EFFECTS OF WORRY ON INTERPERSONAL PERCEPTIONS AND BEHAVIORS

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by
Ki Eun Shin

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The thesis of Ki Eun Shin was reviewed and approved* by the following:

Michelle G. Newman  
Professor of Psychology  
Thesis Adviser

Aaron L. Pincus  
Professor of Psychology

Reginald B. Adams, Jr.  
Associate Professor of Psychology

Melvin M. Mark  
Professor of Psychology  
Head of the Department of Psychology

*Signatures are on file in the Graduate School.
Abstract

Worry, the hallmark symptom of generalized anxiety disorder, has been linked to maladaptive social cognitions and interpersonal behaviors. However, previous studies have been limited only to examining effects of trait worry. Therefore, effects of state worry and associated anxiety on interpersonal processes are largely unknown. The current study aimed to fill the gap by examining effects of trait worry, state worry, and state anxiety on participants’ self- and other-perception and their actual influence on a confederate in the context of a dyadic interaction. 126 undergraduates (40 GAD analogues) received either worry (n = 65) or relaxation (n = 61) inductions and interacted with a same-sex confederate in two interaction tasks (introduction, collaborative story construction). Confederate behaviors were standardized to remain neutral across participants. Interpersonal perception and behaviors were assessed through self- and informant-reports based on two dimensions (affiliation, dominance). Both trait worry and state anxiety were associated with perceiving the confederate as hostile, self as submissive, and impacting the confederate in a submissive manner. Results were discrepant on self-perception of affiliation, with trait worry predicting greater affiliation in ratings of self, whereas state anxiety predicting lower self-rated affiliation. Effects of state worry were not significant across interpersonal variables. Theoretical and clinical implications of the findings as well as issues related to measurement of worry are discussed.
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Chapter 1. Introduction

Worry refers to a chain of negative thoughts that are future-focused and difficult to control (Borkovec, Robinson, Pruzinsky, & DePree, 1983). Worry can be assessed at both trait and state levels and is closely related to other constructs such as anxiety. In terms of its clinical relevance, worry has been mostly linked to generalized anxiety disorder (GAD), characterized by excessive and uncontrollable worry. However, there has been increasing attention toward worry as a transdiagnostic factor (e.g., Ehring & Watkins, 2008). Research has shown that worry is present in a range of disorders including anxiety and mood disorders (Gladstone et al., 2005; Mohlman et al., 2004; Starcevic et al., 2007), eating disorders (Sassaroli et al., 2005), and psychosis (Morrison & Wells, 2007), and accounts for greater comorbidity between disorders (McEvoy, Watson, Watkins, & Nathan, 2013; Starcevic et al., 2007).

There has been growing evidence that worry might be associated with interpersonal dysfunction, another commonly occurring symptom across disorders (McEvoy, Burgess, Page, Nathan, & Fursland, 2013; Whisman, Sheldon, & Goering, 2000). College students with pathological worry symptoms showed a bias toward perceiving confederates in a first-encounter interaction as more hostile, attacking, ignoring, and controlling than non-anxious controls (Erickson & Pincus, 2005). Trait worry also predicted a similar bias even after controlling for the effects of social anxiety and depression (Erickson & Newman, 2007b). The direction of this bias in other-perception is consistent with worry’s definition (anticipating threats) and associated hypervigilance to threats (e.g., Mogg et al., 2000). Trait worry was also positively associated with a bias in self-perception, over- or underestimating one’s negative impact on others (Erickson & Newman, 2007a). A recent study using daily diary methods (Erickson et al., 2015) found that whereas trait worry predicted higher affiliative tendencies in self-report across clinical
and undergraduate samples, it predicted greater hostile impact on others in informant-report.

Consistent with the findings of trait worry, a sizeable portion of GAD patients reported affiliative and submissive types of interpersonal problems in both U.S. (Przeworski et al., 2011) and German samples (Salzer et al., 2008). In addition, GAD analogues endorsed having more problems with being overly accommodating, self-sacrificing, nonassertive, and intrusive than controls, but such group difference was not confirmed in peer-report (Eng & Heimberg, 2006). Overall patterns emerging across studies suggest that trait worry is associated with a tendency to perceive others as hostile and poor awareness of one’s interpersonal impact, especially in the direction of perceiving oneself as more affiliative than their actual impact on others.

One limitation of previous studies is that they examined effects of worry on interpersonal processes only in the context of trait worry or diagnostic status of GAD. Therefore, it remains a question whether prior results would generalize to state worry and associated anxiety. By definition, traits are relatively stable characteristics or predispositions of individuals whereas states are transient and specific to contexts (e.g., trait vs. state anxiety; Spielberger, 1975). Research has shown that although related, trait and state worry are distinct. Trait worry positively predicted state worry (duration and frequency), but accounted for only a modest percentage of the variance (Verkuil, Brosschot, & Thayer, 2007). Trait and state worry were also differentiated based on treatment effects, with trait worry exhibiting a comparable change in response to cognitive behavioral therapy (CBT) and applied relaxation whereas state (daily) worry showed greater reduction in response to applied relaxation than to CBT (Borkovec & Costello, 1993).

Investigating effects of state worry on interpersonal perceptions and behaviors is advantageous for several reasons. First, it may help to contextualize previous findings on trait
worry and inform more precise interpretations. For instance, if similar results were to be found across state and trait worry, the associated interpersonal dysfunction might be linked to a shared mechanism or characteristic between trait and state worry. Alternatively, if different results were to emerge, previous findings might be better explained by unique features of trait worry that are not shared with state worry (e.g., chronicity). In addition, most assessments of trait worry are susceptible to retrospective bias. Examining effects of state worry through an experiment or ecological momentary assessment would reduce the bias and provide an opportunity to examine the process at a more micro level.

Despite lack of previous research on the topic, several hypotheses may be considered regarding effects of state worry on interpersonal processes. First, state worry may produce similar effects as trait worry, especially with respect to other-perception. Like trait worry, state worry is associated with hypervigilance to threats (Oathes, Squillante, Ray, & Nitschke, 2010) and sustained expectancy of threats (Stapinski, Abbott, & Rapee, 2010). Given findings, state worry might predispose individuals to expect and perceive threats in an interpersonal situation (e.g., hostility from others). Predictions on the effects of worry on self-perception and impact on others were more exploratory. Previous studies using induction of perseverative thinking (e.g., worry, rumination) showed that perseveration led to negative appraisals, less effective problem-solving (Lyubomirsky & Nolen-Hoeksema, 1995), and impaired processing of emotional information (Lehtonen et al., 2009) in hypothetical interactional contexts. Therefore, it might be the case that high state worry produces negative self-appraisal akin to a negative self-focus (Ingram, 1984), leading to hostile self-perception. High state worry may also predict hostile impact on others. By taking up attentional and cognitive capacity, perseverative thinking involved in worry may compromise an individual’s ability to attend to social cues from others.
and respond appropriately.

Another mechanism through which state worry affects interpersonal processes might be through associated anxiety. Worry has been repeatedly shown to produce heightened anxiety (Llera & Newman, 2014; McLaughlin, Borkovec, & Sibrava, 2007), and higher levels of both trait anxiety and social anxiety have been linked to self-reported hostile and submissive tendencies (Allan & Gilbert, 1997; Rappaport, Moskowitz, & D’Antono, 2014; Russell et al., 2011; Sadikaj, Moskowitz, Russell, & Zuroff, 2015). State anxiety was also associated with a bias in self-report on personality, in which individuals described themselves as less extroverted and more dependent (Reich, Noyes, Coryell, & O’Gorman, 1986). Based on the findings, increased anxiety from worrying may lead to hostile and submissive self-perception in interpersonal situations. Previous findings also indicate that higher levels of state anxiety may induce hostile impact on others. In an undergraduate sample, high state anxiety led to less intimate self-disclosure (Post, Wittmaier, & Radin, 1978), and children with higher levels of anxiety were perceived as less likable by their peers (Verduin & Kendall, 2008).

In sum, state worry may affect interpersonal processes through cognitive (hypervigilance to threats, perseveration) and/or affective mechanisms (increased anxiety). However, expected effects of state worry through each mechanism do not entirely converge. For instance, whereas anxiety has been repeatedly shown to elicit submissiveness in self-perception and behaviors (e.g., Allan & Gilbert, 1997), such evidence is lacking for the cognitive factors. In addition, there has been increasing emphasis on differentiating affective consequences of worry (e.g., anxiety) from worry itself, treating them as separate constructs. (Borkovec et al., 1983; Davey, Hampton, Farrell, & Davidson, 1992). Whereas worry is considered primarily cognitive in nature, involving verbal, negative-valenced repetitive thoughts, anxiety is more strongly associated with
affective and somatic experiences (e.g., Borkovec & Inz, 1990). Evidence for the distinction between worry and anxiety also comes from previous findings that worry produces increase in other negative affect (e.g., depressed feelings) in addition to anxiety (e.g., McLaughlin et al., 2007). In the literature on test anxiety, worry (perseverative thoughts) and associated emotionality (anxiety) predicted test performance to different degrees, with worry having stronger effects than anxiety (Morris & Liebert, 1970). Collectively, these findings indicate that it is necessary to avoid confounding between worry and associated anxiety and examine their effects on interpersonal processes separately.

A conceptual framework for examining interpersonal processes associated with trait worry, state worry, and state anxiety can be found in the interpersonal paradigm of personality assessment (Wiggins, 2003). The interpersonal paradigm provides a powerful nomological net called the interpersonal circumplex (IPC; Wiggins & Broughton, 1985), which organizes and assesses the full range of interpersonal tendencies based on two orthogonal dimensions, dominance-submissiveness and affiliation-coldness (Gurtman, 2009; Wiggins, 1979; See Figure 1). The two dimensional space defined by dominance (y-axis) and affiliation (x-axis) can be broken down to eight octants, each representing different blends of the two axial dimensions. The IPC has been widely used across basic research in personality and interpersonal processes as well as clinical research (e.g., Pincus & Wright, 2010; Wiggins & Broughton, 1991). Currently, various empirically validated IPC measures are available for assessing interpersonal constructs on multiple surfaces (Locke, 2010), including traits (Wiggins, 1995), problems (Alden, Wiggins, & Pincus, 1990; Soldz, Budman, Demby, & Merry, 1995), covert reactions to others (Kiesler & Schmidt, 1983), and sensitivities (Hopwood et al., 2011).

The IPC has been also applied to understanding interpersonal dynamics that occur during
an interaction, especially how individuals mutually influence each other’s behaviors on the affiliation and dominance dimensions (Sadler, Ethier, & Woody, 2011). Based on empirical evidence (e.g., Sadler, Ethier, Gunn, Duong, & Woody, 2009), certain patterns of reciprocal behaviors have been identified as a common baseline in dyadic interaction. Referred to as complementarity (Carson, 1969; Kiesler, 1983), the pattern involves a relation of oppositeness on the dominance dimension (reciprocity: dominance pulling for submissiveness, and vice versa) and a relation of sameness on the affiliation dimension (correspondence: friendliness pulls for friendliness; coldness pulls for coldness). Dyadic complementarity is considered a stable interactional state because the interactants’ behaviors are expected to be mutually reinforcing, with both individuals’ agentic (dominance) and communal (affiliation) needs met. On the contrary, acomplementarity (i.e., complementary on only one dimension) or anticomplementarity (complementary on neither dimension) are considered an unstable state, exerting pressure to recover a complementary state. It has been shown that deviations from complementarity are associated with pathology or deficits in interpersonal functioning (e.g., Roche, Pincus, Conroy, Hyde, & Ram, 2013). Nonetheless, a- or anticomplementarity is not necessarily a definitive indicator of maladaptive interpersonal functioning. For instance, in therapist-client relationship, therapists may strategically employ acomplementary or anticomplementary behaviors to shift client’s behaviors toward the desired pattern of complementarity (e.g., from hostility-hostility to friendliness-friendliness; Kiesler, 1986). In the current study, complementarity was examined with respect to the effects of trait worry, state worry, and state anxiety on self- and other-perception during a dyadic interaction.

**The Present Study**

The current study aimed to examine and compare effects of trait worry, state worry, and
state anxiety on interpersonal perception and behaviors. Trait worry was assessed through the Penn State Worry Questionnaire (Molina & Borkovec, 1994), a well-validated and widely used measure of trait worry. State worry was manipulated through mood induction (worry, relaxation) with random assignment in order to isolate the causal relationship between state worry and interpersonal outcomes. The present study also used confederates who enacted neutral behaviors across participants to serve as standardized stimuli. The current sample included a significant number of individuals with clinical-level pathological worries to cover a wide range of trait worry and other symptoms (social anxiety, depression) and ensure clinical relevance of findings. In assessing interpersonal variables, multiple interpersonal measures (e.g., problems, behaviors, impacts) were used to see convergence and divergence in results across measures. The current study also employed a multi-method approach, using both self- and informant-reports.

Based on previous findings, the following hypotheses were proposed. Hypothesis 1: Higher trait worry, state worry, and state anxiety would predict participants’ perception of lower affiliation in a confederate. Hypothesis 2: With respect to participants’ perception of themselves, higher trait worry would predict higher self-rated affiliation whereas higher state worry and state anxiety would predict lower self-rated affiliation. Hypothesis 3: On the dominance dimension, both trait worry and state anxiety would predict lower self-rated dominance. Hypothesis 4: All three predictors would predict confederate’s perception of lower affiliation in participants. Each predictor was expected to be associated with the proposed patterns of interpersonal perceptions and behaviors even after controlling for the other predictors’ effects. Given the exploratory nature of the current study and limited previous research on the topic, hypotheses were made on specific IPC dimensions (affiliation, dominance) across predictors.
Chapter 2. Methods

Participants

Based on a priori power analysis using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), the sample size of 120 was required to detect a medium sized effect ($f^2 = .15, \eta^2_p = .13$) in multiple regression analyses with an $\alpha$-level of .05 and power of .95. In addition, simulation studies indicated that confidence intervals for structural summary method statistics are interpretable in the sample size of at least 120 (Zimmermann & Wright, 2015).

Based on power considerations, 126 participants were recruited from the community and introductory psychology courses at a large eastern university, using their responses on the Generalized Anxiety Disorder Questionnaire IV (GAD-Q-IV; Newman, Zuellig, Kachin, Constantino, Przeworski, Erickson, & Cashman-McGrath, 2002). A stratified random sampling was used to ensure an adequate sample of participants with clinical levels of pathological worry. The final sample included 40 participants (32%) who met the DSM-IV criteria for GAD on the GAD-Q-IV and 86 (68%) who did not receive a diagnosis on the GAD-Q-IV. Participants who were invited into the study were randomly assigned to either worry ($n = 65$) or relaxation condition ($n = 61$). The mean age of participants was 19.13 ($SD = 1.54$). The sample included 82 females (65%) and 44 males (35%). 90 participants identified as Caucasian (71%), 13 as Asian (10%), 11 as Hispanic (9%), 7 as African American (6%), and 5 as Multiracial (4%). All participants received either class credits or $16 for their participation.

Measures

Symptom Measures. Generalized Anxiety Disorder Questionnaire IV (GAD-Q-IV; Newman et al., 2002). The GAD-Q-IV is a 14-item self-report diagnostic measure for GAD based on the DSM-IV criteria. The first four yes-no questions assess excessiveness and
uncontrollability of worry (e.g., “Do you experience excessive worry?”). The number of most frequent worry topics is also assessed. If participants endorse having been bothered by excessive and uncontrollable worries for more days than not for the past six months, they are prompted to complete yes-no questions assessing somatic symptoms (e.g., “restlessness or feeling keyed up or on edge”) and two questions on interference and distress caused by worry and somatic symptoms on a 0 (“None”) to 8 (“Very Severe”) Likert scale. The GAD-Q-IV has shown high internal consistency (α = .94), retest reliability, convergent and divergent validity. The measure can be scored continuously or categorically. In continuous scoring, a cutoff of 5.7 was shown to optimize sensitivity (83%) and specificity (89%), demonstrating a kappa agreement of .67 with a structured diagnostic interview. Categorical scoring compares items to the DSM-IV criteria for GAD and indicates the absence/presence of a diagnosis. Based on evidence that categorical scoring leads to fewer false positives than continuous scoring (e.g., Turk, Heimberg, Luterek, Mennin, & Fresco, 2005), categorical scoring was used in the current study. The GAD-Q-IV showed good internal consistency in the current sample (α = .81).

**Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990).** The PSWQ is a 16-item self-report inventory of the generality, excessiveness, and uncontrollability of worry (e.g., “I’ve been a worrier all my life.”). It has been widely used as a measure of trait pathological worry (e.g., Brosschot, Gerin, & Thayer, 2006; McEvoy, Watson, et al., 2013). Items are rated on a 5-point Likert scale from “not at all typical” to “very typical.” The PSWQ has shown high internal consistency (α = .91; Meyer et al., 1990) and retest reliability ranging from .74 to .93 across 2 to 10 weeks (Molina & Borkovec, 1994). The PSWQ discriminated GAD from other anxiety disorders and showed convergent and divergent validity when correlated with measures of anxiety, depression, and emotional control (Brown, Antony, & Barlow, 1992).
consistency of the PSWQ in the current sample was high, with Cronbach’s alpha of .96.

**Beck Depression Inventory-II (BDI-II: Beck, Steer, & Brown, 1996).** The BDI-II is a 21-item instrument that assesses presence and severity of depression symptoms. Items are rated on a scale of severity from 0 to 3, and the ratings are summed to yield a total score. The BDI-II has shown high internal consistency (Cronbach’s $\alpha = .91$; Beck, Steer, Ball, & Ranieri, 1996) and 1-week retest reliability ($r = .93$; Beck, Steer, & Brown, 1996). Convergent and divergent validity of the measure was also supported (Beck, Steer, & Brown, 1996). In the current sample, the BDI-II showed good internal consistency ($\alpha = .89$).

**Social Interaction Anxiety Scale (SIAS; Mattick & Clark, 1998).** The SIAS is a 20-item self-report measure of anxiety in dyadic or group social interactions. Items are rated on a 5-point Likert-type scale from “not at all characteristic or true of me” to “extremely characteristic or true of me.” The SIAS has shown good internal consistency and retest reliability and discriminated social anxiety disorder from other anxiety disorders (Mattick & Clark, 1998). It has also demonstrated convergent validity with other measures of social anxiety and divergent validity with measures of general distress, depression, and social desirability (Mattick & Clark, 1998). Internal consistency of the SIAS in the current sample was high ($\alpha = .94$).

**Anxiety Ratings. Manipulation Check Measure.** Participants rated their levels of anxiety, worry, and relaxation on a 5-point Likert scale from “not at all” to “definitely.” This measure was previously used as manipulation check for similar mood induction (Llera & Newman, 2014). The measure had good internal consistency in the current sample ($\alpha = .79$ to .91).

**Subjective Units of Distress (SUDs).** A 4-item scale was used to assess participants’ level of anxiety/distress during the experiment. Participants rated their current levels of mental
anxiousness, bodily tension, annoyance/irritation, and overall discomfort/uneasiness on a 0-to-100 scale anchored by absence of distress (0) and highest level of distress ever experienced (100). A similar measure was used in a previous study (Erickson & Newman, 2007a). In the current study, the measure showed good internal consistency (α = .88 to .92). SUDs ratings were collected at multiple time points over the course of the experiment: before and after mood induction and after each interaction task. State anxiety was assessed using the SUDs ratings collected after mood induction.

Mood Induction. State worry was operationalized through mood induction (worry, relaxation). Participants in the worry condition were provided with a definition of worry and asked to think of three topics that they have worried most about recently. The induction task was to worry about the three topics as intensely as they could in their usual way while closing their eyes. Participants in the relaxation condition received instructions for diaphragmatic breathing and progressive muscle relaxation and completed the relaxation exercises while following an audio guide. In both conditions, the induction task took six minutes. Similar manipulation of state worry was used in past studies and successfully elicited a worrisome state (e.g., Llera & Newman, 2014; McLaughlin et al., 2007; Verkuil, Brosschot, Borkovec, & Thayer, 2009). The decision to use experimental induction of state worry was made for several reasons. Random assignment to induction conditions allowed for dissociating the effects of trait and state worry more precisely. In addition, statistical tests could be conducted to compare coder ratings on confederate behaviors to ensure that any difference between the two induction conditions was due to the effects of the induction, not due to differences in confederates’ behaviors. Another goal was to avoid confounding with social anxiety. Participants were explicitly instructed to worry about their usual worry topics and later inquired about their worry contents to ensure that
state worry and state anxiety were not confounded with anticipatory social anxiety before an interaction task.

**Interpersonal Measures.** *Inventory of Interpersonal Problems-Short Circumplex* (*IIP-SC; Soldz et al., 1995*). The IIP-SC is a 32-item measure assessing interpersonal problems and distress based on eight octants of the interpersonal circumplex (domineering, vindictive, cold, socially avoidant, nonassertive, exploitable, overly nurturant, and intrusive). Items assess interpersonal behaviors that respondents find difficult to do (e.g., “It is hard for me to…”) or engage in “too much”. Each octant scale includes 4 items rated on a 5-point Likert scale from “not at all” to “extremely”. The measure has shown good test-retest reliability (*r* = .83), and Cronbach’s alphas for octant scales ranged from .61 to .79 (Soldz et al., 1995). Internal consistency of the scales was adequate to good in the current sample (*α* = .65 to .90). The current study used axes scores (affiliation, dominance) in addition to octant scores.

**Social Perception Ratings.** Participants rated their own and confederate’s behaviors during the introduction task on two dimensions, dominant (vs. submissive) and friendly (vs. distant). Items were based on a previous study which examined participants’ perception of a confederate in a dyadic interaction (Taylor & Alden, 2005). Friendliness scale consisted of seven items (friendly, talkative, distant, supportive, disinterested, disapproving, open), and dominance scale included other seven items (dominant, controlling, intrusive, confident, cocky, domineering, timid). All items were rated on a 0 (Extremely inaccurate) to 7 (Extremely accurate) Likert scale. Both scales showed adequate internal consistency (*α* = .77 to .90 for friendliness; *α* = .75 to .77 for dominance).

**Social Behavior Inventory* (SBI; Moskowitz, 1994). The SBI is a 46-item self-report assessing individuals’ interpersonal behaviors. Items form scales based on the four poles of the
interpersonal circumplex: Dominant (e.g., “I set goals for the other person.”), Submissive (e.g., “I let the other person make plans or decisions.”), Agreeable (e.g., “I showed sympathy.”), and Quarrelsome (e.g., “I criticized the other person.”). The dominant and quarrelsome scales share one item (i.e., “I criticized the other person”), and the submissive and agreeable scales share an item (i.e., “I went along with the other person”). Reliability and validity of the measure has been well-established (e.g., Moskowitz, 1994). Although not assessing all eight octants of the IPC, the SBI scales demonstrated a pattern of correlations that generally conformed to the circumplex model and converged with measures of the interpersonal circumplex (Moskowitz & Coté, 1995; Moskowitz, 1994). The SBI has been typically used in the context of intensive repeated measurements in natural settings in the form of a rotating behavioral checklist using subsets of items (IRM-NS; Moskowitz, Russell, Sadikaj, & Sutton, 2009). The current study used an adopted version of the SBI (Sadler & Woody, 2003), using the full items except one dominant item that did not apply to the assessment context (“I asked for a volunteer.”). Items were rated on a 6-point Likert scale anchored by “Never” (1) and “Almost always” (6). Scale scores were calculated by averaging across items for each subscale. Based on scale scores, composite warmth (affiliation) and dominance scores were computed. Two versions of the SBI were used in the present study so that participants could rate their own and confederates’ behaviors. Confederates also rated participants’ behaviors. The adopted version of the SBI showed adequate internal consistency in a previous study (e.g., α = .62 to .78; Sadler & Woody, 2003). In the current study, the measure demonstrated comparable to better internal consistency with Cronbach’s alphas ranging from .61 to .92 across subscales.

*Impact Message Inventory-Circumplex (IMI-C; Kiesler & Schmidt, 1983).* IMI-C assesses a target person’s interpersonal style through the self-report of an interaction partner on
her/his covert reactions to the target’s behaviors. The measure consists of 56 items assessing the impact of the target’s behaviors on the respondent’s feelings, action tendencies, and perceived interpersonal messages. Items are rated on a 4-point scale anchored by “not at all” (1), “somewhat” (2), “moderately so” (3), and “very much so” (4). Based on the IPC (Wiggins, 1982), items form eight octant scales: Dominant, Hostile-Dominant, Hostile, Hostile-Submissive, Submissive, Friendly-Submissive, Friendly, and Friendly-Dominant. For this study, participants and confederates completed the IMI-C to rate interpersonal impact of each other, and participants additionally completed the IMI-C Self (Wagner, Kiesler, & Schmidt, 1995) to rate their own interpersonal impact on a confederate. The IMI-C has shown adequate to good internal consistency with Cronbach’s alphas for octant scales ranging from .60 to .90. In the current sample, the octant scales showed comparable internal consistency (α = .55 to .90).

**Procedure**

Participants were told that the purpose of the study was to investigate how strangers interact in a first-encounter setting. After a participant arrived at the experiment room, a same-sex confederate pretending to be another participant knocked on the door 3 minutes later and apologized for her/his lateness. The behavior was pre-scripted to enhance credibility of the setup. To prevent interactions between the confederate and participant prior to interaction tasks, the confederate was told to wait outside the room, and the experimenter escorted her/him to a different room. Participants were informed that the initial portion of the study would be conducted separately for them and their interaction partner (confederate).

After participants provided informed consent, their baseline anxiety was assessed using the manipulation check measure and SUDs ratings. Participants also completed a baseline survey online, which included the IIP-SC, BDI-II, SIAS, and PSWQ. Instruction for mood induction
was provided afterwards. Participants in the worry condition were told to close their eyes and worry about their most worrisome topics as intensely as they could. Those in the relaxation condition received instructions on diaphragmatic breathing and progressive muscle relaxation. After training, participants completed six-minutes of self-administered induction. The relaxation exercise was guided by an audio-recorded script. After the task, participants completed the manipulation check measure and SUDs ratings again.

Following the induction task, participants were informed that they would meet their interaction partner and have a 3-minute introduction period. The confederate was escorted to the experiment room, and the experimenter instructed the participant and confederate to introduce themselves and talk about where they were from, their hobbies, and family. Confederates were trained to remain neutral, following a predetermined script of verbal and nonverbal behaviors. The interaction was video-recorded to check for confederates’ adherence to the script. To make video-recording as unobtrusive as possible, the experimenter started video-recording without participants’ knowledge when they were completing the manipulation check measure and SUDs ratings after mood induction. A built-in webcam of a desktop computer was used for video-recording. During the task, participant and confederate sat at a small table positioned across from the computer desk. Experimenter left the room during the introduction task and came back after 3 minutes. The confederate was asked to stay in the room and complete social perception ratings, and the participant was asked to relocate to another room to make the ratings.

The second interaction task involved collaboration between the participant and confederate to come up with stories for pictures from the Thematic Apperception Test (TAT; Murray, 1943). Experimenter provided the following instruction: “The purpose of this portion of the study is to examine how students achieve agreement in a creative story construction task.
You will work together to come up with stories you agree are best for four pictures. Determine together the best story” (Strong et al., 1988). Participant and confederate were given four TAT cards and asked to complete the task for 12 minutes. Congruent with previous studies which used the same task to examine interpersonal interactions (e.g., Strong et al., 1988), no further instruction was provided to leave the task relatively unstructured. Following the task, the participant moved to a different room as before to complete interpersonal measures for both themselves and confederate (SBI, IMI-C). The confederate remaining in the room completed the same interpersonal measures for the participant.

Participants completed a third interaction task for a separate study and completed measures. At the end, they were inquired about any suspicion they had about the experiment and received debriefing. The procedure was approved by the IRB at Penn State.

**Personnel.** Undergraduate research assistants were trained and served as experimenters, confederates, and trained coders. All personnel remained blind to the specific hypotheses of the study. Confederates and coders also remained blind to the induction condition of participants. Two females and two males participated as experimenters. One female and one male served as the same-sex confederate during the experiment. Two females received training and coded video-recorded interactions.

**Confederates.** Confederates were trained to remain neutral throughout the introduction period. They followed a script of verbal and nonverbal behaviors modeled after Taylor & Alden (2005). Confederates were instructed to behave in a reserved but not unfriendly manner toward participants. The script included speaking in a steady and neutral tone, making few encouraging comments (e.g., “That’s cool”), asking questions infrequently, disclosing about the self at a minimal level, and pausing between disclosures for 2 to 3 seconds. Confederates’ nonverbal
behaviors were also scripted so that they did not lean toward the participant and only occasionally made direct eye contact, nodded, or smiled. Their verbal responses on the conversation topics (where they were from, hobbies, and family) were also scripted.

Confederates practiced by role-playing with other research assistants and participating in pilot sessions that were coded for adherence to the script. Confederates continued training until they did not show any deviation from the script.

For the story construction task, confederates’ behaviors were less scripted, but they followed similar guidelines for nonverbal and verbal responses. Confederate’s initial comments on each picture were scripted and rehearsed. They were instructed not to initiate a conversation at the beginning of the task unless the participant did not start talking in thirty seconds to let the participant set the tone of the interaction.

**Coders.** Trained coders rated confederate behaviors during the introduction task using 1 (Not at all) to 7 (Very much) point scales on warmth and friendliness, openness, eye contact, pause, smiling/nodding, encouraging comments, and active engagement. The score of 4 indicated the target behaviors (neutrality). A similar measure was used in previous studies (e.g., Taylor & Alden, 2005). Reliability between the two coders was good with the intra-class correlation coefficient of .83 ($p < .001$). Coder ratings were averaged across the items to calculate composite ratings. Internal consistency of the composite ratings was adequate ($\alpha = .72$).

**Data Analysis**

Distributions of study variables were examined based on skewness, kurtosis, leverage, histograms, and residual scatterplots. Both skewness and kurtosis values were between -1 and 1 (-.68 to .93 for skewness; -.81 to .73 for kurtosis), indicating no marked deviation from normality. Z-tests for normality were also not significant based on the sample-size adjusted
critical value \( (z = 3.29; \text{Kim}, 2013) \). Inspection of leverage values did not reveal any outlier when using the conventional cut-off \( (2\times\text{number of predictors/sample size} = .063; \text{Hoaglin & Welsch}, 1978) \). Residual scatterplots did not indicate heteroscedasticity. Overall, distributional assumptions for multiple regression analyses were supported.

For preliminary analyses, one-way ANOVAs and MANOVAs were conducted to examine differences between worry and relaxation conditions on baseline symptom scores (PSWQ, SIAS, and BDI-II) and anxiety (SUDs ratings) as well as confederate behaviors during the introduction task. Manipulation check was also conducted using a one-way MANOVA. Additionally, a repeated measures ANOVA was conducted to see change in participants’ anxiety levels over the course of the experiment by induction condition.

For main analyses, descriptive statistics and bivariate correlations were conducted to examine relations between trait worry (PSWQ), state worry (mood induction), and state anxiety (SUDs ratings). Measures of social anxiety (SIAS) and depression (BDI-II) were also included to assess divergent validity of the constructs.

Multiple regression analyses and structural summary method (SSM; Gurtman & Pincus, 2003; Gurtman, 1994) were used to test proposed hypotheses. The hypotheses were tested across multiple interpersonal measures assessing initial impressions (social perception ratings), behaviors (SBI), and covert reactions to the other person (IMI-C). For trait worry, associations with interpersonal problems were also examined using the IIP-SC. Multiple regression analyses were conducted for non-circumplex measures (social perception ratings, SBI), and structural summary method was used for circumplex measures (IMI-C, IIP-SC).

In regression analyses, state worry was coded as a dummy variable \( (1 = \text{worry}; 0 = \text{relaxation}) \) to facilitate interpretation of the results. When predictors (trait worry, state worry,
and state anxiety) were entered simultaneously, multicollinearity was not present (tolerance > .5, variance inflation factors (VIFs) < 2.1).

The SSM was used to analyze data from the circumplex measures because it takes into account the circular structure of IPC data, allowing for more precise interpretation than examining octant or axes scores separately. The method capitalizes on the structure of the circumplex, in which octants closer to each other share similar contents (e.g., nonassertive, exploitable) and have higher correlations. When plotted, the pattern of correlations follows a cosine wave (Gurtman, 1992). Using the characteristics of the cosine curve, the SSM yields four parameters that summarize an interpersonal profile: elevation, amplitude, angular displacement, and $R^2$ (Figure 2).

Elevation is defined as an average score/correlation across the eight octants. Depending on the measure, it may reflect a response style (e.g., IMI-C) or a general factor of the measure (e.g., general interpersonal distress for the IIP-SC). Amplitude quantifies the degree of differentiation in an interpersonal profile. A low value suggests lack of specificity in the interpersonal theme of the profile whereas a high value indicates a distinctive theme. For elevation and amplitude, cutoffs at $\geq .15$ have been proposed as indicating an elevated and differentiated profile (Wright et al., 2012). A review of the empirical distribution of the parameters also suggested that a value of $.11$ and .16 each marked the 50th percentile of the distribution of the elevation and amplitude parameters (Zimmermann & Wright, 2015). Another structural summary parameter is angular displacement, which represents a predominant interpersonal theme of the profile by a location on the IPC (e.g., $90^\circ =$ Dominant (PA)). Lastly, $R^2$ is a goodness-of-fit statistic that quantifies how well the given profile corresponds to the expected pattern of correlations (cosine curve). $R^2$ value greater than .8 indicates a good fit to the
cosine curve, and value greater than .7 indicates an adequate fit. $R^2$ can be conceptualized as an index for prototypicality of the profile (Wright, Pincus, Conroy, & Hilsenroth, 2009). If the profile is too complex to be summarized by the structural summary parameters (i.e., $R^2 < .7$), amplitude and angular displacement parameters are not interpretable.

The SSM has been applied to analyzing interpersonal profiles of individuals, groups (e.g., females and males), and constructs (e.g., narcissism). In the current study, the SSM was used to identify interpersonal profiles of trait worry and state anxiety. To examine interpersonal problems associated with trait worry, PSWQ scores were projected onto the interpersonal circumplex (IIP-SC). For the IMI-C, both trait worry and state anxiety were projected to see which types of self- and other-interpersonal impact were associated with each construct. In addition to the four SSM parameters (elevation, amplitude, angular displacement, and $R^2$), dominance and affiliation scores were calculated. Also, bootstrapped 95% confidence intervals (CIs) were created for each parameter using syntax developed in R (Zimmermann & Wright, 2015). The method has been used to examine statistical significance of SSM parameters associated with theoretical constructs and test differences in the parameters between groups or constructs (Dinger et al., 2015; Dowgwillo & Pincus, 2016). The syntax also yields probability estimates which specify the probability that the CIs for the amplitude and angular displacement parameters are accurate. According to Zimmermann and Wright (2015), the CIs for amplitude and angular displacement should not be interpreted when the probability estimate is below .5. The CIs with the probability estimate between .5 and .95 should be interpreted with caution because the CIs might be biased to some extent. The probability estimate value greater than .95 indicates that the CIs for amplitude and angular displacement can be interpreted with confidence. Simulation studies showed that the method can provide accurate CIs for the other parameters.
(elevation, dominance, and affiliation) when sample size is at least 50 (Zimmermann & Wright, 2015). Because the current sample meets the requirement, the CIs for the three parameters are interpreted with confidence.

Because obtaining an IPC profile of a construct requires the target construct to be continuous, the SSM was not used for examining effects of state worry, which was coded as a binary variable. A one-way MANOVA was conducted to test effects of state worry on composite affiliation and dominance scores across participant- and confederate-versions of the IMI-C.
Chapter 3. Results

Preliminary analyses.

**Baseline differences in symptoms.** There was no significant difference in baseline symptom scores (PSWQ, SIAS, and BDI-II) between worry and relaxation condition, $F(3,122) = .25, p = .86, \eta^2_p = .01$.

**Manipulation check.** Results indicated no significant difference between the conditions in baseline anxiety (manipulation check, SUDs ratings), $F(2,122) = .15, p = .86, \eta^2_p = .002$. As expected, there was a significant difference after mood induction, with worry condition reporting greater feelings of being worried and anxious than relaxation condition, $F(2,122) = 100.76, p < .001, \eta^2_p = .62$. Follow-up univariate analyses showed that the effects were significant for both manipulation check measure, $F(1,124) = 196.83, p < .001, \eta^2_p = .61$, and SUDs ratings, $F(1,124) = .92.91, p < .001, \eta^2_p = .43$. Table 1 presents means and standard deviations of baseline and post-induction anxiety ratings by condition.

For participants in the worry condition, their worry contents were also examined to assess potential confounding with anticipatory social anxiety before interaction tasks. Participants reported that they worried about school (94%), relationships (79%), family (42%), finance (40%), work (22%), and physical health/safety (12%) during the induction period. None of the participants reported worrying about the upcoming interaction with a confederate.

**Change in anxiety over the course of the experiment.** When examining three SUDs ratings collected after mood induction and the two interaction tasks, participant’s anxiety levels significantly decreased in a linear fashion over time across worry and relaxation conditions, $F(2,246) = 7.39, p = .001, \eta^2_p = .06$. There was also a significant time by condition interaction such that participants in the worry condition showed decrease in anxiety in a linear fashion whereas
those in the relaxation condition experienced a slight increase in anxiety after the introduction
task and maintained the anxiety level, $F(2,246) = 29.97, p < .001, \eta^2_p = .20$ (See Figure 3). The
between-subjects test indicated that participants in the worry condition reported higher anxiety
than those in the relaxation condition overall, $F(1,123) = 37.62, p < .001, \eta^2_p = .23$. For the worry
condition, the mean SUDs ratings at post-induction and after each interaction task were 35.07
($SD = 19.84$), 27.77 ($SD = 21.43$), and 21.94 ($SD = 21.91$). The relaxation condition showed the
mean SUDs ratings of 7.13 ($SD = 11.72$), 11.92 ($SD = 14.41$), and 11.58 ($SD = 16.25$) at each
assessment point.

Confederate behaviors during the introduction task. On average, confederates showed
high adherence to the neutrality script based on coder ratings, $M = 4.18, SD = .28$. There was no
difference between worry and relaxation conditions in coder-rated confederate behaviors during
the introduction task, $F(1,119) = .10, p = .75, \eta^2_p = .001$.

Suspicion. Eight participants reported suspicion of the confederate’s identity. The
distribution of the participants was not significantly different across induction conditions, $\chi^2(1, \n= 126) = .68, p = .32$. Exclusion of the participants’ data led to the same patterns of results as
when including the whole sample. Therefore, the eight participants’ data were retained in the
final analyses.

Main Analyses.

Descriptives and Correlations between Trait Worry, State Worry, and State Anxiety.
Descriptive statistics and bivariate correlations for the three predictors and social anxiety and
depressive symptoms are summarized in Table 2.

The current sample exhibited a range of symptoms related to pathological worry
(PSWQ), social anxiety (SIAS), and depression (BDI-II) as well as experienced varying levels of
anxiety (SUDs ratings) after the mood induction task. Scores ranged from 19 to 80 on the PSWQ (possible range: 16-80), 1 to 67 on the SIAS (possible range: 0-76), 0 to 32 on BDI-II (possible range: 0-63), and 0 to 69 on the SUDs (possible range: 0-100).

Bivariate correlations indicated that trait worry (PSWQ) had a moderate positive relationship with state anxiety, $r(126) = .30, p < .001$. Trait worry was also positively associated with depressive symptoms, $r(126) = .31, p < .001$, but was not significantly correlated with social anxiety, $r(126) = .14, p = .13$. State worry (mood induction) was not significantly related to any of the symptom measures, understandably given that random assignment was used to assign participants to the induction condition, $r(126) = .07, p = .47$ for PSWQ; $r(126) = -.01, p = .95$ for SIAS; $r(126) = .04, p = .64$ for BDI-II. State worry had a strong positive relation with state anxiety, $r(126) = .6, p < .001$. State anxiety was not associated with social anxiety, $r(126) = .02, p = .87$, or depression, $r(126) = .08, p = .39$. Overall, results supported convergent and divergent validity of the constructs.

**Trait worry’s associations with interpersonal problems.** Structural summary parameters and associated 95% bootstrap confidence intervals (CIs) for trait worry’s profile on the IIP-SC are summarized in Table 3. $R^2$ value indicated that the profile was not prototypical. Therefore, parameters were not interpretable except for elevation. Elevation value showed that trait worry (PSWQ) was associated with significant interpersonal distress.

To complement the SSM analysis, regression analyses were conducted with PSWQ as a predictor and affiliation and dominance axes scores on the IIP-SC as outcomes. Consistent with the hypothesis, higher PSWQ scores predicted greater affiliation, $\beta = .01, p = .003, \eta^2_p = .07$, and lower dominance on the IIP-SC, $\beta = -.01, p = .004, \eta^2_p = .07$.

**Trait worry, state worry, and state anxiety’s effects on initial social perception.** Higher
levels of trait worry predicted participants’ perception of lower friendliness in confederates during the introduction task, $\beta = -.02, p = .01, \eta^2_p = .05$. The effects of state worry and anxiety were not significant, $\beta = -.15, p = .55, \eta^2_p = .003; \beta = .002, p = .76, \eta^2_p = .001$. For participant’s rating of confederate’s dominance, none of the predictors had significant effects, $\beta = -.003, p = .46, \eta^2_p = .004$ for trait worry; $\beta = -.11, p = .57, \eta^2_p = .003$ for state worry; $\beta = .01, p = .21, \eta^2_p = .01$ for state anxiety.

When participant’s self-perception was examined, higher levels of state anxiety predicted lower self-reported friendliness, $\beta = -.011, p = .03, \eta^2_p = .04$. Effects of the other predictors were not significant, $\beta = -.001, p = .78, \eta^2_p = .001$ for trait worry; $\beta = .28, p = .20, \eta^2_p = .01$ for state worry. Results on participant’s self-reported dominance were also not significant, $\beta = -.005, p = .49, \eta^2_p = .004$ for trait worry; $\beta = .14, p = .62, \eta^2_p = .002$ for state worry; $\beta = -.003, p = .72, \eta^2_p = .01$ for state anxiety.

**Trait worry, state worry, and state anxiety’s effects on interpersonal behaviors.** As in the introduction task, trait worry predicted participants’ report of less warmth in confederate behaviors during the story construction task, $\beta = -.01, p = .03, \eta^2_p = .04$. Neither state worry nor state anxiety significantly predicted the outcome, $\beta = .20, p = .38, \eta^2_p = .01; \beta = -.006, p = .32, \eta^2_p = .01$. In addition, none of the predictors significantly predicted participant-reported dominance in confederate behaviors, $\beta = .01, p = .06, \eta^2_p = .03$ for trait worry; $\beta = -.13, p = .68, \eta^2_p = .001$ for state worry; $\beta = .004, p = .62, \eta^2_p = .002$ for state anxiety. When participants’ reports on their own behaviors were examined, the effects of the predictors on self-reported warmth were not significant, $\beta = -.005, p = .49, \eta^2_p = .004$ for trait worry; $\beta = -.005, p = .49, \eta^2_p = .004$ for state worry; $\beta = -.005, p = .49, \eta^2_p = .004$ for state anxiety. However, as hypothesized, trait worry and state anxiety significantly predicted lower self-reported dominance, $\beta = -.01, p = .03, \eta^2_p = .04$; $\beta$
The effect of state worry was not significant, $\beta = .36, p = .19, \eta^2_p = .01$. For confederate’s report on participant behaviors, none of the predictors had significant effects on either warmth or dominance, $\beta = .01, p = .21, \eta^2_p = .01; \beta = -.004, p = .63, \eta^2_p = .002$ for trait worry; $\beta = -.17, p = .53, \eta^2_p = .003; \beta = .07, p = .84, \eta^2_p = .0003$ for state worry; $\beta = .003, p = .68, \eta^2_p = .001; \beta = -.008, p = .35, \eta^2_p = .01$ for state anxiety.

**Trait worry, state worry, and state anxiety’s effects on interpersonal impact.** Table 4 presents structural summary parameters and associated 95% bootstrapped CIs for trait worry and state anxiety’s profiles on the IMI-C measures. Probability estimates were lower than .95 except for trait worry’s profile on the participant IMI-C and state anxiety’s profile on the participant IMI-C Self. Therefore, the CIs associated with amplitude and angular displacement for the other profiles should be interpreted with caution due to a potential bias in the CIs. In particular, probability estimates were lower than .5 for both trait worry and state anxiety’s profiles on the confederate IMI-C. Therefore, the CIs for amplitude and angular displacement are not interpretable for the two profiles.

Based on R$^2$ values, the profiles associated with trait worry and state anxiety on each IMI-C measure were prototypical (R$^2 > .7$), warranting interpretation of the amplitude and angular displacement parameters. Amplitude values indicated that trait worry was associated with particular types of interpersonal impact based on participants’ report on confederates. The profile of trait worry based on participants’ report on themselves had a less distinctive interpersonal theme, and there was a marked lack of specificity for confederates’ report on participants’ impact. State worry was associated with relatively specific types of interpersonal impact across the IMI-C measures, but the degree of specificity was lower for participant and confederate’s report on each other relative to participants’ report on themselves. Elevation
showed an overall pattern in which trait worry and state anxiety’s profiles had higher elevation on the participant IMI-C measures than the confederate IMI-C. This may indicate a difference in response style between participant- and confederate-measures (Grosse Holtforth, Altenstein, Ansell, Schneider, & Caspar, 2012). Higher elevation in participant measures might be also due to common method variance given that trait worry and state anxiety were assessed using participants’ self-report. Angular displacement values indicated that trait worry was associated with participant’s experience of hostile (DE) impact from a confederate. State anxiety was similarly associated with participant’s perception of hostile (DE) and hostile-dominant (BC) impact from a confederate. Results on participants’ perception of their own impact were more distinct. Whereas trait worry was associated with self-reported friendly impact (LM), state worry was associated with self-reported hostile (DE) and hostile-submissive (FG) impact. For confederate’s report on participant’s impact, both predictors were associated with submissive (HI) impact. Figure 3 and 4 provide visual representations of trait worry and state anxiety’s locations on the IPC with 95% CIs for amplitude and angular displacement.

Overall, trait worry and state anxiety showed similar effects on how participants and confederates experienced each other. However, their effects were different for participants’ perception of their own impact. In addition, based on participant report, state anxiety was associated with a relatively complementary pattern of mutual impacts (confederate: hostile and dominant, self: hostile and submissive). In contrast, trait worry was associated with an acomplementary pattern (confederate: hostile, self: friendly).

For state worry, a MANOVA indicated no significant effect, $F(6,119) = .18, p = .98, \eta^2_p = .01$. Therefore, participants’ and confederates’ responses on the IMI-C measures were not different between worry and relaxation conditions.
Chapter 4. Discussion

As hypothesized, trait worry, state worry, and state anxiety showed specific patterns of associations with interpersonal perceptions and behaviors in the context of a dyadic interaction. Specifically, the hypothesis on the effects of predictors on other-perception (Hypothesis 1) was partially supported, with trait worry and state anxiety predicting participant’s perception of lower affiliation in a confederate. There was also an overall support for the hypothesis on self-perception (Hypothesis 2). As predicted, trait worry was associated with higher self-reported affiliation whereas state anxiety was associated with lower self-reported affiliation. Consistent with Hypothesis 3, both predictors were also associated with lower self-reported dominance, but the effects were specific to participants’ report on their behaviors than their initial presentations or interpersonal impact. The hypothesis on participants’ actual impact on confederates (Hypothesis 4) was not supported because both trait worry and state anxiety were associated with confederates’ perception of participants’ submissive rather than hostile impact. Across the four hypotheses, predictions on state worry were not supported because state worry did not significantly predict any of the interpersonal variables. Overall, trait worry and state anxiety showed similar effects for both the participants’ and confederates’ perceptions of each other, but showed different effects for participants’ self-perception.

One notable finding from the current study was an acomplementary pattern in the effects of trait worry on self- and other-perception. Higher trait worry was associated with perceiving others as less friendly and oneself as more friendly. These effects were observed across multiple interpersonal measures. Trait worry predicted a hostile other-perception on the initial social perception ratings collected after the introduction task and on ratings of the confederate’s behaviors (SBI) and interpersonal impact (IMI-C) during the story construction task. A positive
association between trait worry and affiliative self-perception was found for both interpersonal problems (IIP-SC) and participants’ reports of their own impact on confederates (IMI-C Self). Interestingly, the association between trait worry and negative bias in other-perception emerged early during the experiment (introduction task) and persisted throughout the remainder of the interaction. Conversely, the association between trait worry and affiliative self-perception was specific to the later interaction task. These findings may indicate that the effect of trait worry on other-perception preceded its effect on self-perception. Based on the current finding, this perceptual bias-response sequence may mark a potential if-then behavioral signature (e.g., Mischel, Mendoza-Denton, & Shoda, 2002) in individuals with high trait worry. As previously proposed (Newman, Llera, Erickson, Przeworski, & Castonguay, 2013), individuals with chronic pathological worries may have a tendency to perceive others as hostile and respond to perceived hostility with increased friendliness to appease others and avoid hostility. Nonetheless, the prediction remains quite speculative because the results are based on a single, relatively brief interaction. Further testing is warranted, using repeated sampling of if-then contingencies across multiple social contexts.

Results also indicated a discrepancy in the effects of trait worry on self- and confederate-ratings of participants’ interpersonal impact. Whereas trait worry predicted perception of friendly impact in self-report, it was associated with perception of submissive impact in confederate-report. These results suggest that confederates perceived participants with higher levels of trait worry as less friendly and more submissive than participants perceived themselves. This pattern of results corresponds to previous findings of the association between trait worry and poor awareness of one’s impact on others. In an undergraduate sample (Erickson & Newman, 2007a), trait worry predicted both under- and overestimation of one’s hostile-submissive impact on
others. A similar result was found in a clinical sample of anxious and depressed patients (Erickson et al., 2015), with higher levels of trait worry predicting affiliative tendencies in self-report, but hostile impact in spousal report. The current finding adds to the converging evidence that high levels of trait worry are associated with inaccurate self-perception in an interpersonal context, especially in the direction of underestimating one’s hostile impact.

Interestingly, trait worry predicted higher self-reported affiliation when participants rated their interpersonal impact (IMI-C Self), but not when they rated their discrete behaviors during an interaction (SBI). On the SBI, higher trait worry predicted ratings of greater submissiveness rather than affiliation. The inconsistent results might be due to a difference in target constructs between the IMI-C and the SBI. Whereas the IMI-C Self asked participants to estimate how they influenced the confederate (e.g., “I made the other person feel appreciated by me.”), the SBI focused on specific behaviors (e.g., “I complimented or praised the other person.”). Therefore, responses on the SBI might have been less affected by participants’ global self-evaluations or impressions of the interaction. It is also noteworthy that participants’ responses on the SBI showed greater correspondence to confederates’ ratings (IMI-C). On both measures, trait worry was associated with higher ratings of submissiveness in participants. Putting these results together, it might be the case that participants with high levels of trait worry engaged in more submissive behaviors, but misperceived the behaviors’ impact as affiliative. In other words, those participants might have enacted an affiliative intent by engaging in submissive behaviors, but lacked an awareness of how those behaviors actually affected the confederate.

These results may provide insight into the discrepancy between self- and other-report on interpersonal problems in individuals with pathological worry symptoms (Eng & Heimberg, 2006). Compared to non-anxious controls, GAD analogues endorsed greater interpersonal
distress related to being overly warm, accommodating, and exploitable. However, peer-report suggested that GAD analogues were perceived as less assertive than controls rather than overly warm (Eng & Heimberg, 2006). The inconsistency between self- and peer-report might be linked to GAD participants’ misappraisal of their submissive behaviors’ impact on others. Submissive behaviors have been shown to appease others (Keltner, Young, & Buswell, 1997), but they may not pull for others’ affiliation. If individuals engage in submissive behaviors with an expectation that they will have an affiliative impact and elicit affiliation in return, they may not experience the expected increase in others’ affiliation and misattribute it to others’ failure to reciprocate.

Increasing evidence points to the potential role of affiliative interpersonal problems in the maintenance of pathological worry symptoms. For instance, GAD clients who endorsed affiliative interpersonal problems had higher levels of anxiety at baseline and over the course of treatment (Newman, Jacobson, Erickson, & Fisher, 2016). Affiliative interpersonal problems also predicted a worse treatment outcome in psychodynamic treatment for GAD (Crits-Christoph et al., 2004). These findings indicate that it is important to clarify the nature and mechanisms behind the endorsements of affiliative interpersonal problems, but current understanding of this topic is limited. Despite its speculative nature, the foregoing theory may inform ways to integrate previous disparate findings and therefore merits further consideration and testing.

Despite the association between trait worry and affiliative and submissive self-reported tendencies in the current study, there might be still some interpersonal heterogeneity in individuals with high trait worry. For instance, although higher trait worry predicted greater affiliation and lower dominance on the IIP-SC, the IPC profile associated with trait worry had low prototypicality ($R^2 < .7$). Low prototypicality could have been due to individuals high in trait worry endorsing opposing types of interpersonal problems (e.g., both intrusive and socially
avoidant). Alternatively, the sample might have included subgroups that endorsed distinct types of interpersonal problems. Although this possibility was not directly tested, research has repeatedly identified interpersonal subgroups within disorders associated with high trait worry (Cain, Pincus, & Grosse Holtforth, 2010; Cain et al., 2012; Kachin, Newman, & Pincus, 2001; Przeworski et al., 2011). In the current study, the IPC profile associated with trait worry on the Impact Message Inventory (IMI-C) surface had high prototypicality. This indicates that despite heterogeneity in endorsed interpersonal problems, individuals with higher levels of trait worry rated their impact on the confederate in a consistent manner. Nonetheless, because the experiment included a relatively brief interaction with a confederate who was enacting a neutral interpersonal style, it is possible that this pattern may not generalize across contexts. In particular, possible moderation by types of endorsed interpersonal problems should be explored in future studies.

The current study did not find a significant effect of state worry on interpersonal variables. These results might be explained by both methodological and theoretical reasons. First, state worry was operationalized using experimental worry induction and therefore, was coded as a binary variable. The categorical nature of the state worry variable might have limited the statistical power to detect a significant effect if one existed. Relatedly, although multicollinearity was not present, the effects of state worry might not have been detected due to controlling for the shared variance between state worry and state anxiety. However, post hoc analyses run after excluding state anxiety suggested that this was not the case. This led to an alternative, more conceptual interpretation that the affective and somatic consequence of worry (anxiety) might be more pertinent to interpersonal processes than the perseverative nature of the worry process. This interpretation, however, is not consistent with research suggesting that when
cognitive performance (e.g., academic functioning) was examined as an outcome, worry predicted the outcome more strongly than associated emotionality at both trait and state levels (Liebert & Morris, 1967; Seipp, 1991). Thus, the relative effects of worry and associated anxiety may depend on the nature of the predicted outcome (e.g., cognitive vs. affective-motivational).

One caveat for understanding the non-significant effects of state worry is that the distinction between state worry and associated anxiety can be artificial at a phenomenological level. Although empirical evidence supports the distinction between the constructs (e.g., Gana, Martin, & Canouet, 2002; McLaughlin et al., 2007; Zebb & Beck, 1998), state worry and anxiety are often intertwined and difficult to separate in one’s subjective experience. Since state worry creates and sustains an anxious emotional state (Newman & Llera, 2011), a mediational relationship may exist such that state worry affects interpersonal processes through increased state anxiety. Unreported exploratory post-hoc analyses supported this prediction.

Present findings on the effects of state anxiety were largely consistent with the existing literature. Higher state anxiety predicted participants’ perception of lower affiliation and submissiveness in themselves, and lower affiliation in the confederate. State anxiety was also positively associated with actual submissive impact on others. Nonetheless, it is necessary to note that most previous studies examined effects of anxiety in the context of social anxiety or state anxiety experienced during an interaction (e.g., Oakman, Gifford, & Chlebowsky, 2003; Russell et al., 2011; Sadikaj et al., 2015). State anxiety in the current study was assessed before interacting with a confederate, and correlation analyses indicated that state anxiety was not confounded with trait-level social anxiety (SIAS). In addition, inspection of the content of participants’ worry showed that none of the participants in the worry condition were worried about the upcoming interaction tasks during the induction task. Therefore, the current findings
suggest that a general anxious state independent of social anxiety has similar effects on interpersonal perception and behaviors as social anxiety. Relatedly, in a recent study using an event-contingent assessment (Rappaport et al., 2014), generic trait-level anxiety significantly predicted higher self-reported quarrelsomeness and submissiveness in interpersonal situations. Although it is possible that increasing generic anxiety before interaction tasks predisposed individuals to experience greater social anxiety during the tasks, participants’ anxiety ratings in the current study showed that participants’ anxiety decreased rather than increased after going through interaction tasks. The result further supports that the current findings on state anxiety are unlikely due to social anxiety experienced during interaction tasks.

State anxiety, like trait worry, was associated with different impact messages depending on the source of the report. Participants with high levels of state worry described their impact as more hostile than confederates did. The results indicate that whereas trait worry was associated with underestimation of one’s hostile impact, state anxiety was associated with overestimation. One way to understand these associations is that they may represent rigid perceptual biases in individuals with high trait worry and anxiety. Alternatively, the biases might lead to greater perceptual variability in interpersonal situations for those individuals. For instance, individuals with high trait worry may have a schema of themselves as being affiliative and submissive. At the same time, those individuals may also experience varying levels of anxiety from situation to situation, which might cause them to perceive themselves as more hostile than their baseline self-schema. Although these hypotheses have not been directly tested, a previous study using event contingent assessments showed that trait anxiety uniquely predicted greater variability in self-reported behaviors across interpersonal situations compared to depression (Rappaport et al., 2014). Greater within-person variability in self-reported interpersonal behaviors and perception
of others have been also shown to be associated with greater interpersonal distress (Erickson, Newman, & Pincus, 2009). Therefore, investigating potential perceptual variability and its link to interpersonal difficulties might be a promising way to extend the current findings on perceptual biases associated with trait worry and state anxiety.

It is important to note several limitations of the current study. Interpersonal variables were assessed through a one-time interaction which occurred in a controlled setting and was relatively brief. The specificity in the setting may limit generalizability of the current findings. In addition, participants interacted with a same-sex confederate who portrayed a specific interpersonal style (neutral). The use of confederates allowed for standardizing confederate behaviors to increase confidence in drawing inferences on participant factors. Nonetheless, it is uncertain whether the current results would hold when participants interact with the opposite sex, acquaintances or significant others, or individuals enacting a different interpersonal style (e.g., friendly). The above limitations warrant replication of the findings, using multiple interactional contexts and repeated assessment in naturalistic settings to examine their ecological validity.

In addition, the current sample was recruited from an undergraduate population. However, about 30% of the sample were GAD analogues who met the DSM-IV criteria for GAD. Based on the suggested cut-offs for the SIAS (>34; Heimberg, Mueller, Holt, Hope, & Liebowitz, 1992) and BDI-II (>20: moderate depression; Beck, Steer, & Brown, 1996), 33% (n = 42) and 21% (n = 27) of the sample had clinical levels of social anxiety and depressive symptoms respectively. Therefore, support for clinical relevance of the findings is strong. Given the encouraging nature of these findings, further testing in clinical populations is warranted. Lastly, it appears that the operationalization of state worry as a categorical variable led to insufficient statistical power to detect a significant effect. Therefore, future studies using a
dimensional measure of state worry (e.g., "the extent to which the same thoughts occurred over and over again"; Verkuil, Brosschot, Putman, & Thayer, 2009) or augmenting mood induction with such a measure would provide a more adequate test of the effects of state worry on interpersonal processes.

Despite the above limitations, the current study added to previous findings by examining effects of both trait-level and state-level worry and associated anxiety on interpersonal perceptions and behaviors. Trait worry and state anxiety had similar effects on participants’ other-perception and impact on confederates. In both cases, trait worry and state anxiety were associated with a bias toward perceiving others as unfriendly and having a submissive impact on others. Their effects on self-perception diverged on the affiliation dimension. Trait worry predicted primarily affiliative and submissive self-perception and state anxiety predicted hostile and submissive self-perception. Although there is increasing evidence that interpersonal dysfunction is prevalent and has significant effects on the maintenance of symptoms and treatment outcomes in individuals with pathological worry symptoms, the topic still remains relatively understudied. The current findings can be used to inform new theories and predictions to extend the existing literature and elucidate maladaptive interpersonal processes implicated in pathological worry.
Appendix A: Tables
Table 1.

Means and Standard Deviations of Baseline and Post-Induction Worry/Anxiety by Condition

<table>
<thead>
<tr>
<th></th>
<th>Worry (n = 65)</th>
<th>Relaxation (n = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline MC</td>
<td>2.16 (.85)</td>
<td>2.09 (.74)</td>
</tr>
<tr>
<td>Baseline SUDs</td>
<td>14.93 (15.57)</td>
<td>14.61 (15.83)</td>
</tr>
<tr>
<td>Post-induction MC</td>
<td>3.39 (.89)</td>
<td>1.51 (.58)</td>
</tr>
<tr>
<td>Post-induction SUDs</td>
<td>35.22 (19.73)</td>
<td>7.13 (11.72)</td>
</tr>
</tbody>
</table>
Table 2.

Descriptive Statistics and Bivariate Correlations between Study Variables

<table>
<thead>
<tr>
<th></th>
<th>M (SD)</th>
<th>Range</th>
<th>Trait Worry (PSWQ)</th>
<th>State Worry (Mood Induction)</th>
<th>State Anxiety (SUDs)</th>
<th>Social Anxiety (SIAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait Worry (PSWQ)</td>
<td>50.63 (16.93)</td>
<td>19 – 80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Worry&lt;sup&gt;a&lt;/sup&gt; (Mood Induction)</td>
<td></td>
<td>.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Anxiety (SUDs)</td>
<td>21.62 (21.54)</td>
<td>0 – 69</td>
<td>.30**</td>
<td>.60**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Anxiety (SIAS)</td>
<td>26.69 (15.65)</td>
<td>1 – 67</td>
<td>.14</td>
<td>-.01</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>Depression (BDI-II)</td>
<td>11.24 (8.78)</td>
<td>0 - 32</td>
<td>.31**</td>
<td>.04</td>
<td>.08</td>
<td>.61**</td>
</tr>
</tbody>
</table>

Note. PSWQ = Penn State Worry Questionnaire. Mood Induction = 1 (worry); 0 (relaxation). SUDs = Subjective Units of Distress scale. SIAS = Social Interaction Anxiety Scale. BDI-II = Beck Depression Inventory-II. <sup>a</sup>Since state worry is a binary variable, point-biserial correlations were calculated for the variable’s associations with other variables.

**p < .001.
Table 3.

Structural Summary Parameters with 95% Bootstrap CIs for the Interpersonal Profile of Trait Worry on the IIP-SC

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Dominance</th>
<th>Elevation</th>
<th>Amplitude</th>
<th>Angle</th>
<th>R²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.04</td>
<td>.001</td>
<td>.15</td>
<td>.04</td>
<td>178°</td>
<td>.21</td>
<td>.12</td>
</tr>
<tr>
<td>[-.13, .04]</td>
<td>[-.10, .11]</td>
<td>[.02, .26]</td>
<td>[.01, .15]</td>
<td>[54°, 307°]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* IIP-SC = Inventory of Interpersonal Problems-Short Circumplex. p = probability that the CIs for the amplitude and angular displacement parameters are accurate.
Table 4.
Structural Summary Parameters with 95% Bootstrap CIs for the Interpersonal Profiles of Trait Worry and State Anxiety on the IMI-C and IMI-C Self

<table>
<thead>
<tr>
<th>Construct</th>
<th>Affiliation</th>
<th>Dominance</th>
<th>Elevation</th>
<th>Amplitude</th>
<th>Angle</th>
<th>R²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participant IMI-C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TW</td>
<td>-.29</td>
<td>.01</td>
<td>.17</td>
<td>.29</td>
<td>178°</td>
<td>.92</td>
<td>.99</td>
</tr>
<tr>
<td>[-.40, -.16]</td>
<td>[.09, .12]</td>
<td>[.09, .24]</td>
<td>[.17, .41]</td>
<td>[156°, 198°]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>-.13</td>
<td>.06</td>
<td>.1</td>
<td>.14</td>
<td>155°</td>
<td>.79</td>
<td>.57</td>
</tr>
<tr>
<td>[-.26, -.01]</td>
<td>[-.05, .16]</td>
<td>[-.001, .2]</td>
<td>[.05, .27]</td>
<td>[93°, 203°]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Participant IMI-C Self</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TW</td>
<td>.10</td>
<td>-.004</td>
<td>.12</td>
<td>.10</td>
<td>358°</td>
<td>.75</td>
<td>.59</td>
</tr>
<tr>
<td>[.01, .20]</td>
<td>[-.11, .11]</td>
<td>[.01, .23]</td>
<td>[.03, .22]</td>
<td>[296°, 74°]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>-.23</td>
<td>-.07</td>
<td>.24</td>
<td>.24</td>
<td>196°</td>
<td>.91</td>
<td>.96</td>
</tr>
<tr>
<td>[-.36, -.10]</td>
<td>[-.15, .02]</td>
<td>[.12, .37]</td>
<td>[.12, .37]</td>
<td>[174°, 223°]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Confederate IMI-C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TW</td>
<td>.02</td>
<td>-.12</td>
<td>.02</td>
<td>.13</td>
<td>277°</td>
<td>.88</td>
<td>.39</td>
</tr>
<tr>
<td>[-.14, .15]</td>
<td>[-.26, -.01]</td>
<td>[.05, .08]</td>
<td>[.04, .28]</td>
<td>[198°, 351°]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>.02</td>
<td>-.12</td>
<td>.06</td>
<td>.12</td>
<td>278°</td>
<td>.92</td>
<td>.37</td>
</tr>
<tr>
<td>[-.12, .16]</td>
<td>[-.24, -.01]</td>
<td>[.01, .12]</td>
<td>[.04, .26]</td>
<td>[206°, 344°]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* IMI-C = Impact Message Inventory-Circumplex. TW = Trait Worry; SA = State Anxiety.

p = probability that the CIs for the amplitude and angular displacement parameters are accurate.
Appendix B: Figures
Figure 1.
The Interpersonal Circumplex.
Figure 2.

Structural Summary Parameters
Figure 3.

Mean SUDs Ratings after Mood Induction and Interaction Tasks by Condition
Figure 4.

IMI-C Profiles of Trait Worry on the Interpersonal Circumplex with 95% CIs for Amplitude (radial) and Angular Displacement (angular)

Note. Participant IMI-C: participant’s report of confederate’s impact on them; Participant IMI-C Self: participant’s report of their own impact on confederate; Confederate IMI-C: confederate’s report of participant’s impact on them
Figure 5.

IMI-C Profiles of State Anxiety on the Interpersonal Circumplex with 95% CIs for Amplitude (radial) and Angular Displacement (angular)

Note. Participant IMI-C: participant’s report of confederate’s impact on them; Participant IMI-C Self: participant’s report of their own impact on confederate; Confederate IMI-C: confederate’s report of participant’s impact on them.
References


