>20.2 (3.2)</td>
<td>21.9 (2.7)</td>
<td>14.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>GFFS</td>
<td>34.2 (4.4)</td>
<td>23.2 (6.6)</td>
<td>166.2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>BITS PDI</td>
<td>11.6 (10.8)</td>
<td>-.1 (4.7)</td>
<td>57.2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>BIA PDI</td>
<td>1.6 (2.2)</td>
<td>-.2 (1.6)</td>
<td>29.8</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>BIA IBS</td>
<td>2.4 (1.1)</td>
<td>3.4 (1.1)</td>
<td>34.2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>BITS IBS</td>
<td>63.1 (14.8)</td>
<td>67.3 (7.3)</td>
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</tr>
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<td>BSS BODY</td>
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</tr>
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</tr>
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<td>EDI BD</td>
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<td>17.6 (2.9)</td>
<td>10.5 (5.2)</td>
<td>84.3</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Note 1: df = (1,173)

Note 2: Numbers in parentheses are standard deviations

Note 3: GFFS = Goldfarb Fear of Fat, BIA PDI = Perceptual distortion from the Body Image Assessment; BITS PDI = perceptual distortion index from the Body Image Testing System; BIA IBS = ideal body size from the BIA; BITS IDEAL = ideal body size from the BITS; EDI BD = body dissatisfaction scale from the EDI; BSS BODY = body factor from the Body Satisfaction Scale; BITS BODY = Satisfaction Ratings from the BITS; BULFAST = Fasting factor from the Bulimia Test-Revised; TFEQR = restraint factor from the Three Factor Eating Questionnaire
BULIT and EAT scores (Williamson, Davis, et al., 1989) a condition suggestive of bulimia nervosa symptomatology. The IBS score and a deviation score (see below) was used in the present investigation.

The Body Image Testing System (BITS; Schlundt & Bell, 1988). The BITS is a microcomputer program for assessing both perceptual and affective components of body image. The program generates frontal view and side view silhouettes of a human body and subjects can enlarge or shrink the body parts from nine different regions via the computer control system. Using this program, subjects can create images based on their perceived current and ideal body size. Subjects are also instructed to provide subjective ratings of satisfaction with each of the nine body parts. The authors have developed a perceptual distortion index (PDI) by taking the difference between actual body size scores and scores predicted from height, weight, and body mass. Preliminary data suggests good reliability and validity for the BITS (Schlundt & Bell, 1988). The PDI, Ideal Body Size score and Satisfaction ratings were used in the present investigation.

The Eating Disorder Inventory (EDI; Garner, Olmsted, & Polivy, 1983) (See appendix A). The EDI, is a 64 item multi-dimensional inventory that is designed to measure psychological characteristics associated with anorexia and
bulimia nervosa. The EDI consists of three subscales (Drive for Thinness, Bulimia, Body Dissatisfaction) that measure behavioral and symptomatic patterns of bulimia and anorexia, and five subscales (Ineffectiveness, Perfectionism, Interpersonal Distrust, Interoceptive Awareness, Maturity Fears) that measure psychological factors believed to be related to these eating disorders. These scales have been shown to differentiate bulimics and normals (Garner et al. 1983; Gross, Rosen, Leitenberg, & Willmuth, 1986). The Body Dissatisfaction scale was used in the present investigation.

The Bulimia Test-Revised (BULIT-R: Thelen, Farmer, Wonderlich, & Smith, 1991) (See appendix B). The BULIT-R is a 28 item self report measure designed to assess eating behaviors and attitudes related to bulimia. The BULIT-R has been shown to differentiate bulimics from normals (Thelen et al., 1991). The BULIT-R was used as a descriptive measure and to help make the diagnosis of Bulimia Nervosa. A score of 102 is recommended for such purposes (Thelen et al., 1991). The BULIT has also been factor analyzed, and the fasting factor was used as an indicator for restrictive behaviors.

The Eating Attitudes Test (EAT; Garner & Garfinkel, 1979) (See appendix C). The EAT is a 40 item scale to assess anorexic tendencies regarding eating. It is one of
the most widely used assessment instruments for eating disorders. A cutoff of 30 has been recommended for screening out anorexic symptomatology. Test retest reliability of the test has been reported to be .79 for a clinical sample and .94 for a sample of anorexics and normal subjects. The EAT has been factor analyzed and the Dieting factor was used as an indicator of restrictive eating.

**The Body Satisfaction Scale (BSS; Slade, Dewey, Newton, Brodie, & Keimle, 1990)** (See appendix D). The BSS is a simple paper-and-pencil test designed to measure satisfaction or dissatisfaction with 16 body parts. There are three sub-scales: "general", "head" and "body". The internal consistency and construct validity of the BSS is satisfactory (Slade et al, 1990). The "Body" scale was used in the present investigation.

**The Body Shape Questionnaire (BSQ; Cooper, Taylor, Cooper, & Fairburn, 1987)**. The BSQ is a self report measure designed to measure concerns with body shape. It has been validated on samples of anorexia and bulimia nervosa patients as well as a non-eating disordered community sample. The concurrent and discriminant validity of the BSQ have been shown to be good.

**The Three Factor Eating Questionnaire (TFEQ; Stunkard & Messick, 1985)**. The TFEQ is a 51 item questionnaire
which measures three dimensions of eating behavior: "cognitive restraint of eating", "disinhibition", and "hunger". These factors have been found to be stable. The TFEQ has been found to be superior to the commonly used Restraint Scale (Herman & Mack, 1975). The "cognitive restraint of eating" factor of the TFEQ was used in the present investigation.

The Goldfarb Fear of Fat Scale (GFFS: Goldfarb, Dykens, & Gerrard, 1985). The GFFS is a ten item self-report questionnaire designed to measure fear of fatness. The scale has demonstrated reliability and has been found to significantly differentiate anorexic, bulimic, repeat dieters, and non-dieting women.

The Interview for Diagnosis of Eating Disorders (IDED: Williamson, 1990). The IDED is a structured interview for diagnosing anorexia nervosa, bulimia nervosa, and compulsive overeating. The questions are all based on the DSM-III-R criteria. Test-retest reliability and discriminant validity has been established for the IDED (Williamson, Davis, Norris, & Van Buren, 1990).

Experimental Design and Procedures

Data were collected on the eating disorder subjects that presented for treatment during their eating disorder evaluation or during the course of their stay in the hospital. They were administered the BULIT, EAT, GFFS,
EDI, BSS, BSQ, TFEQ, BITS and BIA by a graduate student in clinical psychology or an undergraduate research assistant. Non-clinical subjects were those undergraduate psychology students that volunteered for extra credit. They completed the same self-report and body image assessment measures and were debriefed following participation. Non-clinical subjects that exceeded the cutoffs for the BULIT-R or EAT were interviewed by a masters level graduate student using the IDED and were offered treatment if it was determined that they had an eating disorder.

Generation of deviation scores from the BIA. Data collected for an earlier investigation (Williamson, Davis, et al, 1989) from 423 normal female subjects was used to generate a deviation score as a measure of body size distortion or overestimation. The data were first subjected to a linear regression analysis with Body Mass Index (BMI; weight/height$^2$) as the predictor and CBS values as the criterion variable. The regression equation from this analysis was then used to generate a predicted CBS value, based on a subject's BMI. The difference between a subject's reported CBS and the predicted CBS was used as a deviation score which represented a normative perceptual distortion.
Initial Indicators for Latent Dimensions. Indicators for body size distortion were (a) the Perceptual Distortion Index from the BITS (BITS PDI), and (b) deviation scores for CBS (BIA PDI) derived from the regression equation as described above. Indicators for preference for thinness were (a) BITS Ideal Body Size scores (BITS Ideal), and (b) BIA Raw ideal body size scores (BIA Ideal). For body dissatisfaction, indicators were (a) the body dissatisfaction scale from the EDI (EDI BD), (b) satisfaction ratings from the BITS (BITS BODY), and (c) the Body Factor from the Body Satisfaction Scale (BSS BODY). Indicators for fear of fatness were (a) the Goldfarb Fear of Fatness Scale (GFFS), and (b) the Body Shape Questionnaire (BSQ). For restrictive eating, indicators were (a) the EAT Dieting factor (EAT DIET), (b) the TFEQ Restraint factor (TFEQ-R), (c) the EDI Drive for thinness scale (EDI DT), and (d) the BULIT fasting factor (BUL FAST). Finally, the indicator for actual body size was body mass index (BMI).

Data Analysis

The structural modelling analyses were performed using the LISREL 7 program (Joreskog & Sorbom, 1989). A sequential approach such as that described by Anderson and Gerbing (1988), Bollen (1989) or Lomax (1982) was used. For the examination of the structural model, the data were
analyzed as an "all Y model" (see Hayduk, 1987). All factor loadings refer to the LAMDA Y matrix. Causal paths refer to loadings of the BETA matrix. This strategy was used to simplify the process of model specification.

Examining the Quality of the Indicators. As a preliminary step to examine the quality of the indicators, the correlation matrix of all the variables was examined and an exploratory factor analysis was performed. Based on the results of these analyses and an item analysis and a recently completed factor analytic investigation (Williamson, Barker, & Bertman, 1993), it was determined that the BSQ was a poor measure of fear of fatness in that it appeared to measure a wide range of constructs including dieting behavior and body dissatisfaction. An item level principle components analysis of the BSQ was also performed, but the results did not yield a factor that appeared to purely measure fear of fatness. Because it is preferable to use indicators that measure only one underlying dimension (Anderson & Gerbing, 1988) the BSQ was not included in further analyses.

There was also a problem with the Drive for Thinness Scale of the EDI. It appeared to be confounded by also measuring fear of fatness. It included items such as "I am terrified of gaining weight", and " If I gain a pound,
I worry that I will keep gaining". Because of these confounds, it was also eliminated from further analyses.

Testing for Model Invariance Across Groups. Both clinical and non-clinical subjects were included in the sample to increase the amount of variability among the indicator. However, to justify combining the two samples, it was also necessary to rule out the possibility that the factor structure differed for the two groups. Box's M test was performed to compare the variance-covariance matrices of the two groups. The chi-square statistic was significant $X^2 (66) = 104.20, p = .002$, suggesting that the variance-covariance matrices were not equivalent for the normal and clinical groups. However, given the fact that the sample variances differed for several of the indicators (see standard deviations in Table 1), the finding of a difference in the variance-covariance matrices was not unexpected and did not necessarily suggest that the nature of the relationship between underlying variables differed for the two groups. It could have only suggested that the variances or covariances among indicators or dimensions were simply less in one sample or another. However, the possibility that there was a different relationship between observed variables or underlying dimensions could not be ruled out. Thus, it was determined to initially analyze the data both
as a combined sample and separately for the two samples, and to further examine group differences.

Examination of the Measurement Model. Hypotheses 1 and 2 stated that body image, as a whole, could be distinguished from restrictive eating, and that the body image variables would best fit a four dimensional model with latent dimensions fear of fatness, body size distortion, preference for thinness and body dissatisfaction. To test these hypotheses, a series of "nested" confirmatory factor analysis models were examined to compare the fit of the proposed model against alternative models (Anderson & Gerbing, 1988; Hayduk, 1987). Changes in the Chi-square value were examined to determine relative changes in fit. In all of these analyses, actual body size was included as a separate dimension, which was measured by BMI. It was included for descriptive purposes and so that the measurement model could be compared with the structural models where actual body size was included to control for its effects. For all of the analyses, the error term for BMI was fixed to zero, assuming that it was measured without error.

This series of nested measurement models is depicted in Figure 2. To first determine if measures of body image disturbance could be distinguished from restrictive eating
Figure 2a. Body Image Disturbance and Restrictive Eating Indicators all Loading on One Dimension

Figure 2b. One Body Image Disturbance Dimension

Figure 2c. Perceptual and Affective Body Image Disturbance Dimensions

Figure 2d. Four Body Image Disturbance Dimensions (Hypothesized Model)

Figure 2. Sequence of Nested Measurement Models
the data for the complete sample were analyzed with all of the body image indicators and restrictive eating indicators loading on a single dimension (Figure 2a) and then compared with a model with all of the body image indicators loading on one dimension and the restrictive behaviors indicators on a second (Figure 2b). The body image variables were then specified to measure two dimensions (affective and perceptual; Figure 2c). The affective and perceptual dimensions were then sequentially broken down into the four hypothesized body image dimensions: body size distortion, preference for thinness, fear of fatness, and body dissatisfaction (figure 2d). When the GFFS was used as the only indicator measuring fear of fatness, its error term was fixed to equal .10, which assumed moderately high but less than perfect reliability of the indicator. The same process of sequential analysis of nested models was then followed for the clinical and non-clinical sub-samples separately.

**Examination of Specific Hypothesized Effects.**

Hypotheses 3, 4, and 5 concerned specific relationships among the latent dimensions. To test these hypothesis, the data were re-specified as a causal model. Paths of the BETA (causal paths) matrix were freed in accordance with the hypothesized effects (see figure 1). Exogenous variables in all models tested were allowed to correlate
by freeing the appropriate paths of the PSI (residual correlation) matrix. All other off-diagonal elements of the PSI matrix were fixed to zero.
Results

The Number of Body Image Dimensions

The results of the analyses of the measurement model with the total sample are presented in Table 2. The drop in chi-square when the body image variables were separated from the restrictive eating variables was statistically significant, $X^2 (2) = 41.83$, $p < .0001$. This effect demonstrated that body image disturbance (as a whole) could be discriminated from a related construct. Separating the body image measures into affective and perceptual dimensions also led to a significant decrease in the chi-square value, $X^2 (3) = 93.95$, $p < .0001$. Thus, the fit of a two dimensional model (affective and perceptual) of body image disturbance was superior to that of a unidimensional model. Separating fear of fatness and body dissatisfaction led to a further significant improvement in fit, $X^2 (3) = 56.44$, $p < .0001$. Finally, separating the body size distortion and preference for thinness dimensions also led to a significant chi-square reduction, $X^2 (5) = 42.29$, $p < .0001$. As can be seen in Table 2, all goodness-of-fit indices supported the hypothesized model with four separate body image dimensions, relative to the other models.

This final measurement model was further examined to determine overall fit. All the loadings of the Lambda Y
Table 2

Goodness-of-fit Indices for Nested Measurement Models with Total Sample

<table>
<thead>
<tr>
<th>Model</th>
<th>df</th>
<th>X^2</th>
<th>GFI</th>
<th>AGFI</th>
<th>BBI</th>
<th>TLI</th>
<th>CFI</th>
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<tbody>
<tr>
<td>Null</td>
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<td>1</td>
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<td>107.03</td>
<td>.91</td>
<td>.83</td>
<td>.92</td>
<td>.92</td>
<td>.95</td>
</tr>
</tbody>
</table>

Note: GFI = Goodness-of-fit Index; AGFI = Adjusted Goodness-of-fit Index; TLI = Tucker Lewis Index; BBI = Bentler-Bonett Index; CFI = Comparative Fit Index

Model 1 = Body Image and restrictive eating indicators loading on one dimension (As in figure 3a).
Model 2 = Body Image indicators on one dimension and restrictive behaviors on a second (As in figure 3b).
Model 3 = As above but separating body image variables into affective and perceptual dimensions (As in figure 3c).
Model 4 = As above but separating Fear of fatness and body dissatisfaction into separate dimensions.
Model 5 = As above but separating body size distortion and preference for thinness dimensions (Hypothesized model, as depicted in figure 3d).
(factor loading) matrix were statistically significant. These data are presented in Table 3. They were also sufficiently high to suggest a very stable solution (Guadagnoli & Velicer, 1988). Squared multiple correlations for the indicators (the amount of variance accounted for each variable) ranged from .34 to .86 with the total coefficient of determination of .994. Only, four (7%) of the standardized residuals were statistically significant, which suggested that they were largely due to chance. The correlation matrix for the dimensions is presented in Table 4.

The high correlation between restrictive eating and fear of fatness was not expected. To make sure that these constructs represented separate dimensions, one additional model was tested with the indicators of fear of fatness and restrictive behaviors loading on one dimension. The increase in Chi-square was statistically significant, $X^2 (4) = 14.53, p < .01$, suggesting that the fit was better if the dimensions were left separate.

To further test for discriminant validity between dimensions, confidence intervals (+ or - 2 standard errors) (Anderson & Gerbing, 1988) and estimates of average variance extracted (Fornell & Larcker, 1981) were examined. Anderson and Gerbing (1988) noted that discriminant validity can be further established if the
Table 3
Factor Loadings for Measurement Model with Total Sample
(Standardized Solution)

<table>
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</tr>
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<td></td>
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</tbody>
</table>

Note 1: Dimensions: 1 = Fear of Fatness; 2 = Body Size Distortion; 3 = Preference for Thinness; 4 = Body Dissatisfaction; 5 = Restrictive Eating; 6 = Actual Body Size

Note 2: GFFS = Goldfarb Fear of Fat, BIA PDI = Perceptual distortion from the Body Image Assessment; BITS PDI = perceptual distortion index from the Body Image Testing System; BIA IBS = ideal body size from the BIA; BITS IDEAL = ideal body size from the BITS; EDI BD = body dissatisfaction scale from the EDI; BSS BODY = body factor from the Body Satisfaction Scale; BITS BODY = Satisfaction Ratings from the BITS; BULFAST = Fasting factor from the Bulimia Test-Revised; TFEQR = restraint factor from the Three Factor Eating Questionnaire
Table 4
Correlations Among Dimensions (Standardized Loadings of the PHI-Matrix) for the Total Sample

<table>
<thead>
<tr>
<th>Dimension</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
<tr>
<td>1.</td>
<td>.60*</td>
<td>-.38*</td>
<td>.83*</td>
<td>.92*</td>
<td>-.08</td>
</tr>
<tr>
<td>2.</td>
<td>-</td>
<td>-.46*</td>
<td>.71*</td>
<td>.63*</td>
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<tr>
<td>3.</td>
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<td>-.55*</td>
<td>.40*</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>-</td>
<td></td>
<td>.81*</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>-</td>
<td></td>
<td></td>
<td>-.14</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>-</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note: Significant Estimates are Denoted with an Asterisk

Dimensions: 1 = Fear of Fatness; 2 = Body Size Distortion; 3 = Preference for Thinness; 4 = Body Dissatisfaction; 5 = Restrictive Eating; 6 = Actual Body Size
confidence interval around the correlation estimate between two factors does not include 1.0. Fornell and Larcker (1981) suggested that further evidence of discriminant validity exists if the average variance extracted between two factors is greater than the square of the estimate of the correlation between the two factors. These tests supported the discriminant validity between each of the body image dimensions. None of the confidence intervals included 1.0 and the average variance extracted for each pair of correlated factors was greater than the squared factor correlation. However, both of these indices failed to further support discriminant validity between the fear of fatness and restrictive eating dimensions.

When the measurement model was examined for the clinical and non-clinical sub-samples, results regarding the number of factors were identical to those when the samples were combined. All goodness-of-fit indices supported the hypothesized model with four separate body image dimensions and differences in the Chi-square statistic were significant as with the total sample. Examination of confidence intervals and average extracted also supported the discriminant validity of the body image dimensions. For the interested reader, Tables presenting
goodness-of-fit statistics for the clinical and non-clinical samples are presented in Appendix E.

The fit of the final measurement model for the clinical and non-clinical sample was then directly compared using the procedure suggested by Bollen (1989) or Hayduk (1987). The two sub-samples were analyzed in a "stacked" fashion, first allowing all parameters to be estimated separately, and then sequentially constraining the LAMBDA X (factor loadings) and PHI (correlations among factors) matrices to be invariant across the two groups. If constraining two matrices to be invariant leads to a significant increase the Chi-square value, one could conclude that the matrices are not equivalent for the two groups.

Constraining the LAMBDA X (factor loadings) matrix led to a non-significant decrease in model fit, \( X^2 (6) = 4.32, p > .05 \), suggesting that the factor loadings for the six dimensions did not differ for the two samples. Thus, given this finding and the results of the Chi-square difference tests with the two sub-samples, one could conclude that the clinical and non-clinical samples did not appear to differ in terms of the number of factors or in terms of the factor loadings. However, constraining the PHI matrix (along with the LAMBDA X matrix) to be invariant led to a significant decrease in fit, \( X^2 (21) = \)
57.6, \( p < .001 \), suggesting that the factor correlation matrix for the two samples was not equivalent. These matrices for the two samples are presented in Table 5. To determine where significant differences occurred, each of the correlations was sequentially examined by constraining it to be equal across the two groups and examining the increase in Chi-square. Of the 15 possible factor correlations, two appeared to be different for the two groups. Both of these correlations included the preference for thinness dimension; its correlation with the body dissatisfaction and body size distortion dimensions differed for the two groups. In both cases, the correlation was higher in the clinical sample.

The six variance terms of the PHI matrix were then examined. Using the same procedure described above, it was determined that the variance estimate for preference for thinness was higher for the clinical sample than for the non-clinicals. Thus, it appeared that the two differences found between clinicals and non-clinicals were simply due to differences in variance, which were expected given the nature of the samples. Thus, it was concluded that the two groups did not differ in terms of the underlying structural model and the two groups were then analyzed only as a combined sample in all further analyses.
Table 5

Correlations Among Dimensions for Clinical and Non-clinical Sub-samples

<table>
<thead>
<tr>
<th>Dimension</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-clinicals (n = 121)</strong></td>
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<tr>
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<td>.22*</td>
<td>-.49*</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>-.07</td>
<td>-.24</td>
<td>.38*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>.66*</td>
<td>.32*</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5.</td>
<td>-.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clinicals (n = 54)</strong></td>
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<td></td>
</tr>
<tr>
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<td>.47*</td>
<td>.72*</td>
<td>-.07</td>
</tr>
<tr>
<td>2.</td>
<td>-.47*</td>
<td>.76*</td>
<td>.32</td>
<td>-.24</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>-.48*</td>
<td>-.52*</td>
<td>.23</td>
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</tr>
<tr>
<td>4.</td>
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<td>-.16</td>
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</tr>
</tbody>
</table>

Note: Significant Estimates are denoted with an Asterisk

Dimensions: 1 = Fear of Fatness; 2 = Body Size Distortion; 3 = Preference for Thinness; 4 = Body Dissatisfaction; 5 = Restrictive Eating; 6 = Actual Body Size
Specific Hypothesized Effects

Goodness-of-fit indices for the structural models are presented in Table 6. As can be seen, the hypothesized structural model yielded a Chi-square of 239.63 with a GFI of .83. The increase in Chi-square, relative to the measurement model, was statistically significant, $X^2 (8) = 132.6, p < .0001$. Examination of the modification indices suggested the model could be significantly improved by freeing the path from fear of fatness to restrictive eating. As there was a theoretical justification for making this modification, the path was freed. The reduction in Chi-square was statistically significant, $X^2 (1) = 75.79, p < .0001$, suggesting a significant improvement to the model. No other modifications could be justified on theoretical grounds. The squared multiple correlations for the body size distortion, body dissatisfaction, and restrictive eating dimensions were .38, .98, and .86 respectively. This model, with standardized LISREL estimated is depicted in Figure 3.

As can be seen in Figure 3, both body size distortion and preference for thinness appeared to directly affect body size dissatisfaction: the path estimates were both statistically significant. To test the alternative to hypothesis 2, each of these two paths was then sequentially fixed to zero (specifying that the variable
### Table 6

**Goodness-of-fit Indices for Structural Models**

<table>
<thead>
<tr>
<th>Model</th>
<th>df</th>
<th>$X^2$</th>
<th>GFI</th>
<th>AGFI</th>
<th>BBI</th>
<th>TLI</th>
<th>CFI</th>
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<tbody>
<tr>
<td>Null</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>49</td>
<td>239.63</td>
<td>.83</td>
<td>.73</td>
<td>.83</td>
<td>.81</td>
<td>.86</td>
</tr>
<tr>
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</tr>
<tr>
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<td>.92</td>
<td>.94</td>
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</tbody>
</table>

*Note: GFI = Goodness-of-fit Index; AGFI = Adjusted Goodness-of-fit Index; TLI = Tucker Lewis Index; BBI = Bentler-Bonett Index; CFI = Comparative Fit Index*

- **Model 1** = Full Hypothesized Model (as in Figure 2a)
- **Model 2** = Model 1 with path from fear of fatness to restrictive eating freed.
- **Model 3** = Fear of fatness as a effect of body size distortion and actual body size and a cause of restrictive eating (as in Figure 2b)
- **Model 4** = Final model, same as above with path from fear of fatness to body dissatisfaction freed.
Fear of Fatness

Fatness

Body Size Distortion

Restrictive Eating

Actual Body Size

Body Disatisfaction

Preference for Thinness

Note: Significant Parameter Estimates are Denoted with an Asterisk

Figure 3. Standardized LISREL Estimates for Hypothesized Structural Model (with one modification)
did not affect body dissatisfaction) and the model was re-estimated. Fixing the path from body size distortion led to a significant decrease in fit, $X^2 (1) = 32.92, p < .0001$, as did fixing the path from preference for thinness, $X^2 (1) = 24.99, p < .0001$. Thus, both variables appeared to directly affect body dissatisfaction.

Consistent with Hypothesis 5, body dissatisfaction appeared to directly affect restrictive eating. The parameter estimate was statistically significant, and fixing it to zero led to a significant decrease in model fit, $X^2 (1) = 3.86, p < .05$.

The alternative model, where the relationship between body size distortion and fear of fatness was reversed, produced a chi-square of 144.53 with 47 degrees of freedom. The difference between this value and that of the initial model (after its modification) was statistically significant, $X^2 (1) = 18.31, p < .001$, suggesting a better fit with the data for the alternative model. The modification indices suggested that the model could be improved by freeing the path from fear of fatness to body dissatisfaction. As there was theoretical justification for the effect, the path was freed. The increase in fit was significant, $X^2 (1) = 18.79, p < .001$.

There were no other suggested modifications that could be theoretically justified. The squared multiple
correlations for the fear of fatness, body dissatisfaction and restrictive behaviors dimensions were .42, .84, and .85 respectively. This final model with standardized LISREL estimates is depicted in Figure 4. As can be seen in the figure, the paths related to hypotheses 3, 4, and 5, were all significant. Fixing any of these to zero also led to a significant increase in the Chi-square value, suggesting that each contributed to the overall fit of the model.
Note: All Parameter Estimates were Statistically Significant (T-Values greater than 2.0)

Figure 4. Final Structural Model with Standardized LISREL Estimates
Discussion

Before discussing the results, a few problems and limitations of the study need to be addressed. The main limitations are those of the structural modeling methodology, particularly those related to the hypothesized causal relationships between the variables. While it is impossible to prove causality in a structural modeling analysis, a causal relationship can be supported or unsupported by the data. However, even when a model appears to fit the data well, one must not rule out the possibility that another model may fit the data equally well. Given this possibility, the results should be interpreted with caution.

There are certain conditions to which one must strive in order to support a causal relationship among variables. Bollen (1989) suggested the need to demonstrate association, direction of causation, and isolation. Association was demonstrated for all of the hypothesized effects by virtue of the statistically significant parameter estimates. The condition of direction of causation should then be considered. While direction of causation is difficult to establish, temporality can be an important fact. That is, a cause must precede an effect.

Considering the variables in the study, some support exists for the temporal relationship between the dimensions for several of the hypothesized effects. The
strongest support exists for the hypothesized relationship between body dissatisfaction and restrictive eating. Longitudinal studies have found body dissatisfaction to be the best predictor of the development of disordered eating (Attie, & Brooks-Gunn, 1989; Garner, Garfinkel, Rockert, & Olmsted, 1987; Striegel-Moore, Silberstein, Frensch, & Rodin, 1989). Given the self minus ideal conceptualization of body dissatisfaction (Williamson et al., 1993), changes in preference for thinness or body size distortion would, by definition, lead to changes in body dissatisfaction.

The temporal relationship between fear of fatness and body size distortion is less clear. The theory suggests that the fear leads to the perceptual bias. However, as noted in the discussion of the alternate hypotheses, it is easy to understand how a distorted perception of body size could lead to an increased fear of fatness. Laboratory experiments have suggested that manipulations of fear of fatness have led to increases in body size distortion (Crisp & Kalucy, 1974; Haimovitz, Lansky, & O’Reilly, 1993; McKenzie et al., 1993). These experiments generally have the subjects consume a feared food and examine changes in body size distortion and fear of fatness. However, McKenzie et al. (1993) actually found that fear of fatness did not increase after the experimental
manipulation, whereas body size distortion did. The authors noted, however, that the failure to find increases in fear of fatness could have been due to the ceiling effect of the instrument used. Even if both variables (fear of fatness and body size distortion) are found to increase in response to an experimental manipulation, one cannot conclude that one variable caused the other. Thus, the theoretical support for the directional nature of the relationship between fear of fatness and body size distortion is non-conclusive, given research evidence at this point.

Concerning the condition of isolation, to truly isolate a dependent variable from all influences except a single explanatory variable is impossible in reality, and one can really only strive for "pseudo-isolation" by correctly specifying the model and assuming that omitted determinants are uncorrelated with exogenous variables in the equation (Bollen, 1989). This assumption is somewhat dubious for the current investigation, considering what is now known about the constructs being studied.

Problems with the condition of isolation may have led to the poorer fit of the causal model relative to the measurement model. To explain how or why this effect may have occurred, it is necessary to briefly discuss what the re-specification of the model meant in terms of the
relationships between dimensions. In the confirmatory factor analysis (measurement) model, all of the dimensions were allowed to correlate with one another. In the causal model, the parameters were constrained to co-vary only in the way specified by the model. Some of the observed covariance between the dimensions may have actually been due to omitted variables affecting both exogenous and endogenous dimensions.

What might these omitted variables be? Recent research would suggest that certain psychological or emotional variables may have significant effects on body image variables. For example, Davis, Durnin, Gurevich, Le Marie, & Dionne, (in press) have recently found neuroticism to be as powerful a predictor of body dissatisfaction as actual body size. Gleaves et al. (1993a) also found body dissatisfaction to be highly correlated with affective and personality disorder symptomatology. In controlled laboratory experiments, negative mood has been found to lead to increased body size distortion and body dissatisfaction Parkinson & Lohr, 1990; Taylor & Cooper, 1992). Future structural modeling analyses of body image disturbance could attempt to control for and examine the effects of these other psychological variables by measuring and including them in the model.
Another limitation of the study was the poor quality of some of the indicators, which may have somewhat confounded the results. We noted earlier that two proposed indicators (BSQ and EDI DT) were not used because they appeared to confound the measurement of dieting and fear of fatness. Close examination of individual items of the remaining indicators suggested that problems of measurement still may have occurred. The EAT Dieting factor contained an item "I am terrified about being overweight" and "I am preoccupied with the thought of having fat on my body". The restraint factor from the TFEQ appeared to be a more pure measure of dietary restraint, but does contains an item "Would a weight fluctuation of 5 lbs. affect the way you live your life?". On the GFFS, which is supposed to measure fear of fatness, one of the ten items appeared to be more of a measure of restrictive eating ("I feel like all my energy goes into controlling my weight"). These confounds of measurement may have led to the difficulties discriminating between the two dimensions (i.e. standard errors overlapping 1.0).

The problems with some of the instruments resulted in having only one indicator for fear of fatness. Thus, this study was not able to capitalize on one of the benefits of structural modeling methodology over path analysis: the use of multiple indicators to improve measurement accuracy.
of underlying dimensions. It would be desirable to measure fear of fatness using other validated measures. Unfortunately, no such instruments have been developed. Thus, an important conclusion of this study is that better, more valid measures of fear of fatness and restrictive eating need to be developed if we are to more accurately identify and study these constructs. Even with these confounds of measurement, the results of the study demonstrated that the two constructs represent separate dimensions, and from a theoretical perspective they are separate constructs. Fear of fatness refers to a trait-like construct while dieting refers to a behavior. While it is theoretically sound to suggest that fear of fatness strongly affects restrictive eating, it is not theoretically meaningful to say that fear of fatness is a form of restrictive eating. Thus, there is no justification for assessing them as if they were the same construct.

Another limitation of this study was the weight range of the subjects. Because the ceiling effect of the BIA, subjects who were significantly overweight were excluded. Future research could attempt to examine and validate the model presented here on an obese sample using indicators that are valid at higher weight ranges. Furthermore, as the subjects were all women, the findings cannot be
generalized to the male population. Future research could attempt to test the model on a male sample.

These limitations not withstanding, these data did support the proposed multidimensional model of body image disturbance and several of the specific hypothesized effects. Body image disturbance as a whole could be distinguished from a related construct (restrictive eating). This finding supports the validity of body image disturbance as a discrete construct. The data also supported a distinction between affective and perceptual dimensions, which supports the position held by Garner and Garfinkel (1981). However, as hypothesized, fear of fatness appeared to represent a separate affective dimension and preference for thinness a separate perceptual dimension. All goodness-of-fit indices supported the four dimensional model of body image disturbance relative to the alternative models. This finding supported hypothesis 2. The factor structure for this model appeared stable, given the strength of the factor loadings (Guadagnoli & Velicer, 1987).

It is important to note that the data did not fit the model perfectly. The chi-square value was statistically significant even for the final model, and the AGFI was less than .90. However, the chi-square is significantly affected by sample size, and trivial differences may
appear significant if the sample is large enough. Indices that are not affected by sample size (e.g. TLI and CFI) were all above .90. Further, it has recently been noted that the LISREL program may not be as efficient in dealing with models with highly correlated constructs and indicators. The most important finding was the fit of the hypothesized model relative to the alternate models.

Given the finding that preference for thinness could be distinguished from the body size distortion dimension (which more clearly assesses perceptual accuracy), it may be more appropriate to conceptualize preference for thinness as an attitudinal component rather than a disturbance in perception. Thus, the final model could be regarded of as containing perceptual, affective and attitudinal dimensions.

In support of hypothesis 3, both body size distortion and preference for thinness appeared to affect body dissatisfaction above and beyond the effects of actual body size. In all of the structural models tested, the parameter estimates for these effects were significant. Further, the fit of the model decreased significantly when either of the paths was fixed to zero. These findings were consistent with the finding by Williamson et al. (1993) that both current and ideal body size predicted body dissatisfaction; however in the current investigation
the effects of estimates of current body size were separated into the effects of actual body size and body size distortion. The effect of body size distortion and actual body size were greater than that of preference for thinness which would be expected given the restricted range of the latter. Fear of fatness also appeared to directly affect body dissatisfaction. In the final model, the combined effects of fear of fatness, body size distortion, preference for thinness, and actual body size were able to account for 84% of the total variance in the body dissatisfaction dimension. This finding illustrates the ability of perceptual variables to explain affective variables when they are studied within a multi-dimensional context, and illustrates the utility of the structural modeling methodology to examine such multivariate relationships. The finding further illustrates the strong emphasis that women in our society place on body size.

In support of hypothesis 5, body dissatisfaction appeared to directly affect restrictive eating; however, fear of fatness appeared to have a far greater effect. Both structural models supported the strong relationship between fear of fatness and restrictive behaviors. All of the other dimensions, in combination, were able to explain a total of 85% of the variance in the restrictive behaviors dimension. This finding again suggests that
previous failures to find a relationship between body image variables and measures of eating disturbance may have been due to the failure to control for other important variables.

The findings regarding the relationship between fear of fatness and body size distortion were very interesting. A strong relationship between the two dimensions was found. Although it was hypothesized that fear of fatness would directly affect body size distortion, the alternative model where the reverse relationship was hypothesized, yielded a better fit with the data. While there were also other differences between the two models, such as the alternative model allowing fear of fatness to directly affect restrictive behaviors, the difference in fit appeared to be due to the reversed relationship between fear of fatness and body size distortion. This conclusion is based on the finding that the fit of the alternative model was superior to the initial even after it had been modified to include the path from fear of fatness to restrictive eating.

These findings suggest that the relationship between fear of fatness and body size distortion is a complex one, and it may be inappropriate to assume that there is a unidirectional relationship between the two constructs. Even if the original hypothesis, that the fear leads to
the perceptual distortion, were true, it would also make sense that the distorted perception would further intensify the fear. This reciprocal effect would be consistent with what is observed in patients with anxiety disorders where anxiety leads to hypervigilance which leads to further increased anxiety. In such a conceptualization, cognitive or perceptual biases are regarded as factors that contribute to the maintenance of emotional disorders (MacLeod, Mathews, & Tata, 1986).

Theoretically, the only way in which the relationship between the two variables might be unidirectional would be if the perceptual distortion were totally caused by some variable other than fear of fatness. The failure to adapt theory, for example, suggests that body size distortion develops as a result of prior weight loss. Individuals, in a sense, "fail to adapt" their perceptions to their new body size. However, research to date suggests that weight loss per se is not enough to cause body size distortion (Cranford, 1976; Gleaves, Williamson, & Fuller, 1992). Greater support has been found for what has been called the abnormal sensitivity hypothesis (Garner & Garkinkel, 1981; Slade, 1970) which essentially says that the distortion is due to a fear of fatness. Future structural modeling analyses of body image disturbance could attempt to examine the
relationship between fear of fatness and body size distortion as being one of reciprocal causation.

The results of this study may help to explain many of the current controversies in the body image literature. As fear of fatness was found to represent a separate dimension that had the greatest total effect on restrictive eating, these data support the position taken by the Hsu and Sobkiewicz (1991) that greater attention should be given to the construct of fear of fatness. However, the data do not support his contention that the concept of body image disturbance should be abandoned. Doing so would lead to ignoring at least one of the important dimensions of the disturbance (body size distortion).

Previous research with eating disorder patients has found that some demonstrate body size distortion and some do not (Hsu & Sobkiewicz, 1991). These data help explain such findings by the inclusion and examination of other relevant variables. As body size distortion, preference for thinness, fear of fatness, and actual body size all appear to be relatively independent dimensions, an individual's resulting body disparagement and eating problems may result from one or a combination of the other variables. For example, one may not demonstrate body size distortion, but may have an extreme preference for
thinness or an extreme fear of fatness which lead to a high level of body dissatisfaction and attempts to lose or control weight. Similarly, an individual may simply be very overweight and have a relatively normal ideal body size and have a resulting high degree of body dissatisfaction. The possibility also exists that an individual who is overweight but has a relatively large ideal body size would experience very little body dissatisfaction. Thus, when the multidimensional nature of body image disturbance is understood, the findings related to individual components become clearer.

Another possible reason why this study found different results regarding the effects of body size distortion on other related dimensions was the type of indicators used. Most of the previous studies have used actual size estimation tasks such as the Body Image Detection Device. In the current study, two measures based on normative perceptual overestimation were used. These tasks do not assess actual size estimation accuracy, but rather accuracy relative to normative samples. Williamson et al. (1993) concluded that these two types of instruments measure similar but not identical constructs. Future structural modeling research could attempts to use both types of assessment instruments to determine each's
reliability of measurement and the relative effects of each on other relevant variables.

The data also support the contention that body image disturbance occurs on a continuum, with eating disordered individuals at the high end of the continuum (Rodin et al., 1984; Silberstein et al., 1987). Clinical subjects scored in the more pathological range relative to non-clinicals on all of the individual indicator variables. However, the underlying dimensions of the disturbance were not found to differ for the clinical and non-clinical subsamples.

These data also have implications for the assessment and treatment of problems related to eating and body image disturbance. All of the relevant dimensions should be assessed using appropriate assessment tools. These data support the position taken by Rosen (1992) that it is not enough to simply use crude measures of body dissatisfaction such as the EDI body dissatisfaction scale. All relevant dimensions should also be a focus for treatment. The findings of the effect of body image disturbance on restrictive eating suggest that getting a person to stop dieting would be unsuccessful if the causal components of body image disturbance were not also addressed in treatment. Similarly, it would be difficult to modify feelings of body dissatisfaction without also
changing variables that may be directly causing the dissatisfaction. These data suggest that fear of fatness may be one of the most critical variables to address in treatment.

In conclusion, these data supported the hypothesized multidimensional model of bulimia nervosa. The measurement model was supported more strongly than was the causal model, most likely due to omitted variables or problems with measurement. The findings support the need for multidimensional assessment and treatment of problems related to eating and body concerns. The results also suggest the need for further study of the construct of fear of fatness including the development of more sound instruments for assessing the construct. Finally, the results illustrate the utility of the structural modeling methodology for studying multidimensional psychological constructs such as body image disturbance.
References


Cuttance, P., Ecob, R. (Eds.) *Structural modeling by example: Applications in educational, sociological, and behavioral research* (pp. 241-279. New York:Cambridge University Press.


image among college men and women. Genetic, Social, and General Psychology Monographs, 114, 511-528.


Appendices

Appendix A

Eating Disorder Inventory (EDI)

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This is a scale which measures a variety of attitudes, feelings, and behaviors. Some of the items relate to food and eating. Others ask you about your feelings about yourself. There are no right or wrong answers so try very hard to be completely honest in your answers. Results are completely confidential. Read each question and fill in the circle under the column which applies best to you. Please answer each question very carefully. Thank you.

1. I eat sweets and carbohydrates without feeling nervous.
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
2. I think that my stomach is too big.
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
3. I wish I could return the security of childhood
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
4. I eat when I am upset.
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
5. I stuff myself with food.
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
6. I wish I could be younger.
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
7. I think about dieting.
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
8. I get frightened when my feelings are too strong.
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
9. I think my thighs are too large.
   Always __ Usually __ Often __ Sometimes __ Rarely __ Never
10. I feel ineffective as a person.
    Always __ Usually __ Often __ Sometimes __ Rarely __ Never
11. I feel extremely guilty after overeating.
    Always __ Usually __ Often __ Sometimes __ Rarely __ Never
12. I think my stomach is just the right size.
    Always __ Usually __ Often __ Sometimes __ Rarely __ Never
13. Only outstanding performance in my family is good enough.
    Always __ Usually __ Often __ Sometimes __ Rarely __ Never
14. The happiest time is when you are a child.
    Always __ Usually __ Often __ Sometimes __ Rarely __ Never
15. I am open about my feelings.
16. I am terrified of gaining weight.
17. I trust others.
18. I feel alone in the world.
19. I feel satisfied with the shape of my body.
20. I feel generally in control of things in my life.
21. I get confused about what emotion I’m feeling.
22. I would rather be an adult than a child.
23. I can communicate with others easily.
24. I wish I were someone else.
25. I exaggerate or magnify the importance of weight.
26. I can clearly identify what emotion I am feeling.
27. I feel inadequate.
28. I have gone on eating binges where I have felt that I could not stop.
29. As a child, I tried very hard to avoid disappointing my parents and teachers.
30. I have close relationships.
31. I like the shape of my buttocks.
32. I am preoccupied with the desire to be thinner.
33. I don’t know what’s going on inside me.
34. I have trouble expressing my emotions to others.
35. The demands of adulthood are too great.
36. I hate being less than best at things.
37. I feel secure about myself.
38. I think about binging (overeating).
39. I feel happy that I am not a child anymore.
40. I get confused as to whether or not I am hungry.  
41. I have a low opinion of myself.  
42. I feel that I can achieve my standards.  
43. My parents have expected excellence of me.  
44. I worry that my feelings will get out of control.  
45. I think my hips are too big.  
46. I eat moderately in front of others and stuff myself when they're gone.  
47. I feel bloated after eating a normal meal.  
48. I feel that people are happiest when they are children.  
49. If I gain a pound, I worry that I will keep gaining.  
50. I feel that I am a worthwhile person.  
51. When I am upset, I don't know if I am sad, frightened, or angry.  
52. I feel that I must do things perfectly, or not do them at all.  
53. I have the thoughts of trying to vomit in order to lose weight.  
54. I need to keep people at a certain distance (feel uncomfortable if someone tries to get too close).  
55. I think that my thighs are just the right size.  
56. I feel empty inside (emotionally).  
57. I can talk about personal thoughts or feelings.  
58. The best years of your life are when you become an adult.  
59. I think my buttocks are too large.  
60. I have feelings that I can't quite identify.  
61. I eat or drink in secrecy.
62. I think that my hips are just the right size.
   Always  Usually  Often  Sometimes  Rarely  Never
63. I have extremely high goals.
   Always  Usually  Often  Sometimes  Rarely  Never
64. When I am upset, I worry that I will start eating.
   Always  Usually  Often  Sometimes  Rarely  Never
Appendix B

Bulimia Test-Revised (BULIT-R)

Answer each question on the following pages by checking the appropriate number under each question. Please respond to each item as honestly as possible; remember, all of the information you provide will be kept strictly confidential.

1. I am satisfied with my eating patterns
   1. agree
   2. neutral
   3. disagree a little
   4. disagree
   5. disagree strongly

2. Would you presently call yourself a "binge eater"?
   1. yes, absolutely
   2. yes
   3. yes, probably
   4. yes, possibly
   5. no, probably not

3. Do you feel you have control over the amount of food you consume?
   1. most or all of the time
   2. a lot of the time
   3. occasionally
   4. rarely
   5. never

4. I am satisfied with the shape and size of my body.
   1. frequently or always
   2. sometimes
   3. occasionally
   4. rarely
   5. seldom or never

5. When I feel that my eating behavior is out of control, I try to take rather extreme measures to get back on course (strict dieting, fasting, laxatives, diuretics, self-induced vomiting, or vigorous exercise).
   1. always
   2. almost always
   3. frequently
   4. sometimes
   5. never or my eating behavior is never out of control

6. I use laxative or suppositories to help control my weight
   1. once a day or more
   2. 3-6 times a week
   3. once or twice a week
   4. 2-3 times a month
5. once a month or less (or never)
7. I am obsessed about the size of my body.
   1. always
   2. almost always
   3. frequently
   4. sometimes
   5. seldom or never
8. There are times when I rapidly eat a very large amount of food.
   1. more than twice a week
   2. twice a week
   3. once a week
   4. 2-3 times a month
   5. once a month or less (or never)
9. How long have you been binge eating (eating uncontrollably to the point of stuffing yourself)?
   1. not applicable; I don’t binge eat
   2. less than 3 months
   3. 3 months - 1 year
   4. 1-3 years
   5. 3 or more years
10. Most people I know would be amazed if they knew how much food I can consume at one sitting.
    1. without a doubt
    2. very probably
    3. probably
    4. possibly
    5. no
11. I exercise in order to burn calories
    1. more than 2 hours per day
    2. about 2 hours per day
    3. more than 1 but less than 2 hours per day
    4. one hour of less per day
    5. I exercise but not to burn calories or I don’t exercise.
12. Compared with women your age, how preoccupied are you about your weight and body shape?
    1. a great deal more than average
    2. much more than average
    3. more than average
    4. a little more than average
    5. average or less than average
13. I am afraid to eat anything for fear that I won’t be able to stop.
    1. always
    2. almost always
    3. frequently
    4. sometimes
    5. seldom or never
14. I feel tormented by the idea that I am fat or might
gain weight
1. always
2. almost always
3. frequently
4. sometimes
5. seldom or never

15. How often do you intentionally vomit after eating?
1. 2 or more times a week
2. once a week
3. 2-3 times a week
4. once a month
5. less than once a month or never

16. I eat a lot of food when I’m not even hungry.
1. very frequently
2. frequently
3. occasionally
4. sometimes
5. seldom or never

17. My eating patterns are different from the eating patterns of most people.
1. always
2. almost always
3. frequently
4. sometimes
5. seldom or never

18. After I binge eat I turn to one of several strict methods to try to keep from gaining weight (vigorous exercise, strict dieting, fasting, self-induced vomiting, laxatives, or diuretics).
1. never or I don’t binge eat
2. rarely
3. occasionally
4. a lot of the time
5. most or all of the time

19. I have tried to lose weight by fasting or going on strict diets.
1. not in the past year
2. once in the past year
3. 2-3 times in the past year
4. 4-5 times in the past year
5. more than 5 times in the past year

20. I exercise vigorously and for long periods of time in order to burn calories.
1. average or less than average
2. a little more than average
3. more than average
4. much more than average
5. a great deal more than average

21. When engaged in an eating binge, I tend to eat foods that are high in carbohydrates (sweets and
22. Compared to most people, my ability to control my eating behavior seems to be:
   1. greater than others' ability
   2. about the same
   3. less
   4. much less
   5. I have absolutely no control

23. I would presently label myself a ‘compulsive eater’, (one who engages in episodes of uncontrolled eating).
   1. absolutely
   2. yes
   3. yes, probably
   4. yes, possibly
   5. no, probably not

24. I hate the way my body looks after I eat too much.
   1. seldom or never
   2. sometimes
   3. frequently
   4. almost always
   5. most or all of the time

25. When I am trying to keep from gaining weight, I feel that I have to resort to vigorous exercise, strict dieting, fasting, self-induced vomiting, laxatives, or diuretics.
   1. never
   2. rarely
   3. occasionally
   4. a lot of the time
   5. most or all of the time

26. Do you believe that it is easier for you to vomit than it is for most people?
   1. yes, it’s no problem at all for me
   2. yes, it’s easier
   3. yes, it’s a little easier
   4. about the same
   5. no, it’s less easy

27. I use diuretics (water pills) to help control my weight.
   1. never
   2. seldom
   3. sometimes
   4. frequently
   5. very frequently
28. I feel that food controls my life.
   1. always
   2. almost always
   3. frequently
   4. sometimes
   5. seldom or never

29. I try to control my weight by eating little or no food for a day or longer.
   1. never
   2. seldom
   3. sometimes
   4. frequently
   5. very frequently

30. When consuming a large quantity of food, at what rate of speed do you usually eat?
   1. more rapidly than most people have ever eaten in their lives
   2. a lot more rapidly than most people
   3. a little more rapidly than most people
   4. about the same rate as most people
   5. more slowly than most people (or not applicable)

31. I use laxatives or suppositories to help control my weight.
   1. never
   2. seldom
   3. sometimes
   4. frequently
   5. very frequently

32. Right after I binge eat I feel:
   1. so fat and bloated I can’t stand it
   2. extremely fat
   3. fat
   4. a little fat
   5. OK about how my body looks or I never binge eat

33. Compared to other people of my sex, my ability to always feel in control of how much I eat is:
   1. about the same or greater
   2. a little less
   3. less
   4. much less
   5. a great deal less

34. In the last 3 months, on the average how often did you binge eat (eat uncontrollably to the point of stuffing yourself)?
   1. once a month or less (or never)
   2. 2-3 times a month
   3. once a week
   4. twice a week
   5. more than twice a week
35. Most people I know would be surprised at how fat I look after I eat a lot of food.
   1. yes, definitely
   2. yes
   3. yes, probably
   4. yes, possibly
   5. no, probably not or I never eat a lot of food

36. I use diuretics (water pills) to help control my weight.
   1. 3 times a week or more
   2. once or twice a week
   3. 2-3 times a month
   4. once a month
   5. never
Appendix C

Eating Attitudes Test (EAT)

Please circle the response which best applies to each of the numbered statements. Please answer each question carefully. Thank you.

0 1 2 3 4 5
1. Am terrified about being overweight.
0 1 2 3 4 5
2. Avoid eating when I am hungry.
0 1 2 3 4 5
3. Find myself preoccupied with food.
0 1 2 3 4 5
4. Have gone on eating binges when I feel that I may not be able to stop.
0 1 2 3 4 5
5. Cut my food into small pieces.
0 1 2 3 4 5
6. Aware of the calorie content of foods that I eat.
0 1 2 3 4 5
7. Particularly avoid foods with a high carbohydrate content (e.g. bread, potatoes, rice, etc.).
0 1 2 3 4 5
8. Feel that others would prefer if I ate more.
0 1 2 3 4 5
9. Vomit after I have eaten.
0 1 2 3 4 5
10. Feel extremely guilty after eating.
0 1 2 3 4 5
11. Am preoccupied with a desire to be thinner.
0 1 2 3 4 5
12. Think about burning calories when I exercise.
0 1 2 3 4 5
13. Other people think that I am too thin.
0 1 2 3 4 5
14. Am preoccupied with the thought of having fat on my body.
0 1 2 3 4 5
15. Take longer than others to eat my meals.
0 1 2 3 4 5
16. Avoid foods with sugar in them.
0 1 2 3 4 5
17. Eat diet foods.
0 1 2 3 4 5
18. Feel that food controls my life.
0 1 2 3 4 5
19. Display self-control around food.
0 1 2 3 4 5
20. Feel that others pressure me to eat.
0 1 2 3 4 5
21. Give too much time and thought to food.
0 1 2 3 4 5
22. Feel uncomfortable after eating sweets.
0 1 2 3 4 5
23. Engage in dieting behavior.
0 1 2 3 4 5
24. Like my stomach to be empty.
0 1 2 3 4 5
25. Enjoy trying new rich foods.
0 1 2 3 4 5
26. Have impulses to vomit after meals.
## Appendix D

**Body Satisfaction Scale (BSS)**

**Instructions**

For each of the 16 body parts listed below, please indicate how satisfied you feel right now for the scale from 1 (very satisfied) to 7 (very unsatisfied).

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<td>Slight</td>
<td>Un-</td>
<td>Slight</td>
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<td>Very</td>
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<td>satis</td>
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Appendix E

Goodness-of-fit Indices for Nested Measurement Models with Clinical Sample.

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<th>BBI</th>
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Note: GFI = Goodness-of-fit Index; AGFI = Adjusted Goodness-of-fit Index; TLI = Tucker Lewis Index; BBI = Bentler-Bonett Index; CFI = Comparative Fit Index

Model 1 = Body Image and restrictive behaviors indicators loading on one dimension (As in figure 3a).
Model 2 = Body Image indicators on one dimension and restrictive behaviors on a second (As in figure 3b).
Model 3 = As above but separating body image variables into affective and perceptual dimensions (As in figure 3c).
Model 4 = As above but separating Fear of fatness and body dissatisfaction into separate dimensions.
Model 5 = As above but separating body size distortion and preference for thinness dimensions (Hypothesized model, as in figure 3d)
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Model 5 = As above but separating body size distortion and preference for thinness dimensions (Hypothesized model, as in figure 3d).
Vita

David Hunter Gleaves was born April 8, 1964 in Nashville, Tennessee. He attended Vanderbilt University where, in 1986, he received his Bachelor of Science degree in psychology with a minor in biology. He earned his Master of Arts degree in psychology from Louisiana State University in 1989. Currently, he is a candidate for the Doctor of Philosophy degree in clinical psychology at Louisiana State University and anticipates graduating in August of 1993.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate:  David H. Gleaves

Major Field:  Psychology

Title of Dissertation:  Analysis of a Multidimensional Model of Body Image Disturbance Using Structural Modeling

Approved:

[Signature]

Major Professor and Chairman

[Signature]

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

July 8, 1993