

The Evolved Function of Social Anxiety: Detecting High Stakes Social Interactions

by

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Table of Contents

List of Tables.....	iii
List of Figures.....	iv
Abstract.....	v
Chapter	
1. Introduction.....	1
2. Evolutionary Explanations for Social Anxiety.....	7
3. Are Moderate Levels of Social Anxiety Adaptive? An Analysis of Speed and Errors in Identifying Emotional Expressions	53
4. Content Analysis of Descriptions of Social Anxiety-Inducing Events.....	113
Appendix A: Social Anxiety Vignette Coding Scheme.....	136
5. Conclusion.....	141

List of Tables

2.1	Comparing Evolutionary Approaches to Understanding the Function of Social Anxiety.....	45
3.1	Means and Standard Deviations by Experimental Group (Study 1).....	91
3.2	Model Fit for Stepwise Regressions Predicting Response Time to Emotional Faces (Study 1).....	92
3.3	Multiple Regression Predicting Response Time to Sad Faces (Study 1)	93
3.4	Multiple Regression Predicting Response Time to Angry Faces (Study 1).....	94
3.5	Multiple Regression Predicting Response Time to Neutral Faces (Study 1).....	95
3.6	Descriptive Statistics for Signal Detection Parameters by Experimental Group (Study 1).....	96
3.7	Multiple Regression Predicting Discriminability of Angry Faces (Study 1).....	97
3.8	Means and Standard Deviations by Experimental Group (Study 2).....	98
3.9	Multiple Regression Predicting Response Time to Sad Faces (Study 2).....	99
3.10	Multiple Regression Predicting Response Time to Angry Faces (Study 2).....	100
3.11	Descriptive Statistics for Signal Detection Parameters by Experimental Group (Study 2)	101
3.12	Means and Standard Deviations by Experimental Group (Study 3).....	102
3.13	Descriptive Statistics for Signal Detection Parameters by Experimental Group (Study 3)	103
3.14	Multiple Regression Predicting Bias for Angry Faces (Study 3).....	104
3.15	Multiple Regression Predicting Efficiency for Angry Faces (Study 3).....	105
4.1	Intercoder Reliability and Descriptive Statistics.....	133
4.2	Measures of Association between Trait Social Anxiety and Coded Situational Variables.....	134
4.3	Descriptive Statistics and Correlations for LIWC Analysis.....	135

List of Figures

3.1	Differences between Control and Social Anxiety Conditions in the Relationship between Trait Social Anxiety and Response Time to Different Types of Emotional Expressions (Study 1).....	106
3.2	Differences between Control and Social Anxiety Conditions in the Relationship between Trait Social Anxiety and Discriminability of Angry Expressions (Study 1).....	107
3.3	Differences between Control and Social Anxiety Conditions in the Relationship between Trait Social Anxiety and Response Time to Different Types of Emotional Expressions (Study 2).....	108
3.4	Differences between the Control and Social Anxiety Conditions in the Relationship between Trait Social Anxiety and Efficiency in Responding to Angry Expressions (Study 3).....	109

Abstract

In three articles, I explore the evolved function of social anxiety. Social anxiety – like other responsive defenses – is useful only when the magnitude of the response is appropriate to the demands of situations that involve genuine social threats. In the first article, I review the literature on the ultimate function of social anxiety and argue that the computational systems that underlie social anxiety function to: 1) detect high stakes social interactions; and, 2) minimize the risk of subsequent negative evaluation. In the second article, I present the results of a series of studies in which participants from across the distribution of levels of trait social anxiety completed a threatening or non-threatening priming task, then were asked to identify the emotion displayed in a series of faces. Results revealed a curvilinear relationship between dispositional social anxiety scores and response time, suggesting that social anxiety is advantageous in certain situations. The final article used content analysis to examine the characteristics of the interaction partners and types of situations that college-aged participants recall – as well as the vocabulary and pronouns used – when asked write about an anxiety-provoking situation.

Chapter 1

Introduction

“Everyone is shy --- it is the inborn modesty that makes us able to live in harmony with other creatures and our fellows.” – Kirkpatrick Sale (Simon, 1999)

It would probably be difficult to find many Americans who would agree with Kirkpatrick Sale’s positive view of shyness. Social anxiety is typically viewed as a liability. For children, behavioral inhibition makes it difficult to separate from the primary caregiver or play with other children. For adolescents, social anxiety makes it hard to approach an attractive member of the opposite sex or speak-up in class. For adults, social phobia may prevent us from presenting ideas at work, thus delaying or preventing promotion. We tend to focus on such negative outcomes of the social anxiety response, ignoring the benefits that social wariness can entail. For children, behavioral inhibition leads to the avoidance of potentially hostile strangers. For adolescents, social anxiety prevents us from picking a fight with a burly football player. For adults, social phobia ensures that we do not “put our foot in our mouth” by saying something in front of the boss that we later regret. This dissertation seeks to explore some such benefits of the social anxiety response.

Perhaps the most influential perspective for research on social anxiety is the cognitive model (Clark & Wells, 1995; Rapee & Heimberg, 1997). On this perspective, “the persistence of social phobia is a puzzle” (Clark, 2001, p. 405). It is impossible for social phobics to avoid all social situations, therefore exposure to the feared events should help to eliminate their anxiety. What research by cognitive theorists has shown is that social fears are maintained due to the ways in which social phobics process information during social interactions. While in social situations, those with high social anxiety tend to be hyper-focused on their own internal states and to have a negative bias when interpreting social cues. For example, a social phobic may interpret a smile on the face of an interaction partner as mocking rather than encouraging. With its focus on refuting patients’ unconditionally negative beliefs and exposure to feared situations, cognitive-behavioral therapy has emerged as the primary treatment for social phobia. The cognitive perspective focuses on how the individual’s cognitions and behaviors reinforce his or her social anxiety, and this perspective is not concerned with the ultimate, or evolutionary, reasons for the existence of the social anxiety response among humans.

The social anxiety response is a product of evolution by natural selection. Wakefield and colleagues have argued that social anxiety should only be considered disordered if it fails to perform the function for which it was designed by natural selection (Wakefield, Horwitz, & Schmitz, 2005). This evolved function of social anxiety is the topic of Chapter 2. Leary (2001) argues that social anxiety is a gauge that alerts us to imminent social exclusion by our interaction partners. In contrast, Gilbert (2001) believes that social anxiety results from omnipresent human status hierarchies. Those with high social anxiety fail to engage in social interactions because they believe they

have low status and fear losing resources to higher status others. Both Leary and Gilbert suggest plausible functions for the social anxiety response. We argue that their accounts are limited by the treatment of social anxiety as a single, specific type of response to a single, specific type of situation (i.e., being socially excluded or being threatened by higher status others). We present a more general model for understanding the function of social anxiety, which we call the *High Stakes Model of Social Anxiety*. We argue that the social anxiety response is best understood as having two primary functions: 1) identifying social interactions during which there is the possibility of being negatively evaluated by interaction partners; and, 2) taking steps to minimize the subsequent risk of receiving a negative evaluation.

Social anxiety is a responsive defense against social threats (Nesse, 1990; 2005). The response is triggered by environmental cues to the possibility of negative evaluation, and individuals differ in their sensitivity to such cues. Whereas a person who is high in trait-level social anxiety may be afraid of a one-shot interaction with a store clerk, someone with lower trait social anxiety may only experience social fears while speaking publically in front of a large audience. The former individual has a social anxiety response that is more sensitive than the social anxiety response of the latter individual. If social anxiety is a mechanism designed to minimize the risk of negative evaluation, then most people – whose trait-level of social anxiety falls toward the middle of the normal distribution of social anxiety scores – should be expected to have a healthy amount of social fear that alerts them to genuine social threats. Relatively few individuals will have trait-levels of social anxiety that place them in the tails of the normal distribution. As suggested by Wakefield et al. (2005), the responses of those who fall at the extremes of

the distribution may be considered disordered, in that those individuals are either over- or under-responsive to threat cues. In contrast, those at the center of the normal distribution will be able to detect meaningful social threats without wasting physiological and psychological resources on responding to more benign social interactions.

The studies presented in Chapter 3 were designed to test the hypothesis that individuals with moderate levels of social anxiety are both faster and more accurate in identifying social threats than are those who have either very high or very low dispositional levels of social anxiety. Participants were asked to identify different emotional expressions – happy, sad, angry, or no expression – with the expectation that if we were to create a scatterplot with trait social anxiety on the x-axis and response time to angry faces on the y-axis, the relationship between the two variables would best be described by a U-shaped, rather than by a linear function. This approach to studying individuals from across the distribution of social anxiety scores is a departure from traditional research on social anxiety, in which researchers compare the performance of a group of social phobics (i.e., a high or disordered social anxiety group) to a group of nonanxious controls (See Crozier & Alden, 2001, for a review of studies that use this approach). Studies that compare these two groups ignore the possibility that a moderate amount of social anxiety may be advantageous in certain types of situations.

The work presented in Chapter 4 marks another departure from traditional studies of social anxiety, which often involve a laboratory manipulation of the anxiety response or real-world interventions designed to treat social phobia. Chapter 4 presents the content analysis of a group of vignettes written about social anxiety-provoking experiences. Using linguistic analysis by both human coders and computer software, we are able to

look for differences in the ways that those with high and low social anxiety think about and reconstruct anxiety-provoking events. We also examine the relationships between those who are recalling the events and their “audience” of interaction partners, testing for status and age differentials as well as the degree of familiarity with the audience members.

In sum, this dissertation presents three papers that use insights from evolutionary psychology to advance our understanding of the function of social anxiety. The results of the empirical work suggest that the social anxiety response is not simply an embarrassing physiological reaction that we should seek to camouflage, if not eliminate. Instead, these findings suggest that the social anxiety response functions to protect us from meaningful social threats. When the social anxiety response is triggered, the emotional and physiological symptoms appear to be similar for individuals from across the distribution of social anxiety levels, suggesting that there is no clear cut-off between those who have normal social anxiety and those who have disordered levels. Our work serves as a reminder that it is those with *no* social anxiety, rather than those with *some* social anxiety, who are at a disadvantage.

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Chapter 2

Evolutionary Explanations for Social Anxiety

The social world is a dangerous place. Strangers are unpredictable and potentially hostile. Audiences laugh when speakers make mistakes. Potential mates spurn romantic advances. Those with higher status can limit – or terminate – career advancement. In a world in which the social stakes are so high, it is unsurprising that feelings of social anxiety are prevalent. Notably, 90% of people experience shyness or worry about social interactions at least occasionally (Zimbardo, 1977), and the lifetime prevalence rate of social phobia (i.e., social anxiety disorder) is 12.1% (Ruscio, Brown, Chiu, Sareen, Stein, & Kessler, 2008).

Most research on social anxiety has focused on identifying those with crippling levels of anxiety. The emphasis has been on diagnosis, etiology, and treatment of disorders. This perspective on social anxiety as pathology overlooks the view on social anxiety to be presented here, namely, that it is a valuable and life-saving personality trait that is normally distributed in the population. There is no bimodal distribution of social anxiety, and there appears to be no clear boundary between pathological and non-pathological anxiety. In the absence of a clear definition for pathological anxiety, the American Psychiatric Association (APA, 2000) bases its criteria for identifying social

phobia, in part, on the patient's "excessive or unreasonable" social fears, as well as "intense anxiety or distress" during the feared situations.

Before we can develop an understanding of disordered social anxiety, we must first understand the origins and functions of normal social anxiety. Prevailing theories about the evolved function of social anxiety (e.g., Gilbert, 2001; Leary, 2001) posit that social anxiety represents a specific, functional emotional response to a single type of eliciting situation. In contrast, we argue that the social anxiety response prevents a variety of costly negative outcomes, by detecting different types of high stakes social interactions and triggering behavior that will minimize the subsequent risk of negative outcomes.

Defining Social Anxiety

The social anxiety response is defined by the physiological, cognitive, and behavioral components of its phenomenology. Many of the physiological components of the social anxiety response result from increased activity in the sympathetic nervous system. Heart and respiration rates increase, as do blood pressure and muscle tension. This "fight or flight" response also shunts blood from areas such as the gastrointestinal tract and the face toward the large muscles of the legs that would facilitate escape (Cannon, 1915). The physiological response to social threats can even include symptoms of a panic attack such as sweating, trembling, feeling sick, dizziness, heart palpitations, and difficulty breathing (Amies, Gelder, & Shaw, 1983).

Research on the cognitive changes associated with the social anxiety response has been extremely influential for the treatment of social anxiety. The cognitive model of social phobia holds that social anxiety is associated with cognitive distortions that occur during social interactions. Clark and Wells (Clark, 2001; Clark & Wells, 1995) have

identified three kinds of distortions. First, social phobics have excessively high standards for social performance and tend to be perfectionists (e.g., “I must always sound intelligent” or “I should always have something interesting to say”). Second, they tend to have conditional beliefs about the consequences of their actions in social settings (e.g., “If my hands shake, people will think I’m stupid” or “If I disagree with someone, he or she will reject me”). Third, social phobics tend to have unconditional negative beliefs about themselves (e.g., “I’m stupid” or “I’m boring”). Because social phobics are so focused on their own distorted perceptions, they often fail to process all external social cues, and the social cues that are processed tend to be taken as signs of others’ disapproval. For example, social phobics have better memory for critical faces than do those who are not socially anxious (Lundh & Öst, 1996).

In addition to its physiological and cognitive components, social anxiety is marked by certain behavioral responses. The social anxiety response entails a strong desire to avoid the feared situation. If a situation cannot be avoided, then the socially anxious person will experience intense distress during the social interaction. Anxious individuals tend to be inhibited in social settings; they speak less frequently and for shorter periods than do those who are not socially anxious (Leary & Kowalski, 1995). Furthermore, socially anxious individuals may go to great lengths to ensure that others see them as being agreeable, perhaps by smiling and nodding during conversations. They are also concerned that their behavior is seen as being socially appropriate. In fact, socially anxious individuals are less likely to help others if doing so requires breaking a social norm (McGovern, 1976).

Despite clear patterns of physiological, cognitive, and behavioral responses to feelings of social anxiety, much writing about social anxiety has been devoted to defining social anxiety as distinct from other types of fears and to categorizing the types of situations that cause the social anxiety response. Schlenker and Leary (1982) define social anxiety as fear that arises due to the prospect of being evaluated by others in a real or imagined social situation. The socially anxious individual is motivated to make a certain type of impression on others, but fears that he or she will not be able to live up to that desired standard (Leary & Kowalski, 1995). Most researchers view social phobia as simply an extreme – or disordered – form of trait level social anxiety, which merits a clinical diagnosis according to the DSM-IV (Leary & Kowalski, 1995).

Situational Elicitors of Social Anxiety

Public speaking fears are perhaps the most common type of social anxiety, yet social anxiety is also reported in situations such as interacting with others at a party or eating in public. The most prominent measure of social phobia is the Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987). The LSAS asks respondents to report the severity of the anxiety they experience in 13 performance situations and 11 social interaction situations. The performance items include “Giving a report to a group,” “Entering a room when others are already seated,” and “Working while being observed,” whereas the social interaction items include “Talking to people in authority,” “Looking at people you don’t know very well in the eyes,” and “Being the center of attention.” These two categories do not appear to be mutually exclusive, and it seems that some items could belong to both categories. For example, “being the center of attention” appears to suggest a type of social performance, despite the fact that it is one of the social interaction items.

There have been many attempts to identify meaningful categories of social anxiety-provoking situations. Holt, Heimberg, Hope, and Liebowitz (1992) classified the LSAS social situations into four types: formal speaking and interaction (e.g., speaking in front of an audience), informal speaking and interaction (e.g., interacting with strangers at a party), assertive interaction (e.g., disagreeing with an authority figure), and being observed (e.g., eating in public). Others have used various statistical techniques in their attempts to extract meaningful subtypes. Perugi et al. (2001) used factor analysis of the LSAS to identify subtypes of social anxiety in a sample of Italians who met the criteria for a diagnosis of social phobia. The study identified five subtypes, including formal speaking anxiety, stranger-authority anxiety, eating and drinking in public, anxiety due to being observed, and interpersonal anxiety – a catch all for the remaining types of interactions. A more recent factor analysis of the LSAS items based on data from the National Comorbidity Replication Survey suggests that eliciting situations can best be understood as falling into three categories: social interactions with strangers, being observed, and speaking in public (Cox, Clara, Sareen, & Stein, 2008).

Other researchers have identified subtypes based on the severity of social anxiety. Using cluster analysis, Furmark, Tillfors, Stattin, Ekselius, and Fredrikson (2000) distinguished generalized social phobics (i.e., those who fear a broad range of social situations) from non-generalized social phobics (i.e., those who fear a moderate number of situations) and discrete social phobics (i.e., those who fear specific situations such as performing in front of an audience). These subtypes fall along a continuum of social fears, which ranges from absent or mild social anxiety at one extreme to crippling social phobia at the other extreme.

Clearly, researchers have failed to reach a consensus on meaningful categories of social fears. And in fact, results from the growing body of research on subtypes of social anxiety are undermined by studies that find little evidence for subtypes based on either the type or number of social situations that are feared (Stein, Torgrud, & Walker, 2000). Studies that attempt to identify subtypes are limited in that they are largely atheoretical; researchers largely rely on various exploratory statistical techniques. Many different situations arouse the same kinds of symptoms, and, both the situational precipitants and the symptoms can vary dramatically from person to person. This suggests that the cognitive mechanisms that trigger social anxiety do not represent a fixed action tendency in response to certain environmental triggers. That is, the social anxiety mechanism does not respond identically to all performance or all interaction situations. A person who experiences social anxiety at the thought of talking to one type of authority figure will not necessarily experience fear at the prospect of interacting with all types of authority figures. Rather, the social anxiety response is triggered in response to a series of appraisals of relevant elements of the situation. Individual differences in social anxiety may be due more to the differences in how people interpret various aspects of the social situation than to dispositional differences in the tendency to fear certain types of situations.

Proximate Explanations of Social Anxiety

Many of the studies of individual differences in social anxiety have attempted to explain why some people experience little social anxiety, whereas others are crippled by their social fears. For example, researchers have identified behavioral inhibition and shyness during childhood as antecedents of adult social anxiety. Infants with overactive –

or dysregulated – fear responses to novel stimuli tend to mature into preschool-age children who are inhibited and shy and then into adults who are socially anxious (Kagan, 1999). Others argue that environmental factors are the primary contributors to shyness. For example, insecure infant attachment to the primary caregiver and distant or rejecting parenting styles are both associated with shyness and low social competence during childhood (Schmidt, Polak, & Spooner, 2001).

There are several reasons that such approaches are limited in their ability to explain the function of social anxiety. First, some models do not distinguish between proximate and ultimate explanations for social anxiety. Whereas a certain parenting style might be one immediate cause of later social anxiety, such an explanation does not address why the social anxiety response has persisted among humans. Still other accounts of social anxiety can be characterized as neither proximate nor distal. For example, the cognitive model (Clark & Wells, 1995) explains how it is that self-focused attention, safety behaviors, and avoidance of feared situations serve to reinforce the social anxiety response, but the model neither explains why some struggle with social anxiety and others do not, nor explains why the social anxiety response exists. The second reason that some models have limited explanatory power is that they tend to assume that negative emotions are abnormal, rather than appropriate responses to recurring adaptive problems (Nesse, 1990). This assumption contributes to the view that all social anxiety is disordered. Rather than focusing solely on explaining individual differences in social anxiety, researchers should seek to explain why it is that most individuals react to certain types of social situations with anxiety.

The Harmful Dysfunction Model

The Harmful Dysfunction Model posits that with respect to most psychiatric diagnoses, the medical community has needlessly pathologized the conditions (Wakefield, Horwitz, & Schmitz, 2005). Wakefield and colleagues define a dysfunction as “a failure of some mental or physical mechanism to perform a biologically designed function” (p. 317). They argue that the social anxiety response evolved in an environment in which people lived in small bands of familiar others who were at some times cooperators and at other times competitors for obtaining resources and status. In this environment, it was best to avoid conflict when possible, and to engage in submissiveness displays in an effort to diffuse conflict if it did occur. In contrast, in our modern society, individuals must frequently negotiate multiple social hierarchies, often involving others they barely know. Although the social anxiety response would have been viewed as an appropriate appeasement display in an analogous situation in some environments, in the modern society, social anxiety is viewed as a sign of weakness.

According to this model, mild to moderate social anxiety that occurs in response to tasks that involve genuine threats of scrutiny and humiliation (e.g., speaking before an audience or interacting with strangers) is not disordered. Rather, only the most extreme forms social anxiety responses, in which anxiety is not proportional to the demands of the eliciting situation, should be considered disordered. Social anxiety should only be considered extreme if it occurs in situations in which cues to threat are likely to be absent (e.g., interacting with family members, eating in public, or sitting in the back of a lecture hall). In short, most social anxiety is normal and situationally appropriate.

Evolutionary Explanations of Social Anxiety

Wakefield's model is important in that it emphasizes the function of social anxiety in the ancestral environment and the mismatch of this evolved function to the modern world. Other researchers have postulated different specific evolutionary benefits of the social anxiety response. Leary (2001) argues that the social anxiety response prevents social exclusion. In contrast, Gilbert (2001) argues that social anxiety is designed to prevent attack by higher status others. These two accounts are united in that both postulate a single, specific function of the social anxiety response (See Table 2.1 for a comparison of these two models).

The Social Inclusion Model

According to the Social Inclusion Model (Leary, 2001), the social anxiety response is a system designed to prevent social exclusion. Humans have a fundamental need to belong (Aronson, 1999; Axelrod & Hamilton, 1981; Baumeister & Leary, 1995; Bowlby, 1969; Hazan & Shaver, 1994; James, 1890) that arose because groups have historically provided necessary resources such as mates, food, and protection. Because group membership was so essential, humans evolved a mechanism to track their level of social inclusion and to alert them, via negative affect (i.e., social anxiety), when the threat of social inclusion was imminent. This mechanism is the *sociometer*. The activation of the social anxiety response allows the individual to take steps to address the threat and to ensure that he or she remains a valued relationship partner.

There is much evidence to support a link between fluctuations in negative affect and feelings of social exclusion. For example, in one test of the Social Inclusion Model, individuals who believed that other group members did not select them for a group

decision-making task, rated themselves less favorably on a series of bipolar adjective scales than did those who were chosen to be group members (Leary, Tambor, Terdal, & Downs, 1995). Leary and colleagues argue that the sociometer is a mechanism that functions to avoid the loss of valuable social relationships. A properly functioning mechanism that is designed to avoid such social losses must first detect when there is a risk of social exclusion, and then reallocate resources to making the individual a desirable social partner. Whereas the social anxiety response appears to be adept at the first part of this task, it is not optimally designed to accomplish the second part.

Individuals who suffer from social phobia are extremely sensitive to the possibility of social exclusion (Clark, 2001). Compared to those who are low in social anxiety, the socially anxious more readily identify negative audience behaviors such as yawning or glancing at a watch than they do positive audience behaviors such as smiling and nodding (Veljaca & Rapee, 1998). Social phobics also show better recall for faces they have previously categorized as critical than for those they categorized as accepting (Lundh & Öst, 1996).

Leary and colleagues suggest that the social anxiety mechanism functions to detect cues of social exclusion so that resources can be redirected toward increasing social desirability and avoiding social exclusion. If the goal of the social anxiety mechanism is to ensure that the individual is not socially excluded, rather than avoiding the feared situation and withdrawing from the social sphere, an appropriate response would be to take steps to ensure the anxious individual remains a valued social partner. However, research has shown that confederates are less likely to report a desire for future interaction with their socially anxious than their nonanxious interaction partners

(Papsdorf & Alden, 1998). Similarly, confederates reported that they felt less liking for – and less comfort around – socially anxious conversation partners than nonanxious partners (Meleshko & Alden, 1993). It appears that observers interpret social anxiety as a cue that the individual would make a poor relationship partner. Such findings suggest that social anxiety is not a mechanism that functions primarily to reallocate resources toward ensuring social inclusion.

Leary and colleagues have argued that it is an increase in negative affect that alerts the individual to imminent social exclusion. According the PANAS – one common measure of negative affect (Watson, Clark, & Tellegen, 1988) – there are ten types of negative affect, including distress, guilt, fear, and hostility. To the extent that the sociometer is driven by all of these types of negative affect, Social Inclusion Theory does little to explain the function of the specific social anxiety response, and its specific physiological response (e.g., sweating, shaking, etc.).

In many discussions of the sociometer model (Leary & Downs, 1995; Leary, Tambor, Terdal, & Downs, 1995), Leary and colleagues have argued that *self-esteem* – rather than social anxiety – functions as a gauge by which adjustments in affect alert the individual to social exclusion. It makes sense that fluctuations in affect should be related to general positive or negative feelings about one’s place in the social world. Although social anxiety does serve to alert the individual to the possibility of social exclusion, the specific physiological symptoms of the social anxiety response appear to drive social disengagement, and thus look poorly designed to increase integration in the social world.

The Social Dominance Model

Gilbert (2001) argues that cognitive mechanisms shaped for status competition underlie the social anxiety response. Because individuals have finite resources to invest in others, individuals must constantly compete to be targets of investment for others' limited resources (Nesse, 2007; Tooby & Cosmides, 1996). Thus, people are motivated to differentiate themselves from others by increasing their social attention-holding power (SAHP; Gilbert, 1992). According to Gilbert, SAHP is an index of the amount of interest that others have in the individual. Whereas high SAHP is associated with high status, receiving benefits from others, and positive emotions, low SAHP is associated with losses of status, little social exchange, and negative emotions.

According to Gilbert (2001), individuals who experience higher trait levels of social anxiety tend to see themselves as having chronically low SAHP. Therefore, they view social situations as competitions they are certain to lose. When an organism is likely to fail in a dominance competition, it makes sense to automatically engage in a submissiveness display, thus signaling to the higher status organism that the low status organism is not a threat and avoiding an aggressive encounter. In support of this idea, Trower, Sherling, Beech, Harrop, and Gilbert (1998) found that socially anxious participants rated themselves as more subordinate – and a confederate as more dominant – while watching a videotape of a previous dyadic interaction. Similarly, Hope, Sigler, Penn, and Meier (1998) showed that socially anxious participants saw a dyadic interaction with a confederate as being more competitive than did nonanxious controls. Rather than attempting to compete, socially anxious participants tended to engage in self-effacing – or submissive – behaviors.

An extensive body of research has documented the relationship between low levels of testosterone and submissive behavioral displays (Mazur & Booth, 1998). Maner, Miller, Schmidt, and Eckel (2008) found that men who were high in social anxiety experienced a significant drop in testosterone after losing a rigged competitive leadership task, whereas there were no changes in testosterone for women or men who were dispositionally low in social anxiety. As suggested by the Social Dominance Model, such a hormonal change might serve to avoid future conflict and additional losses of status or resources.

In the modern social world, most higher status individuals do not pose a physical threat, and the signals of submissiveness displayed by the socially anxious (e.g., gaze aversion, a shaking voice, and sweating) are most often interpreted as signs of weakness or incompetence. That is, they are seen as signs of low SAHP. Gilbert's is a mismatch theory. The social anxiety response that might have saved the social phobic's life in the ancestral environment backfires in the modern environment and dooms the social phobic to life at the bottom of the social hierarchy.

According to this model, social anxiety is a mechanism that serves to minimize costs incurred during interactions with higher status individuals who are alert to potential challenges to their dominance. The social anxiety mechanism solves this problem by always signaling deference to those with higher status. Thus, the social anxiety mechanism has two primary functions. First, it must correctly detect the threat that a higher status individual plans to impose costs. Second, it must either signal deference or avoid interactions with the superior.

In support of Gilbert's account, the social anxiety mechanism does appear to be sensitive to status differences, with individuals experiencing greater anxiety when interacting with individuals of higher status (Hilmert, Christenfeld, & Kulik, 2002; Jackson & Latané, 1981). However, the social anxiety response does not appear to be especially sensitive to cues of physical size. If social anxiety is designed to prevent attack from higher status others, we should expect to find that social anxiety is triggered by common cues to higher status or dominance, such as physical size, sex, or vocal pitch. For example, we might expect that males would be likely to experience social anxiety when interacting with large, dominant males rather than less physically intimidating females. In point of fact, one of the most common antecedents of social anxiety is interacting with potential mates. Many individuals also report feeling anxiety in social situations such as parties that involve interacting primarily with their peers.

Many of the behavioral and physiological responses that accompany social anxiety do appear to signal deference. Downcast eyes, a shaking voice, and a collapsed posture all signal that the individual is not a physical threat. Other aspects of the social anxiety response such as a desire to avoid the feared situation prevent the individual from ever entering into a status competition.

Together, the Social Inclusion Model and the Social Dominance Model represent an important step forward in theorizing about social anxiety, in that both consider the ultimate function of that anxiety. However, both theories have limitations. Both accounts posit that social anxiety is a specific response to a particular type of situation and that the social anxiety response has a single adaptive function. We now present a more inclusive model of the function of social anxiety that can incorporate the advantages of previous

evolutionary models, without the constraints. Specifically, we argue that social anxiety is an adaptive response to a cluster of situations characterized by high social stakes. Such situations are detected not by specific cues, but by an individual's appraisal about the meaning of a situation for his or her ability to reach current personal goals. In such situations, social anxiety minimizes the risk of myriad costly negative outcomes by triggering behavioral responses appropriate to that particular situation. Table 2.1 compares this model to Gilbert and Leary's models.

The Evolution of Human Social Emotions

Humans are fundamentally social (Aronson, 1999; Axelrod & Hamilton, 1981; Baumeister & Leary, 1995; Bowlby, 1969; Hazan & Shaver, 1994; James, 1890) and rely on others for their survival and reproduction. Thus, selection pressures should have shaped cognitive mechanisms designed to avoid social exclusion. Throughout much of our species' evolutionary history, humans lived in small bands made up largely of kin (Lowie, 1948; Murdock, 1949). In that social environment, it would be essential to be viewed as a valuable contributor to the group. Any type of negative social evaluation would have been potentially costly. At the extreme, negative social evaluation could have led to being shunned from the group, and possibly to death.

Social capacities such as social anxiety have undoubtedly been shaped by multiple selection forces, including kin selection (Hamilton, 1964) and reciprocity (Trivers, 1971). Over evolutionary time, those with a social anxiety response produced more offspring than did those with no social anxiety response. Whereas evolutionary explanations that rely on notions of groups selection are problematic (Williams, 1966; see also West, Mouden, & Gardner, 2009), the effects of decisions made by groups and other

individuals can also give rise to important selection forces that shape desirable traits such as a tendency to behave altruistically or morally (Nesse, 2007). Just as the peacock's tail is advantageous because it leads to being selected more often as a mate, capacities for altruism, social intuition, and resource display lead to being selected more often as a long-term social partner or group member. This kind of “runaway social selection” is likely to have shaped an extreme sensitivity to others’ opinions (i.e., a strong tendency towards social anxiety). Although those with a strong social anxiety response may make others uncomfortable during initial interactions (Meleshko & Alden, 1993; Papsdorf & Alden, 1998), as long-term relationship partners, they may be valued for their attentiveness to others. This line of thinking may help to explain why social anxiety is so extraordinarily prevalent and why so many people have apparently excessive social anxiety. Such mechanisms are calibrated according to the “smoke detector principle” (Nesse, 2005). False alarms are normal and common because the costs of social anxiety are small compared to the potentially catastrophic losses that could follow insufficient social anxiety in a high stakes situation.

We argue that social anxiety is best understood at a level one step more general than the prevailing hypotheses. We believe it is a mechanism designed to detect high stakes social interactions and minimize the subsequent risk of negative evaluation. Thus, the social anxiety response can be thought of as having two distinct phases. The first phase involves identifying social interactions in which there is the possibility of social judgment. At this stage, the organism must calculate the magnitude of the social stakes as a function of various inputs about the nature of the social situation. The relevant dimensional inputs are described below. It should be possible to mathematically describe

the relationship between these inputs for calculating the magnitude of the social stakes, but such calculations are beyond the scope of this paper, as any attempt to provide such an equation at this stage of inquiry would be purely speculative. The second phase of the social anxiety response, once situations involving high social stakes have been identified, involves minimizing the risk of receiving a negative evaluation.

Detecting High Stake Social Interactions

Appraisal theories of emotion posit that before an organism can respond adaptively to an environmental trigger, it must first perceive and evaluate the relevant features of the eliciting situation (Ellsworth & Scherer, 2003). Situational appraisals thus shape the emotional experience. Appraisals fall along a few key dimensions (Ellsworth & Scherer, 2003), which include assessments of novelty, valence, goals and needs, agency, and norms or values. The appraisal of novelty alerts and orients the organism to changes in its immediate environment and includes an assessment of the organism's level of familiarity with the stimulus. During the assessment of valence, the organism attends to the pleasantness of a stimulus. The goals and needs stage is primarily about determining the value of a situation for meeting the organism's immediate or long-term goals. During the assessment of agency, the organism examines its own role in causing the situation to occur as well as its ability to cope with the situation. Finally, the norms or values appraisals allow the organism to consider any social rules governing behavior in the situation. According to appraisal theorists, different patterns of appraisal map to different emotional experiences, and different emotional experiences motivate different behavioral responses.

Situational appraisals play an important role in determining the magnitude of the social anxiety response. The strength of the social anxiety response should be directly proportional to social risks that are inherent in the situation. Several theorists have attempted to identify the types of appraisals that are most relevant for social anxiety.

In his book *Self-Consciousness and Social Anxiety*, Buss (1980) drew on psychological research to argue that the affective reactions of embarrassment, shame, shyness, and audience anxiety together comprise social anxiety – or discomfort in the presence of others. According to Buss’s account, there are five dimensions of social context that cause social anxiety. These include the size of the social group, the amount of attention paid to the target person, familiarity with the others, the formality of the situation, and the extent to which others are evaluating the target. Drawing from Buss’s conceptualization, McCroskey (1984) argued that the key dimensions in determining the magnitude of communication anxiety (i.e., fear of real or anticipated communication with others) include novelty, formality, subordinate status, conspicuousness, unfamiliarity, dissimilarity, degree of attention from others, degree of evaluation, and prior history.

Novel situations entail a high degree of uncertainty and are thus associated with greater anxiety. The formality of a situation is dictated by the degree of rigidity in the prescribed behavioral norms. According to McCroskey (1984), stricter rules of conduct (i.e., a narrower range of acceptable behavior) are associated with higher anxiety. Subordinate status is associated with the belief that “appropriate behavior is defined by the person holding higher status” (p. 25). Conspicuousness refers to the degree to which the speaker stands out from others, with greater visibility being associated with higher anxiety. Unfamiliarity refers to the extent to which the speaker and his or her audience

have previously interacted, with individuals thought to experience less anxiety around those they know better. Dissimilarity refers to the relationship between the actor and the audience. People should feel less anxiety when interacting with similar others, yet people are thought to be “most uncomfortable when communicating to similar peers, because they are more concerned with the evaluations such people make” (McCroskey, 1984, p. 26). Degree of attention is an index of the extent to which others actively attend to actor (i.e., staring and nodding at the actor versus ignoring him or her). Degree of evaluation refers to the audience’s ability to pass judgment on the speaker. Finally, prior history is an index of a speaker’s previous public speaking experience.

Beatty (1988) developed self-report measures of each of these situational variables and administered the items to undergraduate students enrolled in a speech course. Of the nine dimensions posited by Buss (1980) and McCroskey (1984), only novelty ($r = .32$) subordinate status ($r = .45$), conspicuousness ($r = .42$), dissimilarity ($r = .26$), and prior history ($r = .64$) were significantly correlated with a measure of public speaking anxiety (all p ’s < .05).

We believe that a subset of these situational appraisals should be most relevant for detecting the magnitude of social stakes. These include attention to the details of the situation, including its novelty, its formality, and the individual’s degree of investment – or specialization – in the domain, as well as attention to specific characteristics of one’s interaction partners, including their familiarity, the number of interaction partners, the interaction partners’ ability to evaluate performance in the relevant domains, and the interaction partners’ status. One’s assessments of these situational characteristics should determine the severity of the anxiety response.

Novelty

Appraisals of the novelty of the social situation should play a role in calibrating the social anxiety response. Beatty (1988) found that speech students for whom giving a presentation in class was a relatively new experience scored higher on a measure of public speaking anxiety than those who felt that they had more experience giving class presentations.

An extensive body of work on *social facilitation* provides support for the importance of situational novelty in determining social anxiety. Researchers find that the presence of others improves performance on simple tasks in domains in which the participant has achieved mastery (Bond & Titus, 1963; Zajonc, 1965), whereas performance on novel, unmastered tasks is undermined by the presence of others. In the classic demonstration of this phenomenon, Triplett (1898) found that performance on a simple motor task was faster when others were watching than it was when the task was completed without an audience. The social phobic in a fear-inducing situation is often faced with a relatively novel situation because the most common response to situations that provoke social anxiety is avoidance. Therefore, the mere presence of others in a social setting serves to hinder the social phobic's performance.

Formality

McCroskey (1984) argued that more formal situations should provoke greater social anxiety, as there is only a limited range of acceptable behavior. However, research suggests that social anxiety may be greater in situations that involve less structure, as the demands on the individual are less clear. Furthermore, individuals with social anxiety may lack social skills that would facilitate smooth social interactions in less-structured

situations. Pilkonis (1977) found that whereas high and low social anxiety participants did not differ in their performance on an structured speech task, high anxiety participants performed significantly worse during an unstructured interaction with a confederate in a waiting room. Similarly, Thompson and Rapee (2002) first placed female participants in an unstructured situation with a male confederate, then asked participants to take part in a structured role-playing game that required the pair to “imagine you are at a party and have to get to know each other as well as possible in 5 minutes.” The interactions were videotaped, and the participants’ behavior was coded for cues of social anxiety such as voice quality, nonverbal behavior, and conversational skill. Participants who were high in social anxiety performed worse than low socially anxious participants in both the structured and unstructured interactions, but the deficit was larger in the unstructured situation.

Degree of Specialization

Individuals should experience more social anxiety when they are facing the prospect of evaluation in a domain in which they are heavily invested. If a person has spent significant resources on cultivating their abilities in a given domain, negative evaluation of their abilities in that domain would be extremely costly. Gendolla (1999) manipulated the self-relevance of a memory task by telling undergraduate participants in the self-relevant condition that the task was a test of mnemonic abilities that were essential for academic success, whereas participants in the self-irrelevant condition were told that the task was a simple filler with no implications for future academic performance. When the task was difficult, compared to participants in the self-irrelevant condition, those in the self-relevant condition experienced significant changes in heart

rate and systolic blood pressure, which are indicative of sympathetic nervous system activation.

Familiarity of Observers

A social anxiety mechanism should be sensitive to the *familiarity* of the others who are involved in the situation. The potential social costs of interacting with a stranger are vastly greater than the potential costs of interacting with an acquaintance, a friend, a family member, or a romantic partner. Acquaintances, friends, kin, and romantic partners hold opinions about the individual that are based on a history of repeated interactions. Although it is possible that a social faux pas could affect the opinions of close others, the magnitude of such a mishap would have to be large in order to erase or threaten a strong social bond. Such major mistakes are rare, so any given interaction with acquaintances, friends, kin, and romantic partners is likely to have little impact on their opinions. In contrast, strangers have no prior knowledge of the individual, meaning the social stakes in an initial interaction are high. Any small misstep could lead the other to form an unfavorable impression. If the function of the social anxiety response is to detect high stakes social interactions, then we should expect a stronger social anxiety response to interactions with a new person than to familiar others.

Size of Audience

A social anxiety mechanism should also be sensitive to the *number of interaction partners*. Social interactions with more people entail higher social stakes, and the strength of the social anxiety response should be related to the size of the audience. Jackson and Latané (1981) asked undergraduate participants to imagine singing “The Star Spangled Banner” before an audience of one, three, or nine observers. Participants’ self-reported

nervousness was best described with a power function, such that the difference in nervousness between an audience of one and three was much larger than the increase in nervousness between an audience of three and nine. McKinney, Gatchel, and Paulus (1983) found a similar pattern of results among high social anxiety participants, who reported more nervousness when speaking in front of a six-person audience than when speaking in front of a two-person audience. In contrast, the opposite pattern was seen among low anxiety participants, who reported more nervousness in front of the two-person audience than in front of the six-person audience. Additional research suggests that the interaction of audience size with other dimensions of audience composition may be crucial in determining the magnitude of the social anxiety response, an idea discussed in detail below.

Audience's Capacity for Evaluation (Expertness)

Also important for determining the intensity of the social anxiety response is an appraisal of interaction partners' *capacity to evaluate performance* in the relevant domain. Whereas a professor might experience no anxiety when discussing his or her research in an undergraduate seminar, he or she might feel severe social anxiety when presenting that research at a conference attended by colleagues and peers. Other academics have the necessary knowledge base to evaluate the merit of scientific findings, thus interactions with them involve high social stakes. Jackson and Latané (1981) found that participants reported more nervousness at the prospect of singing in front of an audience of graduate students and professors from a music school than they did at singing in front of tone-deaf undergraduates.

In a study of cardiovascular reactivity, women who were asked to give a speech to an audience of public speaking experts experienced greater increases in blood pressure and heart rate during their speech than did women who spoke before an audience of public speaking novices (Hilmert et al., 2002). Beatty (1988) found that undergraduate speech students who more strongly agreed with statements such as “The other students seem to know more about my topic than I do” scored higher on a measure of public speaking anxiety than did students who did not endorse such statements.

Researchers have explored the importance of *evaluation apprehension* as a mechanism for determining the magnitude of social facilitation effects (Cottrell, 1972). When an individual believes that others are explicitly evaluating performance on a task, the individual’s level of arousal is increased and dominant – or learned – responses are reinforced, whereas novel responses are undermined. According to this perspective, an audience of experts should undermine performance on unlearned tasks to a greater degree than should an audience of peers. Evidence for this claim is mixed, with some meta-analytic results suggesting that explicit social evaluation has little effect on performance above and beyond the presence of others (Bond & Titus, 1963). A more recent review (Sanders, 1981) of the social facilitation literature provided some support for the importance of evaluation apprehension. The findings suggested that when cues to social evaluation are explicit, the individual’s attention is directed toward gleaning social feedback from the audience and away from the task at hand. It is this lack of attention to the experimental task that undermines performance.

There is some evidence that a similar mechanism could be at work during a social anxiety-provoking situation. The cognitive model of social phobia (Clark & Wells, 1995)

suggests that when social phobics feel they are at risk of negative social evaluation, the focus of their attention shifts to closely monitoring their own internal state, while neglecting external social cues. On the surface, this would seem to contradict the evaluation apprehension model of social facilitation effects, which attributes performance deficits to the shift in attention from the task to the audience's response. However, Clark and Wells also argue that social phobics tend to be negatively biased in their processing of cues from the social world. That is, those with dispositionally high levels of social anxiety pay special attention paid to cues signaling audience disapproval.

Audience's Power

In addition to appraisals of others' capacity to evaluate in a given domain, a social anxiety mechanism should be attuned to interaction partners' *power*, or relative status. As discussed above, the magnitude of the social anxiety response has been tied to observers' capacity to evaluate in the domain of interest. However, an audience with an extensive breadth of knowledge in a relevant domain will not pose a significant threat if the audience members have no power over the person they are evaluating. A graduate student might experience no social fear when interacting with fellow graduate students, yet become very nervous during one-on-one interactions with a professor. In this case, both fellow graduate students and the professor have an extensive knowledge in the relevant domain, but only the professor has the power to facilitate or hinder the student's research.

Interaction of Audience Size, Capacity for Evaluation, and Power

Social Impact Theory (Latané, 1981; Latané & Nida, 1981) posits that the amount of influence a group of others has on the individual should be determined by the strength, immediacy, and number of others involved in the group. Strength refers to the others'

status, age, or power over the individual, and immediacy refers to the physical closeness of the others. According to Social Impact Theory, impact is calculated by multiplying strength times immediacy times the number of others. Latané (1981) used the metaphor of luminance perception to describe the impact of groups. As the intensity of two 100-watt bulbs plus two 50-watt bulbs will be greater than the intensity of two 100-watt bulbs, so will the impact of an audience of two high status and two low status observers be greater than the impact of an audience of only two high status observers.

The Averaging-Summation Model of social anxiety makes slightly different predictions about the interaction of the number and status of audience members in predicting social anxiety. According to this approach, individuals' anxiety responses to complex social situations are sensitive to both the average and summative impacts of characteristics of the audience members such as their level of expertise, power, or status (Seta, Crisson, Seta, & Wang, 1989; Seta, Wang, Crisson, & Seta, 1989; Seta & Seta, 1992; 1996). The summative component of the model holds that individuals should be sensitive to the number of people in their audience and experience more anxiety before a larger audience. The averaging component of the model argues that individuals complete a "weighted averaging process that results in an integrated impression of the central tendency of the audience" (Seta & Seta, 1992, p. 174). Individuals perform assessments of audience members along dimensions such as their expertise or status, and the average of these assessments predicts the magnitude of the social anxiety response. Support for this idea comes from studies such as one in which undergraduates were asked to imagine reading their written work to audiences of different sizes that included varied combinations of faculty members, fellow undergraduates, or high school students (Seta et

al., 1989a). The participants reported that they would experience less anxiety before audiences of either two faculty members and two high school students or two faculty members and four high school students than they would before an audience of only two faculty members. It was not simply the size or the status of the audience that predicted the amount of social anxiety. Instead, adding lower status high school students to an audience of faculty members lowered the average influence of the audience and decreased the severity of the social anxiety response. Here, a prediction derived from Social Impact Theory – that the larger audiences would cause more anxiety – was not supported. Rather, the level of social anxiety was related to both the mean influence of each audience member and the sum of all the individuals' influence.

Likelihood of Future Interaction

It might seem reasonable to assume that the social anxiety mechanism should be sensitive to the *likelihood of future encounters* with interaction partners. In the same way that tit-for-tat is a winning strategy only in the context of repeated social interactions (Axelrod & Hamilton, 1981), the appropriate social anxiety response should be governed by the likelihood of future meetings with one's interaction partners. Our modern environment is replete with one-shot social interactions, yet it is unlikely that the human mind is adapted to such transient social relationships (Hagen & Hammerstein, 2006). Distinct bands of our hunter-gatherer ancestors likely encountered each other with some amount of regularity, setting up the possibility of repeated cooperation and social exchange among members of the different groups. Experiments in behavioral economics routinely show that participants act against their own self-interest by cooperating with others in games involving one-shot interactions. Such findings suggest a mismatch

between players' evolved psychological mechanisms and the laboratory situation. In a world in which you are likely to repeatedly encounter others, cognitive mechanisms should encourage reciprocal altruism. Thus, these mechanisms may perform as if expecting future interaction, even in laboratory situations that are explicit one-shot interactions.

To the extent that the mind has been shaped to expect repeated social interactions, such expectations should play a role in determining the amount of social anxiety that individuals experience in a variety of common situations. Those with severe social phobia may struggle to complete every day errands such as visiting the bank or checking out at a cash register because they fear the possibility of an awkward social interaction. This fear occurs despite the high probability that their encounter with the clerk will be a one-shot interaction. If natural selection has molded the mind to expect future social interactions, then we should not expect the social anxiety mechanism to monitor the likelihood of future interactions, but to calibrate the social anxiety response as if future interactions are a certainty.

Calculating the Social Stakes

The social anxiety mechanism must calculate the magnitude of social stakes based on inputs about the novelty and formality of the setting, the individual's degree of investment in the performance domain, and the familiarity, number, expertise, and status of the others who are involved. Like predictor variables in a multiple regression equation, each dimension can be thought of as having a unique beta coefficient that describes how strongly it predicts the social stakes. It is likely that some of these inputs will receive more weight than others in calculating the social stakes. However, as suggested by the

Averaging-Summation Model, it is also likely to be important to examine the interaction of these dimensional appraisals. For example, the social stakes may be very low in a situation involving an audience of ten non-experts, whereas the social stakes may be very high with an expert audience of the same size. Future research should examine the mathematical relationship among these input variables.

Minimizing the Risk of Negative Evaluation

Once the stakes have been calculated, the mechanism must forecast the likelihood of various potential outcomes based on different possible behavioral responses. At this stage, the goal is to minimize the risk of subsequent negative evaluation. With respect to many social interactions modeled as games, it is less costly for the individual not to play the game than it is for the individual to play and suffer large potential losses. From the perspective of the socially anxious person, it may be better that others have no information on which to judge them, than it is for others to judge their actions negatively. However, the potential losses and appropriate responses should differ depending on the type of social situation. There are three general ways in which the individual can attempt to minimize the subsequent risk of negative evaluation. First, the individual can reallocate resources toward preparing for the social interaction. Second, and in line with Gilbert's (2001) Social Dominance Model, the individual can act submissively toward the evaluator(s). Finally, the individual can attempt to avoid the threatening social interaction.

Preparing Extensively

One strategy for minimizing the possibility of negative evaluation is to invest a great deal of time and effort into thinking about and preparing for the social interaction.

Safety behaviors such as rehearsal and memorizing what one plans to say are used to minimize the risk of social catastrophe (Clark & Wells, 1995). However, these safety behaviors can backfire, leading others to view social phobics as neither likeable nor desirable social partners (Clark, 2001).

Another strategy that can help in preparing for future interactions is to consider one's performance in previous social interactions. Comments or actions that worked poorly in the past probably should not be repeated in future interactions. Research has demonstrated that the socially anxious tend to spend a good deal of time ruminating about previous social interactions (Clark, 2001). Mellings and Alden (2000) surveyed participants about their level of rumination in response to an informal interaction with a confederate that occurred on the previous day. Participants were asked about the extent to which they experienced positive, negative, or neutral thoughts about the interaction as well as their experience of self-critical thoughts concerning their behavior. Socially anxious participants reported significantly more post-event processing than did nonanxious controls. Rachman, Grüter-Andrew, and Shafran (2000) designed a 13-item Post Event Processing Questionnaire that assessed individual differences in rumination during the previous few months. Compared to nonanxious controls, socially anxious individuals experienced a more post event processing. Furthermore, those high in social anxiety reported that their memories of previous interactions were more intrusive and interfered more with their concentration. Detailed thoughts about previous social interactions may, however, help the individual to plan for future social encounters.

Other types of extensive preparation may significantly decrease the likelihood of negative evaluation. For example, an individual who suffers from public speaking

anxiety, but spends a great deal of time preparing and practicing a speech, is likely to be more positively evaluated than a person who spent less time preparing.

Signaling Deference

According to the Social Dominance Model (Gilbert, 2001) socially anxious participants respond to threatening situations by signaling submissiveness. As discussed above, socially anxious participants tend to rate themselves as more submissive during social interactions than do less anxious individuals (Trower et al., 1998). Such submissive displays may help the individual to avoid harm at the hand of dominant others (Öhman, 1986).

Some safety behaviors can both promote avoidance of social conflict and signal submissiveness to observers. For example, Gilbert (2001) argues that safety behaviors such as rehearsing before speaking, talking only briefly, avoiding others' gazes, and allowing long pauses in conversation can be interpreted by others as signs of subordinate status.

Leary and Kowalski (1995) argued that socially anxious individuals tend to be *innocuously social*. That is, socially anxious individuals engage in behaviors such as nodding, agreeing, and asking questions, while avoiding making substantive contributions to conversations. Such behavior leads others to regard the socially anxious person as agreeable and encourages others to assume a more dominant, leading role in the conversation (Leary, Knight, & Johnson, 1987).

Other research suggests that the socially anxious are more likely to conform to group norms, perhaps because conformity entails a “desire to reduce or avoid social judgment” (Lewis et al., 2008, p. 65). Santee and Maslach (1982) asked participants to

select from a group of possible solutions to each of a series of social problems. Some participants were exposed to the opinions of other participants before making their decisions. The researchers calculated the percent of the scenarios in which participants agreed with the majority. The results showed that high anxiety participants were more likely than those low in social anxiety to conform to the majority's choice, but the correlation between social anxiety and conformity was small ($r = .19, p < .05$). Providing further support for the positive association between social anxiety and conformity, Lewis and colleagues (2008) found that socially anxious undergraduates were more likely than their less anxious counterparts to report that they drank alcoholic beverages due to pressure from their friends. Such behavior suggests a willingness to compromise one's own desires in order to defer to the wishes of others.

Avoidance

Leary and Kowalski (1995) observed that one common behavior seen among individuals who are high in social anxiety is a tendency to disaffiliate – or reduce their social contact. A daily diary study showed that socially anxious participants had fewer overall social interactions than their nonanxious counterparts (Dodge, Heimberg, Nyman, & O'Brien, 1987). Specifically, anxious participants took part in fewer social interactions in public settings, their residence, and the classroom. Anxious participants also spent less time in the company of friends and romantic partners.

Social phobics may take steps to minimize the likelihood that others will negatively evaluate them, such as not enrolling in classes that require public speaking or avoiding errands that require interactions with strangers. Many laboratory studies of social anxiety require that participants be exposed to feared situations. Although avoiding

such social interactions might be the social phobic's preferred coping strategy, that option is not available in such a setting. When feared situations cannot be avoided, Clark and Wells (1995) argue that social phobics tend to engage in elaborate *safety behaviors* in an attempt to avoid awkward social interactions.

Safety behaviors include speaking only briefly in social settings, avoiding eye contact, and not expressing one's ideas or opinions. Such behaviors suggest a desire to minimize social interactions. For example, Alden and Bieling (1998) asked socially anxious and nonanxious participants to participate in a "getting acquainted" task that involved reciprocal social disclosure with a confederate. Participants were led to believe that the confederate's appraisals of them were likely to be either strongly positive or strongly negative. Following the social interaction, the confederate evaluated the extent to which participants engaged in two types of verbal safety behaviors: speaking briefly and avoiding intimate disclosures. Overall, participants spoke for less time in the negative than in the positive appraisal conditions. There was also a significant interaction of appraisal condition and anxiety, such that socially anxious participants disclosed less than did nonanxious controls when they thought they were being negatively appraised. Socially anxious participants were also rated as less appropriate and less likeable than were controls in the negative appraisal condition.

Wells et al. (1995) asked eight participants to identify social anxiety-inducing situations and the types of safety behaviors that they routinely used in those situations. For example, one participant reported a fear of walking through crowded shops. In response to this feared situation, the participant reported a tendency to engage in safety behaviors such as looking for an exit, walking close to walls, and avoiding looking at

others. Study participants received both a therapy session that involved simple exposure to the feared situation as well as a therapy session that focused both on exposure and reducing safety behaviors. Participants experienced a greater drop in anxiety surrounding the feared situation following the sessions that included a focus on reducing safety behaviors. Some safety behaviors appear to facilitate the avoidance of social encounters, and such avoidance may, paradoxically, increase anxiety.

Types of Interaction Partners

For an individual living in a small band of allies in the ancestral environment, most social interactions would have involved kin or close friends. Such interactions entailed very little risk of negative evaluation, as kin and friends tend to have strong and long-held positive feelings about their close relationship partners. The most significant risk during an interaction with such an in-group member is likely to be a slight loss of reputation or status. In contrast, during an interaction with a stranger, social evaluation is certain, as the stranger has no previously held beliefs about the individual. Behavioral cues will matter more to strangers than to established relationship partners. The first transmission of social information should matter a great deal for others' decisions about their desire for future interactions.

In the ancestral environment, some strangers would have presented a significant threat of harm or exploitation to their out-group members. When brought on by such hostile strangers, social anxiety should function to alert the individual that large social losses are likely and to motivate escape from the situation. In other cases, more affable strangers from neighboring bands would have represented opportunities for the exchange of information and goods. When elicited by such friendly strangers, social anxiety should

function to alert the individual that social evaluation is likely and to trigger either extensive preparation for the interaction or signals of deference. The social anxiety mechanism should respond to cues such as the number of strangers and their status and should trigger appropriate steps to minimize the threat of negative evaluation. With respect to hostile strangers in the EEA, it was probably better for the individual to avoid the social interaction than for the individual to suffer the large potential costs of engaging with the other person. With respect to friendly strangers, it was best for the individual to signal the value of a future relationship via deference displays or to spend time cultivating skills or abilities that exchange partners might value. During in-group conflicts it might have been best to submit, whereas extensive preparation might be the best way to deal with a performance situation. Part of the function of the social anxiety response should be to guide the organism toward the appropriate type of response according to the type of other – be he or she stranger, acquaintance, friend, family member, or possible romantic partner – who is involved in the situation.

Similarly, modern social situations should arouse social anxiety in response to appraisals of social risk, and different types of responses are appropriate to different types of social situations. Strangers may have represented a rare and significant threat in the ancestral environment, but in the modern environment, interactions with them are a part of daily life. As in the ancestral environment, when interacting with a stranger, social evaluation is certain. The stranger has no opinion of the individual, and he or she is certain to make a judgment about how valuable a future relationship with the individual would be. Because there is the possibility of negative social evaluation, the social anxiety mechanism is activated. However, the adaptive response to strangers in the EEA is not

necessarily an adaptive response to strangers in the modern environment. For example, avoidance might have prevented exploitation at the hand of a hostile stranger in the EEA, but in the modern environment, a severe avoidance response could prevent the individual from engaging in routine social interactions.

In many performance situations, there is a significant chance that the individual will make a costly mistake that will be apparent to all the members of the audience. Due to the large social cost to having many people form a negative evaluation, the social anxiety mechanism guides the individual to avoid performance situations. If avoidance is not possible, the social anxiety response should motivate extensive preparation for the performance. In contrast, when interacting with a small group of friends, there is little chance of negative social evaluation, as friends are familiar with the individual and likely to disregard any small social mistakes. The social stakes are small, therefore the social anxiety mechanism may not be activated at all.

Anecdotally, most people would agree that they are far more likely to experience social anxiety when attending a cocktail party with strangers than during happy hour with their extended family, yet researchers have not systematically examined the role of different interaction partners in determining the anxiety response (Kashdan & Wenzel, 2005). Nonetheless, there is some empirical evidence suggesting that the social anxiety response is sensitive to the type of interaction partner. A significant body of work suggests that there are important distinctions in the way that people negotiate communal relationships (i.e., those in which interaction partners have mutual concern for each other's welfare) and exchange relationships (i.e., those in which interaction partners are primarily interested in the reciprocal trading of benefits) (Clark & Mills, 1993; Clark,

Mills, & Corcoran, 1989; Fiske, 1992), and some work in this area suggests that people experience social anxiety less frequently in the context of communal relationships than they do when interacting with exchange partners such as non-kin and strangers. For example, when asked to imagine themselves attending a party full of strangers, either alone or with a group of friends, female participants reported that they would experience less social anxiety if attending with friends (Carron, Estabrooks, Horton, Prapavessis, & Hausenblas, 1999). Additional research has shown that people are more likely to experience embarrassment when interacting with acquaintances and strangers and less likely to feel embarrassment around loved ones than they are to feel either shame or guilt (Tangney, Miller, Flicker, & Barlow, 1996). Such a finding can be applied to understanding social anxiety when we recall Buss's (1980) argument that embarrassment is one type of social anxiety. Future research should more thoroughly investigate the impact of different types of others in determining the intensity of the social anxiety response.

Conclusion

Social anxiety exists because it serves adaptive functions, but descriptions of a single such function offer only partial explanations, which are prone to being inappropriately considered as mutually exclusive alternatives. A broader, more evolutionary view of the origins of social anxiety suggests that it is an emotion aroused by appraisals that indicate the presence of a high-stakes social interaction. In such situations, many of the cognitive, physiological and behavioral responses characteristic of social anxiety help to minimize the subsequent risk of negative social evaluation.

This argument applies to social anxiety that falls within a “normal” range, rather than to excessive – or disordered – social anxiety. Social anxiety can be thought of as a responsive defense in which the system faces a trade-off between being alert to potential threats and both the physiological and psychological costs of maintaining its defenses (Nesse, 1990; 2005). In the case of social anxiety, the ability to rapidly identify and avoid a threat is potentially life saving. However, there are adverse long-term health consequences associated with maintaining high levels of stress and anxiety and avoiding social interactions.

Social anxiety is a universal human capacity, but how readily an individual experiences social anxiety is a personality trait that is normally distributed in the population (Crozier, 1979; Leary & Kowalski, 1995). If anxiety is useful, then too much or too little will decrease fitness, so we should expect that natural selection has maintained a moderate level of anxiety among most organisms. Those with moderate social anxiety experience a healthy amount of anxiety in response to genuine social threats. Moderate social anxiety should be associated with caution among strangers, extensive preparation – not panic – before public speaking, and respect for people with higher status. Moderate social anxiety should be considered advantageous, although in some cases, a mismatch between social demands in the EEA and the modern social world may make cause evolved social anxiety responses to appear maladaptive (Wakefield, Horwitz, & Schmitz, 2005).

Table 2.1
Comparing Evolutionary Approaches to Understanding the Function of Social Anxiety

Model	Adaptive Problem	Proposed Solution	Appropriate Function of Proposed Mechanism	Analysis
Social Inclusion (Leary)	Social exclusion means the loss of valuable social support.	Take steps to make oneself more valuable as a social partner	<ol style="list-style-type: none"> 1. Detect risk of social exclusion. 2. Devote time and energy to making oneself desirable 	<p>Social anxiety tends to drive social exclusion.</p> <p>Social inclusion looks like an unlikely function of social anxiety.</p>
Social Dominance (Gilbert)	Higher status others can inflict costs on those they perceive to be threats.	Minimize costs by signaling deference to high status others.	<ol style="list-style-type: none"> 1. Detect threat of imposition of costs by higher status others. 2. Signal deference or avoid the threat. 	<p>Aspects of the physiological response to social anxiety look like deference. Not all threat situations involve status differences. Some support for model.</p>
High Stakes Model	Social evaluation is potentially costly.	Minimize costs by detecting high stakes interactions and disengaging when high costs are possible/likely.	<ol style="list-style-type: none"> 1. Detect threat of evaluation. 2. Socially disengage, signal deference, or prepare extensively for interaction. 	<p>Social anxiety tends to be greatest with risk of devaluation in valued domain or when evaluation is likely.</p>

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Chapter 3

Are Moderate Levels of Social Anxiety Adaptive? An Analysis of Speed and Errors in Identifying Emotional Expressions

Evolutionary theorists view the emotions as specialized cognitive states that guide adaptive responses in specific types of situations (Nesse, 1990; Tooby & Cosmides, 2000). For example, cues to the presence of a threat in the environment trigger the fear response, which includes increase in attention toward the threat, a shift in goals such that attaining safety becomes paramount, and physiological changes that prepare the organism to fight or flee. Because emotions are seen as responses to specific types of situations, different subtypes of fear should correspond to different types of elicitors. As Nesse (1990) points out, “different kinds of fear are aroused by predators, high places, threatening strangers, hostile relatives, crucial social situations, diseases, and illicit wishes” (p. 270). In the present paper, we are concerned specifically with social fears.

An important implication of the evolutionary approach to understanding the emotions is that social fear or anxiety is a normal response to genuine social threats (Nesse, 1990; Marks & Nesse, 1994). Only social anxiety that is not proportional to the situational threat should be considered disordered (Wakefield, Horwitz, & Schmitz, 2005). Thus, an individual whose social anxiety prevents him or her from leaving the house would be considered to have too much anxiety. By the same token, an individual

who obliviously rises to give a presentation for which he has not prepared might be considered to have too little anxiety. These individuals represent the tail ends of the distribution of trait social anxiety levels. Whereas these individuals may suffer reputational consequences due to their extreme levels of social anxiety, we should expect that a majority of individuals will experience moderate levels of trait social anxiety and that those individuals will benefit from their social anxiety.

According to the High Stakes Model of Social Anxiety (see Chapter 2), the social anxiety response has two primary functions. First, the system detects high stakes social interactions. Second, the system guides adaptive responding to social threats. During the detection phase, the system appraises the social situation along a variety of dimensions, including assessments of elements of the situation – such as its novelty and formality – and assessments of the others involved in the situation – such as the number of others and their status. According to this model, those with some social anxiety are thought to pay closer attention to social hazards than do those who do not experience social anxiety. In other words, social anxiety is thought to be advantageous when it comes to identifying and preparing to counter meaningful social threats.

Beck, Emery, and Greenberg (1985) first framed this *hypervigilance hypothesis* for anxiety disorders, arguing that those with higher anxiety should be biased toward recognizing threatening cues. With respect to social anxiety, evidence in support of this hypothesis has been mixed. Several studies have examined how social phobics respond to threatening words. For example, Asmundson and Stein (1994) used a dot-probe paradigm in which participants were briefly exposed to pairs of words on a computer monitor. After the words disappeared, in some trials, a dot appeared in the place where one of the

words had been, and participants were asked to press a key as soon as the dot appeared. Most of the word pairs included only neutral words, but some contained words associated with physical threat (e.g., attack, pain) and others included words associated with social threat (e.g., stupid, ridiculed). The results showed that, unlike nonanxious controls, participants with generalized social phobia were faster to respond to dots that appeared in the same position as social threat words than to dots that followed physical threat and neutral words. This was taken as evidence that social phobics showed a bias in their attention toward the threatening words.

Other studies have used a Stroop task to test for increased attention to threatening cues among social phobics. Hope, Rapee, Heimberg, and Dombeck (1990) asked a group of social phobics and a group of panic disorder patients to name the color in which neutral, physical threat, or social threat words were printed. Social phobics took longer to name the color of the social threat words, whereas those with panic disorder took longer to name the color of the physical threat words. The authors argue that social phobics were slow to name the color of the type because of their heightened attention to the socially threatening word. Such findings reinforce the notion that social anxiety is distinct response from other types of anxiety.

In a review of many of the studies that have looked for information processing biases among those with social phobia, Heinrichs and Hofmann (2001) concluded that social phobics do appear to show an attentional bias toward information that is socially threatening. However, they also pointed out that, up to the time at which their review was published, studies had relied primarily on linguistic cues and had not investigated responses to threatening facial expressions, which represent a very different type of

socially threatening signal. We review the subsequent studies of attention to facial expression below.

A Processing-Deficit Model of Social Anxiety

The idea that those with some social anxiety are especially attuned to social threats differs from another prominent perspective on social anxiety, which suggests that those with social phobia direct their attention away from threatening cues. According to cognitive models of social anxiety (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997), individuals with high levels of social anxiety attend closely to their own internal state rather than to cues about the external social world. For example, when in an anxiety-provoking situation, a social phobic is likely to closely monitor his or her own discomfort and beliefs about how he or she appears to others, rather than attending to cues to how others are actually responding, be those cues positive (e.g., smiling or nodding) or negative (e.g., frowning or shaking one's head).

Using a modified dot-probe paradigm, Chen, Ehlers, Clark, & Mansell (2002) exposed participants to pairs of stimuli that included one face and one household object. After each pair, a probe appeared where one of the two stimuli had been, and participants were asked to respond as quickly as possible to the probe. Social phobics were faster to respond to probes that appeared in the same position as a household object than to probes that appeared in the same position as faces that were positive, negative, or neutral. There were no differences in the response times of nonanxious controls to the faces and the household objects. This finding suggests that social phobics may direct their attention away from facial expression stimuli, resulting in a reduction in their processing of external cues. The authors speculated that social phobics may direct their attention away

from such social cues because looking away makes it more difficult for others to engage with the social phobic. Alternatively, looking away could serve as an appeasement gesture. One shortcoming of this study is that Chen et al. (2002) combined the emotions of anger, sadness, fear, and disgust into the negative emotion category. Whereas angry and disgusted faces are socially threatening responses that could indicate rejection of the observer, sad and fearful faces do not necessarily indicate reactions to the observer. Because all of these negative emotions were combined into a single category, it is impossible to interpret the results of the study in terms of social phobics' reactions to clear social threats.

Another prediction derived from the processing-deficit model is that higher levels of social anxiety should be associated with more errors in recognizing meaningful social cues. This prediction has not been supported. Mullins and Duke (2004) found that trait social anxiety was not associated with the frequency of errors made in identifying different types of emotional expressions. Thus, although the study by Chen et al. (2002) suggests that social anxiety is associated with a deficit in identifying broad categories of emotional expressions, the evidence for processing-deficit models is limited. In fact, in direct conflict with such models, as we will discuss in the following section, a growing body of work suggests that individuals with higher levels of social anxiety are faster to respond to threatening facial stimuli when the observer does not feel a contemporaneous social threat.

Social Anxiety and Vigilance to Threat

Gilboa-Schechtman, Foa, and Amir (1999) showed participants arrays of twelve faces. In some of the arrays, all of the faces had the same emotional expression. In other

arrays, one of the faces displayed an emotion that differed from the other eleven faces. Participants were asked to press one of two keys to identify whether or not the array contained a disparate face. The study showed that participants were faster to detect arrays that contained one angry face in a neutral array than they were to detect one happy face in a neutral array, but the magnitude of this difference was larger for those with generalized social phobia than for non-anxious controls. In other words, social phobics were faster to identify arrays that contained a socially threatening face.

Additional support for a link between social anxiety and vigilance to social threat comes from a masked prime study in which participants were exposed to pairs of emotional expressions that were flashed so briefly as to prohibit conscious processing of the stimuli (Mogg & Bradley, 2002). Next, a probe appeared in the same position as one of the faces. Participants were asked to press a key as soon as the probe appeared. The study showed that compared to a low social anxiety group, high social anxiety participants were faster to respond to the probe when it appeared on the same side as a threatening, but not a neutral face, suggesting that even though the threat face was not consciously processed, the socially anxious participants were attending to threatening stimulus. Using a similar method, Mogg, Philippot, and Bradley (2004) showed participants pairs of emotional expressions for either 500 ms or 1,250 ms. The 500 ms exposure was used to examine the initial shift of attention to the faces, whereas the 1,250 ms exposure was used to examine sustained attention to the faces. Participants were asked to respond to a probe that appeared in the same position as one of the faces. Following the 500 ms exposure, social phobics were faster to respond to probes that appeared in the same position as angry faces than to probes that followed happy or

neutral faces. There was no effect of facial expression among nonanxious controls. Both social phobics and controls were faster to respond to angry faces following the 1,250 ms exposure to paired faces.

Finally, Heuer, Rinck, and Becker (2007) created the *Approach-Avoidance Task*, which required participants to respond to stimuli using a joystick to either pull toward their body (i.e. approach) or push away from their body (i.e. avoid). Highly socially anxious participants were faster to respond to both angry and happy faces with pushing than with pulling motions, whereas there were no differences in the response times of nonanxious controls to pushing and pulling following the same emotional expressions. This finding suggests that those with high levels of social anxiety may be primed to respond to positive and negative social threats with avoidance. Additional research suggests that this tendency to avoid feared stimuli is common to other types of anxiety disorders. Using a similar approach-avoidance task, Rinck and Becker (2007) found that spider phobics were faster to respond to pictures of spiders with a pushing motion than were nonanxious controls.

Social Anxiety and Vigilance to Threat While Under Threat

Other researchers have studied how the responses of individuals with high and low social anxiety differ depending on whether or not the person is currently under threat. Mansell, Clark, Ehlers, and Chen (1999) used the modified dot probe paradigm described above (Chen, Ehlers, Clark, & Mansell, 2002) to compare participants' responses to faces and household objects, but also manipulated the participants' level of social threat prior to the reaction time task. Specifically, participants in the social threat condition were told that they would have to give an impromptu speech following the reaction time task. The

study showed that participants in the social threat condition with high levels of social anxiety were slower to respond to probes that appeared in the same place as positive and negative emotional faces relative to neutral faces than were participants with low levels of social anxiety. There were no differences in the response times of high and low social anxiety participants in the control condition. The authors offered two possible explanation for social phobics' avoidance of both positive and negative faces when under threat. First, it is possible that the socially anxious divert their attention from other people at the first sign that others are evaluating them, either positively or negatively, in hopes of avoiding the social interaction. Second, social phobics may interpret both the positive and negative emotional expressions as signs of rejection (e.g. a smiling face is laughing at me).

Juth, Lundqvist, Karlsson, and Öhman (2005) exposed participants to arrays of twelve faces and asked them to identify whether or not the array contained a face with a disparate emotional expression. In this study, the arrays were made up of schematic pictures of faces showing angry, happy, or neutral expressions. Prior to completing this task, all participants were alerted to a social threat: at some points during the study, they would be observed by an "expert rater." Highly socially anxious participants were more accurate in identifying neutral arrays that included an angry face than neutral arrays that included a happy face, but only when the observer was present during the task. There were no differences in accuracy for highly socially anxious participants when the observer was not present, nor were there differences in accuracy for those who were low in social anxiety.

Examining Performance Under Moderate Social Anxiety

One element that all of these studies have in common is that the researchers compare the performance of a group of social phobics or highly socially anxious participants to the performance of a group of nonanxious or low social anxiety controls. Such an experimental design ignores those with moderate levels of social anxiety. Dispositional social anxiety is normally distributed in the population (Crozier, 1979; Leary & Kowalski, 1995), thus most individuals have moderate levels of the trait. This is exactly the type of distribution we should expect to see if social anxiety is an adaptive response to genuine social threats that natural selection has maintained in the population. Had previous researchers included a moderate social anxiety group in their studies, we should expect that group to be faster than either a low or high social anxiety group to identify social threats. The absence of a moderate trait social anxiety group from previous work is a significant shortcoming.

One study points to the importance of studying those with moderate trait social anxiety. Mullins and Duke (2004) examined differences between participants from across the distribution of trait social anxiety scores following *inductions* of mild, moderate, or severe social anxiety. All participants were asked to complete an emotion labeling task that involved identifying the type of emotional expression shown in a series of photos of faces. The stimuli include happy, sad, angry, and fearful emotional expressions, and the faces displayed either high or low intensity expressions. Participants were assigned to one of four experimental conditions: No Threat (Mild State Social Anxiety), Observer (Moderate State Social Anxiety), Speech (Moderate State Social Anxiety), or Speech/Observer (Severe State Social Anxiety). In the Observer conditions, participants

were asked to complete the emotion labeling task while the experimenter stood next to them, making notes. In the Speech conditions, participants were told that immediately following the emotion labeling task, they would be asked to give a brief speech before two faculty members. Those in the No Threat condition completed the emotion labeling task while alone in a quiet room.

When responding to high intensity stimuli, those in the Speech condition (Moderate State Anxiety) who were high in social anxiety were faster to identify the emotional expressions than were high social anxiety participants in the No Threat (Mild State Anxiety) and Speech/Observer (Severe State Anxiety) conditions. This finding was strongest for angry and fearful faces. Mullins and Duke (2004) described this pattern of results in terms of differences between the experimental conditions in the levels of state anxiety that were induced. At “moderate levels of state anxiety, socially anxious individuals are faster to identify anger and fear than when state anxiety levels are either too low or too high,” and the findings point to a “potential inverted-U curvilinear relationship” (p. 21) across the state anxiety conditions. A similar pattern of results was found among high anxiety participants for low intensity emotional expressions.

The Present Studies

Mullins and Duke (2004) examined the performance of those with high levels of social anxiety under different levels of social threat (i.e. different levels of state social anxiety). Those who were dispositionally high in social anxiety were faster to respond to threatening faces when under moderate threat, but were slower under no threat or under severe threat. This result suggests that in the face of genuine threats, social anxiety may be advantageous in that it sensitizes individuals to environmental dangers, but Mullins

and Duke (2004) found a curvilinear pattern of results only among those who were high in social anxiety.

In the present studies, we sought to examine the performance of individuals from across the spectrum of trait social anxiety scores on an emotion labeling task. Whereas Mullins and Duke found that those who were high in social anxiety were fastest to respond to threatening faces when under moderate threat, we sought to examine whether those with dispositionally moderate social anxiety were faster to respond to threatening faces than were those who were very high or very low in dispositional social anxiety. In other words, we wanted to look for the curvilinear pattern of results that Mullins and Duke found following state anxiety inductions among individuals from across the distribution of trait social anxiety scores.

Study 1

The design of Study 1 was similar to the design of the study by Mullins and Duke (2004) in that participants completed an emotional labeling task following a social anxiety induction. In the present study, rather than inducing social anxiety using a speech task or through the presence of an observer, we used a writing task in which participants in the social anxiety condition were asked to recall an anxiety-provoking situation. We examined both the speed and accuracy of responses to the emotion labeling task following the emotion induction task.

The High Stakes Model of Social Anxiety posits that the social anxiety response is designed to detect high stakes social interactions. However, social anxiety is normally distributed in the population (Crozier, 1979; Leary & Kowalski, 1995), with some having a response that is too sensitive to threat and others having a response that is not sensitive

enough to threat. Most individuals – those with moderate social anxiety – should be optimally attentive to threat cues. Therefore, in our study, with regard speed of responding, we hypothesized that participants with moderate levels of social anxiety would be faster to identify emotional expressions than would those with very low or high levels of social anxiety when not under threat (control condition). We expected those with high levels of social anxiety to be slower based on studies that suggest that social phobics direct their attention away from social cues, perhaps as part of an avoidance mechanism (Chen et al., 2002).

Although participants may have a baseline attentiveness to social threats that is higher than the attentiveness of with lower trait anxiety, this pattern might change when the organism is under threat. When under threat, a person with low trait social anxiety may redirect resources toward attending to social threats. Therefore, we predicted that participants with very low social anxiety would be faster to identify emotional expressions when under threat (social anxiety condition) than when not under threat. Finally, because angry faces are more threatening than happy, sad, or neutral facial expressions, we expected the relationship between trait social anxiety and response time to be stronger for angry faces than for other types of emotional expressions.

We also used signal detection analysis to examine participants' accuracy in identifying the different types of emotional expressions. For each emotion, we compared participants' number of hits (i.e., correctly detected emotional expression) with their number of false alarms (i.e., incorrectly detected emotional expression) using two signal detection parameters: discriminability and response bias. Discriminability (d') is an index of how easy or difficult it is to distinguish signal from noise. Bias is an index of

conservative responding. Individuals with a stronger bias are inclined against making errors and are thus more likely to respond as if a signal is not present. With regard to these signal detection parameters, we expected that: (a) participants with moderate and high levels of social anxiety would score higher on discriminability for emotional expressions and would have a smaller bias than would those with low levels of social anxiety when not under threat (control condition); (b) participants with very low social anxiety would score higher on discriminability for emotional expressions when under threat (social anxiety condition); and, (c) these effects would be more pronounced for angry faces than for other types of emotional expressions.

Methods

Participants

Ninety-five undergraduate students at the University of Pennsylvania participated in this study. The participants were paid \$10.00 for taking part in an hour-long session. Data from two participants were removed from the sample because the participants had taken part in an earlier round of data collection for this series of studies. Data from one additional participant were removed because she was a non-native English speaker who failed to complete the study materials. The average age of the participants was 21.11 ($SD = 2.71$), and 65.2% of participants were female.

Materials

Priming task. Participants were given ten minutes, to read a prompt, think about a relevant situation (i.e., “get into the experience”), and write about that situation. In both conditions, participants were instructed to “include the details of what happened, exactly how you felt at the time, why you felt this way, and what you thought about.”

The control prompt instructed participants to write about a “typical weekday, preferably a day that you experienced within the past year.” The social anxiety prompt instructed participants to think about a “recent social event or interaction, preferably within the past year, which made you feel really anxious, nervous, and worried that people were forming an unfavorable impression of you.” Participants were given several examples of such situations: “having a blind date, giving a presentation in front of an audience, or interacting with people you barely know at a party.”

Self-report measures. Participants completed three widely used measures of social anxiety. The Social Avoidance and Distress Scale (SAD; Watson & Friend, 1969) is a 28-item true-false measure that assesses subjective distress surrounding social interactions as well as the tendency to avoid such encounters. The Brief Fear of Negative Evaluation Scale (FNE; Leary, 1983) is a 12-item revision of The Fear of Negative Evaluation Scale (Watson & Friend, 1969). The Interaction Anxiousness Scale (IA; Leary, 1983) is a 15-item measure of social anxiety. Responses on the FNE and IA scales were given on a scale from 1 (Not at all characteristic of me) to 5 (Extremely characteristic of me). Participants also provided basic demographic information.

Facial expression labeling task. The facial expression labeling task consisted of 48 photos. The photos were of equal numbers of men and women, who made happy, sad, angry, and neutral emotional expressions. The photos were drawn from the NimStim Face Stimulus Set (Tottenham et al, in press). This set of faces includes 646 emotional expressions that have been validated using samples of children and adults. For the present study, we selected only those photos that were reliably identified by the respondents in the validation study (i.e. greater than 90% correctly identified the emotion).

Each of the four target emotions was displayed in 12 of the photographs. Participants completed a series of eight practice trials, followed by the 48 study trials. Participants' responses to the practice trials were not recorded, and the order in which the 48 study trial photos appeared was completely randomized.

The task was administered on desktop computers, using software that was designed to administer the task while the experimenter was out of the room. Prior to completing the practice trials, participants were given detailed written instructions. Participants were instructed to use the keyboard arrow keys to identify the emotion shown in the photos – up arrow for happy, down arrow for sad, left arrow for angry, and right arrow for neutral/no expression – and were asked to be both accurate and fast when making their responses.

During each trial, a participant saw a blank screen for two seconds, followed by a fixation cross in the middle of the screen for one second. Next, a photo appeared in the middle of the screen and remained on the screen until the participant pressed a response key. The response time began as soon as a photo appeared and ended when a response key was pressed. For each trial, the program stored the number of the photo that was presented, the response key that was pressed, and the response time (in milliseconds). The subsequent trial began immediately after the response key had been pressed.

Procedure

After giving their informed consent to take part in the present study, participants were each assigned a random six-digit laboratory ID number. Participants were instructed to provide this number on all of their study materials so that their responses on the various parts of the study could be matched up at the end of the session.

Participants were randomly assigned to either the control or social anxiety prime condition. The researcher instructed the participants to read their prompt and begin writing, then timed the participants while they wrote for ten minutes. Participants next completed the facial expression task, and were instructed to complete the self-report measures immediately after the conclusion of the computer task. The self-report measures of social anxiety were completed at the end of the study because we did not want participants to be primed to think about social anxiety prior to completing the other parts of the study. At the end of the study, participants were asked to read a written debriefing before they were dismissed from the study.

Results

Group Differences

Because the individual differences variables were measured after the social anxiety manipulation was complete, a series of ANOVA's was performed in order to test for group differences between the control and social anxiety prime groups and between males and females. We conducted a 2 (condition) x 2 (sex) ANOVA with SAD as the dependent variable. There was neither a main effect of condition, $F(1,88) = 0.59, p = .44$, nor a main effect of sex, $F(1,88) = 2.33, p = .13$. The interaction of condition and sex was not significant, $F(1,88) = 2.33, p = 0.45, p = .51$. The absence of a main effect for condition tells us that participants' responses to a dispositional measure of social anxiety were not influenced by the experimental manipulation.

The FNE scale measures individual's anticipatory anxiety of being viewed negatively by others, and the IA scale measures nervousness surrounding social

interactions. We chose to focus the subsequent analysis on the SAD scale, because it was used as the target social anxiety measure in similar studies (i.e., Mullins & Duke, 2004).

Response Accuracy

For each of the 48 study trial photos, we examined participants' accuracy in identifying the emotion. Overall, participants were extremely accurate in their responses for happy faces ($M = 98.9\%$ correct), sad faces ($M = 95.8\%$ correct), neutral faces ($M = 92.8\%$ correct), and angry faces ($M = 92.6\%$ correct). One angry face was problematic in that only 78.3% of respondents accurately identified the emotion. Of the 20 participants who incorrectly labeled the expression, 19 identified the emotion as sadness, suggesting that the emotional expression was ambiguous. Because we used only correct responses in the response time analysis and the number of correct responses for this picture was low, the data gathered for this picture were dropped from subsequent response time analyses.

Response Time

Only correct responses were used in the RT analysis. For each participant, RT outliers (defined as values falling outside $\pm 3 * SD$ from the individual's mean RT) were replaced with the individual's mean RT. This method removed outliers from within an individual's responses, but did not remove influential observations from the data set. After examining the scatterplots for each emotion, we recognized that there were a few individuals whose response times were much slower than the rest of the participants' reaction times. Therefore, for each emotion, we replaced outlying average response times (defined as values falling outside $\pm 3 * SD$ from the average RT for that emotion) with the average response time for that emotion.

Table 3.1 displays the means and standard deviations for the RT variables. A

repeated measures ANOVA revealed that there were significant differences in the speed with which participants responded to the four types of emotional expressions, $F(3, 273) = 44.37, p < .001$. Simple contrasts revealed that participants were faster to respond to happy than neutral faces, $F(1, 91) = 61.25, p < .001$, and slower to respond to angry than neutral faces, $F(1, 91) = 6.87, p = .01$. There were no differences in response times to neutral and sad faces, $F(1, 91) = 2.31, p = .13$.

Because we hypothesized that there would be a nonlinear relationship between trait social anxiety and response time to emotional expressions, we conducted a series of curvilinear regression analyses. Curvilinear regression is typically conducted hierarchically (Pedhazur & Schmelkin, 1991). As a first step, the researcher enters the independent variable, X , into the model. In the subsequent steps, the researcher enters the quadratic term, X^2 , which is followed by higher order polynomial terms (i.e., X^3, X^4 , etc.) until the addition of a subsequent higher order polynomial term no longer significantly improves the model fit. Because the interpretation of models involving higher order polynomials can be problematic, and because our hypothesis involved a quadratic function, we decided a priori that we would stop our stepwise regression with the cubic term. We were interested in fitting separate curves to the data gathered from participants in the control and social anxiety conditions. Therefore, we examined the interaction of condition and trait social anxiety as a predictor of response time.

Table 3.2 presents the model fit for the results of stepwise multiple regressions predicting each of the different types of emotional expressions. In each regression, in the first step we entered condition, SAD score, and their interaction. In the second step, we added the squared SAD score and its interaction with condition. In the third step, we

added the cubed SAD score and its interaction with condition. As shown in Table 3.2, for the sad, angry, and neutral expressions, the step including the cubic term significantly improved the model fit over the previous step. Therefore, Tables 3.3 through 3.5 present the results of multiple regressions predicting response times to sad, angry, and neutral expressions using linear, quadratic, and cubic terms. As shown in these tables, the interaction of SAD^3 and condition was a marginally significant predictor of response time to sad expressions ($\beta = .68, p = .06$), angry expressions ($\beta = .64, p = .07$), and neutral expressions ($\beta = .70, p = .06$).

In order to interpret the interaction terms in our models, we created separate scatter plots for the control and social anxiety prime conditions in which we plotted SAD scores on the x-axis and response time on the y-axis. These plots for the sad, angry, and neutral expressions include the regression line for the SAD^3 term and are shown in Figure 3.1.

Signal Detection Analysis

We used signal detection analysis to examine participants' accuracy in identifying emotional expressions of happiness, sadness, and anger. For each participant, we calculated the number of hits for each of the three target emotions (e.g., a happy expression was correctly identified) and the number of false alarms for each of the three target emotions (e.g., a sad, angry, or neutral expression was incorrectly labeled as happy). Next, we computed the hit and false alarm rates for each emotion. Signal detection parameters cannot be calculated when hit and false alarm rates are equal to 0 or 1. Therefore, we calculated hit rate = $(hits + 0.5)/(number\ of\ happy,\ sad,\ or\ angry\ faces + 1)$ and false alarm rate = $(false\ alarms + 0.5)/(number\ of\ faces\ displaying\ an\ expression$

other than the target emotion + 1), using a common approach to eliminating such values (Snodgrass & Corwin, 1988). We computed d' (discriminability) and c (bias), such that $d' = Z(\text{hit rate}) - Z(\text{false alarm rate})$ and $c = -0.5 * (Z(\text{hit rate}) + Z(\text{false alarm rate}))$ (for SPSS syntax see Stoeber & Eysenck, 2008). The means and standard deviations of the signal detection parameters are shown in Table 3.6.

Next, we used hierarchical curvilinear regression to predict discriminability for each type of emotional expression. In each regression, in the first step we entered condition, SAD score, and their interaction. In the second step, we added the squared SAD score and its interaction with condition. In the third step, we added the cubed SAD score and its interaction with condition. The models predicting discriminability for happy and sad faces were not significant. R^2 for Step 1 of the model predicting discriminability for angry faces was .047. The addition of the squared SAD term and its interaction with condition marginally improved the fit of the model, $\Delta R^2 = .051, p = .09$. The addition of the cubic SAD term and its interaction did not improve the model fit, $\Delta R^2 = .012, p = .57$. Table 3.7 presents the results of the multiple regression predicting discriminability for angry faces, including the predictors entered through Step 2, and Figure 3.2 graphically represents the regression lines for the social anxiety and the control conditions.

We used the same progression of hierarchical curvilinear regression models to predict bias. The models predicting bias for happy and sad faces did not provide an adequate fit to the data. With respect to bias for the angry expressions, the model fit for Step 1 was marginally significant, $\Delta R^2 = .07, p = .09$, but neither the predictors entered in Step 2, $\Delta R^2 = .019, p = .41$, nor the predictors entered at Step 3, $\Delta R^2 = .008, p = .69$, significantly improved the fit. At Step 1, only condition was a significant predictor ($\beta =$

.23, $p = .03$), such that participants in the social anxiety condition tended to have a stronger bias than did participants in the control condition.

Discussion

The results of this study provide some support for the idea that the relationship between social anxiety and response time to threats is best described by a curvilinear function, but the effect of condition on this relationship was in the opposite direction that we hypothesized, and the shape of the curve was not what we predicted. When asked to identify sad, angry, or neutral expressions, participants in the social anxiety condition with moderate levels of trait social anxiety were faster to respond than were those who were slightly lower or higher in trait social anxiety. However, those at the bottom tail of the distribution were also fast to respond in the social anxiety condition. There was no effect of trait social anxiety among participants in the control condition. We found a slightly different pattern of curvilinear results when predicting discriminability for angry facial expressions. In the control condition, participants at either extreme of the distribution of social anxiety scores were more sensitive to angry faces than were those with more moderate levels, but the pattern was reversed among participants in the social anxiety condition. Those with moderate levels of social anxiety who were assigned to the social anxiety condition were more sensitive to angry faces than were those with higher trait levels of social anxiety.

There are several possible explanations for our findings. First, in line with our pattern of results, it is possible that individuals with moderate levels of social anxiety have an advantage over those with slightly higher or lower social anxiety only when they are under some social threat. It is possible that those with no social anxiety (those at the

left extreme of the distribution) are faster to respond to threatening cues only when they have been primed to look for dangers in their environment. This would explain the absence of an effect of trait social anxiety in the control condition, but the existence of an effect in the social anxiety condition. Second, it is possible that our priming manipulation was either weak, or was a manipulation of something other than social anxiety. For example, writing about a time when one felt socially anxious might lead to feelings of regret rather than to feelings of social anxiety.

Because our results were unexpected and because this approach to studying participants from across the distribution of social anxiety scores is novel, we wanted to check the reliability of our results by attempting to replicate our findings.

Study 2

Study 2 was a replication of Study 1, with a few modifications. Because we had so few high social anxiety participants in Study 1, in Study 2 we used prescreening to recruit more individuals with high trait social anxiety levels. In addition, we replaced the ambiguous emotional expression mentioned in Study 1 with a face that clearly displayed an angry expression.

Methods

Participants

Data were gathered from the University of Pennsylvania over the course of two semesters. Two hundred undergraduate students at the University of Pennsylvania participated in study prescreening during the first semester, and two hundred participated during the second semester. All participants completed prescreening in exchange for course credit. Forty-six qualifying participants completed the second phase of the study

during the first semester, and 47 qualifying participants completed the second phase during the second semester. All second phase participants received additional course credit. Data from one second-phase participant were removed because the participant failed to complete the response time task.

The average age of participants over the course of the two semesters was 19.26 ($SD = 1.41$), and 68.5% of participants were female.

Materials

Prescreening. Participants completed online versions of the SAD Scale, the FNE scale, and the IA Scale, in addition to providing basic demographic information. Prior to completing these measures, participants were informed that the study involved two phases and were told that their responses to the survey questions would be used to evaluate their eligibility to participate in the second phase of the study. Participants who were interested in being invited to take part in the second phase were asked to opt in by providing their name and email address.

Phase II. Participants completed the same priming task and self-report measures that were used in Study 1. The facial expression labeling task was also the same as Study 1, but we replaced the ambiguous “angry” face from Study 1 with a different picture of the same actor displaying a more clearly angry expression.

Procedure

Participants were recruited to participate in Study 2 prescreening using a link on a Psychology Subject Pool website. The researcher later emailed participants who provided contact information and who qualified to participate in Phase II. The email included upcoming session times, and recipients were asked to respond with their

availability if they wanted to participate. In an effort to recruit socially anxious participants, the researcher initially contacted participants who scored a nine or above on the SAD Scale. After giving these higher social anxiety participants the opportunity to sign-up for the study, the researcher emailed the low socially anxious participants to offer them the opportunity to sign-up for the study on a first-come, first-served basis.

The procedure followed during the second phase of the study was identical to the procedure used in Study 1.

Results

Prescreening

The mean SAD score during prescreening was 6.25 ($SD = 6.37$), and the median was 4.00. Because we were interested in recruiting highly socially anxious participants, we initially focused our recruitment on participants who scored a 9 or above on the SAD Scale. In our sample, a score of nine on the SAD Scale corresponded to the 75th percentile.

In order to check the stability of SAD scores over time, we calculated test-retest reliability using participants' scores from prescreening and their scores during the second phase of the study. Scores from the first and second phases of the study were highly correlated ($r = .76, p < .001$), indicating that there was acceptable test-retest reliability for scores on the SAD scale.

Group Differences

Because the individual difference variables were measured after the social anxiety manipulation was complete, a series of ANOVA's was performed in order to test for group differences between the control and social anxiety prime groups and between

males and females. We conducted a 2 (condition) x 2 (sex) ANOVA with SAD as the dependent variable. There was not a main effect of condition, $F(1,88) = 0.24, p = .63$, but there was a main effect of sex, $F(1,88) = 6.29, p = .01$, with men reporting higher levels of trait social anxiety ($M = 11.02, SD = 1.31$) than women ($M = 7.08, SD = 0.88$). The interaction of condition and sex was not significant, $F(1,88) = .19, p = 0.45, p = .66$.

Response Accuracy

As in Study 1, participants were extremely accurate in their identification of happy faces ($M = 99.0\%$ correct), sad faces ($M = 95.8\%$ correct), neutral faces ($M = 90.9\%$ correct), and angry faces ($M = 93.4\%$ correct).

Response Time

Following the procedure used in Study 1, only correct responses were used in the RT analysis. For each participant, RT outliers (defined as values falling outside $\pm 3 * SD$ from the individual's mean RT) were replaced with the individual's mean RT. For each emotion, we replaced outlying average response times (defined as values falling outside $\pm 3 * SD$ from the average RT for that emotion) with the average response time for that emotion. The mean RTs for each emotion are shown in Table 3.8.

As in Study 1, we used stepwise multiple regression to determine whether quadratic or cubic regression equations provided adequate fit to our data. In each regression, in the first step we entered condition, SAD score, and their interaction. In the second step, we added the squared SAD score and its interaction with condition. In the third step, we added the cubic SAD score and its interaction with condition. At none of the steps did the models provide an adequate fit to the data predicting response time to neutral or happy faces. For the sad and angry faces, none of the models involving the

cubic interaction terms fit the data significantly better than the model involving the predictors entered in Step 2. At Step 2, the interaction terms did not significantly improve the model fit. Therefore, we removed the interaction terms at each step and reexamined the models.

For the model predicting response time to angry expressions, the change in R^2 from Step 1 to Step 2 – when we entered SAD^2 – was marginally significant, $\Delta R^2 = .039$, $p = .06$. For the model predicting response time to sad expressions, the change in R^2 from Step 1 to Step 2 was significant, $\Delta R^2 = .055$, $p = .03$. Tables 3.9 and 3.10 present the results of these multiple regressions predicting reaction times to sad and angry expressions. SAD^2 was a significant predictor of response time to sad faces and a marginally significant predictor of response time to angry faces.

In order to illustrate the effects seen in these models, we created scatter plots in which we plotted SAD scores on the x-axis and response time on the y-axis. Although the interaction of SAD^2 and condition was not a significant predictor in these models, in order to facilitate the comparison of our results between Study 1 and Study 2, we again created separate scatter plots for the control and social anxiety prime conditions (See Figure 3.3).

Signal Detection Analysis

As in Study 2, we used signal detection analysis to examine participants' accuracy in identifying emotional expressions of happiness, sadness, and anger. For each participant, we calculated the number of hits for each of the three target emotions (e.g., a happy expression was correctly identified), the number of false alarms for each of the three target emotions (e.g., a sad, angry, or neutral expression was incorrectly labeled as

happy), hit and false alarm rates for each emotion, d' (discriminability), and c (bias). The means and standard deviations of these measures are shown in Table 3.11.

We used hierarchical curvilinear regression to predict discriminability for each type of emotional expression. In each regression, in the first step we entered condition, SAD score, and their interaction. In the second step, we added the squared SAD score and its interaction with condition. In the third step, we added the cubed SAD score and its interaction with condition. The fit of the model predicting discriminability for angry faces was marginally significant at Step 1, $R^2 = .061, p = .13$. The addition of the predictors at Step 2, $\Delta R^2 = .019, p = .42$, and Step 3, $\Delta R^2 = .003, p = .88$, did not improve the model fit. The only significant predictor of discriminability for angry faces in Step 1 was SAD ($\beta = -.21, p = .05$). The model predicting discriminability for sad faces did not provide an adequate fit to the data, but SAD was a marginally significant predictor of discriminability for sad faces in Step 1 ($\beta = -.19, p = .08$). The model predicting discriminability for happy expressions did not adequately fit the data.

We used the same progression of hierarchical curvilinear regression models to predict bias. The models predicting bias for happy and angry faces did not provide an adequate fit to the data. With respect to response bias for the sad expressions, the model fit for Step 1 was significant, $R^2 = .089, p = .04$, but the predictors entered in the subsequent steps did not significantly improve the fit. At Step 1, only condition was a significant predictor ($\beta = .28, p < .01$), such that participants in the social anxiety condition tended to have a stronger bias than did participants in the control condition.

Discussion

As in the Study 1, the results of Study 2 provide some support for the idea that the relationship between social anxiety and response time to threats is best described by a curvilinear function. In this study, participants with low to moderate levels of trait social anxiety were faster to respond to both sad and angry faces than were those with higher trait levels of social anxiety. Unlike in Study 1, in this study we did not find a significant interaction between SAD³ and condition, but rather found a significant effect of SAD². Taken together, the results of Studies 1 and 2 point to a problem with our priming task. In Study 1, there was no effect of social anxiety in the control condition, in Study 2, there was no effect of condition.

In Studies 1 and 2, we failed to find a significant pattern of results for the relationship between social anxiety and our signal detection parameters. This could be due to the fact that participants were extremely accurate in their identification of the different emotional expressions, with average accuracies of well over 90% for each of the different types of emotional expression. Therefore, we attempted to decrease participants' accuracy by introducing more ambiguous facial expressions to the response time task.

Study 3

In Study 3, instead of using photos of pure emotional expressions, we created morphs that combined a happy, sad, or angry prototype photo with a neutral emotional expression. Previous studies of social anxiety have examined responses to morphed facial expressions. Schofield, Coles, and Gibb (2007) created morphs in 10% increments between neutral expressions and either happy or disgusted expressions (i.e. 10% neutral; 90% emotion, 20% neutral; 80% emotion, etc.). Participants were asked to identify the

emotion shown in the face after a brief exposure (60ms) or when they could look at the photo until they registered a response. Membership in the high or low social anxiety group was not related to a participant's ability to identify either happy or disgust morphs of varying emotional intensities at either duration of exposure. Using a clinical sample, Philippot and Douilliez (2005) examined attention to facial expression among a group of social phobics, a group of individuals with other anxiety disorders, and a group of nonanxious controls. The stimuli were morphs of neutral and emotional faces (i.e., happy, sad, angry, disgusted, afraid) of varying intensity. For each morph, participants were asked to identify the emotion and its intensity and to rate the difficulty of identifying the emotion. Despite sufficient power, there were no differences between the groups on the dependent variables, meaning that anxiety was not associated with either increased attention toward or increased avoidance of threatening faces.

Both of these studies failed to find a relationship between trait social anxiety and attention to threatening faces. However, both studies compare a high social anxiety group to a low social anxiety group, ignoring those with moderate levels of social anxiety. In Study 3, we examine how individuals from across the distribution of social anxiety scores respond to morphed facial expressions. We expected to find that individuals with moderate levels of social anxiety would be more sensitive to the emotions displayed by the morphed faces than would participants with especially high or low trait levels of social anxiety.

Participants

Data were collected at the University of Michigan over the course of two semesters. During the first semester, prescreening was not used, and all members of the

Introductory Psychology Subject Pool were eligible to take part in the study. Fifty-six students participated in exchange for course credit.

During the second semester, all students in the Introductory Psychology Subject Pool were eligible to complete prescreening. One thousand and one students completed the prescreening questions for this study. Of those, 350 were eligible to participate in the second phase of our study, and 36 took part in exchange for course credit.

The average age of participants from across the two semesters was 18.47 ($SD = 0.81$), and 67.4% of participants were female.

Materials

Prescreening. Participants completed the three-item Mini-Social Phobia Inventory (Mini-SPIN; Connor, Kobak, Churchill, Katzelnick, & Davidson, 2001). This brief scale is routinely used to screen for generalized social anxiety disorder. Total scores on the scale range from 0 to 12, and scores of 6 or above are indicative of disordered levels of social anxiety.

Morph labeling task. The morph labeling task consisted of 48 photos. The morphs were created from prototype photos of two men and two women, who were making happy, sad, angry, and neutral emotional expressions. The prototypes were drawn from the NimStim Face Stimulus Set (Tottenham et al, in press). We created morphs that represented 25% increments of each of the emotions and the neutral expressions (e.g., 25% Happy, 75% Neutral; 50% Happy, 50% Neutral; 75% Happy, 25% Neutral). For each of the four actors and each of the three emotions, participants saw the prototype images (i.e., 100% Emotion and 100% Neutral) and the three incremental morphs.

As in Studies 1 and 2, participants completed a series of eight practice trials, followed by the 48 study trials. Participants' responses to the practice trials were not recorded, and the order in which the 48 study trial photos appeared was completely randomized. The software and response time task were identical to those used in previous studies. Participants were instructed to use the keyboard arrow keys to identify the emotion shown in the photos – up arrow for happy, down arrow for sad, left arrow for angry, and right arrow for neutral/no expression – and were asked to be both accurate and fast when making their responses.

Procedure

All participants in the Introductory Psychology Subject Pool during the second semester of data collection were asked to complete prescreening on the Psychology Subject Pool website. Session times for the second phase of the study were only visible to participants who scored a six or above on the Mini-SPIN. Enrollment in the second phase of the study was handled by the Subject Pool website, and the researcher had no contact with participants.

The procedure followed during the second phase of the study was identical to the procedure used in Studies 1 and 2. Participants completed the priming task, followed by the morph labeling task and the self-report measures.

Results

Prescreening

The mean Mini-SPIN score during prescreening was 4.61 ($SD = 2.70$), and the median was 4.00.

Group Differences

Because the individual differences variables were measured after the social anxiety manipulation was complete, a series of ANOVA's was performed in order to test for group differences between the control and social anxiety prime groups and between males and females. We conducted a 2 (condition) x 2 (sex) ANOVA with SAD as the dependent variable. There was a marginally significant main effect of condition, $F(1,88) = 3.84, p = .05$, but no main effect of sex, $F(1,88) = 1.97, p = .16$. The interaction of condition and sex was not significant, $F(1,88) = 0.85, p = 0.36$. The descriptive statistics for the self-report measures and response times are shown in Table 3.13, and descriptive statistics for the signal detection analysis are shown in Table 3.14.

Response Accuracy

Averaging across the three emotions, we examined participants' accuracy in identifying each increment of the morphs. Few participants were able to identify the emotion shown in the 25% emotion morphs ($M = 13.6\%$ correct), but accuracy in identifying the 50% morphs was much higher ($M = 80.1\%$ correct). Accuracy in identifying the 75% morphs ($M = 95.5\%$ correct) and the 100% emotion prototypes ($M = 96.5\%$ correct) was almost at ceiling. In the previous studies when we conducted our analyses of response times, we used only correct responses. Because accuracy in identifying the 25% and 50% morphs was low, conducting a response time analysis was not possible in this case, as the sample size for response times was drastically reduced.

Signal Detection Analysis

We used signal detection analysis to examine participants' accuracy in identifying the emotions shown in the morphed photos. For each participant, we calculated the

number of hits (e.g., a happy prototype or happy morph was correctly identified as happy) and the number of false alarms (e.g., a sad or angry prototype or morph or a neutral expression was incorrectly labeled as happy). Next, we computed the hit and false alarm rates using the formulas described in Study 1 and used those values to calculate discriminability and bias values for each type of emotion.

We were also interested in taking response time into account, therefore we calculated participants' efficiency in detecting the three types of emotional expressions by dividing discriminability by the total time participants required to complete the response time task. Prior to calculating efficiency, both discriminability and total time were transformed in order to give them equal weight (Craig & Condon, 1985). We computed $\text{efficiency} = (z\text{-value of discriminability} + \text{minimum } z\text{-value of discriminability} + 1) / (z\text{-value of total time} + \text{minimum } z\text{-value of total time} + 1)$ for each of the three emotions.

As in the previous studies, we hypothesized that there would be a nonlinear relationship between trait social anxiety and our signal detection parameters. Therefore, we conducted a series of curvilinear regression analyses predicting discriminability, bias, and efficiency. In each regression, in the first step we entered condition, SAD score, and their interaction. In the second step, we added the squared SAD score and its interaction with condition, and in the third step we added cubed SAD score and its interaction with condition. The cubic term did not significantly improve the fit of any of the models. The models predicting discriminability for happy, sad, and angry faces were not significant. Furthermore, the models predicting bias for happy and sad faces did not provide an adequate fit to the data. With respect to bias for the angry expressions, the model fit for

Step 1 was marginally significant, $\Delta R^2 = .07, p = .10$, and with addition of the predictors entered in Step 2, $\Delta R^2 = .081, p = .02$, the model showed an adequate fit to the data. The results of the regression are shown in Table 3.14.

Finally, we were interested in fitting models predicting participants' efficiency in their responses to the different types of emotional expressions. The models predicting efficiency for happy and sad faces were not significant, but there was a marginally significant fit at Step 1 of our regression predicting efficiency for angry faces. The results of that multiple regression are shown in Table 3.15, and the results are illustrated graphically in Figure 3.4.

Discussion

We failed to find support for our hypothesis that those with moderate social anxiety are better able to discriminate the emotions shown in morphed faces than are those with more extreme trait social anxiety scores. In this study, we did find that SAD² was a significant predictor of bias for morphs involving angry facial expressions. Individuals with moderate levels of trait social anxiety had lower bias scores than did participants who were either very low or very high on trait social anxiety. This means that those with moderate social anxiety were less biased against false alarms (i.e., errors). This is the pattern we would expect if the cost of a false alarm is low, but the cost of missing a social threat is high.

There is a trend in the data such that among participants in the control condition, higher trait social anxiety is associated with higher efficiency in detecting angry expressions. In contrast, among participants who completed the social anxiety prime, higher trait social anxiety is associated with lower efficiency in detecting angry

expressions. Efficiency is a measure of discriminability divided by total time spent on the response time task. This means that for participants in the control condition, holding discriminability constant, highly socially anxious participants would on average spend less time identifying angry faces than would those low in social anxiety. Or, holding time constant, highly socially anxious participants would on average show higher discriminability for angry expressions than would those lower in social anxiety.

General Discussion

The first conclusion to be drawn from this series of studies is that the relationship between social anxiety and response time to sad and angry facial expressions is best described by a curvilinear function. What is less clear is how this pattern is affected by the presence or absence of a social threat. In Study 1, those in the social anxiety condition with moderate and very low levels of social anxiety were faster to respond to sad and angry faces than were those with low to moderate or very high levels of trait social anxiety. In Study 3, those with low to moderate trait social anxiety were faster to respond to sad and angry faces than were those with more extreme social anxiety, regardless of condition.

The relationship between social anxiety and response accuracy remains murky. Examined against other research on social anxiety, our inconsistent pattern of results is perhaps less surprising, as other researchers have failed to find a relationship between social anxiety and errors in identifying emotional expressions (Mullins & Duke, 2004). In Study 1, we found a curvilinear relationship between the squared social anxiety predictor and discriminability, such that in the control condition, those with higher social anxiety showed higher discriminability, whereas those with higher anxiety in the social anxiety

condition showed lower discriminability. In Study 2, we found a linear relationship between social anxiety and discriminability for angry expressions, such that those with higher social anxiety exhibited lower discriminability. This lower discriminability could be driven by an especially low hit rate or high false alarm rate among those with higher social anxiety. In order to examine these possibilities, we tested the correlations among social anxiety, hits, and false alarms. These data suggest that the relationship between discriminability and social anxiety is due to a greater degree to a higher false alarm rate ($\beta = 0.16, p = .13$) than it is to a lower hit rate ($\beta = -0.10, p = .36$). Again, this pattern suggests that the cost of missing a social threat is high, whereas the cost of falsely detecting a social threat is low. In Study 2, these cost differentials could have been magnified by the social anxiety prime, resulting in lower discriminability for those with high social anxiety.

Implications for Research on Social Anxiety

Research on the cognitive model of social phobia (Clark & Wells, 1995) suggests that for social phobics, focused attention on their own feelings of anxiety may lead to a processing-deficit for external social cues. Results of our response time analyses appear to support this idea. Those with the highest levels of trait social anxiety were slower to respond to sad and angry faces than were those with moderate social anxiety. The view that very high social anxiety is associated with a processing deficit is not incompatible with the notion that moderate levels of social anxiety are associated with increased attention to meaningful social threats. Social anxiety may provide an advantage in the detection of social threats up to the point that that social anxiety begins to interfere with normal social interactions.

Most research on social anxiety ignores the possibility that some social anxiety may be advantageous and instead compares the performance of social phobics to nonanxious controls in an attempt to identify deficits among those highest in anxiety. This approach overlooks the possibility that those with no or very low social anxiety may also be at a disadvantage on certain types of tasks. In Study 1, we found that those with no social anxiety were fast to respond to threat cues only when they had been primed to think about anxiety-provoking experiences. When not under threat, these individuals may not pay enough attention to social threats. Ours is the first study we know of to examine the performance of individuals from across the distribution of social anxiety scores.

Limitations and Future Directions

The most significant weakness in the present series of studies is our priming task. We attempted to develop a mild written induction of social anxiety, and it appears that our manipulation was so subtle as to make it difficult to draw firm conclusions from our findings. It will be important to repeat the facial expression labeling task and the morph task using a stronger manipulation of social anxiety, such as a speech task or the presence of an observer. When repeating the morph task, it would also be helpful to include more subtle gradations of the morphs (i.e., 10% emotion, 20% emotion, 30% emotion, etc.), thus introducing more variability to the possible number of hits and false alarms.

The morph task provided a first test of the relationship between trait social anxiety and sensitivity to threat cues in ambiguous stimuli. In future studies, it would be interesting to examine the impact of degraded stimuli on performance on the response time task. Degrading the stimuli would serve to make the presence or absence of threat more ambiguous. Suitable degraded stimuli could be created by decreasing the length of

exposure to the stimulus faces, using blurred or pixilated faces, or decreasing the amount of contrast between the face and the background. If those with moderate social anxiety are most sensitive to threat cues, we would expect them to be more likely to identify a degraded stimulus as displaying anger than would those with lower or higher social anxiety.

Another important limitation of the present studies was that participants completed the self-report measures of social anxiety after completing the priming task. In Study 2, we found that scores on the SAD scale met acceptable standards for test-retest reliability ($r = .76, p < .001$). This suggests that measuring trait social anxiety after the priming task did not significantly impact trait social anxiety scores. We also gain support for this interpretation in the finding that there were not significant differences between the control and social anxiety prime groups in their scores on the SAD scale. This can also be taken as further evidence for the weakness of our priming task. Although our results suggest that measuring trait social anxiety using a post-test did not influence scores on the measure, in future studies trait social anxiety should be measured using a pretest. That way, we can be certain that we have a stable measure of trait social anxiety that is not influenced by experimental manipulations.

Finally, the present studies were also limited by relatively small sample size and thus low power to identify significant predictors. Despite our attempts to use prescreening to recruit participants with high levels of trait social anxiety, we were unable to induce many of these participants to take part in our study. We must continue to try to address this problem with recruitment in future studies.

Table 3.1
Means and Standard Deviations by Experimental Group (Study 1)

<i>Response Time (sec)</i>	Control Prime (n = 47)		Social Anxiety Prime (n = 45)	
	Mean	SD	Mean	SD
Happy	924.35	193.15	921.55	204.02
Sad	1103.11	280.77	1100.31	278.24
Angry	1121.93	210.87	1145.28	352.14
Neutral	1077.37	263.63	1086.50	312.99
<i>Predictor Variables</i>				
SAD	8.04	7.01	7.53	6.28
FNE	3.18	0.78	3.33	0.82
IAS	2.76	0.73	2.76	0.77

Note. SAD = Social Avoidance and Distress. FNE = Fear of Negative Evaluation. IAS = Interaction Anxiousness.

Table 3.2
 Model Fit for Stepwise Regressions Predicting Response Time to Emotional Faces
 (Study 1)

Emotion	Step Number & Predictors Added to Model	ΔR^2	R^2
Happy	1. SAD, Condition, SAD \times Condition	.003	.003
	2. SAD ² , SAD ² \times Condition	.002	.004
	3. SAD ³ , SAD ³ \times Condition	.046	.050
Sad	1. SAD, Condition, SAD \times Condition	.017	.017
	2. SAD ² , SAD ² \times Condition	.023	.040
	3. SAD ³ , SAD ³ \times Condition	.085*	.126
Angry	1. SAD, Condition, SAD \times Condition	.025	.025
	2. SAD ² , SAD ² \times Condition	.021	.046
	3. SAD ³ , SAD ³ \times Condition	.129**	.175
Neutral	1. SAD, Condition, SAD \times Condition	.004	.004
	2. SAD ² , SAD ² \times Condition	.004	.008
	3. SAD ³ , SAD ³ \times Condition	.192*	.100

Note. $N = 92$. * $p < .05$. ** $p < .01$

Table 3.3
Multiple Regression Predicting Response Time to Sad Faces (Study 1)

Variable	<i>B</i>	<i>SE B</i>	β
SAD	-8.88	7.36	-.24
Condition	4.31	41.34	.02
SAD \times Condition	-17.04	7.36	-.46*
SAD ²	-1.63	1.12	-.37
SAD ² \times Condition	-1.33	1.12	-.38
SAD ³	0.17	0.09	.64#
SAD ³ \times Condition	0.17	0.09	.68#

Note. $N = 92$. # $p < .10$. * $p < .05$.

Table 3.4
Multiple Regression Predicting Response Time to Angry Faces (Study 1)

Variable	<i>B</i>	<i>SE B</i>	β
SAD	-13.39	6.69	-.39*
Condition	33.01	37.59	.15
SAD \times Condition	-10.87	6.69	-.32
SAD ²	-1.92	1.01	-.47#
SAD ² \times Condition	-2.22	1.01	-.68*
SAD ³	0.23	0.08	.95**
SAD ³ \times Condition	0.15	0.08	.64#

Note. $N = 92$. # $p < .10$. ** $p < .01$.

Table 3.5
Multiple Regression Predicting Response Time to Neutral Faces (Study 1)

Variable	<i>B</i>	<i>SE B</i>	β
SAD	-8.20	6.79	-.25
Condition	19.26	38.16	.09
SAD \times Condition	-9.15	6.79	-.27
SAD ²	-1.96	1.03	-.49#
SAD ² \times Condition	-1.61	1.03	-.51
SAD ³	0.16	0.09	.67#
SAD ³ \times Condition	0.16	0.09	.70#

Note. $N = 92$. # $p < .10$.

Table 3.6
Descriptive Statistics for Signal Detection Parameters by Experimental Group (Study 1)

	Control Prime (n = 47)		Social Anxiety Prime (n = 45)	
<i>Hits</i>	Mean	SD	Mean	SD
Happy	11.83	0.56	11.91	0.36
Sad	11.38	0.92	11.62	0.58
Angry	11.28	0.95	10.93	1.16
<i>False Alarms</i>				
Happy	0.11	0.31	0.16	0.37
Sad	1.40	1.58	1.60	1.60
Angry	0.74	1.09	0.40	0.58
<i>Discriminability (d')</i>				
Happy	3.85	0.31	3.86	0.23
Sad	3.23	0.53	3.26	0.52
Angry	3.37	0.45	3.31	0.51
<i>Bias (c)</i>				
Happy	0.24	0.13	0.21	0.13
Sad	0.15	0.30	0.07	0.23
Angry	0.25	0.30	0.38	0.24

Table 3.7
Multiple Regression Predicting Discriminability for Angry Faces (Study 1)

Variable	<i>B</i>	<i>SE B</i>	β
SAD	-0.02	0.01	-.21
Condition	0.08	0.07	.17
SAD \times Condition	0.01	0.01	.15
SAD ²	0.00	0.00	.05
SAD ² \times Condition	-0.00	0.00	-.37*

Note. $N = 92$. $R^2 = .099$. * $p < .05$.

Table 3.8
Means and Standard Deviations by Experimental Group (Study 2)

	Control Prime (n = 46)		Social Anxiety Prime (n = 45)	
<i>Response Time (sec)</i>	Mean	SD	Mean	SD
Happy	862.70	151.70	883.87	168.35
Sad	1020.46	182.09	999.85	172.41
Angry	1126.73	269.42	1061.09	168.18
Neutral	1098.62	292.47	1075.21	266.61
<i>Predictor Variables</i>				
SAD	8.24	7.26	8.27	6.99
FNE	3.40	0.96	3.30	0.85
IAS	2.75	0.72	2.82	0.76

Note. SAD = Social Avoidance and Distress. FNE = Fear of Negative Evaluation. IAS = Interaction Anxiousness.

Table 3.9
Multiple Regression Predicting Response Time to Sad Faces (Study 2)

Variable	<i>B</i>	<i>SE B</i>	β
SAD	-2.76	3.03	-.12
Condition	1.97	16.89	.012
SAD ²	0.75	0.33	.30*

Note. $N = 91$. $R^2 = .06$. * $p < .05$.

Table 3.10
Multiple Regression Predicting Response Time to Angry Faces (Study 2)

Variable	<i>B</i>	<i>SE B</i>	β
SAD	-0.32	3.69	-.01
Condition	-20.02	20.49	-.10
SAD ²	0.77	0.40	.25#

Note. $N = 91$. $R^2 = .071$. # $p < .10$.

Table 3.11
 Descriptive Statistics for Signal Detection Parameters by Experimental Group (Study 2)

	Control Prime (n =46)		Social Anxiety Prime (n =45)	
<i>Hits</i>	Mean	SD	Mean	SD
Happy	11.80	0.62	11.95	0.21
Sad	11.35	0.85	11.65	0.60
Angry	11.20	1.13	11.22	1.25
<i>False Alarms</i>				
Happy	0.26	0.68	0.17	0.44
Sad	1.22	1.40	1.80	1.83
Angry	0.76	0.95	0.41	0.69
<i>Discriminability (d')</i>				
Happy	3.79	0.36	3.88	0.24
Sad	3.26	0.61	3.24	0.50
Angry	3.33	0.52	3.46	0.53
<i>Bias (c)</i>				
Happy	0.22	0.18	0.20	0.10
Sad	0.18	0.24	0.03	0.25
Angry	0.26	0.29	0.31	0.26

Table 3.12
Means and Standard Deviations by Experimental Group (Study 3)

<i>Response Time (sec)</i>	Control Prime (n = 45)		Social Anxiety Prime (n = 47)	
	Mean	SD	Mean	SD
Happy	1169.64	417.42	1133.12	207.45
Sad	1274.87	317.06	1228.85	290.85
Angry	1318.30	468.25	1236.21	269.91
Neutral	1264.05	576.43	1182.92	311.06
<i>Predictor Variables</i>				
SAD	6.20	5.66	8.45	6.38
FNE	3.00	0.71	3.17	0.89
IAS	2.66	0.62	2.77	0.76

Note. SAD = Social Avoidance and Distress. FNE = Fear of Negative Evaluation. IAS = Interaction Anxiousness.

Table 3.13
 Descriptive Statistics for Signal Detection Parameters by Experimental Group (Study 3)

	Control Prime (n = 45)		Social Anxiety Prime (n = 47)	
<i>Hits</i>	Mean	SD	Mean	SD
Happy	10.82	1.21	10.45	1.46
Sad	11.20	1.65	11.09	1.52
Angry	9.49	1.59	9.72	1.53
<i>False Alarms</i>				
Happy	0.11	0.32	0.09	0.28
Sad	1.22	1.86	1.15	1.12
Angry	0.33	0.52	0.64	0.94
<i>Discriminability (d')</i>				
Happy	2.69	0.28	2.63	0.30
Sad	2.45	0.45	2.37	0.41
Angry	2.35	0.38	2.30	0.40
<i>Bias (c)</i>				
Happy	0.78	0.14	0.82	0.14
Sad	0.57	0.33	0.56	0.24
Angry	0.85	0.17	0.78	.021
<i>Efficiency</i>				
Happy	2.40	0.89	2.40	0.95
Sad	1.82	0.81	1.78	0.75
Angry	2.02	0.77	2.00	0.77

Table 3.14
Multiple Regression Predicting Bias for Angry Faces (Study 3)

Variable	<i>B</i>	<i>SE B</i>	β
SAD	-0.01	0.00	-.19
Condition	-0.05	0.03	-.28*
SAD \times Condition	0.00	0.00	.03
SAD ²	0.00	0.00	.33*
SAD ² \times Condition	0.00	0.00	.21

Note. $N = 92$. $R^2 = .150$. * $p < .05$.

Table 3.15
Multiple Regression Predicting Efficiency for Angry Faces (Study 3)

Variable	<i>B</i>	<i>SE B</i>	β
SAD	0.01	0.01	.04
Condition	-0.01	0.08	-.02
SAD \times Condition	-0.03	0.01	-.22*

Note. $N = 92$. $R^2 = .047$. * $p < .05$.

Figure 3.1
 Differences between Control and Social Anxiety Conditions in the Relationship between Trait Social Anxiety and Response Time to Different Types of Emotional Expressions (Study 1)

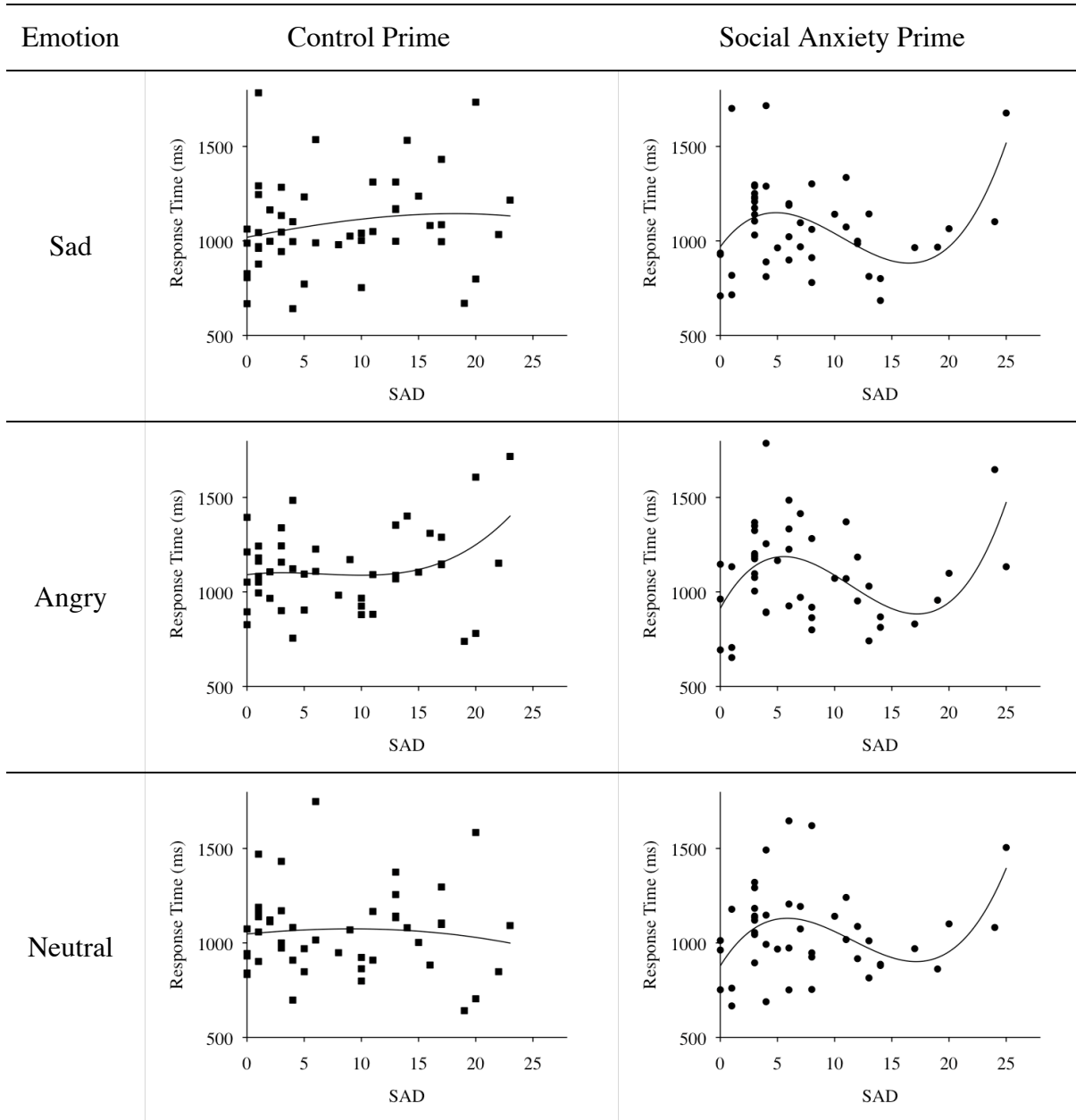


Figure 3.2
 Differences between Control and Social Anxiety Conditions in the Relationship between
 Trait Social Anxiety and Discriminability of Angry Expressions (Study 1)

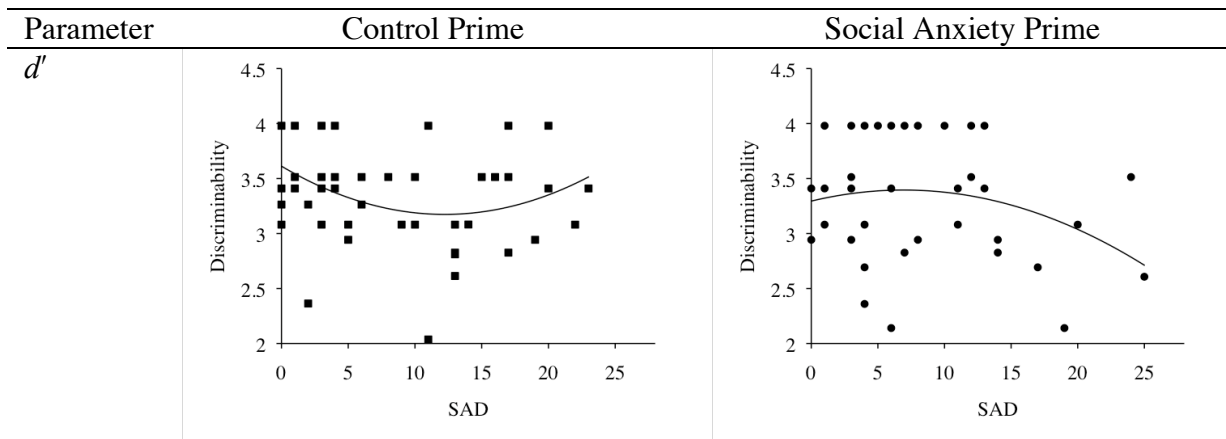


Figure 3.3
 Differences between Control and Social Anxiety Conditions in the Relationship between
 Trait Social Anxiety and Response Time to Different Types of Emotional Expressions
 (Study 2)

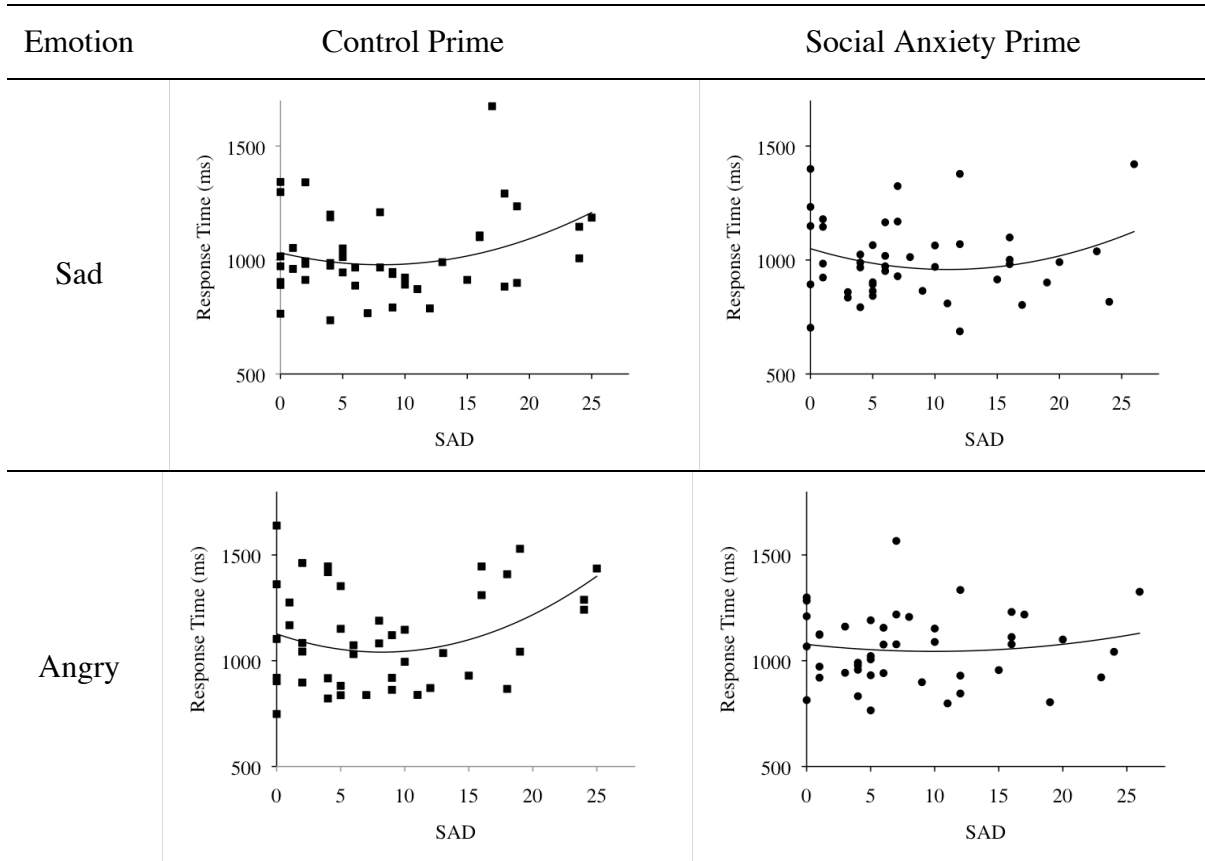
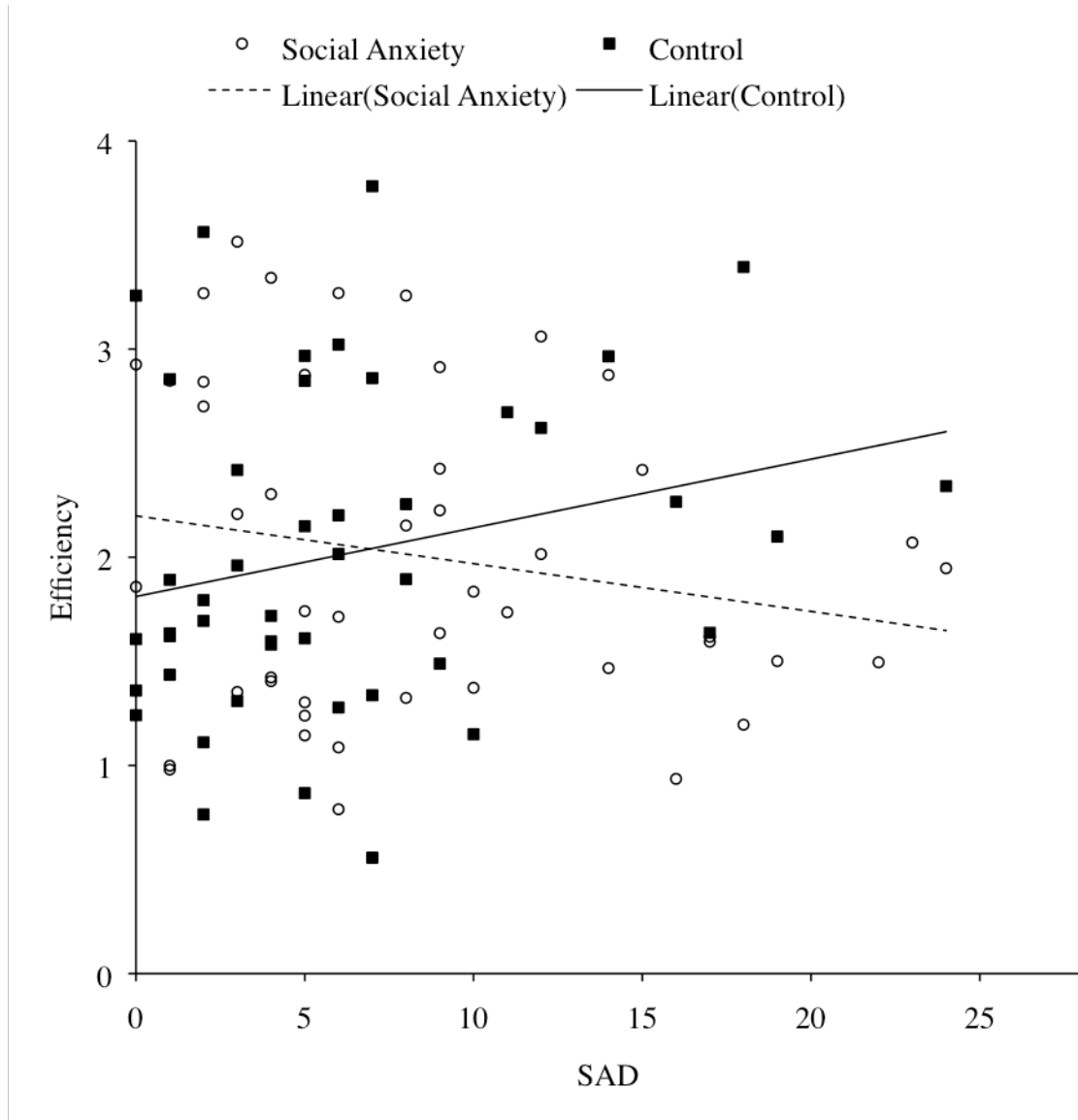


Figure 3.4
Differences between the Control and Social Anxiety Conditions in the Relationship between Trait Social Anxiety and Efficiency in Responding to Angry Expressions (Study 3)



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Chapter 4

Content Analysis of Descriptions of Social Anxiety-Inducing Events

Many studies of social anxiety place participants in a single, artificial laboratory situation that is designed to cause an anxiety response. The situation might involve giving a speech in front of an audience (e.g., The Trier Social Stress Test; Kirschbaum, Pirke, & Hellhammer, 1993) or a dyadic interaction. Although these studies provide the experimenter with a great deal of control, they do not necessarily represent the types of situations that cause social anxiety during daily life. The present study has two primary purposes: (1) to examine the antecedents of the social anxiety response, including characteristics of the audience; and, (2) to provide insight into the relationship between levels of trait anxiety and patterns of cognitive processing of cues that provoke anxiety.

In the present study, we used content analysis to assess vignettes about social anxiety-provoking experiences. Participants were asked to write a story about a situation in which they felt that others were forming a negative impression of them. We used coders as well as computer-based linguistic analysis to examine these vignettes. The variables that we examined included: the identity of the others involved in the situation, the status and age of the others, the number of others, the types of pronouns used by the writer, and the words used to indicate the emotional and physiological responses felt by the writer. The participants who wrote the vignettes were drawn from the entire

distribution of social anxiety scores, and in addition to writing the vignettes, participants completed several measures of trait social anxiety. Therefore, it was possible to examine the results of the linguistic analysis in the context of participants' baseline anxiety levels.

Audience Characteristics

A school teacher may lecture confidently in front of a group of several dozen students, but quake with fear before a blind date. A teenager may chatter ceaselessly among a group of close friends, yet live in terror of being called on to answer a question in class. Whether or not a situation causes social anxiety is determined in part by the nature of the interaction partner(s).

One prominent evolutionary theory of social anxiety focuses on how the status differentials that are inherent in different social interactions impact feelings of social anxiety (Gilbert, 2001). According to this account, those with high trait levels of social anxiety view themselves as having low status and thus tend to disengage from social interactions lest they risk the loss of their limited social resources. When watching video of themselves interacting with a confederate, socially anxious participants rated themselves as being subordinate to their interaction partner (Trower, Sherling, Beech, Harrop, & Gilbert, 1998). Furthermore, in laboratory situations, participants experience larger physiological responses to situations that involve performing a task in front of a high as compared to a low status audience (Hilmert, Christenfeld, & Kulik, 2002).

Buss (1980) and McCroskey (1984) have argued that several additional characteristics of the audience influence the magnitude of the social anxiety response. These include audience size and familiarity, with social anxiety being directly related to the size of the audience and inversely related to the familiarity of the audience. Some

work suggests that the relationship between social anxiety and audience size is best described by a power function (Jackson & Latané, 1981; McKinney, Gatchel, & Paulus, 1983), with, for example, the change in anxiety for an audience of 15 as compared to 10 being smaller than the change in anxiety for an audience of five as compared to one. In other research, undergraduate participants reported that they would feel more nervous interacting with a single professor than they would a group composed of one professor and three high school students (Seta & Seta, 1996), suggesting that the interaction of audience status and size may be important for determining the severity of the social anxiety response.

While there is evidence that audience characteristics such as status, size, and familiarity impact the social anxiety response, the number of studies in which researchers have examined these variables outside of laboratory studies is surprisingly small (Glass & Arnkoff, 1989). In one study, over the course of two weeks, high and low social anxiety participants were asked to make diary entries following ten one-on-one conversations that lasted at least ten minutes (Vittengl & Holt, 1998). The diary entries did not require a description of the event, but rather were composed of a series of questions about the interaction, including ratings of familiarity with the interaction partner, the quality of the communication, and the participant's mood following the interaction. There were no differences between the high and low social anxiety groups in their average degree of familiarity with their interaction partners, but the high social anxiety group reported lower quality communication, higher negative affect, and marginally lower positive affect than did the low social anxiety group.

Dodge, Heimberg, Nyman and O'Brien (1987) used a diary study to identify differences in the ways that high and low socially anxious participants interacted with members of the opposite sex. Each day during a two-week period, participants were asked to complete diary entries, which included questions about the duration and nature of their interactions with members of the opposite sex, as well as questions about their performance and level of anxiety during the interactions. Participants with high social anxiety engaged in significantly fewer interactions with members of the opposite sex than did those with lower social anxiety. High social anxiety participants also interacted less frequently with opposite sex friends and lovers than did those with lower social anxiety.

Lee, Okazaki, and Yoo (2006) used an experience sampling method to look for differences in the social anxiety experiences of Asian and European Americans. Over the course of two weeks, participants were asked to make diary entries for any experience that caused them to experience social discomfort. The diary entries consisted of a brief description of the event, followed by questions about the emotions experienced during the interaction. Participants' descriptions of the events were coded for the gender, race, and number of others (i.e., one other person or more than one other person) involved in the interaction. Asian and European Americans did not differ in the frequency with which they reported social anxiety-inducing events, nor did they differ in the number of others who were involved in those interactions, but there was a significant interaction between race and number of others, such that Asian Americans tended to experience more anxiety during dyadic interactions, whereas European Americans tended to experience more anxiety during group interactions. Regardless of race, compared to those with lower trait

social anxiety, individuals with higher trait social anxiety tended to report more frequent anxiety-inducing events and during those events their anxiety tended to be more intense.

In the present study, the others mentioned in the vignettes were identified by their degree of familiarity to the writer (i.e., friend, acquaintance, stranger, family member, romantic partner). We hypothesized that more scenarios would involve strangers than friends and acquaintances, as social anxiety should be greatest in situations involving unknown others. The scenarios were also coded according to the number of others involved in the situation, with the expectation that scenarios involving more, rather than fewer others would be most common. Finally, the others were coded according to their social status relative to the writer (i.e., higher status – such as a boss or interviewer, lower status – such as an employee or student, or equal status – such as a classmate) as well as their age relative to the writer. We hypothesized that the writer would be more likely to experience social anxiety in the presence of high status others and others who were older.

Interpreting Social Events

According to the cognitive model of social phobia (Clark, 2001; Clark & Wells, 1995), those with social phobia tend to focus their attention on themselves and their internal states. For example, following an interaction with a confederate, socially anxious participants were more likely to endorse items concerning self-focused attention (e.g., “I was focusing on what I would say or do next”) than were nonanxious controls (Mellings & Alden, 2000). This self-focused attention is associated with a reduction in the processing of external social cues (Mansell, Clark, Ehlers, & Chen, 1999), and the external cues that are processed tend to be interpreted negatively. For example, Gilboa-Schechtman, Foa, and Amir (1999) found that socially anxious participants were

faster to detect a disparate face in an array of neutral faces if the disparate face displayed an angry expression than if the facial expression was happy.

Veljaca and Rapee (1998) asked participants to give a brief speech in front of an audience of confederates who had been trained to display a variety of behaviors during the participant's speech. While speaking, participants were asked to press one button when they observed an audience member engaging in a positive behavior (e.g., smiling or nodding) and one button when they observed an audience member engaging in a negative behavior (e.g., frowning or yawning). The audience members were videotaped, and third-party observers coded the videotapes for positive and negative behaviors, making it possible to determine how accurate participants had been in detecting different behaviors. As expected from the cognitive model, those with higher trait social anxiety were more accurate in detecting negative audience behaviors, whereas those with lower trait social anxiety were more accurate in detecting positive audience behaviors.

If those with high social anxiety are focused on their own internal states during an anxiety-provoking event, they may differ from those who are lower in trait anxiety in their recall of the event. Therefore, in the present study, we predicted that those with high levels of social anxiety would be more likely to use the first person singular when describing their experience (e.g., I felt anxious), whereas those with lower trait levels of social anxiety would be more likely to observe how others are behaving in the situation, resulting in an increased use of the third person (e.g., She smiled at me).

Post-Event Processing

The cognitive model of social phobia (Clark, 2001; Clark & Wells, 1995) also argues that social phobics tend to invest a great deal of time and cognitive energy in

thinking about previous social encounters. Using a questionnaire designed to measure post-event processing, Rachman, Grüter-Andrew, and Shafran (2000) asked participants to reflect on the extent of their rumination over the preceding months and found that those with high levels of social anxiety engaged in more post-event processing. Thoughts about previous social events tended to occur more frequently and more intrusively for individuals with high trait levels of social anxiety. A recent meta-analysis of studies of post-event processing confirmed these initial findings (Brozovich & Heimberg, 2008). Social anxiety is associated with higher levels of post-event processing, and post-event processing tends to be biased toward negative social interactions.

Although most studies of rumination have relied on self-report scales (e.g., Rachman, Grüter-Andrew, & Shafran, 2000), Lundh and Sperling (2002) used a diary method to examine post-event processing. Over the course of a week, participants were asked to write a brief description of a socially distressing event immediately after it occurred. Participants were then asked to complete a brief battery of questions concerning their feelings about the event on the day the event occurred and again on the day after the event occurred. The findings confirmed that those with high levels of social anxiety tend to engage in more post-event processing of socially distressing events, especially if the event they are thinking about involves an explicit threat of being negatively evaluated by others. This study set an important precedent in that participants were asked to report on a situation that caused them to feel social anxiety during the course of their daily lives.

Studies of post-event processing suggest that those with higher levels of trait social anxiety are more likely to recall socially threatening events (Brozovich &

Heimberg, 2008). Such research also suggests that when these events are recalled, those with high social anxiety are especially likely to focus on the negative aspects of the situation. Therefore, we predicted that the vignettes written by those with high social anxiety would be more likely to use negative emotion words than would the vignettes of those who were lower in trait social anxiety. In addition, we expected that social phobics' increased attention to their own internal states would be associated with greater recall of the physiological response to the anxiety-provoking event. Thus we predicted that those with higher trait social anxiety would use more words to describe their physiological response to the situation (e.g., blush, shake, sweat) than would those with lower levels of social anxiety.

Methods

Participants

One hundred and ninety students from the University of Michigan and the University of Pennsylvania participated for either course credit or monetary compensation. The average age of the participants was 21.11 ($SD = 2.71$), and 65.2% of participants were female.

Materials

Writing task. Participants were given ten minutes, to read the prompt, think about a relevant situation (i.e., “get into the experience”), and write about that situation. Participants were instructed to “include the details of what happened, exactly how you felt at the time, why you felt this way, and what you thought about.” The prompt instructed participants to think about a “recent social event or interaction, preferably within the past year, which made you feel really anxious, nervous, and worried that

people were forming an unfavorable impression of you.” Participants were given several examples of such situations: “having a blind date, giving a presentation in front of an audience, or interacting with people you barely know at a party.”

Self-report measures. Participants completed three widely used measures of social anxiety. The Social Avoidance and Distress Scale (SAD; Watson & Friend, 1969) is a 28-item true-false measure that assesses subjective distress surrounding social interactions as well as the tendency to avoid such encounters. The Brief Fear of Negative Evaluation Scale (FNE; Leary, 1983) is a 12-item revision of The Fear of Negative Evaluation Scale (Watson & Friend, 1969) that measures individual’s anticipatory anxiety of being viewed negatively by others. The Interaction Anxiousness Scale (IA; Leary, 1983) is a 15-item measure of social anxiety that measures nervousness surrounding social interactions. Responses on the FNE and IA scales were given on a scale from 1 (Not at all characteristic of me) to 5 (Extremely characteristic of me). Responses on these three scales were significantly correlated (range from $r = .41, p < .001$ to $r = .79, p < .001$), therefore, we report results from only the SAD Scale in the present study. Participants also provided basic demographic information.

Coding Scheme. The coding guidelines were developed for this study, with some of the questions modeled after those used in a study by Tangney, Miller, and Flicker (1996). In that study, participants wrote three separate vignettes about times they felt shame, guilt, and embarrassment. Participants were then asked to answer questions about the age and status of the audience in their story relative to them and about their level of intimacy with the audience members (e.g., loved one, acquaintance, stranger). The coding scheme used in the present study is shown in Appendix A.

Procedure

After giving their informed consent, participants were each assigned a random six-digit laboratory ID number. Participants were instructed to provide this number on all of their study materials so that their responses on the various parts of the study could be matched up at the end of the session.

Participants were randomly assigned to complete either the social anxiety prompt described above or were assigned to write about their typical day (control condition). The researcher instructed the participants to read their prompt and begin writing, then timed the participants while they wrote for ten minutes. Only participants who completed the social anxiety prompt are included in the present set of analyses.

Participants next completed a response time task, which was part of a separate study, then were immediately instructed to complete the self-report measures. Participants were then asked to read a written debriefing before they were dismissed from the study.

Linguistic Analysis by Coder

All of the vignettes were analyzed by the same two coders. After independently examining the vignettes, the coders agreed that sixteen of the vignettes should be removed from the sample. These vignettes were eliminated for various reasons. Some were excessively short (e.g. only one sentence), some were difficult to follow as they were written by non-native English speakers, and some were not about social anxiety.

Table 4.1 shows the coders' inter-rater reliability on each of the coding variables, with the exception of the variables concerning the number of others involved in the story. For each variable in the table, we examined both percent agreement among the coders

and Cohen's kappa, a measure that corrects for agreement among coders due to chance. Although researchers differ in their standards for acceptable reliability, there is some consensus that levels above .80 are acceptable, with levels of .70 acceptable for exploratory research, and even lower standards acceptable for conservative indices such as Cohen's kappa (Lombard, Snyder-Duch, & Bracken, 2002). The coders had acceptable levels of reliability for all of the variables except the friend and acquaintance variables. The lower reliability for these variables reflects the ambiguity in many of the stories about the writer's level of familiarity with his or her audience. Due to this lower level of reliability, results involving these variables should be treated as strictly exploratory.

In cases in which the coders disagreed in their analysis, the researcher independently coded the vignette in question. If the researcher's response was the same as one of the coders' responses, that response was used in the final analysis. If the researcher's response did not agree with either of the coders a response of zero (unknown) was used in the final analysis.

The coding of the number of others involved in a story was determined using four separate questions. The final variable used in our analysis was based on the ordinal coding scheme from Question 6 (See Appendix A). If the coders agreed on an exact number of others specified in the story, that number was then recoded using the ordinal scale (i.e., 0 = Unspecified number of others; 1 = 1 other person; 2 = 2-5 other people; 3 = 6-10 other people; 4 = 11-30 other people; 5 = 31-50 other people; 6 = 51-100 other people; 7 = > 100 other people; 8 = > 1000 other people). If the coders agreed on a range for the number of others specified in the story, those numbers were averaged and recoded using the ordinal scale. If the coders agreed on an estimated number of others, that

estimate was retained for subsequent analyses. Using this coding scheme, the number of others involved in the story could be exactly determined or approximated for 86 of the vignettes (49.4%).

Computer-Based Linguistic Analysis

The vignettes were also analyzed using Linguistic Inquiry and Word Count (LIWC; Pennebaker, Booth, & Francis, 2007). LIWC is a program designed to compute the percentage of various categories of language that are present in text documents. LIWC searches for and categorizes words that are part of its internal dictionary of approximately 4,500 words. Some of the categories represent basic parts of speech (e.g., adverbs, prepositions), but others were designed to assess psychological processes.

In the present study, we examined the relationship between the use of different types of pronouns and trait social anxiety. We were also interested in assessing the frequency with which participants mentioned their emotional and physiological response to social anxiety provoking situations. Therefore, we focused our content analysis on the following LIWC categories: negative emotions (e.g., hurt, ugly, nasty), positive emotions (e.g., love, nice, sweet), anxiety (e.g., worried, fearful, nervous), social processes (e.g., mate, talk, they, child), affective processes (e.g., happy, cried, abandon), perceptual processes (e.g., observing, hearing, feeling), biological processes (e.g., eat, blood, pain), and body (e.g., cheek, hands, spit).

Results

Linguistic Analysis by Coder

Table 4.1 presents the percentage of vignettes (out of all 174 coded vignettes) in which each of our categories occurred. The categories were not mutually exclusive, so a

vignette could, for example, involve an interaction with both a higher and equal status other. There was a significant difference in the frequency with which the various types of others occurred in the vignettes, Cochran's $Q(4) = 203.5, p < .001$. A majority of the vignettes (62.1%) involved an interaction with at least one stranger, and approximately half of the vignettes clearly specified that an acquaintance was involved, whereas few vignettes explicitly identified either a romantic partner or a family member. These results are explained, in part, by our findings about the types of interactions that participants chose to write about, Cochran's $Q(9) = 139.2, p < .001$. Many of the vignettes involved parties, classroom activities, and public speaking, activities that commonly involve interaction with others who are either unknown to the participant or who are casual acquaintances. There was a significant difference across the three status conditions in the type of others involved in the story, Cochran's $Q(2) = 140.4, p < .001$, with a similar pattern of results for the age of the others, Cochran's $Q(2) = 161.4, p < .001$. In our sample of college-aged participants, a majority of vignettes involved interactions with others of the same age and equal status as the writer. Older and higher status others were fairly common in the stories, but stories involving younger and lower status others were rare.

We were also interested in exploring the association between trait social anxiety and the coded variables for others' status, others' age, relationship with others, nature of the social anxiety-producing event, and number of others. All of these coded variables are categorical, but have an inherent order (e.g., higher status other is not present; high status other is present). SAD score is an interval variable, but for the purposes of the present analyses, we performed a median split on the variable, thus identifying a high and a low

social anxiety group. This variable is ordinal, therefore we examined the association between our variables using gamma and Kendall's tau. The significant and marginally significant tests of association between the coded variables and trait social anxiety are reported in Table 4.2. There was a significant association between trait social anxiety and the presence of absence of an acquaintance, such that those with high social anxiety were more likely to write about an acquaintance than were those with low social anxiety. There was a marginally significant association between social anxiety and the presence or absence of a lower status other. Those with high social anxiety were more likely than were those with low social anxiety to write about an anxiety-provoking event that involved a lower status other. Finally, there was a marginally significant association between trait social anxiety and whether a vignette discussed a dating situation. Those with high social anxiety were more likely to write about dating situations than were those with lower trait social anxiety.

Finally, we wanted to examine the relationship between the number of others involved in a story and the writer's level of trait social anxiety. Looking only at the 86 cases in which the number of others could be determined, the median number of others involved in the story was six to ten, and the modal number of others involved in the story was two to five. Number of others was assessed on an ordinal scale, so we examined the correlation between the variables using Spearman's rho. The relationship between number of others and trait social anxiety approached significance, $\rho(86) = -0.16, p = .15$. Those with higher social anxiety tended to write about events involving a smaller number of others.

Linguistic Analysis by Computer

Table 4.3 presents the results of the content analysis using LIWC. The table includes the mean and standard deviation of the percent of individual vignettes that correspond to each of our categories of function words and psychological processes. So, for example, the mean percentage of words in a vignette that are categorized as anxiety words is 1.71%. Table 4.3 also includes the correlations between each linguistic category and trait social anxiety, as measured by the SAD Scale. Because the distribution of scores in each linguistic category tended to be positively skewed, we used Spearman's rho to assess the relationship between our variables. There was only one significant relationship between trait social anxiety and the linguistic categories that we examined. Individuals with higher trait social anxiety tended to use more third person singular pronouns ($\rho = .18, p < .05$).

Discussion

We analyzed stories about anxiety-inducing events to look for differences in the manner in which participants with varying levels of trait social anxiety recalled such events. The results of our study revealed that when asked to think about a social anxiety-provoking situation, college-aged students most frequently wrote about an incident that involved strangers (62.1% of vignettes), and that the others involved in the incident were likely to include people who were similar to the person recalling the event in both age (83.3%) and status (79.9%). We predicted that participants would be more likely to write about situations involving strangers and situations involving others with higher status than about more familiar others or those with lower status. Our prediction concerning strangers was supported in that the majority of vignettes involved strangers.

As for status, equal status others were most common. Not surprisingly, events involving parties (31.0% of vignettes), classes (17.8%), and public speaking (20.1%) were some of the most frequently mentioned types of social anxiety-provoking events for the members of our sample.

As predicted, there was a relationship between the presence of acquaintances and trait social anxiety (See Table 4.2), such that individuals with high social anxiety were more likely to report the presence of acquaintances in their stories than were those who were low in trait social anxiety. In contrast to our predictions, we did not find a similar pattern for the presence of friends. It is possible that regardless of trait social anxiety, the effect of the presence of friends on feelings of social anxiety is highly contingent on what is happening in the situation. Our coding scheme noted the presence or absence of different kinds of others, but the categories of others were not mutually exclusive. This means that a story about attending a large party in the company of friends and a story about auditioning for a dance troupe in the company of friends would both have been coded for the presence of friends and strangers. In these situations, the effect of friends on social anxiety could be quite different. Individuals might feel less anxiety when attending a party full of strangers if several close friends are present. In contrast, individuals might feel more anxiety when dancing in front of friends, knowing that a lack of dancing skills could become fodder for future jokes. Although everyone – regardless of trait social anxiety – should be concerned about their relationship with their friends, those with high trait social anxiety may be more concerned about how they appear to casual acquaintances than are those with lower trait social anxiety. This could account for

the finding that those with higher trait social anxiety were more likely to recall situations involving casual acquaintances than were those with lower trait social anxiety.

We found that individuals who were higher in trait social anxiety were marginally more likely to write vignettes that involved lower status others and dating situations than were those with low trait social anxiety (See Table 4.2). This could be a reflection of the fact that those with the highest levels of trait social anxiety are likely to recall events that would not provoke significant social anxiety among those who are lower in trait social anxiety. Whereas someone with low trait social anxiety may worry little about an interaction with an underclassman as compared to a professor, an individual with high trait social anxiety might avoid interactions with professors, making it more likely that he or she will recollect a situation involving a lower status other. Individuals with high trait social anxiety may also be more likely to avoid dating situations than are those with lower trait social anxiety. Therefore, when a socially anxious individual cannot avoid a dating situation, it is more likely to be memorable and more likely to cause significant social anxiety.

One notable finding is the absence of a relationship between trait social anxiety and the use of pronouns. High social anxiety participants were not more likely to use the first person singular than were those low in social anxiety, and low social anxiety participants were not more likely to use the third person than were those high in social anxiety. In fact, the relationship between these variables was in the opposite direction as we predicted, with those high in social anxiety using more third person singular pronouns. Recall that there was a marginally significant inverse relationship between the number of others involved in a recalled event and trait social anxiety. This means that the

higher frequency with which those high in social anxiety used the third person singular could be due to the fact that they were more likely to write about situations that involved one or two – rather than many – others. However, it is also possible that this finding is a false positive. By the logic of null hypothesis testing, when using an alpha level of .05, there is a 5% chance that the researcher will find a significant relationship between two variables – and reject the null hypothesis – when the variables are, in fact, not correlated. This means that for every 20 correlations examined, we should expect there to be one spurious correlation. In our analysis of the vignettes using LIWC, we examined the correlations between trait social anxiety and 16 linguistic categories and found only one significant correlation. Thus, the relationship between social anxiety and the use of third person singular pronouns may simply be the result of a Type I error.

Limitations and Future Directions

Participants with higher levels of trait social anxiety were no more likely to use emotion words or words associated with the physiological responses to anxiety-provoking situations. This null finding is especially surprising in light of research that demonstrates that those with higher dispositional social anxiety tend to be hyper-focused on their own internal states (Mellings & Alden, 2000). Our results could be due to the nature of the writing task. Participants were asked to relive an anxiety-provoking experience in as much detail as possible. Almost everyone experiences social anxiety at least occasionally (Zimbardo, 1977). Although those with higher trait anxiety might experience such events at a higher frequency than do those with lower levels of trait social anxiety, when such events do occur, the emotional and physiological experiences should be similar. Thus, everyone – regardless of trait social anxiety – should

be able to recall an event that involved highly salient emotional and physiological responses. Although we know that those with higher trait social anxiety engage in more post-event processing than do those with lower trait social anxiety (Brozovich & Heimberg, 2002), this is not to say that those with low social anxiety do not engage in post-event processing following especially threatening events. Thus, when asked to recall a salient event, those with high and low trait social anxiety appear not to differ in the vividness with which they can recall a threatening situation.

There was a significant amount of variability in the amount of time that had passed since the events reported in the vignettes occurred. The prompt asked participants to write about an event that had occurred in the previous year, but whereas some participants wrote about events that occurred only hours before, others recalled events that had occurred years before. It could be that events that occurred in the distant past are reported in less vivid detail than are events that occurred in the recent past. To the extent that this is true, our ability to detect differences between high and low social anxiety participants in their use of language to describe their physiological and emotional states would be undermined. Future studies might employ a method similar to that used by Lundh and Sperling (2002) in their diary study of post-event processing. In that study, participants were asked to describe an anxiety-provoking event soon after it occurred. It is possible that if vignettes were written soon after the anxiety-provoking events occurred, high and low social anxiety participants would differ in their use of words to describe their emotional and physiological responses. Future studies should attempt to clarify whether our failure to find differences in recall between those with different trait

levels of social anxiety is due to a weakness in our methodology or to genuine similarities in the way in which those with high and low social anxiety recall threatening events.

Conclusion

Individuals cannot be neatly divided into those who have too much social anxiety and those who have too little. Our study revealed a notable absence of differences between high and low social anxiety participants in their descriptions of anxiety-inducing events. Although those with higher trait levels of social anxiety may experience anxiety-provoking events more frequently than do those with lower levels of trait anxiety, our study provides preliminary evidence that the underlying experience of the situations – when they do occur – are similar.

Table 4.1
Intercoder Reliability and Descriptive Statistics

Variable	Percent Agreement	Cohen's kappa	Percent of Stories
<i>This Type of Other is Involved</i>			
Romantic Partner	.99	.79	4.0%
Friend	.83	.64	37.4%
Acquaintance	.74	.48	49.4%
Stranger	.86	.70	62.1%
Family Member	.97	.61	4.6%
<i>This Occurs in the Story</i>			
Party	.90	.76	31.0%
Class	.98	.92	17.8%
Meeting	.88	.43	6.9%
Interview	.98	.86	8.6%
Audition	.99	.89	2.9%
Performance	.98	.56	2.9%
Public Speaking	.98	.93	20.1%
Rush	1.00	1.00	6.3%
Date	.97	.61	6.3%
Family Gathering	.99	.85	2.3%
<i>Age of Others</i>			
Younger	.97	.76	6.9%
Same Age	.94	.76	83.3%
Older	.91	.82	38.5%
<i>Status of Others</i>			
Lower	.96	.70	8.0%
Equal	.89	.65	79.9%
Higher	.94	.87	48.9%

Note. $N = 174$.

Table 4.2
Measures of Association between Trait Social Anxiety and Coded Situational Variables

Variable	Low Social Anxiety	High Social Anxiety	Measures of Ordinal Association
<i>Lower Status Other</i>			
Not mentioned/Absent	85	75	gamma = 0.48, $p = .08$
Present	4	10	tau = 0.13, $p = .08$
<i>Acquaintance</i>			
Not mentioned/Absent	52	36	gamma = 0.31, $p = .03$
Present	37	49	tau = 0.16, $p = .03$
<i>Date</i>			
Not mentioned/Absent	86	77	gamma = 0.50, $p = .10$
Present	3	8	tau = 0.12, $p = .10$

Table 4.3
Descriptive Statistics and Correlations for LIWC Analysis

Variable	Mean	SD	Correlation with Social Anxiety (Spearman's ρ)
Word Count	174.71	43.05	-0.02
<i>Function Words</i>			
All Pronouns	17.93	3.89	0.11
Personal Pronouns	13.16	3.38	0.08
1 st Person Singular	9.97	2.64	0.04
1 st Person Plural	0.91	1.38	0.01
2 nd Person	0.11	0.36	-0.04
3 rd Personal Singular	1.21	2.05	0.18*
3 rd Person Plural	0.95	1.16	-0.13#
<i>Psychological Processes</i>			
Negative Emotions	2.74	1.63	-0.06
Positive Emotions	3.49	1.93	-0.06
Anxiety	1.71	1.22	-0.12
Social Processes	10.19	4.28	0.11
Affective Processes	6.25	2.42	-0.06
Perceptual Processes	2.54	1.61	-0.05
Biological Processes	1.20	1.30	-0.08
Body	0.43	0.66	0.00

Note. $N = 174$. With the exception of word count, which is measured as frequency, all means and standard deviations are computed for percent of words in a vignette. * $p < .05$. # $p < .10$.

Appendix A
Social Anxiety Vignette Coding Scheme

1. ID
Enter the participant's 6 digit ID number
2. CODE
Should the story be included in the analysis?
0 = Not enough relevant info/Too short/Not about social anxiety
1 = Story should be included in analysis
3. NUMBER
Does the story specify the exact number of people involved?
0 = Number not exactly specified (i.e., impossible to determine the exact number of people involved from the story)
Otherwise, enter the number of other people involved
4. BOTTOMRANGE
Does the story specify a range of the number of people involved?
0 = Range not specified
Enter the bottom number of the range specified
5. TOPRANGE
If the story specified a range of the number of people involved, enter the top of the range
0 = Range not specified
Enter the top number of the range specified
6. ESTNUMBER
If the story specifies neither an exact number, nor a range, estimate the number of others
0 = Exact number or range is specified
1 = 1 other person
2 = 2-5 other people
3 = 6-10 other people
4 = 11-30 other people
5 = 31-50 other people
6 = 51-100 other people
7 = > 100 other people
8 = > 1000 other people

Who are the others involved in the story (enter all that are present)?

0 = Not present

1 = Present

7. ROMANTIC – Romantic Partner (Do not also count as friend)
8. FRIEND – Friend(s)/Well-known other(s)
9. ACQUAINT – Acquaintance(s) – (Note: count classroom setting as acquaintances)
10. STRANGER – Stranger(s)
11. FAMILY – Family Member(s) (Should be writer's family member(s))

What is going on in the story (enter all that situations that happen in the story)?

0 = Doesn't Happen

1 = Happens in the story

12. PARTY – Party
13. CLASS – Class
14. MEETING – Meeting for work/Class Project
15. INTERVIEW – Job/Internship/Scholarship
16. AUDITION – Club/Part in play/Speaking role
17. PERFORMANCE – Performance other than public speaking
18. PSPEAK – Public speaking
19. RUSH – Rushing a fraternity or sorority
20. DATE – Going on a date, regular or blind
21. FGATHER – Attending a family gathering (Doesn't need to be the writer's family)

What is the age of the others in the story as compared to the writer (enter all that are present)?

0 = Not present

1 = Present

22. YOUNGER – Person in the story is younger than the writer
23. SAMEAGE – Person in the story is the same age as the writer (Count all college students as being the same age)
24. OLDER – Person in the story is older than the writer

What is the status of the others in the story as compared to the writer (enter all that are present)?

0 = Not Present

1 = Present

25. LOWER – Person in the story has lower status/is subordinate to the writer (e.g., employee, child, student)
26. EQUAL – Person in the story has equal status/is a peer to the writer (e.g., classmate, roommate, co-worker, friend, fellow party attendee)
27. HIGHER – Person in the story has higher status/is an authority figure to the writer (e.g., employer, boss, parent, teacher, cop, Sorority/Frat member to person rushing)

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Chapter 5

Conclusion

As discussed in Chapter 2, the social anxiety response was shaped by natural selection because, over evolutionary time, those who displayed some social anxiety had an advantage over those with no social anxiety in certain types of situations. The modern environment differs significantly from the environment in which natural selection shaped the social anxiety response (Wakefield, Horwitz, & Schmitz, 2005). For example, the modern world demands that we maintain large social networks and interact frequently with strangers – tasks that are difficult for social phobics. Although normal levels of social phobia may make it difficult to give a presentation at work or go on a blind date, those tasks cause social anxiety because they involve a genuine threat of negative evaluation. In those situations, the social anxiety response functions exactly as it was designed to. It alerts the individual to social threats and guides adaptive responses, which might range from avoidance to extensive preparation. Moderate social anxiety – which entails sensitivity to genuine threats – is normal, not disordered.

A primary focus of the research presented in this dissertation has been to examine how individuals from across the distribution of trait social anxiety scores differ in their responses to different types of social stimuli. In Chapter 3, we examined the relationship between trait social anxiety and response time and accuracy in identifying threatening

faces. In Chapter 4, we looked at the relationship between trait social anxiety and the types of others who induce feelings of social anxiety, as well as the relationship between trait social anxiety and the use of different types of linguistic categories in recalling anxiety-provoking events.

In Chapter 3, we presented preliminary evidence that the relationship between trait social anxiety and response time to threatening social stimuli is best described by a curvilinear function, although the effect of our experimental manipulation on social anxiety was unclear. Had we taken a traditional approach to studying social anxiety and simply compared a high to a low social anxiety group, we would have overlooked the apparent nonlinear relationship between these variables.

In Chapter 4, we presented a content analysis of vignettes about social anxiety-inducing events. When asked to write about a time when they worried that “others were forming an unfavorable impression” of them, college-aged participants most frequently wrote vignettes that involved strangers. As we argued in Chapter 2, interactions with strangers involve high social stakes because strangers are certain to make evaluative judgments during an initial social encounter. Participants were also likely to write about social interactions with others of the same age with equal status. This probably reflects the fact that a majority of a college student’s interactions are with people of the same age and equal status. Finally, although previous research suggests that high and low social anxiety participants differ in the way that they process – or ruminate on – social anxiety-inducing events (Brozovich & Heimberg, 2002), we found that there was not a relationship between the language that participants used to write about such events and their trait social anxiety.

An evolutionary approach to understanding social anxiety reminds us that there is not a clear cut-off between normal and pathological social anxiety. This is not a new insight, as clinicians have long struggled to identify patients with dysfunctional levels of social anxiety. For many years, the American Psychiatric Association (2000) has used a patient's subjective distress as one of its criteria for diagnosing social anxiety. In a sense, if a patient's anxiety is severe enough to cause him or her to seek treatment, then that patient's anxiety is disordered. The null findings from our content analysis hint that the cognitive mechanisms underlying normal and disordered social anxiety are inherently similar. Almost everyone can recall an anxiety-causing event, and individuals' memories of such events are similar, regardless of their trait social anxiety level.

One challenge in studies that seek to study individuals from across the continuum of trait social anxiety scores is finding and recruiting participants from the middle to the top of the social anxiety continuum. Individuals with very high social anxiety may be reluctant to sign-up for psychological studies, and those who do participate may experience higher levels of state anxiety during laboratory session than do their less-anxious counterparts. Although we attempted to manipulate state social anxiety using a written priming task, those with high trait anxiety may have experienced high levels of trait anxiety regardless of whether they were randomly assigned to the control or social anxiety condition. In our work, we took care to recruit socially anxious participants using prescreening, yet we still struggled to fill out the top end of our sample. We must continue to address these limitations in future studies.

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