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Patterns of Felt and Expressed Positive Affect in Social Anxiety:

Concordance, Discordance, and their Correlates

A dissertation submitted in partial satisfaction of the
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in

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by

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The dissertation of Sarah Lilah Pearlstein is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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DEDICATION

Dedicated to my family: to Lisa Pearlstein, Ed Levy, and Julia Pearlstein-Levy for supporting me unconditionally; to Michael Meirowitz for providing unwavering encouragement and acts of service throughout my doctoral training; to Agnes Meirowitz, Randy Meirowitz, and Rebecca Meirowitz for offering me a home away from home. Dedicated also to the eight brilliant women of my doctoral cohort, who have been a rock-solid support system and have felt like family, too: Alena Stasenko, Feifei Gao, Janna Gordon, Karen Schwartz, Lauren Poth, Maddi Werhane, Jackie Szajer, and Chelsea Hayes.

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ABSTRACT OF THE DISSERTATION

Patterns of Felt and Expressed Positive Affect in Social Anxiety:

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by

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Individuals with high social anxiety (HSA) may experience subtle impairments in social processes that, if identified and targeted in treatment, could enhance social relationship functioning. Discordance in positive affect (PA), i.e., mismatch between PA experience and expression, may be one impactful treatment target if it is prevalent among HSA and if it weakens social bonds. The current study tested whether, during a positive social interaction: 1) a cross-

section of individuals with HSA vs. low social anxiety display heterogeneous, highly distinct "PA profiles," reflecting four patterns of discordant or concordant PA; 2) displaying discordant profiles is linked to HSA, and displaying all predicted profiles aside from concordant high PA is linked to additional clinical symptoms; 3) discordance is associated with lower desire for future interaction (DFI) with one's conversation partner and with conversation partners' lower reciprocal DFI; and 4) discordant profiles reflect use of specific emotion regulation strategies. Ninety-six adults age 18-55 participated, with scores on the Liebowitz Social Anxiety Scale either ≥ 50 (HSA; n = 70) or ≤ 20 (n = 26). All engaged in a positive laboratory-based relationship formation task with a confederate conversation partner and rated their internally felt PA several times during the interaction. Next, participants and confederates rated their DFI, and participants rated their use of emotion regulation strategies. Automated software was later used to code video recordings of participants' intensity of smiling. Latent profile analysis tested for the predicted PA profiles. Three of the four predicted profiles emerged, including one concordant high (n = 21), one concordant low (n = 23), and one discordant (high felt, low expressed) PA profile (n = 52). Compared to either of the other two profiles, displaying concordant low PA was associated with higher social anxiety, higher anhedonic depression, and higher use of expressive suppression to regulate emotions. Discordant PA was not more strongly associated with HSA and was not maladaptive for DFI. Instead, concordant low internally felt and low expressed PA was identified as a potentially useful indicator of both clinical severity and impairment in social relationship functioning and may point to more urgent or intensive treatment need.

INTRODUCTION TO THE DISSERTATION

Social anxiety disorder (SAD) is highly pervasive and highly comorbid with other psychiatric disorders (Kessler et al., 2005). Individuals diagnosed with SAD on average report lower quality of life than others (Stein & Stein, 2008), perhaps due in part to disrupted processes of forming and maintaining social relationships (Alden & Taylor, 2010; 2004). A difference in self-reported quality of life tends to remain even after those with SAD complete empirically supported treatments (Alden & Taylor, 2011; Eng, Coles, Heimberg, & Safren, 2005). Research suggests that subclinical levels of social anxiety exist on the same continuum with SAD (Ruscio, 2010; Stein, Torgrud, & Walker, 2000) and that during laboratory-based social interaction tasks with strangers, individuals with high social anxiety (HSA; e.g., those in the top 20th percentile on continuous measures of social anxiety symptoms in undergraduate samples) tend to be rated lower by their conversation partners than those with low social anxiety on aspects of overall partner liking and subtle interpersonally effective behaviors (Heerey & Kring, 2007; Meleshko & Alden, 1993; Voncken, Alden, Bögels, & Roelofs, 2008; Vrijsen, Lange, Becker, & Rinck, 2010). Identifying particular aspects of emotion experience and expression that tend to impede positive social processes in HSA could inform treatment strategies in order to ultimately improve social relationship functioning and subjective well-being in individuals who have HSA, including those with principal SAD and many other comorbid forms of psychopathology.

Positive affect (PA) is widely recognized as a key element in the development of social bonds (See Ramsey & Gentzler, 2015 for a review). Experimental evidence in non-clinical samples suggests that typically, boosts in PA increase our motivation to socialize with others (Whelan & Zelenski, 2012) and precede increases in our feelings of social connectedness (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Kok et al., 2013; Waugh & Fredrickson,

2006). Our research group has found evidence that these phenomena extend to individuals diagnosed with SAD, for whom boosts in internally experienced PA during a social interaction were associated with subsequent increases in social connectedness towards interaction partners, and that PA increases were more closely linked with connectedness than were reductions in anxiety (Taylor, Pearlstein, & Stein, 2017). Successful social relationship development "takes two to tango," and literature suggests that our outward expressions of PA, particularly smiling, are associated with our social partners' positive reactions toward us (aan het Rot et al., 2017; Knutson, 1996; Palmer & Simmons, 1995). Thus, internal PA experience increases our own desire for further connection with others, and external PA expression increases others' desire to connect with us.

The extent to which emotions tend to be experienced and expressed concordantly within an individual has been an area of interest in basic emotions research (for reviews see Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005; Reisenzein, Studtmann, & Horstmann, 2013). In a sample not selected for clinical characteristics, *dis*cordance of PA (i.e., incongruence between PA experience and expression) at one time point was associated with lower feelings of social connectedness and higher symptoms of depression assessed six months later (Mauss et al., 2011), leading the authors to conclude that habitual tendencies to exhibit PA discordance may be maladaptive for social relationship functioning. The association between PA discordance and low social connectedness held when controlling for level of PA experience and PA expression in isolation, and discordance mediated increases in clinical symptoms. The authors therefore proposed that PA discordance per se may hinder social connectedness, perhaps due to interaction partners' reduced motivation to engage with individuals whom they perceive to be behaving inauthentically.

PA discordance and its interpersonal correlates have not been well-studied in HSA; however, prior research suggests that individuals with HSA may respond to positive social interactions with a heterogeneous mix of reactions, including some that are concordant and some discordant (for a diagram of possible patterns, or "PA profiles," see Figure 1.1). PA discordance may be particularly high within this population during social encounters and may take different forms. Individuals with HSA tend to report higher-than-average habitual use of the emotion regulation strategy, expressive suppression (Kashdan & Breen, 2008; Turk, Heimberg, Luterek, Mennin & Fresco, 2005; i.e., attempting to block outward expression of emotions, both negative and positive; Gross & John, 2003). This strategy should logically result in *lower expression* of emotion relative to *higher internally felt* emotion (profile 1 in Figure 1.1) at any given moment, and may be driven by beliefs that expressing emotion, including positive emotion, carries risk of social rejection (Spokas, Luterek, & Heimberg, 2009). Experimental research suggests that deliberate use of expressive suppression does in fact constrict emotional expression to a degree that is behaviorally observable (e.g., Butler et al., 2013). However, some individuals with HSA also report deliberately engaging in a subset of behaviors often considered to be socially adaptive (e.g., frequent smiling and nodding), in order to increase the odds that they will be liked by others, thereby preventing feared social outcomes related to social rejection (Plasencia, Alden, & Taylor, 2011). At times when these displays of positive affect are not internally felt, this strategy theoretically may result in a different discordant pattern: *higher PA expression* relative to *lower internally felt PA*, or PA expression amplification (profile 4 in Figure 1.1). Thus, individuals with HSA may commonly display two different types of PA discordance, with opposite predicted patterns of PA experience and expression.

Although the research cited above suggests that individuals with HSA often attempt to regulate their emotional expression during social encounters, if they were to refrain from regulating during a given interaction, or if their attempts to regulate were unsuccessful, then *concordant low* PA experience and expression may be a common outcome (profile 2 in Figure 1.1). Individuals with HSA tend to experience low PA during social situations compared with non-clinical populations and often report low PA more broadly and chronically (for reviews, see Gilboa-Schechtman, Shachar, & Sahar, 2014; Kashdan, Weeks, & Savostyanova, 2011). Overall then, individuals with HSA may respond to positive social interactions with one of several distinct varieties of PA profile, possibly depending on whether and how they regulate PA. The idea that there may be particularly high variation in emotional expression styles within the HSA population is consistent with past anecdotal observations (e.g., Hirsch, Meynen, & Clark, 2004; Schlenker & Leary, 1982) and with factor analytic work in self report data (Plasencia et al., 2011). Thus far, however, heterogeneity in patterns of PA experience and expression has not been investigated behaviorally in HSA during a standardized live social interaction.

Chapter 1: Study Aims

A diagram of the three overarching aims of the current research is shown in Figure 1.2. The first core aim (represented in the center of Figure 1.2) was to investigate whether different patterns of PA discordance and concordance in a positive social context can be conceptualized as highly distinct PA profiles, with the hypothesis there are four distinct PA profiles, consistent with the profiles described above. An additional component of the first aim (Aim 1a) involved testing the prediction that higher social anxiety would be tied to increased likelihood of displaying discordant PA, given the findings described above that have linked social anxiety symptoms to higher emotion regulation efforts. Aim 1a also sought to examine possible associations between PA profiles and other clinical symptoms. Few studies to date have behaviorally investigated expression of positive emotion in clinical populations using highly validated measures (for a meta-analysis and comments on gaps in the literature, see Davies et al., 2016). Nonetheless, extant research and theory have supported that atypical patterns of emotional experience and expression may be common across a wide range of psychopathology (Geller, Cockell, Hewitt, Goldner, & Flett, 2000; Gur et al., 2006) and has suggested that this may be one transdiagnostic mechanism for disrupted social relationship functioning (Keltner & Kring, 1998). Thus, Aim 1a of the current research also included exploratory hypotheses that additional symptoms beyond social anxiety (specifically, anhedonic depression, anxious arousal, and general distress) would be associated with increased likelihood of displaying profiles apart from concordant high PA (i.e., profiles 1, 3, and 4 in Figure 1.1). Individuals with HSA who also have the common comorbidity of anhedonic depression (who, by definition, experience low levels of PA) are less likely than others to feel a sense of positive anticipation or reward when engaging in positive social encounters or to seek out opportunities to build social connections (Kashdan &

Steger, 2006). Thus, it may be reasonable to expect those individuals with HSA who have especially high anhedonic depression to have a higher likelihood of displaying concordant low PA. However, due to limited extant clinical data on patterns of PA experience and expression specifically during a positive social interaction, no more specific formal a priori hypotheses were made regarding relationships between PA profiles and clinical symptoms other than social anxiety. Rather, these relationships were investigated on an exploratory basis in an effort to expand empirical knowledge of emotion concordance and discordance in treatment-seeking individuals and to generate hypotheses for future research.

The second core aim of the current research was to investigate whether PA discordance during positive social contexts is detrimental for social relationship functioning. Mauss and colleagues (2011) found preliminary support for this hypothesis. However, in that study, PA discordance was assessed while participants were alone watching film clips, whereas displaying discordant patterns during a social interaction may be importantly different both in prevalence and in outcomes. Further, the study operationalized discordance as a unidimensional cross-correlation score between internally felt and externally expressed PA. This method was highly sensitive to the *degree* of concordance or discordance being displayed but not sensitive to different *types* of discordance or concordance. Specifically, using a unidimensional scale, a discordant pattern of low internally felt PA with high expressed PA would be indistinguishable from high felt and low expressed PA, and concordant high would be indistinguishable from concordant low PA. Thus, potential effects of some subtypes may have been masked. Mauss and colleagues concluded based on their findings that any type of *con*cordant response should yield better social outcomes than any *dis*cordant response regardless of PA expression level. Yet literature reviewed above regarding the interpersonal function of PA suggests that only

concordant *high* PA during a positive social interaction should yield *high* desire for further engagement on the part of both interaction partners, whereas *low* concordant PA should yield *low* desire to engage. Thus, the second aim of the current study was to clarify between these two competing hypotheses.

The current study implemented latent profile analysis (LPA), a method with the capability to distinguish between different types of PA concordance and discordance. LPA is used to classify individuals similar to each other on observed variables (e.g., PA experience and expression), which allows for inferences regarding latent variables that may be responsible for the observed patterns (e.g., use of emotion regulation strategies; Roesch, Villodas, & Villodas, 2010). LPA is a person-oriented approach; that is, it seeks to describe the way variables relate to one another within each individual, in order to reflect key aspects of responses that may not be possible to capture via linear associations (Muthén, 2001; Zalewski, Lengua, Wilson, Trancik, & Bazinet, 2011). Person-centered approaches (as opposed to variable-centered approaches) are recommended when investigating discordance between emotion channels (e.g., between experience and expression), because emotion discordance may involve conceptually important relationships and descriptive patterning between variables within a given person, and these patterns (rather than the emotion channels themselves) are the constructs of interest (Lanteigne, Flynn, Eastabrook, & Hollenstein, 2014; Mauss et al., 2005; Reisenzein et al., 2013; Turpyn, Chaplin, Cook, & Martelli, 2015).

In addition to the possibility that different social outcomes are linked to different types of concordance and discordance, whether PA discordance during positive social contexts hinders social relationship functioning might also depend on whether the outcomes are measured within the individual or in his or her interaction partners. Mauss and colleagues (2011) proposed that

PA discordance may impair social connectedness specifically as a result of one's *interaction partners'* low desire for further engagement. Yet it is at least equally plausible that social connectedness may weaken in the wake of PA discordance due to individuals' *own* reduced satisfaction with their social engagements. Research suggests that one's self-reported habitual use of expressive suppression can diminish one's sense of satisfaction and connectedness in social relationships over time (English, John, Srivastava, & Gross, 2012; Srivastava, Tamir, McGonigal, John, & Gross, 2009), perhaps due to a sense of inability to express one's authentic self (English & Oliver, 2013). Among those with HSA specifically, self-reported habitual expressive suppression use has been linked to one's own reduced feelings of connectedness to others and to the social world (Kashdan & Breen, 2008; Kashdan & Steger, 2006). Therefore, Aim 2 of the current research involved testing the additional hypothesis that a pattern of PA discordance characterized by lower expressed PA relative to higher internally felt PA (predicted profile 1 in Figure 1.1) is associated with individuals' own lower desire for future social interaction.

The third core aim of the current study was to directly test hypotheses that the two putative discordant profiles would be linked to two separate emotion regulation strategies. Specifically, it was hypothesized that the predicted PA profile involving lower expressed PA relative to higher internally felt PA (profile 1 in Figure 1.1) would be linked to conscious use of expressive suppression, and the putative PA profile involving higher expressed PA relative to lower internally felt PA (profile 4 in Figure 1.1) would be linked to an impression management-based emotion regulation strategy, referred to here as PA expression amplification.

In order to carry out these three core aims, the current research analyzed data that were collected as part of three previous studies, in either treatment-seeking adults who were

experiencing HSA or in adults who had low social anxiety and no clinical diagnoses. All participants completed symptom measures and took part in a laboratory-based relationship formation task with an interaction partner (a confederate) during which they rated their internally felt PA, and video recording equipment measured their expressed PA. Afterward, participants rated their desire for future interaction and their use of expressive suppression and PA amplification during the interaction they had just completed. Subsequently, LPA tested for highly distinct profiles based on levels of internal PA experience and external PA expression that each participant displayed during the interaction.

Chapter 2: Method

Participants

Data for the current research were culled from a subset of participants who had enrolled in one of three "parent" treatment studies. The first of these studies (Parent Study 1) selected for participants who had either a current principal diagnosis of SAD and clinically elevated dimensional social anxiety symptoms [i.e., had scores on the clinician-administered Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987) ≥ 60] or control participants who had no clinical diagnoses and low social anxiety symptoms (LSAS < 20). For Parent Study 1, clinical assessors determined SAD diagnosis using the Structured Clinical Interview for the Diagnostic and Statistical Manual (4th ed.[1]; DSM–IV; American Psychiatric Association, 2000) Axis 1 Disorders (SCID-I; First, Spitzer, Gibbon, & Williams, 2002). Parent Study 2 sampled participants who had a current principal diagnosis of major depression, as determined by clinical assessment via the clinician-administered Mini International Neuropsychiatric Interview for DSM-5 (MINI Version 7.0.0[2]). Participants enrolled in this study additionally were required to score 10 or higher on the Patient Health Questionnaire-9 (PHQ-9) in order to meet inclusion criteria. Parent Study 3 included participants who had current clinically elevated symptoms of anxiety and/or depression, defined by scores ≥ 10 on the PHQ-9 and/or ≥ 8 on the Overall Anxiety Severity and Impairment Scale (OASIS). Across all individuals who had participated in any one of the three parent studies, inclusion criteria for the current research were 1) having either LSAS ≥ 50 or LSAS < 20, and b) having video data with sufficient quality for automated facial expression coding (described in detail below).

Across all three parent studies, participants were recruited through posted announcements in community and online settings (e.g., flyers, ResearchMatch.org) and were required to be

between the ages of 18 and 55. Also across all three parent studies, assessments to determine principal and comorbid diagnoses were conducted using the MINI by a PhD-level clinician, a PhD student in clinical psychology, or one of two post-baccalaureate clinical research coordinators, all of whom received extensive training in the interview protocols. Diagnostic consensus was reached by reviewing completed interviews during team meetings. Exclusionary criteria across all studies were: (1) active suicidal ideation with intent or plan; (2) moderate to severe alcohol or marijuana use disorder in the past year; (3) other substance use disorders in the past year at any level; (4) bipolar I or psychotic disorders; (5) moderate to severe traumatic brain injury with evidence of neurological deficits, neurological disorders, or severe or unstable medical conditions that might be compromised by participation in the study; (6) inability to speak or understand English; (7) concurrent psychotherapy (unless 12-week stability criteria had been met for non-empirically supported therapies only); (8) concurrent psychotropic medication (e.g., SSRIs, benzodiazepines); and (9) characteristics that would compromise safety to complete an MRI scan (e.g., metal fragments in body), due to aspects of the parent studies that were unrelated to and subsequent to collection of the data used in the current research.

Measures

Symptom and demographic measures. The LSAS assessed social anxiety symptoms; it is a measure that poses 24 social situations related to interacting with or performing in front of others. Participants rate their level of fear and level of avoidance for each situation on a 4-point scale ranging from "none/never" to "severe/usually." Summed item responses result in a total score that reflects social anxiety severity. Participants also completed the Mood and Anxiety Symptom Questionnaire-Short Form (MASQ-SF), a measure designed to take a transdiagnostic approach to assessing symptom types that are shared across anxiety and depressive disorders, by

separating them into distinct symptom dimensions that have minimal overlap with one another (Watson & Clark, 1991). This feature of the measure made it a good fit for the current research, which had a transdiagnostic sample and which sought to identify particular features of clinical presentations that have bearing on social relationship formation, irrespective of traditional diagnostic categories. The subscales (reflecting the commonly shared dimensions) are as follows: anxious arousal, anhedonic depression, general distress-anxiety, and general distress-depression. The 62-item measure is rated on a 5-point scale from "not at all" to "extremely." High internal consistency has been found in multiple samples (Watson et al., 1995).

Participants also completed a questionnaire to report on their demographic characteristics, including their age (in years), gender ("Male," "Female," or "Neither Male nor Female"), ethnicity ("Hispanic" or "Non-Hispanic"), and race. Response options for race were separate from ethnicity, and they reflected those provided by the U.S. Census Bureau. They were the following: "White," "Black or African American," "American Indian and Alaskan Native," "Asian," "Native Hawaiian and Other Pacific Islander," "Some other race," and "Two or more races." Two additional response options were also included: "Other" and "Unknown/Decline to respond."

Internally experienced PA. At several points throughout the relationship formation task, participants reported how pleasant they were feeling "right now" using 0-100 scales with anchors of "not at all" and "extremely." Single-item scales provide an efficient and minimally intrusive means to index an individual's current mood state and are commonly used to measure changes in mood in response to laboratory tasks (Arch & Craske, 2006; Taylor et al., 2017; Tsao & Craske, 2000). They have also been used in prior studies assessing emotion concordance and regulation (Smith, Hubbard, & Laurenceau, 2011; Shiota & Levenson, 2012; Zalewski et al., 2011).

Participants completed PA ratings each time both they and their partners had answered a given question during the relationship formation task. The structure of the task involves a participant and a confederate trading answers to a series of six questions about themselves, with both individuals answering each question before moving to the next one and taking turns being the first person to answer a new question. Because they alternated the order of providing answers, three PA ratings reflected how pleasant participants were feeling immediately after listening to the confederate's answers. These three time points were selected as the target moments during the conversation because: 1) moments when individuals are not providing their own answers may afford greater opportunity for emotion regulation, which was the proposed mechanism of potential PA discordance in individuals with HSA, and 2) prior research suggests that either seizing or missing opportunities to react responsively to interaction partners' self-disclosures are particularly important for partners' subsequent desire for further engagement (Miller, Berg, & Archer, 1983; see Reis & Shaver, 1988 for a review). Therefore, moments immediately following interaction partners' utterances may be critical time points within social interactions. PA ratings were averaged across the three time points to create an overall PA experience score, consistent with overall affective experience scores used in prior work that used latent profile analysis (LPA) to examine emotion regulation profiles and concordance (Roisman et al., 2004; Smith et al., 2011; Turpyn et al., 2015).

Outwardly expressed PA (smiling displays). To quantify expressed PA, the current study used the Facial Action Coding System (FACS; Ekman & Friesen, 1978), which was designed to impartially categorize facial expressions by tracking individual muscle movements within the face, called action units (Ekman, Friesen & Ancoli, 1980). CERT tracks facial action units across video footage and yields numeric weights that represents their estimated intensity

within each video frame (Littlewort et al., 2011). A CERT output value of 0 or greater identifies when an action unit is more likely to be present than absent, with higher values reflecting the presence of more intense emotional expressions.

Facial action unit 12 (AU12) was selected as an index of smiling, consistent with prior research on emotion concordance (Harris & Alvarado, 2005; Ruch, 1995). AU12 is produced via contraction of the zygomaticus major muscle, which is responsible for upward pull of the lip corners and is agreed upon among researchers to represent smiling (Ekman & Friesen, 1978; Reisenzein et al., 2013). Because temporal lags in concordance of up to 10 seconds can occur between different emotion channels (Mauss et al., 2005; Butler et al., 2013), the target window of facial expression intensity was 10 seconds prior to each PA experience rating time point, consistent with prior research. Intensity of smiling was operationalized as the mean output value for AU12 averaged across all video frames during these windows (a total of 30 seconds per participant) in which AU 12 had an output value of 0 or greater. This yielded a single overall PA expression score.

Desire for future interaction. The Desire for Future Interaction scale (DFI; Coyne, 1976) was administered to both participants and confederates following the relationship formation task as a measure of motivation to engage in further contact with their interaction partner. The DFI is a well-established measure used in studies investigating interpersonal dimensions of psychopathology (Segrin, 1993). The DFI consists of eight items rated on a 7-point scale with anchors of "not at all" and "very much" that assess the extent to which the rater would be willing to engage in a variety of social activities with their interaction partner in the future (for list of items, see Figure 2.1). The items of the DFI have been shown to reliably load on a single factor (e.g., Segrin, 1993). Higher scores reflect greater motivation to engage in

further contact with one's conversation partner. Prior studies support the reliability and validity of the DFI (Powers & Zuroff, 1988; Voncken & Dijk, 2013).

Emotion regulation strategies. The Safety Behaviors Questionnaire (SBQ) comprised a list of 20 behaviors that individuals may engage in during a social interaction. The original version was developed for SAD intervention trials (Clark, Wells, Hackmann, Butler, & Fennell, 1994), and a modified version demonstrated high internal consistency and construct validity (Placensia et al, 2011). Instructions asked participants to rate the degree to which they used each behavior during the social interaction they had just completed "in order to make yourself feel safer or to try to prevent your feared outcome(s) from happening." Ratings were made on a 9-point scale from "not at all" to "very much."

In the current study, two SBQ items assessed conscious use of emotion regulation strategies. Ratings on the item, "Tried to conceal your anxiety" indexed use of expressive suppression. Research suggests that expressive suppression of both negative emotion (e.g. anxiety) and positive emotion loads on a single factor reflecting a unitary strategy of attempting to suppress all emotional expression (Gross & John, 2003). Ratings on the item, "Frequently smiled or nodded your head" indexed PA expression amplification. These two items were the best analogs of participants' attempts to suppress and amplify expression, respectively, that were available in the current dataset. Because their reliability and convergent validity with the constructs of interests have not previously been demonstrated, however, analyses performed using these single items were considered exploratory.

Relationship formation task. The relationship formation task used here was an abbreviated version of a previously validated social interaction task (Aron, Melinat, Aron, Vallone, & Bator, 1997) and involved the participant and confederate alternating responses to a

series of questions that gradually increased in the depth of self-disclosure they were designed to elicit (see Taylor & Amir, 2012; Taylor et al., 2017; Kashdan & Roberts, 2006, Study 1). Immediately before the task, an experimenter informed a given participant that he or she would be getting to know an assistant who worked in the lab (i.e., the confederate) and once the confederate was present stated that the purpose of the task was to get to know one another by answering a series of questions about themselves. Interactions began with an open-ended "ice-breaker" question ("Tell your partner a bit about yourself") followed by five relationship-building questions selected from the Aron et al. (1997) paradigm (the full list of questions is presented in Figure 2.2; also used in Taylor & Amir, 2012 and Taylor et al., 2017)[3]. They were asked to take turns acting as the "speaker" and the "listener" and to refrain from speaking during their listening turns. Both confederates and participants answered all six questions. Confederates completed DFI ratings in relation to the participant with whom they had interacted immediately following the relationship formation task.

Personnel. Confederates were trained both to deliver standardized responses to maintain consistency across participants and to act warmly towards participants using a scripted set of verbal and nonverbal behaviors. Confederates were not informed about participants' diagnostic status or about the hypotheses of the current research. Confederates were undergraduate students and recent college graduates (age 19-25; 16 women and 3 men). They comprised a racially diverse group roughly reflective of the student body of University of California, San Diego as a whole and were not matched to participants on any demographic characteristics. Experimenters were undergraduate, post-baccalaureate, or graduate students who were thoroughly trained on the study protocol to deliver scripted instructions to participants.

Confederate consistency. To evaluate consistency of confederate performance, observers previously rated confederate behavior while viewing videotapes of the social interaction using five items written to reflect displays of warmth and friendliness (e.g., friendly, talkative, self-disclosive). Items were rated on a 7-point scale with anchors of "not at all" and "very much" and were summed to create an overall index of confederate warmth and friendliness (scale range = 5-35). Past examination of observer ratings of the confederates suggested that they adhered to expected levels of warmth and openness (M = 29.63, SD = 1.53).

Facial action data acquisition and CERT processing. Videos were recorded at a rate of 15 frames per second using a Logitech C920 HD Pro webcam. This camera remained within plain sight throughout the relationship formation task and was mounted on top of a desktop computer monitor directly facing participants and immediately behind the left shoulder of confederates. Prior to CERT processing, videos were edited to ensure focus on a given participant's face, occluding extraneous background content. For the current study, time stamps were noted corresponding to the ten-second windows prior to when participants rated their experienced PA, and facial coding data were mapped to these windows.

To arrive at the current sample, data from 17 participants were excluded on the basis of a priori criteria that would present obstacles to accurate facial coding, determined based on previous work with CERT by the author and consistent with published reports by other research groups (Grafsgaard, Wiggins, Boyer, Wiebe, & Lester, 2013). Two observers blind to diagnostic group and to the hypotheses of the current study screened all videos for the following features: camera framing error that omitted part of the face (n = 1), gum chewing (n = 5), visible tongue movements inside closed mouth throughout the video (n = 1), face turned all the way in profile view throughout the video (n = 1), lighting abnormalities that led to poor video resolution (n =

4), gesturing with hands on and around the face throughout the video (n = 1), hair covering both eyebrows (n = 3), and hats or other headwear that cast shadows over the face (n = 1). One additional participant was also excluded due to being an outlier on age (> 3 SD above the sample mean).

Overview of Statistical Analysis Plan

Aim 1. The first aim of the current research was to test the hypothesis that PA concordance and discordance in a positive social context can be conceptualized as four highly distinct PA profiles, as depicted in Figure 1.1. For this aim, LPA was employed using version 8 of MPlus[4]. When using LPA, several possible statistical indices can assess model fit, i.e., to determine the number of profiles that best accounts for the observed data. Considering findings from multiple of these indices is recommended (Ram & Grimm, 2009; Roesch et al., 2010; Tekle, Gudicha, & Vermunt, 2016), including Akaike's information criterion (AIC; Akaike, 1987), the Bayesian information criterion (BIC; Schwarz, 1978), and sample size adjusted BIC (aBIC; Sclove, 1987). For each of these indices, lower values suggest better model fit. Entropy can also aid evaluation of fit, with values closer to 1 suggesting higher differentiation between profiles (Celeux & Soromenho, 1996), as well as hypothesis test results yielded by the Bootstrapped Log-likelihood Ratio Test (BLRT), where $p < .05$ indicates that the incremental contribution to model fit of a given additional profile is statistically significant at the level of $\alpha = .05$ (the level selected for the current research). The current research adhered to the recommendation of evaluating model fit based on multiple indices in combination, and it considered all of the fit indices listed above.

However, disagreement is very common among fit indices (Ram & Grimm, 2009; Roesch et al., 2010), and even when they appear to be in agreement, interpretation can still be

challenging if a given model with *k* number of profiles appears to have only slightly better fit than a model with *k*-1 profiles (e.g., if the *k*-profile model has an AIC value only 1-10 points lower than the *k*-1-profile model). In these cases, careful consideration is required to determine whether selecting the more complex model is justified, due to inherently lower parsimony compared to a simpler model. To further complicate this task, some quantitative methods researchers have discussed that the risk of under-extracting (i.e., of selecting models with a lower number of profiles than the true best-fitting model) may be especially high in small samples (Tekle et al., 2016), and the current sample was smaller than is typical for LPA (N = 96 compared to 200, often the smallest sample size investigated in simulation studies of LPA and similar mixture models).

Thus, a plan was formulated a priori to implement in the case of disagreement between fit indices and/or the case of only small improvements on fit indices for a more complex versus a simpler model. First, fit index values were considered, and while attention was paid to all of the indicators listed above (AIC, BIC, aBIC, entropy, and BLRT), it was determined that particular consideration would be granted to aBIC and to BLRT if disagreements or ambiguities arose, because findings from simulation research have suggested that aBIC and BLRT may be more accurate indices of model fit than others, particularly for small samples (Nylund, Asparouhov, & Muthén, 2007). Thus, the aBIC and the BLRT were identified for use as "tie breakers" between potentially conflicting fit index findings in the current research.

After attending to all fit indices with special attention paid to aBIC and BLRT, the above-mentioned contingency plan also involved evaluating the validity of emergent profiles by considering their conditional response means and latent class probabilities across emergent profiles (with higher values suggesting better model fit and higher likelihood that profiles

constitute stable subgroups; Roesch et al., 2010). Finally, t-tests were planned to investigate hypothesized mean differences between profiles, as well as multinomial logistic regression to test predicted associations between the profiles and clinical characteristics (see Aim1a for further detail). This was consistent with recommendations, in order to evaluate whether the outcomes fit with existing research and theory (Ram & Grimm, 2009). Finally, it was determined a priori that only emergent profiles that were observed in at least 15 cases would be interpreted, to maintain greater confidence in the stability of the profile, consistent with prior research (e.g., Lanteigne et al., 2014).

Because the sample size of the current study was smaller than is typical for LPA, ensuring adequate power was a point of consideration. However, simulation research has suggested that, even in small samples, LPA has high power to detect differences between subgroups when the subgroups are highly distinct from one another (e.g., when Cohen's $d = 1.5$ for the distance between subgroups on the selected indicators; Tein, Coxe, & Cham, 2013). Tekle and colleagues (2016) found that under some simulation conditions, if the separation between the latent groups was large (defined as class-specific response probabilities of .9), then a sample of only 41 was sufficient for the BLRT to detect the true number of latent groups at power of .80. This estimate appears to suggest that the current study was adequately powered to test the hypothesis that *highly distinct* PA profiles exist with large separation (e.g., class specific response probabilities of .9) between them.

Aim 1a. Following the LPA, multinomial logistic regression performed in MPlus separately tested relationships between PA profiles and each clinical symptom scale (LSAS, MASQ anhedonic depression, MASQ anxious arousal, MASQ general distress-depression, and MASQ general distress-anxiety). It was hypothesized that higher social anxiety would be

associated with higher relative log odds of displaying the two discordant profiles (profile 1 and profile 4 in Figure 1.1). On an exploratory basis, it was also hypothesized that additional symptoms beyond social anxiety (anhedonic depression, anxious arousal, and general distress) would be associated with increased likelihood of displaying profiles apart from concordant high PA (i.e., profiles 1, 3, and 4 in Figure 1.1). Due to the relatively small sample size and the hypothesis-generating nature of the investigation, it was determined a priori that Type I error control would not be applied.

Aim 2. The second aim was to investigate two competing hypotheses regarding the nature of the relationship between PA profile and DFI, each with a different set of predictions. A "maladaptive discordant PA" hypothesis predicted lower DFI associated with discordant profiles (i.e., putative profiles 1 and 4) than with concordant profiles (i.e., putative profiles 2 and 3), in both participants and confederates. Alternatively, a "maladaptive low PA" hypothesis predicted lower *participant* DFI in profiles with relatively low internally felt PA (i.e., putative profiles 3 and 4) than in profiles with relatively high internally felt PA (i.e., putative profiles 1 and 2); it predicted lower *confederate* DFI in profiles with relatively low externally expressed PA (i.e., putative profiles 1 and 3) than in profiles with relatively high externally expressed PA (i.e., putative profiles 2 and 4). Two separate one-way analyses of variance (ANOVAs) tested the overall hypothesis that PA profile predicts participant and confederate DFI, respectively, along with follow-up pairwise comparisons that investigated specific differences between profiles predicted by each competing hypothesis.

Following from the findings of Mauss and colleagues, 2011, the "maladaptive discordant PA" hypothesis additionally predicted that discordant PA profile 1) should relate to DFI with one's conversation partner over and above a continuous index of internally felt PA alone and 2)

should relate to one's conversation partner's DFI over and above a continuous index of externally expressed PA alone. In contrast, the "maladaptive low PA" hypothesis predicted 1) that a continuous measure of low internally felt PA should relate to DFI with one's conversation partner over and above PA profile and 2) that continuous low externally expressed PA should relate to one's conversation partner's DFI over and above PA profile. To test these additional components of the competing hypotheses, two analyses of covariance (ANCOVAs) were planned to predict participant and confederate DFI respectively via general linear modeling procedures using SPSS version 26.

Aim 3. The third aim of the current study was to investigate the relationship between PA profile and two specific emotion regulation strategies; specifically, it tested hypotheses that putative profile 1 would be associated with use of expressive suppression and that putative profile 4 would be associated with use of PA amplification. Multinomial logistic regression in Mplus addressed this study aim. Because no psychometric data were available regarding the use of the single items that were available as proxy measures of expressive suppression and PA expression amplification for the current research, this final set of analyses was considered exploratory.

Chapter 3: Results

Final Sample

Data from 96 participants were included in the final sample of the current research, 70 of whom had HSA and 26 of whom had low social anxiety. All participants with low social anxiety whose data were included in the current study had been enrolled in the control group of Parent Study 1. Of the HSA participants whose data were included, 40 participants had been enrolled in the SAD group of Parent Study 1; 12 had been enrolled in Parent Study 2; and 18 had been enrolled in Parent Study 3. HSA participants in the current sample met DSM criteria for a wide array of clinical conditions: social anxiety disorder (81.4%), major depressive disorder (current episode; 45.7%), generalized anxiety disorder (28.6%), agoraphobia (4.3%), obsessive compulsive disorder (2.9%), posttraumatic stress disorder (2.9%), mild alcohol use disorder (2.9%), and mild marijuana use disorder (1.4%). Some degree of suicidal ideation was endorsed by 20.0% of the sample. Two thirds of the total sample identified as female, 30% identified as Hispanic, and half identified as white. Additional characteristics of the total sample appear in Table 3.1, including descriptive statistics for all continuous variables that were assessed.

Aim 1: Latent Profile Analyses

Findings of the LPA are presented in Table 3.2. Each of the information criterion statistics, including aBIC, as well as results of the bootstrapped likelihood ratio hypothesis tests, were consistent with at least marginally increased model fit for a two- versus a one-profile model and for a three- versus a two-profile model. Models with four and five profiles each involved at least one profile with $n < 15$ and thus were not considered further. Because the values of the information criterion statistics were relatively similar for the three- and the two-profile models,

these two models were further evaluated in order to determine whether the superior fit of the three-profile model outweighed the superior parsimony of the two-profile model.

Table 3.3 presents descriptive statistics for these two models. Each displayed high average latent class probabilities and high classification probabilities for their respective emergent profiles. To test for statistically significant differences between profile means within each model, Mplus was used to generate estimates of mean differences between each of the profiles on PA experience and PA expression, respectively. One-sample *t* tests then examined whether each of these difference values was significantly different from 0. Significant differences were observed between the profiles in the 2-profile model on both PA experience, $t(95) = 10.91$, $p = .03$, and expression $t(95) = .60$, $p < .001$. Significant differences were also observed in mean PA experience and expression within the 3-profile model, between all pairings that were predicted to be different (all $p < .001$). No differences were observed between profile pairings that were not predicted to be different. Graph 3.1 presents a graphical representation of the 3-profile model, including results of these tests.

Because the three-profile model demonstrated a) at least marginally enhanced fit on each of the information criterion statistics, including lower aBIC and significantly improved fit compared to the two-profile model on the BLRT, b) significant differences between profile means in each of the predicted ways (see Graph 3.1), and c) associations with clinical variables consistent with rational inferences (described in detail below, within "Clinical and demographic characteristics by profile"), the three-profile model was determined to be superior.

Within the 3-profile model, one profile was consistent with predicted profile 2, exhibiting both high internally felt PA and high outwardly expressed PA and was thus interpreted as a *High-High* (H-H) PA profile (n = 21). Another profile was consistent with predicted profile 1,

exhibiting internally felt PA at high levels similar to the H-H group, but had low externally expressed PA, and was thus deemed a high felt, low expressed, *Discordant-Low Expression* (D-LE) profile (n = 52). The third profile was consistent with predicted profile 3, exhibiting both low internally felt PA relative to either of the other two profiles and low outwardly expressed PA relative to either of the other two profiles and was interpreted as a *Low-Low* (L-L) PA profile (n = 23). No profile in this model was consistent with predicted profile 4, i.e., no profile exhibited low internally felt PA relative to the H-H profile and the D-LE profile and high expressed PA on par with that of the H-H profile.

Aim 1a: Clinical and demographic characteristics by profile

Characteristics of each profile are presented in Table 3.4, and multinomial logistic regression results appear in Table 3.5. Counter to hypotheses, increases in LSAS symptoms were not associated with higher relative log odds of displaying the discordant profile (D-LE) than either of the two concordant profiles. Instead, increases in LSAS symptoms were associated with increases in the relative log odds of displaying the L-L profile compared to either the H-H profile or the D-LE profile. Increases in MASQ anhedonic depression symptoms were also associated with increases in the relative log odds of displaying the L-L profile compared to the H-H profile. Counter to hypotheses, none of the remaining clinical characteristics measured were associated with differences in the relative log odds of displaying any one PA profile compared to any other.

In order to more fully characterize the emergent profiles and to provide additional context for subsequent findings, post hoc exploratory multinomial logistic regressions were run to assess relative log odds of displaying a given profile based on gender, racial majority status (identifying as “White” vs. not identifying as “White”), and ethnicity (“Hispanic” vs. “Non-Hispanic”). The only demographic characteristic that was found to significantly predict PA profile was

identifying as white compared to not identifying as white; this was associated with decreased relative log odds of displaying the D-LE profile versus either the H-H profile (p = .007) or the L-L profile (p = .048). There was no association between PA profile and gender, age, or ethnicity.

Aim 2: Desire for future interaction

All assumptions of ANOVA were met. Overall, the effect of PA profile on participant DFI was significant, $F(2, 93) = 5.68$, p = .005, η^2 = .11. Results of the post hoc pairwise comparisons are presented in Graph 3.2. Consistent with the "maladaptive low PA" hypothesis and inconsistent with the "maladaptive discordant PA" hypothesis, participants who displayed the L-L profile reported significantly lower DFI with their conversation partners than either participants who displayed the H-H or those who displayed the D-LE profile, and there was no difference in participant DFI between the D-LE and the H-H profiles. Confederate DFI also differed depending on PA profile overall, $F(2, 93) = 3.26$, p = .04, η^2 = .07. This finding, too, may be consistent with the "maladaptive low PA" hypothesis: trends emerged (marginally significant) such that confederate conversation partners of participants who displayed the L-L profile reported lower DFI with the participant than confederate partners of those who displayed the H-H profile. Counter to both the "maladaptive discordant PA" and the "maladaptive low PA" hypotheses, the D-LE profile (characterized both by PA discordance and by low PA expression) was not associated with lower confederate DFI than the H-H profile.

Prior to testing the additional hypotheses regarding the effects of PA profile per se (i.e., controlling for PA experience or expression alone) and the effects of PA experience or expression per se (while controlling for PA profile), a violation was detected of the ANCOVA assumption of homogeneity of regression slopes. Therefore, multiple linear regression was used to test these hypotheses instead of ANCOVA. All regression assumptions were met. Because

significant associations had been found between the L-L profile and symptom severity (Aim 1a), symptoms were also included in the multiple linear regression models to control for their potential effects on DFI. However, zero-order Pearson's correlations revealed that social anxiety and anhedonic depression symptoms were highly correlated with one another, $r(96) = .81$, $p < .001$. Thus, to avoid redundancy between the symptoms, scores on these two symptom dimensions were combined into a single composite index by averaging the z-scores ($M = 0$, $SD = 1$) of LSAS and MASQ anhedonic depression (Rosenthal & Rosnow, 1991). This single SA-anhedonic symptoms score was included in each model to control for the effects of symptoms.

Linear regression results are shown in Tables 3.6 and 3.7. A model of participant DFI that included predictors of PA profile, internally felt PA, and composite SA-anhedonic symptoms score accounted for 18% of the total variance in participants' desire to engage further with their conversation partner. Consistent with the "maladaptive low PA" hypothesis, internally felt PA was a highly significant predictor even controlling for the other variables in the model, while PA profile per se made no significant unique contribution over and above the other predictors. Symptoms also did not predict participant DFI over and above internally felt PA.

A model of confederate DFI that included PA profile, externally expressed PA, and SA-anhedonic symptoms also accounted for 18% of the total variance in confederate desire to connect further with their participant partner. However, inconsistent with both the "maladaptive discordant PA" and the "maladaptive low PA" hypotheses, neither PA profile nor externally expressed PA made significant unique contributions in accounting for confederate DFI, over and above symptom score. However, SA-anhedonic symptom score was a highly significant predictor of confederate DFI even after controlling for the effects of the other variables in the model.

Aim 3: Emotion regulation strategies

Results of multinomial logistic regressions testing the relationships between emotion regulation strategies and PA profile are presented in Table 3.5. Counter to predictions, higher expressive suppression was associated with increases in the relative log odds of a participant displaying the L-L profile versus either the D-LE profile or the H-H profile, and there were no differences in the relative log odds of displaying the D-LE profile versus the H-H profile on the basis of expressive suppression. PA expression amplification was also not associated with differences in the relative log odds of having displayed any one of the emergent PA profiles compared to any other.

Chapter 4: Discussion

The first aim of the current research was to investigate and characterize response styles to a positive social interaction among a cross section of individuals experiencing high or low levels of SA. As predicted, participants displayed heterogeneous combinations of high and low internally felt and externally expressed PA, such that three highly distinct PA profiles emerged. About half of participants displayed concordant PA profiles, and of these, about half displayed high and half low PA. Both of these concordant patterns are consistent with seminal work in basic emotions research that facial expressions often follow spontaneously from and concordantly with internally felt emotion (Ekman, 1993; Ekman & Friesen, 1982; Ekman, Friesen, & O'Sullivan, 1988). The other roughly half of participants displayed emotion discordance, and this too is consistent with prior findings: discordance between emotional experience and expression tends to be common (Mauss et al., 2005; Reisenzein et al., 2013) and is influenced by individual differences (Kring, Smith, & Neal, 1994), by the particular context's potential to elicit emotion (Tassinary & Cacioppo, 1992), by perceived sociocultural demands (Butler et al., 2007; Crivelli & Fridlund, 2018; Le & Impett, 2013), and by complex interactions between individual and contextual factors.

Although the current findings align with past research, this is the first study to identify empirically derived, highly distinct PA profiles in a sample selected based on clinical characteristics during a standardized positive social interaction. By using LPA to identify profiles, rather than using unidimensional difference scores, the current research was able to distinguish between varieties of concordance (high versus low) that differed from each other on key outcomes. It was also able to detect that all emergent discordant responding reflected low externally expressed PA compared to relatively higher internally felt PA (i.e., predicted profile

1), and that no discordant responding reflected high externally expressed PA compared to relatively lower internally felt PA (i.e., predicted profile 4) in this particular sample and social context. Unidimensional measures of discordance typically are not designed to detect these nuances and thus may draw conclusions about concordant and discordant responding and their correlates that are based on an incomplete or even misrepresentative picture.

Of the three profiles that emerged, the L-L profile was linked to higher severity of both anhedonic depression and social anxiety, compared to either of the other two profiles. It is unsurprising that participants who reported high anhedonic depression symptoms (and thus who were by definition experiencing low levels of PA globally) experienced low internally felt PA during the social interaction. The link between social anxiety symptoms and the L-L profile were consistent with robust data that social anxiety often involves low levels of internally felt PA (Gilboa-Schechtman et al., 2014; Kashdan, 2007; Kashdan et al., 2011). The current research builds on this literature by suggesting that higher severity of social anxiety and anhedonic depression increases the likelihood of responding to positive social contexts not only with a relative paucity of internally felt PA but with a distinctive pattern of concordant low PA experience *and* expression. Emotional expression has not been intensively investigated thus far in populations with anxiety disorders using validated facial coding systems (see Davies et al., 2016 for a meta-analysis). However, the current study and some prior research (Heerey & Kring, 2007; Pearlstein, Taylor, & Stein, 2019) suggest that social anxiety and commonly comorbid symptoms may have the potential to subtly influence PA expression and/or to alter the dynamics between PA experience and expression in ways that could interfere with adaptive processes of social relationship formation.

The second aim of the current study was to investigate two competing hypotheses regarding whether either PA discordance or levels of PA experience or expression alone predict desire for further connection following a positive social interaction. With respect to participants' desire for further engagement, findings appeared consistent with the "maladaptive low PA hypothesis:" not only did participants who displayed the concordant L-L profile experience lower participant DFI than those who displayed either of the other two profiles, but lower internally felt PA remained linked to lower participant DFI even after controlling for PA profile and clinical symptom severity. This pattern of findings appears to contradict the notion that PA concordance is always more socially adaptive than PA discordance. Instead, it builds on the sizable body of research conducted outside of clinical psychological science suggesting that internally felt PA during a positive social encounter is uniquely linked to processes that subserve social relationship formation (Fredrickson et al., 2008; Kok et al., 2013; Whelan & Zelenski, 2012) and is consistent with recent clinical findings suggesting that the same phenomenon extends to treatment-seeking individuals with HSA (e.g., Taylor et al., 2017).

With respect to confederates' level of desire to connect further with participants, the current research found support for neither the "maladaptive discordant PA hypothesis" nor the "maladaptive low PA hypothesis." Instead, the strongest predictor of low confederate DFI with participants was the severity of participants' social anxiety and anhedonic depression symptoms. This finding fits with past literature suggesting that individuals with HSA tend to experience lower liking by conversation partners (Voncken et al., 2008; Voncken & Dijk, 2012). However, given that confederates were not informed of participants' diagnostic status or symptom levels, the mechanism of the relationship between participant symptoms and confederate DFI remains an open question. Rather than investigating smiling alone, future research would likely benefit

from testing the impact of additional aspects of PA expression on confederate DFI beyond facial displays alone. For example, future studies may investigate positive valence of verbal content, positive vocal tone, positive responsiveness to the conversation partner, and synchrony between partners (Vacharkulksemsuk & Fredrickson, 2012; Vrijsen et al., 2010). Each of these and likely other aspects of PA expression may importantly contribute to relationship formation even in the absence of positive facial displays. Future research could also expand the time window over which smiling is sampled. Consistent with past emotion concordance research, the current study limited the target window of smile measurement to the ten seconds prior to when participants rated their internally felt PA. However, partner DFI may be more strongly related to smiling as it occurs over the full duration that a partner spends speaking (Pearlstein et al., 2019).

The final aim of the current research was to explore use of emotion regulation strategies as potential mechanisms underlying PA discordance. Expressive suppression was expected to be linked with the D-LE profile, given that D-LE was characterized by low PA expression compared to higher internally felt PA: a pattern seemingly consistent with an expressive suppression strategy. Thus, the finding that displaying the concordant L-L profile was associated with higher expressive suppression than the discordant D-LE profile was counter to predictions. However, it is plausible that participants who displayed the L-L profile experienced atypically low PA *because* they were using more expressive suppression. Expressive suppression has been associated with lower PA both after manipulating its use in a laboratory-based social interaction (e.g., Butler et al., 2003) and in daily life (e.g., Brans, Koval, Verduyn, Lim, & Kuppens, 2013; Brockman, Ciarrochi, Parker, & Kashdan, 2017), including among individuals experiencing high social anxiety (Kashdan & Steger, 2006). It is possible, then, that expressive suppression extinguishes internally felt PA as quickly as it arises and intensely enough that it in fact tends to

result in displays of the L-L profile for the majority of a given social interaction. However, there are a number of alternative possible explanations specific to methods employed in the current research that could account for the lower reports of expressive suppression associated with the D-LE profile. For example, participants who displayed the D-LE profile may have been altering their emotional expression not in order to prevent feared outcomes from happening (as was probed for by the expressive suppression measure that was available for the current study), but for different reasons, such as to conform to imagined expectations of the study procedures.

Although at first glance the findings of the current study appear contradictory to those of Mauss and colleagues' (2011) that higher PA discordance level predicted higher social disconnection and depression symptoms over and above internally felt PA, several differences in study design may account for the apparent disparities. First, the current study took place within a social context, in which both the prevalence and the outcomes of PA discordance may be different from discordance that occurs in response to non-social stimuli (Reisenzein et al., 2013). Second, the current research tested hypotheses in a sample that was selected based on social anxiety symptom level and in which the majority of participants were seeking treatment for clinically elevated anxiety and/or depression, rather than a sample not selected for clinical symptoms. Third, in the current research, participants rated their social affiliation immediately after they displayed concordant or discordant PA, rather than six months later. Additional research into the possible impacts of these differences in context, population, and/or time scale may shed light on potentially important moderators of the relationship between PA discordance and social affiliation.

Counter to predictions, no discordant profile emerged that was characterized by low felt PA relative to higher expressed PA [i.e., putative profile 4, a Discordant-High Expression (D-

HE) profile]. A profile with these characteristics was predicted to be displayed more often 1) by individuals with higher SA symptoms, who may deploy certain interpersonally effective behaviors (including smiling) as a way to prevent feared social outcomes (Plasencia et al., 2011) and 2) by individuals who reported higher conscious use of a PA expression amplification emotion regulation strategy. Neither of these hypotheses were supported in the current research. However, it may be that in the positive context employed here, the participants who had this type of "fake it 'til you make it" strategy in their repertoire were feeling genuinely positive and so did not need to "fake" the external impression that they were feeling high PA. In contrast, participants who displayed the L-L profile may have lacked either the skills, the emotional resources, or the motivation to use a discordant PA amplification style. It remains possible that a D-HE profile might emerge in a larger sample or in a different social context.

An exploratory finding emerged that identifying as part of the racial majority (i.e., identifying one's race as "white" versus not identifying as white) was associated with higher likelihood of displaying either the H-H or the L-L profile compared to the D-LE profile. There are a variety of possible explanations for this finding, including explanations related to differences in cultural norms involving emotional expression (e.g., Butler et al., 2007; Le & Impett, 2013; Soto, Perez, Kim, Lee, & Minnick, 2011), as well as explanations related to comfort level within the current laboratory setting or standardized social interaction task. Conclusions cannot be drawn from this unexpected finding given that the current study was not designed a priori to test for a potential impact of racial identity on PA profile. However, this may be a fruitful avenue for future research.

Overall, the findings of the current research have several important clinical implications. For one, they suggest that the response style of displaying both low expressed and low internally

felt PA during a positive social context may be a marker of particularly high clinical symptom severity and of maladaptive emotion regulation attempts compared to other individuals with HSA, even though individuals who use this profile may be indistinguishable from those who use a D-LE profile based on outward appearances. This suggests that when it comes to outwardly expressed PA, it is inadvisable for clinicians (or for any social interaction partners) to "judge a book by its cover." This idea may be useful to bear in mind especially for providers in settings that involve a high volume of clients (e.g., a psychiatric emergency department within a busy medical center), in which relying heavily on a patient's expressed affect may be perceived as a useful heuristic for gauging urgency of treatment need. The current findings suggest that over-reliance on such a heuristic may lead to mischaracterizing severity and inappropriate triage, and that systematic assessment of internally felt PA is critical. Finally, the finding that low internally felt PA predicted low participant desire for future interaction even after controlling for PA profile and symptoms is clinically relevant. Consistent with past research, it may suggest that programs designed to increase internally felt PA (e.g., Alden & Trew, 2013; Craske, Meuret, Ritz, Treanor, & Dour, 2016; Strege, Swain, Bochicchio, Valdespino, & Richey, 2018; Taylor, Lyubomirsky, & Stein, 2017; Taylor, Pearlstein, Kakaria, Lyubomirsky, & Stein, 2020) may be an effective strategy for upregulating processes that promote social relationship satisfaction.

Although the current research makes important contributions, it is not without limitations. The total sample size was smaller than is typical when using LPA (although there are no hard and fast rules around this). While three PA profiles emerged that were highly distinct from one another, there may be additional important subgroups that went undetected, and the PA profiles identified here will need to be replicated in order to demonstrate their reliability across samples. In addition, because the L-L profile differed from the other two response styles in multiple ways,

this complicates the task of evaluating which factors may drive unfavorable social affiliation. Specifically, the L-L profile was uniquely associated with low internally felt PA, high social anxiety, high anhedonic depression, and expressive suppression, and these interrelated factors may dynamically interact with and even exacerbate one another. Because the current research was cross-sectional, it could not definitively address questions regarding the directionality or causality of the relationships with desire for future interaction that were observed. Potentially confounding variables were statistically controlled in order to aid interpretation, and although multicollinearity diagnostics did not suggest that conducting these analyses was inadvisable, relationships between these variables may have led to some core facets of the profiles being unintentionally suppressed using this method. Therefore, experimental research will be needed to isolate the specific role of PA concordance and discordance in predicting aspects of social relationship functioning in individuals with elevated social anxiety and anhedonic depression. Finally, the experimental paradigm employed in the current research involved a positive social interaction between participants and an unknown research assistant. Response styles and their social affiliation correlates may be different during positive social interactions with close others or with a clinician, and in settings that are more naturalistic than a standardized laboratory task.

In spite of the above limitations, the current research had important methodological strengths. It included a face-to-face, standardized social interaction; a clinically selected and assessed sample with severe symptom presentations; automated coding of facial expressions that allowed for fine-grained and unbiased expression measurement; and empirically derived patterns of PA experience and expression. The current research contributes to the knowledge base by shedding light on which response styles are displayed during a positive social interaction and yielding empirical evidence for the first time that a heterogenous array of styles exist in the form

of highly distinct PA profiles. Further, it identified that individuals who display both low PA experience and expression comprise a subgroup with notably severe clinical symptoms. In addition, the current study serves as a proof-of-concept that statistical methods for identifying latent subgroups have the potential to deepen our understanding of the way that positive emotion experience and expression operates across psychopathology and to yield new opportunities for clinical benefit.

Footnotes

[1]Enrollment began prior to the release of the SCID for DSM-5. Interview questions were subsequently scored to reflect DSM-5 criteria for SAD.

[2]Because enrollment began prior to the release of MINI Version 7.0.0 for DSM-5, 30 participants were administered MINI Version 5.0.0 for DSM-IV (SAD group: 18, control group: 12) and 35 participants were administered the MINI 7.0.0 for DSM-5 (SAD group: 23, control group: 12) to assess comorbid diagnoses.

[3]Participants were randomized to use one of two parallel forms of question sets, because they completed the relationship formation task on a second occasion (post-treatment), in order to address aims of the parent research unrelated to the current study.

[4]In comparing models with different latent profile compositions, MPlus estimates error variances for each profile. In the current research, these error variances were constrained to be equal across profiles, which is the default setting in MPlus. This is a less conservative approach than allowing the variances to be estimated freely. The default, less conservative approach was used here due to the small sample size of the current research and considerations regarding power. Different results on model fit indices may be observed with variances estimated freely.

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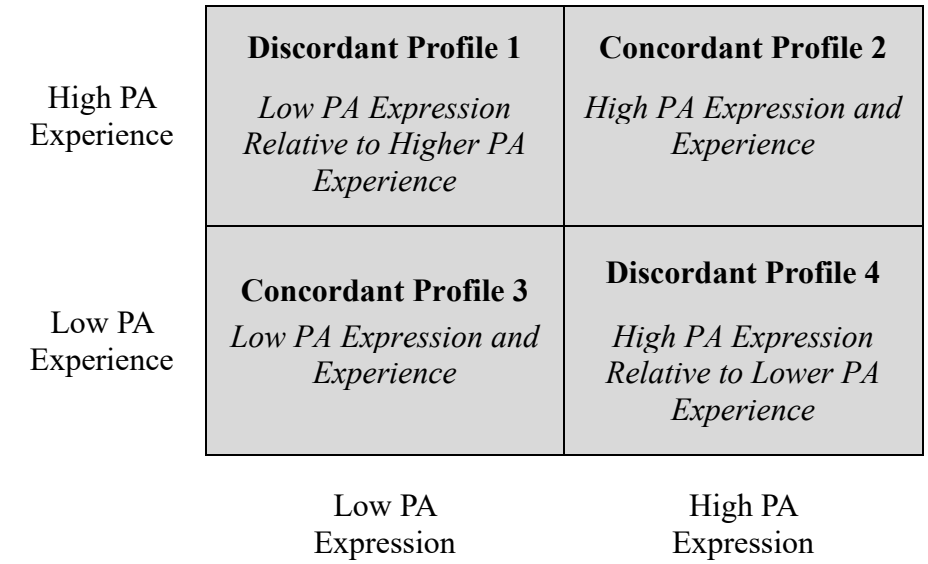


Figure 1.1: Predicted PA Profiles

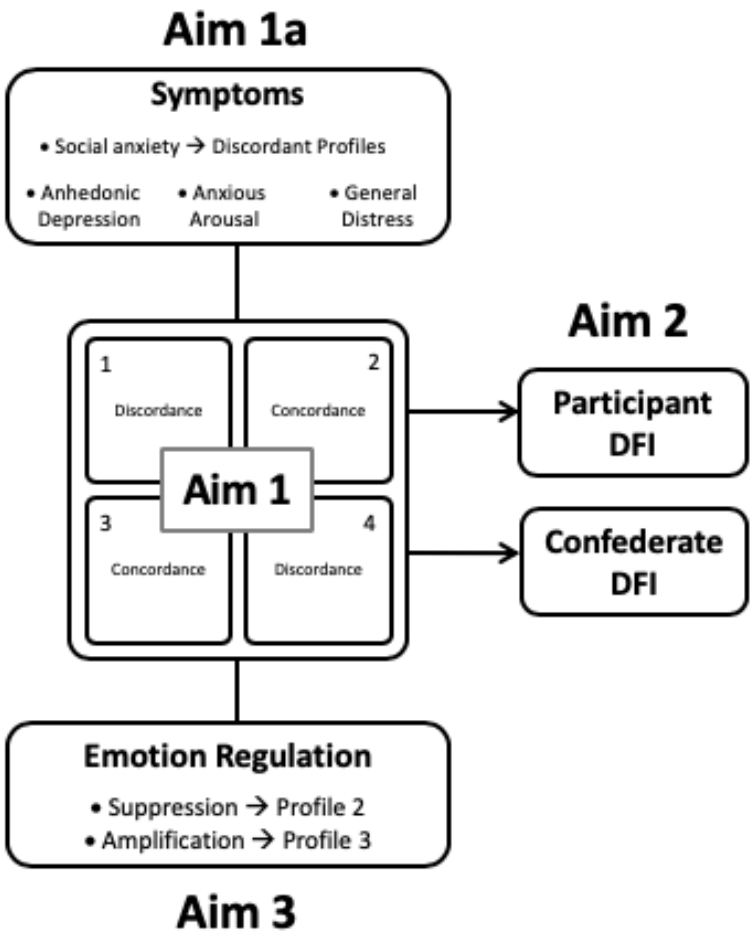


Figure 1.2: Study Aims and Hypotheses

1. Would you like to meet this person again?

2. Would you like to spend more time with a person like this in the future?

3. Would you like to work with a person like this in the future?

4. Would you like to sit next to a person like this on a 3-hour bus ride?

5. Would you invite a person like this to visit you?

6. Would you like to have a person like this as a friend?

7. Would you ask a person like this for advice?

8. Would you consider sharing an apartment with a person like this or having a person like this for a roommate?

Figure 2.1: Desire for Future Interaction (DFI) Scale Items

Form A

1. Tell your partner a bit about yourself.
2. What would constitute a perfect day for you?
3. For what in your life do you feel most grateful?
4. Is there something that you've dreamed of doing for a long time? Why haven't you done it?
5. What is your most treasured memory?
6. If you were going to become a close friend with your partner, please share what would be important for him or her to know.

Form B

1. Tell your partner a bit about yourself.
2. What would your ideal or perfect life be?
3. What is the greatest accomplishment of your life?
4. If a crystal ball could tell you the truth about yourself, your life, the future, or anything else, what would you want to know?
5. Can you envision how you are likely to look back upon the things you are doing today? If so, how much do you try to live now as you think you will one day wish you had lived?
6. Do you believe our life is predetermined by fate or is solely a consequence of the choices we make (or both)? Explain why.

Figure 2.2: Relationship Formation Task Question Sets

Table 3.1: Characteristics of the Final Sample
*One participant did not identify as female or male.
**Two participants did not select any of the response options regarding their racial identity.
LSAS = Leibowitz Social Anxiety Scale; AnDep = Anhedonic Depression subscale of the Mood and Anxiety Symptom Questionnaire (MASQ); AnxArous = Anxious Arousal subscale of the MASQ; GD-Dep = General Distress-Depression subscale of the MASQ; GD-Anx = General Distress-Anxiety subscale of the MASQ; DFI-P = Participant Desire for Future Interaction; DFI-C = Confederate Desire for Future Interaction; Exp Sup = Expressive Suppression item; Amp PA = Positive Affect Amplification item.

	Mean (SD)	Minimum - Maximum
Age	24.34 (7.07)	18 – 48
LSAS	61.48 (35.56)	1 – 118
AnDep	69.09 (20.95)	23 – 103
AnxArous	25.85 (8.98)	17 – 64
GD-Dep	29.35 (13.17)	12 – 58
GD-Anx	23.04 (8.78)	11 – 47
DFI-P	41.72 (9.22)	11 – 56
DFI-C	36.33 (9.83)	12 – 56
Exp Sup	3.98	0 – 8
Amp PA	5.79	0 – 8
	% of total N	
Gender: female*	66.67	
Ethnic Identity: Hispanic	30.21	
Racial Identity: White **	50.00	

Table 3.2: Fit Indices from Analyses of 1-5 Latent Profiles
*At least one profile had n < 15
AIC = Akaike's Information Criterion; BIC = Bayesian Information Criterion; aBIC = sample size Adjusted Bayesian Information Criterion; BLRT = Bootrstrapped Log-likelihood Ratio Test.

Model	AIC	BIC	aBIC	Entropy	BLRT approximate *p*
1 class	926.60	936.85	924.22		
2 class	913.31	931.26	909.15	.83	< .0001
3 class	904.42	930.07	898.49	.75	< .0001
4 class*	901.46	934.80	893.75	.83	.14
5 class*	903.53	944.56	894.04	.79	1.00

Table 3.3: Characteristics of the 2-Profile Model and the 3-Profile Model
Exp PA = Expressed PA; Int PA = Internally felt PA.

Model	Profile number	n	Exp PA mean	Int PA mean	Exp PA variance	Int PA variance	Average Latent Class probabilities	Classification probabilities
2-Profile	1	79	0.28	66.23	0.04	498.00	0.96	0.98
	2	17	0.88	77.14	0.04	498.00	0.91	0.83
3-Profile	1	52	0.24	78.24	0.03	234.65	0.91	0.91
	2	23	0.34	39.22	0.03	234.65	0.84	0.81
	3	21	0.87	77.42	0.03	234.65	0.89	0.93

Graph 3.1: Representation of the 3-Profile Model
*$p < .05$, **$p < .01$, ***$p < 001$. No bracket indicates no significant difference.
The center point of each oval lies at the coordinates of the profile's mean PA expression value (X) and mean PA experience value (Y). The outer bounds of each oval reflect 1 unit of error variance. Darker shading reflects greater number of participants classified as having used the given profile.

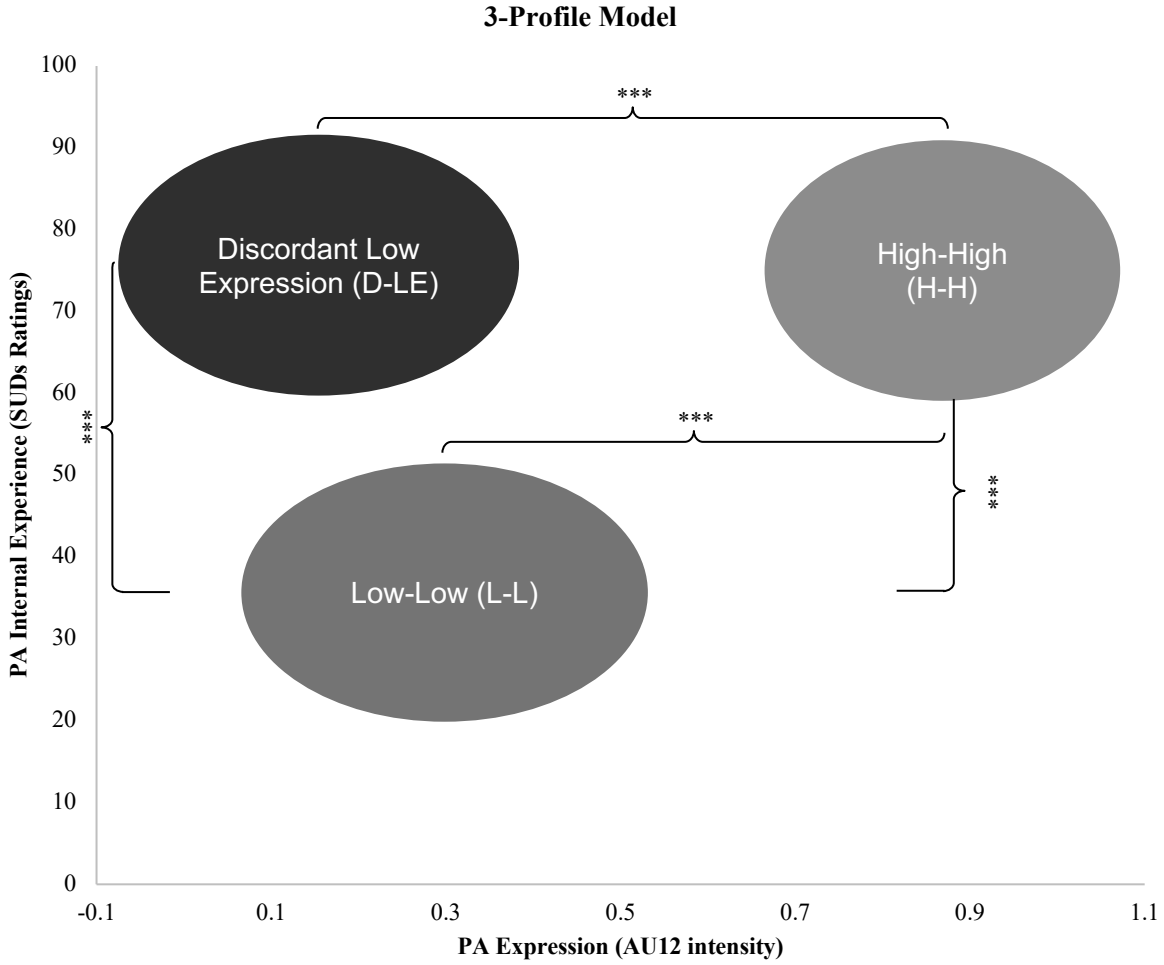


Table 3.4: Demographic and Clinical Characteristics by PA Profile
*One participant did not identify as female or male.
**Two participants did not select any of the response options regarding their racial identity.
LSAS = Leibowitz Social Anxiety Scale; AnDep = Anhedonic Depression subscale of the Mood and Anxiety Symptom Questionnaire (MASQ); AnxArous = Anxious Arousal subscale of the MASQ; GD-Dep = General Distress-Depression subscale of the MASQ; GD-Anx = General Distress-Anxiety subscale of the MASQ.

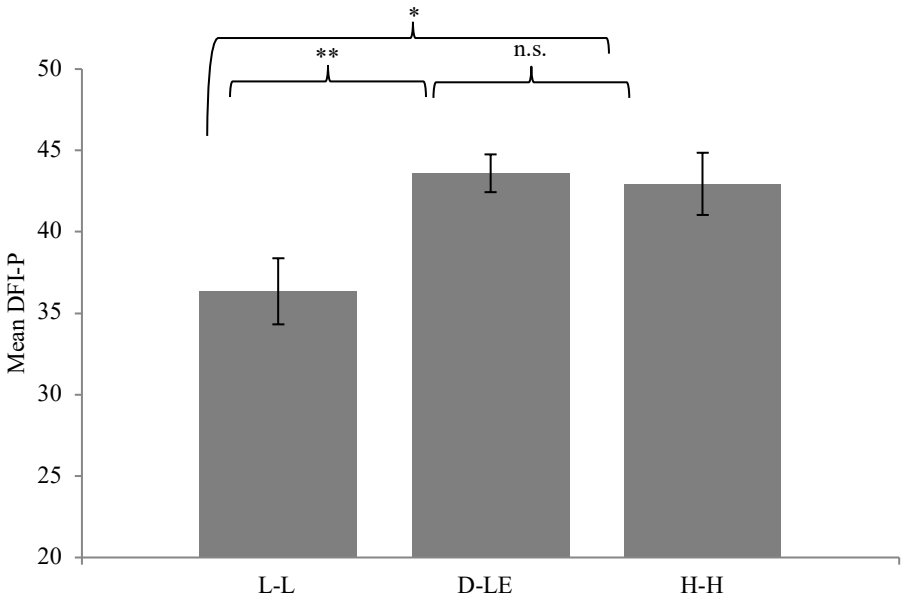
	L-L	D-LE	H-H
Mean age (SD)	25.56 (5.78)	24.29 (6.49)	27.57 (9.26)
Gender (% female)*	82.61	59.52	66.67
Ethnicity (% Hispanic-identifying)	39.13	25.00	33.33
Race (% White-identifying)**	60.87	35.29	75.00
Mean LSAS (SD)	82.78 (18.29)	52.27 (36.52)	60.95 (38.66)
Mean AnDep (SD)	81.57 (13.89)	63.06 (21.23)	70.38 (21.17)
Mean AnxArous (SD)	28.30 (8.50)	24.58 (8.50)	26.33 (10.40)
Mean GD-Dep (SD)	32.70 (12.62)	27.27 (13.19)	30.86 (13.34)
Mean GD-Anx (SD)	25.04 (7.76)	21.85 (7.76)	21.84 (8.45)

Table 3.5: Multinomial Logistic Regression Associations with Profile
LSAS = Leibowitz Social Anxiety Scale; AnDep = Anhedonic Depression subscale of the Mood and Anxiety Symptom Questionnaire (MASQ); AnxArous = Anxious Arousal subscale of the MASQ; GD-Dep = General Distress-Depression subscale of the MASQ; GD-Anx = General Distress-Anxiety subscale of the MASQ

	L-L vs. H-H (Reference)			L-L vs. D-LE (Reference)			D-LE vs H-H (Reference)		
	B	SE	*p*	*B*	SE	*p*	*B*	SE	*p*
Age	-0.04	0.04	0.38	0.04	0.05	0.39	-0.07	0.05	0.11
Gender	1.22	1.01	0.23	1.55	0.97	0.11	-0.33	0.63	0.60
Ethnicity (Hispanic-identifying)	0.36	0.75	0.63	0.86	0.70	0.22	-0.50	0.67	0.45
Race (White-identifying)	-0.67	0.88	0.45	1.41	0.71	0.048*	-2.07	0.77	0.007**
LSAS	0.03	0.01	0.02*	0.04	0.01	0.000**	-0.01	0.01	0.42
AnDep	0.06	0.03	0.04*	0.08	0.03	0.002**	-0.02	0.02	0.21
AnxArous	0.03	0.04	0.54	0.06	0.04	0.15	-0.03	0.04	0.45
GD-Dep	0.01	0.03	0.57	0.04	0.02	0.08	-0.03	0.02	0.28
GD-Anx	0.02	0.04	0.66	0.05	0.03	0.11	-0.03	0.04	0.42
Exp Sup (anx)	0.36	0.13	0.007**	0.32	0.12	0.007**	0.04	0.11	0.68
Amp (PA)	-0.05	0.14	0.75	-0.06	0.12	0.63	0.01	0.14	0.92

Graph 3.2: Results of ANOVA Post-hoc Pairwise Comparisons of Mean Participant and Confederate DFI by Profile

† $p < .1$, * $p < .05$, ** $p < .01$, *** $p < 001$



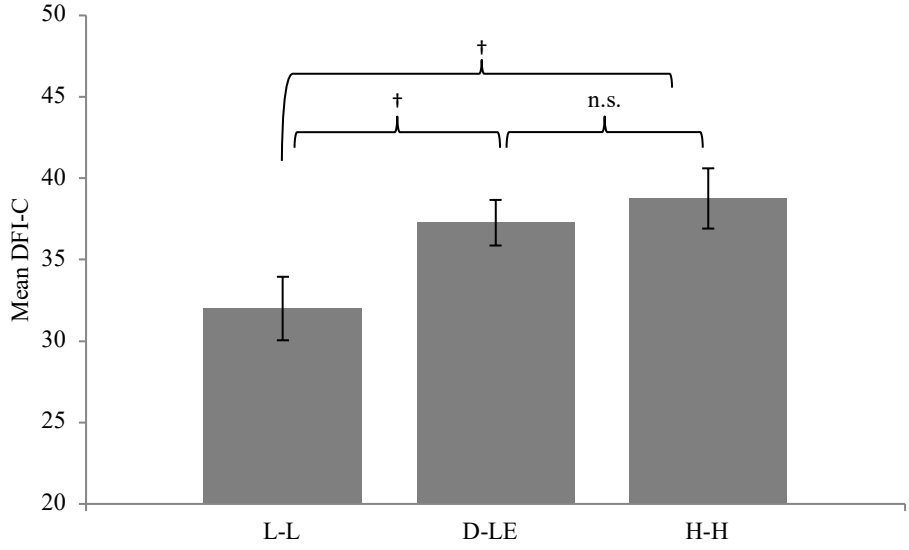


Table 3.6: Multiple Linear Regression Models Predicting Participant DFI
*$p < .05$, **$p < .01$, ***$p < 001$
LSAS-AnDep = Composite of Liebowitz Social Anxiety Scale and MASQ Anhedonic Depression subscale.

Predictor				
	B	*SE B*	β	ΔR^2
Regression model				.18***
Profile	.13	1.65	.01	
Internally Felt PA	.15	.06	.38*	
LSAS-AnDep	-.62	1.18	-.06	

Table 3.7: Multiple Linear Regression Models Predicting Confederate DFI
*$p < .05$, **$p < .01$, ***$p < 001$
LSAS-AnDep = Composite of Liebowitz Social Anxiety Scale and MASQ Anhedonic Depression subscale

Predictor				
	B	*SE B*	β	ΔR^2
Regression model				.18***
Profile	1.50	1.66	.10	
Expressed PA	3.22	3.43	.11	
LSAS-AnDep	-3.66	1.00	-.35*	