THE LATENT STRUCTURE OF SOCIAL ANXIETY DISORDER: A TAXOMETRIC ANALYSIS

A Thesis
by

GRACE BLISS BOYERS

Submitted to the Graduate School
At Appalachian State University
In partial fulfillment of the requirements for the degree
MASTER OF ARTS

December 2012
Department of Psychology

THE LATENT STRUCTURE OF SOCIAL ANXIETY DISORDER:
A TAXOMETRIC ANALYSIS

A Thesis
by
GRACE BLISS BOYERS
December 2012

APPROVED BY:

____
Joshua J. Broman-Fulks
Chairperson, Thesis Committee

____
Lisa Curtin
Member, Thesis Committee

____
Kurt D. Michael
Member, Thesis Committee

____
James C. Denniston
Chairperson, Department of Psychology

____
Edelma D. Huntley
Dean, Research and Graduate Studies

ABSTRACT

THE LATENT STRUCTURE OF SOCIAL ANXIETY DISORDER:

A TAXOMETRIC ANALYSIS

Grace Bliss Boyers
B.S., University of Mary Washington
M.A., Appalachian State University

Chairperson: Dr. Joshua J. Broman-Fulks, Ph.D.

Debate exists regarding whether social anxiety is most accurately conceptualized as a categorical or dimensional phenomenon, and existing taxometric research has generated equivocal evidence. Further, researchers have yet to examine the latent structure of specific and generalized forms of social anxiety. The present study sought to extend previous research by further examining the latent structure of social anxiety, as well as the specific and generalized types, in a large nonclinical sample of adults (n = 2,019). Three taxometric procedures (MAXCOV, MAMBAC, and L-Mode) were applied to indicators derived from two commonly used measures of social fears. Results yielded convergent evidence of a dimensional structure for social anxiety, with specific and generalized social fears also exhibiting continuous relationships with milder social fears. The implications of these findings for the assessment, diagnosis, classification, and treatment of social anxiety are discussed.

ACKNOWLEDGEMENTS

I would like to thank my mentor and thesis chair, Dr. Joshua Broman-Fulks, for his support and guidance through this thesis process and throughout my graduate training. Many additional thanks are warranted to my thesis committee, Dr. Lisa Curtin and Dr. Kurt Michael, and to Dr. David P. Valentiner and Kathleen McCraw of Northern Illinois University for their help and for the use of their datasets. Finally, I would like to thank my parents, Scott and Rebecca Boyers, for their unfailing encouragement and support.

TABLE OF CONTENTS

FOREWORD

This thesis is written in accordance with the style of the *Publication Manual of the American Psychological Association (6th Edition)* as required by the Department of Psychology at Appalachian State University.

The Latent Structure of Social Anxiety: A Taxometric Analysis

Social phobia, also known as Social Anxiety Disorder (SAD), is defined as the pervasive fear of social or performance situations due to concerns about being judged or embarrassed (American Psychiatric Association, 2000). To be diagnosed with social phobia according to current nosological standards (i.e., the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision criteria), social fears must lead to avoidance behaviors or intense anxiety in unavoidable situations and be associated with clinically significant impairment or distress. Indeed, research suggests that social phobia tends to be a pervasive, chronic, and debilitating condition that affects occupational, social, and academic functioning, resulting in diminished social occupational achievement, restricted social relationships, and substance abuse (Bruch, Fallon, & Heimberg, 2003; A. M. Ruscio et al., 2008). Social phobia is highly prevalent, affecting 12-13 percent of American adults and representing the third most common psychological disorder and the most common anxiety disorder (Kessler, et al., 1994; A. M. Ruscio et al., 2008).

Although social phobia is currently conceptualized as a discrete pathological phenomenon, research has indicated that social fear is a common experience, with nearly one-quarter of adults reporting having experienced at least one significant social fear during their lifetime (A. M. Ruscio et al., 2008). Yet, according to DSM-IV criteria, individuals with acute social fear who may benefit from intervention might not qualify for a diagnosis if other criteria are not met. The universality of social fear and the prevalence of social phobia have led some to question whether individuals with social anxiety are qualitatively distinct from individuals without the diagnosis, as is implicitly assumed by the DSM-IV, or whether they are quantitatively different, varying only in frequency and severity of symptoms (e.g., Rapee, 1995; Rapee & Spence, 2004).

Taxometrics refers to a series of statistical procedures that provide an empirical means of investigating whether a construct is categorical (taxonic) or dimensional (continuous) at the latent level (Meehl, 1995). Taxometric procedures infer latent structure by examining naturally occurring patterns among data, which contrasts taxometrics with other classification methods that may force structure on data (Meehl & Yonce, 1994; Schmidt, Kotov, & Joiner, 2004). In addition, the taxometric approach is unique in its use of multiple consistency tests rather than determining significance of findings based on a single, fallible mathematical technique.

Knowing the latent structure of social anxiety has important implications for both assessment and treatment of social anxiety disorder (Meehl, 1995). For example, the goal of assessment instruments is influenced by latent structure, with tests for taxonic variables generally aiming to assign individuals to their respective group with maximum efficiency and accuracy, whereas measures of dimensional variables generally aim to locate an individual's relative position on a continuum (see Grove, 1991, for an extended discussion on this point).

In addition, knowing latent structure helps to inform research aimed at identifying the most effective diagnostic and treatment methods. Etiological research is also informed by knowing latent structure, with taxonic structure suggesting the existence of a discrete etiological source (e.g., biological disposition, environmental event, or a specific interaction of multiple sources), whereas dimensional structure implies an additive or graded etiology. Finally, knowing the latent structure of the social anxiety is consistent with the goal of science, which is to provide an accurate understanding of phenomena in the natural environment.

Debate exists within the social anxiety literature regarding whether social anxiety is most accurately conceptualized as a dimensional or categorical construct. Several lines of evidence suggest that social anxiety may have a dimensional latent structure. For example, impairment due to social fears appears to increase linearly with number of social fears, with no detectable threshold (Stein, Torgrud, & Walker, 2000). In addition, individuals tend to oscillate over time between subthreshold and full diagnostic levels of symptomology (Merikangas, Avenevoli, Acharyya, Zhang, & Angst, 2002). Further, scores on measures of anxiety and avoidance in social situations (Mattick & Clarke, 1998; Stein et al., 2000; Watson & Friend, 1969) tend to be distributed normally, which is suggestive of dimensionality. For example, research has indicated that individuals with generalized social phobia without comorbid avoidant personality disorder demonstrated quantitative, rather than qualitative, differences in impairment, anxiety, and social distress when compared to individuals with comorbid avoidant personality disorder (Herbert, Hope, & Bellack, 1992). Based on these findings, some researchers have suggested a dimensional conceptualization of social anxiety where avoidant personality disorder indicates the most severe cases at one extreme of the spectrum, non-socially-anxious individuals represent the other end, and individuals with non-generalized and generalized social anxiety represent the middle to upper end of the continuum (Hofmann, 2000; Merikangas et al., 2002).

Conversely, some infant temperament research provides evidence that social anxiety may have a taxonic latent structure (i.e., representing a naturally occurring class or category). High infant reactivity has been proposed to be a temperamental trait antecedent to behavioral inhibition. Research suggests that highly reactive infants also have high scores on measures of behavioral inhibition at a 4.5-year follow-up (Woodward, Lenzenweger, Kagan, Snidman, & Arcus, 2000). In addition, the latent structure of high reactivity has been taxometrically analyzed, with results supporting a categorical, or taxonic, latent structure (Woodward et al., 2000). High infant reactivity and behavioral inhibition have been suggested to be causally related to the development of social anxiety (Kagan, 2001). In an 11-year follow-up study, 61% of adolescents previously classified as inhibited as infants were found to qualify for generalized social anxiety at follow-up, whereas only 20% were found never to have experienced social anxiety disorder (SAD). In contrast, only 27% of uninhibited infants had generalized social anxiety as adolescents (Schwartz, Snidman, & Kagan, 1999). The evidence of taxonicity in a potential developmental precursor to social anxiety raises the possibility that social anxiety itself may also be taxonic.

To date, four taxometric studies of social anxiety symptoms have been conducted, with results being inconsistent. A study using a mixed sample of social anxiety disorder patients and community members reported convergent evidence across two taxometric procedures (MAMBAC and MAXEIG) that social anxiety may have taxonic latent structure (Weeks, Carleton, Asmundson, McCabe, & Antony, 2010). Seven indicators (i.e., markers of social anxiety) were constructed using item pairs from the Social Interaction Phobia Scale (SIPS; Carleton et al., 2009), a 14-item self-report measure derived from the Social Interaction Anxiety Scale (SIAS; Mattick, Peters, & Clarke, 1989), and the Social Phobia Scale (SPS; Mattick & Clarke, 1998). Participants were also administered the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1996). The MAXEIG analysis generated 21 curves, which were interpreted by the authors as supporting taxonic structure. Analysis yielded a Comparison Curve Fit Index score of .62 (CCFI values greater than .55 are suggestive of taxonic structure); results estimated the base-rate of SAD symptoms in the sample at .11. This base-rate is close to the estimated base-rate of participants with clinically significant social anxiety symptoms (9.1%; Weeks et al., 2010). The MAMBAC analysis initially resulted in ambiguous curves but produced 42 curves indicative of taxonic structure after being re-run using the MAXEIG estimated base-rate. The obtained CCFI for the MAMBAC analysis was .69, which is suggestive of taxonic structure; however, prior research has suggested that using separate putative taxon and complement member samples (i.e., separate clinical and community population samples) can produce pseudotaxonic results (Schmidt et al., 2004), raising questions regarding the validity of the study's findings.

Three additional taxometric studies have failed to yield evidence of a social phobia taxon. Kollman, Brown, Liverant, and Hofmann (2006) used the SIAS and Albany Panic and Phobia Questionnaire (APPQ; Rapee, Craske, & Barlow, 1995), in addition to the Anxiety Disorders Interview Schedule for DSM-IV—Lifetime Version (ADIS-IV-L; Di Nardo, Brown, & Barlow, 1994), to assess social anxiety symptoms in 2,035 outpatients with diagnosed anxiety and mood disorders. Five indicator sets reflecting assertiveness, authority, dating, public speaking, and social interaction were submitted to three taxometric analyses (MAXEIG, MAMBAC, and L-Mode). Results across taxometric procedures provided convergent support for a latent dimension, with visual inspection of plots and a quantitative curve-fit index (Fit_{RMSR}) supporting a dimensional interpretation. It should be noted that although the indicators closely corresponded with key features of Social Phobia diagnostic criteria, this study used indicators that were not based on diagnostic criteria.

A second taxometric study using data from the National Comorbidity Survey Replication also reported finding evidence that social anxiety has a latent dimensional structure (A. M. Ruscio, 2010). Using data derived from 2,166 participants who endorsed initial SAD screener questions, five indicators representing pervasiveness (e.g., number of feared situations), fear of negative evaluation, bodily sensations and related concerns, impact on functioning, and persistence of symptoms over time were submitted to multiple taxometric procedures (MAXEIG, MAMBAC, and L-Mode). Results provided consistent evidence of dimensional structure, with curves favoring simulated dimensional plots and objective fit indices supporting visual interpretation (i.e., all CCFI scores were below .32). Results also suggested that a dimensional severity-based diagnosis provided increased predictive value over categorical DSM-IV diagnosis in predicting several outcome variables, including onset of suicidal ideation, suicide attempts, and onset of a mood disorder. The author noted that somewhat low correlations and validity estimates for indicators may comprise a methodological weakness, though simulated comparison data indicated that dimensional and taxonic plots were clearly distinguishable. In addition, because participants overwhelmingly endorsed a history of high social fear, indicator score differences between putative taxon and complement members were somewhat smaller than the ideal (A. M. Ruscio, 2010).

A third recent study found somewhat inconsistent evidence of dimensionality using two large epidemiological samples. Crome, Baillie, Slade, and Ruscio (2010) used data from the Australian National Survey of Mental Health and Wellbeing (NSMHWB) and the

National Comorbidity Survey: Replication (NCS-R) to assess the latent structure of social phobia. The authors subjected data from a total of 4,017 respondents to MAMBAC, MAXEIG, and L-mode analyses. For the participants who completed the NSMHWB, three indicators were constructed assessing feared or avoided social situations, avoidant personality traits, and cognitive processes/distress. Likewise, three indicators were constructed to analyze the data of the participants who completed the NCS-R: feared or avoided situations, impairment/distress, and a combined cognitive/avoidant personality traits indicator. Results indicated that MAXEIG analyses supported dimensional structure (CCFIs = .40 and .30) for the NSMHWB and NCS-R outcomes, though MAMBAC results were more ambiguous. While judges rated the curves as dimensional, the CCFI yielded evidence of an ambiguous fit for the NSMHWB (CCFI =.53) and evidence of dimensional structure for the NCS-R (CCFI = .22). L-mode results were also judged visually to support a dimensional structure and the fit index for the NCS-R sample suggested a latent dimension (CCFI = .16), though the fit index revealed ambiguous fit for the NSMHWB (CCFI = .48). Thus, although the evidence was largely suggestive of a dimensional structure, results lacked complete consistency and suggest the need for further replication.

In sum, relatively little research has attempted to examine the latent structure of social anxiety, with three of the four taxometric studies generating modest support for the dimensional model. One purpose of the present study is to provide additional clarification regarding the latent structure of social anxiety disorder using taxometric procedures. Based on previous research, as well as non-taxometric evidence, analyses of social anxiety disorder are expected to yield evidence of a dimensional construct.

Social Anxiety Disorder Subtypes and Latent Structure

Under the current diagnostic system, individuals with pervasive fear in most social situations warrant a diagnosis of generalized social phobia to delineate those symptoms from more circumscribed social fears. However, some researchers have argued for the existence of two separate social phobia subtypes, generalized and specific, citing several observed qualitative distinctions between the putative groups (Hook & Valentiner, 2002). While generalized social phobia (GSP) is thought to reflect a fear of nearly all social situations, specific social phobia (SSP) describes impairing social fear restricted to only one performance situation.

In addition to number of feared situations, the two subtypes are thought to differ in several ways. With regard to severity of impairment, individuals with generalized social anxiety often report greater avoidance, fear of negative evaluation, and overall anxiety in social situations (Holt, Heimberg, & Hope, 1992). Higher comorbidity rates, especially with anxiety and mood disorders, have been observed in individuals with GSP versus those with SSP (Holt et al, 1992). Individuals with GSP also tend to report more severe symptoms on other measures of pathology, such as social skills deficits, depression, and trait anxiety

(Herbert, Hope & Bellack, 1992; Holt et al., 1992; Turner, Beidel, & Townsley, 1992). Type of feared situation also appears to be important in differentiating between the two putative social phobia subtypes. Early research found evidence that GSP was more closely related to fear of interaction situations, whereas SSP was more closely linked to performance situation fear alone (Stemberger, Turner, Beidel, & Calhoun, 1995).

Lastly, some evidence for differences in heritability may also distinguish between the two proposed subtypes. One study found that relatives of GSP patients were more likely to be diagnosed with social phobia than relatives of individuals with SSP (Mannuzza et al., 1995). Relatives of SSP patients and relatives of normal controls did not differ in their likelihood of social phobia diagnosis. Some researchers suggest that this observed differential heritability may reflect an underlying delineation between the two subtypes; they argue that if the two subtypes simply represented a distinction in severity, relatives of individuals with SSP and GSP should have equal likelihood of diagnosis (Hook & Valentiner, 2002; Mannuzza et al., 1995).

On the other hand, some recent research may provide evidence against the case for social anxiety disorder subtypes, suggesting that heterogeneity observed is more closely related to a continuous latent structure without subtypes. One study using an all-female community sample found that using models of social phobia subtypes (based on number of clinically relevant fears, types of feared social situations, or formal speaking fear versus other social fears) imparted no extra value above and beyond a continuous conceptualization based on number of social fears (Vriends, Becker, Meyer, Michael, & Margraf, 2007). Instead, authors argued that symptom heterogeneity observed in individuals with social anxiety disorder could be explained by a continuum model.

Two recent studies found little evidence for separate SAD subtypes using data from the National Comorbidity Survey Replication (NCS-R; El-Gabalawy, Cox, Clara, & Mackenzie, 2010; A. M. Ruscio et al.,2008). The most recent study found that individuals fearing at least 8 of 14 possible feared social situations were at greater risk for experiencing comorbid major depression and a comorbid anxiety disorder, as well as suicidal ideation (El-Gabalawy et al., 2010); but, after controlling for number of feared situations, differences between the two putative subtype groups were no longer significant. In addition, A. M. Ruscio and colleagues (2007) conducted a factor analysis of the 14 performance and interactional fears and found that both proposed dimensions loaded onto a single latent factor.

Recently, some proponents of the theorized subtypes have argued that social anxiety is comprised of two dimensions reflecting performance and interaction anxiety (Hook & Valentiner, 2002). Specific social phobia, characterized by impairing levels of performance anxiety, is thought to be categorical in structure, reflecting its similarity with other simple phobias. Conversely, GSP, reflecting both performance and interaction anxiety, is hypothesized to have an underlying dimensional structure because of evidence of its additive heritability (Hook & Valentiner, 2002). Although performance and interaction anxiety appear to be distinct dimensions, and several instruments have been developed to measure symptoms in these areas (Mattick & Clarke, 1998), there have been no known taxometric analyses examining the underlying structure of either social phobia subtype or their putative anxiety dimensions. Thus, although convergent evidence suggests that the higher order social phobia construct represents a latent dimension, analyses were also conducted to determine whether specific and generalized social phobia represent categorical or continuous constructs.

Methods

Participants

Participants consisted of 2,019 (57% female) college students at Northern Illinois University who volunteered to participate in one of six research studies between 2003 and 2009 in exchange for course credit. Participants ranged in age from 17-53 (M = 19.23, SD = 2.65) and were predominately Caucasian (69%) and African American (16%). Participants were administered the Social Interaction Anxiety Scale (SIAS; Mattick et al., 1989) and the Social Phobia Scale (SPS; Mattick & Peters, 1988), which were embedded in a larger package of assessment measures. All procedures for this study were approved by the

Institutional Review Board at Appalachian State University on October 10, 2011 (see Appendix A for IRB approval notification), and adhered to ethical principles.

Measures

SIAS. The Social Interaction Anxiety Scale (Mattick et al., 1989) is a 19-item self-report questionnaire designed to assess general social interaction anxiety (i.e., anxiety when interacting with authority figures, acquaintances, members of the opposite sex, etc.). Items are rated on a 5-point Likert scale, ranging from 0 (“not at all characteristic or true of me”) to 4 (“extremely characteristic or true of me”). The SIAS has been found to demonstrate high test-retest reliability, internal consistency, and discriminant validity (Mattick & Clarke, 1998). Previous research has indicated that the two SIAS items that are reverse-scored are psychometrically unstable and were therefore excluded from analyses.

SPS. The Social Phobia Scale (Mattick & Clarke, 1998; Mattick & Peters, 1988) is a 20-item self-report questionnaire that assesses distress in specific situations that are often the focus of social phobia (i.e., anxiety about eating or writing in front of others, or about being watched by others). The SPS uses a 5-point Likert scale identical to that of the SIAS. The SPS has also been found to have sound psychometric properties (Mattick & Clarke, 1998). The SIAS and SPS are similar measures and were designed to be administered together.

Indicator Selection

Indicators used in taxometric analysis should be selected to be representative of the studied construct and have good content and discriminant validity (J. Ruscio & Ruscio, 2004). To derive indicators for the present study, an exploratory factor analysis (EFA) was conducted by combining the 39 SIAS and SPS items and submitting them to Principal Axis Factoring with Promax oblique rotation. Items with initial communalities less than 0.40 were removed. The criterion used to identify factors was an Eigenvalue greater than 0.7 (Jolliffe, 1972), with all putative factors located to the left of the inflection point on a scree plot (Cattell, 1966). Because factors derived from the SIAS and SPS items are theoretically related, analyses utilized the Promax oblique rotation method, which allows factors to correlate. Finally, all items with factor loadings less than 0.50 were discarded from further analyses. All remaining items that loaded on the three factors were then averaged to comprise the three indicators used.

Procedures

Taxometric analysis relies primarily on consistency of results, rather than significance testing, to support conclusions. Thus, the latent structure of social anxiety was examined by submitting indicators to three separate taxometric procedures: MAXCOV (maximum covariance; Meehl & Yonce, 1996), MAMBAC (mean above minus below a cut; Meehl & Yonce, 1994), and L-mode (latent mode; Waller & Meehl, 1998). The procedures were performed using R statistical software (R Development Core Team, 2005) and taxometric algorithms published by John Ruscio (2010).

Each taxometric procedure generated a series of plots that were visually inspected to determine whether plot shape was consistent with taxonic or dimensional latent structure. In addition, simulated taxonic and dimensional plots were generated using Monte Carlo data that matched the unique distributional characteristics (i.e., skew, sample size, nuisance covariance, etc.) of the research data to assist in the interpretation of study results (J. Ruscio & Ruscio, 2004b). Two experienced judges independently rated the research plots as suggestive of latent taxonic, dimensional, or ambiguous structure using the simulated data plots for comparison; the raters were in perfect (100%) agreement in their independent plot ratings. In addition, an objective measure of fit (Comparison Curve Fit Index) was implemented to supplement visual assessments.

To derive parameter estimates and generate categorical comparison data, cases were assigned to the putative taxon and complement groups using the mean base-rate classification method (J. Ruscio, 2009). Specifically, analyses were conducted initially to determine the mean base rate across taxometric procedures, and then analyses were repeated a second time using the mean base rate to classify cases into conjectured taxon and complement groups.

MAXCOV. The MAXCOV (Maximum Covariance; Meehl & Yonce, 1996) procedure uses at least three indicators to analyze latent structure. Covariances of two indicators are calculated and plotted as a function of every possible value of a third indicator. In the case of a taxonic construct, indicators will be negligibly correlated within groups; however, correlations will increase where the two groups overlap. In this case, a plot of the indicator intercorrelations will peak where the two groups overlap. Dimensional data, on the other hand, will show comparable correlations across the distribution, and will yield a relatively flat line. The procedure was conducted using 25 intervals and 4 internal replications in order to stabilize the curves.

MAMBAC. The MAMBAC (Mean Above Minus Below a Cut; Meehl & Yonce, 1994) procedure only requires two variables and calculates the mean difference between scores on one variable above and below a cut on a second variable. This process is repeated at each possible value of the input variable, and results are plotted. A taxonic plot yields a graph with a distinct peak or ∩-shape; the differences would be greatest at the cut which best separates the two distinct groups. In the case of continuous data, the differences between average group scores would be small when the cut was located near the center of the distribution, since the resulting groups would share similar scores. A non-taxonic plot resembles a concave curve that arcs upwards at one or both ends of the plot. For each curve, a total of 300 cuts were made at evenly spaced intervals across the input variable, beginning 25 cases from either end of the input. Results were pooled across five internal replications to improve the interpretability of plots.

L-mode. The L-mode (Latent mode; Waller & Meehl, 1998) procedure extrapolates latent structure using the distribution of factor scores. L-mode combines all candidate indicators and conducts an exploratory factor analysis on the covariances between indicators. Factor score estimates for the first unrotated factor are computed and plotted in a factor-score probability density distribution. A plot with one mode suggests dimensional structure, while one with two modes is indicative of latent taxonicity.

Comparison Curve Fit Index. The comparison curve fit index (CCFI; J. Ruscio, Ruscio & Meron, 2007) is an objective measure of the extent to which the averaged data plots resemble those of the simulated dimensional and taxonic plots. The CCFI measurements range from 0.0 to 1.0, with values closer to 1.0 being suggestive of a taxon, and values closer to 0.0 supporting a dimensional structure. Values between 0.45 and 0.55 do not favor either structure and are considered ambiguous (J. Ruscio et al., 2007). Recent research has indicated that the CCFI demonstrates high levels of accuracy in interpreting taxometric output (J. Ruscio, 2007; J. Ruscio & Kaczetow, 2009; J. Ruscio & Marcus, 2007; J. Ruscio, Ruscio, & Meron, 2007; J. Ruscio & Walters, 2011).

Results

Preliminary Analyses

The structural relationships underlying the 17 SIAS items were evaluated to ensure the six samples of undergraduates used to create the larger sample were suitable to combine to create the larger sample for taxometric analysis. More specifically, multiple-group analysis in LISREL 8.54 (Jöreskog & Sörbom, 2003) was used to evaluate whether the inter-item relationships could be restricted to be invariant across samples. Robust maximum likelihood estimation (Satorra & Bentler, 1994), which analyzes covariance and asymptotic covariance matrices, was used because, unlike maximum likelihood estimation, this method does not rely upon assumptions of normality (Brown, 2006). We determined adequate model fit using three criteria (see Brown, 2006; Hu & Bentler, 1999): (1) a comparative fit index (CFI) of greater than .95; (2) a non-normed fit index (NNFI) of greater than .95; and (3) a root mean square error of approximation (RMSEA) close to .06. Constraining the relationships between the 17 SIAS items to be identical across the six samples resulted in a good model fit, χ^2 (df = 765) = 2418.43, p < .01; CFI = .98; NNFI = .98; RMSEA = .043. Similarly, constraining the relationships between the 20 SPS items to be identical across the six samples resulted in a good model fit, χ^2 (df = 1050) = 4098.16, p < .01; CFI = .97; NNFI = .97; RMSEA = .052. These analyses provided no evidence of differential structural relationships between the items as a function of sample.

EFA. A three-factor model was extracted based on the scree test and Eigenvalues greater than 0.7; these three factors accounted for 61.05% of the total variance. The first factor consisted of nine items from the SIAS (items 10, 12, 14, 15, 16, 17, 18, 19, and 20). The second factor consisted of seven items from the SPS (items 8, 9, 14, 15, 16, 17, and 19), and the third factor consisted of an additional five SPS items (4, 6, 13, 18, and 20). Each indicator was constructed by averaging the items with acceptable loadings on each factor. All three indicators met minimum validity criteria and had appropriately low levels of nuisance covariance (see Table 1 for indicator criteria and CCFI scores for each procedure).

Taxometric Analyses

MAXCOV analyses generated three curves. A visual inspection of the plots revealed that none of the curves yielded peaks characteristic of taxonic structure and were consistent with a dimensional solution. The research curves closely resembled the dimensional simulated plot in that they rose somewhat towards the right of the plot, but without any distinct peaks. In contrast, the simulated taxonic plot showed a large peak in the center of the plot, with lower data points on both sides. In addition, as can be seen in Figure 1, the averaged MAXCOV curve more closely resembled the simulated dimensional plots.

MAMBAC analyses generated six curves. A visual inspection of the 6 plots revealed that all six rose slightly to the right, with a distinctive incline at the far right of the plot. A comparison of the data plots with simulated taxonic and dimensional plots revealed that the data plots were consistent with the simulated dimensional plots (see Figure 1 for the averaged MAMBAC plot superimposed on simulated taxonic and dimensional plots).

L-Mode analysis generated a single factor score density plot. A visual inspection revealed a unimodal curve, which is suggestive of dimensionality, in contrast to the bimodal structure of the categorical comparison curves. The research curve more closely resembled the dimensional comparison curve.

As noted above, the CCFI provides an objective index of whether the data plots more closely resemble simulated taxonic or dimensional plots. The mean CCFI score across MAXCOV, MAMBAC, and L-Mode analyses was .40, providing additional objective evidence that the social anxiety data plots were more comparable to the simulated dimensional plots. The mean CCFI score also indicates that social anxiety, as measured by the SPS and SIAS in a large undergraduate sample, is dimensional at the latent level.

Specific Social Phobia versus Generalized Social Phobia

Indicator Selection. Correlational analyses were conducted on items within the two social anxiety measures, wherein the SPS is thought to measure characteristics associated with specific social phobia and the SIAS assesses factors associated with generalized social phobia. Indicators of specific social phobia were created by combining the 3 pairs of items on the SPS with the highest correlations (indicator 1 = items 12 and 15; indicator 2 = items 16 and 17; indicator 3 = items 19 and 20; all correlations > .60). Similarly, indicators of generalized social phobia were generated using the 3 pairs of items on the SIAS with the highest intercorrelations (indicator 1 = items 12 and 18; indicator 2 = items 15 and 17; indicator 3 = items 16 and 19; all correlations > .51).

Specific Social Phobia Results. MAXCOV analyses of the three SPS item pairs generated three curves, none of which demonstrated clear a clear peak. Rather, the three curves were highly consistent with simulated dimensional curves. Similarly, MAMBAC curves generated six curves, all of which lacked peaks and were consistent with dimensional simulations. The L-Mode curve exhibited a single peak, lacking the second peak exhibited by simulated taxonic plots. Thus, all 10 SPS plots were rated as dimensional, and the averaged CCFI score supported the dimensional interpretation (CCFI = .38).

Generalized Social Phobia Results. MAXCOV analyses of the three SIAS item pairs generated three curves, all of which were relatively flat and consistent with dimensional simulations. The six MAMBAC plots demonstrated slight rises toward the right without peaks, consistent with simulated dimensional plots. The L-Mode plot was somewhat ambiguous, though it favored simulated dimensional more than simulated taxonic plots. The averaged CCFI score provided further support for a generalized social anxiety dimension (CCFI = .41).

Discussion

Debate exists in the literature regarding whether SAD represents a discrete disorder or an arbitrary threshold along a continuum of social anxiety symptom severity. Some researchers have argued that SAD should be conceptualized as a dimensional construct and that individuals diagnosed with SAD differ quantitatively, rather than qualitatively, from non-diagnosed individuals. This study examined the latent structure of social anxiety disorder by applying taxometric procedures to data assessing social anxiety symptoms in a large undergraduate sample. Multiple taxometric procedures generated converging evidence that SAD is a dimensional construct. These findings are consistent with previous research supporting a continuous structure of social anxiety (Crome, et al., 2010; Kollman, et al., 2006; A. M. Ruscio, 2010) but contrast with the taxonic findings reported in a fourth study (Weeks et al., 2010). In addition, recent taxometric research suggests that fear of evaluation, which is thought to comprise a core characteristic of SAD, also has an underlying dimensional structure (Weeks, Norton & Heimberg, 2009). Taken together, it appears that differences in levels of social anxiety reflect quantitative rather than qualitative differences between “disordered” and non-disordered individuals.

This study also examined the latent structure of performance and interaction anxiety, fears theorized to reflect symptoms of SSP and GSP. Some researchers have argued that qualitative differences found between individuals in these two putative groups (traditionally delineated by number of feared social situations), in addition to observed differential heritability patterns, provide evidence for separate latent structures. SSP, thought to be similar to simple phobias, has been conceptualized as a taxonic construct, while GSP has been thought to be dimensional in structure. This study applied taxonic procedures to measures assessing performance and interaction anxiety in the large undergraduate sample discussed above. Multiple taxometric procedures generated converging evidence that both constructs have underlying dimensional structures, providing further evidence that social anxiety disorder comprises a single dimensional condition.

These findings are consistent with some recent non-taxometric research in supporting a continuous structure of social anxiety without subtypes (El-Gabalawy et al., 2010; A. M. Ruscio et al., 2008; Vriends et al., 2007) but contrast with other findings that suggest the existence of subtypes (e.g., Hook & Valentiner, 2002; Turner et al., 1992). While the current study examined the two proposed subtypes reflecting delineation between performance versus interaction anxiety, previous factor analyses have found support for between three (Safren, Turk, & Heimberg, 1998) and five (Perugi et al., 2001) putative subtypes.

Despite similar findings in three of the four previous taxometric analyses, the current study differs from earlier ones in several important ways. Consistent with the studies by Kollman and colleagues (2006) and Weeks and colleagues (2010), indicators in the present research were derived from items collected via self-report questionnaires. In contrast, both these studies also utilized diagnostic interviews, along with studies by Crome and colleagues (2010) and A. M. Ruscio (2010), where indicators were derived exclusively from Version 3.0 of the Composite International Diagnostic Interview (CIDI 3.0; Kessler & Üstün, 2004), allowing for diagnosis of SAD and the calculation of a sample base rate.

The current study applied taxometric procedures to a large (*n* = 2,019) non-clinical sample of undergraduates. In comparison, previous studies have used community participants (Crome et al., 2010; A. M. Ruscio, 2010), anxiety disorder outpatients (Kollman et al., 2006), and a composite sample comprised of community participants, undergraduates, and SAD outpatients (Weeks et al., 2010). All previous studies reported a larger age range and higher mean age of participants than in the current study, although sex and race demographics were similar across all studies.

These findings have several important implications for assessment and treatment of social anxiety. First, a dimensional construct is optimally assessed using instruments designed to measure the full range of social anxiety and to discriminate across the distribution of scores rather than attempting to classify individuals into SAD or non-SAD groups. Artificial dichotomization of a continuous variable is contraindicated as it would result in a loss of potentially important data (Cohen, 1983). If the latent structure of SAD is dimensional, the continued use of instruments aimed at measuring a taxonic construct could result in far less available information about symptom severity or treatment gains. Continuous measurement of dimensional variables increases the number of available analytical techniques, rather than limiting analysis to procedures appropriate for categorical or dichotomous variables.

Second, a dimensional latent structure suggests the influence of an additive etiology, taking into account multiple factors rather than a discrete, all-or-nothing event or cause. This conceptualization coincides with modern behavioral theories regarding the etiology of social anxiety. For example, several models posit that general biological (e.g., genetics, behavioral inhibition) and psychological (e.g., early uncontrollable or unpredictable life experiences) vulnerability factors combine with stress and direct negative experiences in socio-evaluative situations to affect the development of social anxiety. Note that any of these variables alone are generally considered insufficient to generate high social anxiety without interaction with other factors (Bitran & Barlow, 2004).

Third, a continuous conceptualization of social anxiety symptoms would affect the diagnosis and treatment of SAD. Specifically, individuals undergoing treatment could track improvement (or deterioration) along a continuum of severity, rather than marking change in dichotomous terms (i.e., disordered/non-disordered). Previous research has indicated that using a dimensional, rather than categorical, system increases predictive validity of a SAD diagnosis (A. M. Ruscio, 2010). Specifically, research indicated that a dimensional system was more strongly associated with 10 of the 11 outcome variables, six of which were statistically significant. These outcomes included suicidal ideation and attempt following diagnosis, treatment-seeking behaviors, and subsequent mood disorder diagnosis (A. M. Ruscio, 2010). Additionally, adopting a dimensional conceptualization would allow for clinicians to detect gradual progress or decline in patients following the implementation of an intervention, rather than targeting major shifts in overall functioning.

The findings of the current study, in conjunction with support from previous research, suggest that delineation of social anxiety disorder subtypes based on type of social fear or number of feared situations is arbitrary. Given the lack of consistent operationalized subtype criteria in the literature and in the DSM-IV-TR definition itself, the classification of subtypes in research, assessment, and treatment is frequently left open to interpretation. This inconsistency may preclude the reliable detection of actual subtypes that, as some authors suggest, might provide clinical utility (Vriends et al., 2007). Even in the absence of clinically relevant subtypes, however, data suggests that individuals with a high number of social fears are likely to experience more psychological, social, and functional impairment than individuals with few social fears, and may at be at higher risk for suicidal ideation and attempt. Therefore, in cases of multiple significant social fears, a higher dosage of psychotherapy may be warranted in addition to assessment for suicidal ideation and comorbid psychological conditions.

The current study had several strengths, including the use of two commonly used measures of social anxiety symptoms, multiple taxometric procedures, and large sample size (n = 2,019). Three different taxometric procedures converged on a dimensional interpretation for SAD, which was supported by an objective fit index and interrater agreement. A total of six taxometric procedures converged on dimensional interpretations for both performance and interaction anxiety, also supported by an objective fit index and interrater agreement. Unfortunately, there are several limitations that should be taken into account when interpreting these findings. First, the ability of taxometric procedures to detect an underlying taxon or dimensional construct is dependent on the quality of the selected indicators. Although the indicators used in the present research demonstrated appropriate levels of nuisance covariance, content validity, and discriminant validity and were derived from commonly used social anxiety measures with good psychometric properties, the indicators were derived from two similar self-report measures. Beauchaine (2007) cautions that dimensional findings may be particularly related to the use of rating scale data. Thus, it is possible that the use of other indicators could result in a different interpretation. Future research would benefit from the implementation of greater diversity in the type of measures from which indicators are derived.

The study was conducted in a large non-clinical undergraduate sample, which may limit its generalizability to the general population. In addition, structured diagnostic interviews were not administered to participants, precluding calculation of the base rate of SAD diagnoses in the sample. Research suggests that sufficient numbers of putative taxon group members must be present in the sample for taxometric procedures to be capable of detecting the taxon. Although previous research estimates the base rate of SAD in the general population from 12 to 13% (Kessler, et al., 1994; A. M. Ruscio et al., 2008), if a SAD taxon exists, it is possible that the base rate of SAD in the present sample was too low to detect. Future research would benefit from assessing latent structure in clinical or mixed samples to exclude the influence of sample composition on our findings and to help clarify any heterogeneity in disordered individuals that could be explained by underlying subtypes.

References

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (Revised 4th ed.). Washington, DC: Author.

Beauchaine, T. P. (2007). A brief taxometrics primer. *Journal of Clinical Child and Adolescent Psychology, 36,* 654-676.

Bitran, S., & Barlow, D. H. (2004). Etiology and treatment of Social Anxiety: A commentary. *Journal of Clinical Psychology, 60,* 881-886.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York: Guilford Press.

Bruch, M. A., Fallon, M., & Heimberg, R. G. (2003). Social phobia and difficulties in occupational adjustment. *Journal of Counseling Psychology, 50,* 109-117.

Carleton, R. N., Collimore, K. C., Asmundson, G. J. G., McCabe, R., Rowa, K., & Antony, M. M. (2009). Refining and validating the Social Interaction Anxiety Scale and the Social Phobia Scale. *Depression and Anxiety, 26,* E71-E81.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research, 1*, 245-276.

Cohen, J. (1983). The cost of dichotomization. *Applied Psychological Measurement, 7,* 249-253.

Crome, E., Baillie, A., Slade, T., & Ruscio, A. M. (2010). Social phobia: further evidence of dimensional structure. *Australian and New Zealand Journal of Psychiatry, 44,* 1012-1020.

Di Nardo, P. A., Brown, T. A., & Barlow, D. H. (1994). *Anxiety Disorders Interview Schedule for DSM-IV: Lifetime Version (ADIS-IV-L).* San Antonio, TX: Psychological Corporation.

El-Gabalawy, R., Cox, B., Clara, I., & Mackenzie, C. (2010). Assessing the validity of social anxiety disorder subtypes using a nationally representative sample. *Journal of Anxiety Disorders, 24*, 244-249.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1996). *Structured clinical interview for DSM-IV axis I disorders—patient edition.* New York, NY: Biometrics Research Department, New York State Psychiatric Institute.

Grove, W. M. (1991). When is a diagnosis worth making? A comparison of two statistical prediction strategies. *Psychological Reports, 68,* 3-17.

Herbert, J. D., Hope, D. A., & Bellack, A. S. (1992). Validity of the distinction between generalized social phobia and avoidant personality disorder. *Journal of Abnormal Psychology, 101*, 332-339.

Hofmann, S. G. (2000). Treatment of social phobia: Potential mediators and moderators. *Clinical Psychology: Science and Practice, 7,* 3-16.

Hook, J. N., & Valentiner, D. P. (2002). Are specific and generalized social phobias qualitatively distinct? *Clinical psychology: Science and Practice, 9,* 379-395.

Holt, C. S., Heimberg, R. G., & Hope, D. A. (1992). Avoidant personality disorder and the generalized subtype of social phobia. *Journal of Abnormal Psychology*, *101,* 318-325.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55.

Jolliffe, I. T. (1972). Discarding variables in a principal component analysis, I: Artificial data. *Applied Statistics, 21,* 160-173.

Jöreskog, K. G., & Sörbom, D. (2003). LISREL (Version 8.54) [Computer software]. Chicago: Scientific Software Inc.

Kagan, J. (2001). Temperamental contributions to affective and behavioral profiles in childhood. In: S. G. Hofmann & M. DiBartolo (Eds.), *From social anxiety to social phobia: Multiple perspectives.* Needham Heights, MA: Allyn and Bacon.

Kessler, R. C., McGonagle, K. A., Zhao, S., Nelson, C. B., Hughes, M., Eshleman, S., … Kendler, K. S. (1994). Lifetime and 12-month prevalence of *DSM-III-R* psychiatric disorders in the United States: Results from the National Comorbidity Survey. *Archives of General Psychiatry, 51,* 8-19.

Kessler, R. C., & Üstün, T. B. (2004). The World Mental Health (WMH) survey initiative version of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI). *International Journal of Methods in Psychiatric Research, 13,* 93-121.

Kollman, D. M., Brown, T. A., Liverant, G. I., & Hofmann, S. G. (2006). A taxometric investigation of the latent structure of social anxiety disorder in outpatients with anxiety and mood disorders. *Depression and Anxiety, 23,* 190-199.

Mannuzza, S. S., Schneier, F. R., Chapman, T. F., Liebowitz, M. R., Klein, D. F., & Fyer, A. J., (1995). Generalized social phobia: Reliability and validity. *Archives of General Psychiatry, 52,* 230-237.

Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy, 36,* 455-470.

Mattick, R. P., & Peters, L. (1988). Treatment of severe social phobia: Effects of guided exposure with and without cognitive restructuring. *Journal of Consulting and Clinical Psychology, 56,* 251-260.

Mattick, R. P., Peters, L., & Clarke, J. C. (1989). Exposure and cognitive restructuring for social phobia: A controlled study. *Behavior Therapy, 20,* 3-23.

Meehl, P. E. (1994). Bootstraps taxometrics: Solving the classification problem in psychopathology. *American Psychologist, 50,* 266-275.

Meehl, P. E., & Yonce, L. J. (1994). Taxometric analysis I: Detecting taxonicity with two quantitative indicators using means above and below a sliding cut (MAMBAC procedure). *Psychology Reports, 74,* 1059-1274.

Meehl, P. E., & Yonce, L. J. (1996). Taxometric analysis II: Detecting taxonicity using covariance of two quantitative indicators in successive intervals of a third indicator (MAXCOV procedure). *Psychological Reports, 78,* 1091-1227.

Merikangas, K. R., Avenevoli, S., Acharyya, S., Zhang, H., & Angst, J. (2002). The spectrum of social phobia in the Zurich cohort study of young adults. *Biological Psychiatry, 51,* 81-91.

Perugi, G., Nassini, S., Maremmani, I., Madaro, D., Toni, C., Simonini, E., & Akiskal, H. S. (2001). Putative clinical subtypes of social phobia: A factor-analytical study. *Acta Psychiatrica Scandinavica, 104,* 280-288.

R Development Core Team (2005). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org.

Rapee, R. M. (1995). Descriptive psychopathology of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneider (Eds.), *Social phobia: Diagnosis, assessment, and treatment*, 41-66. New York, NY: Guilford Press.

Rapee, R. M., Craske, M. G., & Barlow, D. H. (1995). Assessment instrument for panic disorder that includes fear of sensation-producing activities: The Albany Panic and Phobia Questionnaire. *Anxiety, 1*, 114-122.

Rapee, R. M., & Spence, S. H. (2004). The etiology of social phobia: Empirical evidence and an initial model. *Clinical Psychology Review*, *24*, 737-767.

Ruscio, A. M. (2010). The latent structure of social anxiety disorder: Consequences of shifting to a dimensional diagnosis. *Journal of Abnormal Psychology.* Advance online publication. doi: 10.1037/a0019341

Ruscio, A. M., Brown, T. A., Chiu, W. T., Sareen, J., Stein, M. B., & Kessler, R. C. (2008). Social fears and social phobia in the USA: results from the National Comorbidity Survey Replication. *Psychological Medicine, 38,* 15-28.

Ruscio, J. (2007). Taxometric analysis: An empirically grounded approach to implementing the method. *Criminal Justice and Behavior, 34,* 1588-1622.

Ruscio, J. (2009). Assigning cases to groups using taxometric results: An empirical comparison of classification techniques. *Assessment, 16,* 55-70.

Ruscio, J. (2010). Taxometric programs for the R computing environment: User's manual. Ewing, NJ: The College of New Jersey, Psychology Department. Retrieved from http://www.tcnj.edu/~ruscio/taxometrics.html.

Ruscio, J., & Kaczetow, W. (2009). Differentiating categories and dimensions: Evaluating the robustness of taxometric analysis. *Multivariate Behavioral Research, 44,* 259-280.

Ruscio, J., & Marcus, D. K. (2007). Detecting small taxa using simulated comparison data: A reanalysis of Beach, Amir and Bau's (2005) data. *Psychological Assessment*, *19,* 241-246.

Ruscio, J., & Ruscio, A. M. (2004). A conceptual and methodological checklist for conducting a taxometric investigation. *Behavior Therapy*, *35*, 403-447.

Ruscio, J., & Ruscio, A. M. (2004b). A nontechnical introduction to the taxometric method. *Understanding Statistics, 3,* 151-194.

Ruscio, J., Ruscio, A. M., & Meron, M. (2007). Applying the bootstrap to taxometric analysis: Generating empirical sampling distributions to help interpret results. *Multivariate Behavioral Research, 42,* 349-386.

Ruscio, J., & Walters, G. D. (2011). Differentiating categorical and dimensional data with taxometric analysis: Are two variables better than none? *Psychological Assessment, 23*, 287-299.

Safren, S. A., Turk, C. L., & Heimberg, R. G. (1998). Factor structure of the Social Interaction Anxiety Scale and the Social Phobia Scale. *Behaviour Research and Therapy, 36,* 443-453.

Satorra, A., & Bentler, P. M. (1994). Corrections to test statistics and standard errors in covariance structure analysis. In C. C. Clogg & A. von Eye (Eds.), *Latent variables analysis: Applications for developmental research*, 399-419. Thousand Oaks, CA: Sage Publications.

Schmidt, N. B., Kotov, R., & Joiner, T. E., Jr. (2004). *Taxometrics: Toward a new diagnostic scheme for psychopathology*. Washington, DC: American Psychological Association.

Schwartz, C. E., Snidman, N., & Kagan, J. (1999). Adolescent social anxiety as an outcome of inhibited temperament in childhood. *Journal of the American Academy of Child and Adolescent Psychiatry, 38,* 1008-1015.

Stein, M. B., Torgrud, L. J., & Walker, J. R. (2000). Social phobia symptoms, subtypes, and severity. *Archives of General Psychiatry, 57,* 1046-1052.

Stemberger, R. T., Turner, S. M., Beidel, D. C., & Calhoun, K. S. (1995). Social phobia: An analysis of possible developmental factors. *Journal of Abnormal Psychology, 104,* 526-531.

Turner, S. M., Beidel, D. C., & Townsley, R. M. (1992). Social phobia: A comparison of specific and generalized subtypes and avoidant personality disorder. *Journal of Abnormal Psychology, 101,* 326-331.

Vriends, N., Becker, E. S., Meyer, A., Michael, T., & Margraf, J. (2007). Subtypes of social phobia: Are they any use? *Journal of Anxiety Disorders, 21,* 59-75.

Waller, N. G., & Meehl, P. E. (1998). *Multivariate taxometric procedures.* Thousand Oaks, CA: Sage.

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of Consulting and Clinical Psychology, 33,* 448-457.

Weeks, J. W., Carleton, R. N., Asmundson, G. J., McCabe, R. E., & Antony, M. M. (2010). "Social anxiety disorder carved at its joints": Evidence for the taxonicity of social anxiety disorder. *Journal of Anxiety Disorders, 24,* 734-742.

Weeks, J. W., Norton, P. J., & Heimberg, R. G. (2009). Exploring the latent structure of two cognitive components of social anxiety: Taxometric analyses of fears of negative and positive evaluation. *Depression and Anxiety, 26,* E40-E48.

Woodward, S. A., Lenzenweger, M. F., Kagan, J., Snidman, N., & Arcus, D. (2000). Taxonic structure of infant reactivity: Evidence from a taxometric perspective. *Psychological Science, 11,* 296-301.

Appendix A

To: Grace Boyers

CAMPUS MAIL

From: Jessica Yandow, Office of Research and Sponsored Programs
Date: 10/10/2011
RE: Notice of IRB Exemption
Study #: 12-0028

Study Title: The Latent Structure of Social Anxiety Disorder: A Taxometric Analysis
Exemption Category: (4) Collection or Study of Existing Data, If Public or Unable to Identify Subjects

This submission has been reviewed by the IRB Office and was determined to be exempt from further review according to the regulatory category cited above under 45 CFR 46.101(b). Should you change any aspect of the proposal, you must contact the IRB before implementing the changes to make sure the exempt status continues to apply. Otherwise, you do not need to request an annual renewal of IRB approval. Please notify the IRB Office when you have completed the study.

Best wishes with your research!

CC:
Joshua Broman-Fulks, Psychology

Table 1

Descriptive Statistics and Summary of Taxometric Output for MAXCOV, MAMBAC, and L-Mode Analyses of the Social Anxiety, Specific Social Anxiety, and Generalized Social Anxiety Research Data

	Validity (*SD*)	Nuisance Covariance (Taxon, Complement)	CCFI
Social Anxiety			
	2.56 (.17)	.16, .41	0.39
Specific Social Anxiety			
	2.79 (.19)	.12, .33	0.38
Generalized Social Anxiety			
	2.61 (.14)	.22, .55	0.41

MAXCOV

MAMBAC

L-Mode

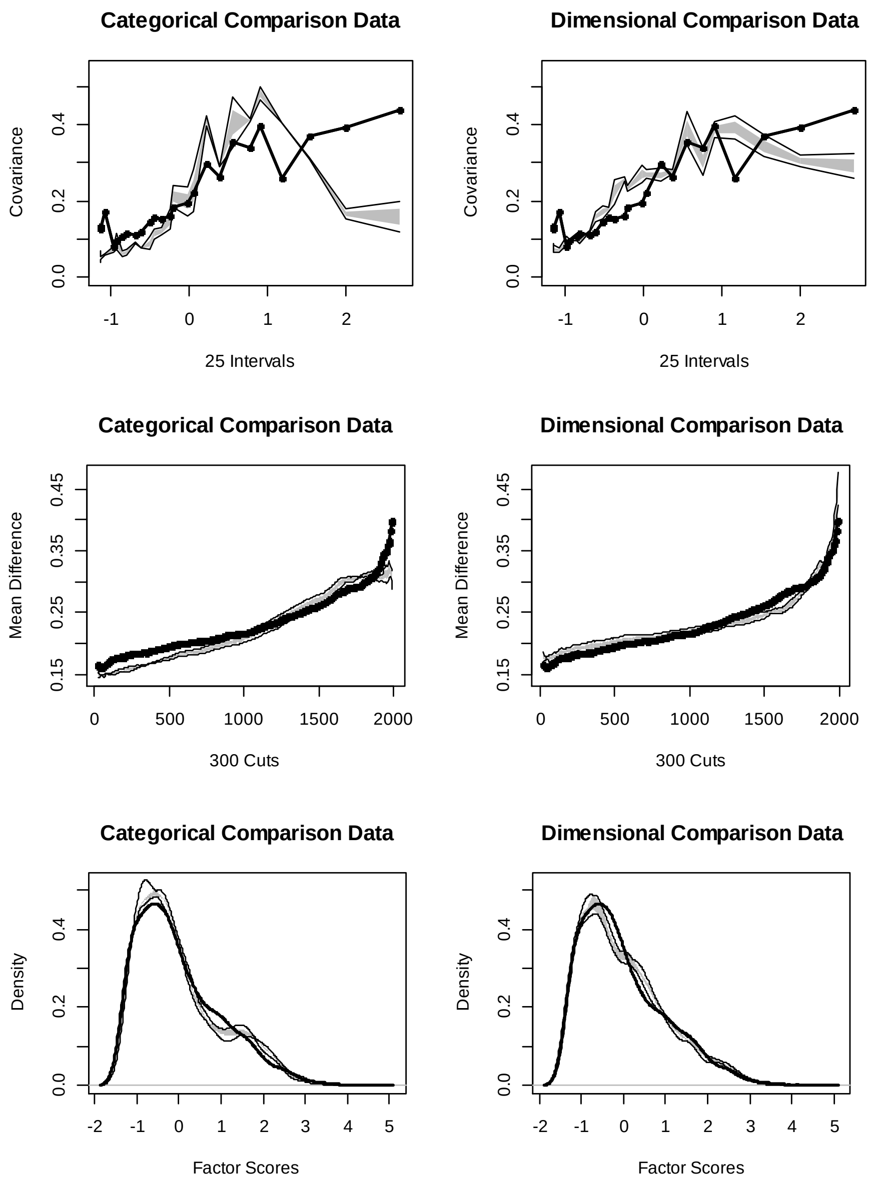

Figure 1. Averaged social anxiety MAXCOV (top), MAMBAC (middle), and L-Mode (bottom) curves imposed on simulated categorical (left) and dimensional (right) comparison curves.

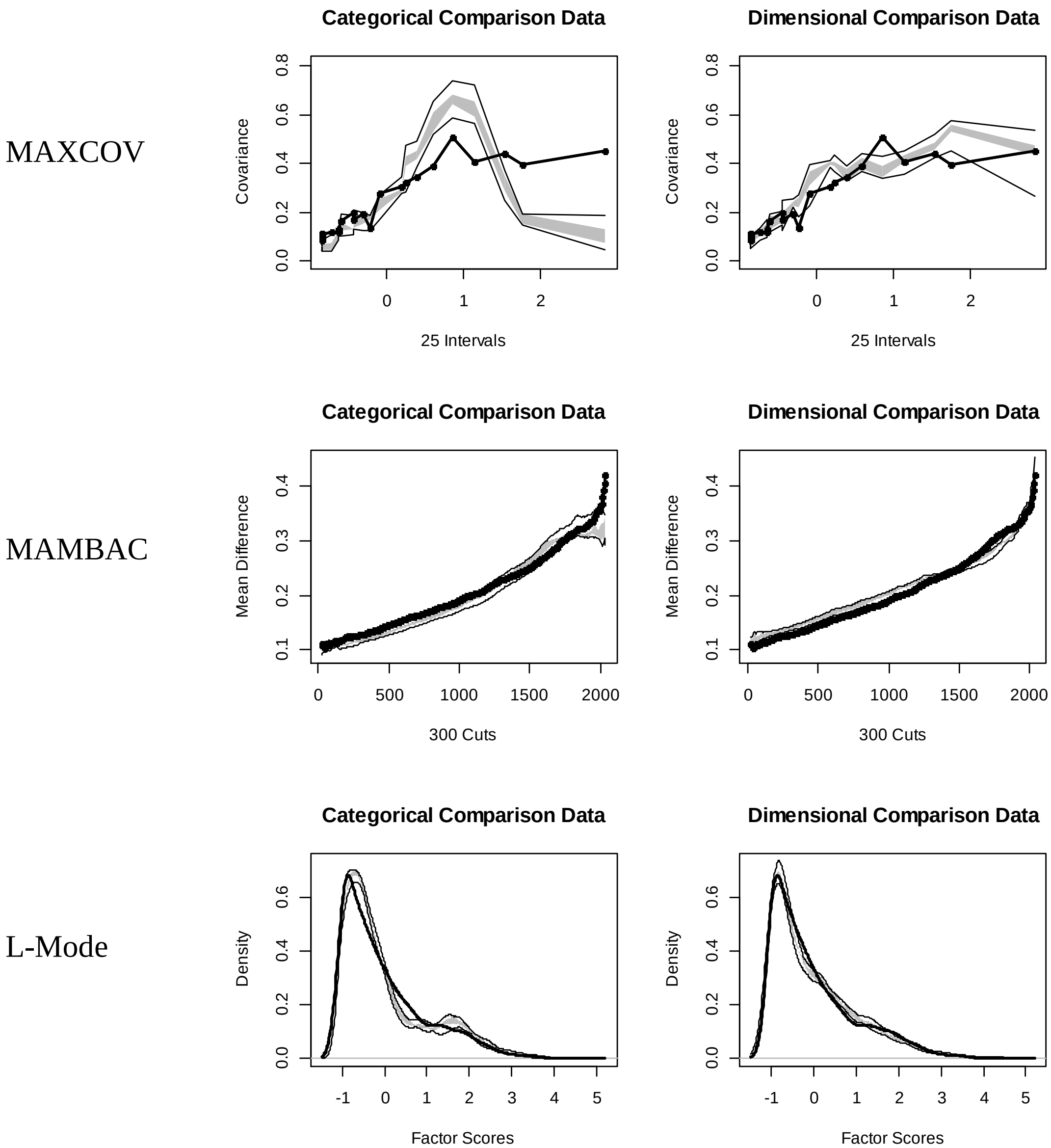

Figure 2. Averaged specific social anxiety (SPS) MAXCOV (top), MAMBAC (middle), and L-Mode (bottom) curves imposed on simulated categorical (left) and dimensional (right) comparison curves.

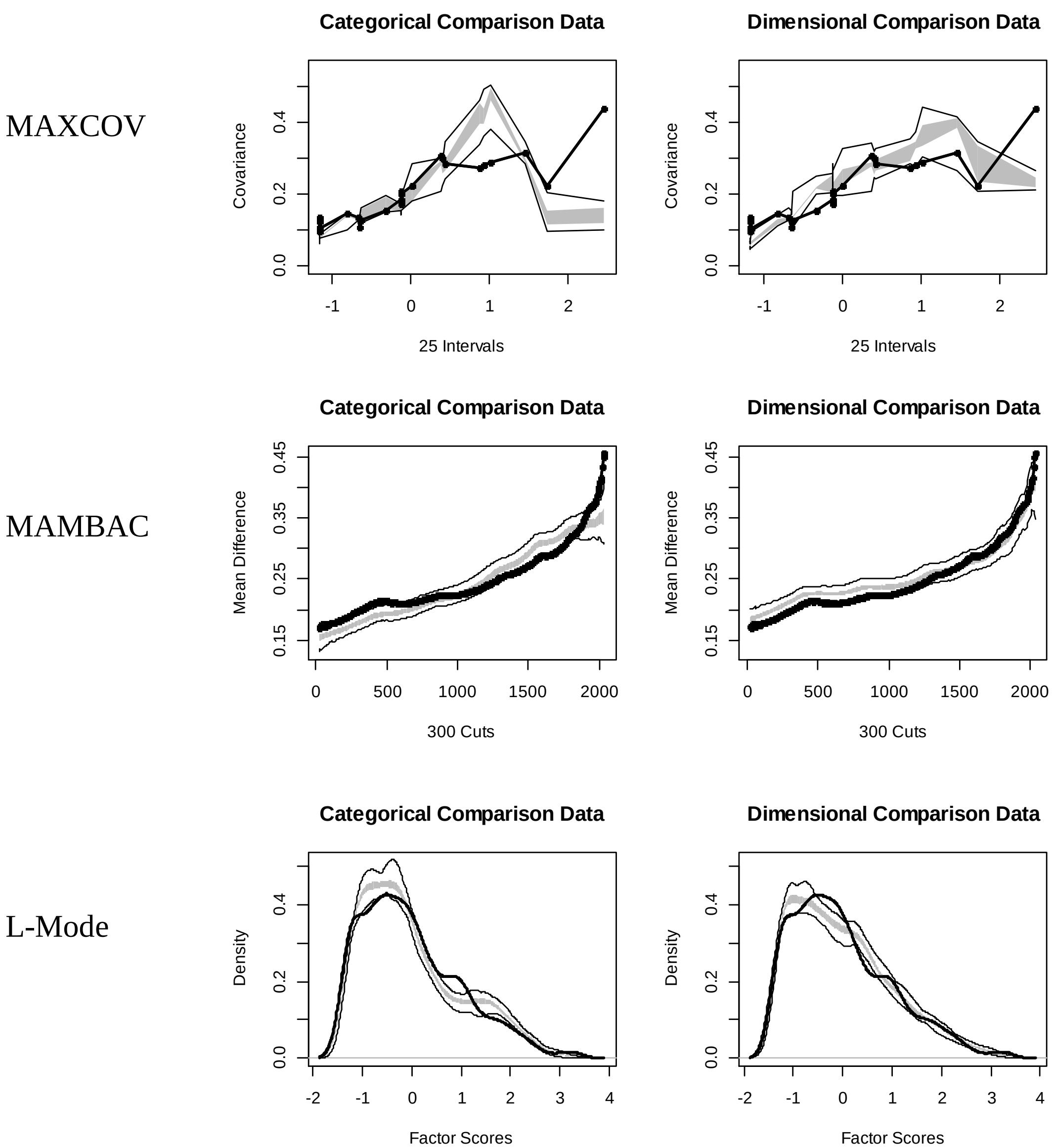

Figure 3. Averaged generalized social anxiety (SIAS) MAXCOV (top), MAMBAC (middle), and L-Mode (bottom) curves imposed on simulated categorical (left) and dimensional (right) comparison curves.

VITA

Grace Boyers was born in Richmond, Virginia, where she graduated from St. Catherine’s School in June 2005. The following August, she entered the University of Mary Washington in Fredericksburg, Virginia, and majored in Psychology. She was awarded a Bachelor of Science degree in May 2009. In the fall of 2010, Ms. Boyers began study toward a Master of Arts degree in Clinical Health Psychology at Appalachian State University and was awarded the degree in December 2012.