Interpersonal Style Predicts Behavioral Heterogeneity During Economic-Exchange Task Gameplay in Individuals With Social Anxiety

by

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ABSTRACT

Recent evidence suggests that individuals who exhibit socially anxious (SA) symptoms endorse patterns of maladaptive interpersonal behavior that can be parceled into three subtypes based upon interpersonal circumplex theory: friendly-submissive, hostile-submissive, and hostile-dominant. It remains unclear, however, whether these subtypes translate into observable social behavior in laboratory contexts. I used two economic-exchange tasks, the prisoner's dilemma game (PDG) and the ultimatum game (UG), as models of domains of social behavior to detect interpersonal differences in a sample of college students (N= 88) who endorsed mild-to-severe levels of SA based upon responses to the Liebowitz Social Anxiety Scale Self-Report (LSAS-SR). Using a two-step automatic clustering procedure, the sample was divided into three groups according to their responses on the Inventory of Interpersonal Problems – 32 (IIP-32). Interpersonal profiles were constructed for these groups and two of the three expected subtypes were identified (friendly-submissive and hostile-submissive); however, instead of hostile-dominance, friendly-dominance emerged as a potential subtype. Hierarchical and quantile regressions were conducted to examine whether SA severity and interpersonal subtype predicted cooperation and acceptance rates in the PDG and UG respectively. The data revealed that in the PDG, SA severity significantly predicted an increase in cooperation rate, while the interpersonal subtypes did not have a significant effect. However, when analyses included only those individuals who met a clinical cutoff for severe SA (N = 66), SA severity no longer predicted cooperation rates. But friendly-submissiveness predicted cooperation rates exceeding 65% during gameplay, while friendly-dominance predicted a ceiling cooperation rate of 65%. Hostile-submissiveness did not predict variance in cooperation rate. In the UG, the interpersonal subtypes and SA severity did not significantly predict acceptance rate. These findings build upon

a burgeoning literature substantiating links between self-reported interpersonal problems and unique interindividual psychopathological presentations. However, improvements in sample recruitment, the implementation of economic-exchange tasks, and data-analytic methods need to be put into practice before stronger assertions can be made concerning the therapeutic relevance of these games as social decision-making paradigms.

INDEX WORDS: Social anxiety, Interpersonal theory, Circumplex theory, Relationships, Prisoner's dilemma, Ultimatum game

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DEDICATION

This dissertation is dedicated to my extraordinary, supportive parents Catherine Thompson and Henrie Thompson for giving me the tools to succeed throughout my life!

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Purpose of the Study

Social Anxiety (SA), or fear that others will evaluate one negatively in social situations, is a common problem. For roughly 13% of the adult United States (US) population, symptoms are severe enough to warrant a diagnosis of Social Anxiety Disorder (SAD) at some point in their lives (Kessler et al., 2012), and as many as 20% experience one or more SAD symptoms. SAD has a chronic course (Steinert et al., 2013) and is associated not only with high comorbidity with other syndromal disorders (62.9%; Thibaut, 2017), but also with pervasive functional and quality of life impairments (Ruscio et al., 2008). Standard therapies for SAD rely heavily on cognitive-behavioral approaches (e.g., cognitive restructuring, exposure therapy) to reduce anxiety-related symptoms, including avoidance behaviors (Hofmann et al., 2017). However, they only prove effective for about 40% of those treated (Springer et al., 2018); thus for most people with SAD, even those who receive the best interventions available, relief is limited or temporary.

The interpersonal perspective (Alden & Taylor, 2010) suggests that treatment for SAD may be more effective if it promotes approach-based, affiliative behavior in addition to decreasing anxiety and avoidance behavior (Alden et al., 2018; Plasencia et al., 2016; Rodebaugh et al., 2016). Use of this method could strengthen treated individuals' relationships with others and facilitate positive social outcomes. This idea is grounded in work that has linked SA to interpersonal styles—or patterns of interpersonal behavior—characterized by a reduced tendency to interact in ways that draw others close and facilitate bonding (Alden & Taylor, 2010; Rodebaugh et al., 2017). However, much of this research has relied solely upon self-report regarding perceptions of one's own interpersonal behavior (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001). We know surprisingly little about the degree to

which these self-perceptions align with objectively observed behavior among people who endorse high levels of SA (high SA), whether or not they meet criteria for an anxiety disorder. Moreover, people with high SA are particularly prone to social desirability biases and impaired insight when completing self-report measures, due to their fears of negative evaluation (Mortel, 2008).

A small, but growing, body of research has begun to address the gap in our knowledge about the correspondence between self-perceived and observed behavior by examining associations among SA, self-reported interpersonal styles, and patterns of play during economic-exchange tasks. These tasks offer a structured, yet flexible and ecologically valid, framework for use in studies of social interaction. The current study aimed to extend this line of work by comparing patterns of decision-making among young college-age adults during two economic-exchange games. The students needed to endorse mild-to-severe levels of SA and they were expected to conform to one of three interpersonal styles.

1.2 Cognitive-Behavioral versus Interpersonal Models of Social Anxiety

Two well-established cognitive-behavioral models (Clark & Wells, 1995; Rapee & Heimberg, 1997) form the backbone for much of our current understanding of SA. These distinct, but compatible, models center on the notion that individuals with SA have negative beliefs about their appearance and behavior in social settings that evoke anticipatory anxiety about how others will respond to them. Moreover, these models hold that those experiencing SA assume that others will hold them to excessively high social standards and evaluate them negatively when they fail to achieve the perfection that they imagine that their "audience" expects from them. Hofmann (2007) further emphasized that negative self-beliefs can also provoke a bias to believe that anticipated negative outcomes are likely to come with heavy social

costs, such as rejection and loss of social standing. In addition, they can cause individuals with SA to underestimate the likelihood of positive interactions with peers. In a recent update to their model of SA, Heimberg and Rapee (2010) described how additional factors, including negative self-imagery, post-event rumination, fear of positive evaluation, and maladaptive emotional regulation, help to maintain and reinforce core symptoms.

With the exception of avoidance, cognitive-behavioral models focus surprisingly little on maladaptive social behaviors associated with SA. Alternate models, such as those that have emerged from interpersonal theory, may be useful for capturing these important correlates of SA. Interpersonal models are grounded in the idea that healthy social relationships are linked to psychological and emotional well-being, while unhealthy social relationships precipitate and exacerbate psychopathology (Dawood et al., 2018). They thus have the potential to complement cognitive-behavioral models of SA in useful ways.

According to interpersonal theory (Dawood et al., 2018; Pincus & Ansell, 2003), people's earliest social experiences interact with their neurobiological predispositions to foster persistent patterns of interpersonal behavior (Bretherton, 1992; Zeanah & Gleason, 2015). Other people's reactions to an individual's pattern of interpersonal behavior help to shape that person's self-schema, or beliefs about the self (Leary & Tangney, 2011). Over time, individuals store what they have learned since early childhood about their actions and others' reactions in knowledge structures called working models (Bretherton, 2005) or relational schemas (Baldwin, 2006) that represent themselves in relation to others. These relational schemas help people select interaction strategies from learned interpersonal scripts to facilitate navigation of their social environments (Baldwin, 2006). Pincus and Ansell (2003) defined the "interpersonal situation" as an experience

in which social learning influences the development of self-concept and social behavior through the regulation of anxiety and management of self-esteem.

Interpersonal theory suggests that most significant personality and psychopathological phenomena are relational in nature (Dawood et al., 2018). Ideally, people develop scripts that allow them to select interaction strategies in a flexible and adaptive way as their social contexts shift and change. However, many people instead tend to repeat strategies that proved useful in the past, even when other, less familiar or comfortable strategies could be more appropriate; such repetitive responses further reinforce our principal beliefs about ourselves and others (Kiesler, 1996; Pincus & Wright, 2012). We thus commonly enter self-perpetuating interpersonal transactional cycles that become deeply ingrained (Alden & Taylor, 2011). Because we tend to elicit the same responses from others over and over again, we also begin to assume that other people's behaviors are inherently inflexible and unlikely to change (Sadler et al., 2012). The safest approach then is to continue to use interaction strategies that we used in the past, thus eliciting anticipated responses, even if those responses are unwanted (Pincus & Wright, 2012). The presence of these familiar responses validates our continual dependence on these maladaptive interpersonal strategies. As a result, psychopathology is often recognized via disturbed interpersonal functioning (Pincus & Wright, 2012).

A number of social behaviors facilitate adaptive interpersonal functioning; these include reciprocity, responsivity, openness, and genuine emotional expression (Butler et al., 2003; Lang et al., 2009, 2009; Sparkman, 2020). Individuals with SAD can experience difficulties within all of these domains (Kaplan et al., 2015; Rodebaugh et al., 2017; Sparrevohn & Rapee, 2009; Tone et al., 2019). Interpersonal problems among people experiencing SAD may be rooted in dysregulation of the social approach-avoidance system, a model of social behavior with plausible

neural substrates (Kaldewaij et al., 2017; Robin & Martin, 2010). This model is compatible with interpersonal theory.

The social approach-avoidance system comprises two interacting components. The social *approach* component regulates positive affect and motivation to approach desired outcomes, both of which facilitate social initiation and openness to experience; the social *avoidance* component regulates negative affect and avoidance motivation of feared outcomes, thus facilitating self-protection and emotional and behavioral inhibition (Elliot et al., 2006; Gable, 2006). Individuals prone to SA are vulnerable to dysfunction resulting from conflict between these two components, such that they struggle to reconcile desires for social belongingness with coexisting desires to avoid social contact, as a consequence of pervasive fears of ridicule or rejection (Elliot et al., 2006; Gable, 2006). This motivational dissonance may serve to perpetuate maladaptive interpersonal transaction styles that can harm an individual's ability to build and maintain strong relationships with others.

1.3 Interpersonal Processes in Social Anxiety

People with SAD generally have fewer social relationships—whether with friends or romantic/sexual partners—than people with other anxiety disorders or members of the general population (Mendlowicz & Stein, 2000; Olatunji et al., 2007; Falk Dahl & Dahl, 2010; Schneier et al., 1994). Youth (Beidel et al., 2007; Kashdan & Herbert, 2001) and adults (Fehm et al., 2008; Stein et al., 2004) who experience SA that does not meet diagnostic thresholds report similar problems forming and maintaining relationships. For example, adolescents who endorse experiencing SA not only have fewer intimate friendships than nonanxious adolescents, but they also report reduced peer acceptance and more peer victimization (Greco & Morris, 2005; La Greca & Lopez, 1998; Tillfors et al., 2012). Additionally, youths and college students with high

SA have fewer opposite sex interactions and sexual experiences than less-anxious peers (Dodge et al., 1987; Kashdan et al., 2011; Leary & Dobbins, 1983).

Even when individuals with SA manage to foster close relationships, those connections seem less intense and stable. People with SAD tend to report lower perceived levels of social support from family and peers than do individuals with no psychiatric disorder (Aderka et al., 2012; Mendlowicz & Stein, 2000; Wong et al., 2012). They also endorse reduced satisfaction and more frequent feelings of isolation from significant others (Aderka et al., 2012; Mendlowicz & Stein, 2000; Wong et al., 2012). Similar patterns are evident among people who self-report high SA but do not necessarily meet criteria for SAD (Davidson et al., 1994; Fehm et al., 2008; Stein et al., 2000).

The feelings of disconnection that people with elevated SA report may reflect tendencies to behave in ways that inadvertently push others away. For example, one study found that those who endorse high SA also endorse more use of maladaptive behavioral strategies in close relationships than do less anxious peers. These strategies include nonassertiveness and avoidance, as well as tendencies to forgo warm, approach-based behavior (Davila & Beck, 2002). An observational study of varied types of conversations between students and their romantic partners yielded evidence that these self-perceptions may be at least partly accurate. In this study, students with high SA engaged in more negative interpersonal behaviors (e.g., mind reading with negative affect, blaming, put-downs) and fewer positive interpersonal behaviors (e.g. compliments, clarifications, agreement or disagreement with rationale provided) across all conversation types than did students with low SA (Wenzel et al., 2005). Furthermore, SA has been associated with difficulties in reciprocating intimacy, self-disclosure, and responding to

expressed and perceived criticism in romantic relationships (Porter & Chambless, 2014; Porter et al., 2017; Porter et al., 2019).

Additionally, people with SA may perceive the quality of their friendships as poorer than do less anxious peers (Rodebaugh, 2009; Rodebaugh et al., 2014, 2015). A study of adults with SAD found a significant negative association between SAD and self-reported friendship quality (Rodebaugh, 2009). Rodebaugh and colleagues (2014) replicated and extended these findings in a study that gathered ratings of friendship quality and participant characteristics from the participants' real friends. Participants with SAD received lower ratings from their friends on indices of assertiveness and adjustment than did participants without SAD; however, for SAD participants, these ratings were not associated with friends' ratings of friendship quality (Rodebaugh et al., 2014). Lastly, a longitudinal study examining self-reported friendship quality over six months indicated that in a college-aged sample, high SA did not significantly predict impaired friendship quality over time; however, this result could stem from perceptions of impairment in friendship quality that preceded the study (Rodebaugh et al., 2015).

Adults with SAD also rely on avoidance (safety) behaviors to avoid undesirable social outcomes; these behaviors may impede bonding and affiliation (Piccirillo et al., 2016). Behaviors such as gaze avoidance, concealing trembling hands, speaking for shorter durations, using softer vocal tones, and conversational rehearsals and pauses enable interpersonal avoidance and impression management in socially threatening situations (Galili et al., 2013; Glass & Arnkoff, 1989; McManus et al., 2008; Meleshko & Alden, 1993; Roth et al., 2001; Weeks et al., 2013).

Although individuals with SA perceive safety behaviors to be self-protective and effective in preventing catastrophic outcomes, the behaviors not only function minimally to alleviate anxiety, but also negatively influence others' evaluations of the person who emits them

(Piccirillo et al., 2016). In at least one study, observers rated individuals with SA as poor at socializing, unexpressive, unassertive, and visibly anxious (Stravynski et al., 2010). In other studies, both objective observers and close friends described individuals with high SA or who identified themselves as shy as less pleasant, warm, or intelligent than those who endorsed low SA or shyness (Gough & Thorne, 1986; Stangier, et al., 2006; Voncken et al., 2008, 2010). Furthermore, Creed and Funder (1998) found that college friends viewed individuals with SA as fearful, moody, self-pitying, and sensitive to demands. Finally, studies that have used "getting-acquainted" conversation paradigms have found that conversation partners typically judge their interactions with peers with high SA as less interesting or appropriate than they judge interactions with peers with low SA. They also perceive high-SA peers as disinterested and report less desire for future interaction with them (Alden & Wallace, 1995; Langer & Rodebaugh, 2013; McManus et al., 2008; Meleshko & Alden, 1993; Plasencia et al., 2011).

Along with safety behaviors, use of maladaptive strategies for regulating anger may exacerbate interpersonal impairment in SA. Individuals who report high SA have difficulty regulating anger during the receipt of either real or imagined negative evaluation, as well as under circumstances when others expect them to participate in anxiety-provoking activities (Breen & Kashdan, 2011; Erwin et al., 2003; Versella et al., 2016). In particular, instead of using constructive coping strategies such as cognitive reappraisal to manage angry feelings, individuals with high SA often elect to avoid or suppress their anger (Spokas et al., 2009; Werner et al., 2011). Reasons for suppressing anger may vary across individuals with SA; for some, suppression is rooted in beliefs that others will perceive their emotional expression as weakness and that this perception might precipitate a negative response that will culminate in rejection (DeWall et al., 2010; Moscovitch et al., 2008; Spokas et al., 2009).

Taken together, findings from multiple studies suggest associations between SA and avoidance, nonassertiveness, lack of warmth, and anger suppression. However, research over the last two decades has yielded evidence of heterogeneity in patterns of maladaptive interpersonal behavior within a variety of psychiatric conditions, including SAD (Erickson et al., 2016; McEvoy et al., 2013; Uhmann et al., 2010). Interpersonal heterogeneity also appears to be evident in people who endorse high SA, but do not necessarily meet SAD criteria (Cooper & Anderson, 2019).

Some individuals with high SA do, in fact, endorse maladaptive interpersonal behaviors that comprise avoidance, lack of warmth, nonassertiveness, and anger suppression (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Girard et al., 2017). However, others endorse problems with hostility, self-centeredness, distrust and resentment of others, and expressions of anger in response to criticism and negative evaluation (Erwin et al., 2003; Kachin et al., 2001; Kashdan et al., 2009; Versella et al., 2016). Still, others describe themselves as overly transparent, excessively trusting, and easily taken advantage of (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001). The emergence of these three self-reported interpersonal patterns suggests that there are individual differences in types of interpersonal behavior among individuals with SA. Moreover, these patterns appear to be marked by distinctive combinations of dysfunction in social approach and avoidance behaviors. For example, friendly-submissive individuals tend to disclose too much personal information about themselves while hostile-submissive individuals fail to disclose enough or display any genuine signs of vulnerability or openness (Barkham et al., 1996; Horowitz et al., 2000).

1.4 Pathoplasticity and the Interpersonal Circumplex

Identifying distinctive patterns of interpersonal behavior among individuals experiencing psychopathological symptoms may be useful for advancing our understanding of SA. Increasingly, researchers are acknowledging the value of considering individual differences in characteristics that extend beyond symptom profiles when trying to understand psychopathology. As Widiger (2011) noted, personality and psychopathology have historically been treated as independent concepts; however, they are inextricably intertwined. For example, they can share common substrates; one may also cause the other's development. A third way in which personality and psychopathology may be related is through pathoplasticity: a continual, dynamic interplay between two etiologically distinct entities, such that one or both influences the expression or presentation of the other (Widiger, 2011).

Pathoplasticity is an intuitively plausible concept. As Cain and colleagues (2010) underscored, it is improbable that the usual manner in which people think, feel, perceive, and behave in relation to their surroundings would have no impact on how they manifest symptoms of psychopathology. Thus, it makes sense that personality might not only constrain the content and trajectory of psychopathology, but also influence how individuals with psychological disorders appraise and cope with stressors in the social environment (Andersen & Bienvenu, 2011). A foundational tenet of pathoplastic models is that differences in interpersonal expression should explain psychopathology over and above the effects of symptom severity as classified by standard diagnostic criteria. Widiger (2011) suggested this guideline because differences in core diagnostic criteria could serve as a plausible explanation for the interpersonal problems being demonstrated in a given sample.

Interpersonal behavior is a key element of personality that intersects in meaningful ways with psychopathology. In particular, interpersonal theorists have long contended that habitual patterns of maladaptive interpersonal behavior elicit complementary responses from others which serve to reinforce distorted views of social situations and difficulty shifting to more adaptive ways of interacting (Benjamin, 1996; Kiesler, 1996; Leary, 1957; Sullivan, 2013). Persistent deviations from adaptive social behavioral patterns are suggestive of psychopathology because they can indicate problems in appreciating the consensual nature of interpersonal interactions, appropriately conveying one's own interpersonal needs and motives, and understanding the needs of others and the motivations underlying their interpersonal behavior (Cain & Pincus, 2016). Social impairment thus poses a high risk for precipitating psychopathology and its prevalence in people with psychiatric illnesses further warrants the application of interpersonal approaches to uncovering the mechanisms behind its occurrence.

A substantive thread of interpersonal research uses interpersonal circumplex (IPC) models to organize interpersonal behavior into a meaningful taxonomy that can be graphically represented by a two-dimensional (2D) circular space with two orthogonal axes. The poles of the vertical axis of the IPC represent dominance and submissiveness (*agency dimension*) and the poles of the horizontal axis represent affiliation versus separation (*communion dimension*; Gurtman, 2009). Considerable evidence has accumulated to support this model by showing that the dimensions of agency and communion account for a large amount of variance in interpersonal traits, problems, emotions, and values (Bliton & Pincus, 2019; Foa, 1961; Hatcher & Rogers, 2009; Hopwood et al., 2011; Locke, 2000; Pincus & Ansell, 2003; Plutchik & Conte, 1997; Wiggins, 1979). Agency and communion thus serve as meta-constructs that systematize the examination of interpersonal phenomena (Dawood et al., 2018).

In theory, flexible and appropriate selection of behaviors distributed along these two dimensions should facilitate successful social adaptation in environments that vary in their composition and predictability (Bugental, 2000). Inflexible or inappropriate selection of social behaviors, in contrast, should increase risk for poor adaptation and concomitant distress. Thus, the IPC provides a model for mapping adaptive and maladaptive interpersonal behaviors (Gurtman, 2009). Among the most widely used IPC measures is the Inventory of Interpersonal Problems – Circumplex Scale (IIP-C; see Figure 1), developed to index self-reported dysfunctional or pathological interpersonal behavior (Alden et al., 1990; Horowitz et al., 2000).

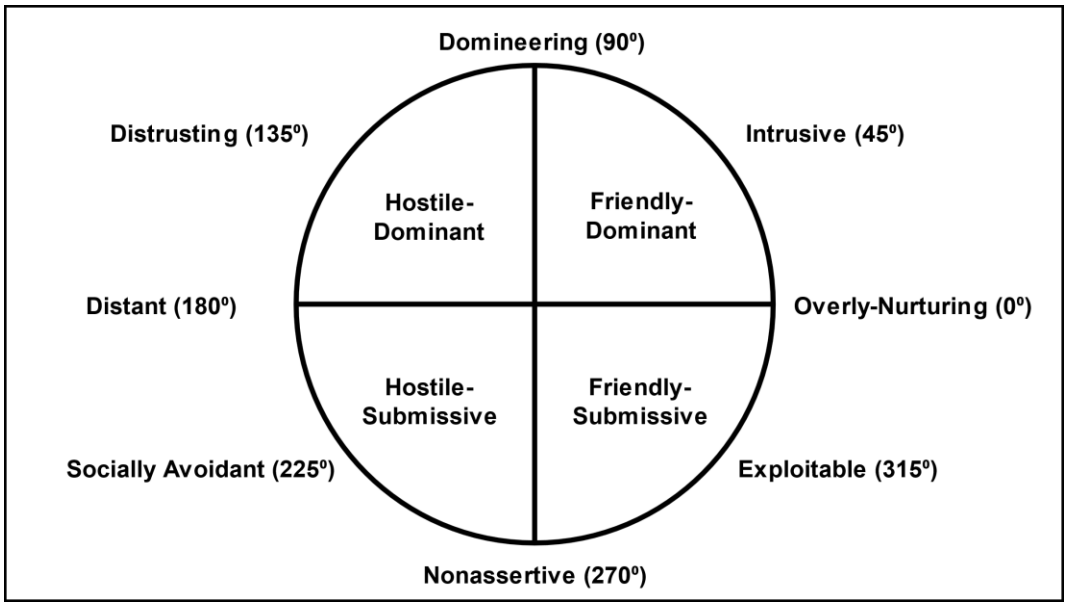

Figure 1 An illustration of the IIP-C scoring space with descriptive labels of pathological interpersonal behavior.

1.4.1 The IIP-C and Social Anxiety

The IIP-C has been used to examine associations between SA and distinct patterns, or profiles, of interpersonal behavior outside of a therapeutic context. Kachin and colleagues (2001), for instance, compared interpersonal problems among adults with generalized SAD, nongeneralized SAD, or no diagnosis (N=30 for each group; N=90 total). Diagnosis-free

participants showed a single interpersonal profile that the authors did not describe. In contrast, participants with either type of SAD exhibited one of two profiles of problematic behavior; the first was characterized by friendly-submissive behavior and the second was characterized by hostile-dominant behavior. Notably, participants with different interpersonal problem profiles did not differ significantly as a function of symptom severity, a requirement of pathoplasticity in IPC-based studies.

Cain and colleagues (2010) attempted to replicate these findings in a sample of 77 adults undergoing treatment for SAD. Like Kachin et al. (2001), they found evidence of a friendly-submissive cluster in their sample; however, their second cluster showed hostile-submissive, instead of hostile-dominant, characteristics. Notably, participants with different profiles showed different patterns of response to treatment. Post-treatment, individuals in the friendly-submissive cluster reported better well-being and quality of life, as well as more sharply reduced symptom severity, than those in the hostile-submissive cluster.

More recently, Cooper and Anderson (2019) examined associations between SA and interpersonal styles in a sample of 51 students who endorsed varying levels of submissive and aggressive behavior. Much like Cain and colleagues (2010), the researchers identified two clusters: low hostility-high submissiveness (friendly-submissive) and high hostility-high submissiveness (hostile-submissive). A post-hoc analysis revealed that the low hostility-high submissiveness group reported greater levels of empathic concern, lower levels of emotional suppression and paranoia, and less peer victimization than did the high hostility-high submissiveness group.

Interpersonal profiles associated with SA also appear to differ from those linked to depression (Alden & Phillips, 1990; Girard et al., 2017; Stangier, et al., 2006). Interpersonal

comparisons between these disorders are motivated by their high degree of comorbidity (Bandelow & Michaelis, 2015; Thibaut, 2017). Alden and Phillips (1990) found that young adults with either high SA or comorbid SA and depression endorsed more nonassertiveness, social avoidance, and distancing than healthy controls and participants with high depression levels alone. Stangier and colleagues (2006) extended these findings in a clinical sample. While participants with SAD and those with major depressive disorder (MDD) reported similar levels of interpersonal distress, the SAD group reported more problems with nonassertiveness and social avoidance than the MDD group. However, both samples reported more social avoidance, nonassertiveness, exploitability, and self-sacrificing than did healthy controls.

Finally, a recent examination of the relationship between interpersonal problems and psychopathology in 825 participants recruited from both clinical and community populations (SAD = 9.1%, MDD = 41.1%) found that while participants with either disorder primarily endorsed problems with nonassertiveness, participants with SAD showed a more clearly defined problem profile than participants with MDD (Girard et al., 2017). Taken together, findings from studies of SA and its association with IIP-C profiles suggest that there are multiple interpersonal profiles linked to SA; furthermore, there appears to be some overlap between profiles associated with SA and depression.

1.5 Economic-Exchange Tasks as Models of Interpersonal Behavior

A key limitation of most studies that examine associations between psychopathology and patterns of interpersonal behavior is that they rely exclusively on self-report measures, which can be susceptible to social desirability biases (Holtgraves, 2004). Participants may, for instance, over- or underestimate their feelings and behavior; participants may also be embarrassed to reveal certain details about themselves (Paulhus & Vazire, 2007). One way in which

interpersonal researchers have begun to address this limitation is by using interactive economic-exchange tasks to evaluate interpersonal behavior. These tasks have the advantage of closely simulating real-life social interactions, while also permitting isolation and quantification of complex social behaviors (King-Casas & Chiu, 2012; Sanfey, 2007). Using these tasks in conjunction with self-report measures can provide a more accurate picture of potential participants.

Economic-exchange tasks consist of simple decision-making scenarios that are structured around game theoretic principles. Game theory has yielded a collection of mathematically robust models designed to explain situations in which rational decision-makers must interact with or bargain with one another while optimizing their interests by selecting options that provide the greatest personal utility (Von Neumann & Morgenstern, 1947). However, the contemporary economic-exchange task literature suggests that rational decision-making theories do not completely account for all of human behavior when social norms, individual differences, and situational context are taken into account (Fehr & Fischbacher, 2005). Consequently, social researchers regularly integrate interpersonal principles with game-theoretic decision-making models to enhance our understanding of social behavior (Fehr & Schmidt, 2006).

Economic-exchange games are structured in one of two formats. The one-shot format models a single interaction with a stranger who has no relevant ties to the participant (Harrington, 1995). In comparison, in the iterated format, the participant plays multiple rounds of the game with the same partner (Axelrod, 1980). Both formats create suitable conditions for answering distinct questions. The one-shot format allows researchers to explore situations in which people will cooperate or levy punishment, even when the decision holds no risk of punishment or damage to their reputations (Clark & Sefton, 2001). The iterated format, in

contrast, is useful for examining how people adapt to the changing behavior of stable partners and incorporate knowledge from past experience into decision-making (Axelrod & Hamilton, 1981).

Economic-exchange games have the benefit of being easy for participants to comprehend. They also model a diverse array of social dilemmas that are familiar to most participants. These games are used to evaluate several aspects of social decision-making, such as reciprocal exchange, altruism, norm-enforcing punishment, and responses to unfairness. Reciprocal exchange and cooperative norms have been extensively assessed using the Prisoner's Dilemma game (PDG) and the Trust Game (TG), while norm-enforcing punishment and responses to unfairness have been examined using the Ultimatum Game (UG; Strang & Park, 2017).

The iterated PDG (Figure 2 illustrates a single iteration) provides a model of how people may achieve stable cooperation over the course of multiple interactions, even when they believe it is in their own best interests to risk conflict by not cooperating (Kreps et al., 1982). In this paradigm, a player and a co-player must simultaneously decide to cooperate or not cooperate (defect) with each other; each player's individual monetary payoff is determined by the combination of both players' decisions. Mutual cooperation over the course of an iterated game offers the most lucrative outcomes for both participants; however, in many cases people will betray their partners by defecting for a greater short-term individual payoff.

Figure 2 An illustration of a mutual cooperation round during the Prisoner's Dilemma game. In each round the participant must decide whether to cooperate or not cooperate with a partner to earn varied sums of money.

The TG (see Figure 3 for a single iteration) has been used to evaluate willingness to extend and reciprocate trust (Berg et al., 1995). Like the PDG, the TG involves reciprocal exchange. However, the TG progresses sequentially in that the first player, the investor, must first decide how much he/she is willing to invest in the second player, the trustee. Once the investment value has been multiplied (usually by a factor of three), the trustee must then decide whether to reciprocate that trust by returning some of the gains of the original investment to the investor.

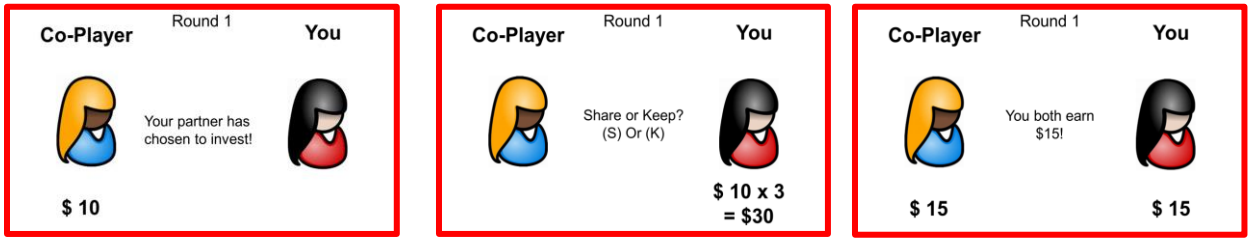

Figure 3 An illustration of a share decision during the Trust Game. In each round the participant (trustee) decides to share the money their partner (investor) has invested in them or to keep the money for themselves. The partner can also make the decision to invest nothing, keeping the initial amount for themselves and awarding the participant nothing.

Finally, the UG (see Figure 4 for illustration of a single iteration) has been used to assess inequity aversion and perceptions of fairness in resource distribution (Güth et al., 1982). The game is also used to explore the mechanisms underlying social punishment (Sigmund, et al., 2001). In the UG, one player, the proposer, must decide whether to divide a sum of money equally or unequally, and the other player, the responder, must decide whether to accept or reject that offer. Rejection of the offer means both players receive nothing. This interaction dynamic allows researchers to evaluate the monetary thresholds that need to be reached to motivate a responder to "punish" the proposer for breaching social fairness norms by rejecting their offer.

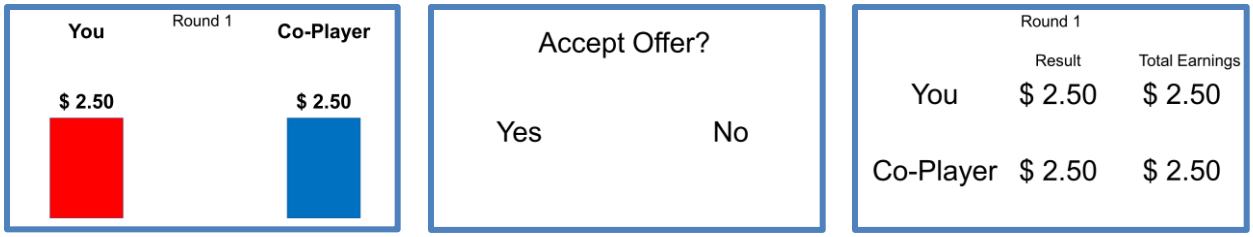

Figure 4 An illustration of a fair offer in the Ultimatum Game. In each round the participant (responder) can accept or reject a fair (50:50) or unfair (80:20) offer. Rejection of an offer, fair or unfair, means that the participant and their partner will earn nothing for that round.

1.5.1 Economic Exchange Tasks and SA

Economic-exchange tasks are useful paradigms for studying SA and its interpersonal correlates for several reasons. First, these tasks require participants to make repeated predictions about others' behavior and to face rewarding or painful consequences based on their accuracy. Thus, for people with SA, who commonly lack confidence that they can act competently and anticipate another person's behavior in ambiguous social settings (Whiting, Davis, & Reuther, 2012), these paradigms present a realistic and stressful set of social challenges. Second, behavioral studies that use static images of expressive faces or self-referential statement paradigms as substitutes for social feedback from others to examine SA lack ecological validity, in that they may not effectively simulate the environmental stressors encountered during a social interaction (Asnaani et al., 2014; Radke, et al., 2013; Taylor & Amir, 2012). Third, the economic-exchange task literature is voluminous, with decades worth of well-characterized, mathematical depictions of social behavior in healthy populations. This characteristic facilitates the comparison of rapidly growing psychiatric datasets with large normative datasets to identify deviations from typical human behavior (Robson et al., 2019; Sharp, et al., 2012; Zald & Treadway, 2017).

The PDG, the TG, and UG have all been used to examine social behavior both in people across the SA severity spectrum and in individuals with high trait anxiety (HTA), a broader construct associated with a general propensity toward anxiety across contexts, including social settings (Robson et al., 2019). Each task has displayed utility for detecting behavioral patterns linked to anxious symptoms in adolescents and adults (Anderl et al., 2018; Peterburs et al., 2017; Tone et al., 2019). However, among individuals with high SA, the UG and the PDG may be particularly useful for isolating differences along the interpersonal dimensions of agency and communion based on recent findings detailing descriptive and statistical similarities and differences among various economic-exchange tasks (Peysakhovich et al., 2014).

1.5.1.1 Ultimatum Game (UG)

The UG is particularly well suited for evaluating agency in SA. In the UG, there is a power differential between players, in that the responder can reject offers from the proposer. The player in the role of responder is thus advantageously positioned to act with agency or by retaliating against perceived transgressions and reinforcing normative behavior. However, this asymmetric relationship may be uncomfortable for individuals with high SA who are either prone to nonassertiveness and avoidance or overly-accommodating, exploitable behavior. Consequently, it is plausible that they should be the least likely to reject offers, even unfair offers. In contrast, is seems likely that those who are prone to more hostile, distrusting behaviors would be more likely to reject unfair offers.

Only two published studies appears to have examined UG play in a sample selected for high SA (Anderl et al., 2022; Peterburs et al., 2017). Several additional UG studies have recruited samples with high trait anxiety (HTA) (Craig & Tran, 2014; Moriya & Sugiura, 2012; Surcinelli et al., 2006). In one of two studies that used a sample characterized by high SA,

Peterburs and colleagues (2017) found that individuals with high SA tended to reject unfair offers, a pattern commonly observed in healthy populations (Camerer, 2003a, 2003b). This rejection rate was amplified when research team members watched participants play the game, which suggests that sensitivity to social context could influence behavior in the UG. In the second study, Anderl and colleagues (2022) found that higher levels of SA were correlated with negative affective reactions, which grew in magnitude in correlation with the unfairness of the offer. However, this affective response did not predict significant differences in behavior when compared to those with low levels of SA.

Examining studies that recruited participants with HTA, Luo and colleagues (2014) obtained a similar pattern of findings, in that while both LTA and HTA participants were more likely to reject than not reject unfair offers, the HTA group members rejected more offers than did members of the LTA group. However, personality characteristics may modulate this pattern of response. Wu and colleagues (2013) observed that for individuals with HTA, low levels of self-esteem were positively correlated with acceptance of unfair offers from the proposer, whereas they found the opposite pattern in individuals with HTA and high levels of self-esteem.

1.5.1.2 Prisoner's Dilemma Game (PDG)

The reciprocation of positive gestures is a fundamental element of two economic exchange tasks—the PDG and the TG. Thus, both tasks provide useful contexts within which to measure behaviors along the dimension of communion. Nevertheless, research on SA and PDG play is more comprehensive at this point; additionally, several recent studies have used an adaptation of the traditional PDG to more effectively capture the lack of social approach behavior in the context of SA (Rodebaugh, et al., 2011; Rodebaugh, et al., 2013; Rodebaugh, et al., 2016; Rodebaugh, et al., 2017). Additionally, in comparison to interpersonal exchanges

during the TG, interactions during the PDG are symmetric, in that participants cooperate or defect simultaneously with no foreknowledge of their co-player's decision. This arrangement ensures that neither player can gain leverage over the other during an individual round. It also increases the likelihood that players will have difficulty determining their co-player's motives; such uncertainty and ambiguity restrict the use of social approach behaviors and are particularly challenging for individuals with SA (Carleton, et al., 2010; Counsell et al., 2017; Grupe & Nitschke, 2013).

A few studies have examined associations between iterated PD (iPD) gameplay and both SA and other types of anxiety. McClure and colleagues (2007) found that adolescents with anxiety and depressive (A/D) disorders (N = 21), particularly girls, were more likely to cooperate following co-player cooperation than were healthy controls. However, they reported more intense feelings of anger toward their co-players than did other participants, particularly during periods of co-player defection. In a subsequent study, McClure-Tone and colleagues (2011) found that, regardless of gender, adolescents with A/D disorders (N = 11) reported elevated anger at their co-players but cooperated more frequently than diagnosis-free peers. However, in this study, cooperation was elevated following co-player defection, rather than following co-player cooperation. A different pattern of findings emerged in a later study with adult participants (N = 106) who varied as a function of self-reported SA (Tone et al., 2019). In this sample, SA was positively associated with increased defection, particularly following co-player cooperation, as well as with an elevated likelihood to endorse competitive goals, nervousness, and anger during gameplay. One way to reconcile these divergent patterns of outcome is to attribute the differences to developmental mechanisms that contribute to SA expression. However, another possibility is that the samples in these studies constituted individuals who

varied as a function of interpersonal style. The adolescent samples may have been more heavily weighted toward individuals who exhibit a friendly-submissive interpersonal approach characterized by a conciliatory, conflict-avoidant pattern of behavior. The adult sample, in contrast, could have been weighted instead toward those with a hostile-dominant interpersonal style, characterized by self-centeredness and feelings of distrust and hostility towards others.

Studies on adults using an alternate version of the PDG, the flexible iPD (FIPD), have yielded evidence that interpersonal behavioral style may interact with SA to shape patterns of play (Rodebaugh et al., 2011, 2013, 2016, 2017). In the FIPD, rather than simply opting to cooperate with or defect from each other, both players must divide ten tokens between themselves and their partner in each round of play. Giving a token to the partner results in a mutual payoff; keeping a token results in a payoff for the participant alone. In the first study to use this paradigm, Rodebaugh and colleagues (2011) found that high SA in college students was associated with reduced giving rates over the course of a game. However, this association was mediated by self-reported interpersonal constraint (less frequent reciprocation of positive gestures), such that giving was particularly reduced among participants who endorsed both high SA and high interpersonal constraint.

In subsequent studies, Rodebaugh and colleagues administered the FIPD and the IIP-C to participants who met criteria for SAD and to diagnosis-free peers. In the first of these studies, participants with a SAD diagnosis reported more problems with distant, nonassertive behavior and lower friendship quality; they also exhibited reduced giving during the game and less willingness to reestablish positive reciprocity over the final four rounds of the game (Rodebaugh et al., 2013). However, in the second study, as well as a re-analysis of data from the first study, reduced giving was only evident in participants with elevated SA severity who also reported

problems with self-centered, hostile behavior (Rodebaugh et al., 2016). Findings in the third study (Rodebaugh et al., 2017) underscored the importance of examining interpersonal behavioral styles; self-reported and friend-reported self-centered behavior had a stronger effect on reduced giving than severity or diagnosis of SA.

1.5.2 Economic Exchange Tasks and Depression

The literature on the PDG and its association with depression indicates a lack of consensus concerning the association between depressive symptoms and cooperation rates. Out of four studies, two found a significant negative association between depression and cooperation rate (Clark et al., 2013; Pulcu et al., 2015); the other two did not find a significant association between the two variables (Gradin et al., 2016; Sorgi & van 't Wout, 2016). The literature on UG play and depression reveals a similar pattern of results; out of seven studies, three have found a significant negative association between depression severity and acceptance rate (Radke, et al., 2013; Scheele et al., 2013; Wang et al., 2014) while the other four did not find a significant association between the two variables (Clark et al., 2013; Destoop et al., 2012; Gradin et al., 2015; Pulcu et al., 2015).

In conclusion, there appears to be variability between adolescent and adult SA samples in patterns of behavior associated with PDG play. Furthermore, Rodebaugh and colleagues (2016, 2017) indicate that patterns of behavior in adult SAD samples could also be linked to differences in interpersonal characteristics within the population. Interpersonal heterogeneity in SA could be associated with UG play as well, but this relationship has not been explored. More empirical evidence is required to determine whether economic-exchange tasks are an effective behavioral tool for capturing interpersonal heterogeneity among people who experience different types of psychological symptoms, particularly individuals across the SA spectrum.

2 CURRENT STUDY

2.1 Aims

The proposed study was designed to examine associations between self-reported interpersonal styles and patterns of decision-making during the PDG and UG in college students who endorsed mild to severe levels of SA. This overarching goal comprised four specific aims. The first aim was to use self-reported interpersonal behavioral styles to categorize young adults who endorse at least mild levels of SA. The second aim was to determine whether the resulting interpersonal profiles significantly differed as a function of SA severity. The third aim was to evaluate associations between SA severity and behavior in the PDG and UG. The fourth aim was to evaluate whether interpersonal style explained variance in cooperation rate (PDG) and acceptance rate (UG) over and above what could be explained by SA severity.

Predictions concerning the behavioral trends of the larger sample and the interpersonal subtypes were based on the findings Tone et al. (2019), Rodebaugh et al. (2016, 2017), and the evolutionary theory of SA first posited by Gilbert and colleagues (Gilbert, 2001, 2014; Trower et al., 1990; Trower & Gilbert, 1989). While the Tone and Rodebaugh findings have already been elaborated at length, the evolutionary model of SA has yet to be discussed. Briefly, Gilbert and colleagues (2014) suggested that in more egalitarian human and nonhuman primate societies, successfully navigating social interactions is contingent upon the ability to flexibly alternate between agonic and hedonic modes of interaction. Agonic mode is conflict-oriented, with the interactants primarily fixated on matters of status, dominance, and competition, while hedonic mode is peace-oriented, with the interactants prioritizing affiliation, solidarity, and intimacy. Gilbert and colleagues claimed that people susceptible to SA seem to display a rigid tendency to view their social environment as agonic, even when there are no discernible signs of threat or

competition. However, while they may at least partially desire to achieve dominance and display social mastery, they do not have confidence in their ability to actually accomplish these lofty social goals and thus have internalized an ineffective, subordinate role. In agonic-oriented primate societies, subordinates who feel incapable of challenging the dominance structure tend to avoid competition by sending conciliatory signals to aggressors or withdrawing from the interaction completely to avoid physical conflict and a descent down the hierarchy. When applied to individuals with SA, they also tend to withdraw or deploy safety behaviors, albeit with the intention of avoiding socially catastrophic outcomes as opposed to physical harm.

2.2 Hypotheses

Aim 1: Classify a college-age sample expressing mild-to-severe SA symptoms into interpersonal groups according to their self-reported interpersonal problems.

Hypothesis: Based on previous SA-IPC studies (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001) and a pilot cluster analysis performed on a legacy data set (Tone, unpublished data), I predicted that college students who endorsed mild-to-severe SA would exhibit one of three interpersonal styles based on their self-reported interpersonal problems: (1) a friendly-submissive style, (2) a hostile-submissive style, or (3) a hostile-dominant style. Furthermore, I predicted that these profiles would meet criteria for interpersonal prototypicality (Zimmermann & Wright, 2017).

Aim 2: Demonstrate pathoplasticity as defined by the absence of a significant relationship between interpersonal style and SA severity.

Hypothesis: I predicted that there would be no significant differences in SA severity among the three interpersonal groups, satisfying the assumption of pathoplasticity that

personality alone, not symptom severity, should explain behavioral variability when both factors are accounted for in subsequent statistical modeling.

Aim 3: Evaluate the relationship between SA severity and behavior in the PDG and UG.

Hypotheses:

A. SA severity would exhibit a significant, negative relationship with cooperation rate in the PDG. The prediction would correspond to the findings of Tone et al. (2019), who detected this same relationship in a larger adult sample. Notably, this behavioral pattern contradicted findings from their previous studies in anxious-depressive adolescents (McClure et al., 2007; McClure-Tone et al., 2011), whose behavior adhered to the evolutionary model of SA, with cooperation being employed even following conflict-laden outcomes.

B. I did not predict a significant relationship between SA severity and acceptance rate in the UG, aligning with previous studies investigating UG gameplay in SA adults (Anderl et al., 2022; Luo et al., 2014; Peterburs et al., 2017; Wu et al., 2013). Here findings also diverge from the evolutionary model, which suggests that individuals with SA would be reluctant to assert themselves in a situation where an interactant is attempting to exploit them (e.g. providing an unfair distribution of resources).

Aim 4: Evaluate the relationship between SA severity, interpersonal style, and behavior in the PDG and UG.

Hypotheses:

A. There would a significant relationship between interpersonal style and behavior such that friendly-submissiveness would be associated with higher rates of cooperation and acceptance in the PDG and UG, respectively. Furthermore, friendly-submissiveness

would explain cooperative behavior over and above what could be explained by symptom severity. This behavioral pattern would conform to the evolutionary model of SA, which describes SA as primarily conflict-avoidant and likely to send appeasing signals (Gilbert, 2014). Additionally, friendly-submissive individuals describe themselves as too open and transparent based on the IIP-C, suggesting an overly hedonic, affiliative disposition that would support cooperative tendencies.

B. I did not hypothesize a significant relationship between hostile-submissiveness and behavior in either the PDG or the UG. Hostile-submissive individuals endorse difficulties being sociable and tend to have a difficult time making friends. While this observation may suggest a trend towards reduced cooperation and acceptance, they also endorse a desire to avoid conflict. This aversion supports the notion that rates would not be depressed enough to significantly deviate from the average behavioral trends of the larger sample.

C. There would a significant relationship between interpersonal style and behavior such that hostile-dominance would be associated with reduced rates of cooperation and acceptance in the PDG and UG, respectively. Furthermore, hostile-dominance would explain behavior over and above what could be explained by symptom severity. This prediction was primarily based on the findings of Rodebaugh et al. 2017, who observed that the distrusting, self-centered disposition, which overlaps with the hostile-dominance subtype, predicted reducing giving behavior over and above SA severity and diagnosis. In light of Gilbert and colleagues' evolutionary model of SA, these individuals may not only strongly endorse competitive goals, but also display the nerve to act upon them.

3 METHODS

3.1 Participants

Potential participants (*N* = 92; 90.2% women) were screened and recruited at Georgia State University (GSU) via the SONA platform (Sona Systems, 2019), a cloud-based research and participant management system. This study was approved by the GSU Institutional Review Board. Data from four potential participants were excluded from the study because they reported disbelief that they were playing with a human co-player (as opposed to a computerized co-player) during debriefing. The final sample included 88 participants with a mean age of 19.89 years (*SD* = 3.67). The sample was racially and ethnically diverse and comprised African-American (37.5%), Asian (21.6%), Hispanic (18.2%), and Caucasian (14.8%) respondents. A summary of the sample's demographic characteristics can be found in Table 1. Participants completed the Liebowitz Social Anxiety Scale-Self Report (Rytwinski et al., 2009: described in the next section) and provided contact information during a prescreening portion of the study to ensure that individuals met a minimum threshold of SA symptom severity (score of 30 or more) before being invited to participate in any of the virtual games. The principal investigator contacted prescreened individuals who met the minimum SA threshold via phone call, text message, or email. The Georgia State University IRB granted a waiver of documentation of consent and thus, respondents consented implicitly to participate in prescreening by clicking a link. The principal investigator obtained verbal consent for participation in the full study prior to gameplay. This included providing the participant with their own copy of the consent form to maximize transparency for the participant.

Table 1. *Demographics Characteristics of Sample*

Variable	**Measure**	**Ethnicity**	**Frequency (N/%)**
Sample Size	88	White	13 (14.8%)
Age, Mean (± SD)	19.89 (± 3.67)	African-American	33 (37.5%)
Female (%)	81 (92%)	Hispanic or Latino	16 (18.2%)
Male (%)	6 (7.6%)	Asian	19 (21.6%)
Prefer not to Answer (%)	1 (1.1%)	Two or More	6 (6.8%)
LSAS-SR (± SD, Range)	76.72 (± 20.77, 81)	Prefer Not to Say	1 (1.1%)
CES-D-SF (± SD)	13.97 (± 4.70)	Total	88 (100%)

Note: LSAS-SR = Liebowitz Social Anxiety Scale-Self Report; CES-D-SF = Center for Epidemiologic Studies Depression Scale-Short Form

3.2 Measures

Social Anxiety Measure. Severity of fear and avoidance during social interaction and performance situations was assessed using the Liebowitz Social Anxiety Scale – Self Report (LSAS-SR; Rytwinski et al., 2009), a widely used self-report measure of SA. The measure consists of 24 items, each of which identifies a social or performance context that could be perceived as anxiety-provoking. Thirteen items evaluate performance anxiety and eleven evaluate interaction anxiety. For each of the 24 social situations, participants rated on a Likert-type scale from 0 to 3 how much fear or apprehension they would feel in that context (0 = *none*, 1 = *mild*, 2 = *moderate*, and 3 = *severe*). They then rated how likely they are to avoid each social situation (0 = *never*, 1 = *occasionally*, 2 = *often*, and 3 = *usually*). Combining the total scores of the Fear and Avoidance sub-sections of the questionnaire yields an overall score with a maximum of 144 points. Scores of 30 and 60 mark the thresholds beyond which people who

meet criteria for nongeneralized (NSAD) and generalized SAD (GSAD), respectively, typically score (Rytwinski et al., 2009).

This scale, which was originally designed to be used as a clinician-administered interview, has been validated as a self-report measure (Baker, et al., 2002). Baker and colleagues (2002) found that the self-report version of the scale has excellent test-retest reliability ($r = 0.83$); internal consistency ($\alpha = 0.95$); and convergent, discriminant, and construct validity. Fresco and colleagues (2001) compared the clinician-administered and self-report versions of the LSAS and failed to find significant differences on any scale or subscale score. Both forms were internally consistent and the subscale intercorrelations for the two forms were fundamentally identical. Correlations of each LSAS-SR index with its complement, the Liebowitz Social Anxiety Scale–Children and Adults were all significant. Finally, the convergent and discriminant validity of the two forms of the LSAS was shown to be robust (Fresco et al., 2001).

Interpersonal Functioning Measure. The Inventory of Interpersonal Problems – 32 (IIP-32; Barkham et al., 1996) was used as a measure of interpersonal behavioral style. This 32-item version of the IIP-C (Horowitz et al., 2000) has been used previously in research examining the relationship between SA, interpersonal style, and economic-exchange game play (Rodebaugh et al., 2017). Participants were asked to rate how prone they are to both behavioral excesses (interpersonal behaviors that "you do too much") and deficiencies (interpersonal behaviors that "you find hard to do") using a 5-point scale ranging from 0 = *Not at all* to 4 = *Extremely*. Responses yield scores on eight intercorrelated subscales (four items for each subscale), each of which reflects one of the behavioral subtypes on the interpersonal circumplex (see Figure 1). The IIP-32 exhibits excellent internal consistency ($\alpha = 0.87$) and good test-retest reliability ($r = .70$; Barkham et al., 1996). Due to the measure's circumplex properties, responses can also be used to

construct an interpersonal profile for the participant sample that identifies angular displacement (interpersonal style), elevation (mean interpersonal distress), and amplitude (distinctiveness) indices (see Figure 5) (Zimmermann & Wright, 2017). These indices were used to determine whether profiles developed for participant groups were markedly elevated and distinct. The significance of these summary parameters is further discussed in the Data Analytic Strategy section of the manuscript.

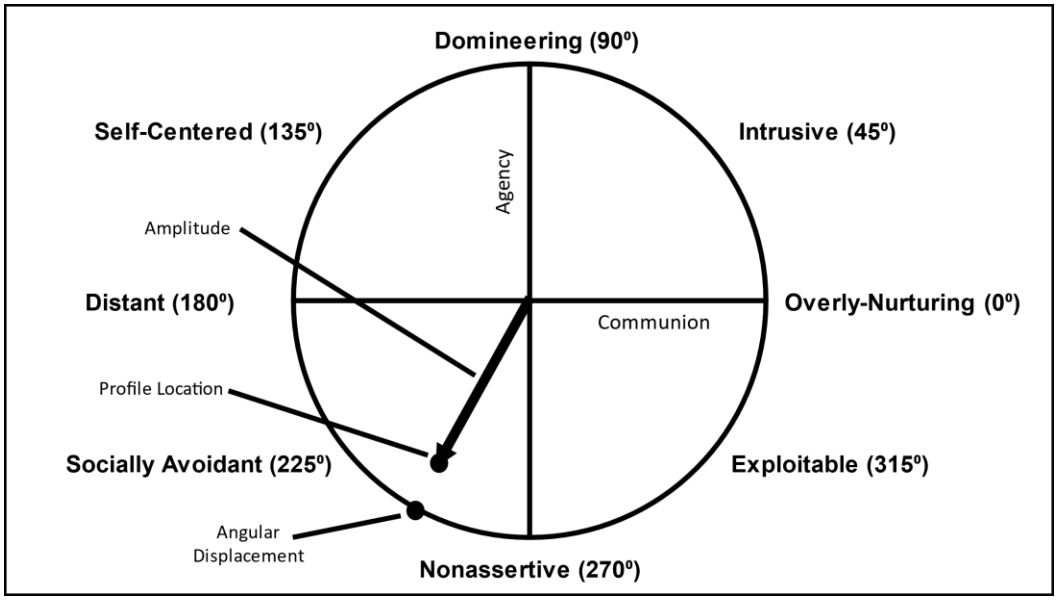

Figure 5 An illustration of the IIP-C scoring space with the structural parameters (amplitude and angular displacement) labelled. Elevation is not illustrated because it is simply the standardized mean score across all circumplex octants.

Depression Measure. Depressive symptoms were evaluated using the Center for Epidemiologic Studies Depression Scale Short Form (CES-D-SF; Smarr & Keefer, 2011). The National Institute of Mental Health created the CES-D for rapid screening of depression in community samples. The scale has 10 items, each of which is scored on a 4-point scale ranging from 0 = *rarely or none of the time* to 3 = *all of the time*, yielding a maximum score of 30. The scale has modest internal consistency in community samples ($\alpha = .69$) in comparison to the

original, full-length CES-D (α =.85). The specificity (.85) and the sensitivity (.71) metrics rival those of the original CES-D (.83 and .60 respectively) (Devins et al., 1988). Total scores on the CES-D-SF will be included in analyses as a covariate if interpersonal groups significantly differ in their magnitude of depression.

Social Desirability Measure. To assess for a preference to provide desirable responses while completing questionnaires, which could be associated with biased responses across measures, participants completed the Brief Social Desirability Scale (BSDS; Haghighat, 2007). The BSDS is a 4-item short form of the 33-item Marlowe-Crowne Social Desirability Scale (Ballard et al., 1988), which was developed to measure the degree to which individuals are motivated to project a positive, socially acceptable image of themselves when completing questionnaires. Participants provide yes/no responses to each question. Alpha (α) for this scale is 0.60, indicating moderate reliability; additionally, in a test of construct validity, Haghighat (2007) found a significant and moderate negative correlation between the BSDS and scores on the Stigmatization Questionnaire (r = -.37; Haghighat, 2005), which measures an undesirable trait (predisposition to stigmatize others). A cross-validation of the scale supported the validity of the four selected questions. In the present study, a Pearson correlation coefficient was computed to assess the relationship between social desirability (BSDS) and behavior in the PDG (cooperation rate) and UG (acceptance rate). There was no significant correlation between either BSDS and cooperation, $r(88) = -.07$, $p = .504$, or BSDS and acceptance rate, $r(88) = -.06$, $p = .617$. Based on these findings, BSDS score was not included as a covariate in the hierarchical regression analyses detailed in section 3.4.4.

3.3 Procedure

Potential participants were first screened for eligibility to participate. Undergraduate students who registered for the screening component of the study obtained a link via SONA to a questionnaire presented using the online Qualtrics platform. If a prospective participant chose to click the link, the action was interpreted as providing consent for the survey portion of the experiment only. Following implicit consent, screening participants completed the LSAS-SR, the IIP-32, the CES-D-SF, and the BSDS. Additionally, participants provided demographic information (sex, age, race/ethnicity), as well as an email address and/or phone number at which they could be reached. The principal investigator contacted students who obtained a cumulative score of 30 or above on the LSAS-SR via phone or email and alerted them that they qualified to participate in the behavioral component of the study. Students who responded and expressed interest in participating in the full study were invited to attend a virtual session with two of their peers from the university. Participants were also informed that they would be compensated with one class credit for completing the screening surveys regardless of whether they qualified for the virtual session.

Prior to the virtual session, the PI provided participants with a Zoom meeting link and a PDF copy of the consent form. The PI reviewed the consent form at the start of each Zoom meeting and informed the individual being consented that during the study protocol they would be given misleading or inaccurate information, but would not know when this information would be presented. Following consent, participants were informed that they would be playing games with other study participants via a wireless computer network. Participants were also told that they would earn money, up to a maximum limit of $30, during play. This information was part of the deception procedure for the study; in reality, they played with a computerized co-player that

simulated human patterns of play. We followed recommended procedures for ethical deception (Miller et al., 2008).

To enhance deception, following consent, the participant was introduced to two confederates (both of whom were research team members) and given 5 minutes to talk with them and get acquainted. Once this socialization period had concluded, the PI verbally trained the participants on how to play both games and the expected payouts they would earn following different types of contingent decision during the games. The PI then informed the participants of the order in which they would be playing the games, clarifying that each participant would play two games total (one with each available participant) and that they would not see or hear one another during gameplay. The PI then told the first dyad of participants to wait for a link to the first game (PDG) via email and the video call was ended. In reality, the confederates were given permission leave the study while the real participant alone was sent a game link. The games were stored and distributed through Pavlovia, a psychology behavioral experiment repository that serves as a launch platform for PsychoPy experiments (Peirce et al., 2019). When the participant finished the PDG, he/she was told to wait while the PI prepared the second game (UG) for the participant and the second confederate. This link was then sent to participants via email. Participants played the PDG and the UG one time each. Each game consisted of five practice rounds and twenty game rounds. Each game lasted roughly 10 to 15 minutes, accounting for variation in response time between participants, meaning participants spent approximately 20 to 30 minutes in gameplay.

Once the participant had completed both games, they were told access the Zoom meeting link once again to be debriefed while the other “participants” finished playing their last game together. The debriefing form was adapted from Tone and colleagues (2019) and comprised

questions about participants' goals during the game, strategies during play, and emotional reactions to the behavior of their ostensible partner (see Appendix A). Participants were then paid an average of the amount that they earned over the two games, up to a maximum of $30.

Subsequently, in accordance with guidelines for ethically appropriate authorized deception (Miller et al., 2008), participants were debriefed about the deception involved in the task and the motivation for its use. Specifically, the PI read each participant a statement that described how they had been deceived and explained that the deception was necessary to ensure that they experienced the game as an authentic interaction with another person. After the researcher explained the deception process and rationale, participants were asked if they had believed the deception and were encouraged to express any concerns that they had about being deceived. If the participant expressed concerns about the deception process, they had the option of having their data deleted; otherwise, participant data will be retained for further analysis. No participant expressed concerns about the deception procedure and only four reported disbelief with the game procedure. Data were collected from participants in one-hour sessions.

PsychoPy v3.0 was used to present both tasks to the participant (Peirce et al., 2019). PsychoPy is an open-source, cross-platform software that is primarily used to build psychology and neuroimaging experiments using the Python coding language. Participant responses were recorded and stored on Pavlovia servers. The data files are only accessible to the PI who has an established account with the service. Copies of participant data were transferred to an encrypted, password and firewall protected hard drive in the Imaging Genetics Lab.

The 20-round iterated PDG proceeded as shown in Figure 2. In each round, participants chose to cooperate or not cooperate (defect) while a "co-player" independently and simultaneously chose to cooperate or to defect. After a brief pause, the participants were shown

their earnings. The participant and co-player were equally rewarded ($2) if both cooperated; if one player cooperated but the other did not, the defecting player received a reward ($3) and the cooperating player received nothing ($0). If both chose to defect, both received a small reward ($1). After both players submitted their choices, the outcome of the round appeared on the screen, along with a running total of each player's cumulative earnings for the game.

The algorithm used for the PDG is based on human patterns of decision-making (Rilling et al., 2002) and has been used for other published studies (McClure-Tone et al., 2011; Thompson et al., 2019b). The computerized co-player always cooperates during the first round of a game and always defects during the final two rounds of the game. During the other rounds of the game, the computer makes a "choice" based on the participant's pattern of decisions in the prior two rounds. A pattern of defection in the prior two rounds increases the likelihood of computer defection, while a pattern of cooperation in the prior two rounds increases the likelihood of computer cooperation. The algorithm additionally computes a 100% likelihood of computer defection after four consecutive rounds of mutual cooperation. We specified this rule because prior research has shown that in an iterated game with two human players, players regularly engage in mutual cooperation for the majority of the task (Rilling et al., 2002) and such a pattern of play would limit variability of outcomes for data analysis.

The 20-round iterated UG proceeded as shown in Figure 4. In each round, the participant chose whether to accept or reject an offer from the co-player (computerized algorithm). If the participant accepted a fair offer, both the participant and the co-player earned $2.50. If the participant accepted an unfair offer, the participant earned $1 and the co-player earned $4. If the participant rejected a fair or unfair offer, both participants received $0. After the participant decided to accept or reject an offer, the outcome of the round appeared on the screen, along with

a running total of each player's cumulative earnings for the game. These earnings ratios were used in previous anxiety-UG studies (Luo et al., 2014b; Peterburs et al., 2017; Wu et al., 2013).

Previous anxiety-UG studies have used algorithms in which the computer makes fair (50:50), moderately inequitable (30:70), or inequitable (20:80 or 10:90) offers. However, moderately inequitable offers were excluded from analysis in two of these studies (Luo et al., 2014b; Wu et al., 2013), based on evidence from previous studies that UG players do not agree about whether such offers should be labelled as fair or not (Halko et al., 2009; Hewig et al., 2011; van 't Wout et al., 2010). For this reason, moderately inequitable offers were not programmed into the present version of the game. Additionally, in the Luo and Wu studies the algorithm was configured so that an equal number of offer types were presented in a pseudorandom sequence. In their 2013 study, Wu and colleagues used the fewest number of rounds for a game (24), meaning there were eight rounds of each type of offer. To maintain this structure for the current study, ten rounds were programmed for each offer type, yielding a total of twenty rounds.

3.4 Data Analytic Procedure

The initial steps of the data analytic process focused on calculation of agency and communion scores for each participant based on their IIP-32 responses. These two variables were then used to construct an interpersonal profile for the entire sample using the Structural Summary Method (SSM; Wright et al., 2009; Zimmermann & Wright, 2017) described below. Model fit did not meet the minimum threshold ($R^2 > .70$) necessary to conclude that the sample displayed interpersonal prototypicality. This lack of good model fit supported the use of a cluster analysis to classify participants according to their scores on both agency and communion meta-dimensions, with the expectation that three clusters would emerge. After labeling the identified

clusters, an interpersonal profile was constructed for the participants in each cluster, to determine whether identified profiles conformed to the hypothesized profiles of interest. I then determined whether clusters demonstrated pathoplastic characteristics by evaluating whether they significantly differed as a function of SA severity. Finally, the identified groups were deviation-coded and used as categorical predictors for behavior in the PDG and UG in two hierarchical regression analyses that also included SA severity as a continuous variable.

3.4.1 Agency and Communion Scores

Octant (subscale) scores from each participant were generated in order to calculate agency and communion scores. The IIP-32 includes four items for every octant (32 items total). Summing the responses for all four items in an octant yields a total octant score.

The agency and communion scores were then calculated by summing the product of the individual octants and the angular location (see below) of each octant along the circumplex while accounting for the number of subscales (8) in the circumplex scale (Wright et al., 2009). Previous SA circumplex studies have used individual scores from the agency and communion dimensions as the basis for profile construction and cluster analyses because they represent variability along the core meta-dimensions of interpersonal behavior (Cain, Pincus, & Holtforth, 2010; Kachin et al., 2001).

The equations (X = equation 1; Y = equation 2) for these scores are as follows:

$$X = c \times \sum(S_i \times \cos\theta_i) \qquad Y = c \times \sum(S_i \times \sin\theta_i)$$

where X = communion score, Y = agency score, c = a constant equal to two divided by the number of circumplex subscales (in this case eight, so c = .25), S_i = score for octant i, and θ_i = the angular location of octant i.

Participants' agency and communion scores were treated as continuous variables.

3.4.2 Structural Summary Method

To determine whether the entire sample conformed to an interpersonal prototypical profile, we used the structural summary method (SSM), which can be implemented in R using the *circumplex* package (Zimmermann & Wright, 2017). SSM is a technique that is used to construct interpersonal profiles for individuals or groups based on their responses on measures with circumplex properties such as the IIP-32 (Gurtman & Balakrishnan, 1998; Wright et al., 2009; Zimmermann & Wright, 2017). The term circumplex implies that the octants of an IPC measure exhibit circular intercorrelation properties, such that adjacent octants mapped on the circular space display an increased correlation with one another. Correlations between octants begin to decrease as the angular distance between subscales increases, up to 180º. Therefore, octants that are adjacent are statistically and conceptually related, octants at right angles are statistically and conceptually independent, and octants on opposite sides of the circle are statistically and conceptually the opposite of one another. Thus, responses to circumplex measures are expected to conform to a specific pattern that is sinusoidal in form and is defined by summary parameters (see Figure 6).

The summary parameters that define this sinusoidal wave include *elevation*, which reflects the general (mean) interpersonal distress levels of the group, *amplitude* which reflects the degree of rigidity and distinctiveness of the interpersonal style, and *angular displacement* which reflects the primary interpersonal style as mapped on the IPC space (see Figure 6).

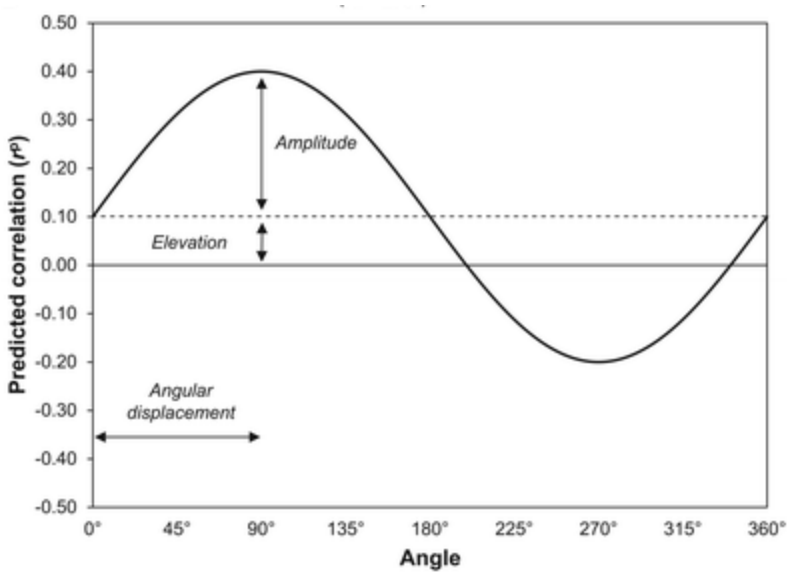

Figure 6 Circumplex Profile Structural Summary. Adapted from "Beyond Description in Interpersonal Construct Validation: Methodological Advances in the Circumplex Structural Summary Approach" by Zimmerman & Wright, 2017, *Assessment, 24*(1), p. 3-23 (p. 5). Copyright by SAGE Journals.

Summary parameters are estimated by mapping either individual or group octant scores onto the cosine curve (see Figure 6); an interpersonal profile can be depicted as a single point in IPC space through the estimation of Cartesian coordinates (see Figure 5), providing a useful descriptive summary of individual or group behavior.

An interpersonal profile can be separated into two parts: a structural component (elevation, amplitude and angular displacement mapped to the cosine function) reflecting the interpersonal "prototype" for a group and a deviation component, reflecting the difference between the expected and actual value of the group octant score.

The formulas for each parameter of the structured component are calculated as follows:

1) Elevation, *e*, is the standardized mean of all octant scores
2) Amplitude, *a*, is calculated as follows in equation 3:

$$a = sqrt(X^2 + Y^2)$$

3) Angular displacement, δ, is calculated as follows in equation 4:

$$\delta = \tan^{-1}\left(\frac{Y}{X}\right) \times \frac{180}{\pi}$$

For equations 3 and 4, X and Y represent scores for the communion and agency dimensions, respectively. However, communion and agency scores need to be estimated for each group identified via cluster analysis by calculating the mean octant scores for each group and inserting them into equations 1 and 2. Each group had a single set of agency and communion scores. Structural parameters (*e*, *a*, δ) can then be calculated for each group by inserting agency and communion scores into equations 3 and 4. Elevation, once again, is simply the mean across all octant scores for each group.

Profiles rarely mirror a perfect cosine curve; to account for this observation a deviation component can be calculated alongside the structural component to account for the difference between the expected value and actual value for the group octant score. The deviation component for a specific octant is conceptually like the error value in a regression equation and can be calculated by subtracting the structural component of the equation (i.e., *e*, *a*, and δ) from the group octant score (see equation 5).

The deviation component for a given octant is calculated as follows in equation 5:

$$d_i = S_i - [e + a \times \cos(\theta_i - \delta)]$$

where and d_i = deviation component of the octant; S_i = the group score on octant i; *e* = elevation (mean); *a* = amplitude (difference between mean and peak value); θ_i = the angular location of the octant; and δ = angular displacement (the angular shift from 0° for the peak of the curve).

Finally, a *goodness of fit* (R^2) statistic was calculated which reflects the interpersonal prototypicality of the circumplex data, or the degree to which the profile conforms to the predicted sinusoidal wave pattern illustrated in Figure 6.

This statistic is calculated as follows in equation 6:

$$R^2 = 1 - \frac{\sum d_i^2}{SS_{Total}},$$

where SS_{Total} is the profile's total variance as the deviation sum of squares.

R^2 values greater than .70 are interpreted as fitting a prototypical profile; values below this threshold indicate a lack of prototypicality, meaning a stable, sinusoidal interpersonal profile cannot be determined from the data (Zimmermann & Wright, 2017). $R^2 > .70$ also indicates that the elevation and amplitude parameters can be accurately interpreted. Both elevation and amplitude must meet a minimum absolute value threshold of .15 for the group to be described as demonstrating a markedly elevated and differentiated profile (Zimmermann & Wright, 2017).

For my analysis, I first constructed a profile for the entire sample because in IPC psychopathology literature, the presence of a shared profile across a sample indicates that pathoplastic principles are not applicable (an issue that could generalize to the population from which the sample was drawn). My expectation was that the R^2 value would be less than .70, suggesting a lack of prototypicality and necessitating a cluster analysis to decompose the sample into its constituent profiles. Agency and communion scores were used as the basis for this cluster analysis, consistent with prior SA-IPC research (Cain, Pincus, & Holtforth, 2010; Kachin et al., 2001).

In summary, the procedure for profile construction was as follows:

1) Using R 3.6.2, agency and communion scores were calculated for the entire sample using individual octant scores for each participant (equations 1 and 2).

2) Communion and agency scores were then used in equations 3 and 4 to calculate amplitude (*a*) and angular displacement (δ) parameters. Elevation (*e*), once again, is simply the standardized mean across all eight octant scores for each participant.
3) The structural component (a, *e*, δ) parameters and the mean octant scores for each participant were used in equation 5 to calculate each participant's deviation components. An individual produces a set of eight deviation components.
4) Each deviation score was used in equation 6 to determine the goodness-of-fit (R^2) of the profile. The sample was expected to exhibit an $R^2 < .70$, indicating heterogeneity of interpersonal style within the sample. The angular displacement parameter was computed to confirm the sample's general location in IPC space. Elevation and amplitude parameters were evaluated to determine whether the profile was markedly elevated and differentiated. Once this was completed, agency and communion scores for each participant were entered in SPSS 28 and subjected to a two-step clustering analysis to decompose the sample into its constituent profiles if possible.

3.4.3 Cluster Analysis

Based on pilot analyses conducted using a two-step clustering procedure on a legacy dataset (N = 168; Tone, unpublished data), I anticipated that a two-step cluster analysis would detect three interpersonal subtypes within the full sample: friendly-submissive, hostile-submissive, and hostile-dominant subtypes. Two-step clustering allows for the automatic, natural selection of the ideal number of clusters to summarize data and the ability to create cluster models based on categorical and continuous variables. This method also provides the option of specifying the number of clusters expected based on an a priori hypothesis. Two-step clustering is accomplished by first pre-clustering data via a quick sequential cluster algorithm that

constructs a cluster feature tree and yields estimates of the distances among clusters (Tkaczynski, 2017). Subsequently, data are subjected to hierarchical clustering procedures, in which multiple methods are employed to measure dissimilarity among clusters (Tkaczynski, 2017).

The cluster analysis included two continuous variables: agency and communion dimension scores. Log-likelihood was used as the distance criterion for both steps of the two-step clustering analysis. The distance between two clusters is related to the decrease in log-likelihood as they are combined into one cluster (Li & Sun, 2018). Log-likelihood is robust to deviations from its underlying assumptions; all variables are assumed to be independent and continuous variables are assumed to have normal distributions (Radovic et al., 2017).

Two-step clustering relies on two indices as criteria for clustering: the Bayesian Information Criterion (BIC) or the Akaike Information Criterion (AIC). Both criteria compare a finite set of clustering models to input data (communion and agency variables) and penalize for complex models with unnecessary parameters (Jones, 2011). The model selection procedure is based upon maximum likelihood estimations. However, BIC also penalizes for smaller sample sizes, making it a more stringent clustering criterion than the AIC (Jones, 2011). The AIC was used to delineate clusters because of the small sample size anticipated for this study.

Cluster quality was evaluated by computing the cohesion (intra-cluster similarity) and separation (inter-cluster dissimilarity) of the clusters. I expected that overall cluster quality (summation of cohesion and separation) would be at least fair (> .25; Tkaczynski, 2017) which is the bare minimum for interpretable clusters. Clusters were generated using an automated clustering procedure to allow for their natural parcellation from the original sample.

After the clusters were identified and their interpersonal prototypicality evaluated using the procedure described in the previous section, I conducted an analysis of variance (ANOVA)

with cluster membership as the independent variable and LSAS-SR total score as the dependent variable to determine whether there was a main effect of interpersonal subtype on SA severity.

3.4.4 Hierarchical Regression Analysis

To evaluate aims 3-4, I planned to conduct two hierarchical regression analyses; cooperation rate (PDG) and acceptance rate (UG) served as the outcome variables, respectively. In each model, interpersonal subtype would be included as a two-level deviation coded categorical predictor (Table 1) and LSAS-SR total score (SA severity) would be included as a continuous variable. Therefore, in total, both models would include three predictors total [SA severity, Friendly-submissive, Hostile-Dominant]. However, this number of predictors could vary depending on the number of clusters that emerged during the cluster analysis.

Interpersonal subtype was coded using a deviation coding technique (Wendorf, 2004) that allows for comparison between the grand mean of the outcome variable at each level of the predictor to the overall grand mean of the outcome variable. The first contrast would compare the friendly-submissive subtype (level 1) to all levels of interpersonal subtype. The second contrast would compare the hostile-dominant subtype (level 2) to all levels of interpersonal subtype. Finally, the hostile-submissive subtype would not be compared to the other interpersonal subtypes because I did not hypothesize a significant relationship between hostile-submissiveness and behavior in both the PDG and UG. See Table 2 for the deviation coding contrast scheme.

Table 2 *Deviation Coding Contrast Matrix*

Interpersonal Subtype	Level 1 vs. Mean	Level 2 vs. Mean
Friendly-Submissive	1	0
Hostile-Dominant	0	1
Hostile-Submissive	-1	-1

The framework for each hierarchical regression proceeded as follows: In the first step, SA severity was inserted to examine the relationship between SA severity and cooperation rate (PDG) and acceptance rate (UG) respectively. I predicted that results would align with previous studies: there would be a significant negative relationship between SA severity and cooperation rate, and there would be no significant association between SA severity and acceptance rate.

Then, in the second step, the coded interpersonal variables were included in both models to test the prediction that there would be a relationship between interpersonal style and behavior in both games and that furthermore, these relationships would explain behavior over and above what could be explained by SA severity. See Figure 7 below for graphical illustrations of expected associations.

A series of assumption tests were conducted prior to model analysis to determine whether the models fit the observed data or were influenced by specific cases. Standardized residuals were calculated and examined to identify abnormal cases influencing the data. Case outliers (scores ±3.0 standard deviations away from the mean) were identified using Mahalanobis distance; if standardized values exceeded 3, I ran the analyses while correcting for the outliers' influence by altering the score to be one unit higher than the next highest score (Barnett and Lewis, 1978). Extreme multi-collinearity (correlation between predictors) was examined by

calculating *R*, variance inflation factor (VIF, or $1–R^2$), and tolerance ($1/(1–R^2)$) statistics. The values of $R > 0.80$, VIF > 10.0, or tolerance < 0.10 would indicate the presence of extreme multicollinearity. Independence of errors was assessed using the Durbin-Watson statistic; significant deviation from a value of 2 would indicate residuals could be correlated with one another. *ZRESID (y-axis; the standardized residuals, or errors) and *ZPRED (x-axis; the standardized predicted values of the dependent variable based on the model) were plotted on a standard line graph to test the assumption of homoscedasticity (equal variance in the outcome variable across predictor levels). The normality of variables and residuals were examined using histogram and normal probability (P-P) plots; a K-S test was also conducted on the standardized residuals to detect significant deviations away from normality.

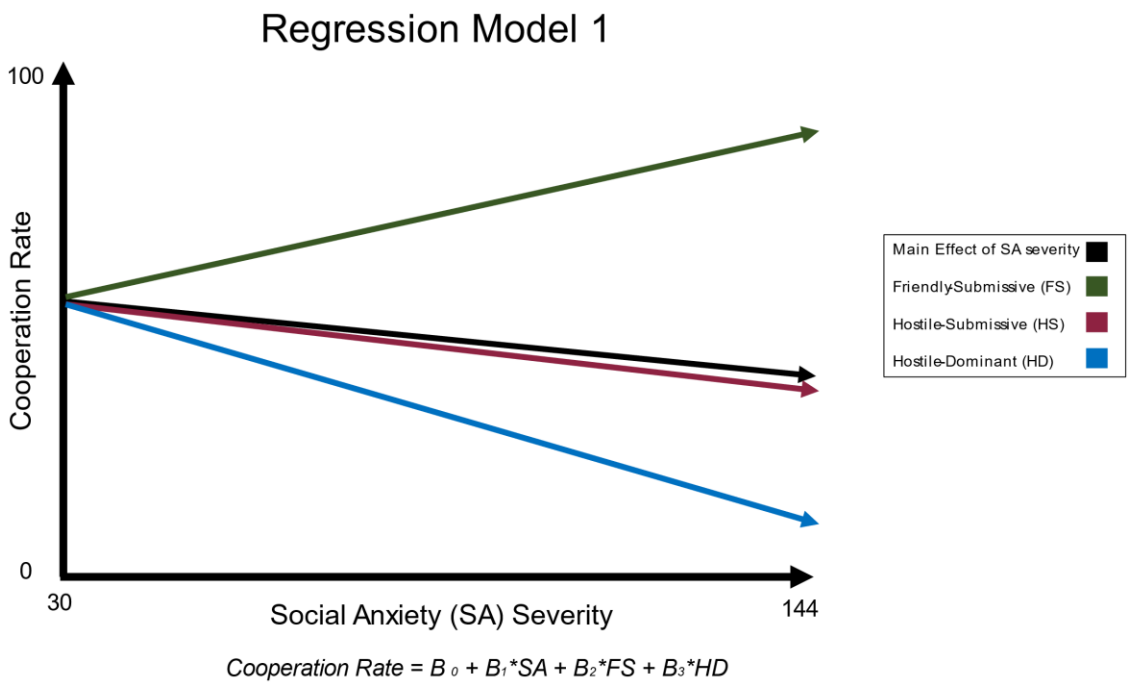

Figure 7 Hierarchical regression model illustrating predicted relationships among SA severity, interpersonal style, and cooperation rate in the PDG (this model should be similar for the UG except for a lack of a significant association between SA severity and acceptance rate)

4 RESULTS

4.1 Descriptive Statistics

A preliminary analysis of data from the debriefing questionnaire was conducted to aid in interpretation of behavioral results. First, paired samples t-tests were conducted to compare participant responses to the PDG versus the UG. The results indicated that participants perceived their partner as significantly more cooperative in the PDG than in the UG. The effect size for this analysis was medium (d = .634) based on Cohen's convention (Cohen, 1988). Additionally, participants endorsed significantly more anger during the UG than they did during the PDG and participants were happier with their earnings in the PDG then they were in the UG. The effect sizes for both of these analyses were small, (d = -.330 and .415). See table 3 for a summary of results from all analyses of debriefing data.

Next, independent samples t-tests were run to determine whether happiness with earnings in each game varied as a function of the partner's earnings. Results revealed that there were significant differences in ratings of happiness following the UG, such that participants whose earnings were equal to their partner's reported being significantly happier than participants whose earnings were less than their partner's. This was a medium sized effect (d = .567). In contrast, there was no significant difference in ratings of happiness following the PD based on whether the final outcome for the participant was greater than/equal to or less than their partners. See Table 4 for results of all t-tests.

Finally, Pearson's correlations were conducted to examine potential associations between SA severity and debriefing responses. Correlations exhibiting a minimum effect size of .21 (equivalent to p = .05, uncorrected) are described in the text; all correlations are presented in Appendix B. LSAS-SR scores displayed a small positive association with postgame reports of

nervousness during PDG and UG play, (r = .23 and .24). Pearson's correlations were also conducted to test associations between agency, communion, and debriefing responses. In the PDG, agency scores displayed a medium positive association with endorsement of the importance of winning (r = .31), and small positive associations with perceptions of heightened competitive behavior from the co-player and nervousness during gameplay, (r = .26, .25). In the UG, agency scores displayed small positive associations with endorsement of the importance of winning and nervousness during gameplay (r = .28 and .21*)*. Communion levels were not associated with any debriefing scores for the PDG or UG.

Table 3 *Paired Samples T-Test – Self-Report Responses following the PDG vs UG*

	Prisoner's Dilemma		Ultimatum Game				
Variable	**M**	**SD**	**M**	**SD**	**t(87)**	***p***	***d***
How happy were you with your earnings	8.28	1.881	7.56	2.207	3.891	0.000*	0.415
How competitive did you feel with your partner	6.59	2.689	6.93	2.711	-1.345	0.182	-0.143
How cooperative was the other person	6.45	2.154	4.94	2.119	5.950	0.000*	0.634
How angry did you get	2.95	2.095	3.51	2.691	-3.096	0.003*	-0.330
How nervous were you waiting for your partners response	4.41	2.935	4.32	3.080	0.451	0.653	0.048
How important was winning to you	5.66	3.096	5.77	3.117	-0.810	0.420	-0.086
Do you think winning was important to your partner	7.33	2.429	7.59	2.400	-1.197	0.235	-0.128

Table 4 *Independent Samples T-Test – Ratings of Happiness with Earnings vs Monetary Outcome of Game in Relation to Partner*

	Greater than/Equal to Partner		Less than Partner				
Variable	**M**	**SD**	**M**	**SD**	**T**	***p***	***d***
How happy were you with your earnings - PD	8.71	1.775	8.00	1.912	1.76	.081	.384
How happy were you with your earnings - UG	8.56	2.159	7.33	2.169	2.05	.043*	.567

4.2 Interpersonal Problem Profiles for Social Anxiety

4.2.1 Structural Summary Method for Whole Sample Circumplex Data

Using the structural summary method, an interpersonal profile was generated for the entire sample. Agency (M = -1.91) and communion (M = 1.06) scores were computed for each participant using the participant's individual responses to the IIP-32. These scores were entered into the *circumplex* package in R to generate an interpersonal profile for the sample. The sample's profile indicated that, on average, participants' individual profiles were located near the Exploitable octant (299.02^{o}), reflecting a friendly-submissive interpersonal style for the group as a whole. The elevation for the profile was strikingly high (6.24), indicating significant levels of interpersonal distress. The amplitude of the profile was also noticeably high (2.18), signifying a profile that was significantly distinct and inflexible in nature. To reiterate, the absolute minimum for markedly elevated and differentiated profiles is .15. However, the goodness of fit (R^2 = .46) of the profile did not meet the minimum threshold (R^2 > .70) necessary to infer that the sample displayed interpersonal prototypicality. This observation necessitated the administration of a cluster-analytic procedure to parcel the sample into its constituent profiles.

4.2.2 Cluster Analysis

To assess the possibility that multiple profiles exist, I cluster-analyzed the participants' scores using their individual agency and communion scores as the basis of the analysis. A two-step clustering procedure was employed to generate an automatic solution for the sample. The output suggested that a three-cluster solution would classify the sample optimally. An examination of cluster quality indicated an average silhouette measure of 0.5, signaling good overall quality in terms of intragroup cohesion within the clusters and intergroup separation between the clusters. Agency scores (1.00) were moderately more important than communion

scores (0.75) to the organization of the clusters. Participants were almost evenly distributed among clusters (Cluster 1; N = 30, Cluster 2; N = 30, Cluster 3; N = 28). These clusters were retained for a subsequent SSM analysis.

Interpersonal profiles were calculated for each cluster. The first group was located at 309.12°, near the Exploitable octant and reflecting a friendly-submissive orientation. The profile was significantly elevated at 6.23 and significantly distinct at 4.05, indicating elevated interpersonal distress and inflexibility. Additionally, the profile displayed a model fit of 0.74, reaching the minimum threshold of .70 necessary to infer interpersonal prototypicality. The second group was located at 14.39°, near the Intrusive octant and reflecting a friendly-dominant orientation. The profile was significantly elevated at 5.93 and significantly distinct at 1.96, indicating significantly elevated interpersonal distress and moderate inflexibility. However, group 2 displayed only displayed a moderate model fit of 0.49, failing to reach the minimum threshold necessary to infer interpersonal prototypicality. Finally, the profile for Cluster 3 was located at 244.73°, near the Socially Avoidant octant and reflecting a hostile-submissive orientation. The profile was significantly elevated at 6.643 and significantly distinct at 3.45, indicating elevated interpersonal distress and inflexibility. However, Cluster 3 also displayed a moderate model fit of 0.49, failing to reach the minimum threshold necessary to infer interpersonal prototypicality.

Two additional cluster analyses were conducted forcing two and four group solutions to determine whether either solution provided appreciable improvement to the model fit of the resultant clusters. The two-cluster solution was suboptimal to the three-cluster solution, with the model fit for both clusters equal to 0.50 and 0.56, respectively. A four-cluster solution generated two profiles whose model fit met the threshold for prototypicality [friendly-submissive (R^2 = .75;

N =27; 307.80º) and overly-nurturing (R^2 = .74; N = 22; 348.70º)]; however, the other two profiles displayed moderate to poor fit [hostile-submissive (R^2 = .49; N = 28; 244.73º) and domineering (R^2 = .30; N = 11; 77.09º)]. A separate set of hierarchical regression analyses were planned for the four-cluster solution to compare with the three-cluster solution. Overall, no solution produced a complete group of profiles that conformed to interpersonal prototypicality. The summary parameters for all profiles can be reviewed in Table 7 and a plot of profiles for the three-cluster solution can be found in Figure 8.

4.2.3 Preliminary Analyses for Interpersonal Subtypes

Before conducting hypothesis tests, preliminary ANOVAs were run to investigate differences in debriefing responses among the subtypes that could indicate whether the sample conformed to the conditions of pathoplasticity.

For the three-cluster solution, there was a statistically significant effect of interpersonal subtype on feelings of competitiveness and the importance of winning in the PDG. The effect sizes for both analyses were medium (η^2 = .078 and .074). There was also a significant effect of interpersonal subtype on the importance of winning in the UG. The effect size of this analysis was also medium (η^2 = .095). Tukey's HSD post-hoc procedure was employed because it provides the simplest way to control familywise error rate when all pairwise comparisons among groups are performed (Kim, 2015). Post-hoc tests revealed that friendly-dominant individuals endorsed greater feelings of competitiveness in comparison to the friendly-submissive individuals in the PDG, p = .036. Friendly-dominant individuals also felt winning was more important in comparison to hostile-submissive individuals in the PDG, p = .029 and in the UG, p = .011. See Table 5 for an overview of these analyses.

For the four-cluster solution, there was a statistically significant effect of interpersonal subtype on nervousness, feelings of competitiveness, and the importance of winning during PDG play. The effect sizes of all of these analyses were medium (η^2 = .113, .111, .106). There was also a significant effect of interpersonal subtype on the importance of winning and nervousness during UG play. The effect sizes of these analyses were also medium (η^2 = .118, .112). Post-hoc tests revealed that in the PDG, domineering individuals reported greater nervousness during gameplay than did participants in the overly-nurturing, friendly-submissive, and hostile-submissive subtypes, p = .007, .009, .020; domineering individuals also reported greater feelings of competitiveness than friendly-submissive individuals, p = .014 ; finally, domineering individuals also reported a greater emphasis on the importance of winning than hostile-submissive individuals, p = .014. Post-hoc tests for the UG revealed that domineering individuals reported a greater emphasis on winning in comparison to hostile-submissive individuals, p = .011, and domineering individuals also reported greater nervousness during gameplay in comparison to the friendly-submissive, overly-nurturing, and hostile-submissive subtypes, p = .016, .026, .039. See Table 6 for an overview of these results.

Table 5 *Analysis of Variance – Interpersonal Style and Self-Report Responses (Three-Cluster)*

	FS		FD		HS				
Variable	**M**	**SD**	**M**	**SD**	**M**	**SD**	***F*(2,85)**	***p***	η^2
How happy were you with your earnings-PD	8.13	2.063	8.47	1.717	8.25	1.898	.238	.789	.006
How competitive did you feel with your partner-PD	5.57	2.417	7.27	2.227	6.96	3.144	3.595	.032*	.078
How cooperative was the other person-PD	6.17	2.291	6.93	2.067	6.25	2.084	5.267	.325	.026
How angry did you get-PD	2.97	2.205	3.13	2.209	2.75	1.898	.239	.788	.006
How nervous were you waiting for your partners response-PD	3.80	2.870	5.17	3.196	4.25	2.619	1.715	.186	.039
How important was winning to you-PD	5.57	3.256	6.70	2.588	4.64	3.165	3.395	.038*	.074
Do you think winning was important to your partner-PD	7.33	2.537	7.50	7.50	7.14	2.520	.154	.858	.004
How happy were you with your earnings-UG	6.87	2.389	7.93	2.116	7.89	1.988	2.295	.107	.051
How competitive did you feel with your partner-UG	6.30	2.680	7.53	2.713	6.96	2.687	1.575	.213	.036
How cooperative was the other person-UG	4.87	2.129	4.77	2.079	5.21	2.200	.347	.707	.008
How angry did you get-UG	3.50	2.825	3.83	2.925	3.18	2.310	.423	.656	.010
How nervous were you waiting for your partners response-UG	3.67	2.952	5.13	3.126	4.14	3.076	1.800	.172	.041
How important was winning to you-UG	5.97	3.168	6.80	2.905	4.46	2.912	4.486	.014*	.095
Do you think winning was important to your partner-UG	7.80	2.511	8.00	2.068	6.93	2.552	1.639	.200	.037

Note. PD = Prisoner's Dilemma, UG- Ultimatum Game, FS = Friendly-Submissive, FD = Friendly-Dominant, HS = Hostile-Submissive

Table 6 *Analysis of Variance – Interpersonal Style and Self-Report Responses (Four-Cluster)*

	FS		HS		ON		Dom				
Variable	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	***F(3,84)***	***p***	***η^2***
How happy were you with your earnings-PD	8.04	2.139	8.25	1.898	8.50	1.766	8.55	1.508	.318	.812	.011
How competitive did you feel with your partner-PD	5.59	2.291	6.96	3.144	6.41	2.557	8.45	1.368	3.490	.019*	.111
How cooperative was the other person-PD	6.07	2.252	6.25	2.084	6.68	2.102	7.45	2.115	1.247	.298	.043
How angry did you get-PD	2.89	2.172	2.75	1.898	2.77	2.202	4.00	2.145	1.069	.367	.037
How nervous were you waiting for your partners response-PD	3.96	2.955	4.25	2.619	3.77	2.689	7.18	2.926	4.291	.007*	.133
How important was winning to you-PD	5.48	3.239	4.64	3.165	6.05	2.497	7.91	2.663	3.335	.023*	.106
Do you think winning was important to your partner-PD	7.30	2.524	7.14	2.520	7.00	2.430	8.55	1.809	1.115	.348	.038
How happy were you with your earnings-UG	6.63	2.388	7.89	1.988	7.91	2.308	8.27	1.489	2.501	.065	.082
How competitive did you feel with your partner-UG	6.56	2.651	6.96	2.687	6.64	2.904	8.36	2.378	1.297	.281	.044

How cooperative was the other person-UG	4.56	1.928	5.21	2.200	5.14	2.274	4.82	2.183	.519	.670	.018
How angry did you get-UG	3.59	2.965	3.18	2.310	3.36	2.665	4.45	3.078	.615	.607	.022
How nervous were you waiting for your partners response-UG	3.78	3.068	4.14	3.076	3.86	2.475	7.00	3.225	3.531	.018*	.112
How important was winning to you-UG	5.89	3.226	4.46	2.912	6.27	2.914	7.82	2.601	3.749	.014*	.118
Do you think winning was important to your partner-UG	7.89	2.501	6.93	2.552	7.59	2.261	8.55	1.753	1.451	.234	.049

Table 7. *Structural Summary Parameters for Interpersonal Subtypes*

Whole Sample						
Group	***e***	**A**	**Δ**	**x-value**	**y-value**	***R²***
Whole Sample	6.24	2.18	299.02°	1.06	-1.91	.46
Three-Cluster Solution						
Group (N)	***e***	**A**	**δ**	**x-value**	**y-value**	***R²***
FS (30)	6.23	4.05	309.12°	2.56	-3.15	.74
FD (30)	5.93	1.96	14.39°	1.90	0.49	.49
HS (28)	6.64	3.45	244.73°	-1.47	-3.12	.49
Four-Cluster Solution						
Group (N)	***e***	**A**	**δ**	**x-value**	**y-value**	***R²***
FS (27)	6.32	4.19	307.80	2.57	-3.31	.75
Dom (11)	6.61	1.97	77.09°	0.44	1.92	.30
HS (28)	6.64	3.45	244.73°	-1.47	-3.12	.49
ON (22)	5.46	2.78	348.70°	2.73	-0.55	.74

Note. FS = Friendly-Submissive, FD = Friendly-Dominant, HS = Hostile-Submissive, ON = Overly-Nurturing, Dom = Domineering, *e* = elevation, a = amplitude, δ = angular displacement, x-value = communion, y-value = agency

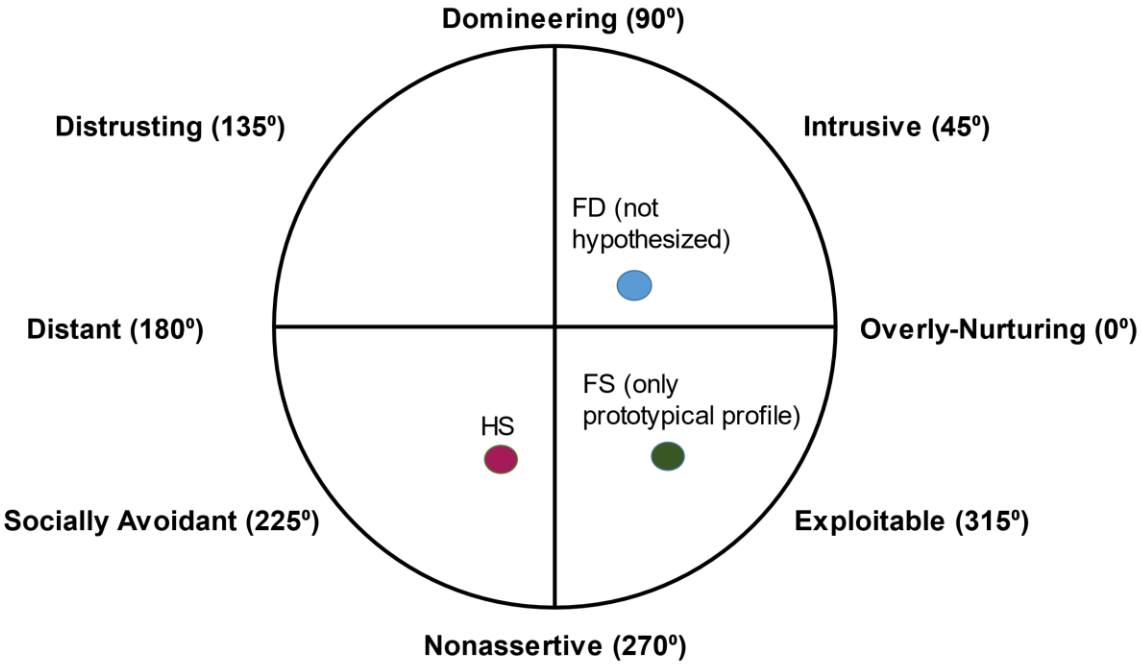

Figure 8 Circumplex locations of the principal interpersonal problems reported by the college-age SA sample based on a three-cluster solution. Circumplex locations are approximate.

4.3 Interpersonal Pathoplasticity

Before evaluating the interpersonal clusters for evidence of pathoplasticity, I ran a descriptive analysis to determine whether LSAS-SR (SA severity) and CES-D-SF (depression severity) scores met assumptions for parametric testing. The average LSAS-SR score was 76.72 (*SD* = 20.24), which exceeds the threshold of 60 consistent with the likely presence of GSAD (Rytwinski et al., 2009). The minimum score was 41 and the maximum score was 122. The results of a K-S test of normality for LSAS-SR scores was nonsignificant, $D(88) = .077$, $p = .200$, indicating that the scores conformed to a normal distribution. The average CES-D-SF score was 13.99 (*SD* = 4.78), indicating moderate levels of depression in the sample. The minimum score was 4 and the maximum score was 27. This maximum score was classified as an outlier and adjusted to the next highest score (25). Furthermore, the results of a K-S test were significant, $D(88) = .124$, $p = .002$, indicating that the score distribution was non-normal. This

observation was confirmed through a histogram examination and P-P plot. The distribution was positively skewed.

I conducted two ANOVAs to determine if there was a main effect of interpersonal style on SA severity. For the three-cluster solution, there was a statistically significant effect of interpersonal subtype on SA severity. The effect size for this analysis was medium ($\eta^2 = 0.11$). A Tukey's HSD post hoc test revealed that SA severity for the hostile-submissive group, was significantly higher than SA severity for the friendly-dominant group, $p = .005$ but not the friendly-submissive group, $p = .186$. For the four-cluster solution, there was also a statistically significant effect of interpersonal subtype on SA severity. The effect size for this analysis was large ($\eta^2 = .14$). A post hoc test revealed that SA severity for the hostile-submissive group was significantly higher than SA severity in the overly-nurturing group, $p = .002$, but not the friendly-submissive group, $p = .534$ or the domineering group, $p = .569$. In either case, I did not find necessary and sufficient evidence of pathoplasticity in the sample, indicating that SA severity may predict behavior over and above interpersonal style. A summary of ANOVA findings can be found in Tables 8 and 9.

To account for the non-normal distribution of CES-D-SF scores, two nonparametric Kruskal-Wallis tests were conducted to determine if there was a significant main effect of interpersonal style on depression severity. There was no statistically significant effect of interpersonal style on depression severity for the three-cluster, $H(2) = .040$, $p = .980$, or four-cluster solution, $H(3) = 2.49$, $p = .477$. As a result of these analyses, it was determined that CES-D-SF scores would not need to be included as a covariate in the regression analyses.

Table 8 *Analysis of Variance – Interpersonal Style and SA Severity (Three-Cluster Solution; Original Sample)*

	Friendly-Submissive		**Friendly-Dominant**		**Hostile-Submissive**				
Measure	**M**	**SD**	**M**	**SD**	**M**	**SD**	***F*(2,85)**	***p***	η^2
SA Severity	76.10	20.24	69.10	20.88	85.54	16.30	5.27	.007*	.11

Table 9 *Analysis of Variance – Interpersonal Style and SA Severity (Four-Cluster Solution; Original Sample)*

	Friendly-Submissive		**Domineering**		**Hostile-Submissive**		**Overly-Nurturing**				
Measure	**M**	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**	***F*(3,84)**	***p***	η^2
SA Severity	77.44	19.67	75.18	20.90	85.54	16.30	65.36	20.67	4.63	.005*	.14

4.4 Hierarchical Regression Analyses

Before conducting hierarchical regression analyses, I ran a descriptive analysis of the cooperation and acceptance rate variables. The rates are expressed as percentages, with a minimum of 0 and a maximum of 100. First, the average rate of cooperation in the PDG was 53.69 (*SD* = 17.72). The minimum rate was 5 and the maximum rate was 100. No outliers were identified. The results of a K-S test of normality were nonsignificant, $D(88) = .071$, $p = .200$.

Second, the average rate of acceptance in the UG was 64.33 (*SD* = 15.16). The minimum rate was 35 and the maximum score was 100. No outliers were identified. However, the results of a K-S test were significant, $D(88) = .129$, $p = .001$, indicating that the rate distribution was non-normal. This finding was confirmed through a histogram examination and P-P plot. The distribution was positively skewed. A set of transformations (log, square root, reciprocal) was applied to the variable to correct the skewed distribution. These transformations were ineffective. As an alternative, I opted to conduct a quantile regression for acceptance rate, rather than a standard hierarchical linear regression. Quantile regression is an extension of ordinary least squares (OLS) regression that allows researchers to evaluate the relationship of a predictor(s) to an outcome variable at several points along the distribution of the outcome variable (Koenker, 2017). The points are quantiles (percentiles) along the distribution of the outcome variable such that, for example, the 25^{th}, 50^{th} and 75^{th} percentiles are congruent with the .25, .50, and .75 quantiles computed through the regression. Theoretically, a researcher can specify as many quantiles along the distribution as desired to fully illustrate the contribution of the predictor(s) at varying levels of the outcome variable. It is important to note that quantile regression uses an asymmetric weighting system of data points, meaning all data points are weighted based on their distance from the specified quantile for that model (Petscher et al., 2013; Petscher & Logan,

2014). Therefore, quantile regression is not synonymous with fitting a OLS regression line for each quantile. Lastly, quantile regressions are more robust to breaches in assumptions applied to parametric tests and effective at modeling nonlinear data (Koenker, 2017).

Prior to conducting hierarchical regression analyses, I evaluated relevant assumptions. Power analysis indicated that a sample size of 88 was adequate to detect a large effect size, given three or four predictors to be included in each analysis (d = .35, power = .80, alpha = .05). Collinearity statistics were all within acceptable limits and the assumption of multicollinearity was met. Residual and scatter plots indicated the assumptions of normality, linearity and homoscedasticity were all satisfied for the residuals of the model. An examination of Mahalanobis and Cook's distance scores indicated no multivariate outliers.

For the three-cluster solution, a two-stage hierarchical regression was conducted with cooperation rate as the dependent variable. SA severity was entered in stage one and the interpersonal variables (friendly-submissive and friendly-dominant) were entered in stage two. The model revealed that at stage one, SA severity significantly contributed to the model, p = .039, but accounted for only 4.9% of the variation in cooperation rate. In this model, SA severity significantly predicted cooperation rate, p = .039. Introducing the interpersonal variables explained an additional 3.5% of variance (8.4% total) but this change was not statistically significant. SA severity remained a significant predictor of cooperation rate, p = .037; however, neither friendly-submissiveness, p = .079, nor friendly-dominance, p = .552, significantly predicted variation in cooperation rate. A subsequent regression with SA severity, friendly-submissiveness and hostile-submissiveness as predictors revealed that hostile-submissiveness also did not significantly predict variance in cooperation rate, p = .282.

For the four-cluster solution, a two-stage hierarchical regression was conducted with cooperation rate as the dependent variable. SA severity was entered in stage one and the interpersonal variables (friendly-submissive, hostile-submissive and overly-nurturing) were entered in stage two. The model for stage one was equivalent to the model produced for the three-cluster solution. Introducing the interpersonal variables explained an additional 3.6% of variance (8.5% total) but this change was not significant, $p = .113$. SA severity significantly predicted variance in cooperation rate, $p = .049$, but the friendly-submissive, $p = .095$, hostile-submissive, $p = .389$, and overly-nurturing, $p = .666$, subtypes were not significant predictors in the model. A summary of hierarchical regression findings for both cluster solutions can be found in Tables 10 and 11.

Table 10 *Hierarchical Regression Model Summary (Three Cluster-Solution; Original Sample)*

Model	Parameter	Estimate	SE	95% CI		t	*p*
				LB	UB		
1	Intercept	38.925	7.318	24.377	53.473	5.319	0.000
	SA Severity	0.193	0.092	.010	.377	2.094	0.039*
2	Intercept	37.871	7.696	22.568	53.175	4.921	0.000
	SA Severity	0.206	0.097	.013	.399	2.122	0.037*
	Friendly-Submissive	4.612	2.594	-.548	9.771	1.778	0.079
	Friendly-Dominant	-1.612	2.702	-6.985	3.761	-0.597	0.552

Note: Dependent Variable = Cooperation Rate. SE = Standard Error. CI = Confidence Interval. LB = Lower Bound. UB = Upper Bound

Table 11 *Hierarchical Regression Model Summary (Four Cluster-Solution; Original Sample)*

Model	Parameter	Estimate	SE	95% CI		t	*p*
				LB	UB		
1	Intercept	38.925	7.318	24.377	53.473	5.319	< 0.001
	SA Severity	0.193	0.092	.010	.377	2.094	0.039*
2	Intercept	38.283	7.801	22.767	53.799	4.907	< 0.001
	SA Severity	0.199	0.099	.001	.396	1.998	0.049*
	Friendly-Submissive	5.220	3.093	-.933	11.372	1.687	0.095
	Hostile-Submissive	-2.777	3.204	-9.149	3.596	-0.867	0.389
	Overly-Nurturing	-1.496	3.451	-8.360	5.367	-0.434	0.666

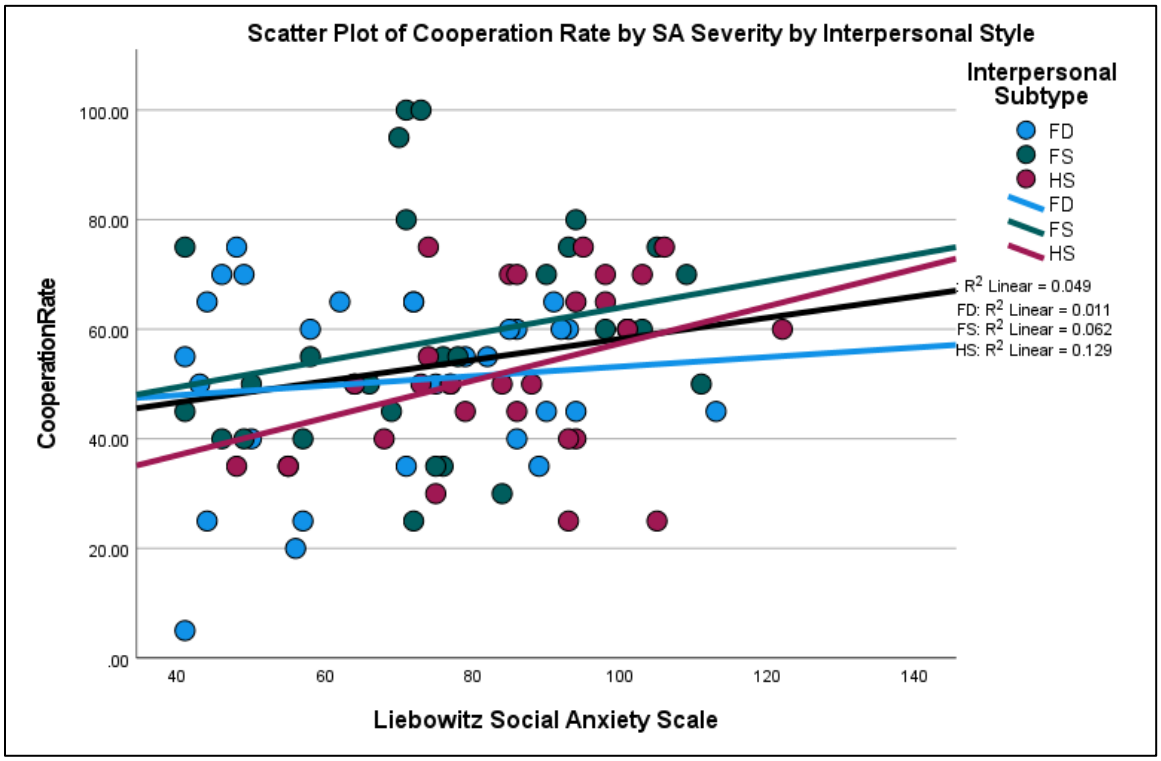

Figure 9 Scatter Plot Depicting Regression Relationship Between SA Severity, Interpersonal Style, and Cooperation Rate in the PDG (Three-Cluster Solution; Original Sample)

4.4.1 Quantile Regression Analyses

Quantile regression in SPSS does not allow for hierarchical regression modelling; therefore all models should be treated as extensions of standard multiple regression (Koenker, 2017). For the three-cluster solution, a quantile regression was conducted using acceptance rate as the dependent variable. SA severity, friendly-submissive and friendly-dominant were entered as independent variables. Three models were produced using 25th, 50th and 75th quantile thresholds, respectively. Comparing pseudo R^2, the 50th and 75th quantile models best explained variance in acceptance rate (R^2 = .045 and .046 respectively, R^2 = .020 at the 25th quantile). However, none of the models yielded any significant predictors. See Table 12 for an overview of these analyses.

This procedure was replicated for the four-cluster solution. SA severity, friendly-submissive, hostile-submissive, and overly-nurturing were entered as independent variables. Comparing pseudo R^2, 75th quantile best explained variance in acceptance (R^2 = .060) followed by the 50th quantile (R^2 = .050) and the 25th quantile (R^2 = .030). None of the models produced any significant predictors. See Table 13 for an overview of these analyses.

Table 12 *Quantile Regression Model for Acceptance Rate (Three-Cluster; Original Sample)*

Model	Parameter	Estimate	SE	95% CI		*t*	*p*
				LB	UB		
QR-25	Intercept	51.667	5.6597	40.412	62.922	5.319	0.000
	SA Severity	3.940E-17	0.0714	-0.142	0.142	0.000	1.000
	Friendly-Submissive	3.333	1.9081	-0.461	7.128	1.747	0.084
	Friendly-Dominant	-1.667	1.9872	-5.618	2.285	-0.839	0.404
QR-50	Intercept	63.333	10.5140	42.425	84.242	6.024	0.000
	SA Severity	-2.847E-16	0.1327	-0.264	0.264	0.000	1.000
	Friendly-Submissive	6.667	3.5446	-0.382	13.716	1.881	0.063
	Friendly-Dominant	-3.333	3.6916	-10.674	4.008	-0.903	0.369
QR-75	Intercept	67.925	12.7610	42.548	93.301	5.323	0.000
	SA Severity	0.094	0.1611	-0.226	0.415	0.586	0.560
	Friendly-Submissive	7.358	4.3021	-1.197	15.914	1.710	0.091
	Friendly-Dominant	0.283	4.4805	-8.627	9.193	0.063	0.950

Table 13 *Quantile Regression Model for Acceptance Rate (Four-Cluster; Original Sample)*

Model	Parameter	Estimate	SE	95% CI		*t*	*p*
				LB	UB		
QR-25	Intercept	52.500	5.7081	41.147	63.853	9.197	0.000
	SA Severity	-6.725E-17	0.0727	-0.145	0.145	0.000	1.000
	Friendly-Submissive	2.500	2.2633	-2.002	7.002	1.105	0.273
	Hostile-Submissive	-2.500	2.3443	-7.163	2.163	-1.066	0.289
	Overly-Nurturing	2.500	2.5250	-2.522	7.522	0.990	0.325
QR-50	Intercept	62.500	10.6041	41.409	83.591	5.894	0.000
	SA Severity	-2.817E-16	0.1351	-0.269	0.269	0.000	1.000
	Friendly-Submissive	7.500	4.2045	-0.863	15.863	1.784	0.078
	Hostile-Submissive	-2.500	4.3550	-11.162	6.162	-0.574	0.567
	Overly-Nurturing	2.500	4.6907	-6.830	11.830	0.533	0.595
QR-75	Intercept	58.568	11.2606	36.171	80.965	5.201	0.000
	SA Severity	0.182	0.1435	-0.104	0.467	1.267	0.209
	Friendly-Submissive	7.705	4.4649	-1.176	16.585	1.726	0.088
	Hostile-Submissive	-7.295	4.6247	-16.494	1.903	-1.578	0.118
	Overly-Nurturing	8.068	4.9812	-1.839	17.976	1.620	0.109

4.5 Exploratory Analysis (LSAS-SR Severe SA Sample)

Pathoplasticity and regression analyses using a clinically recommended cutoff for severe SA for the participant sample were included to facilitate comparison with findings from published SA IIP-C studies (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001). When the sample was limited to people whose scores exceeded 60 (Rytwinski et al., 2009), the sample size was reduced from N = 88 to N = 66. This number closely corresponds to sample sizes from previous studies and reflects their focus on severe SA populations (Kachin et al. 2001, N = 60; Cain et al. 2010; N = 77; Cooper & Anderson, 2019; N = 51).

Descriptive analyses of LSAS-SR and CES-D-SF scores were conducted using the newly trimmed dataset. The average LSAS-SR score was 85.97 (*SD* = 13.72). The minimum score was 62 and the maximum score was 122. The results of a K-S test of normality were nonsignificant, $D(66) = .107$, $p = .06$, indicating that the scores conformed to a normal distribution. The average CES-D-SF score was 14.23 (*SD* = 4.78), continuing to reflect moderate levels of depression in the sample. The minimum score was 5 and the maximum score was 25. Furthermore, the results of a K-S test were significant, $D(66) = .126$, $p = .01$, indicating that the score distribution was non-normal. The distribution remained positively skewed.

To evaluate the sample for pathoplasticity, I conducted two ANOVAs to determine if there was a main effect of interpersonal style on SA severity. For the three-cluster solution, there was no significant effect, $p = .492$. For the four-cluster solution, there was also no significant effect $p = .765$. In both cases, the removal of the mild-to-moderate segment of the original sample resulted in the conditions of pathoplasticity being met for the severe SA sample, coinciding with previously published SA IPC studies. See tables 14 and 15 for an overview of these analyses.

Table 14 *Analysis of Variance – Interpersonal Style and SA Severity (Three-Cluster Solution; Severe SA Sample)*

Measure	**Friendly-Submissive**		**Friendly-Dominant**		**Hostile-Submissive**		***F*(2,63)**	***p***
	M	**SD**	**M**	**SD**	**M**	**SD**		
SA Severity	85.73	14.92	83.11	12.47	88.15	13.64	.717	.492

Table 15 *Analysis of Variance – Interpersonal Style and SA Severity (Four-Cluster Solution; Severe SA Sample)*

Measure	**Friendly-Submissive**		**Domineering**		**Hostile-Submissive**		**Overly-Nurturing**		***F*(3,62)**	***p***
	M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**		
SA Severity	85.00	14.88	84.88	14.83	88.15	13.64	83.45	11.81	.383	.765

Two nonparametric Kruskal-Wallis tests were conducted to determine if there was a significant main effect of interpersonal style on depression severity. There was no statistically significant effect of interpersonal style on depression severity for the three-cluster ($H(2) = .695$, $p = .707$) or four-cluster solution ($H(3) = .922$, $p = .820$). Once again, CES-D-SF scores would not need to be included as a covariate in the hierarchical regression analyses.

I ran a descriptive analysis on the cooperation and acceptance rate variables before conducting the regression analyses. The average rate of cooperation in the PDG was 56.81 (SD = 17.00). The minimum rate was 5 and the maximum rate was 100. No outliers were identified. The results of a K-S test of normality were nonsignificant, $D(66) = .094$, $p = .200$. The average rate of acceptance in the UG was 64.03 (SD = 14.90). The minimum rate was 35 and the maximum score was 100. No outliers were identified. However, the results of a K-S test were significant, $D(88) = .129$, $p = .001$, indicating that the rate distribution was non-normal.

For the three-cluster solution, a hierarchical regression was run using cooperation rate as the outcome variable. SA severity and the interpersonal variables (friendly-submissive and friendly-dominant) were entered as predictors. The results revealed that for the first model, SA severity did not significantly predict variance in cooperation rate, $p = .487$. In the second model, the predictors did not significantly explain variance in cooperation rate, $p = .137$. However, an exploratory examination of the predictors suggested that the friendly-submissive subtype may positively predict some degree of variance in cooperation rate, $p = .026$. In an attempt to lay the groundwork for future studies investigating interpersonal and behavioral heterogeneity in psychiatric populations, I elected to run a quantile regression using the previously specified predictors to determine whether friendly-submissiveness demonstrated a non-linear relationship with cooperation rate in the PDG.

For the quantile regression, nine models were produced using every 10th quantile in the distribution up to the 90th quantile. Using every 10th quantile enhances the sensitivity of the analysis by improving the detection of both discrete and continuous changes across a large distribution (Koenker, 2017). Comparing pseudo R^2, the 60th, 70th, 80th and 90th quantile models best explained variance in cooperation rate (R^2 = .090, .097, .129, .233 respectively). An evaluation of these models revealed that the friendly-dominance subtype exhibited a significant negative relationship with cooperation rate at the 70th, p = .05, 80th , p = .008, and 90th, p < .001 quantiles. The friendly-submissive subtype exhibited a significant positive relationship with cooperation rate at the 70th, p =.018, 80th, p = .003 and 90th, p < .001 quantiles. No other models produced any significant predictors. Notably, SA severity was no longer a significant predictor in any of the models. See table 16 for an overview of these analyses.

This procedure was not replicated for the four-cluster solution because two of the resulting four clusters were too small to provide to any meaningful results from the analysis (Friendly-dominant, N = 8; Overly-Nurturing, N = 11). Finally, quantile regressions were conducted with for the three-cluster solution with acceptance rate as the dependent variable. However, this analysis did not produce a statistically significant model.

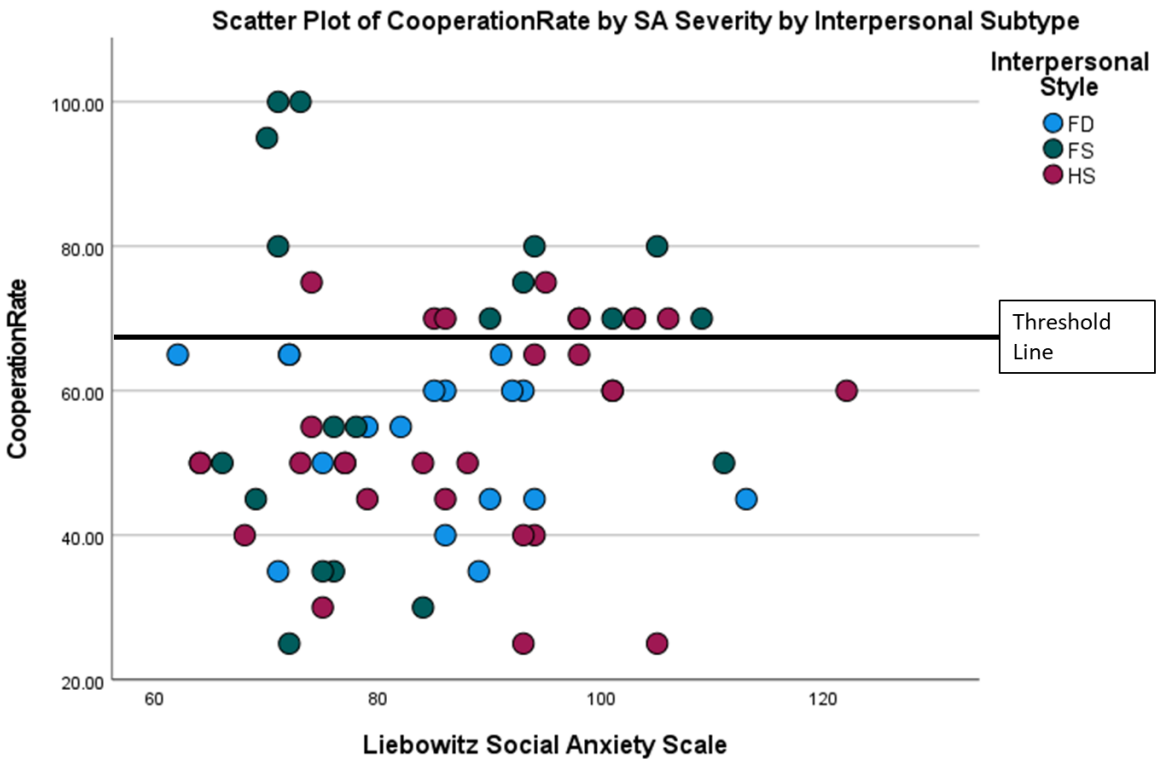

Figure 10 Scatter Plot Depicting Relationship Between SA Severity, Interpersonal Style, and Cooperation Rate in the PDG. The black line is not a regression line, but a simple boundary line that distinguishes between the lower 70% and upper 30% of cooperation rate scores (Three-Cluster Solution; *Severe SA Sample*)

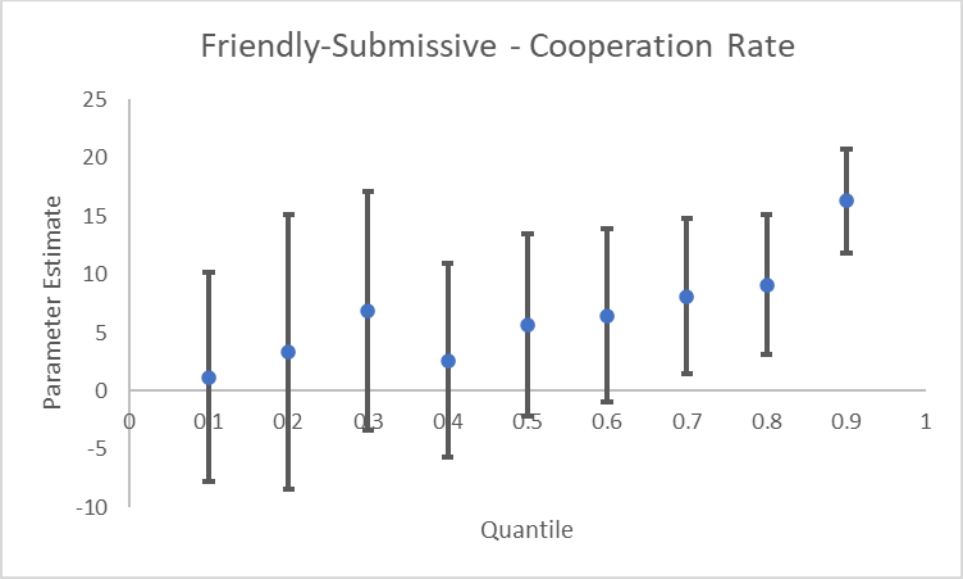

Figure 11 Plot of the parameter estimates produced for the nine quantile regression models (predictor: friendly-submissive, outcome: cooperation rate)

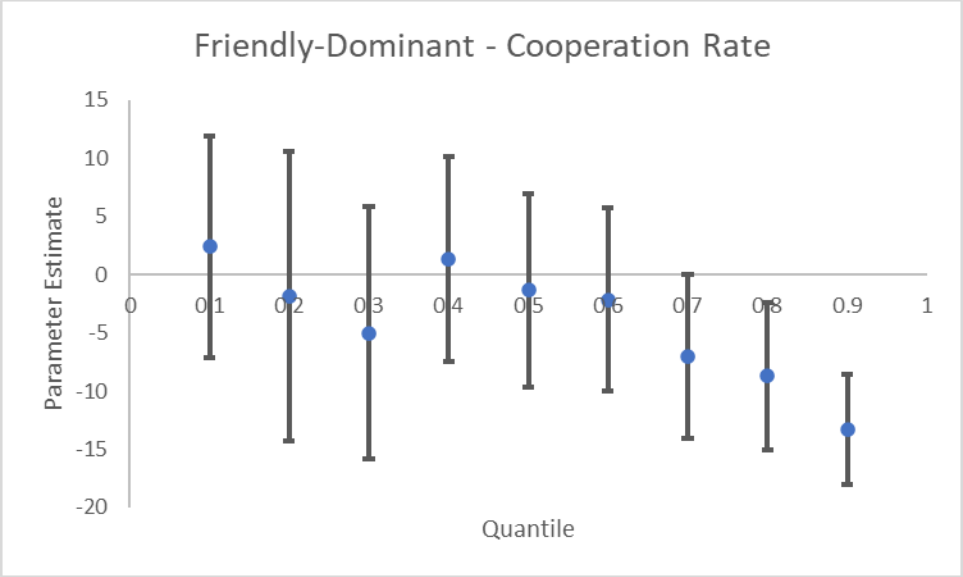

Figure 12 Plot of the parameter estimates produced for the nine quantile regression models (predictor: friendly-dominant, outcome: cooperation rate)

Table 16 *Quantile Regression Model for Cooperation Rate (Three-Cluster; Severe SA Sample)*

Model	Parameter	Estimate	SE	95% CI		t	*p*
				LB	UB		
QR-60	Intercept	37.027	16.7431	3.558	70.496	2.211	0.031
	SA Severity	0.270	0.1930	-0.116	0.656	1.400	0.166
	Friendly-Submissive	6.486	3.6968	-0.903	13.876	1.755	0.084
	Friendly-Dominant	-2.162	3.9256	-10.009	5.685	-0.551	0.584
QR-70	Intercept	82.389	15.0930	52.218	112.559	5.459	0.000
	SA Severity	-0.167	0.1740	-0.514	0.181	-0.958	0.342
	Friendly-Submissive	8.111	3.3325	1.450	14.773	2.434	0.018*
	Friendly-Dominant	-7.056	3.5387	-14.129	-0.018	-1.994	0.050*
QR-80	Intercept	90.873	13.4942	63.899	117.847	6.734	0.000
	SA Severity	-0.238	0.1556	-0.549	0.073	-1.530	0.131
	Friendly-Submissive	9.127	2.9794	3.171	15.083	3.063	0.003*
	Friendly-Dominant	-8.730	3.1639	-15.055	-2.406	-2.759	0.008*
QR-90	Intercept	90.747	10.1055	70.547	110.948	8.980	0.000
	SA Severity	-0.172	0.1165	-0.405	0.060	-1.480	0.144
	Friendly-Submissive	16.322	2.2312	11.862	20.782	7.315	0.000*
	Friendly-Dominant	-13.333	2.3693	-18.070	-8.597	-5.627	0.000*

5 DISCUSSION

Promising research at the intersection of personality and psychopathology posits that SAD and other psychiatric illnesses are characterized by generalized interpersonal distress and a propensity to favor maladaptive behavioral strategies in the face of unpredictable or potentially conflict-laden social interactions. The interpersonal perspective (Alden & Taylor, 2010) suggests that treatment for SAD may be more effective if a heavier emphasis is placed upon relational dysfunction by promoting approach-based, affiliative behavior in addition to alleviating self-protective avoidance behavior (Alden et al., 2018; Plasencia et al., 2016; Rodebaugh et al., 2016). Incorporating this approach into contemporary psychotherapeutic programs could help facilitate positive social outcomes by rehabilitating the afflicted individual's fractured relationships while laying the foundation for new connections, a goal that is often unaddressed in most gold standard treatment programs today. However, there is a scarcity of literature linking self-reported interpersonal problems to objectively observed social behavior and decision-making in ecologically valid contexts. The current study aimed to address this gap in knowledge by exploring whether the endorsement of maladaptive interpersonal strategies modulated the decision-making behavior of college-age students exhibiting mild-to-severe levels of SA symptoms while playing two different dynamic economic-exchange games.

5.1 Hypothesis 1: Three Interpersonal Subtypes of SA

In this study, I addressed four aims. The first aim was to parcellate a college-age sample of individuals reporting mild-to-severe levels of SA into groups based on their self-endorsed interpersonal problems with the expectation that three interpersonal profiles would emerge. Furthermore, I expected that these profiles would adhere to the conditions of interpersonal prototypicality, signifying that the profiles would be internally stable and the majority of

participants in each profile would endorse converging dysfunctional relational patterns. Finally, the profiles would be markedly elevated and differentiated from each other, suggesting disproportionate interpersonal distress and lack of flexibility in relational strategies.

The results of a two-step cluster analysis and subsequent implementation of the profile construction procedure only provided partial support for this hypothesis. The outcome of the original automatic clustering procedure yielded three clusters with statistically sufficient cohesion within and separation among the clusters. Additionally, the clusters displayed near-equivalent sample size. However, only one of the three groups, the friendly-submissive group, met the conditions for interpersonal prototypicality. The other two groups, the hostile-submissive and friendly-dominant groups, displayed moderate model fit but not enough to assume prototypicality. Moreover, I had not expected a friendly-dominant group to emerge in the sample, given that such a group had never been detected in previous SA-IPC studies (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001).

I had predicted that one subset of participants would be classified as hostile-dominant, consistent with Kachin et al. (2001), who identified friendly-submissive and hostile-dominant groups in a clinical sample screened and interviewed for generalized and nongeneralized SAD. Differences in sample characteristics may have contributed to my divergent findings. Whereas Kachin et al.'s participants were predominantly white students at a large rural university, the current sample was racially and ethnically diverse and was recruited from a large urban university. Additionally, while both samples primarily comprised women, Kachin and colleagues' study had more male participants (N = 25) than did the current study (N = 6). Given that no SA-IPC studies to date except for Kachin et al. (2001) have identified a hostile-dominant group, it may also be that the population base rate for this profile is low, making it harder to

detect in relatively small samples. Profiles marked by avoidant or exploitable behavior, in contrast, may be more typical, consistent with the ways in which individuals with SA are commonly characterized (Heimberg et al., 2010a).

To evaluate whether the hypothesized three-cluster solution was optimal for the sample, two and four-cluster solutions were forced using the same clustering procedure. While the two-cluster solution produced groups with only moderate fit, the four-cluster solution produced two groups with good fit that displayed interpersonal prototypicality (friendly-submissive, n = 27; overly-nurturing, n = 22), one group with moderate fit (hostile-submissiveness, n = 28), and one small group with poor fit (domineering; n = 11). Ultimately, neither solution appeared superior to the other based on cluster quality or model fit alone. I thus elected to evaluate interpersonal pathoplasticity for both solutions to facilitate stronger inferences about contributions of dispositional personality features and psychopathological symptoms to behavior. Only the friendly-submissive group demonstrated characteristics of prototypicality in both the three and four-cluster solutions; this outcome is unsurprising, given that the friendly-submissive profile is the only one that has been identified in every published SA IIP-C study to date (Cain, Pincus, & Grosse Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001).

The degree of interpersonal heterogeneity in the sample was surprising, given that earlier SA IIP-C studies have each identified only two internally stable profiles (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001). However, the present sample differed in important ways from those in prior research; in particular, although most participants report LSAS-SR scores that exceeded 60 and indicated severe and pervasive SA, a quarter of the dataset (n = 22) comprised individuals with scores between 30 and 59, a range that suggests mild to moderate SA in a narrower range of social and performance situations (Rytwinski et al.,

2009). Previous SA IIP-C studies focused exclusively on individuals with severe SA and comprised people who met DSM diagnostic criteria for SAD or who obtained LSAS-SR scores of 60 or higher (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001). Given this context, two broader sets of analyses were conducted; one including the original participant sample (denoted "original sample"; N = 88) and one composed of participants who met a clinically recommended cutoff for severe SA based on LSAS-SR scores (denoted "severe sample"; N = 66).

5.2 Hypothesis 2: Interpersonal Pathoplasticity

The second aim of this study was to test for interpersonal pathoplasticity in the sample. Analyses of the original sample revealed significant differences in average SA severity between two of the subtypes for both the three- and four-cluster solutions. For the three-cluster solution, the hostile-submissive group endorsed significantly higher levels of SA than the friendly-dominant group and in the four-cluster solution, the hostile-submissive group reported significantly higher levels of SA than the overly-nurturing group. In both cases, interpersonal pathoplasticity could not be confirmed, indicating that at least for the original sample, SA severity could not be ruled out as an explanation for any variance in behavior during PD and UG gameplay.

However, when these analyses were replicated in the severe SA sample, there were no significant differences in SA severity among subtypes for either solution. This outcome was consistent with the presence of pathoplasticity within this sample and corresponded with findings from previous SA IIP-C studies, although a portion of the profiles only displayed moderate, rather than good, fit. This outcome was unsurprising given recent evidence that a positive relationship may exist between SA severity and generalized interpersonal distress (Frandsen et

al., 2020; Girard et al., 2017). When conceptualizing SAD and avoidant personality disorder (AvPD) as different presentations of the same underlying pathology (with AvPD being the most extreme variant of SAD), both studies found that SAD was characterized by lower levels of interpersonal distress and distinctiveness compared to AvPD. While AvPD was not evaluated for the current study, one could reason that interpersonal impairment associated with SA symptomology potentially increases in a linear fashion up the spectrum from mild to AvPD-like symptoms. Therefore, it may be exceedingly difficult to consistently identify the levels of interpersonal distress necessary to detect pathoplasticity when including participants with lower levels of SA. However, it could also be the case that restricting the range of LSAS-SR scores by removing the mild-to-moderate subsample contributed to the original expected outcome. In either case, these observations underscore the necessity for future studies to broaden the number of psychometric measures used to distinguish symptom-based and interpersonal subtypes in SA, especially given the spectrum of functional domains in which participants are likely to display variability.

Finally, there was evidence of pathoplasticity for depression severity regardless of sample or the cluster solution, signaling that depression severity did not need to be factored into subsequent analyses as a comorbid variable that could explain behavior during gameplay over and above interpersonal subtype. Furthermore, in other research, individuals experiencing depression have reported interpersonal problems that show moderate correspondence to problems reported by individuals with SA; differences primarily revolve around intensity of interpersonal distress, such that individuals with SAD demonstrate more acute signs of generalized impairment (Girard et al., 2017).

5.3 Hypothesis 3: SA Severity and Behavior in the PD and UG

The third aim of the study was to evaluate the relationships between self-reported SA severity and both cooperation rate in the PDG and acceptance rate in the UG. For the original sample, SA severity significantly, but modestly, predicted cooperation rate such that as severity increased, cooperation rate increased. This finding was inconsistent with the study hypothesis and with findings from previous PD studies focused on adults that reported a negative association between self-reported SA and cooperation rate in the PDG (Tone et al., 2019). However, this finding did align with observations of elevated cooperative tendencies during the PDG in adolescents with anxiety and depressive disorders (McClure et al., 2007; McClure-Tone et al., 2011).

Tone and colleagues (2019) had originally predicted, on the basis of evolutionary models of SA, that higher SA would be associated with noncontingent and conciliatory patterns of play, operationalized as heightened cooperation following partner defection. According to evolutionary models, although individuals with SA strive for social recognition and dominance, they have low expectations of their ability to actually achieve this goal (Gilbert, 2014; Trower & Gilbert, 1989). Consequently, these individuals tend to opt for a less competitive approach (e.g., avoidance or appeasement) that allows them to avoid a catastrophic outcome (e.g., humiliation or rejection) that would cause them to tumble down the social hierarchy and lose access to vital physical and social resources (Henderson et al., 2014).

However, contemporary cognitive-behavioral models of SA have underscored that self-protective interpersonal behaviors can vary as a function of individual preferences (Heimberg et al., 2010a; Piccirillo et al., 2016). For example, safety behaviors may in fact be grouped into categories such as avoidance and impression management subtypes. When framed in an

interpersonal context, individuals on the left end of the communion dimension of the IPC (hostile/distant) may display more avoidance tendencies in comparison to those on the right end of the dimension (warm/nurturing), who may opt for an impression management approach. Existing literature suggests that avoidance behaviors that diminish one's involvement in a social situation are likely to be interpreted or perceived negatively by social partners (Rapee & Heimberg, 1997) while impression management behaviors are likely to elicit anxiety but avoid negative reactions from social partners (Hirsch et al., 2004). These characterizations should heavily influence the interpretation of behavior, yet these factors are often not taken into account, resulting in researchers attempting to fit one pattern of behavior to an ostensibly homogenous SA sample.

It is important to note that the relationship between SA severity and cooperation rate was modest and was detected only in the original sample of individuals with mild-to-severe SA. When participants who reported mild-to-moderate symptoms were removed from the sample, SA severity no longer significantly predicted cooperation rate. While this outcome may be linked to the restriction in scores used for the analysis, it may also suggest that lower levels of SA do not detrimentally impair responsiveness to social partners, but as severity reaches levels indicative of generalized interpersonal distress, individuals with SA become more constrained and self-protective in the behavioral strategies they choose to employ.

For example, two studies using the Trust Game and flexible iPD found that SA severity was negatively associated with reciprocal giving behavior, with one of the studies finding that the relationship was moderated by extreme interpersonal problems (Anderl et al., 2018; Rodebaugh et al., 2016). Furthermore, a fMRI study using the Trust Game to explore social

reward functioning in generalized SAD found that SA severity was negatively associated with reward response to cooperative partners in the ventral striatum (Sripada et al., 2013).

These observations highlight that, even at a neurobiological level, socially normative gestures meant to build trust and facilitate sustained reciprocation may be perceived and processed in an increasingly distorted manner as one traverses up the spectrum of SA severity. These maladaptive interpersonal responses are likely to become exceedingly acute at the highest levels of SA and detrimentally impact the ability to appropriately respond to and relate to others, as suggested by two recent large-scale IIP-C analyses (Frandsen et al., 2020; Girard et al., 2017). Replication of the current study comparing larger samples of individuals endorsing generalized and nongeneralized levels of SA may be warranted to establish a baseline behavioral disposition for both groups, controlling for interpersonal style.

In regard to the UG, findings in both the original and the severe SA samples lent support to the hypothesis that SA severity alone would not predict a significant change in acceptance rate. These results correspond with those from studies that evaluated the relationship between SA or trait anxiety and acceptance rate when controlling for individual characteristics like self-esteem and depression severity (Luo et al., 2014b; Peterburs et al., 2017; Wu et al., 2013).

Furthermore, at debriefing, participants endorsed significantly more anger at the behavior of the faux co-player in the UG than they did for the co-player in the PDG. While the size of this effect was small and the relative anger elicited by both games was low-to-moderate, the result somewhat coincides with findings from a recent study (N = 667) that examined associations between trait SA and experienced negative affective reactions to unfair offers during UG gameplay. Confirming the authors' predictions, trait levels of SA correlated positively with stronger aversive reactions to unfair offers and the magnitude of this correlation became stronger

the more inequitable the unfair offer was (Anderl et al., 2022). Moreover, these affective responses were not associated with a significant difference in acceptance rate in comparison to individuals with low trait levels of SA, which also mirrors the findings of the current study.

Given the reputation of the UG as an anger-inducing paradigm (Gilam et al., 2019) it is possible that programming a larger deviation in outcomes for the unfair offer in the current task would have elicited more intense affective responses. However, slightly higher feelings of anger were not all that was reported. Participants also endorsed significantly less happiness with their earnings in the UG when they earned less than their partner versus when they earned equal amounts to the partner. The size of this effect was medium and contrasted with the nonsignificant difference in ratings of happiness with earnings in relation to the partner following the PDG. This finding at least implies that participants were more dissatisfied with the monetary outcome of the UG than they were angry at the other player. A combination of a binary choice pool (participant could earn $2.50 or $1 per round versus the co-player who could earn $2.50 or $4) and the aggressive decision-making strategy of the computerized co-player (multiple unfair offers could be presented in succession) may have contributed to this outcome, given that participants technically could not win the game and purposefully disadvantaged by the co-player.

Future research might magnify the difference in outcomes between partners, then adopt Versella and colleagues' (2016) approach, in which they used a latent class analysis to parcellate a large SAD sample based upon a combination of IIP-C scores and self-reported state/trait anger levels. These profiles varied according to anger experience, expression, distress, and impairment. Anger profiles could be fruitful to examine in research using economic-exchange tasks that emphasize inequity. In particular, they could be helpful in determining whether affective experience may influence interpersonal strategy choices during contentious interactions.

5.4 Hypothesis 4: Interpersonal Style as a Modulator of Behavior

For the fourth aim, I evaluated relationships between SA severity and behavior in the PDG and UG while accounting for variability in self-endorsed interpersonal problems. Beginning with the PDG, in the original sample, SA severity, but not interpersonal style, accounted independently for a moderate amount of variance in cooperation rate. However, when analyses were restricted to participants who endorsed severe SA, friendly-submissiveness and friendly-dominance were significant unique predictors of variance in cooperation rate at the .70, .80 and .90 quantiles of the cooperation rate distribution. However, this relationship was divergent in nature, depending on the interpersonal subtype. The friendly-submissive subtype emerged as an important positive predictor only upon reaching the .70 quantile of the cooperation rate distribution (in some cases participants in this subtype cooperated on 80-100% of trials during gameplay). Conversely, friendly-dominance emerged as a significant negative predictor of cooperation rate once the same upper threshold was reached in the distribution (ceiling rate of 65% during gameplay). Furthermore, interpersonal problems explained variance between the .70 and .90 quantiles of cooperation rate over and above what could be explained by SA severity. SA severity did not predict variance at any quantile of the distribution. Finally, hostile-submissiveness did not significantly predict variance in cooperation rate at any quantile within the distribution when compared to friendly-submissiveness and friendly dominance, corresponding with the original hypothesis. In summary, the findings here largely aligned to the original hypothesis but in a non-linear fashion for individuals who endorsed a friendly-dominant as opposed to a hostile-dominant disposition and in individuals whose SA levels surpassed an explicit clinical cutoff based on LSAS-SR scores.

The differences in cooperation rates between the friendly-submissive and friendly-dominant subtypes are intriguing, given that their interpersonal orientations align along the communion dimension but conflict along the agency dimension. Friendly-submissiveness overlaps with the exploitable octant of the IIP-C, which is associated with excessive transparency and vulnerability around others (e.g., I open up too people too much, I tell personal things to other people too much, I don't find it hard to tell my feelings to others). This style was apparent in self-report responses following gameplay; friendly-submissive individuals, for instance, were more likely to express overtly cooperative goals in comparison to friendly-dominant individuals. Based on these observations, it is possible that participants endorsing this disposition placed greater emphasis upon their ability to connect to their peers and avoid exacerbating contentious outcomes by defecting, despite the risk of exploitation from their partner. Additionally, someone endorsing a friendly-submissive orientation might also want to avoid feelings of guilt, a conflict-laden emotional response which is often elicited when the participant defects while their partner cooperates (Rilling & Sanfey, 2011).

Another point to consider is the role that intolerance of uncertainty, a cognitive construct shown to be a significant predictor of SA severity (Boelen & Reijntjes, 2009; Carleton et al., 2010a; Whiting et al., 2014), might play in patterns of behavioral response during game play. Recent fMRI studies have found that neural regions that commonly activate in the context of uncertainty, such as the dorsal anterior cingulate and the bed nucleus of the stria terminalis, exhibited heightened activity when an individual with elevated SA responded to unpredictably valenced facial stimuli (Clauss et al., 2019) or unreciprocated feedback in the PDG (Thompson et al., 2019a). These observations potentially help clarify why friendly-submissive individuals were the only group who showed proneness to cooperate across the entire game, despite the

potential consequences to their earnings and their self-esteem. Coaxing back cooperation could be a safe strategy in the face of ambiguous and unpredictable feedback. Alternatively, the friendly-submissive participant could have genuinely adhered to the ideal that consistently vying for mutual cooperation is the best way to facilitate positive social outcomes and avoid conflict or rejection. While this mindset could be problematic in a situation in which the co-player had no intention of maintaining stable cooperation (an outcome guaranteed with our computerized algorithm), the participant ultimately had no way of knowing this given the deception involved in the task. Future research will need to clarify exactly what expectations the participant had about their partner before and during gameplay.

The friendly-submissive participants' reports of problems with excessive openness stand in interesting contrast to the empirical data linking SA to difficulties with self-disclosure and the expression of intimacy in close relationships (Laurenceau et al., 1998; Porter & Chambless, 2014; Sparrevohn & Rapee, 2009) and, especially, with strangers (Meleshko & Alden, 1993; Papsdorf & Alden, 1998; Reno & Kenny, 1992). This inconsistency is particularly intriguing, given that the friendly-submissive subtype is the most commonly reported interpersonal style in circumplex studies investigating adults with high levels of SA alone (Cain, Pincus, & Holtforth, 2010; Cooper & Anderson, 2019; Kachin et al., 2001). In contrast, in circumplex studies that have assessed more disorders than just SAD (e.g. generalized anxiety disorder, major depressive disorder etc.), SAD is most commonly linked to socially avoidant (hostile-submissive) and nonassertive tendencies (Alden & Phillips, 1990; Frandsen et al., 2020; Girard et al., 2017). One way to address this divergence in the documentation of interpersonal subtypes in SA might be to conduct large-scale studies that synthesizes self-report of interpersonal problems with informant-

reports from individuals within the individual's social network (friends, significant others etc.). This point will be elaborated upon further in the limitations section.

Conversely, based on their responses to the IIP, friendly-dominant individuals report excessive dependence on others' evaluations, which might include over-valuing others' positive regard or proneness toward jealousy (e.g., I worry too much about other people's reactions to me, I want people to admire me too much, I am too dependent upon other people, I am too jealous and envious of others). Thus, like friendly-submissive individuals with elevated SA, friendly-dominant individuals with high levels of SA might be expected to endorse the opinions, feelings, and behaviors of the people around them in order to maintain and reinforce social connections. However, the self-report data revealed that friendly-dominant individuals endorsed significantly more feelings of competitiveness than the friendly-submissive group and were more invested in winning the PDG, but in comparison to the hostile-submissive group. This evidence may support the notion that a dependent disposition in individuals with SA is more likely to be expressed only when interacting with close others. When interacting with strangers (like our current study) they are less likely to display dependence, which may explain why their cooperative tendencies differed from the friendly-submissive group (Darcy et al., 2005; Kopala-Sibley et al., 2014).

Furthermore, differences in the social concerns reported by individuals with SA may influence their perception about the progression and outcome of a social interaction. Some may place greater weight upon social rank and loss of social dominance (Cain, Pincus, & Holtforth, 2010; Cox et al., 2000, 2004) while others may be more concerned with successfully affiliating with their peers, avoiding judgement from others and maintaining emotional security during social interactions (Cain & Pincus, 2016; Darcy et al., 2005; Davila & Beck, 2002).

Based on behavior and self-report, individuals endorsing friendly-submissiveness may have potentially been more concerned about affiliating with their partner, while individuals subscribing to friendly-dominance may have been more concerned about social rank, driving their motivation to engage with their partner competitively in comparison to the friendly-submissive group. While Gilbert and Trower (2001) postulated that SA should be associated with a lack of confidence in one's ability to maintain status and a lack of willingness to assert dominance, people classed in the friendly-dominant subtype appeared to be capable of enforcing norms and strived to win the game, consequently capping their ceiling rate of cooperation and avoiding the exploitation experienced by some of the friendly-submissive participants. However, a more exhaustive investigation of motivations is required before we can make stronger assertions about participants' evaluative process, especially considering this population's proneness to limitations in insight and social desirability bias (Joinson, 1999; Vigne et al., 2014). Importantly, this overall pattern of behavior in the friendly-dominant group does not match what was expected from a hypothetical hostile-dominant group, whose behavior was predicted to directly contrast the behavior of the friendly-submissive group in a linear fashion. While friendly-dominant individuals displayed average cooperation rates, the hostile-dominant groups behavior would be expected to mirror what was observed in the Tone and Rodebaugh studies (reduced cooperation rates in comparison to the average).

In regard to the UG, neither SA severity nor interpersonal style were significant predictors of acceptance rate in the original or severe SA sample. However, it is important to reiterate that the UG is frequently employed as an anger-inducing paradigm (Gilam et al., 2015, 2019; Gilam & Hendler, 2015), in contrast to the PDG, which is more often used to explore the development and maintenance of sustained cooperation (Jurišić et al., 2012; Mantas et al., 2022;

O'Riordan, 2001). While the anger elicited by the UG task was low-to-moderate, participant negative affect was more apparent in ratings of dissatisfaction with earnings, relative to ratings during the PDG. This dissatisfaction with earnings aligns with findings that healthy participants often seek to correct the inequity established by an unfair offer (Pillutla & Murnighan, 1996; Xiao & Houser, 2005). Unfair UG offers also reliably elicit psychophysiological and neural signatures indicative of a heightened emotional response, especially for individuals who may be hyperaware of their bodily signals and interoceptive state, as is often the case for people with heightened SA symptoms (Dunn et al., 2012; Gabay et al., 2014; Van't Wout et al., 2006). In sum, healthy and SA participants may experience the same emotional aversion to an unfair offer, which may also be linked to corresponding behavior between both groups.

Still, these explanations can only partially account for findings that both SA and trait anxiety have consistently been minimally correlated with behavior in the UG. The UG may evoke an emotional response pattern among highly anxious people that is comparable to that observed in low-anxious individuals, but people with elevated SA should be less likely to act upon the negative affect, whether dissatisfaction or anger, elicited by the unfair offer. Perhaps the consequences of refusing to accept an unfair offer were less apparent and significant to participants with high SA than those with low SA. Given that individuals with high SA levels report increased anxiety when attending to certain facial expressions and other physical signals of evaluation (Gilboa-Schechtman & Shachar-Lavie, 2013), we might have elicited stronger responses and more distinct deviations in behavior had we been able to provide more salient human feedback (e.g., changes in facial expression, posture) during the game.

5.5 Implications

The implications of the current study may best be framed through the lens of Contemporary Integrative Interpersonal Theory (CIIT; Wright et al., 2021), which is grounded in the core assumption that important presentations of personality and psychopathology occur within interpersonal situations, and that psychopathology is fundamentally expressed via disturbed interpersonal functioning. Findings from the current study align with this notion, in that they provide evidence of behavioral heterogeneity among interpersonal subtypes of SA within a reciprocal exchange paradigm, and that furthermore these subtypes explained behavior over and above symptom severity.

This study appears to be the first to compare behavioral tendencies during computerized economic-exchange games between people with high levels of SA who endorse interpersonal problems that cluster into multiple subtypes. However, behavioral variability associated with interpersonal style was only detected in a reciprocal exchange context (PDG) and reciprocal exchange is only one sub-facet of interpersonal behavior. Future research will be required to characterize links between self-report and overt behavior across a range of situations that extend beyond the highly controlled, artificial boundaries of economic-exchange tasks. The current study nonetheless provides evidence aligned with the assertion that at least some forms of psychopathology are fundamentally defined by the interpersonal situation.

Other core assumptions of CIIT (Wright et al., 2021) are that interpersonal functioning can be organized along dimensions of agency and communion, and that agentic and communal motives drive interpersonal behavior. The behavioral data in conjunction with the debriefing responses to the study provide some evidence that, concerns about agency (ex. friendly-dominance → competitiveness) and communion (ex. friendly-submissive → cooperation) drove

participants' decision-making. However, ultimately, we have little insight into the true motivation of the participants. The debriefing questions evaluated the participant's collections of their goals and experiences during play, which could be biased or inaccurate due to post-event processing, among other factors. Interpersonal theory suggests that the perceptions of current experiences are inherently linked to memories of past experiences and expectations about the future, factors that are heavily underscored in cognitive-behavioral models of SA and contribute to the development of a distorted relational schema (how the individual sees themselves in relation to others). Each participant's relational schema likely contributed to how they interpreted the outcomes of the games, but the economic-exchange task literature to date does not include studies that incorporate data about this kind of cognitive construct. Furthermore, the simple nature of interactions during economic-exchange tasks may limit the extent to which they can tap into the complexities of motivation and relational schemas. These limitations would benefit from attention in future research.

A final core assumption of CIIT to consider is that the interpersonal transaction cycle (the interactive process in which individuals reach mutual satisfaction, extend negotiation, or dissolve a relationship) allows for the generation of probabilistic expectations for patterns of behavior and falsifiable predictions about behavioral sequences. At most, findings from the current study can provide a baseline expectation about average behavior over time. They do not offer insight into contingency patterns grounded in the complementarity principle, where dominant behavior invites submissive behavior and warm behavior invites warm behavior (Sadler et al., 2012). Persistent deviation from these expected transactional patterns may reflect psychopathology, and so the elucidation of typical and atypical contingent response patterns will be an important next step toward illuminating the mechanisms underlying interpersonal dysfunction. However,

persistent deviation may also reflect an unstable social environment that is non-conducive to normal social interactions. In either case, expanding the interactive environment to emphasize spontaneity and allow flexible choice options will be integral to future research aiming to model the interpersonal transaction process and its disruptions in psychopathology.

5.6 Limitations

A number of limitations should be factored into the interpretation of the current findings. The first is the relatively limited ecological validity of the economic exchange tasks as social contexts. For instance, in a real-life social interaction, a person typically receives human feedback on a continual basis. Incorporation of task-based feedback that includes SA-relevant social cues could facilitate collection of richer data by enhancing the immersive experience of game play. Such feedback might include cues from emotional faces, valenced social-evaluative and self-referential statements (Regev et al., 2012; Yoon et al., 2019), and nonverbal social cues like body posture (Gilboa-Schechtman & Shachar-Lavie, 2013) all of which help us express and recognize ambiguous affective states. Only a few studies have integrated such social stimuli during economic-exchange gameplay with psychiatric populations (e.g., de la Asuncion et al., 2015), and expanding this kind of work would improve the ecological validity of economic-exchange tasks.

Another major limitation of the present study was the limited number of male participants (N = 6; 10% of the sample). Research in this area has historically focused on samples weighted toward women; a 3:1 distribution weighted towards women appears to be typical (Cooper & Anderson, 2019; Kachin et al., 2001; Rodebaugh et al., 2017), although one study had a gender-balanced sample (Cain, Pincus, & Holtforth, 2010). The small male sample in the present study limits the degree to which findings can be generalized beyond college-aged women.

Two recent reviews summarize evidence that there are sex differences in the clinical presentation of SAD that could relate to distinct patterns of interpersonal behavior (Asher et al., 2017; Jalnapurkar et al., 2018). For example, women with SAD are more likely to meet criteria for comorbid internalizing disorders like major depressive disorder, whereas men with SAD are more likely to meet criteria for comorbid externalizing disorders and substance use disorders. Women with SAD also tend to self-report more severe symptoms and to identify a wider range of fear-eliciting social situations than men, while men may actually experience more subjective distress and display greater likelihood of seeking treatment for SAD (Asher et al., 2017). However, despite these phenomenological differences, the results of a meta-analysis investigating sex differences in cooperation in healthy population revealed no statistical differences in rates of cooperation (Balliet et al., 2011). However, the study did suggest that male-male interactions are more cooperative than female-female interactions, yet women also cooperate more than men in mixed-sex interactions. Another recent meta-analysis evaluating the related construct of negotiation found that while women tend to initiate negotiate less than men, the effect size was small and linked to contextual factors such as subjective valuation of the appropriateness of negotiating (Kugler et al., 2018). Unfortunately, there was no attempt to consider the mediating impact of dyadic congruity or situational context on the stability of cooperation or acceptance and how that may interact with both SA presentation and interpersonal dispositions to drive behavior. While the findings from the meta-analyses may tentatively suggest a trend towards reduced cooperation for women in same-sex dyads, future research will require both recruitment of gender-balanced samples and systematic tracking of dyad composition to fully inform our understanding of possible sex-dependent interpersonal presentations in the context of SA.

A third limitation of the current study was the failure to achieve interpersonal prototypicality for all subgroups in the sample. This unexpected outcome might, at least in part, reflect demographic differences from prior studies; in particular, the sample in the present study was more racially and ethnically diverse than samples in prior studies, which predominantly comprised non-Hispanic white Americans. Research has underscored the impact of cultural factors on the presentation of mental health issues (De Jager et al., 2014; Hofmann et al., 2010; Woody et al., 2015). For example, cultures that encourage the socialization of qualities such as nurturance, dependence, and submissiveness might be less likely to pathologize behaviors associated with SA (Aparicio-García et al., 2018; Hofmann et al., 2010). Furthermore, collectivist cultures might be more likely than individualistic cultures to promote and accept socially subdued and inhibited behavior that might be associated with SA (Heinrichs et al., 2006; Schreier et al., 2010). Finally, African-American women represented a large proportion of the sample in the current study. It warrants consideration that experiences of racism, as well as cultural stigma regarding disclosure of mental illness or psychological symptoms, may have contributed in distinctive ways to these participants' experiences and their responses during the study (Hunter & Schmidt, 2010). Moreover, there is some evidence that SA symptoms cluster in different ways for African-American and White Americans on widely-used measures such as the Fear of Negative Evaluation Scale and the Social Avoidance and Distress Scales (Melka et al., 2010).

It may also be expected that the diversity of the current sample contributed to the behavioral observations of the current study, given that SA severity only displayed modest predictive value in the original sample and interpersonal style explained behavior in an atypical, nonlinear fashion in the severe sample. However, a recently published meta-analysis found no

evidence that cultural, ancestral or linguistic distance across societies explained variance in impersonal cooperation across both the United States and foreign countries (Spadaro et al., 2022). Task parameters such as the opportunity to sanction and the ability to communicate with your partner were more important explanatory variables of cooperative tendencies. Indeed, in the current study, an exploratory ANOVA identified no significant differences in cooperation or acceptance rate as a function of ethnicity, consistent with the findings of the meta-analysis. Overall, while accounting for the potential influence of ethnic and cultural identity on interpersonal subtypes in SA will be important in future research, the extent to which ethnic and cultural identity influence cooperation may be better investigated with a focus on the mechanisms that promote cooperation (e.g. sanctioning, communication, partner selection) as opposed to examining it in isolation.

Another limitation was the absence of data from objective informants (e.g., peers, parents, significant others) that could help to validate participant responses on the self-report IIP-32 measure. Given the risk that individuals with SA may misrepresent themselves, as a function of a distorted, negative self-image (Heimberg et al., 2010a; Rapee & Heimberg, 1997), it would be useful to have third-party informants to provide confirming or discrepant perspectives. Findings from two recent studies underscore the importance of such collateral data. One study found that although the presence of SAD was associated with self-endorsed socially avoidant and nonassertive tendencies, discrepancies between informant and self-reports regarding affiliative and dominant behaviors increased as severity of SAD symptoms increased (Shin & Newman, 2019). In another study, individuals diagnosed with generalized SAD described themselves as less warm, less dominant, and more distressed than individuals without SAD. However, the friends of individuals with SAD evaluated them more positively and their romantic partners

described them as more prone to coldness and distress in comparison to those without SAD (Tonge et al., 2020). Given these findings, it may be expected that self-report, informant-report, and real-world behavioral variability lack congruity. The reconciliation of conflict among these measures therefore serves as a fascinating route for future research.

Moreover, not only did this study rely exclusively on self-report to evaluate interpersonal behavior, but it also based interpersonal style classifications on a single circumplex measure, the IIP-32. Future research might incorporate multi-surface interpersonal assessment (MSIA), which involves the administration of multiple IPC measures that target varied functional domains at different levels (e.g., traits, values, confidence, emotions) (Dawood & Pincus, 2016). This method offers a creative approach to evaluating interpersonal disposition; such a multi-measure approach could be particularly useful, given evidence that tension between multiple interpersonal domains (operationalized as the magnitude of divergence between scores on IPC measures) can contribute to a person's distress and reduced quality of life (Kiesler, 1996; Leary, 1957).

5.7 Conclusions and Future Directions

In conclusion, findings from this study highlight the value of considering the influence of maladaptive interpersonal tendencies on real-life behavior among individuals with elevated SA. Currently, established diagnostic approaches emphasize alleviating cognitive, emotional, and physiological symptoms but essentially neglect behavior, except for avoidance. A focus on individual differences in interpersonal behavior patterns might facilitate better-tailored and more consistently effective clinical services for people with significant impairment.

Applying the IIP-C and circumplex theory more broadly may help improve classification and treatment of SA in several ways. For example, teaching clients about "interpersonal complementarity", or the tendency for patterns of interpersonal behavior between social partners

to complement each other, and the ways in which their behavior affects others' responses to them might help behavioral exercises aimed at facilitating social engagement. Helping clients understand that dominance from one person tends to elicit submission from others (and vice versa), and that warmth elicits warmth might help them make constructive changes in day to day life (Sadler, Ethier, & Woody, 2011). Numerous studies have indicated that behavioral complementarity facilitates social bonding in roommate dyads (Ansell et al., 2008; Markey & Kurtz, 2006), teacher-student dyads (Pennings & Hollenstein, 2020; Roorda et al., 2013), romantic partners (Markey & Markey, 2007; Markey & Markey, 2013) and parents and their children (Nilsen et al., 2015; Rozenblatt-Perkal & Zaidman-Zait, 2020; Shewark et al., 2022).

In the future, the incorporation of dynamic spontaneous interaction paradigms with real-time assessment of interpersonal complementarity could dramatically improve the ability of researchers and clinicians to verify the validity of IPC responses reliably and independently. Such an approach could also allow for more finely-grained analysis of patterns of contingent, complementary responses across economic-exchange tasks. As Sadler et al. (2012) underscored, research using confederates alone is less sensitive to the principle of complementarity, which holds that both individuals in a dyad will mutually influence each other's behavior during interactions. The roles of the confederates are tightly circumscribed in controlled lab studies using economic-exchange tasks; typically, the "confederate" is a computerized algorithm that conforms to decision-making patterns pre-defined to elicit responses of interest to the research team. To counteract these disadvantages, a seminal study examined interpersonal complementarity during dyadic interactions among unacquainted women. Three judges used a computer joystick tracking device to rate individual dyad members' dominance (agency) and warmth (communion) during 12 minutes of spontaneous real-time interaction. Results revealed

that both partners tended to alter their behaviors in a complementary manner and that partners who reciprocated each other's warm gestures tended to like each other and performed tasks more quickly than dyads who appeared to be out of synchrony in their behavior (Markey et al., 2010). Since this study's publication, a growing number of researchers have begun to use real-time interpersonal assessment to examine interactions within teacher-student, parent-adolescent, and therapist-client dyads (Altenstein et al., 2013; Nilsen et al., 2015; Pennings et al., 2014). This work could naturally extend into the realm of economic-exchange based research on SA, in which interpersonal style is coded as a function of interdependent interactions between a participant with elevated SA and a variety of social partners classified based on their social and relational proximity to the participant. This kind of approach could facilitate accurate identification of interpersonal subgroups for the purpose of behavioral analysis.

Another future direction involves the longitudinal evaluation of interpersonal functioning in daily life. Although mapping the real-time components of social interaction in the lab has a number of benefits, interpersonal problems are more likely to occur outside of a lab context, making them difficult to monitor and code systematically. Furthermore, many self-report accuracy issues can at least be partially reduced by asking questions that are temporally closer to the event of interest (Schwarz, 2012). This approach reduces memory and estimation problems and provides greater autobiographical detail to self-report. In this vein, diary methods would allow participants to regularly record the most socially and emotionally salient moments of their lives through response to easily accessible brief surveys and questionnaires (Csikszentmihalyi, 2011). Additionally, advancements in real-time experience sampling methods allow for periodic assessments throughout a single day based on circumscribed schedules or prompts (ecological momentary assessment [EMA]; Shiffman et al., 2008) or following preplanned events (event

contingent recording [ECR]; (Moskowitz & Sadikaj, 2012). Assessments can be collected in ways that do not place additional burden upon the participant and that effectively capture an individual's experience in a natural setting (e.g., paper-and-pencil diaries or electronic diaries recorded on smartphones and other electronic devices). These diary-based methods could serve as useful supplements to cross-sectional evaluations of interpersonal tendencies.

A final suggestion for future research would be the application of a multimodal neuroimaging procedure to computerized and real-time interaction paradigms to elucidate the neurobiological mechanisms underlying interpersonal impairment, the endorsement of specific subtypes, and whether these subtypes may be functionally dissociable from SAD-linked neural irregularities. The foundation to begin this neurointerpersonal profiling has already been established in studies of overlapping personality constructs such as social value orientation and attachment style. However, research examining the modulatory effect of social value orientation on decision-making behavior during economic task gameplay has yielded conflicting results, with differences in paradigm parameters, context, and administration often cited as potential explanations for the discrepancies (Declerck & Boone, 2018; Emonds et al., 2014; Lambert et al., 2017; Lemmers-Jansen et al., 2018; Qi et al., 2017). Neuroimaging findings regarding attachment style have similarly been found to lack uniformity (DeWall et al., 2012; Perlini et al., 2019; Schneider-Hassloff et al., 2015; Tang et al., 2017).

The neural architecture underlying these constructs may be more easily delineated with the application of interpersonal circumplex theory, which expands the spectrum of coded behavior from binary options (prosocial vs. proself; secure vs. insecure) to a suite of qualitatively distinct interpersonal subtypes anchored to meta-constructs (agency and communion) that span across interpersonal constructs. Real-time imaging modalities such as hyperscanning, which

allows for the concurrent recording of fMRI, EEG, or fNIRS data from multiple participants to identify synchronous connectivity networks between interacting social partners, might also be useful for advancing this line of research (Babiloni & Astolfi, 2014; Koike, et al., 2015; Wang et al., 2018). For example, research using hyperscanning has revealed that when pairs of healthy adults play the PD game, they demonstrate enhanced mPFC synchrony during cooperative interactions and diminished synchrony during competitive interactions (Czeszumski et al., 2020). Exposing participants to more varied social contexts and allowing independent judges to rate interpersonal stability and variability over time has the potential to expand on this foundation by identifying complementary regions or networks that engage during dyadic interactions with compatible and incompatible social partners. Such work might also be useful toward helping researchers determine how SA and other psychiatric symptom patterns interact with interpersonal disposition to compromise synchrony between two individuals at a neural level.

In summary, the current study adds to the burgeoning literature on relationships among self-endorsed personality constructs, psychopathology, and overt patterns of behavior. Interpersonal style was significantly associated with behavior during the PDG, making contributions over and above SA severity in a nonlinear relationship. Specifically, within a severe SA subsample, individuals who endorsed friendly-submissiveness were more likely to cooperate above a 65% threshold in comparison to the friendly-dominant group, which was capped at a 65% ceiling rate during PD gameplay. In the UG, however, there were no significant associations between interpersonal style and increased acceptance of offers.

While economic-exchange paradigms have utility in efforts to elucidate behavioral tendencies of those with elevated psychological symptoms, they could be improved by incorporating spontaneous, real-time interaction into research paradigms, collecting confirmatory

reports of interpersonal behavior from objective third parties, collecting longitudinal reports of temporally proximal behavior over time, and linking interpersonal profiles to underlying neural mechanisms of dyadic synchrony during interpersonal interaction.

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APPENDICES

Appendix A

Debriefing Form

ID:_____ Initials: _____

Date:_____ DOB: _____

Earnings: Game 1 _____ Game 2 _____ Game 3_____

Cooperate/Not Cooperate Game Debriefing Form

Thank you for taking the time to play the game. Please take the time to thoughtfully answer the following questions on your reactions to the task.

How happy were you with the amount of money you won?	(Very Unhappy) 1 2 3 4 5 6 7 8 9 10 (Very Happy)
Overall, how competitive did you feel with the other player?	(Not at all) 1 2 3 4 5 6 7 8 9 10 (Very)
How cooperative was the other person with you?	(Not at all) 1 2 3 4 5 6 7 8 9 10 (Very)
What was the angriest that you became with the other player?	(Not at all) 1 2 3 4 5 6 7 8 9 10 (Very Angry)
How nervous did you feel while waiting for the other person to make their choice?	(Not at all) 1 2 3 4 5 6 7 8 9 10 (Very)
Did the other person use a good strategy?	(Not at all) 1 2 3 4 5 6 7 8 9 10 (Very)
How important was winning money to you in the game?	(Not at all) 1 2 3 4 5 6 7 8 9 10 (Very)
How important do you think winning money was to the other person?	(Not at all) 1 2 3 4 5 6 7 8 9 10 (Very)

1) In games like these people play in many different ways; some people have a set strategy that they use to play. Did you have a strategy or certain way of playing? What was it?

2) If you had a strategy, did your strategy change after you had played for a while? How? Why?

3) Did it "feel" different to you when you played on the computer rather than another person? Did you feel different emotions or think different things?

4) If you had the chance to play again, would you use the same strategy(ies)? Why or why not?

5) Did you try to guess what the other person's choices would be? Could you, do it?

6) Did you think the other player was trying to predict what choices you would make? Did you try to be unpredictable? If so, how?

7) Did you try to work with the other player or against him/her? Did you try to mislead the other player about what choices you would make (what strategy you were using)? If so, how?

8) Was your overall goal from the game to win as much money as possible for yourself, to win more money than the other person, to win a similar amount for both you and the other person, or to accomplish something else?

9) Which would you prefer: winning $15 when the other player wins $12, or winning $20 when the other player wins $25?

10) In general, how did you feel during the games? Did you feel stressed or frustrated? Did you feel positively or negatively toward the other player(s)?

11) Did you enjoy playing the game? What, if anything would have made it more enjoyable for you?

***__What follows is important information about our study. Please don't share this part with other people:__**

We asked you to come in and play the cooperation game to help us learn about differences in the ways that people choose to interact with each other and the thoughts and feelings that they have about these interactions. We are especially interested in how these differences relate to the amount of anxiety or worry that people report feeling about social situations. In the cooperation game you were interacting with a computer. NO OTHER REAL PEOPLE played with you. We told you that you were playing with real people during several games because people act differently if they think they are playing with a real person instead of a computer. We have designed this task so that it will be the most helpful to others in the future, and in order for us to do this, we needed you to believe you were playing with another person during most of the games. We wanted to tell you about this immediately now that you are done. This is the only part of this study that involves deception.

We ask is that you do not share this information with *anyone* because it is very important that everyone who takes part in our study believes that there are real people involved. If some players know that they are playing on a computer and others do not, then our study would not yield useful information. If you have any questions or worries, please let us know—we would like very much to discuss this with you and do what we can to make sure you are comfortable with this.

Knowing that you were playing with a computer and not another person, please answer the following questions thoughtfully and honestly.

While you were playing the game did you believe that you were playing another person? **YES NO**

If no, why not? How certain were you that it was not a real person?

Would you have played differently if you had known for sure that you were playing on a computer and not a person? How?

___

You have the option of withdrawing your data and consent at this point if you choose. Please indicate below whether you opt to remain a study participant or to withdraw your data/consent. If you choose the second option, your data will be destroyed.

☐ I have read (or have had read to me) the information given in this debriefing form, and would like to continue to be a volunteer in this study.

☐ I have read (or have had read to me) the information given in this debriefing form, and would like to withdraw from the study. I understand that my data will be destroyed.

_____

Participant Name (printed)

_____

Participant Signature or Date

Legally Authorized Representative

_____ _____

_____

Person Obtaining Consent Signature of Person Obtaining Consent Date

(printed)

Appendix B

Debriefing Response Correlation Matrix

Correlations Between Social Anxiety, Agency, Communion and Self-Report Responses

Variable	1	2	3
1. LSAS-SR	1	-.230*	-.314*
2. Agency	-.230*	1	.094
3. Communion	-.314*	.094	1
4. How happy were you with your earnings-PD	-.111	.005	.196
5. How competitive did you feel with your partner-PD	-.130	.257*	-.061
6. How cooperative was the other person-PD	-.023	.178	.064
7. How angry did you get-PD	.071	.163	-.020
8. How nervous were you waiting for your partners response-PD	.244*	.38*	-.143
9. How important was winning to you-PD	-.104	.307**	.117
10. Do you think winning was important to your partner-PD	-.085	.215*	-.051
11. How happy were you with your earnings-UG	-.100	.130	-.004
12. How competitive did you feel with your partner-UG	-.099	.121	-.029
13. How cooperative was the other person-UG	.128	.032	.025
14. How angry did you get-UG	.117	.073	.096
15. How nervous were you waiting for your partners response-UG	.252*	.206	-.101
16. How important was winning to you-UG	-.064	.266*	.145
17. Do you think winning was important to your partner-UG	-.115	.157	.119