

R U MAD @ ME?

**SOCIAL ANXIETY AND INTERPRETATION BIAS IN COMPUTER-
MEDIATED CONTEXTS**

by

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Abstract

Symptoms of social anxiety are common, and can cause significant impairments to social and occupational functioning. Social anxiety may present unique challenges in the period of emerging adulthood, as peer interactions become increasingly important. Interpretation bias, the tendency to ascribe threatening interpretations to ambiguous social situations, is one of the cognitive distortions commonly associated with the development and maintenance of social anxiety. The goal of this dissertation was to examine the phenomenon of interpretation bias among emerging adults in response to text messages, a previously under-studied context of computer-mediated communication (CMC). In Study 1, a new vignette measure of interpretation bias in the context of text messaging (*IB-CMC*) was developed and piloted with a sample of $N = 215$ undergraduates aged 18-25 years. This new measure displayed good psychometric properties and evidence of construct validity. For example, negative interpretation bias in CMC was found to be associated with two previously established measures of interpretation bias in face-to-face situations, as well as with symptoms of social anxiety. The goal of Study 2 was to examine the effects of text-based nonverbal cues to emotion (*emoticons*) on interpretation bias in text messaging. For this study, vignettes were modified to include positive emoticons (‘:’). In a sample of $N = 219$ undergraduates, the presence of positive emoticons was found to both reduce negative interpretations and increase benign interpretations for all users, independent of levels of social anxiety. In Study 3, the effect of sender characteristics (specifically, gender of sender) was examined in a sample of $N = 353$ undergraduates (159 male, 194 female). Overall, participants interpreted ambiguous text messages from female senders as more negative and less benign than

messages from male senders, and this effect was particularly pronounced among male participants. Results are discussed in terms of implications for the understanding of the cognitive processes underlying social anxiety and theories of computer-mediated communication.

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Social Anxiety and Interpretation Bias in Computer-Mediated Contexts

Social anxiety is one of the most prevalent psychiatric disorders and is associated with myriad impairments to social relationships, occupational and educational success, and general quality of life (Keller, 2003; Wittchen, Stein, & Kessler, 1999). Even at subclinical levels, social anxiety symptoms can cause significant disruptions in daily functioning (Fehm, Beesdo, Jacobi, & Fiedler, 2008; Filho, Hetem, Ferrari, Trzesniak, Martin-Santos et al., 2010). Cognitive biases are a central feature of social anxiety (e.g., Amir & Foa, 2001). In particular, *interpretation bias* is one type of cognitive bias that has been implicated in the development and maintenance of social anxiety symptoms. For example, socially anxious individuals tend to ascribe negative or threatening interpretations to ambiguous social situations (Amir, Foa, & Coles, 1998; Stopa & Clark, 2000).

For socially anxious individuals, the transition to adulthood is fraught with new social challenges. Gaining independence from parents, making new friends, and exploring romantic relationships may be particularly difficult for socially anxious youth (Kessler, 2003; Parade, Leerkes, & Blankson, 2010). In particular, *heterosocial* situations (e.g., interactions with opposite-gender peers) may be especially stressful (Curran, 1977; Orr & Mitchell, 1975). Increasingly, adolescents' and young adults' social interactions are taking place in computer-mediated contexts (e.g., via text messaging, social networking sites, and e-mail; Lenhart, Madden, Macgill, & Smith, 2007; Van Cleemput, 2010). As this shift occurs, researchers are becoming interested in the impact of these

new media on social development, and on the wellbeing of socially anxious youth in particular (Schneider & Amichai-Hamburger, 2010).

Certain features of computer-mediated communication (CMC) may serve to alleviate feelings of social anxiety. For example, the absence of visual and auditory information may allow socially anxious youth to communicate with less self-consciousness and fewer inhibitions (Shepherd & Edelman, 2005). On the other hand, the lack of nonverbal cues to emotion in CMC (e.g., facial expressions, tone of voice, body language; Riordan & Kreuz, 2010) may pose a challenge to socially anxious individuals. This feature of computer-mediated communication creates ambiguity, and has been shown to lead non-anxious people to misinterpret the tone of electronic messages (Kruger, Epley, Parker, & Ng, 2005). However, the effect of social anxiety on ambiguous message interpretation has not yet been studied.

The goal of the present research was to investigate the phenomenon of interpretation bias in the setting of computer-mediated communication. Since this cognitive process has not previously been examined in this context, a new measure of interpretation bias in the context of text messaging was created and validated (factor structure, psychometric properties, reliability, validity). In addition to establishing the unique effect of social anxiety on interpretation bias in this setting, follow up studies examined two potentially important contextual factors. The first was related to the presence or absence of direct emotional cues (i.e., *emoticons*) in the message. For example, it was hypothesized that positive emoticons would reduce negative interpretations of otherwise ambiguous messages. The second factor pertained to the characteristics of the *message sender*. Given that heterosocial interactions are particularly

stressful for socially anxious individuals, a message from an opposite-gender peer might be more likely to elicit interpretation biases as compared to a message from a same-gender friend.

Results of this study provide the first steps towards understanding how the cognitive processes associated with social anxiety might operate in this new and increasingly relevant context. Results may lead to the development of intervention programs designed to address the unique challenges socially anxious youth face when interacting in computer-mediated contexts.

The following sections provide an overview of social anxiety and its etiology, with particular focus on the cognitive biases associated with social anxiety. Literature on interpretation biases is examined in greater detail, including measurement issues and associations with both clinical social phobia and subclinical symptoms of social anxiety. The impact of social anxiety on the social experiences of young adults is then considered. Computer-mediated communication is discussed as a new context for studying social interaction, with particular emphasis on features of mediated communication that may be particularly relevant to the study of social anxiety. Finally, an overview of the present research and its goals and hypotheses is presented.

Overview of Social Anxiety

Social anxiety is characterized by distress and fear of negative evaluation in social situations (Kearney, 2005). Feelings of social anxiety may be considered a normal reaction in many situations, and as such are not always problematic. However, elevated levels of such feelings can lead to significant impairment in daily functioning. At the most extreme end of the spectrum, *Social Anxiety Disorder* (SAD; previously called

Social Phobia) is described as a pattern of excessive and persistent fear of social or performance situations, situations involving unfamiliar others, or situations of perceived social evaluation (DSM-5; American Psychiatric Association, 2013). Social anxiety may be particularly heightened in certain contexts – for example, interactions with authority figures, with strangers, or with potential dating partners – since these are contexts where social evaluation may be particularly salient (Dalrymple & Zimmerman, 2008). Socially anxious individuals are often preoccupied with the worry that they will do or say something that will be perceived negatively by others (i.e., as embarrassing or humiliating) (Mesa et al., 2011). They are typically described as excessively self-conscious and overly sensitive to negative evaluation by others (Albano, Chorpita & Barlow, 2003; Ollendick & Hirshfeld-Becker, 2002). Starting in early childhood, SAD can be observed across the lifespan, with an average age of onset in mid-adolescence (DSM-5; American Psychiatric Association, 2013). The prevalence of SAD increases into early adulthood, with 8.7% of 18-24 year olds meeting diagnostic criteria for the disorder (Mesa, Nieves, & Biedel, 2011).

Anxiety disorders make up the most prevalent class of psychiatric disorders in the general population. Lifetime prevalence of anxiety disorders in the U.S. is estimated at 28.8% - indicating that over one quarter of the population will experience an anxiety disorder in their lifetime (Kessler et al., 2005). Of the anxiety disorders, SAD is the most common (Keller, 2003). SAD is more prevalent among women than men, with lifetime prevalence estimates of 4.9% for males, and 9.0% for females (Essau, Conradt, & Petermann, 1999; Wittchen et al., 1999).

SAD is associated with a host of functional impairments, including social skills deficits (Beidel et al., 2007; Kessler, 2003), disrupted peer relationships (Aderka et al., 2012; Biggs, Samplio, & McFadden, 2011), and reduced quality of life across many domains (Wittchen, Fuetsch, Sonntag, Müller, & Liebowitz, 2000). Most notably, socially anxious individuals experience significant impairments to social functioning, including difficulties with everyday social tasks such as initiating and carrying on conversations (Beidel, Rao, Scharfstein, Wong, & Alfano, 2010). Socially anxious individuals tend to have difficulty forming and maintaining close friendships, and report reduced satisfaction with their social relationships as well as low community involvement (Eng et al., 2005; Wittchen et al., 2000). Socially anxious individuals may avoid social situations altogether, out of fear of embarrassment or disapproval (American Psychiatric Association, 2013). Social anxiety is strongly associated with social isolation, which may itself be a risk factor for deleterious consequences, including mortality (Holt-Lunstad, Smith, & Layton, 2010; Teo, Lerrigo, & Rogers, 2013).

SAD is also associated with impairments to occupational functioning (Aderka et al., 2012; Bruch, Fallon, & Heimberg, 2003). For example, 20% of adolescents and young adults with SAD reported being unable to attend work or school because of their condition (Wittchen et al., 1999). Moreover, even when they were able to attend work, 34-43% reported diminished productivity. Individuals with SAD are also at increased risk of alcohol and substance abuse (e.g., Clark & Wells, 1995; Nelson et al., 2000). This may be because socially anxious individuals tend to use these substances as self-medication to alleviate their anxiety (Wittchen et al., 2000). Studies show that socially anxious individuals report using alcohol to feel more comfortable in social situations (Thomas,

Randall, & Carrigan, 2003) and tend to consume more alcohol after stressful social tasks, such as speech challenges (Abrams, Kushner, Medina, & Voight, 2001).

SAD often displays comorbidity with other psychiatric disorders, most commonly with other anxiety disorders (Wenzel & Holt, 2001) but also often with depressive symptoms and Major Depressive Disorder (e.g., Beesdo et al., 2007; Bittner et al., 2004; Starr, Davila, LaGreca, & Landoll, 2011; Kessler, 2003). SAD seems to precede comorbid depressive symptoms, and there is some evidence to suggest a causal link between SAD and the development of future depressive disorders (Beesdo et al. 2007; Bittner et al. 2004; Fehm et al., 2008). Sadly, SAD may confer increased risk of suicidal ideation and suicide attempts (Mesa et al., 2011; Wittchen et al., 2000). For example, among teenage girls diagnosed with major depression, comorbid SAD was associated with a threefold increase in the risk of suicide attempts (Nelson et al., 2000).

Recent research has also revealed a need to consider individuals who report elevated, albeit subclinical levels of social anxiety in the general population (Crozier & Alden, 2005). Subclinical symptoms of social anxiety are associated with many of the same deleterious concomitants as clinically diagnosed SAD, including major depression (Filho et al., 2010). For example, in a large (N = 4,174) study of German adults, individuals with elevated subthreshold social anxiety symptoms were 4 times more likely to meet criteria for major depressive disorder, and 10 times more likely to meet criteria for another anxiety disorder, than were individuals with low social anxiety symptoms (Fehm et al., 2008). Subclinical social anxiety is also associated with impairments in general psychosocial functioning, in the domains of education, hobbies, romantic relationships, and friendships (Filho et al., 2010; Wittchen et al., 2000). Fehm and

colleagues (2008) reported that subthreshold anxiety was associated with significantly decreased satisfaction with family relationships, work situation, financial situation, and social relationships, as well as reduced general mental health.

There is some evidence to suggest that subclinical social anxiety symptoms may actually confer greater risk of alcohol abuse than clinically diagnosed SAD. For example, Merikangas, Avenevoli, Acharya, Zhang, and Angst (2002) reported that young adults with subclinical social anxiety were twice as likely to develop Alcohol Use Disorder (AUD) than those with SAD. One possibility for this result is that increasing severity of social anxiety tends to result in increased avoidance of social situations, protecting against AUD by limiting access to social situations where alcohol is available (Thompson, Goldsmith, & Tran, 2011).

Etiology. Evidence from twin and family studies suggest a genetic contribution to social anxiety disorder (Hofmann & Barlow, 2002). For example, the risk of social phobia has been found to be approximately three times higher among relatives of probands with the disorder (Fyer, Mannuzza, Chapman, Liebowitz, & Klein, 1993). The genetic disposition towards social anxiety seems to be related to certain temperamental traits, such as *behavioural inhibition* and *shyness*. Behavioural inhibition refers to timidity, fear, and wariness in response to novel stimuli (Kagan, Reznick, & Snidman, 1988). Similarly, shyness is a temperamental trait characterized by wariness in the face of *social* novelty and situations of perceived social evaluation (Cheek & Buss, 1981). Though the exact nature of the relations between these constructs remains uncertain, shyness and behavioural inhibition early in life appear to confer a vulnerability to the development of more serious difficulties with social anxiety (Schwartz, Snidman, &

Kagan, 1999; Rapee & Coplan, 2010). In support of this notion, there is growing empirical evidence implicating shyness in the etiology of social anxiety (Beidel & Turner, 2007; Ollendick & Hirshfeld-Becker, 2002; Rapee & Spence, 2004). For example, shyness in middle and late childhood seems to confer increased risk of anxiety problems in adolescence (Prior, Smart, Samson, & Oberklaid, 2000).

Environmental factors, such as parenting, have also been implicated in the development of social anxiety. In particular, *overprotective* parenting (overmanaging situations for the child, restricting child behaviours, discouraging independence) may interact with child temperament to exacerbate the risk of social anxiety (Alden & Taylor, 2004). For example, shy children whose parents display an overprotective parenting style seem to be at greater risk of later maladjustment (Coplan, Arbeau, & Armer, 2008).

Other factors that may be implicated in the etiology of SAD include social skills deficits, negative peer experiences, stress, and the experience of trauma (e.g., Rapee & Spence, 2004). For the present research, however, the primary focus was on *cognitive* factors. Indeed, contemporary theories of social anxiety emphasize the role of cognitive biases as a primary factor in the etiology of the disorder (Hofmann & Barlow, 2002).

Cognitive Biases in Anxiety

Many theories have emphasized the role of cognitive processes in the development and maintenance of anxiety, both in general and specific to social anxiety (e.g., Beck, Emery, & Greenberg, 2005). Generally, these theories suggest that anxiety is a result of distorted processing of information related to threat and danger (Beck & Emery, 1995). For example, according to Kendall (1985), pathological levels of anxiety arise when cognitive schemas related to vulnerability and danger become overactive. These schemas

are presumed to focus cognitive resources to the processing of threat-relevant situations and stimuli. When these cognitive schemas are overactive, they are thought to result in erroneous, maladaptive thought processes and behaviour (Muris & Field, 2008). In support of this cognitive perspective, anxiety has been associated with a distinctive pattern of cognitive biases, or errors in thinking, in which individuals perceive, interpret, or recall information in ways that are schema-consistent (e.g., Beck et al., 2005; Higa-McMillan & Ebesutani, 2011). Anxiety researchers distinguish between four broad types of cognitive biases: (1) *attentional bias* refers to the tendency of anxious individuals to selectively attend to cues to threat in their environment (MacLeod & Mathews, 1988); (2) *interpretation bias* describes a tendency to ascribe threatening interpretations to ambiguous stimuli (Field & Lester, 2010; Hadwin & Field, 2010; Higa-McMillan & Ebesutani, 2011); (3) *judgment bias* refers to an underestimation of one's ability to cope with or control external threats, and an overestimation of the costs of negative events (Cannon & Weems, 2010); and finally, (4) *memory bias* occurs when individuals remember past experiences as more negative or threatening than they actually were (Heinrichs & Hofmann, 2001).

In the case of social anxiety, individuals are particularly sensitive to cues to *social* threat. One prominent cognitive model of social anxiety, proposed by Rapee & Heimberg (1997), focuses on the idea that socially anxious individuals are preoccupied with the evaluations of others. The idea of “threat”, in this model, refers to the possibility of negative appraisal by others. Under this model, individuals hold a mental representation of themselves, as perceived by others, which is constantly updated according to social feedback. For example, social cues such as frowning or signs of boredom would be

integrated into this mental representation, lowering an individual's estimation of their social performance (Rapee & Heimberg, 1997). Social anxiety occurs when a person's mental representation falls short of their estimation of the external standard for positive evaluation. Cognitive biases are hypothesized to generate and maintain social anxiety, for example, through distorted perceptions of one's social performance, or alternately, of other peoples' standards for positive evaluation.

In support of this cognitive model, recent research suggests that training cognitive biases in non-anxious adults leads to an increase in their social anxiety symptoms (Schmidt, Richey, Buckner, & Timpano, 2009). Conversely, social phobia patients who receive training aimed at reducing these biases show significant decreases in anxiety, even to below diagnostic criteria for social anxiety (Beard & Amir, 2008; Hakamata et al., 2010). Vassilopoulos and colleagues (Vassilopoulos, Banerjee, & Prantzalou, 2009) extended these results to children. When children with high, albeit subclinical levels of social anxiety were trained to endorse non-threatening interpretations of ambiguous scenarios, they showed a subsequent decrease in social anxiety symptoms. In further support of this perspective, *Cognitive Behaviour Therapy* (CBT) has become one of the most commonly used treatments of social anxiety disorder (Heimberg, 2002). A primary focus of this treatment is on altering maladaptive cognitive processes (Barlow & Lehman, 1996; Heimberg, 2002; Taylor & Alden, 2008). CBT has been shown to be effective in reducing social anxiety symptoms (Heimberg, 2002; Herbert, Rheingold, Gaudiano, & Myers, 2004) and seems to confer lasting gains after treatment is completed (Herbert et al., 2004).

Interpretation Biases in Social Anxiety

Social anxiety has been associated with several different types of cognitive bias. First, individuals with social anxiety seem to demonstrate an attention bias towards socially threatening information. For example, social phobia patients have been found to selectively focus attention on negative social-evaluative words (Heinrichs & Hofmann, 2001), as well as negative facial expressions (Gilboa-Schechtman, Foa, & Amir, 1999). Social anxiety has also been associated with judgment bias: socially anxious individuals tend to overestimate the probability of negative social events, and rate these events as more catastrophic than do nonanxious individuals (Stopa & Clark, 2000; Voncken, Bögels, & de Vries, 2003). Social phobia patients have also been found to recall more emotionally negative features of social scenarios (Hertel, Brozovich, Joorman, & Gotlib, 2008), although evidence for such a memory bias in the literature is mixed (e.g., Brendle & Wenzel, 2004).

The present research focused on *interpretation* bias. Interpretation bias refers to the tendency of anxious individuals to ascribe threatening interpretations to ambiguous situations (e.g., Muris & Field, 2008). For example, in the case of health anxiety, an ambiguous physical symptom such as dizziness or tachycardia may be interpreted as a sign of a serious illness (e.g., Stopa & Clark, 2000). In contrast, socially anxious individuals are particularly likely to interpret ambiguous *social* situations in a negative manner (Miers, Blöte, Bögels, & Westenberg, 2008; Vassilopoulos & Banerjee, 2011). Rapee and Heimberg (1997) argue that, in fact, a majority of social cues are “indirect and ambiguous” (p. 744), readily lending themselves to distortion.

Amir and Foa (2001) hypothesized that alternate interpretations of ambiguous social stimuli are activated concurrently and subconsciously, and compete with each

other for entry into awareness. They argued that interpretations which have been accessed in the past will be more readily accessed in the future – meaning that the more negative interpretations an anxious individual makes, the more likely future ambiguous situations will also be interpreted negatively. This process of successive facilitation of negative interpretations is thought to drive the maintenance of social anxiety (Hirsh & Clark, 2004; Rapee & Heimberg, 1997). Due to the requirements of daily life, socially anxious individuals are regularly exposed to at least some feared social situations. Presumably, the feedback they experience during this naturalistic exposure is not entirely negative, which should result in extinction of social fears (Hirsch & Clark, 2004; Murphy, Hirsch, Mathews, Smith, & Clark, 2007). However, negative interpretations of ambiguous feedback may explain why symptoms of social anxiety persist despite repeated exposure.

A large body of evidence has demonstrated the presence of interpretation biases in socially anxious adults (Amir, Beard, & Bower, 2005; Amir, Prouvost, & Kuckertz, 2012; Huppert Foa, Furr, Filip, & Mathews, 2003; Huppert, Pasupuleti, Foa, & Mathews, 2007; Kanai, Sasagawa, Chen, Shimada, & Sakano, 2010), adolescents (Miers et al., 2008), and children (Muris, Merckelbach, & Damsma, 2000; Vassilopoulos & Banerjee, 2011). Interpretation biases have been correlated with social anxiety symptoms in both clinical (Amir et al., 1998) and non-clinical samples (Huppert et al., 2003; Kanai et al., 2010), and have been found to discriminate clinically socially anxious youth from their non-anxious peers (Cannon & Weems, 2010).

Measurement of interpretation biases. In adults, interpretation bias is often measured using vignettes describing ambiguous social scenarios (e.g., “You see a group of friends having lunch, they stop talking when you approach”, Amir et al., 1998). After

reading each vignette, participants are presented with two or more possible interpretations of the situation (e.g., “They are saying negative things about you”, “They just ended their conversation”), and asked either to choose one interpretation, or to rank the likelihood of each interpretation independently. Socially anxious individuals are more likely to endorse the negative or threatening interpretations of ambiguous scenarios than nonanxious controls (Amir et al., 1998; Beard & Amir, 2010; Stopa & Clark, 2000; Voncken et al., 2003). Similarly, some authors have used video vignettes to study interpretation bias. For example, Amir and colleagues (2005) reported that socially anxious individuals rated short videos depicting ambiguous social interactions as more negative than did nonanxious individuals.

Another technique used to study interpretation bias is the *Word-Sentence Association Paradigm* (e.g., Beard & Amir, 2009). Participants are presented with a series of ambiguous sentences (e.g., “you carry a tray of food at a party”), each paired with either a threatening or nonthreatening word (e.g., “graceful”, “clumsy”), and asked to indicate whether the word is related or unrelated to the sentence. Response latency is used as a measure of automatic, ‘online’ interpretation bias, and endorsements of relatedness are used to measure slower, ‘offline’ processing. Amir et al. (2012) used this paradigm to study interpretation bias in a sample of patients diagnosed with SAD. Compared to nonanxious controls, participants with SAD endorsed more threatening words, demonstrating an increased ‘offline’ bias to negative information.

Interpretation bias has also been studied *in-vivo* in laboratory settings. For example, Kanai and colleagues (2010) asked participants to give an impromptu speech, during which a confederate performed ambiguous social behaviours (e.g., throat clearing, head

scratching). Results indicated that participants who scored highest on a measure of social phobia demonstrated more negative interpretations of the confederate's behaviour than participants with low levels of social phobia.

Social specificity of interpretation bias. Social anxiety has been particularly associated with interpretation biases in *social* situations. For example, Amir and colleagues (1998) presented participants with vignettes describing ambiguous social and nonsocial events. Participants were then asked to rank the likelihood of three interpretations: one positive, one negative, and one neutral. Social phobia patients were more likely to form negative interpretations of social events than patients with obsessive-compulsive disorder, as well as nonanxious controls. In contrast, the groups did not differ in their interpretation of nonsocial events. Similarly, Voncken and colleagues (2003) reported that social phobia patients ranked negative interpretations of social - but not nonsocial - situations as more likely than did nonanxious controls. Stopa and Clark (2000) replicated and extended these findings, demonstrating that social phobia patients make more negative interpretations of ambiguous social events than both nonanxious controls, and a group of participants diagnosed with other anxiety disorders (who were deemed equally anxious as the social phobia group). When asked to rank interpretations of ambiguous *nonsocial* events, socially anxious participants did not differ from participants with other anxiety disorders - but both groups of anxious participants endorsed more negative interpretations than did the nonanxious controls.

Interpretation bias in subclinical populations. Interpretation bias has also been associated with *subclinical* social anxiety symptoms in unselected samples. Kanai and colleagues (2010) demonstrated an association between negative interpretations of

ambiguous social cues and social phobia symptoms in a sample of college students. In a study by Huppert and colleagues (2003), young adults were presented with 10 vignettes describing ambiguous social scenarios, and asked to rate their agreement with positive and negative interpretations of each vignette. Higher levels of social anxiety were associated with a tendency to interpret social situations in a negative manner. Similarly, in a self-selected sample of socially anxious university undergraduates, higher levels of social anxiety were associated with higher rankings of negative interpretations of ambiguous social- but not non-social- situations (Beard & Amir, 2010).

Beard and Amir (2009) used the word-sentence association paradigm to study interpretation bias in sample of university undergraduates who self-identified as socially anxious. In this study, higher levels of social anxiety were associated with a tendency to endorse more negative words as well as with reduced response latency for negative words (i.e., both online and offline interpretation biases).

Miers and colleagues (2008) studied interpretation bias in a sample of 356 Dutch adolescents, aged 12 to 16 years. From this non-clinical sample, they created a high social anxiety group, consisting of those who scored in the top 10% of social anxiety symptoms, and a control group, who scored in the average range (45th - 55th percentile). Participants were presented with a series of vignettes describing ambiguous social and non-social situations, adapted from adult measures to be relevant to and appropriate for the age group. Each vignette was accompanied by three possible interpretations: one positive, one negative, and one neutral. Participants were asked to rate on a five-point Likert-type scale how likely each interpretation was to enter their mind. Results indicated that adolescents in the high social anxiety group were more likely to endorse negative

interpretations of the ambiguous social situations than were those in the control group. Mirroring results from the adult literature, groups did not differ in their interpretations of ambiguous nonsocial events.

Positive interpretation biases. Recently, researchers have begun to examine the hypothesis that in addition to possessing a bias towards negativity, socially anxious individuals may lack a so-called ‘positivity bias’ – a tendency to ascribe positive *or benign* interpretations to ambiguous situations which is normative in the general population (Amir et al., 2012; Hirsch & Clark, 2004; Murphy et al., 2007). For example, in studies using the word-sentence association paradigm (Amir et al., 2012; Beard & Amir, 2009), in addition to endorsing more associations with negative words, socially anxious participants also rejected more benign words than nonanxious controls. Moreover, nonanxious controls were quicker to endorse benign words, suggesting that they possess an online benign interpretation bias that is not present in anxious individuals. In further support of this notion, Constans, Penn, Ihen, and Hope (1999) reported that participants high in social anxiety were less likely to endorse positive interpretations of ambiguous social situations than were low-anxious controls. In contrast to other findings (e.g., Amir et al., 1998; Huppert et al., 2003; Kanai et al., 2010; Stopa & Clark, 2000), in this sample, no differences were found in participants’ ratings of negative interpretations. This may be due to differences in the questionnaire used: unlike other studies of interpretation bias, Constans et al. (1999) measured benign and negative interpretations as opposite extremes of a single dimension. Moreover, whereas the Constans et al. (1999) study asked participants to rate interpretations of a hypothetical

ambiguous social scenario involving *other* people, other studies of interpretation bias have asked participants to imagine *themselves* in the ambiguous scenarios.

Some researchers have reported that social anxiety is also associated with a tendency to interpret even *positive* social events in a threat-maintaining manner (Alden, Mellings, & Laposa, 2004; Alden, Taylor, Mellings, & Laposa, 2008; Kashdan, Weeks, & Savostyanova, 2011; Vassilopoulos, 2006; Vassilopoulos & Banerjee, 2010; Voncken, Bogels, & de Vries, 2003). For example, socially anxious individuals may be more likely to feel uncomfortable or apprehensive after a social success, as if waiting for “the other shoe” to drop (Alden et al., 2008). Similarly, social anxiety seems to be associated with a tendency to be skeptical of positive social feedback – believing, for example, that others’ friendliness is disingenuous and that compliments cannot be taken at face value (Alden et al., 2008; Vassilopoulos & Banerjee, 2010). In one study of university undergraduates, Vassilopoulos (2006) reported that individuals high in social anxiety were more likely to endorse negative interpretations of unambiguously positive social events. Taken together, these findings suggest that, in addition to a negative interpretation bias, socially anxious individuals seem to be less likely to make positive inferences about social situations, whether or not these situations are ambiguous.

Gender differences in interpretation bias. There is some evidence to suggest that the pattern of cognitive distortions associated with anxiety may differ by gender. In a study of cognitive distortions in children and adolescents, Cannon and Weems (2011) reported that a measure of cognitive errors discriminated between anxious and nonanxious girls, but not boys. Clinically anxious girls were more likely to endorse negative interpretations of ambiguous scenarios than were girls in the nonanxious control

group. In contrast, boys in the clinical and control groups did not differ significantly in their interpretations of the ambiguous scenarios. In a study of interpretation bias in Dutch adolescents, girls endorsed significantly less positive and more negative interpretations of ambiguous scenarios than did boys (Miers et al., 2008). However, results regarding gender differences in interpretation bias are inconsistent in the child and adolescent literature (Cannon & Weems, 2011). Studies of interpretation bias in adults have either neglected to examine gender differences (Amir et al., 2012; Beard & Amir, 2009, 2010; Huppert et al., 2003; Kanai et al., 2010; Stopa & Clark, 2000) or have not found significant effects of gender (Amir et al., 1998; Constans et al., 1999).

Social Anxiety and Social Experiences in Adolescence and Young Adulthood

Social anxiety may present distinct challenges in adolescence and early adulthood. In childhood, shy and socially anxious children tend to withdraw from their peers, isolating themselves and potentially missing out on the benefits of peer interaction (e.g., Gazelle & Rudolph, 2004). This social withdrawal seems to become increasingly negatively salient to peers with age (Ladd, 2006). As social interaction becomes more normative in mid- to late- childhood, shy and socially anxious children are often rejected and excluded by their classmates, and are likely to be the targets of peer victimization (Crawford & Manassis, 2011; Gazelle & Ladd, 2003; Hanish & Guerra, 2004; Nelson, Rubin, & Fox, 2005; Newcomb, Bukowski, & Pattee, 1993). Moreover, the low friendship quality experienced by anxious children seems to place them at even greater risk of victimization (Crawford & Manassis, 2011).

Peer interaction becomes increasingly important in adolescence, as teens gain independence from their parents (Bowker, Rubin, & Coplan, 2012). Friendships during

this time are a major source of emotional support, intimacy, and acceptance (Berndt, 2004), and good quality friendships are associated with positive psychosocial adjustment (e.g., Bukowski, Hoza, & Boivin, 1993; Demir & Weitekamp, 2007; Hartup, 1996). Adolescents who report high levels of social anxiety tend to have smaller networks of friends (La Greca & Lopez, 1998). The friendships they do form are often of poorer quality, characterized by less time spent together, less intimacy, and poorer conflict resolution as compared to the friendships of nonanxious teens (LaGreca & Lopez, 1998; Rubin, Bukowski, & Parker, 2006; Vernberg, Abwender, Ewell, & Beery, 1992). However, research suggests that high-quality friendships can serve a protective function for socially anxious youth (Erath, Flanagan, Bierman, & Tu, 2010). Social anxiety in adolescence is also associated with difficulties in the larger peer group, including lower peer acceptance and increased risk of peer victimization (Bowker & Raja, 2011; Erath, Flanagan, & Bierman, 2007; Storch, Brassard, & Masia-Warner, 2003).

Emerging adulthood is a developmental phase beginning in the late teens and lasting through the early twenties (ages 18-25 years), which is believed to be distinct from both adolescence and adulthood (Arnett, 2000). In Western cultures, the transition between adolescence and adulthood has been extended over the last half century, giving youth more freedom to explore their identities in the educational, occupational, philosophical, and romantic spheres during this time (Arnett, 2000). This is an important developmental period, often fraught with major life changes such as increasing independence from parents, the beginnings of adult responsibility and, for many, the transition from high school to university (Arnett, 2000).

The formation and maintenance of social relationships becomes increasingly important in this developmental period. As in adolescence, youth continue to differentiate from their parents during emerging adulthood, relying on friends as a main source of support and intimacy (Fraley & Davis, 1997; Furman & Buhrmester, 1992). For many emerging adults, the transition to university also brings about unique social challenges, as students may leave their homes to pursue education, leaving behind existing social networks (Tao, Dong, Pratt, Hunsberger, & Pancer, 2000). An essential part of adjustment during this period therefore involves the formation of new social relationships (Mounts, Valentiner, Anderson, & Boswell, 2006).

The social demands of emerging adulthood may be particularly troubling for socially anxious youth, who tend to have difficulty forming and maintaining high-quality friendships (Parade et al., 2010; La Greca & Lopez, 1998, Stewart & Mandrusiak, 2007). Indeed, socially anxious individuals report the greatest functional impairment during the early adult years (Wittchen et al., 2000). Social anxiety and shyness during this period have been linked with loneliness, difficulty establishing high-quality social relationships (Asendorpf, 2000; Asendorpf & Wilpers, 2000; Bruch, Kaflowitz, & Pearl, 1988), and increased risk of other internalizing problems, such as depression and anxiety (Nelson, 2013). Social anxiety in emerging adulthood has been shown to affect the decision to enroll in university, as well as the choice of subject major (Kessler, 2003), and has deleterious effects on academic performance once enrolled (Turner, Beidel, Borden, Stanley, & Jacob, 1991). Young adults struggling with social anxiety report that their social fears inhibit their class participation (e.g., discussion, oral presentations), which can limit their academic success (Turner et al. 1991). Social anxiety in college has also

been associated with alcohol use, as many anxious students turn to drinking to alleviate their discomfort in social situations (Carriagn & Randall, 2003; Neighbors, Fossos, Woods, et al., 2007).

Exploration of romantic relationships is a particularly central concern for adolescents and emerging adults (Lanz & Tagliabue, 2007). However, for socially anxious youth, *heterosocial* interactions, or interactions with potential dating partners, are also a major source of stress (Curran, 1977; Heinrichs & Hofmann, 2005; Mattick & Clarke, 1998; Orr & Mitchell, 1975; Weiss, Hope, & Capozzoli, 2013; Zimbardo, 1990). As dating and romantic relationships become more normative, older adolescents and young adults encounter increasing pressure to be involved in romantic relationships (Zimmer-Gembeck, Siebenbruner, & Collins, 2001). This may result in increased anxiety in the presence of members of opposite gender peers (Glickman & La Greca, 2004), at least among heterosexual youth. Despite a desire to engage in romantic relationships, socially anxious youth may avoid heterosocial encounters due to their discomfort and fear of negative evaluation (Dodge, Heimberg, Nyman, & O'Brien, 1987; Stevens & Morris, 2007). Social anxiety may therefore hinder adolescents' and young adults' ability to form and maintain intimate relationships (Glickman & La Greca, 2004). Empirically, social anxiety symptoms have been associated with impairments to the initiation of romantic relationships (Kessler, 2003; Wittchen & Fehm, 2003), decreased dating competence, fewer dating partners, and decreased romantic relationship quality (Bruch, Heimberg, Berger, & Collins, 1989; Dodge et al., 1987; LeSure-Lester, 2001; Rowsell & Coplan, 2013; Wittchen et al., 2000). Moreover, socially anxious adults have a lower rate of marriage than the general population, and when they do marry, they tend to do so later

than their non-anxious peers (MacKenzie & Fowler, 2013; Schneier et al., 1994; Teo et al., 2013).

Historically, the study of social interactions among individuals with social anxiety has focused on *face-to-face* situations. However, over the last 25 years, the way that humans, and particularly young adults, interact with one another has undergone rapid and substantive change. The following sections will examine computer-mediated communication as a context for youth social interaction, with a particular focus on features of electronic communication media that may be particularly relevant to the study of social anxiety.

Computer-Mediated Communication as a Context for Studying Social Interaction

Thanks to modern communication technologies, teens' and young adults' social interactions are increasingly taking place electronically, outside of the traditional realm of face-to-face interaction. Some form of electronic communication is available to the vast majority of adolescents in developed countries, and is increasingly available even in developing areas (Schneider & Amichai-Hamburger, 2000). In the U.S., 95% of teens 12-17 and 94% of young adults age 18-29 report using the internet (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013; Zickuhr & Smith, 2012).

Computer-mediated communication (CMC) includes media such as email, instant messaging, text messaging or short message service (SMS), social networking websites such as Facebook, and chat rooms. Recent research indicates that such modes of communication are popular among adolescents and young adults, joining voice calls and face-to-face interactions among the primary modes of communication with the social network (Lenhart et al., 2007; Subrahmanyam & Greenfield, 2008; Valkenburg & Peter,

2007). Such technologies allow youth, more than ever before, to keep in contact with their peer networks even when face-to-face interaction is not possible (van Cleemput, 2010). Moreover, such media provide a greater degree of privacy than voice calls or face-to-face interaction (Ling & Yttri, 2006; Stern, 2007). These features may make CMC particularly attractive in a developmental period when differentiation from parents and communication with peers become increasingly important (van Cleemput, 2010). Such media also appeal to youth because they allow simultaneous communication with multiple peers (Kim, Kim, Park, & Rice, 2007)

Recent research into adolescents' and young adults' communication patterns reveals that youth use different types of CMC for different purposes. Overall, youth tend to use CMC to reinforce existing relationships, rather than to form new ones (Subrahmanyam & Greenfield, 2008). According to reports from the Pew Internet and American Life project, adolescents tend to use email to communicate with adults and authority figures, for communicating the same information to several others, or for transmitting lengthy messages (Lenhart, Madden, & Hitlin, 2005). In contrast, they use media such as instant messaging and text messaging for day-to-day social conversations with a variety of friends and acquaintances (Boneva, Quinn, Kraut, Kiesler, & Shklovski, 2006; Gross, 2004; Stern, 2007). Close friends tend to use all available channels to connect with one another (e.g., using a combination of voice calls, instant messaging, and text messaging), whereas acquaintances tend to rely on less intimate means, such as social networking sites, to communicate (Lenhart, 2012, van Cleemput, 2010).

Text messaging (SMS). Text messaging, or SMS, emerges as the most popular form of CMC among today's youth (Lenhart, 2012; Skierkowski & Wood, 2012). As of

2012, 78% of U.S. adolescents aged 12-17 years reported owning a cell phone, 37% owned smartphones (Madden et al., 2013) and 74% reported using text messaging at least occasionally (Lenhart, 2012; Madden et al., 2013). Among teens who do use text messaging, the frequency of texts is also astounding: according to recent survey data from the Pew project, a typical teen sends and receives over 100 text messages a day, and 18% report exchanging over 200 messages daily (Lenhart, 2012). Use of text messaging increases with age throughout the teenage years, and seems to peak in young adulthood, with 97% of U.S. cell phone users aged 18-29 years engaging in text messaging (Duggan, 2013; Lenhart Ling, Campbell & Purcell, 2010). Within this young adult group, college students appear to be the most likely to engage in text messaging (Smith, Raine, & Zickhur, 2011).

Teens and young adults report a strong preference for text messages over other forms of communication, including emails, voice calls, and even face-to-face communication (Lenhart, 2012). For those who have grown up with such technology, texting seems to be an integral element of daily life, which contributes to feelings of connectedness and belonging (Skierkowski & Wood, 2012). This behaviour is so ingrained that 61% of young adults report sleeping next to their phone so as not to miss any texts during the night (Smith, 2012). Another study asked college students to refrain from texting over a period of five days, with striking results – students reported intense anxiety and feeling ‘as though part of [them] was missing’ (Skierkowski & Wood, 2012, p. 753). Text messaging, the most popular type of CMC among youth, may thus be an ideal context in which to study the communication practices of teens and young adults.

There is some evidence to suggest that use of CMC may differ by gender. For example, teenage girls are more likely to engage in text messaging than are teenage boys (Lenhart, 2012). Teen girls also report stronger preferences for interacting via text messaging and social networking sites versus face-to-face than teen boys do (Pierce, 2009). Research suggests that this gender gap continues into adulthood, with women outnumbering men on social networking sites (Kimbrough, Guadagno, Muscanell, & Dill, 2013; Taylor, 2009) and sending more text messages than men (Kimbrough et al., 2013). There is also evidence to suggest that women use CMC in a more robust way than men do. For example, women use email to communicate with friends and family more often, and about a wider variety of topics, than men do (Fallows, 2005). Women also report a greater preference for text messaging than men do (Kimbrough et al. 2013), as well as feeling more satisfied with the role email plays in nurturing their personal relationships (Fallows, 2005).

Features of CMC

Several features distinguish CMC from face-to-face communication. Many of these features seem particularly relevant to the study of social anxiety.

Anonymity. One feature of CMC that distinguishes it from face-to-face communication is the relative anonymity it affords. Even in media in which conversation partners are typically known, and therefore not truly anonymous (e.g., in text messaging, where one must necessarily have access to a conversation partner's telephone number), text-based CMC lacks the visual and auditory information that makes users' identities salient (Roberts, Smith, & Pollock, 2000).

Several theoretical models have been proposed as to the effects this anonymity may have on human communication. According to the *hyperpersonal* model (Walther, 1996), the visual anonymity inherent in text-based CMC enhances users' control over the impressions they create. CMC, it is argued, allows for more selective self-presentation as users choose which attributes to highlight and which to conceal. Similarly, the Social Identity De-Individuation Effects model (SIDE; Spears & Lea, 1992) also suggests that lack of identifiability in a medium (i.e., one's anonymity to others) reduces self-presentational concerns and allows users to communicate with fewer inhibitions.

These models have implications for socially anxious individuals. The lack of visual and auditory information in text-based media may be particularly appealing to socially anxious individuals, allowing them to communicate with less self-consciousness about their physical appearance and the outward signs of anxiety (e.g., blushing, stuttering; Valkenburg & Peter, 2011). In support of this notion, students with high levels of social phobia report feeling less inhibited, better able to express feelings, more comfortable interacting socially, and less concerned with the judgments of others when interacting online versus offline (Shepherd & Edelman, 2005). Similarly, Valkenburg and Peter (2007) reported that socially anxious adolescents perceive online communication as a valuable tool for intimate self-disclosure.

High and Caplan (2009) studied the effects of CMC on measures of conversational success in a sample of 202 university undergraduates. As expected, conversation partners perceived more anxiety, and reported lower conversation satisfaction, when speaking with socially anxious participants in face-to-face contexts. However, in computer-

mediated contexts, conversation partners of socially anxious participants reported more satisfaction, and perceived less anxiety from their partners.

Similar findings have been reported in studies of shyness. In a study by Roberts and colleagues (2000), shy individuals reported feeling less inhibited when communicating online. Similarly, Stritzke, Nguyen, and Durkin (2004) reported that whereas shy undergraduates showed less self-disclosure and greater rejection sensitivity than their nonshy peers in face-to-face contexts, these group differences were virtually nonexistent in computer-mediated contexts. In an interesting comparison of different communication media, Brunet & Schmidt (2007) paired university undergraduates with other participants with whom they were not acquainted. The dyads engaged in chat room conversation under two conditions: with and without a live webcam. In the webcam condition, shy participants engaged in less self-disclosure than their non-shy peers. Without the webcam, there were no significant differences in self-disclosure between the two groups.

Taken together, these findings suggest that the visual anonymity afforded by text-based CMC may serve to reduce self-presentational anxiety among anxious individuals, as well as to help mask the outward signs of anxiety from conversation partners.

Asynchronicity. Another feature of CMC that distinguishes it from face-to-face communication is its *asynchronicity*. Unlike face-to-face communication, CMC does not require users to be co-present. Rather, users are able to send and reply to messages whenever convenient, independently of one another. Thus, delays between sending, reading, and replying to a message are common (Kitade, 2012). Different communication media vary with respect to their degree of synchronicity (Chan, 2011; Riordan & Kreuz, 2010b). For example, latencies between messages are typically shorter in instant

messaging than in email communication. However, even in the most synchronous of computer-mediated contexts (for example, instant messaging) users must press ‘send’ before their message is transmitted (Walther, 2007).

The asynchronicity of CMC may offer distinct benefits to socially anxious individuals. For example, it may alleviate some aspects of social anxiety by reducing pressure to respond immediately (Chan, 2011). The asynchronicity of text-based CMC also allows users to edit and reword messages any number of times before sending. According to the hyperpersonal model, this feature of CMC allows users greater control over the messages they send, and therefore over the impressions they create (Walther, 1996). This “editability” may promote self-disclosure in socially anxious individuals, by allowing them to optimize their self-presentation (Valkenburg & Peter, 2011). In support of this notion, Chan (2011) reported that shy university students showed greater preference for asynchronous media (e.g., email, social networking) than more synchronous forms of CMC (e.g., instant messaging).

Asynchronicity may therefore be another reason (in addition to relative anonymity, as discussed above) that socially anxious individuals show greater self-disclosure and conversational success in text-based versus face-to-face communication (Brunet & Schmidt, 2007; High & Caplan, 2009; Roberts et al., 2000; Shepherd & Edelman, 2005; Stritzke et al., 2004; Valkenburg & Peter, 2007, 2011).

However, some authors have hypothesized that this asynchronicity comes with a drawback – it may increase the likelihood of miscommunication, since feedback is delayed, and the ability to immediately resolve ambiguity is reduced (Byron, 2008).

Leanness. Another feature that distinguishes CMC from face-to-face communication is its relative *leanness*. Notably, text-based forms of CMC (i.e., text messaging, email) lack the nonverbal cues to emotional tone - such as gestures, vocal intonation, eye-gaze, and social context cues - that are present in face-to-face communication (Riordan & Kreuz, 2010; Walther & Parks, 2002). Whereas speech consists of both content and tone - not only what is said, but *how* it is said - CMC is constrained to content (Kruger et al., 2005). Text-based forms of CMC, such as e-mail, text messages, and instant messages, are therefore said to be *lean* media, in contrast to rich media, the gold standard of which is face-to-face communication.

According to Social Presence Theory (Short, Williams, & Christie, 1976), increased media richness confers greater *social presence* – that is, a greater awareness of one’s interaction partner, and higher salience of the social nature of interactions. According to proponents of this theory, the low degree of social presence afforded by CMC makes it an inadequate tool for satisfying social communication. Relatedly, Media Richness Theory (Daft & Lengel, 1984, 1986) asserts that more complex tasks require greater media richness to be effective. Interactions involving greater degrees of emotional complexity are better suited, it is argued, to media in which a greater number of nonverbal cues are present. Because emotions tend to be expressed nonverbally rather than verbally (Ekman, Freisen, & Ancoli, 1980), media lean in nonverbal cues may make the transmission of emotion more difficult. Messages delivered via lean media are therefore likely to be more ambiguous in tone than messages in which nonverbal cues are present (Byron, 2008).

Indeed, there is evidence to suggest that the lack of cues available in CMC leads to misinterpretations among non-anxious individuals. In a series of studies by Kruger and colleagues (2005), university undergraduates were asked to send a series of short statements, about varied topics, to a partner via e-mail. Half of these statements were intended as sarcastic, the other as serious in tone. Results indicated that conversation partners were significantly less accurate in identifying the sarcastic statements over e-mail than when these same messages were communicated by voice. Similar findings emerged when participants were asked to interpret the tone of messages designed to convey anger and sadness. Interestingly, participants were not aware that they had misinterpreted the intended tone of the messages. When asked to rate their confidence in their identifications after the task, receivers were disproportionately confident in their success at identifying the tone of each statement.

In a theoretical review of research on emotion communication via e-mail, Byron (2008) suggested that the emotional tone of e-mails is likely to be misinterpreted in a predictable way. More specifically, messages intended to convey positive emotions are likely to be perceived as more neutral, and neutral messages are likely to be perceived as more negative than intended. Some empirical evidence exists to support this so called *negativity effect*. For example, in an early study of CMC, undergraduate and graduate student research participants evaluated one another more negatively (and less accurately) after interacting via chat room than face-to-face (Weisband & Atwater, 1999). Okdie, Guadagno, Bernieri, Geers, and Mclarney-Vesotski (2011) recently replicated this finding in a sample of college students. In a similar vein, Walther and D'Addario (2001) reported

a tendency for receivers of e-mails to focus on negative emotional cues, even when both negative and positive cues were present in a single message.

In sum, evidence suggests that the relative leanness of text-based CMC may create more ambiguous social situations, in which senders' meanings are readily misinterpreted. Moreover, it seems that the type of ambiguity generated via CMC is of a different kind than that experienced in face-to-face situations: whereas ambiguity in face-to-face situations is a function of the ambiguity of the social cues present (e.g., laughing, yawning; Amir et al., 2005; Murphy et al., 2007; Rapee & Heimberg, 1997) ambiguity in CMC seems to result from the absence of such cues altogether (Kruger et al. 2005).

It is not yet known how socially anxious individuals might respond to this ambiguity. Byron (2008) suggested that individuals higher in negative affectivity would be more likely to perceive e-mails as more negative than intended. Accordingly, it seems plausible that social anxiety may be associated with similar perception distortions. Just as in face-to-face communication, socially anxious individuals may be biased towards negative interpretations of ambiguous situations in CMC. Interestingly, some authors have postulated that the absence of visual and auditory cues in CMC may in fact *reduce* shy individuals' experience of detecting negative cues from conversation partners (Saunders & Chester, 2008; Stritzke et al., 2004). However, this proposition has received no empirical support to date. Moreover, this suggestion applies to the detection of negatively valenced nonverbal cues, and may not extend to the interpretation of ambiguous messages in a medium devoid of such cues.

Nonverbal Cues to Emotion in CMC

According to the hyperpersonal model (Walther, 1996; 2007) people are cognizant of the challenges inherent in CMC, and therefore adapt their communication style to meet these challenges (Carter, 2003; Walther & Parks, 2002; Whelan, Pexman, & Gill, 2009). Although they are different from the cues to emotion present in face-to-face interactions, nonverbal cues are available for use in CMC (Derks, Fischer, & Bos, 2008; Harris & Paradice, 2007). Carey (1980, as cited in Riordan & Kreuz, 2010) identified five categories of cue: (1) vocal spelling (e.g., “wellll”); (2) lexical surrogates (e.g., “mmhmm”); (3) manipulation of grammatical markers (e.g., “!!!!”, “...”); (4) spatial arrays (e.g., :-); and (5) minus features (e.g., lack of capitalization). Studies of the use of such cues in CMC suggest that their base rate is relatively low (Rezabek & Cochnour, 1998; Riordan & Kreuz, 2010; Tossell et al., 2012; Witmer & Katzman, 1997). However, this may be because they are not appropriate in contexts that require a high degree of formality (e.g., workplace communications; Derks, Bos, & von Grumbkow, 2008). When such cues are used, their primary functions are to express emotion and disambiguate messages (Derks, Bos, & von Grumbkow, 2007; Derks, Bos et al., 2008; Riordan & Kreuz, 2010a).

Of all the nonverbal cues available in CMC, *emoticons* (a type of spatial array) have been the most often studied (Riordan & Kreuz, 2010a). The term ‘emoticon’ is short for ‘emotional icon’, and refers to any one of a set of graphical icons which symbolize emotion by mimicking human facial expressions (e.g., “ :) ”, Derks et al., 2007; Huang, Yen, & Zhang, 2008). Emoticons have been heralded as the primary way to express emotion in CMC (Riva, 2002), and their use has been shown to increase the perceived richness and usefulness of CMC as a communication medium (Huang et al., 2008). Very

few studies have been conducted on the impact of emoticons on message interpretation. However, what little research has been done suggests that emoticons do impact people's interpretation of messages in CMC (Derks, Bos et al., 2008; Ip, 2002; Lo, 2008; Walther & D'Addario, 2001). For example, in a study by Lo (2008), participants were more likely to misinterpret messages when they viewed these without emoticons. When emoticons were included, readers more accurately interpreted both the level and the direction of the intended emotion of a message. There is some evidence to suggest that positive emoticons (e.g. ':') may be more successful at modifying the perceived tone of messages than negative emoticons (Ip, 2002).

Importantly, the extant studies of emoticons have mostly examined the impact of these cues on the interpretation of negatively and positively valenced messages, and not ambiguous messages (Ip, 2002; Lo, 2008; Walther & D'Addario, 2001). Emoticons may serve a particularly important function in disambiguating the tone of ambiguous messages. For example, a positively valenced emoticon, such as “ :) ”, may help determine that an otherwise ambiguous message is intended to carry a positive tone. Only one study to date has examined this hypothesis: Derks, Bos and colleagues (2008) reported that participants rated neutral messages as more positive when accompanied by a smiling emoticon. However, the effect of emoticons on ambiguous message interpretation remains understudied, and their impact on interpretation for socially anxious individuals in particular is as yet unknown.

Overview of Present Research

The purpose of the present research was to investigate the phenomenon of interpretation bias in the novel context of CMC. Three studies were conducted. The goal

of Study 1 was to develop and validate a vignette protocol to measure interpretation bias in CMC. Items were created and refined in collaboration with two focus groups, and a pilot study was conducted to examine the factor structure, psychometric properties, and validity of the new measure. In Study 2, this protocol was modified to compare the effect of positive emoticons, an electronic form of nonverbal communication, on message interpretation in young adults with high, moderate, and low levels of social anxiety symptoms. This study provided further evidence for interpretation bias in CMC, and examined the effect of positive nonverbal cues on this interpretation bias. Finally, Study 3 examined the combined effects of the gender of message recipient and sender on message interpretation, both in general and in interaction with social anxiety symptoms. This study tested the hypothesis that messages from opposite-gender peers would be more likely to elicit interpretation bias among heterosexual young adults.

Study 1 – Measure Development

Traditionally, interpretation biases are studied in face-to-face contexts (e.g., in vivo) or by using hypothetical vignettes or sentences describing face-to-face situations. Using these methodologies, social anxiety has been associated with negatively biased interpretation of ambiguous situations, both in clinical and unselected samples (e.g., Amir et al., 1998; Amir et al., 2005; Beard & Amir, 2009, 2010; Huppert et al., 2003; Kanai et al. 2010; Miers et al., 2008; Stopa & Clark, 2000). It was unknown whether social anxiety would be associated with a similar bias in computer-mediated contexts.

Evidence suggests that certain features of CMC may serve to alleviate some aspects of social anxiety. For example, the anonymity and asynchronicity of CMC seem to decrease the self-presentational concerns associated with social anxiety (e.g., Brunet &

Schmidt, 2007; Roberts et al., 2000; Shepherd & Edelmann, 2005; Stritzke et al., 2004; Valkenburg & Peter, 2007, 2011). However, all of the studies reviewed have focused on socially anxious individuals' *output* via CMC (e.g., self-disclosure), with little work examining socially anxious individuals' perceptions of the messages they receive during computer-mediated social interactions. Specifically, the ways in which cognitive biases may impact socially anxious individuals' interpretations of electronic messages remain virtually unexplored.

The ambiguity inherent in CMC, due to its relative lack of cues to emotional tone, seems to be of a different type than that in face-to-face situations. Moreover, there is some evidence to suggest that nonanxious individuals tend to interpret messages more negatively when relayed via CMC (Byron, 2008; Kruger et al., 2005). Therefore, it was unknown whether more socially anxious individuals would show a bias relative to nonanxious individuals in such contexts.

The primary goal of Study 1 was to develop and validate a vignette protocol to measure interpretation bias in the context of CMC. As the most popular form of CMC among youth, text messaging was chosen as the medium in which to study this question.

To establish the validity of the new vignette measure, scores on this measure were compared with existing measures of interpretation bias in face-to-face situations. It was expected that the tendency to interpret ambiguous text messages in a negative manner would be associated with a similar tendency toward negative interpretation bias in face-to-face contexts. Similarly, it was hypothesized that lower benign interpretations of text messages would be associated with decreased tendency to make benign interpretations of face-to-face situations. The new vignette measure of interpretation bias in CMC was also

expected to correlate with social anxiety symptoms, and, to a lesser extent, with depressive symptoms. Analyses regarding gender were more exploratory in nature. However, in line with research suggesting that the cognitive biases associated with anxiety may be more pronounced among females (Cannon & Weems, 2011; Miers et al., 2008), and that social anxiety is more prevalent among girls and women (Essau et al., 1999; Wittchen et al., 1999), females were expected to have higher social anxiety symptoms, and be more likely to endorse negative interpretations (and less likely to endorse benign interpretations) of the vignettes.

Method

Procedure

Participants were recruited during the summer term of 2012 using the Carleton undergraduate participant pool (SONA), and were offered .5% in a psychology course for their participation. The study was conducted online using *SurveyMonkey*. After providing informed consent (See APPENDIX A), they completed a short demographic questionnaire including questions about their gender, ethnicity, parents' highest level of educational attainment (as a proxy for socioeconomic status), as well as typical use of text messaging (see APPENDIX B). After completing the study, participants viewed a debriefing form (see APPENDIX C) explaining the purpose of the study.

Participants

Participants were $N = 215$ undergraduate students (53 male), 19-25 years old ($M = 20.67$, $SD = 1.86$) recruited via the SONA system. Participants were predominantly Caucasian (56%) with a variety of other ethnicities represented (20% Asian, 10% Black, 7% Middle Eastern, 4% Hispanic, 3% South Asian). Fifty-two percent of participants

indicated that at least one parent had completed a university degree or higher. Seventy-six percent of the sample reported English as their first language. Participants whose first language was not English did not differ from native speakers on any study variables.

With respect to technology usage, 99.5% of participants reported owning a phone with texting capabilities. An overwhelming majority of participants (92%) reported using text messaging “several times a day”; 3% of participants reported using text messaging “once a day”, 4% a few times a week, and a cumulative 1.4% reported texting “a few times a month” or “almost never”. Twenty-eight percent of respondents reported using text messaging for greater than 4 hours per occasion, 12% reported between 3 and 4 hours per occasion, 25% reported 1-2 hours of texting per occasion, and the remainder (36%) reported 1 hour or less per occasion.

Measures

Interpretation bias in computer-mediated communication (IB-CMC). Based on measures of interpretation bias in face-to-face contexts (Amir et al., 1998; Miers et al., 2008; Stopa & Clark, 2000), 24 vignettes were created describing common social scenarios taking place via text message (see Appendix D). The vignettes were created in consultation with two separate focus groups. The first focus group consisted of 23 psychology undergraduates. The group was asked to generate and discuss plausible situations in which a text message might be interpreted in multiple ways. The items generated from this focus group were then presented to a second group consisting of 7 graduate and senior undergraduate psychology students. This focus group was asked to comment on the ambiguity of the scenarios, the plausibility of the two interpretations,

and the wording of the scenarios and interpretations. Items were refined based on feedback from this second focus group.

Each vignette included a screen image of a hypothetical text message received from a friend (see Figure 1). In each case, the intent of the sender was ambiguous. After each vignette, participants were presented with two possible interpretations of the sender's intention: one negative and one benign interpretation. Participants were asked to rate the likelihood of each of these interpretations coming to mind on a 5-point scale (from 1 "Does not come to mind" to 5 "Definitely comes to mind"), yielding separate scores for *negative* and *benign* interpretations, in line with previous research (Constans et al., 1999; Huppert et al., 2003; Miers et al., 2008). Participants also rated the realism of each scenario on a 5-point scale (from 1 "very unrealistic" to 5 "very realistic"). Half (12) of the vignettes described a text message sent from a male friend, and half described the message as coming from a female friend. Vignettes were divided into two blocks of 12, and presentation was counterbalanced such that for half of the participants, Block A described a female sender, and for the other half, Block B described a female sender. Items from both blocks were mixed in the order of presentation.

Interpretation bias in face-to-face contexts. Participants' interpretation bias in face-to-face contexts was assessed using two measures. The *Ambiguous Social Situations Interpretation Questionnaire* (ASSIQ; Stopa & Clark, 2000; see APPENDIX E) is a 24-item measure which assesses negative interpretation bias in 14 social situations (e.g., "you have visitors over for a meal and they leave sooner than you expected") and 10 non-social control situations (e.g., "you have a sudden pain in your stomach"). Each situation is followed by three alternative explanations – one negative, and two benign. For



Figure 1. Example vignette, IB-CMC.

example, for the above social situation, a negative interpretation is “they were bored and did not enjoy their visit”, and the two neutral interpretations are “they did not wish to outstay their welcome” and “they had another pressing engagement to go to”. Participants were asked to rank-order the interpretations in terms of the extent to which they would be likely to come to mind. A score of 3, 2, or 1 was assigned based on whether the negative interpretation was ranked first, second, or third. Scores for social items were summed to create a total negative bias score, with higher scores corresponding to higher rankings of the negative interpretations. This measure has been used to measure social interpretation bias in clinical and community samples (Bowler et al., 2012; Stopa & Clark, 2000). Rankings of the negative interpretations demonstrated good internal consistency in the present sample, $\alpha = .84$.

The *Adolescent Interpretation Bias Questionnaire* (AIBQ, Miers et al., 2008; see APPENDIX F) is a 10-item vignette measure assessing interpretation bias using 5 ambiguous social situations (e.g., “Two classmates, who are standing talking to each other, look at you”) and 5 non-social control situations (e.g., “Suddenly, you feel really sick”). Each vignette is followed by three possible interpretations – one negative (e.g., “They’re gossiping about me”), one neutral (e.g., “They just happen to be looking in my direction”), and one positive (e.g., “They like me and want me to go over to join them”). Participants were asked to rate the likelihood, on a 5-point scale, of each interpretation coming to mind (from 1: “does not come to mind” to 5: “definitely comes to mind”). This measure has demonstrated good reliability in previous research, and has been shown to discriminate between adolescents with high and low social anxiety symptoms (Miers et al., 2008) and between developmental trajectories of social anxiety across adolescence

and emerging adulthood (Miers, Blöte, de Rooij, Bokhorst, & Westenberg, 2013). Scores for the negative interpretations of social situations were averaged to create a negative interpretations subscale ($\alpha = .74$). Scores on the neutral and positive interpretations were averaged to create a benign interpretations subscale ($\alpha = .76$).

Social anxiety symptoms. Participants' social anxiety symptoms were assessed using the *Social Interaction Anxiety Scale* (SIAS, Mattick & Clarke, 1998; see APPENDIX G). The SIAS is a 20-item measure designed to assess anxiety in a variety of social situations (e.g., "I find it difficult to disagree with another's point of view"; "I have difficulty making eye contact with others"). Each item was rated on a 5-point Likert-type scale (0 = "not at all", 4 = "extremely"). Items were summed to create a total social anxiety score.

Together with its sister measure, the *Social Phobia Scale* (SPS; Mattick & Clarke, 1998), the SIAS is one of the most widely used self-report measures of social anxiety. Whereas the SPS was specifically developed for measuring anxiety in clinically diagnosed populations, the SIAS is often used to measure social interaction fears in the general population (Heidenreich, Schermelleh-Engel, Schramm, Hofmann, & Stangier, 2011; Kupper & Denollet, 2012).

Research has demonstrated support for the reliability and validity of the SIAS. The scale shows high internal consistency, and good test-retest reliability (Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992; Mattick & Clarke, 1998). The SIAS also shows good validity, converging with other measures of social anxiety (Brown et al., 1997). This measure has been used previously to assess subclinical levels of social anxiety in college students, and has shown good psychometric properties in such samples (Heimberg et al.,

1992; Mattick & Clarke, 1998; Vassilopoulos & Banerjee, 2010). The SIAS showed excellent internal consistency in the present sample, $\alpha = .94$.

Depressive symptoms. Participants' depressive symptoms were measured using the Center for Epidemiologic Studies Depression scale (CES-D, Radloff, 1977; see APPENDIX H). The CES-D is a 20-item measure designed to assess symptoms of depression in the general population. Participants were asked to indicate how often they had experienced each symptom (e.g. "I could not get 'going'"; "I thought my life had been a failure") during the past week. Items were rated on a 4-point scale, from 0 ("rarely or none of the time; less than one day") to 3 ("most or all of the time; 5-7 days"). Item scores were summed to create a total score for depressive symptoms. The CES-D showed excellent internal consistency in the present sample, $\alpha = .92$.

Results

Preliminary Analyses

Based on examination of Z-scores, no items were identified as univariate outliers on the SIAS, CES-D, negative interpretations, or benign interpretations. Examination of Mahalanobis distance to centroid, Cook's D, and Leverage raised concern for several multivariate outliers and influential cases. However, deleting these cases did not significantly alter the pattern of results. Therefore, results are presented with these cases included in the analyses. Descriptive statistics for all study variables are provided in Table 1.

Psychometric Properties of the IB-CMC

Item analysis. Vignettes had mean ratings of realism between 2.94 (item 1; $SD = 1.34$) and 4.06 (item 14, $SD = .99$) on a 5-point scale, where 3 was labeled "realistic".

Table 1. Descriptive statistics for study variables (excluding IB-CMC)

	Range	Mean	Standard Deviation
Social Anxiety	0 – 74	24.29	15.48
Depressive Symptoms	0 – 53	16.59	10.91
AIBQ – Negative Interpretations	1.00 – 4.80	2.85	0.65
AIBQ – Benign Interpretations	1.11 – 4.70	3.42	0.50
ASSIQ	1.38 – 2.96	2.42	0.34

Therefore, all vignettes were considered sufficiently realistic. With the exception of one item (item 24; mean = 1.95) ratings of the negative interpretations had means between 2.00 and 4.00. Standard deviations ranged between 1.02 (item 24) and 1.56. Six items showed considerable skewness (items 2, 8, 14, 15, 22, and 24). However, when item scores were averaged, mean scores were normally distributed. Mean ratings of benign interpretations ranged from 2.48 (item 5) to 4.4 (item 22). Standard deviations ranged between .89 (item 22) and 1.42 (item 2). Therefore, the variability of all items was deemed sufficient (Clark & Watson, 1995).

Factor analysis. Exploratory factor analysis was conducted on the ratings of negative and benign interpretations using principal axis factoring with an Oblimin rotation. Tests indicated excellent sampling adequacy (KMO = .833) and sphericity ($\chi^2 = 1145$; $\alpha < .001$), indicating that the data was factorable. Based on the factor loadings and examination of the Scree Plot, two factors were retained. Together, these factors accounted for 22% of the total variance. Factor loadings are displayed in Table 2. With the exception of two items (item 15, .13; and item 24, .25), ratings of negative interpretations loaded on a single factor (e.g., loadings above .32, Tabachnik & Fidel, 2007), with eigenvalue = 7.29. This factor, labeled “negative interpretations”, accounted for 13.6% of the total variance. With the exception of 3 items (item 2, .11; item 3, .20, and item 4, .19), ratings of benign interpretations loaded on a second factor (Eigenvalue = 4.9). Item 15 also cross-loaded on Factor 1 (.30). This second factor, labeled “benign interpretations”, accounted for 8.7% of the total variance. The two factors were significantly and negatively correlated ($r = -.18$, $p < .01$).

Table 2. Factor loadings for principal axis factoring of 24 negative and 24 benign interpretations of vignettes on the IB-CMC, with Oblimin rotation.

Item	Factor 1- Negative Interpretations	Factor 2- Benign Interpretations
19 – doesn't want to talk	.61	
5 – doesn't like my advice	.61	
16 – mad at me	.56	
11 – brushing me off	.53	
7 – didn't like my presentation	.51	
8 – something embarrassing I did	.50	
20 – doesn't really care	.50	
23 – mad at me	.50	
13 – doesn't want me to bring someone	.49	
21 – doesn't want to hang out	.48	
18 – doesn't want to have dinner	.47	
10 – doesn't want to hang out	.47	
6 – friend is being sarcastic	.46	
3 – making fun of my photo	.46	
4 – doesn't want to hang out	.44	
12 – mad at me	.43	
17 – doesn't want to see me	.42	
1 – doesn't want to sit with me	.41	
2 – something bad to tell me	.38	
22 – doesn't want to talk	.34	
9 – didn't want to respond to me	.34	
14 – doesn't want to hang out	.44	
24 – doesn't want me to copy notes		
15 – doesn't want me to join		
14 – doesn't mind what we do		.67

Table 2 (continued)	Factor 1 – Negative Interpretations	Factor 2 – Benign Interpretations
24 – doesn't mind lending		.59
11 – though my text was funny		.58
16 – understands I couldn't make it		.54
23 – understands I had to cancel		.54
20 – is happy for me		.54
22 – is busy right now		.52
13 – it's OK if I bring someone		.50
6 – thinks it is interesting		.50
19 – is busy but will talk later		.49
10 – inviting me to join		.48
17 – will be happy to see me		.45
21 – has to check schedule		.44
15 – wants me to join them	.30	.43
7 – liked my presentation		.41
8 – something funny happened		.40
18 – wants to have dinner with me		.40
9 – did not get my message		.40
5 – my advice is good		.37
1 – telling me so I can find him/her		.35
12 – excited to finish project		.33
3 – likes my photo		
4 – wants me to come to the party		
2 – something exciting to tell me		

Note: to ease interpretation, loadings below .30 are suppressed

Although the sample size was smaller than recommended for factor analysis (Tabachnick & Fidell, 2007), Guadagnoli and Velicer (1988; as cited in Field, 2005) argue that a factor result may be deemed reliable if greater than 10 loadings in excess of .40 are found using a sample size of 150. As this was the case in the present study, the result of the factor analysis was deemed reliable.

Since the primary focus of the present study was on individuals' negative interpretations, the loadings on the negative interpretations subscale were given priority when refining the items. Based on these loadings, items 15 and 24 were omitted from further analyses, as well as from future versions of the measure. Based on the 22 retained items, both subscales showed good internal consistency, with $\alpha = .86$ for negative and $\alpha = .85$ for benign interpretations.

Validity of the IB-CMC

Correlations among all study variables are displayed in Table 3. Notably, the measures of interpretation bias in face-to-face contexts were correlated with one another, as well as with symptoms of social anxiety and depression, and social anxiety was correlated with depressive symptoms.

Negative interpretations. Ratings of negative interpretations of the vignettes were significantly correlated, in the expected directions, with measures of interpretation bias in face-to-face situations (see Table 3). Ratings of negative interpretations of the IB-CMC were significantly positively correlated with ratings of negative interpretations on the AIBQ. Fisher's r to Z transformation indicated that the IB-CMC correlated more strongly with the *social* situations than the *non-social* control situations on the AIBQ ($r =$ Table 3. Correlations among study variables.

	2	3	4	5	6	7
1 – IB-CMC: Negative interpretations	-.19**	.46**	-.03	.40**	.14*	.18**
2 – IB-CMC: Benign interpretations	-	-.19**	.38**	-.41**	-.10	-.18**
3 – AIBQ negative		-	-.15*	.53**	.43**	.35**
4 – AIBQ benign			-	-.33**	-.20**	-.16*
5 – ASSIQ				-	.34**	.22**
6 – Social Anxiety Symptoms					-	.52**
7 – Depressive Symptoms						-

** p < .01 * p < .05

IB-CMC – Interpretation Bias in Computer-Mediated Communication

AIBQ – Adolescent Interpretation Bias Questionnaire (Miers et al., 2008)

ASSIQ- Ambiguous Social Situations Interpretation Questionnaire (Stopa & Clark, 2000)

.46 vs. .27, respectively; $Z = 2.22, p < .05$). Ratings of negative interpretations of the vignettes were negatively correlated with rankings of negative interpretations on the ASSIQ. Again, the IB-CMC correlated more strongly with the social situations than the non-social control situations ($r = .40$ vs. $.25$, respectively; $p < .001$; $Z = 1.70, p < .05$). Ratings of negative interpretations on the IB-CMC were also significantly and positively correlated with participants' social anxiety symptoms ($r = .14, p < .05$) and depressive symptoms ($r = .19, p < .05$).

Benign interpretations. Ratings of benign interpretations on the IB-CMC were correlated in the expected directions with the other measures of interpretation bias (Table 1). Correlation with the social situations on the ASSIQ was higher than with the non-social control situations ($r = -.42$ v. $-.22, Z = 2.23, p < .05$). Ratings of benign interpretations were significantly negatively correlated with participants' depressive symptoms, but not social anxiety symptoms.

Gender Differences

Twelve participants did not indicate their gender. Therefore, analyses involving gender were conducted using a subset of $n = 203$ participants (53 male, 150 female). Independent-samples t -tests revealed no gender differences in mean anxiety symptoms ($t(201) = .92, p = .36$), depressive symptoms ($t(201) = -.07, p = .95$), ratings of negative interpretations on the IB-CMC ($t(201) = .44, p = .22$), ratings of benign interpretations on the IB-CMC ($t(201) = .25, p = .55$), or ratings of realism for the IB-CMC ($t(201) = .80, p = .43$). Likewise, no gender differences were found for negative ($t(201) = .34, p = .49$) and benign interpretations ($t(201) = -.95, p = .35$) on the AIBQ, or for rankings on the ASSIQ ($t(201) = -.35, p = .73$).

Hierarchical regression analysis was conducted to examine the interactive effect of social anxiety and gender on negative and benign interpretations on the IB-CMC. Results indicated a significant main effect of anxiety on negative interpretations ($\beta = .16, p < .05$), as well as a significant interaction between anxiety and gender ($\beta = .38, p < .05$). The main effect of gender was not significant ($\beta = .09, p = .17$). Follow-up simple slopes analysis indicated that among women, increasing social anxiety was associated with stronger endorsement of negative interpretations. Among men, this association was attenuated (see Figure 2). Neither social anxiety ($\beta = -.25, p = .09$), gender ($\beta = -.05, p = .51$), nor their interaction significantly predicted ratings of benign interpretations ($\beta = .15, p = .34$).

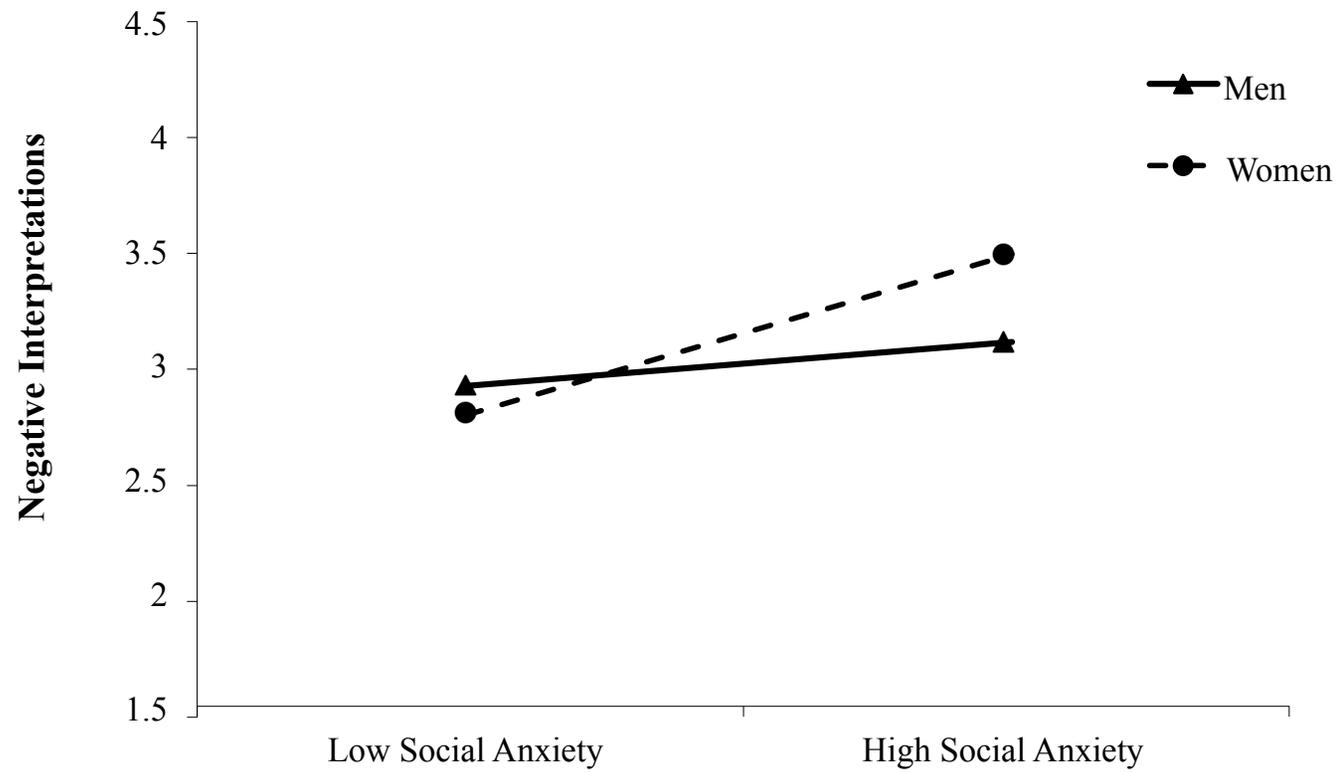


Figure 2. Two-way interaction between social anxiety and participant gender to predict ratings of negative interpretations.

Discussion – Study 1

The primary aim of Study 1 was to develop and validate a vignette protocol for assessing interpretation bias in computer-mediated contexts. Results provided preliminary evidence for the reliability and validity of the IB-CMC as a measure of interpretation bias in CMC. Overall, results indicated support for the existence of interpretation biases in this context, as social anxiety was related to a tendency to endorse negative interpretations of ambiguous text messages. Results also suggested a possible gender difference in this association, with interpretation bias being more pronounced among women than men.

Psychometric Properties

The vignettes created for this study were based on established measures of interpretation bias in face-to-face situations (Amir et al., 1998; Miers et al., 2008; Stopa & Clark, 2000), and were refined based on consultation with a series of focus groups to ensure ecological validity. Results regarding realism support the ecological validity of the vignettes, suggesting that to university undergraduates, these vignettes represented *realistic* social situations occurring via text message. The variability in endorsements of negative and benign interpretations suggests that these situations are in fact ambiguous, that is, that each vignette may be interpreted more negatively or more positively by one individual than another.

Results from factor analysis were used to refine the measure by removing items that did not cluster well with the rest of the scale. Negative and benign interpretations loaded on separate, modestly correlated factors, suggesting that these represent separate constructs, rather than opposite extremes of a single continuum. This suggests that the

tendency to endorse negative interpretations of ambiguous texts does not entirely preclude the possibility of positive interpretations also coming to mind. This finding supports the theoretical distinction between negative interpretation bias characteristic of social anxiety and the positive interpretation bias present in the general population (Amir et al., 2012; Hirsch & Clark, 2004; Murphy et al., 2007).

Results indicated good internal consistency for both the negative and benign interpretations subscales. This provides evidence that the tendency to endorse negative and benign interpretations of the vignettes are dimensions on which individuals vary in predictable ways – a more negative interpretation of any one vignette is associated with negative interpretations on all other vignettes.

Evidence of Validity

The new vignettes demonstrated good *construct* validity, correlating significantly with two separate established measures of interpretation bias in face-to-face situations. As expected, ratings of negative interpretations on the IB-CMC correlated with the negative interpretations subscale of the AIBQ, as well as with the ASSIQ. Benign interpretations on the IB-CMC were likewise correlated with the benign interpretations subscale of the AIBQ, as well as with the ASSIQ. These findings indicate that interpretation bias in face-to-face situations is predictive of a tendency to interpret ambiguous text messages in a negative manner, providing important evidence for the existence of interpretation bias in computer-mediated contexts.

Moreover, interpretations of the CMC vignettes were more strongly related to vignettes describing face-to-face social situations than nonsocial situations. Previous research in face-to-face contexts suggests that the interpretation bias characteristic of

social anxiety may be specific to social events (Amir et al., 1998; Kanai et al., 2010; Miers et al., 2008). The IB-CMC did not include ambiguous nonsocial situations. This is because the medium of text messaging seems inherently social - it is difficult to conceive of a nonsocial situation that might arise via text message. Nonetheless, the stronger associations with the social subscales of the face-to-face measures (AIBQ, ASSIQ) lends confidence that the construct being measured is indeed a *social* interpretation bias, rather than a more general threat perception bias.

As evidence of convergent validity, endorsement of negative interpretations on the IB-CMC was positively related to symptoms of social anxiety. This suggests that socially anxious individuals (who report symptoms of anxiety in face-to-face social situations) are indeed biased towards negative interpretations of ambiguous social situations occurring via CMC. This extends the findings of previous studies (e.g., Amir et al., 1998; Beard & Amir, 2009; Huppert et al., 2003; Kanai et al. 2010; Stopa & Clark, 2000) demonstrating an association between social anxiety and negative interpretation bias in face-to-face situations.

Several authors have suggested that in addition to holding a negative interpretation bias, socially anxious individuals lack the *positive* interpretation bias characteristic of nonanxious individuals (Amir et al., 2012; Beard & Amir, 2009). Interestingly, endorsement of benign interpretations on the IB-CMC was not significantly related to social anxiety symptoms in the present study. One reason for this discrepancy may be that previous studies reporting this finding were conducted with samples selected either for clinical SAD (Amir et al., 2012) or self-identified social anxiety (Beard & Amir,

2009). In contrast, the present study was conducted with an unselected sample of university undergraduates, and utilized a continuous measure of social anxiety symptoms.

Another possibility is that unlike in face-to-face contexts, in the context of computer-mediated communication, nonanxious individuals do not hold a positivity bias for ambiguous information. In support of this explanation, it has been suggested that people generally are less likely to make positive inferences about the tone of messages when they are communicated via CMC versus in person (Byron, 2008; Okdie et al., 2011). A final possible explanation for this discrepancy is that the vignette measure was refined based on criteria for the negative interpretations subscale (i.e., factor loadings), and may therefore not be as robust a measure of benign interpretations. However, the benign interpretations subscale showed good internal consistency, lending confidence in its utility as a measure of the construct. Follow-up studies attempted to provide further clarification of the relations between social anxiety and benign interpretations in computer-mediated contexts.

Participants' depressive symptoms were also positively related to ratings of negative interpretations, and negatively related to ratings of benign interpretations on the IB-CMC. This finding is perhaps not surprising, since depression is also associated with distorted cognitive processes (Voncken et al., 2007). In both clinical and community samples, anxious and depressive symptoms often co-occur (Chartier, Walker, & Stein, 2003). In line with this research, symptoms of depression and social anxiety were strongly correlated in the present sample. The cognitive biases associated with anxiety and depression also seem to share a good deal of overlap (Alden, Bieling, & Meleshko, 1995; Trew & Alden, 2009; Voncken et al., 2007). Depression is associated with negative

cognitions, such as more negative views of the self, the world, and the future (i.e., *cognitive triad*, Beck, 1976), which are similar to the negative views of the self and one's performance experienced by socially anxious individuals (Rapee & Heimberg, 1997).

Some authors have reported that content-specific biases for *social* events, specifically, discriminate between social anxiety and depressive symptoms (Amir et al. 2005; Voncken et al. 2007). However, this did not seem to be the case in the present sample. The IB-CMC did not include any ambiguous non-social situations – therefore, associations of social and non-social situations with depression and social anxiety could not be compared. It is possible that interpretation bias in non-social situations would have been more strongly associated with depression than social anxiety, as has been described in previous research (Voncken et al., 2007). Future researchers may wish to consider the use of non-social CMC messages (e.g., automated emergency texts, messages from service providers) as a separate subscale. In the present sample, depressive symptoms were also associated with measures of interpretation bias in face-to-face contexts, which included non-social as well as social situations. In fact, associations with depressive symptoms were equally strong for social and nonsocial situations (data not shown). These results suggest that social interpretation bias, in either context, did not discriminate between depressive and anxious symptoms.

Role of Gender

It has been suggested that females are more sensitive to nonverbal communication, and thus more affected by its absence in CMC (Dennis, Kinney, & Hung, 1999). Therefore, the lack of a significant main effect of gender on interpretations in Study 1 was surprising. However, the relative lack of male participants may have played a role.

Notwithstanding, a significant interaction was found between participant gender and social anxiety in the prediction of negative interpretations. Anxiety was more strongly associated with endorsements of negative interpretations among women than men (Figure 2). This finding adds to the literature on interpretation bias in childhood and adolescence, which suggests that cognitive biases may be more pronounced among girls than boys (Cannon & Weems, 2011; Miers et al., 2008). This gender difference has not yet been demonstrated in adults, though most studies of interpretation bias in adulthood have not explicitly examined gender differences (Amir et al., 2012; Beard & Amir, 2009; 2010; Huppert et al., 2003; Kanai et al., 2010; Stopa & Clark, 2000). The effects of gender were examined in more detail in Study 2 and Study 3.

Study 2 – Emoticons: Text-based nonverbal cues to emotion

The hyperpersonal model suggests that CMC is far from the stark, impersonal medium it is made out to be, and that in fact, users take advantage of all available means to communicate more effectively (Carter, 2003; Walther, 1996; Walther & Parks, 2002; Whelan, Pexman, & Gill, 2009). Emoticons are a popular tool for increasing the richness of text messaging as a medium (Huang, 2008; Riva, 2002). Research on nonverbal cues to emotion in CMC suggests that emoticons do enhance the accuracy of recipients' interpretations of messages with greater emotional valence (Derks et al., 2008; Ip, 2002; Lo, 2008). However, the function of emoticons in messages in which the verbal content is ambiguous has rarely been studied.

Previous research suggests that the number of cues to emotion present in a communication medium increase its perceived warmth and lead to greater user satisfaction (Walther, 2011). According to Social Presence Theory (Short, Williams, & Christie, 1976) and Media Richness Theory (Daft & Lengel, 1986), these benefits are nonlinear – they depend heavily on the demands of the situation. Situations that are complex or ambiguous in nature are thought to benefit most from an increase in the richness of a medium (Walther, 2011).

Study 2 examined the effect of nonverbal cues to emotion by manipulating the vignettes to include positive emoticons (i.e., “:”) along with the text. It was hypothesized that overall, the addition of a positive emoticon would reduce the ambiguity of the message, leading to weaker endorsement of negative interpretations and stronger endorsement of benign interpretations. Another question of interest was whether emoticons would serve a similar disambiguating function for individuals higher and

lower in social anxiety. There is some evidence to suggest that socially anxious participants may ignore or discount positive social information (Alden et al., 2008; Vassilopoulos, 2006; Vassilopoulos & Banerjee, 2010). Therefore, it was hypothesized that the inclusion of emoticons would have a weaker effect on message interpretation in highly socially anxious participants (i.e., that emoticon presence and social anxiety would *interact*). Results from Study 2 help address the question of whether interpretation bias (i.e., a difference in message interpretation between anxious and nonanxious individuals) may be more pronounced in certain CMC contexts (i.e., when some ‘nonverbal’ cues are present).

A secondary aim of the study was to clarify the role of gender in the associations between social anxiety and message interpretation. Given the findings of Study 1, it was hypothesized that interpretation bias would again be more pronounced among female participants. Hypotheses regarding interactions between gender and emoticon were more tentative. However, given some evidence that women may be more sensitive to nonverbal social information than are men (Dennis et al., 1999), it was hypothesized that the disambiguating effect of emoticons on message interpretation would be particularly pronounced among female participants.

Method

Procedure

Participants were recruited using the Carleton undergraduate participant pool (SONA) in the fall term of 2012, and were offered .25% in a psychology course for their participation. Participants completed all questionnaires online, from any computer of their choosing. After providing informed consent, they completed a short demographic

questionnaire including questions about their gender, ethnicity, parents' highest level of educational attainment (as a proxy for socioeconomic status), as well as typical use of text messaging. After completing the study, participants viewed a debriefing form explaining the purpose of the study.

Participants

Participants were 219 undergraduate students (68 male, 151 female), between the ages of 18 and 25 years ($M_{\text{age}} = 19.78$, $SD = 1.78$). The sample was mostly Caucasian (72%), with a variety of other ethnicities represented (11% Asian, 8.5% Black, 4% Middle Eastern, 2.5% South Asian, 1.5% Hispanic, 1% Aboriginal). Eighty-two percent of participants listed English as their first language. Native English speakers did not differ from non-native speakers on any of the study variables. Fifty-one percent of participants indicated that at least one parent had completed a university degree or higher. With respect to technology use, 99% of the sample indicated that they owned a phone with texting capabilities.

A majority of participants (92.5%) indicated they used text messaging "several times per day"; 5% of participants reported using text messaging "once a day", 1% a few times a week, and a cumulative 1.5% reported texting "a few times a month" or "almost never". Twenty-eight percent of respondents reported using text messaging for greater than 4 hours per occasion, 20% reported between 3 and 4 hours per occasion, 27% reported 1-2 hours of texting per occasion, and the remainder (24%) reported 1 hour or less per occasion.

Measures

Social anxiety symptoms. As in Study 1, participants' social anxiety symptoms were measured using the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1999). For details about this measure, refer to Study 1. This measure demonstrated excellent internal consistency in the present sample, $\alpha = .95$.

IB-CMC. Participants were presented with a modified version of the new vignette measure of interpretation bias in computer-mediated contexts (IB-CMC) developed in Study 1. Half (11) of the vignettes were modified to include a positive 'smile' emoticon (" :) ") at the end of the message (see Figure 3). Vignettes were divided into two blocks of 11, and presentation was counterbalanced such that for half of the participants, Block A included emoticons and Block B did not, and for the other half of participants, Block B included emoticons and Block A did not. Items from both blocks were mixed in the order of presentation. As in Study 1, participants were presented with both a negative and a benign interpretation of each vignette, and asked to rate the likelihood of each coming to mind. Both the negative ($\alpha = .80$) and benign ($\alpha = .82$) subscales demonstrated good internal consistency in the present sample. Participants also rated the realism of each scenario on a 5-point scale (from 1 "very unrealistic" to 5 "very realistic").

Results

Preliminary Analyses

Based on examination of Z-scores, no items were identified as univariate outliers on the SIAS, negative interpretations, or benign interpretations. Examination of Mahalanobis distance to centroid, Cook's D, and Leverage raised concern for several multivariate outliers and influential cases. However, deleting these cases did not significantly alter the pattern of results. Therefore, results are presented with these cases included in the



Figure 3. Modified vignette including positive emoticon.

analyses. Participants' mean SIAS score was 27.61 ($SD = 16.48$). Scores did not differ between males ($M = 26.76$, $SD = 14.93$) and females ($M = 27.90$, $SD = 17.20$, $t(217) = -.48$, $p = .63$). Three groups were created based on SIAS scores. Participants with scores in the bottom 25% on the SIAS were considered to have 'low' social anxiety ($n = 58$, 18 male, 40 female; $M = 8.11$, $SD = 4.06$). Scores in the top 25% were considered 'high' ($n = 55$, 16 male, 39 female; $M = 49.78$, $SD = 8.60$). All other participants were placed in the 'average' social anxiety group ($n = 106$, 34 male, 72 female; $M = 26.47$, $SD = 7.48$). The observed gender distribution in each social anxiety group did not differ from expected values ($\chi^2 = .27$, $p = .87$).

Ratings of the vignettes' realism did not differ depending on Social Anxiety group ($F(2,213) = 1.66$, $p = .19$, partial $\eta^2 = .02$), or Gender ($F(1,213) = .07$, $p = .80$, partial $\eta^2 = .00$), but vignettes containing positive emoticons were rated as more realistic ($M = 3.55$, $SD = .74$) than vignettes without emoticons ($M = 3.41$, $SD = .78$; $F(1,213) = 12.66$, $p < .001$, partial $\eta^2 = .06$).

Negative Interpretations

A 3(Social Anxiety) X 2(Emoticon) X 2(Gender) mixed design ANOVA was conducted on participants' ratings of *negative* interpretations. Results indicated significant main effects of Social Anxiety ($F(2, 213) = 10.25$, $p < .001$, partial $\eta^2 = .09$), Emoticon ($F(1, 213) = 253.22$, $p < .001$, partial $\eta^2 = .55$), and Gender ($F(1, 213) = 7.10$, $p < .01$, partial $\eta^2 = .03$). Interactions between Social Anxiety and Gender ($F(2, 213) = 2.04$, $p = .13$, partial $\eta^2 = .02$), Social Anxiety and Emoticon ($F(2, 213) = 0.03$, $p = .96$, partial $\eta^2 = .00$), and Emoticon and Gender ($F(2, 213) = 0.56$, $p = .45$, partial $\eta^2 = .00$)

were not significant; nor was the three-way interaction between Gender, Emoticon, and Social Anxiety ($F(2, 213) = .731, p = .49, \text{partial } \eta^2 = .01$).

Overall, women rated messages as more negative ($M = 2.93, SE = .05$) than did men ($M = 2.70, SE = .07$), and participants rated negative interpretations more highly when emoticons were absent ($M = 3.29, SD = .72$) than when they were present ($M = 2.44, SD = .64$). As well, follow-up simple comparisons using Bonferonni adjustment indicated that participants in the high social anxiety group endorsed negative interpretations significantly more strongly ($M = 3.12, SE = .07$) than participants in the average anxiety group ($M = 2.86, SE = .05; p < .05$), who in turn endorsed more negative interpretations than the low anxiety group ($M = 2.59, SE = .07; p < .001$).

Benign Interpretations

A similar 3 x 2 x 2 ANOVA was conducted on participants' ratings of *benign* interpretations. Results indicated significant main effects of Social Anxiety ($F(2, 213) = 4.90, p < .01, \text{partial } \eta^2 = .04$) and Emoticon ($F(1, 213) = 178.40, p < .001, \text{partial } \eta^2 = .46$). The main effect of Gender was not significant ($F(1, 213) = 0.76, p = .38, \text{partial } \eta^2 = .00$). Follow-up simple comparisons using Bonferroni adjustment indicated that participants in the low social anxiety group endorsed the benign interpretations more strongly than did participants in the high anxiety group ($M = 3.60, SE = .08$ vs. $3.26, SE = .08, p < .01$).

In general, participants endorsed benign interpretations more strongly when a positive emoticon was present ($M = 3.75, SD = .60$) than when emoticons were absent ($M = 3.04, SD = .67$). However, this main effect was superseded by a significant Gender X Emoticon interaction ($F(1, 213) = 6.78, p < .05, \text{partial } \eta^2 = .03$). This interaction is

presented graphically in Figure 4. Follow-up simple effects analysis indicated that the simple effect of gender was significant in the no emoticon condition ($F(1, 213) = 4.91, p < .05, \text{partial } \eta^2 = .02$), but not in the emoticon condition ($F(1, 213) = 0.75, p = .39, \text{partial } \eta^2 = .00$). When messages did not include emoticons, men rated messages as more benign ($M = 3.20, SE = .08$) than did women ($M = 2.97, SE = .06$). When messages included a positive emoticon, men's ($M = 3.70, SE = .08$) and women's ($M = 3.78, SE = .05$) ratings of benign interpretations did not differ (Figure 4).

The interactions between Social Anxiety and Emoticon ($F(2, 213) = 0.23, p = .80, \text{partial } \eta^2 = .00$) and Gender and Social Anxiety ($F(2, 213) = 0.14, p = .87, \text{partial } \eta^2 = .00$) were not significant, nor was the three-way interaction between Social Anxiety, Emoticon, and Gender ($F(2, 213) = 1.98, p = .14, \text{partial } \eta^2 = .02$).

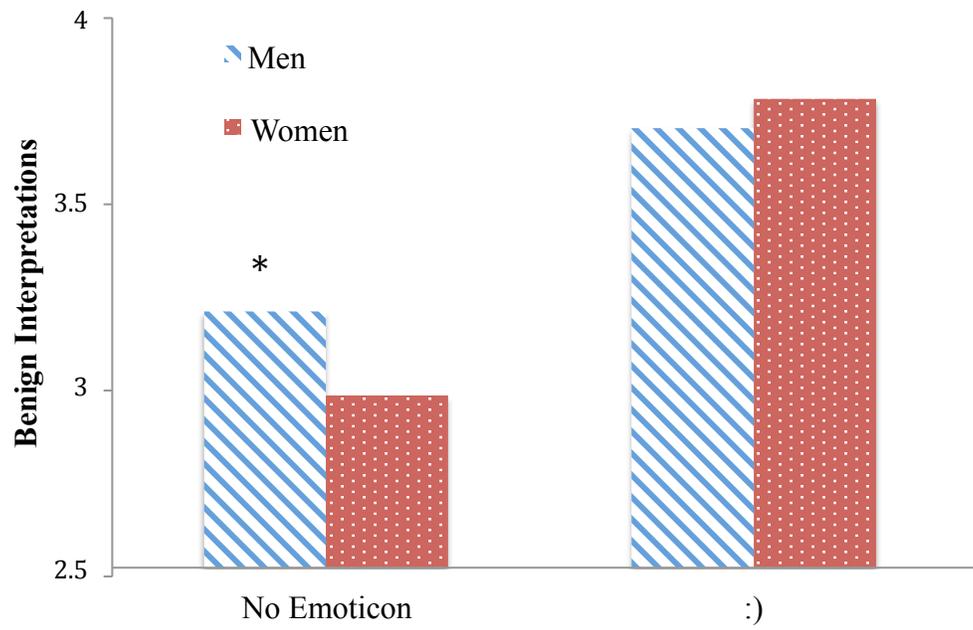


Figure 4. Interaction between emoticon and participant gender to predict ratings of benign interpretations.

Discussion – Study 2

The goal of Study 2 was to examine the effect of nonverbal cues to emotion in CMC (i.e., emoticons) on interpretation of ambiguous messages for socially anxious and nonanxious young adults. Overall, results provided further support for the existence of interpretation biases in CMC, as participants with higher levels of social anxiety were more likely to endorse negative interpretations (and less likely to endorse benign interpretations) of ambiguous text messages. Moreover, results also suggested that positive emoticons (‘:’) serve a disambiguating function for all users, independent of levels of social anxiety.

Psychometric Properties

Results indicated good internal consistency of both the negative and benign interpretations subscales of the IB-CMC, providing additional evidence for the reliability of this measure. The associations between social anxiety symptoms and negative and benign interpretations subscales on the IB-CMC also provide further support for the convergent validity of the measure.

Interpretation Bias in CMC Contexts

This study provided further support for the existence of interpretation biases in computer-mediated contexts for individuals with heightened symptoms of social anxiety. Participants with higher social anxiety symptoms were more likely to endorse negative interpretations of ambiguous text messages, extending the literature indicating that social anxiety is associated with more negative interpretations of ambiguous face-to-face situations (e.g. Amir et al., 1998, 2012; Beard & Amir, 2009; Huppert et al., 2003; Kanai et al., 2010; Stopa & Clark, 2000).

Interestingly, in contrast to Study 1, results from the present study also indicated that highly socially anxious participants were less likely to endorse *benign* interpretations of ambiguous messages than participants with low social anxiety. This provides some support for the theory that in addition to possessing a negative interpretation bias, socially anxious individuals also lack the positive interpretation bias characteristic of nonanxious individuals (Amir et al., 2012; Beard & Amir, 2009; Constans et al., 1999; Hirsch & Clark, 2004; Murphy et al., 2007). Study 3 attempted to further clarify the associations between social anxiety symptoms and benign interpretations in computer-mediated contexts.

Role of Emoticons

The primary objective of Study 2 was to examine the effect of emoticons on message interpretation, both in general and in relation to social anxiety symptoms. Results indicated that, as hypothesized, the addition of a *positive emoticon* to an otherwise ambiguous message did significantly impact upon participants' interpretations of the message. When a positive emoticon was present, participants were less likely to endorse negative interpretations and more likely to endorse benign interpretations. This result adds to the growing body of literature suggesting that emoticons are a useful tool for strengthening the emotional tone of a message (Derks et al., 2008; Ip, 2002; Lo, 2008). Importantly, these results extend this literature to ambiguous messages, suggesting that positive emoticons can also be used to disambiguate messages in which the emotional valence is otherwise unclear. Indeed, this is one of the first studies to demonstrate the disambiguating function of emoticons in otherwise ambiguous messages.

These results provide support for Media Richness Theory (Daft & Lengel, 1986), which posits that ambiguous situations benefit greatly from the increased richness of a medium (i.e., the addition of nonverbal cues to emotion). The findings are also consistent with the hyperpersonal model (Walther, 1996), which suggests that people can engage in effective and satisfying communication via CMC, provided they make use of the tools for increasing perceived social presence.

Interestingly, the effects of emoticon on message interpretation did not differ significantly as a function of participants' levels of social anxiety. This suggests that, contrary to hypotheses, emoticons serve a similar disambiguating function for *all* users, independent of symptoms of social anxiety. It has been suggested that socially anxious individuals may ignore or discount positive social information (Alden et al., 2008; Vassilopoulos & Banerjee, 2010). Results from this study indicate that this tendency may not apply to emoticons – perhaps because these are less subtle positive cues than the nonverbal cues present in face-to-face situations. It may be that real-world smiles and laughs are easier to miss – or misinterpret – than their digital counterparts. This notion will be considered further in the general discussion.

Gender differences. Results also revealed effects of gender on message interpretation. Overall, women in the present study rated messages more negatively than did men. However, women were neither more nor less likely than men to endorse benign interpretations of the vignettes overall. Rather, the effect of gender on benign interpretations seemed to depend on the presence or absence of emoticons. When emoticons were absent from messages, women endorsed fewer benign interpretations

than men did. In contrast, when positive emoticons were included, there was no significant difference in ratings of benign interpretations between genders.

In face-to-face situations, females tend to be more nonverbally expressive than males (Buck, Miller, & Caul, 1974; Burgoon & Dillman, 1995; Spangler, 1995), and seem to be better at decoding nonverbal cues to emotion (Briton & Hall, 1995; Dennis et al., 1999; LaFrance & Henley, 1994). It has been suggested that women may also be more sensitive to the presence of nonverbal cues online, and therefore more affected by their absence (Guagadno & Cialdini, 2007). However, this assertion has received little empirical support to date. There is also some evidence to suggest that women use emoticons more than men (Baron, 2004; Fox et al., 2007). For example, Tossell et al. (2012) reported that messages from females were about twice as likely to include an emoticon as messages from males. Women have also been found to use more exclamation marks in CMC (Waseleski, 2006). Like emoticons, these punctuation marks serve as markers of tone; they were most often used to modify the emotional tone of the message to connote friendliness. However, differences in the way men and women *interpret* emoticons have not been previously studied. The present results provided partial support for the hypothesis that women may indeed be more sensitive to nonverbal cues in CMC, and that the absence of emoticons and other cues may have a greater effect on women's interpretations of messages than on men's.

Contrary to hypotheses based on the results of Study 1, no significant interaction between gender and social anxiety in the prediction of message interpretation was found in Study 2. That is, highly socially anxious women did not demonstrate a more pronounced interpretation bias than highly anxious men in the present sample. This

finding runs counter to the suggestion that the cognitive biases associated with anxiety may be more pronounced among females (Cannon & Weems, 2011; Miers et al. 2008). One possibility is that the gender differences noted in Study 1 were an artifact, due to the unequal gender distribution of the sample. Alternately, the modest size of the effect may make it difficult to detect consistently. Study 3 attempted to provide further clarification of the effects of gender on message interpretation, both uniquely and in interaction with social anxiety. Moreover, in Study 3 the recruitment process was also altered in an attempt to equalize the gender distribution of the sample.

Study 3 – Effects of Participant and Sender Gender

Results from Studies 1 and 2 provided some evidence that men and women may interpret messages differently, at least under some circumstances. It has also been suggested that people's interpretation of electronic messages may depend on who the message is from. For example, a message from a close friend may be interpreted very differently than one from a recent acquaintance (Byron, 2008; Kruger et al., 2005). Therefore, it is plausible that other characteristics of the sender may influence a recipient's interpretation of the same ambiguous message. Moreover, the SIDE model (Spears & Lea, 1992) suggests that the visual anonymity inherent in CMC leads users to rely heavily on information about group membership cues when forming impressions about other users. Therefore, sender characteristics such as gender may be particularly salient in the CMC context.

Interactions with potential dating partners are particularly stressful for socially anxious individuals (Curran, 1977; Kessler, 2003; Wittchen & Fehm, 2003; Zimbardo, 1990). Measures of social anxiety often include questions about anxiety when interacting with members of the opposite gender (Caballo et al., 2008; Weiss et al., 2013), or require participants to interact in-vivo with an opposite-gender participant or confederate (e.g., Heinrichs & Hofmann, 2005), as such interactions are particularly likely to elicit anxiety. Given that the heterosocial context is particularly stressful for socially anxious individuals, interpretation bias may be more prominent in such situations. Indeed, there is some evidence to suggest that cognitive biases may be particularly likely to occur when interacting with a member of the opposite gender. In an early study of contextual differences in social anxiety, socially anxious participants reported more negative, and

fewer positive cognitions when interacting with a member of the opposite gender than with a member of the same gender (Turner, Beidel, & Larkin, 1986). Differences in interpretation of electronic messages in heterosocial contexts have not been explicitly studied. However, it is plausible that heterosexual socially anxious individuals may be more likely to interpret such messages negatively when coming from an opposite-gender sender.

The purpose of Study 3 was to more closely examine the effects of the gender of the message sender and recipient on message interpretation, both overall and in relation to recipients' social anxiety levels. In line with findings from Study 1 and Study 2, it was expected that women would interpret messages more negatively than men, and that anxious women would demonstrate a more pronounced interpretation bias than would anxious men (i.e., both unique and interactive effects of gender). With respect to the gender of the message sender, it was hypothesized that for individuals higher in social anxiety, messages from opposite-gender communication partners would be interpreted more negatively than messages from same-gender senders. It was anticipated that for less anxious participants, this effect would be attenuated (i.e., a three-way interaction).

Method

Procedure

Participants were recruited in the winter of 2013 using the Carleton undergraduate participant pool (SONA), and were offered .25% in a psychology course for their participation. In order to obtain a more equal gender distribution, enrollment was closed to females once 200 female participants had enrolled. Participants completed all questionnaires online from a computer of their choosing. After providing informed

consent, they completed a short demographic questionnaire including questions about their gender, orientation, ethnicity, parents' highest level of educational attainment (as a proxy for socioeconomic status), as well as typical use of text messaging. (APPENDIX B). After completing the study, participants viewed a debriefing form explaining the purpose of the study.

Participants

The original sample included $N = 381$ undergraduate students. Among these participants, $n=28$ (7%) reported a sexual orientation other than heterosexual. This relatively small sub-sample did not allow for results to be analyzed separately as a function of sexual orientation. Accordingly, these cases were excluded from subsequent analyses. The final sample consisted of $N = 353$ undergraduate students (159 male, 194 female), aged 17 – 25 ($M_{age} = 19.67$, $SD = 1.90$). Participants were primarily Caucasian (66.5%), with a variety of other ethnicities represented (10% Asian, 9% Middle Eastern, 5% South Asian, 4% Black, 2.5% Hispanic, 1.1% Aboriginal, 2% Other). Fifty percent of participants indicated that at least one parent had completed a university degree or higher. Eighty percent of the sample reported English as their first language. Participants whose first language was not English did not differ from native speakers on any study variables.

With respect to technology usage, 98% of participants reported owning a phone with texting capabilities. Again, the vast majority of participants (92%) reported using text messaging “several times a day”; 3% of participants reported using text messaging “once a day”, 3% a few times a week, and a cumulative 2% reported texting “a few times a month” or “almost never”. Twenty percent of respondents reported using text messaging for greater than 4 hours per occasion, 14% reported between 3 and 4 hours per

occasion, 30% reported 1-2 hours of texting per occasion, and the remainder (36%) reported 1 hour or less per occasion.

Measures

Social anxiety symptoms. As in previous studies, participants' social anxiety symptoms were measured using the SIAS. The measure showed good internal consistency in the present sample, $\alpha = .93$.

Vignettes. Participants were presented with a modified version of the vignettes developed in Study 1. Half (11) of the vignettes described a text message sent from a male friend, and half described the message as coming from a female friend. Vignettes were divided into two blocks of 11, and presentation was counterbalanced such that for half of the participants, Block A described a female sender, and for the other half, Block B described a female sender. Items from both blocks were mixed in the order of presentation. Both the negative ($\alpha = .85$) and benign ($\alpha = .82$) subscales again showed good internal consistency in the present sample. Participants also rated the realism of each scenario on a 5-point scale (from 1 "very unrealistic" to 5 "very realistic").

Results

Preliminary Analyses

Based on examination of Z-scores, no items were identified as univariate outliers on the SIAS, negative interpretations, or benign interpretations. Examination of Mahalanobis distance to centroid, Cook's D, and Leverage raised concern for several multivariate outliers and influential cases. However, deleting these cases did not significantly alter the pattern of results. Therefore, results are presented with these cases included in the analyses. Participants' mean SIAS score was 26.58 ($SD = 15.66$), and this did not differ

significantly for males ($M = 26.12$, $SD = 15.09$) and females ($M = 26.61$, $SD = 15.96$; $t(351) = -.30$, $p = .77$). As in Study 2, three groups were created based on SIAS scores. Participants with scores in the bottom 25% on the SIAS were considered to have ‘low’ social anxiety ($n = 90$, 41 male, 49 female; $M = 8.31$, $SD = 3.6$). Scores in the top 25% were considered ‘high’ ($n = 79$, 34 male, 45 female; $M = 48.79$, $SD = 7.74$). All other participants were placed in the ‘average’ social anxiety group ($n = 184$, 84 male, 100 female; $M = 25.71$, $SD = 7.26$). The observed gender distribution in each social anxiety group did not differ significantly from expected ($\chi^2 = .19$, $p = .91$). Messages’ perceived realism did not differ depending on participant Gender ($F(1,347) = .41$, $p = .53$, partial $\eta^2 = .00$), Sender Gender ($F(1,347) = 1.87$, $p = .17$, partial $\eta^2 = .01$) or Social Anxiety group ($F(2,347) = .13$, $p = .88$, partial $\eta^2 = .00$).

Negative Interpretations

A 3(Social Anxiety Group) x 2(Participant Gender) x 2(Message Sender Gender) mixed design ANOVA was conducted on participants’ ratings of *negative* interpretations of the IB-CMC. Results indicated significant main effects of Social Anxiety ($F(2, 347) = 8.45$, $p < .001$, partial $\eta^2 = .05$), Participant Gender ($F(1, 347) = 7.56$, $p < .01$, partial $\eta^2 = .02$), and Sender Gender ($F(1, 347) = 14.83$, $p < .001$, partial $\eta^2 = .04$),

Overall, participants in the high anxiety group rated messages as more negative ($M = 3.36$, $SE = .07$) than participants in the average ($M = 3.12$, $SE = .04$; $p < .001$) and low ($M = 2.99$, $SE = .06$; $p < .001$) anxiety groups. Females interpreted messages more negatively ($M = 3.25$, $SE = .04$) than did males ($M = 3.06$, $SE = .05$), and participants interpreted messages from female senders as more negative ($M = 3.19$, $SD = .67$) than messages from male senders ($M = 3.10$, $SD = .65$).

A significant interaction between Participant Gender and Sender Gender was also noted ($F(1, 347) = 32.24, p < .001, \text{partial } \eta^2 = .09$). The interactions between Social Anxiety Group and Participant Gender ($F(2, 347) = 1.03, p = .36, \text{partial } \eta^2 = .01$) and Social Anxiety Group and Sender Gender ($F(2, 347) = 1.80, p = .17, \text{partial } \eta^2 = .01$) were not significant. Finally, these effects were superseded by a significant 3-way interaction ($F(2, 347) = 4.16, p < .05, \text{partial } \eta^2 = .02$).

Relevant means for the 3-way interaction cells are displayed in Table 4. The three-way interaction was probed by examining the simple interaction effects at each level of Participant Gender. These interactions are presented graphically in Figures 5a and 5b. Results indicated that the interaction between Social Anxiety and Sender Gender was significant among males ($F(2, 156) = 3.39, p < .05, \text{partial } \eta^2 = .04$), but not among females ($F(2, 191) = 2.31, p = .10$). For males, the simple simple effects of Social Anxiety on responses to messages from male vs. female senders were then tested. When the text message was received from a male, males in the three social anxiety groups did not differ significantly in terms of their negative interpretations ($F(2, 156) = 1.10, p = .34$). In contrast, there was a significant simple simple effect of Social Anxiety on men's interpretations of messages from female senders ($F(2, 156) = 3.57, p < .05$). Post-hoc pairwise comparisons using Bonferroni adjustment for alpha inflation indicated that high anxious men interpreted messages from female senders more negatively than did low anxious men ($M = 3.35, SD = .62$ v. $3.02, SD = .67; p < .05$). Interpretations for the average anxiety group ($M = 3.26, SD = .57$) did not differ significantly from either the low ($p = .08$) or high ($p = 1.00$) anxiety groups (see Figure 5a).

Table 4. Mean ratings (standard deviations) of negative interpretations of vignettes from male and female senders among male and female participants in low, average, and high social anxiety groups.

	Male Participants		Female Participants	
	Male Sender	Female Sender	Male Sender	Female Sender
Low Anxiety	2.90 (.60)	3.02 (.67)	3.09 (.73)	3.03 (.79)
Average Anxiety	2.88 (.55)	3.27 (.58)	3.27 (.57)	3.13 (.60)
High Anxiety	3.04 (.68)	3.35 (.62)	3.50 (.58)	3.54 (.68)

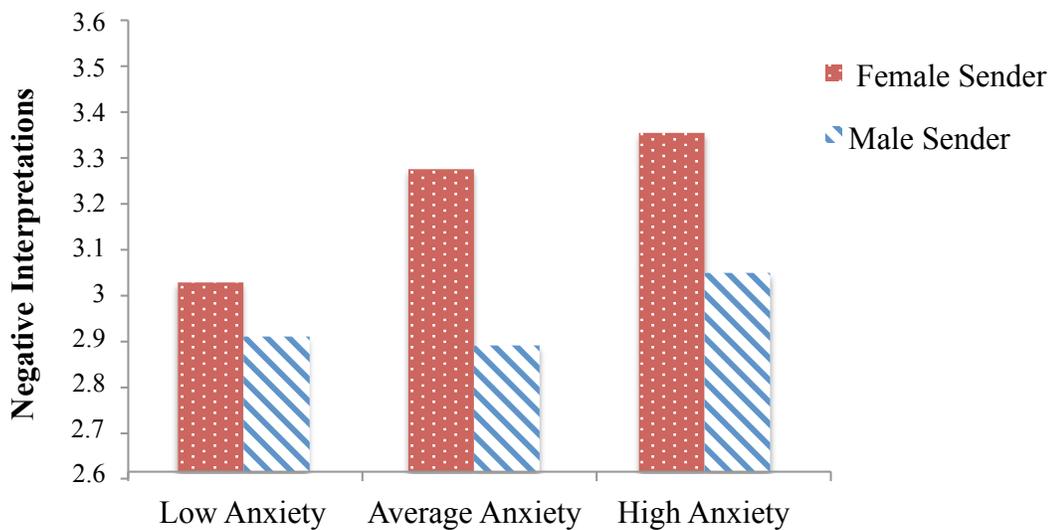


Figure 5a. Mean ratings of negative interpretations of vignettes from male and female senders among male participants in low, average, and high social anxiety groups (significant interaction).

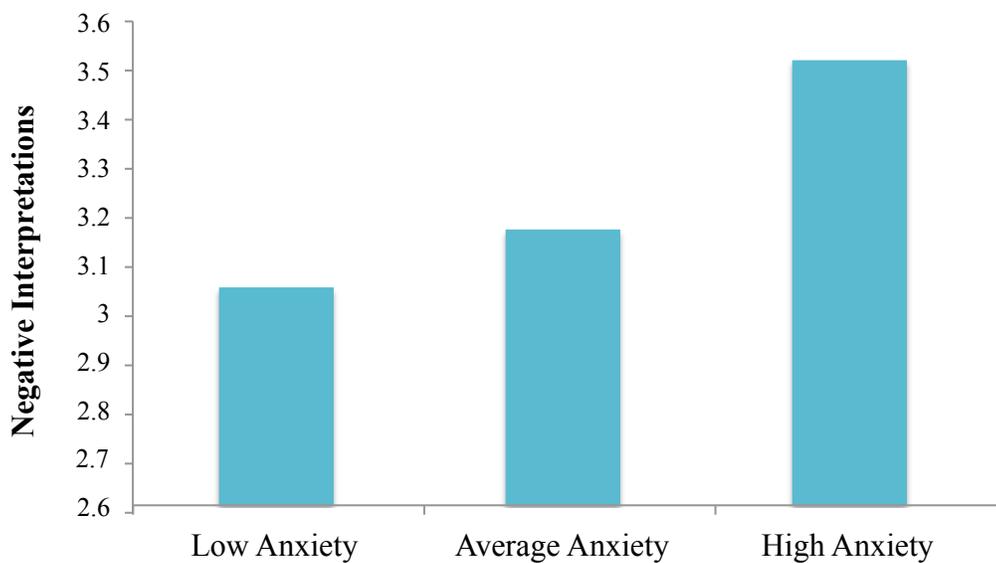


Figure 5b. Mean ratings of negative interpretations of vignettes among female participants in low, average, and high social anxiety groups (interaction with sender gender was not significant).

Among females, the simple main effect of social anxiety was significant ($F(2, 191) = 7.75, p < .01, \text{partial } \eta^2 = .08$). Post-hoc comparisons were conducted using Bonferroni adjustment for alpha inflation. Women in the high anxiety group had higher ratings of the negative interpretations than did women in the average anxiety ($M = 3.52, SE = .09$ vs. $3.17, .06; p < .01$) and low anxiety groups ($M = 3.05, SE = .08; p < .01$). Ratings did not differ significantly between the average and low anxiety groups ($p = .74$) (see Figure 5b).

To summarize, anxious men interpreted text messages sent from women more negatively than did low anxious men, but these groups did not differ in their negative interpretations when these messages were sent by other men. Anxious women were more likely to interpret texts negatively as compared to average and low-anxious women - and this pattern of results did not differ depending on whether the texts were sent by men or women.

Benign Interpretations

A similar 3(Social Anxiety) x 2(Participant Gender) x 2(Sender Gender) mixed design ANOVA was conducted on participants' ratings of benign interpretations of the vignettes. Results indicated significant main effects of Social Anxiety ($F(2, 347) = 8.63, p < .001, \text{partial } \eta^2 = .05$) and Sender Gender ($F(1, 347) = 13.23, p < .001, \text{partial } \eta^2 = .04$). The main effect of Participant Gender was not significant ($F(1, 347) = 0.307, p = .58, \text{partial } \eta^2 = .00$).

Post-hoc simple comparisons using Bonferroni adjustment indicated that participants in the low social anxiety group endorsed more benign interpretations ($M = 3.35, SE = .06$) than those in the average anxiety group ($M = 3.17, SE = .04; p < .05$),

who in turn interpreted messages as more benign than those in the high anxiety group ($M = 3.00$, $SE = .06$; $p < .05$).

Overall, participants interpreted messages from males as more benign ($M = 3.23$, $SE = .03$) than messages from females ($M = 3.13$, $SE = .04$). However, this main effect was superseded by a significant interaction between Participant Gender and Sender Gender ($F(1, 347) = 20.29$, $p < .001$, partial $\eta^2 = .06$). This interaction is presented graphically in Figure 6. Follow up simple effects analysis indicated a simple effect of Sender Gender on ratings of benign interpretations for men ($F(1, 347) = 29.87$, $p < .001$, partial $\eta^2 = .08$), but not women ($F(1, 347) = 0.42$, $p = .52$, partial $\eta^2 = .00$). Male participants rated benign interpretations more strongly when messages were from male senders ($M = 3.30$, $SD = .57$) than female senders ($M = 3.09$, $SD = .61$).

Interactions between Social Anxiety and Participant Gender ($F(2, 347) = 0.99$, $p = .37$, partial $\eta^2 = .01$) and Social Anxiety and Sender Gender ($F(2, 347) = 0.50$, $p = .60$, partial $\eta^2 = .00$) were not significant, nor was the three-way interaction between Social Anxiety, Participant Gender, and Sender Gender ($F(2, 347) = 0.27$, $p = .76$, partial $\eta^2 = .00$).

To summarize, participants' benign interpretations of text messages decreased with increasing levels of social anxiety. Men interpreted text messages from male senders as more benign than those from female senders. For women, the gender of the sender did not affect their ratings of benign interpretations.

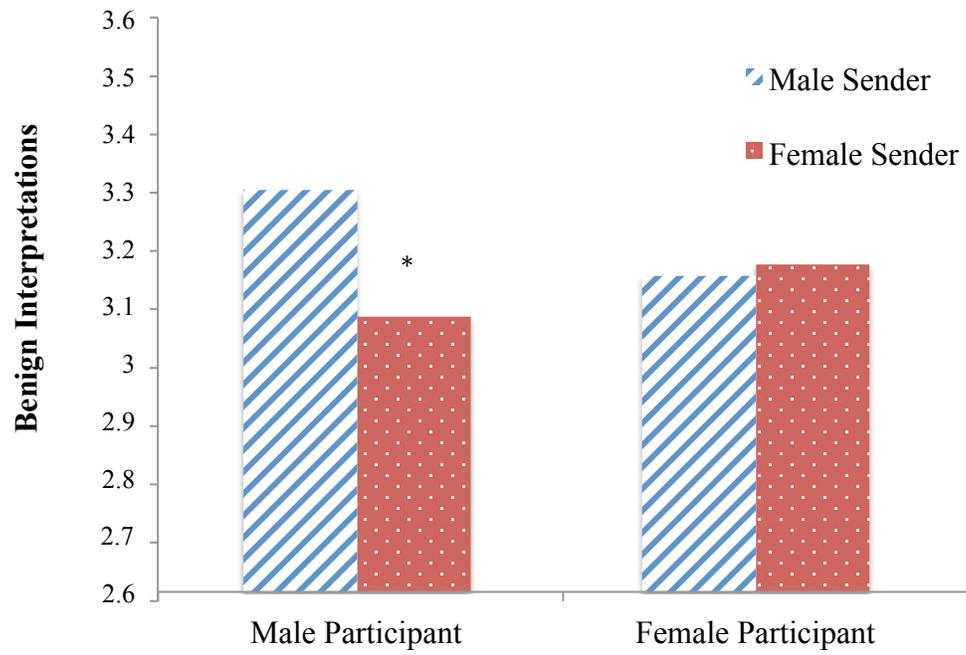


Figure 6. Mean ratings of benign interpretations of vignettes from male and female senders among male and female participants.

Discussion – Study 3

The goal of Study 3 was to examine the effects of social anxiety, participant gender, and recipient gender on young adults' interpretations of ambiguous messages. Overall, results provided further support for the existence of interpretation biases in CMC, as participants with higher levels of social anxiety were more likely to endorse negative interpretations (and less likely to endorse benign interpretations) of ambiguous text messages. Results also suggested that the gender of a message's sender may impact its interpretation, particularly for male recipients.

Psychometric Properties

Results indicated good internal consistency of both the negative and benign interpretations subscales of the IB-CMC, again demonstrating reliability of this measure. Moreover, the associations between social anxiety symptoms and positive and benign interpretations subscales on the IB-CMC provided additional support for the convergent validity of the measure.

Interpretation Bias in CMC Contexts

Results from this study provided more evidence for the existence of an interpretation bias for socially anxious individuals in computer-mediated contexts. Overall, high levels of social anxiety symptoms were associated with stronger endorsements of negative interpretations of ambiguous text messages, suggesting that highly anxious individuals do indeed possess a negative interpretation bias in CMC. High social anxiety was also associated with weaker endorsements of benign interpretations, providing support for the idea that socially anxious individuals also lack the positive

interpretation bias characteristic of nonanxious individuals (Amir et al., 2012; Beard & Amir, 2009).

Effects of Sender Gender

The present results provided further evidence for the notion that the interpretation of a message in CMC may depend on who the message is from (Byron, 2008; Kruger et al., 2005), extending this hypothesis to show that the *gender* of the sender may influence message interpretation. In face-to-face and CMC alike (with some exceptions, notably in anonymous internet discussion groups), women are generally observed as having more a more personal orientation than men – communicating more support and appreciation (Herring, 1999; Tannen, 1990). It is perhaps surprising, then, that in this study messages from women were interpreted as more negative in tone than messages from men. One possibility is that people expect messages from women to include more positive, supportive language. Since the vignettes were designed to be ambiguous in tone, participants may have rated them as more negative when described as from a female sender because they defied their expectations of female communication patterns. Importantly, however, the vignettes were not rated as less *realistic* when sent by women versus men. Additionally, this main effect was superseded by a three-way interaction with participant gender and social anxiety, and should therefore be interpreted with caution.

A primary aim of Study 3 was to test the hypothesis that messages from opposite-gender peers would elicit greater interpretation bias than messages from same-gender peers. Results provided support for this hypothesis, but suggested that this may be the case only for men. For male participants, the effect of social anxiety on ratings of

negative interpretations (i.e., the negative interpretation bias) was significant only for messages from women, not for messages from other men. For female participants, the sender's gender did not significantly affect ratings of negative interpretations.

Opposite-gender interactions are thought to be particularly likely to elicit social anxiety among heterosexual individuals (Curran, 1977; Kessler, 2003; Zimbardo, 1990), and there is some evidence that cognitive biases associated with anxiety may also be more pronounced in such situations (Turner et al., 1986). There is also some evidence to suggest that heterosocial anxiety may be particularly pronounced among men. Results from a recent US epidemiological survey (Xu et al., 2012) suggest that among individuals diagnosed with SAD, men experience greater fear of dating than do women. Likewise, recent Canadian data suggest that socially anxious men, in particular, are more likely to be single and living alone (MacKenzie & Fowler, 2013). Heterosocial interactions may therefore present a greater challenge to socially anxious men than to women. In line with this suggestion, one interpretation of the present results is that text messages from opposite gender peers provoke more anxiety among socially anxious men than women, leading more anxious men to make negatively biased interpretations of text messages from women.

However, it is important to note that within each anxiety group, mean ratings of negative interpretations for opposite-gender interactions were similar between males and females. However, patterns of means for same-gender texts differed between men and women. Specifically, whereas the relation between social anxiety and negative interpretations was attenuated for male-male interactions, negative interpretation bias was *not* similarly attenuated during female-female interactions. An alternate interpretation of

these findings is therefore that female-female interactions may be particularly likely to elicit anxiety. There is evidence to suggest that young adult men are more tolerant of minor social missteps by same-gender peers than are women (Benenson et al., 2009). Friendships between young women may also be more vulnerable to dissolution in the event of conflict (Benenson & Christakos, 2003). The relative *fragility* of women's friendships may be associated, paradoxically, with the greater intimacy shared by female friends: the wealth of sensitive personal information shared among friends may provide fodder for relational aggression, and greater opportunity for hurt feelings in the event of a conflict (Benenson & Christakos, 2003; Crothers, Field, & Kolbert, 2005). Women may, therefore, come to expect more rejection or relational aggression from other women (Crothers et al., 2005).

Results suggested that the gender of the sender may also impact men's benign interpretations of text messages – messages from women were perceived as less benign than messages from other men. However, in contrast to the results regarding negative interpretations, this effect was independent of participants' level of social anxiety. Again, for women, gender of the sender did not significantly affect ratings of benign interpretations. It is possible that even for nonanxious men, interacting with women via CMC triggers significant anxiety. Traditional gender roles prescribe that males should be responsible for “setting the pace” in initial heterosocial interactions (Davis, 1978). Moreover, the initiation of romantic relationships requires stereotypically masculine skills, such as assertion and initiation (Robins, 1986; Shaffer, Pegalis, & Bazzimi, 1996). This pressure to exhibit stereotypically masculine characteristics may make opposite-gender interactions particularly stressful for heterosexual men.

One limitation to the present study was the exclusion of participants who did not identify as heterosexual. Theoretically, interactions with opposite-gender peers are particularly stressful for heterosexual socially anxious individuals due to the possibility of a romantic attachment (Kessler, 2003). Therefore, we might assume that for homosexual individuals with high levels of social anxiety, interactions with same-gender peers might be relatively stressful. However, opposite-gender interactions may elicit anxiety for a number of other reasons. For example, throughout childhood and adolescence, it is common for youth to establish mainly same-gender friendships (McPherson, Smith-Lovin, & Cook, 2001). Opposite-gender interactions may therefore be stressful because they are less familiar.

Little is known about how the experiences of socially anxious LGBTQ youth may differ from those of their heterosexual peers. Indeed, several authors have noted that many existing measures of social anxiety are heteronormatively worded, asking participants about their feelings and behaviours in situations with ‘members of the opposite sex’ (Weiss et al., 2013). Future research examining the effect of the gender of message sender on interpretation bias in LGBTQ participants is needed to provide further insight into how cognitive processes may be associated with social anxiety when interacting with same- and opposite-gender peers.

General Discussion

The goal of this research was to study the phenomenon of interpretation bias in the context of CMC. To achieve this goal, a new vignette measure of interpretation bias for text messages (IB-CMC) was first developed and piloted. Study 1 provided evidence for the factor structure, psychometric properties, and validity of the IB-CMC, and interpretation bias in CMC was shown to be related to symptoms of social anxiety. In Study 2, the IB-CMC was modified to examine the effect of positive emoticons on message interpretation. Social anxiety symptoms were again associated with interpretation bias in CMC, and positive emoticons were found to reduce negative interpretations among all users, independent of social anxiety. Study 3 examined the effect of another contextual factor on interpretation bias in CMC: the gender of the message sender. Results suggested complex associations between social anxiety, gender of sender, and gender of recipient. For example, female participants' interpretations of ambiguous messages were not significantly affected by the sender's gender. Among male participants however, messages from female senders were viewed as less benign (and among highly anxious male participants, as more negative) than messages from male senders.

Measurement of Interpretation Biases in a CMC Context

The IB-CMC is a vignette measure of interpretation bias in computer-mediated contexts that was created for the present study. Study 1 provided evidence for a two-factor structure of the measure, with separate factors representing *negative* and *benign* interpretations. Evidence from three separate samples of young adults suggests that the IB-CMC is a reliable and valid measure of interpretation bias for text messages in this

population. Across three studies, the negative and benign interpretations subscales of the IB-CMC demonstrated good internal consistency, suggesting that this is an *internally* reliable measure of the interpretation of text messages. Future researchers may wish to examine other aspects of reliability (e.g., test-retest). Study 1 provided evidence for the *convergent validity* of the measure, demonstrating significant associations between the IB-CMC subscales and corresponding negative and benign interpretation subscales on two measures of interpretation bias in face-to-face situations. Moreover, all three studies provided evidence for the construct validity of the IB-CMC, showing significant associations with social anxiety symptoms.

Using the IB-CMC, the present research provided the first evidence for the existence of interpretation biases for social situations in computer-mediated contexts. Across three studies, higher social anxiety symptoms were associated with a tendency to endorse negative interpretations of ambiguous text messages. Some authors have postulated that the relative leanness of CMC with respect to visual and auditory cues to emotion may serve to reduce socially anxious individuals' detection of negative feedback (Saunders & Chester, 2008; Stritzke et al., 2004). Findings of the present study, however, suggest that as in face-to-face situations, youth who report higher levels of social anxiety are more likely to interpret CMC messages as negative.

The nonverbal emotional cues present in face-to-face communication (e.g., facial expression, gesture, tone of voice, etc.) are often the source of, rather than the remedy to, ambiguity. For example, a conversation partner's yawn can suggest boredom or tiredness; laughter can signal amusement or disdain (Amir et al., 2005; Murphy et al., 2007). However, CMC presents a different type of ambiguity, arising from a lack of such cues

altogether. The present results suggest that interpretation bias applies not only to the (mis)interpretation of nonverbal cues, but also, in their absence, to the interpretation of the verbal content of the message itself.

This is an important extension to the extant literature on interpretation biases in face-to-face situations. Vignette measures of interpretation bias in face-to-face situations typically involve situations that are ambiguous on the basis of ambiguous cues (gestures, laughter, or other behaviours). The only known *in-vivo* study of interpretation bias conducted to date assessed participants' interpretations of ambiguous social cues (e.g., yawning, head scratching; Kanai et al., 2010). Studies using the word-sentence-association paradigm (Amir et al., 1998; Beard & Amir, 2009) capitalize on participants' interpretations of ambiguous sentence stems. For the most part, these sentences also describe gestures or other cues that are ambiguous in nature (e.g., "people laugh after something you said", Beard & Amir, 2009). A few items in this paradigm do seem to describe situations that are ambiguous due to their lack of cues (e.g., "a friend does not respond when you wave hello"; "your boss wants to meet with you", Beard & Amir, 2009), more akin to the ambiguity inherent in the text message vignettes of the IB-CMC. Only two previous studies of interpretation bias have assessed socially anxious individuals' interpretations of the *verbal* content of ambiguous social situations. Constans et al. (1999) presented participants with a vignette describing a blind date between two people. Participants were asked to rate negative and benign interpretations of several ambiguous events described in the vignette, some of which were verbal utterances (e.g., "Lisa said "you're certainly not what I expected""). However, the vignette used in this

study asked participants to interpret an ambiguous situation involving other people; results may not extend to interpretations of personally-relevant situations.

Amir and colleagues (2005) created a series of videos in which actors and actresses commented on aspects of personal appearance or belongings. Statements were either positive (e.g., “I really like your shoes”), negative (e.g., “that is a horrible hair cut”), or ambiguous (e.g., “that is an interesting shirt you’ve got on”). Undergraduate participants in the socially anxious group rated ambiguous vignettes as more negative than did nonanxious participants. These results suggest that socially anxious individuals are likely to interpret ambiguous verbal statements more negatively than their nonanxious peers. However, in this study, nonverbal information was also (unavoidably) present, due to actors’ tone of voice and body language. The present study represents an important extension of these findings to the CMC environment, demonstrating a negative interpretation bias for text messages in which the verbal content of the message is ambiguous, and nonverbal cues to emotion are absent.

Benign Interpretation Bias

In Studies 2 and 3 (but not Study 1), participants with higher levels of social anxiety were also less likely to ascribe benign interpretations to the ambiguous texts. Moreover, in Study 3, participants in the low social anxiety group were more likely to ascribe benign interpretations to the texts than the average anxiety group. These results extend findings from studies in face-to-face contexts suggesting that socially anxious individuals may lack the *benign interpretation bias* possessed by non-anxious individuals (Hirsch & Clark, 2004; Murphy et al., 2007). The tendency to make benign or positive interpretations of social situations is thought to be psychosocially adaptive, promoting

self-efficacy for social behaviour and allowing individuals to expect positive outcomes from future social situations (Hirsch & Matthews, 2000; Murphy et al., 2007). When this ability is impaired, socially anxious individuals may be prevented from modifying their negative beliefs and cognitions on the basis of positive inferences about their social performance (Hirsch & Matthews, 2000). Thus, whereas a negative interpretation bias may contribute to avoidance of social situations, impairment of the normative benign interpretation bias may limit the amount of positive reinforcement socially anxious individuals derive from social interactions (Kashdan et al., 2011). Results of Studies 2 and 3 suggest that this phenomenon may extend to CMC environment. In Study 1, however, social anxiety symptoms were *not* significantly associated with the tendency to endorse benign interpretations.

One possible explanation for this inconsistency relates to the population subsamples from which participants for each study were selected. Data for Study 1 were collected during the summer term, whereas Studies 2 and 3 were conducted in fall and winter semesters. It is possible that systematic differences exist between students enrolled in summer courses and those enrolled during the regular school year. Given the inconsistent findings between studies, more research is needed to clarify the associations between social anxiety and benign interpretations in computer-mediated contexts.

Gender Differences

Evidence from previous research suggests that girls and women show a greater preference for CMC compared to boys and men. Females send and receive more text messages (Kimbrough et al., 2013; Lenhart, 2012), and outnumber males on social networking sites (Pierce, 2009; Taylor, 2009). Moreover, women report greater

satisfaction with CMC as a way to maintain and enhance relationships with family and friends (Fallows, 2005). However, other authors have suggested that the lack of cues to emotion in CMC may be particularly detrimental to women, who rely more on nonverbal information (Dennis, Kinney, & Hung, 1999). Overall, evidence from Studies 2 and 3 suggests that women interpreted text messages more negatively than men. Additionally, in Study 2, when messages did not include an emoticon, women were less likely to endorse benign interpretations. When positive emoticons were included in these messages, this gender difference was attenuated. Taken together, these findings support the suggestion that women may be more attuned to nonverbal information, and may therefore be more affected by its absence in CMC (Dennis et al., 1999). However, when communication includes additional cues to emotion, this disadvantage may be reduced. Women tend to use more emoticons in their online interactions than men do (Baron, 2004; Fox et al., 2007; Tossell et al., 2012). This increased use of emoticons and other cues to emotion may explain women's greater satisfaction with CMC as a mode of intimate communication, despite a tendency to interpret messages negatively when devoid of such cues.

Women are approximately twice as likely to be diagnosed with social phobia as are men (Essau et al., 1999; Wittchen et al., 1999). Therefore, it is perhaps surprising that none of the present studies revealed significant gender differences in levels of social anxiety symptoms. Some previous studies using the SIAS have reported higher anxiety scores among women (Kupper & Denollet, 2012). However, other authors have reported a lack of gender differences in community samples of young adults and college students (Mattick & Clarke, 1998; Rodebaugh et al., 2011).

Nonetheless, results of the present research did suggest that the cognitive features of social anxiety may differ by gender. Results from Study 1 suggested that the association between social anxiety and negative interpretations was stronger among women than men. This extends findings from certain studies of face-to-face interpretation bias in children and adolescents, suggesting that the cognitive biases associated with social anxiety may be more pronounced among females (Cannon & Weems, 2011; Miers et al., 2008). In Study 3, there was a three-way interaction between social anxiety, participant gender, and sender gender to predict negative interpretations. For males, the effect of social anxiety on negative interpretations was significant only for messages from women. For females, social anxiety was associated with greater endorsement of negative interpretations regardless of the gender of the message sender. Though several interpretations of this finding are possible, this may suggest that socially anxious women experience interpretation biases in a greater number of contexts than men do. At the very least, this provides further evidence that the social-cognitive biases associated with anxiety may operate differently for men and women. Whether this finding is specific to the CMC context is unknown. Given the paucity of research in the area, more studies are needed to clarify the potentially complex relations between social anxiety, gender, and interpretation bias in both face-to-face and computer-mediated contexts.

Factors Influencing the Interpretation of CMC

Studies 2 and 3 examined the effects of two contextual factors on participants' interpretation of ambiguous messages in CMC. The first, *emoticon presence* (a construct that is unique to the context of CMC) involved the addition of nonverbal information (emoticons) to otherwise ambiguous text messages. The second contextual factor

examined did not modify the message itself, but rather involved characteristics of the *sender* of the message (specifically, gender). Results suggested that both of these contextual factors impacted significantly on message interpretation in CMC.

Nonverbal cues to emotion. Several prominent theories of CMC (e.g., Social Presence Theory, Short et al., 1976; Media Richness Theory, Daft & Lengel, 1984) suggest that CMC is a stark medium, devoid of the cues to emotion present in face-to-face communication. Due to its relative leanness, it is argued, CMC is an inadequate tool for complex, satisfying social communication (Kraut et al., 1998). However, the *hyperpersonal* model (Walther, 1996) posits that CMC in fact confers great advantages to its users, in the form of enhanced control over self-presentation and reduced self-consciousness. From this perspective, it is argued that users are aware of the challenges inherent in these media and use the tools available to them to customize messages to convey greater depth and breadth of emotion (Walther & Parks, 2002; Whelan et al., 2009). Using cues such as emoticons, punctuation, and other nonliteral markers of tone, some theorists argue that CMC can be just as warm and personal as more traditional communication media (Walther, 1992; 1996). Indeed, empirical evidence suggests that CMC can be used to foster and sustain intimacy, closeness, and social support in new and existing friendships (Amichai-Hamburger, Kingsbury, & Schneider, 2013).

Previous research suggests that emoticons and other nonverbal cues can be used to enhance the perceived richness of CMC (Huang et al., 2008), and increase the accuracy of message interpretation (Derks et al., 2008; Ip, 2002, Lo, 2008). Results from the present study (Study 2) indicated that, for all users, the addition of positive emoticons to verbally ambiguous text messages rendered them more positive in tone: participants were

more likely to endorse benign interpretations of these messages. This finding extends the existing literature, suggesting that in addition to enhancing the emotional tone of a verbal message, emoticons can be used to convey tone in otherwise ambiguous messages.

The modification of the IB-CMC to include emoticons may also have enhanced the ecological validity of the vignettes. Though many studies of CMC suggest that the base rate of emoticons is low, these studies have mostly focused on workplace communication, in which emoticons may not be appropriate (e.g., Rezabek & Cochnour, 1998; Tossell et al., 2012; Witmer & Katzman, 1997). In more informal CMC exchanges, emoticons are often used to express emotion, and young people may be particularly likely to include emoticons and other nonverbal markers in communication with peers (Krohn, 2004). Indeed, in Study 2, messages containing positive emoticons were rated as more realistic than messages without emoticons. In other words, participants are perhaps more accustomed to receiving messages including emoticons and other signals of emotional tone. This provides support for the hyperpersonal perspective (Walther, 1992; 1996), which suggests that people make use of any tools available to enhance the communicative power of a medium.

Some authors have suggested that socially anxious individuals may routinely ignore or discount positive social information (Alden et al., 2004; 2008; Vassilopoulos, 2006; Voncken et al. 2003). This process may serve to maintain social anxiety symptoms, preventing socially anxious individuals from learning from their social successes (Kashdan et al., 2011). In the present study, positive emoticons served a disambiguating function for *all* users, independent of their levels of social anxiety. This suggests that more socially anxious participants were not entirely ignoring or discounting these

positive cues. Stritzke and colleagues (2004) note that emoticons lack the subtlety of real-world facial expressions. An emoticon ‘smiley’ may thus be less easily misinterpreted than an offline smile – and less easy to miss altogether, as facial expressions are fleeting, and highly contingent on moment-to-moment interactions.

However, results from the present study further indicated that the presence of emoticons did not eliminate the *relative* interpretation bias for socially anxious individuals. That is, participants in the high anxiety group endorsed more negative (and fewer benign) interpretations of text messages than those in the low anxiety group, even when emoticons were present. Interestingly, a similar effect of the valence of facial expression on interpretation has been reported in face-to-face situations. Pozo, Carver, Wellens, and Scheier (1991) asked undergraduates to participate in a mock interview, during which the (videotaped) interviewer sustained either a positive, neutral, or negative facial expression. Participants then rated their impressions of the interviewer’s approval of them. Overall, participants higher in social anxiety made more negative judgments of interviewer approval. However, socially anxious participants were not immune to the effects of the facial expression manipulation: their approval ratings were higher after exposure to the positive facial expression than the neutral and negative expressions. In this study, high and low anxious individuals were affected to a similar degree by this manipulation. These findings echo the results of the present study, suggesting that socially anxious individuals can benefit to some degree from positive social information, but may nonetheless be at a relative disadvantage compared to their nonanxious peers.

Gender of the message sender. The second contextual factor examined involved characteristics of the *sender* of the message. The present results provided further

evidence that the interpretation of a message in CMC may depend on who the message is from (Byron, 2008; Kruger et al., 2005), extending previous findings to show that the gender of a message's sender may influence interpretation. Moreover, the present results suggest that sender and recipient characteristics may *interact* – for example, male recipients may interpret messages from male and female senders differently.

As discussed above, Study 3 provided some evidence to suggest that messages from opposite-gender peers may be interpreted more negatively (and less benignly) than those from same-gender peers, at least among heterosexual male recipients. It was hypothesized that this effect may be due to feelings of stress and anxiety triggered in heterosocial situations. However, the present study did not explicitly examine *romantic* interest between recipient and sender. Previous research and theory suggests that the nature of the relationship between message senders and recipients may influence message interpretation – for example, messages from strangers or recent acquaintances may be more likely to fall victim to a negativity bias than those from close friends (Byron, 2008; Kruger et al., 2005). Future researchers may consider examining the effects of other sender-recipient relationships on message interpretation, for example, explicitly examining messages from romantic interests. Factors such as length of acquaintance or degree of closeness with the sender may also be important to examine, as there is evidence to suggest that communication via CMC changes substantially over time, with interpretation becoming more accurate as users get to know one another better (Byron, 2008; Walther, Anderson, & Park, 1994). It is not yet known whether highly socially anxious individuals would similarly benefit from increased familiarity with a message

sender. Longitudinal studies would provide better insight into how these associations may change as relationships between users progress.

Study 3 also examined opposite-gender interactions, as these are thought to be particularly stressful for socially anxious individuals. Future researchers might consider examining message interpretation in other stressful relationship contexts— for example, messages from a boss or other authority figure.

It would also be of interest to examine whether sender characteristics, such as gender and relationship, may *interact* with message characteristics, such as emoticon presence, to influence message interpretation. For example, given that women tend to use more emoticons in their electronic communications (Baron, 2004; Fox et al., 2007), messages from women may be more strongly impacted by the presence or absence of such cues to emotion.

Limitations and Future Directions

This research represents a first step towards understanding how certain cognitive features associated with social anxiety may operate in the novel context of CMC. Nonetheless, these results should be interpreted in light of some important limitations.

First, the use of hypothetical vignettes may have limited the ecological validity of the study. As Amir et al. (2005) note, the use of written vignettes allows researchers a great deal of experimental control, but may lack “real-world” relevance. However, in the present study, the stimuli used were screen images of actual text messages, designed to maximize the realism of the vignettes. One way to further enhance the ecological validity of this vignette measure for future studies may be to send the hypothetical texts directly to participants’ smartphones. Another aspect worth consideration is the forced-choice

nature of the interpretations. Though the IB-CMC was developed in concord with focus groups to ensure the plausibility of each interpretation, future research examining participants' self-generated interpretations using an open-ended questionnaire format may be useful. One study of interpretation bias in face-to-face contexts reported that self-generated interpretations were less susceptible to training effects than forced-choice interpretations (Salemink, van den Hout, & Kindt, 2007). However, this study was limited in that it did not examine baseline interpretation bias prior to training. The conceptual and empirical differences between participant-generated interpretations and ratings of experimenter-generated negative and benign interpretations remain unclear.

Moreover, the present study asked participants to imagine receiving each text message from 'a friend'. Particular characteristics of the imagined friend, such as gender, length of acquaintance, and closeness, may have affected participants' interpretations of the vignettes in unknown ways. Future researchers may consider asking participants to imagine one particular sender for all vignettes, and record characteristics of these senders to control for potential confounding factors. Of course, it would be most useful to examine participants' interpretations of actual ambiguous messages from real friends. Future researchers should consider event sampling, for example, contacting participants via text message and asking them to reflect on recent text conversations, describing the content of any ambiguous messages and their interpretations of these messages.

The present study examined associations between social anxiety symptoms and interpretation bias for ambiguous text messages in an unselected sample of university undergraduates. Although research in face-to-face situations suggests that interpretation biases are associated with social anxiety in both clinical and subclinical populations, it is

unknown whether the same is true of interpretation biases in the context of CMC. Future researchers may wish to study these constructs in clinical populations, and establish whether the tendency to make negative interpretations of ambiguous text messages discriminates between clinically anxious and non-anxious populations. As well, the present study examined only *social* anxiety symptoms. In face-to-face situations, interpretation bias for social events has been found to discriminate between social anxiety and other anxiety disorders (Amir et al., 1998; Stopa & Clark, 2000). Future research examining other forms of anxiety could help assess whether interpretation bias for social events in computer-mediated contexts would also discriminate between types of anxiety. Further research is also necessary to clarify the associations between interpretation bias in this context and depressive symptoms. In Study 1, scores on the IB-CMC were associated with participants' depressive symptoms, suggesting that interpretation bias in computer-mediated contexts does not discriminate between social anxiety and depression. Evidence from prior studies of cognitive bias in face-to-face situations is mixed: some authors have reported that interpretation bias for social events is specific to social anxiety, whereas biased interpretation of *nonsocial* events is common to both social anxiety and depression (Voncken et al., 2007). However, another study reported that both social anxiety and depression contributed additively to participants' negative judgments of social situations (Trew & Alden, 2009).

Though several of the theories discussed highlight differences between face-to-face and computer-mediated communication, the present study could not offer a direct comparison of these two contexts. For example, Media Richness Theory (Daft & Lengel, 1984, 1986) and Social Presence Theory (Short et al., 1976) focus on the effects of the

relative lack of nonverbal cues in CMC on message interpretability and emotional tone. Given that the relative leanness of CMC seems to result in greater ambiguity (Kruger et al., 2005), it might be expected that socially anxious individuals would experience greater difficulty interpreting social situations in CMC versus face-to-face situations. Though measures of interpretation bias in both contexts were administered in Study 1, mean differences on these disparate measures could not reasonably be compared. Future research directly comparing interpretation bias in these two contexts may be useful to understand contexts that may pose particular challenges to socially anxious individuals.

The SIDE model suggests that we rely on group membership cues more in CMC than in face-to-face communication (Spears & Lea, 1992). Thus, the gender of one's conversation partner may be particularly salient in these media. However, differences in the associations between social anxiety and interpretations in face-to-face and CMC contexts could not be directly compared in the present study, as measures of interpretation bias in face-to-face contexts were ambiguous with respect to the gender of the interaction partner. Future researchers could consider modifying existing measures to compare interpretations of face-to-face scenarios involving same- and opposite-gender peers.

In Studies 2 and 3, participants were divided into groups based on their social anxiety symptoms. Employing a grouped rather than a continuous measure of anxiety necessarily results in loss of information (Shaw, Huffman, & Haviland, 1987). This approach was taken in order to examine interactions with social anxiety while taking advantage of the repeated-measures nature of the manipulation variables (emoticon presence and sender gender). Gelman and Park (2009) argue that discretizing a predictor

using upper and lower quartile cutoffs offers highly interpretable results without sacrificing significant efficiency compared to linear regression using continuous predictors. Results have been interpreted in terms of differences for participants high in social anxiety – that is, it has been assumed that group differences say something meaningful about how individuals with high levels of social anxiety differ from the rest of the population. However, the opposite interpretation is possible: it may be that young adults with extremely low levels of social anxiety are in some way peculiar. The inclusion of an *average* group of participants – those with social anxiety symptoms in the 25th-75th percentiles – lends confidence in the interpretations of the results. Notably, results from studies 2 and 3 indicated significant differences in ratings of negative interpretation between the high and average social anxiety groups. This finding supports the interpretation that high levels of social anxiety are associated with a negative interpretation bias (rather than extremely low social anxiety resulting in the impairment of normative negative interpretations). Examination of these associations within samples drawn from clinical populations would provide support for this interpretation.

The present study used text messages as a proxy for CMC in general. However, different media vary widely with respect to their specific features, including relative synchronicity and anonymity (Chan, 2011, Riordan & Kreuz, 2010b). For example, text messaging is not truly anonymous, as it requires knowledge of one's conversation partner's telephone number. It is possible that the interpretation bias found in the present study would not be present in other contexts (e.g., chat rooms), as social anxiety may be attenuated in more anonymous contexts (Brunet & Schmidt, 2007). Text messaging is also a relatively synchronous form of CMC, which may serve to exacerbate feelings of

social anxiety (Chan, 2011). Moreover, advances and changes in communication technology are resulting in increasing integration of video and images with text communication. For examples, applications such as iMessage and Snapchat allow users to send and receive images and videos, alone or in conjunction with text-based messages. It is not yet known how the integration of nonverbal information from videos or photographs may moderate the interpretation of text-based messages, and whether these integrated media have different effects on users depending on the level of social anxiety they experience. Future research should examine the relations between social anxiety and message interpretation in a variety of CMC contexts.

The present study examined the effects of only *positive* emoticons on message interpretation. Positive emoticons were chosen as a manipulation that would reliably disambiguate ambiguous verbal messages to become more positive. Other types of emoticons may have a less straightforward impact on message interpretation. For example, the winking smiley face (“;”) may be used to convey sarcasm, or to denote a teasing or jocular tone (Derks et al., 2008). As Dresner and Herring (2010) point out, beyond the standard “:)” and “:(“, most emoticons do not clearly map on to a single emotional state, and may therefore introduce even greater ambiguity to messages. Moreover, CMC users routinely employ several different types of quasi-nonverbal cues, in addition to emoticons (Riordan & Kreuz, 2010a; Whelan et al., 2009). For example, punctuation is often used to indicate enthusiasm, and may also serve to disambiguate messages – for example, note the difference between “good for you” and “good for you!!” (Riordan & Kreuz, 2010a). The effects of these various cues to emotion on

message interpretation in CMC remains to be studied. It is also not yet known how such cues may affect message interpretation for socially anxious individuals specifically.

The present research examined the associations between social anxiety, contextual factors, and message interpretation in a Canadian context. However, patterns of associations may differ across cultures. For example, the importance of self-presentation may differ in cultures that place a greater emphasis on social interdependence (Yamagishi et al., 2012). The DSM identifies a culturally-bound subtype of social anxiety in Japanese society- *taijin kyofusho (TKS)* – similarly characterized by fear and avoidance of social situations. However, instead of a fear of personal embarrassment or harsh judgment of the individual, sufferers of TKS report fear of offending *others* (Norasakkunkit, Kitayama, & Uchida, 2012). Like social anxiety, TKS is associated with a set of cognitive biases that serve to maintain anxiety – for example, preoccupation with the idea that others have been offended and are avoiding the individual (Nakamura, 1997). It is plausible that such a bias may influence interpretation of ambiguous messages in a threat-maintaining manner, similar to the interpretation bias shown in the present study. Use of CMC, and the norms surrounding social communication via CMC, may also vary widely according to culture. In Japan, *keitai*, or mobile phones, are ubiquitous among youth, and communication via *keitai* is seen as an important recent sociocultural phenomenon (Matsuda, 2005). Japanese teenagers and young adults routinely use *emoji* (pictorial icons representing a wide variety of facial expressions, objects, and concepts) in text messages (Miyake, 2007). Interestingly, young people report using *emoji* out of a sense of consideration for others, because “they might mistakenly think I am angry if I don’t include *emoji*” (Tszuraharam 2004, as cited in Matsuda, 2005, p.36). The societal norms

surrounding CMC may influence the way messages with varying degrees of cues to emotional tone are interpreted. Future research examining message interpretation in different countries is needed to gain insight into how these constructs might operate in different cultural contexts.

The sample of psychology undergraduates may also limit the generalizability of the findings. The present studies were designed to examine the constructs of interest in the developmental period of emerging adulthood, when text messaging is a particularly ubiquitous mode of communication, and when social anxiety may present distinct challenges. However, university students, and psychology students in particular, may not be representative of the population of emerging adults. Future research should examine these associations in a broader sample of young adults. Future research should also examine developmental effects on these associations. Theory of mind becomes more sophisticated throughout late childhood and adolescence, and evidence suggests that such faculties are still developing well into early adulthood (Bosco, Gabbatore, & Tirassa, 2014). It is likely that interpretation of ambiguous social scenarios changes as adolescents get better at envisioning their peers' mental states. Cross-sectional studies of multiple age groups would be useful in this regard. The cognitive biases associated with anxiety are thought to be a product of both heritable temperamental tendencies and environmental experiences during childhood (Field & Lester, 2010). It is unknown whether use of communication technology during these formative years may influence the development of social anxiety and related cognitions. Longitudinal studies of these constructs over time would provide insight into how computer-mediated social experiences, cognitive biases, and anxiety interact over time.

There are also likely to be significant cohort (or generational) effects on these associations. The participants in the present research were young adults age 18-25 years of age – for the most part considered ‘digital natives’ (Wang, Myers, & Sundaram, 2013). It is unknown whether these constructs would be similarly associated in a sample of older adults, (i.e., ‘digital immigrants’) for whom communication technology has not always been a part of daily life. Moreover, evidence suggests that rapid advances in communication technology are resulting in a great deal of heterogeneity in attitudes towards and use of CMC, even among youth who might otherwise be considered part of the same generation. Some authors have noted that when it comes to technology usage, discrete ‘generations’ of youth are becoming harder to define – homogenous subsets of individuals are becoming narrower (Joiner et al., 2013). For example, young adults born after 1993 have been found to be notably different from those born between 1980 and 1992 in their attitudes towards and usage of communication technology, leading some authors to differentiate between first- and second-generation digital natives (Joiner et al., 2013). These rapid shifts in communication media and the norms surrounding their usage may impact the associations between social anxiety and message interpretation in unknown ways.

Implications

Thanks to modern communication technologies, adolescents’ and young adults’ social development is occurring in environments vastly different from those of previous generations. The advent of computer-mediated communication media such as email, online social networking sites, and text messaging means that youth are in near-constant contact with peers.

Previous research and theory suggests that certain features of the online environment may make it particularly appealing to socially anxious youth. For example, according to the hyperpersonal perspective, the visual anonymity of CMC allows users great control over self-presentation and impression management (Walther, 1996). As suggested by the SIDE model (Spears & Lea, 1992), this may allow users to communicate with fewer inhibitions and less self-consciousness. Moreover, the asynchronicity of electronic communication media reduces the social pressure to respond immediately and allows individuals the time to edit messages, resulting in further control over self-presentation (Chan, 2011; Valkenburg & Peter, 2011). Together, these features seem to confer particular advantages to socially anxious youth, allowing them to communicate intimately while reducing their self-presentational concerns (Brunet & Schmidt, 2007; Chan, 2011; High & Caplan, 2009; Roberts et al., 2000; Shepherd & Edelman, 2005; Stritzke et al., 2004; Valkenburg & Peter, 2007, 2011).

Though CMC may reduce feelings of anxiety related to self-presentational concerns, social anxiety may nonetheless present a disadvantage in the interpretation of *incoming* messages in CMC. To wit, the present results suggest that socially anxious individuals may be at a relative disadvantage when it comes to *interpreting* socially relevant content in CMC. Participants with higher levels of social anxiety were more likely to endorse negative interpretations (and less likely to endorse benign interpretations) of ambiguous text messages. Even when positive emoticons were included, individuals with the highest levels of social anxiety were still at a disadvantage relative to their nonanxious peers. These findings suggest that the impairments to social information processing noted in face-to-face situations – both the presence of a negative

interpretation bias and the lack of a normative benign interpretation bias – may extend to computer-mediated contexts as well. These cognitive biases are thought to maintain social anxiety by triggering avoidance of social situations, and limiting the amount of positive feedback socially anxious individuals derive from social situations (Hirsch & Matthews, 2000; Kashdan et al., 2011).

Interestingly, whereas social anxiety may lead sufferers to avoid face-to-face social situations, it does not seem to be associated with similar avoidance of social situations in CMC. On the contrary, as discussed, shy and socially anxious individuals seem to be particularly drawn to the internet and other electronic media as tools for communication and intimate self-disclosure (Brunet & Schmidt, 2007; High & Caplan, 2009; Roberts et al., 2000; Shepherd & Edelman, 2005; Stritzke et al., 2004; Valkenburg & Peter, 2007, 2011). It may be that the anonymity and asynchronicity of these media make them “the lesser of two evils” vis-à-vis face-to-face communication. Socially anxious youth may therefore seek out social interaction in computer-mediated contexts as a proxy for more threatening face-to-face interactions. However, the interpretation biases experienced by more anxious individuals in such contexts may nonetheless inhibit normative social learning processes, contributing to the maintenance of social anxiety.

These findings may be of particular relevance to clinicians. It is unknown whether therapies targeting maladaptive cognitions in face-to-face situations would be similarly effective in reducing negative interpretations of text messages and other electronic media. Therefore, if the presence of interpretation bias in CMC is acknowledged, clinicians may wish to address this type of interaction as a particular target for such cognitive therapies. Moreover, recent years have seen the introduction of cognitively based therapies for

social anxiety that may be completed online (Spek et al., 2007). These therapies may be particularly appealing for socially anxious individuals, as they do not require the patient to interact face-to-face with a therapist, and are especially useful for targeting patients with a high degree of avoidance, or who are prevented from accessing conventional therapies for other reasons (e.g., those in remote areas). However, developers of such therapies may wish to take into account the additional challenges that may be faced by socially anxious patients when *interpreting* computer-mediated content.

Conclusion

The aim of this dissertation has been to examine one type of cognitive distortion associated with social anxiety (interpretation bias) in the context of computer-mediated communication. A new measure of interpretation bias for ambiguous text messages was created, validated, and used in subsequent studies to examine the associations between social anxiety and interpretation bias in this novel context. In addition to establishing the first evidence for the existence of interpretation bias in this context, the present research explored the effects of two contextual factors on young adults' interpretation of text messages. The first contextual factor was the presence of quasi-nonverbal cues to the emotional tone of messages: *emoticons*. The inclusion of positive emoticons in otherwise ambiguous messages was found to decrease negative (and increase benign) interpretations of those messages, providing the first evidence for the disambiguating effects of positive emoticons. This disambiguating effect was noted for all participants, independent of social anxiety symptoms, suggesting that socially anxious youth do not discount this type of positive social information. The second contextual factor examined was the gender of the message sender. Results suggested that youth, and particularly

socially anxious young men, interpret ambiguous text messages from female senders more negatively than messages from male senders, providing new evidence that characteristics of the message sender impact message interpretation. Results of this study provide important first steps towards understanding how the cognitive processes associated with social anxiety might operate in the increasingly ubiquitous context of computer-mediated communication.

Appendices

APPENDIX A

Informed Consent Form – Study 1

Thank you for signing up to participate in the Text Messaging Study.

The purpose of an informed consent is to insure that you understand the purpose of the study and the nature of your involvement. The informed consent must provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Purpose and Task Requirements

We are interested in how people might react and respond differently when they receive different types of text messages. Participation in this study involves completing a series of questionnaires about text messaging, thoughts and feelings about social situations, and emotional well-being. You will also be asked to interpret several hypothetical social situations.

These questionnaires are all on-line, so you are able to complete them at your convenience at a time and place of your choosing. Participation in this study is expected to require approximately 30 - 45 minutes (but there is no time limit), and will earn you 0.5 % towards your PSYC 1001, 1002, 2001, or 2002 grade.

Potential Risk/ Discomfort

There are no anticipated risks associated with this research. We are asking questions about your background, your emotional well-being, and asking you to imagine yourself in several hypothetical social situations. You may prefer not to answer some questions if they make you uncomfortable. If you would like to talk to a qualified counsellor about your personal situation, you can contact Student Health and Counselling Services at (613) 520 – 6674

Your Rights

Participation in this study is voluntary. There is no obligation for you to participate. If there are questions that you do not wish to answer or that are not relevant to you, you may choose to skip these questions. You have the right to withdraw from the study at any point with no penalty if you feel you are not able to continue. Accordingly, on each page of the on-line survey, you can click on a “withdraw” button that will direct you to the debriefing information.

Anonymity and Confidentiality

All information collected in this study will be kept strictly confidential. Data will only be made available to research personnel associated with this study. You will not be asked to include your name on any of the materials. A list of arbitrary identification numbers will

be assigned to each questionnaire - individual participants will only be identified by their participant number. In no way will this information, or any of your responses to the questionnaire, be linked back to you. We ensure that your internet IP address will not be collected in Survey Monkey. Any publications using the data from this study will use the data of the group together, ensuring that no information about a single individual is given.

For more information

If you have questions about this study or would like more information you may contact Mila Kingsbury (mreichel@connect.carleton.ca), or Dr. Robert Coplan in the Department of Psychology at Carleton University at (613) 520-2600 ext. 8691 (robert_coplan@carleton.ca).

If you have any ethical concerns, please contact the Chair of the Carleton University Psychology Research Ethics Board, Dr. Monique Sénéchal, at (613) 520-2600 ext. 1155 (monique_senechal@carleton.ca). If you have any additional questions or concerns about this research, please contact the Chair of the Department of Psychology, Dr. Anne Bowker (613-520-2600 ext. 8218, anne_bowker@carleton.ca). This study has been approved by the Carleton University Psychology Research Ethics Board (12-xxx).

Consent

By checking the “I agree” box, it will mean that you have consented to participate in this study.

€ *I have read the above form and understand the conditions of my participation. By checking this box, I'm indicating that I agree to participate in this study.*

€ *I have read the above form and understand the conditions of my participation. By checking this box, I'm indicating that I disagree to participate in this study.*

APPENDIX B
Demographics and Technology Use

Name: _____

Birthdate: _____ Age: _____

month day year

Gender: Male _____ Female _____ Transgender _____ Other _____

Do you identify primarily as (optional):

Heterosexual ___ Homosexual ___ Bisexual _____ Other _____

Ethnic group: Caucasian _____ Asian _____ Black _____

South Asian _____ Middle Eastern _____ Hispanic _____ Aboriginal _____

Other (*Specify*) _____

Is English your first language? Yes _____ No _____

Do you own a phone with texting capabilities? Yes _____ No _____

How often do you use each of the following technologies:

E-mail

1 2 3 4 5
almost never a few times a month a few times a week once a day several times a day

Instant messaging (IM)

1 2 3 4 5
almost never a few times a month a few times a week once a day several times a day

Text messaging or SMS (e.g., BlackBerry messenger, iMessage)

1 2 3 4 5
almost never a few times a month a few times a week once a day several times a day

Social networking sites (e.g., Facebook, MySpace, Google+)

1 2 3 4 5
almost never a few times a month a few times a week once a day several times a day

On a day that you use these technologies, how much time do you spend using each?

E-mail

1	2	3	4	5
< 15 minutes	15 – 59 minutes	1 - 2 hours	3 - 4 hours	> 4 hours

Instant messaging (IM)

1	2	3	4	5
< 15 minutes	15 – 59 minutes	1 - 2 hours	3 - 4 hours	> 4 hours

Text messaging or SMS (e.g., BlackBerry messenger, iMessage)

1	2	3	4	5
< 15 minutes	15 – 59 minutes	1 - 2 hours	3 - 4 hours	> 4 hours

Social networking sites (e.g., Facebook, MySpace, Google+)

1	2	3	4	5
< 15 minutes	15 – 59 minutes	1 - 2 hours	3 - 4 hours	> 4 hours

Please fill out this Parent/guardian information about your primary caregivers. Either parent can be designated as Parent One or Parent Two.

Parent One's highest level of education completed (check one):

elementary school _____	high school diploma or equivalent _____
community college or equivalent _____	university degree _____
graduate school degree _____	

Parent Two's highest level of education completed (check one):

elementary school _____	high school diploma or equivalent _____
community college or equivalent _____	university degree _____
graduate school degree _____	

APPENDIX C

Debriefing

Thank you for participating in the Text Messaging Study!

What are we trying to learn in this research?

The purpose of this research is to examine the links between feelings of social anxiety and interpretations of ambiguous social situations, both in person and via text message. Previous research has suggested that people who are more socially anxious tend to interpret ambiguous social situations more negatively. However, researchers have not yet established whether social anxiety also affects interpretations of social situations that take place via computer, for example, through text messaging. Text messaging and other forms of computer-mediated communication lack a lot of the cues to emotion present in face-to-face communication (for example, facial expressions and tone of voice). Therefore, people's interpretations of social situations may be different in such contexts.

Why is this important to scientists or the general public?

As we move further into the digital age, more and more of our social interactions are taking place online, or via other computer-mediated means (i.e., text messaging). Scientists are trying to understand how this shift might affect our psychological and emotional well-being. This research will provide an important first step in determining whether the phenomena that affect socially anxious individuals in face-to-face situations will operate in the same way when interacting via computer-mediated communication.

Where can I learn more?

If you are interested in learning more about this topic, here are a few academic articles that might be of interest:

Kruger, J., Epley, N., Parker, J., & Ng, Z. (2005). Egocentrism over e-mail: Can we communicate as well as we think? *Journal of Personality and Social Psychology*, *89*, 925 – 936.

Stopa, L., & Clark, D.M. (2000). Social phobia and interpretation of social events. *Behavior Research and Therapy*, *38*, 273–283.

What if I have questions?

For more information, or if you have any questions about this study, please contact Mila Kingsbury (mreichel@connect.carleton.ca) or Dr. Robert Coplan in the Department of Psychology at Carleton University (613-520-2600 ext. 8691, robert_coplan@carleton.ca). If you have any ethical concerns, contact Dr. Monique Sénéchal (613-520-2600 ext. 1155, monique_senechal@carleton.ca), head of the Carleton University Psychology Research Ethics Board. If you have any additional questions or concerns about this

research, please contact the Chair of the Department of Psychology, Dr. Anne Bowker (613-520-2600 ext. 8218, anne_bowker@carleton.ca).

If after participating in this research, you feel distressed, uncomfortable, or unhappy for any reason, please contact your family physician or the Carleton University's Health and Counselling Services (613-520-6674).

APPENDIX D
Prototypical vignettes, IB-CMC

In this questionnaire, different scenarios are described that you might have experienced. Below each scenario are two things a person might think in these sorts of situations. Please imagine, for each of the following situations, that you have received the text message described.

Using the scale provided, indicate how likely each thought would be to come to your mind.

Does not come to mind			mind			Definitely comes to
1	2	3	4	5		

Do not worry if neither of the thoughts would come to your mind.

1) A few minutes before class, you message a friend and ask him/her to save you a seat. S/he responds:

I'm sitting with Alex.

What would you think?

a) S/he is telling me where s/he is sitting so I can find him/her

Does not come to mind					Definitely comes to mind
1	2	3	4	5	

b) S/he doesn't want to sit with me

Does not come to mind					Definitely comes to mind
1	2	3	4	5	

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

Not realistic					Realistic
1	2	3	4	5	

2) One evening, you get this message from a friend:

Can you call me asap?

What would you think?

a) S/he has something exciting to tell me

- b) S/he has something bad to tell me

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

- 3) A friend messages you:

I just saw an interesting picture of you

What do you think?

- a) S/he is making fun of my photo
b) S/he likes my photo

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

- 4) You message a friend to ask if s/he wants to hang out on Friday night. Your friend responds:

I'm going to Sam's party

What do you think?

- a) S/he doesn't want to hang out with me on Friday
b) S/he wants me to come to the party with her

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

- 5) Your friend has a problem and texts you to ask you for advice. After you say what you think he/she should do, s/he replies:

Yeah, right.

What do you think?

- a) S/he thinks my advice is good
b) S/he doesn't like my advice

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

- 6) You have just messaged a friend to tell him/her about a new hobby you started. S/he replies:

That's cool

What do you think?

- a) S/he is thinks it is interesting
- b) S/he is being sarcastic

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

7) You message your friend about a presentation s/he saw you give in a class earlier that day, which you were nervous about. S/he writes:

It was fine

What do you think?

- a) S/he didn't like my presentation
- b) S/he liked my presentation

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

8) The day after attending a party, you get this message from a friend:

I heard about last night

What do you think?

- a) S/he heard about something embarrassing I did or said
- b) S/he heard about something interesting that happened at the party

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

9) Yesterday, you sent a friend a long message, and s/he hasn't responded. You text him/her to follow up, and s/he replies:

I didn't get your message

What do you think?

- a) S/he did not get the message
- b) S/he just didn't want to respond to me

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

10) You text a friend to ask what s/he is doing tonight. S/he replies:

We're just going to hang here

What do you think?

- a) S/he doesn't want to hang out with me tonight
- b) It would be ok for me to join my friend at his/her house

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

11) You text a friend about something funny that happened to you. S/he replies

Lol

What do you think?

- a) S/he is brushing me off
- b) S/he thought my text was funny

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

12) You have been working on a group project with a friend. One morning, s/he texts you:

I stayed up to finish the project last night

What do you think?

- a) S/he is mad at me for not doing more work
- b) S/he is excited to have finished the project

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

13) A friend of yours is hosting a party. You send him/her a message asking if it's alright to bring someone with you to the party. S/he replies:

Oh okay

What do you think?

- a) S/he doesn't want me to bring someone
- b) It's fine if I bring someone

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

14) You and a friend have plans to hang out today. You text her:

So what do you want to do today?

S/he replies:

Whatever you want

What do you think?

- a) S/he doesn't really want to hang out
- b) S/he is doesn't mind what we do

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

15) You message a friend to ask what s/he is up to. S/he replies:

I'm out with Jamie.

You can join us if you want.

What do you think?

- a) S/he wants me to join them
- b) She doesn't want me to join them

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

16) You weren't able to attend a friend's birthday party last night. The next morning, you text:

Sorry I didn't make it out last night!

S/he replies:

Don't worry about it

What do you think?

- a) S/he is mad at me for not going
- b) S/he understands I couldn't make it

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

17) You text a friend to say that you are in the same class as s/he is. S/he replies:

I guess I'll see you there

What do you think?

- a) S/he will be happy to see me
- b) S/he doesn't really want to see me

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

18) You are going to a concert with a friend. You message him/her:

Want to get some dinner first?

S/he replies:

We could

What do you think?

- a) S/he wants to have dinner with me
- b) S/he doesn't really want to have dinner with me

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

19) You text a friend to ask if s/he is free to talk on the phone. S/he replies:

Maybe later

What do you think?

- a) S/he doesn't want to talk to me
- b) S/he is busy but wants to talk to me later.

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

20) You text a friend to tell him/her you got offered a great job. S/he replies:

Good for you

What do you think?

- a) S/he is happy for me
- b) S/he doesn't really care

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

21) You text a friend:

Want to hang out on Thursday?

S/he replies:

I'll let you know

What do you think?

- a) S/he has to check his/her schedule
- b) S/he doesn't really want to hang out with me

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

22) You call a friend and s/he doesn't answer. A few seconds later s/he texts:

Can't talk

What do you think?

- a) S/he doesn't want to talk to me
- b) S/he is busy right now

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

23) You are supposed to hang out with a friend tonight but you're feeling too tired. You text him/her to cancel your plans. S/he replies:

Oh okay

What do you think?

- a) S/he is mad at you for cancelling
- b) S/he understands you have to cancel

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

24) You missed a class and you text a friend to ask if you can borrow his/her notes. S/he answers:

Sure

What do you think?

- a) S/he doesn't mind lending them to me
- b) S/he doesn't want me to copy his/her notes

How realistic is this scenario? (e.g., how likely is it that you might receive this text from a friend)

APPENDIX E
Ambiguous Social Situations Interpretation Questionnaire (ASSIQ)
(Stopa & Clark, 2000)

Following are some descriptions of situations in which it is not quite clear what is happening. After each situation, you will see three possible explanations for the situation. Arrange these in the order in which they would be most likely to come to your mind if you found yourself in a similar situation. The explanation that you would consider most likely to be true should come first, and the one that you would consider least likely to be true should come third. Do not think too long before deciding. We want your first impressions, and do not worry if none of them fits with what you actually would think.

1. You have a sudden pain in your stomach. Why?
 - a. You have appendicitis or an ulcer
 - b. You have indigestion
 - c. You are hungry

2. You ask a friend to go out for a meal with you in a few days' time and they refuse. Why?
 - a. They are trying to save money
 - b. They don't want to spend the evening with you
 - c. They've already arranged to do something else

3. You have been eating normally but have recently lost some weight. Why?
 - a. You have cancer
 - b. It's a normal fluctuation
 - c. You have been rushing about more than usual

4. You go into a shop and the assistant ignores you. Why?
 - a. They are bored with their job, and behave rudely
 - b. They are concentrating on something else
 - c. You are not important enough for them to bother with

5. You notice that your heart is pounding, you feel breathless, dizzy, and unreal. Why?
 - a. You have been exerting yourself and are overtired
 - b. Something you ate disagreed with you
 - c. You are dangerously ill

6. Not long after starting a new job, your boss asks to see you. Why?
 - a. He wants to make sure you have settled in alright
 - b. You haven't been doing the job properly

- c. He is going to tell you how well you've been doing
7. A letter marked "URGENT" arrives. What is in the letter?
- a. It is junk mail designed to attract your attention
 - b. You forgot to pay a bill
 - c. News that someone you know has died or is seriously ill
8. A friend overhears your telephone conversation and starts to smile. Why?
- a. You said something funny
 - b. You're making a fool of yourself
 - c. They're remembering a joke
9. You wake up with a start in the middle of the night, thinking you heard a noise, but all is quiet. What woke you up?
- a. You were woken by a dream
 - b. A burglar broke into your house
 - c. A door or window rattled in the wind
10. You have visitors over for a meal and they leave sooner than you expected. Why?
- a. They did not wish to outstay their welcome
 - b. They had another pressing engagement
 - c. They were bored and did not enjoy the visit
11. You are having a conversation with some friends. You say something and there is a long pause. Why?
- a. You said something foolish
 - b. They are thinking about what you said
 - c. There was nothing more to say
12. A member of your family is late arriving home. Why?
- a. They have had a serious accident on their way home
 - b. They met a friend and are talking with them
 - c. It took longer than usual to get home
13. You are in the middle of answering a question at an interview. The interviewers suddenly interrupt and ask you another question. Why?
- a. They were satisfied with your answer and wanted to move on to another question
 - b. They are bad interviewers
 - c. They thought that you were talking rubbish.
14. Your chest feels uncomfortable and tight. Why?

- a. You have indigestion
 - b. You have a sore muscle
 - c. Something is wrong with your heart
15. You join a group of colleagues for lunch at work. As you sit down, two people in the group get up to leave without saying anything. Why?
- a. They have got some work to finish
 - b. They don't much like you
 - c. They have to go run an errand
16. A stranger approaches you in the street. Why?
- a. He's lost and wants directions
 - b. You have done something wrong and are about to be told off
 - c. He wants to ask some questions for a survey
17. You feel short of breath. Why?
- a. You are developing flu
 - b. You are about to suffocate
 - c. You are physically out of shape
18. You are talking to an acquaintance who briefly looks out the window. Why?
- a. Something outside has caught their attention
 - b. They are bored with you
 - c. They are tired and can't concentrate
19. Some people you know are looking in your direction and talking. Why?
- a. They are criticizing you
 - b. They are being friendly and want you to join them
 - c. They just happen to be looking your way
20. You feel lightheaded and weak. Why?
- a. You are about to faint
 - b. You need to get something to eat
 - c. You didn't get enough sleep last night
21. You've made tentative plans to go to the movies with a friend and they tell you that they can't go. Why?
- a. They don't feel well
 - b. You've done something to offend them
 - c. They've arranged something else by mistake and are too embarrassed to tell you.

22. You are talking to someone at a party. They excuse themselves to go get a drink and then start talking to someone else. Why?
- They are just being sociable
 - You are boring them
 - They saw someone they haven't seen for a long time
23. You suddenly feel confused and are having difficulty thinking straight. Why?
- You are going out of your mind
 - You are coming down with a cold
 - You've been working too hard and need a rest
24. You walk past a group of tourists and they start laughing. Why?
- Their guide said something amusing
 - You look odd
 - They're enjoying their holiday

APPENDIX F
Adolescents' Interpretation and Belief Questionnaire (AIBQ)
(Miers et al., 2008)

In this questionnaire different situations are described which you might have experienced. Written below each situation are three different things a person might think in these sorts of situations. A person will usually have a number of different thoughts as an explanation for a situation.

Imagine **yourself** in the following situations. Using the scale provided, indicate whether each of the three thoughts would pop up in **your** mind.

1. You've received a new watch with a stopwatch function but you can't get it to work.

Why can't you get it to work?

I've done something wrong and now it's broken

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

The watch is just too complicated; no-one would be able to get it to work.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

I just need some more time and I'll be able to get it to work.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

2. You've invited a group of classmates to your birthday party, but a few have not yet said if they're coming.

Why haven't they said something yet?

They don't know yet if they can come or not.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

They don't want to come because they don't like me.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

They're definitely coming; they don't need to tell me that

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

**3. You've received bad marks for your last few tests.
Why has this happened?****The tests were really difficult and nearly everybody got bad marks.**

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

This class is too difficult for me; I'll have to repeat next year.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

I need to work harder and then it'll be fine.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
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Lots of people want to go to the cinema tonight.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

6. Suddenly, you feel really sick. Why do you feel sick?**I've eaten too many sweets; it's not that bad, it'll be over in a minute**

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

I'm really ill; I'll have to go to the doctor.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

Oh, everyone feels sick sometimes.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

7. Two classmates, who are standing talking to each other, look at you. Why are they looking at you?**They're gossiping about me.**

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

They like me and want me to go over to join them.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

They just happen to be looking in my direction.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

8. You've locked your bike up somewhere and when you go back for it later on, you can't find it. Why can't you find your bike?

It's been stolen.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

I'm looking in the wrong place but it's definitely around here somewhere.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

There are just so many bikes here that it's difficult to find.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

9. You're standing with a group of classmates. When you begin to talk, no-one looks at you. Why isn't anyone looking at you?

They don't want me hanging around because they don't like me.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

They just happen to be looking at something else, but they are interested in what I have to say.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

I should have waited until my classmate had finished before I began talking.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

10. You're standing on your own at a party and somebody you don't know looks at you. Why is he or she looking at you?

I stand out like a sore thumb. He or she probably thinks I'm pathetic.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

He or she just happens to be looking in my direction.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

He or she likes me and wants to get my attention.

Doesn't pop up in my mind		Might pop up in my mind		Definitely pops up in my mind
1	2	3	4	5

APPENDIX G
Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998)

For each item, please select the number to indicate the degree to which you feel the statement is characteristic or true for you. The rating scale is as follows:

- 0 = **Not at all** characteristic or true of me
- 1 = **Slightly** characteristic or true of me
- 2 = **Moderately** characteristic or true of me
- 3 = **Very** characteristic or true of me
- 4 = **Extremely** characteristic or true of me

1. I get nervous if I have to speak with someone in authority (teacher, boss, etc.).
2. I have difficulty making eye contact with others.
3. I become tense if I have to talk about myself or my feelings.
4. I find it difficult to mix comfortably with the people I work with.
5. I find it easy to make friends my own age.
6. I tense up if I meet an acquaintance in the street.
7. When mixing socially, I am uncomfortable.
8. I feel tense if I am alone with just one other person.
9. I am at ease meeting people at parties, etc.
10. I have difficulty talking with other people.
11. I find it easy to think of things to talk about
12. I worry about expressing myself in case I appear awkward.
13. I find it difficult to disagree with another's point of view.
14. I have difficulty talking to attractive persons of the opposite sex.
15. I find myself worrying that I won't know what to say in social situations.
16. I am nervous mixing with people I don't know well.
17. I feel I'll say something embarrassing when talking.
18. When mixing in a group, I find myself worrying I will be ignored.
19. I am tense mixing in a group.
20. I am unsure whether to greet someone I know slightly.

APPENDIX H
Center for Epidemiological Studies Depression Scale
(CES-D; Radloff, 1977)

Please choose the answer that best represents how you have felt during the past week.

	Rarely or none of the time (less than one day)	Some of a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
	0	1	2	3
1. I was bothered by things that usually don't bother me.				
2. I did not feel like eating; my appetite was poor.				
3. I felt that I could not shake off the blues even with help from my family or friends.				
4. I felt I was just as good as other people.				
5. I had trouble keeping my mind on what I was doing.				
6. I felt depressed.				
7. I felt that everything I did was an effort.				
8. I felt hopeful about the future.				
9. I thought my life had been a failure.				
10. I felt fearful.				

- | | 0 | 1 | 2 | 3 |
|------------------------------------|---|---|---|---|
| 11. My sleep was restless. | | | | |
| 12. I was happy. | | | | |
| 13. I talked less than usual. | | | | |
| 14. I felt lonely. | | | | |
| 15. People were unfriendly. | | | | |
| 16. I enjoyed life. | | | | |
| 17. I had crying spells. | | | | |
| 18. I felt sad. | | | | |
| 19. I felt that people dislike me. | | | | |
| 20. I could not get "going". | | | | |

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