Validity of the PAI Interpersonal Scales for Measuring the Dimensions of the Interpersonal Circumplex

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Two studies evaluated the validity of the interpersonal scales, Dominance (DOM) and Warmth (WRM), from the Personality Assessment Inventory (PAI; Morey, 1991, 2007) to measure the 2 dimensions of the interpersonal circumplex (IPC). In Study 1, 114 college freshmen completed the PAI and the Interpersonal Adjectives Scale (IAS; Wiggins, 1995). In Study 2, 170 college students completed the PAI and the Inventory of Interpersonal Problems—Short Circumplex (IIP–SC; Söhlle, Budman, Denby, & Mercy, 1995). The results of both studies supported the convergent validity of DOM and WRM, although discriminant validity was stronger using the IIP–SC as the criterion. Circumplex projections placed DOM and WRM in the appropriate segments of both the IAS and IIP–SC. These findings provide additional support for the validity of the PAI interpersonal scales as measures of the primary dimensions of the IPC.

The measurement of interpersonal behavior is an important component in the overall assessment of personality and psychopathology. Interpersonal style has implications for social functioning and individual differences that could differentially effect the symptom presentation or manifestation in individuals seeking treatment. For many years others (e.g., Anchin & Pincus, 2010; Critchfield & Benjamin, 2008; Horowitz, 2004; McLemore & Benjamin, 1979; Pincus & Ansell, 2003) have argued that greater attention to interpersonal style in the assessment of psychopathology would enhance understanding of individual patients and the formulation of treatment plans. However, most multiscale inventories used for clinical assessment focus heavily on the internal dispositions of the respondent without including a theoretically based assessment of the individual’s interpersonal style. One exception to this trend is the Personality Assessment Inventory (PAI; Morey, 1991, 2007), which includes two scales for the assessment of interpersonal style together with scales measuring psychopathological syndromes and other clinical variables. Although the PAI has been used in a variety of clinical settings and for an assortment of respondent groups, the PAI interpersonal scales have received relatively less attention than the other scales. The purpose of this study is to evaluate the validity of these PAI interpersonal scales using two established measures of interpersonal style and functioning.

According to interpersonal theorists (Carson, 1969; Kiesler, 1983; Leary, 1957; Sullivan, 1953; Wiggins, 1979), individual differences in interpersonal style give rise to social behavior that is generally consistent over time and across situations. According to Sullivan’s (1953) interpersonal theory, personality is inextricably linked to interpersonal learning and relating such that the understanding of the self and others is made manifest within the “interpersonal situation.” Derived from this theory, Leary (1957) articulated a structural model in which individual differences in interpersonal traits and behaviors can be integrated and understood. These individual differences can manifest in a variety of domains including interpersonal traits (Wiggins, 1979, 1990) and interpersonal problems (Horowitz, Alden, Wiggins, & Pincus, 2000) and are typically conceptualized within a structural model consisting of two dimensions of affiliation, communion, or warmth and agency, control, or dominance (Carson, 1969; Freedman, Leary, Ossorio, & Coffey, 1951; Lorr & McNair, 1965; Moskowitz, Suh, & Desaulniers, 1994; Paddock & Nowicki, 1986; Wiggins, 1979). This model is termed the interpersonal circumplex (IPC). The IPC model depicts a geometric representation of an individual’s interpersonal style by placing him or her in the two-dimensional space created by the orthogonal dimensions of warmth and dominance (see Figure 1). An individual’s interpersonal style consists of a blend of his or her relative standing on warmth and dominance, such that a warm and dominant individual might behave in an extraverted manner, whereas a cold but equally dominant individual might behave in a disagreeable manner. Although the metaconstructs within the IPC can be termed communion and agency, different models articulate different representations of the dimensions of the IPC depending on the focus of the assessment measures (e.g., problems vs. motives) and depending on the interpersonal or attachment literature tradition from which the assessment measure is derived (Critchfield & Benjamin, 2008; Horowitz, 2004; Pincus & Ansell, 2003).

Several assessment measures have been developed that assess a variety of interpersonal behaviors, problems, messages, motives, and goals. An important factor in the evaluation of IPC measures is their geometric fit to a circumplex model. Although discriminant validity between the scales is important in establishing the orthogonal nature of the dimensions they represent, each dimension should also demonstrate sensitivity to constructs that are oblique to those dimensions (Pincus, 1994). This circumplex structure maintains that the correlations for the octants should have a defined circular ordering of correlations with decreasing positive values and then increasing negative values around the first 180° of the circle. In a perfect circumplex, octant scales located at 90° from each other are orthogonal, and thus,
should not be correlated. Octant scales located at 180° from each
other should have identical but inverse magnitude of correlation.
This allows for the accurate assessment of the off-axis blends
of the two main dimensions. The PAI (Morey, 1991, 2007) is a
self-report inventory of adult personality and psychopathology
with several attractive features. The scales of the PAI do not
have item overlap, thereby increasing discriminant validity be-
 tween scales and decreasing the artifactual relationship between
scales. The items were written in simple language to reflect the
phenomenology of disorders and traits. The final items were se-
lected using both rational and empirical approaches, unlike the
highly empirically weighted methodologies of other inventories.
Finally, the PAI addressed continued criticisms that multiscale
inventories ignore interpersonal behavior by including two in-
terpersonal scales, Dominance (DOM) and Warmth (WRM).
These scales were based on the concepts introduced by Leary
(1957), Wiggins (1979), and others; they purport to measure the
main two dimensions of the IPC. The DOM scale includes items
indicating a “forceful, confident, controlling personality, in con-
trast to a more self-critical, passive, and timid style of relating
to others” (Morey, 1991, p. 74). The WRM scale includes items
indicating a “sociable, understanding, and agreeable personal-
ity style, as opposed to a frank, strict, and critical interpersonal
orientation” (p. 74).

The original test manual for the PAI reports good internal
reliability for both WRM and DOM, with coefficient alphas ranging
from .78 to .83 across the community, clinical, and college
normative samples (Morey, 1991). Test-retest correlations over a 4-
week interval are reported at .68 for DOM and .77 for WRM. The
original validation studies of DOM and WRM examined its cor-
relations with Wiggins’s Interpersonal Adjectives Scale (IAS;
Wiggins, Trapnell, & Phillips, 1988) in a sample of 85 commu-
nity adult respondents. DOM correlated .61 with the dominance
scores on the IAS and .25 with nurturance scores on the IAS.

WRM correlated .65 with the nurturance scores on the IAS and
.08 with dominance scores on the IAS. Further evaluation of the
validity of DOM and WRM has not kept pace, however, with
research on the other PAI scales since its publication. Aside
from some unpublished studies presented in the revised test
manual (Morey, 2007), the interpersonal scales have not been
independently examined for their convergence with established
measures of the IPC. This is a potentially serious omission, as
these scales are an important part of the newer supplemental
scores on the PAI, such as the Treatment Process Index (Morey,
1996, 2003). They are also used in several algorithms designed
to make recommendations about specific treatment modalities
(Morey, 1996; Morey & Hopwood, 2007). Prediction of treat-
ment response is an important goal of personality assessment,
and research on the IPC has demonstrated its relevance to ther-
apeutic alliance and treatment outcome (Borkovec, Newman,
Pincus, & Lytle, 2002; Hopwood, Clarke, & Perez, 2007; Huber,
Ruiz et al., 2004; Stepp, 2008). Therefore, validating the cir-
cular structure of the PAI interpersonal scales would support
the potential utility of the PAI for studying therapeutic process
in the IPC tradition. Moreover, if the PAI scales were found to
be equivalent to other established IPC measures, then the PAI
could be administered in lieu, saving resources and testing
time for patients. Studies examining the structural convergence
with other interpersonal circumplex measures besides the IAS
are also needed. In particular, research using circumplex mea-
sures that focus on interpersonal problems relevant to work with
patients would provide useful additional information about the
clinical value of the PAI interpersonal scales.

Two of the most commonly used measures of the IPC are
the IAS (Wiggins, 1995) and the Inventory of Interpersonal
Problems—Short Circumplex (IIP–SC; Soldz, Budman, Demby,
& Berry, 1995). These two measures differ in their focus on
basic interpersonal traits (IAS) versus interpersonal problem
behaviors (IIP–SC), but both measures have well-established
circumplex structure, are associated with one another, and rep-
resent both normal and abnormal interpersonal styles as blends
of the warmth and dominance dimensions (Alden, Wiggins, &
Pincus, 1990; Gurin & Pincus, 2000; Hopwood, Pincus, De-
Moor, & Kooce, 2008). Accordingly, Study 1 replicates the
prior validation work of Morey (1991) by correlating the PAI
scales DOM and WRM with the IAS axes. Study 2 extends this
research by correlating DOM and WRM with the IIP–SC. Both
studies also examine the circular structure of the two PAI scales
using the octant scores from the IAS and the IIP–SC.

STUDY 1

Method
Participants. One hundred fourteen normal-age freshmen
college students (56 male, 58 female) were recruited to par-
ticipate in a study of roommate relationships (Ansell, Kurtz,
& Markey, 2008). The majority of participants was recruited
through introductory psychology courses and received credit
toward course requirements in exchange for participation. Eli-
geble students were also contacted through campus mail about
the study. Sixty-eight students (60%) received credit toward
course requirements in exchange for participation, and 46 stu-
dents (40%) received $10 compensation for completing the
study protocol.
VALIDITY OF THE PAI INTERPERSONAL SCALES

Measures

PAI (Morry, 1991, 2007): The PAI is a 344-item multiscale inventory designed to measure a wide array of clinical constructs. Each item is rated on a 4-point response format labeled False, Slightly True, Mainly True, and Very True. This study focuses on the PAI Interpersonal scales, Dominance (DOM) and Warmth (WRM); each of these scales is composed of 12 items that assess the main dimensions of the IPC. Reliability of the DOM and WRM scores in this sample was estimated using coefficient alpha. The obtained values of alpha were .82 for DOM and .73 for WRM; the two scales correlated at $r = .26$. The sample means for DOM and WRM are highly comparable to those of 1,051 respondents in the college normative sample (Cohen’s $d = .09$ for DOM and $-.11$ for WRM).

IAS (Wiggins, 1995): The IAS is designed to measure the two dimensions that underlie the interpersonal circle: Dominance and Nurturance. The measure consists of 64 trait adjectives that are rated on an 8-point response format ranging from 1 (Extremely Inaccurate) to 8 (Extremely Accurate). A glossary is included with the test booklet to clarify the meaning of unusual terms. The 64 items of the IAS provide scores on the eight segments of the IPC: these 8-item subscales are called octant scores. The octant scores are combined in a weighted formula to determine the participant’s coordinate position on the two axes of the circumplex. The IAS has been shown to have excellent circumplex structure and to be a valid and reliable measure with college students (Gurtman & Pincus, 2000; Wiggins, 1995; Wiggins et al., 1988). All scores were standardized using same-sex college student norms. Alpha coefficients for the octant scales in this sample ranged from .79 (KJ: Unassuming-Impersonal) to .91 (BC: Arrogant-Calculating).

Procedure. Following informed consent, participants were administered the IAS and the PAI scales. The IAS was completed before the PAI in every case. In addition to self-ratings on these measures, participants completed a series of questionnaires about their roommate and their relationship quality unrelated to this study (see Assel et al., 2008). On completion of the questionnaires, participants were given a written debriefing statement and compensated with cash or course credit.

Results and Discussion

Scores on the IPC dimensions of warmth and dominance were calculated for the IAS and the PAI scales. Table 1 reports the correlations between the DOM and WRM scores of the PAI and the axis coordinates of the IAS. Convergent validity was assessed by examining the same-axis correlations and discriminant validity was assessed by examining the off-axis correlations. The convergent validity of the PAI interpersonal scales with their respective IAS axis coordinates was supported by large correlations ($r_{dom} = .67$, $r_{wm} = .82$). Discriminant validity was somewhat compromised by a small correlation between PAI DOM and IAS Warmth ($r = .26$).

Next, the IAS DOM and WRM scores were used to compute the amplitude, angular displacement, and the estimated correlations of the eight IAS octants with the PAI interpersonal scales. With an eight-octant circumplex as the criterion, the pattern of correlations between the octant scores and the PAI DOM and WRM scales should take on a sinusoidal form, as illustrated in this formula (Gurtman, 1992):\footnote{Many assessments of the interpersonal circumplex employ the structural summary method, which results in an omnibus $R^2$ coefficient. However, in our analyses we used dimensional scores (not octant scores) to estimate correlations for each octant; $R^2$ values are not reported using this method; see Gurtman, 1992, 1994).}

\begin{equation}
    r_i = e + a \cos(\theta_i - \theta)
\end{equation}

where $r_i$ is the expected correlation of the PAI score with octant $i$, $e$ is the elevation of the curve, $a$ is the amplitude of the curve, $\theta_i$ is the angle of octant $i$, and $\theta$ is the angular displacement of the curve.

The elevation of the curve represents the average correlation of a given PAI score with the eight octant scores. A scale with perfect circumplex structure will obtain elevation values near zero (e.g., the decreasing positive, increasing negative, decreasing negative, and then increasing positive correlations with octant scores around the circumplex will average out such that the overall elevation is minimal). The elevation value of .01 for PAI DOM and .04 for PAI WRM presented in Table 1 demonstrate good circumplex structure for both scales with respect to elevation.

The amplitude of the curve represents the highest positive correlation of a PAI score across the eight octant scores, minus the elevation of the curve. Practically, amplitude represents the peakness of the curve or the extent of interpersonal prototypicality or content inherent in the PAI scale. Because the dimensions of dominance and warmth are theoretically orthogonal, it is possible to interpret the amplitude for each PAI score in a manner similar to the multiple $R$ between that score and the IPC axes (Gurtman, 1992). Therefore, the amplitude can also be considered an effect size estimate of the “interpersonalness” of the PAI scales. The amplitude of a given PAI score is calculated using this formula (Wiggins & Broughton, 1991):

\begin{equation}
    \text{amplitude} = [(r_{DOM})^2 + (r_{WM})^2]^{1/2}
\end{equation}

where $r_{DOM}$ is the correlation between IPC dominance and the PAI score and $r_{WM}$ is the correlation between IPC warmth and the PAI score.

Table 1. Correlations and circumplex structural summary parameters between PM Interpersonal Scales and IAS scores.

<table>
<thead>
<tr>
<th>IAS Axis Coordinates</th>
<th>PAI DOM</th>
<th>PAI WRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominance</td>
<td>.67*</td>
<td>.09</td>
</tr>
<tr>
<td>Nurturance</td>
<td>.26*</td>
<td>.82*</td>
</tr>
<tr>
<td>Elevation</td>
<td>.01</td>
<td>.04</td>
</tr>
<tr>
<td>Amplitude</td>
<td>.72</td>
<td>.63</td>
</tr>
<tr>
<td>Angular Displacement</td>
<td>.69</td>
<td>.81</td>
</tr>
</tbody>
</table>

Note. $n = 114$. PAI = Personality Assessment Inventory; DOM = Dominance; WRM = Warmth; IAS = Interpersonal Adjectives Scales.

*p < .05.
The amplitude can range from .00 (the PAI scale correlates equally to all IAS octants) to 1.00 (the extent to which the PAI scale discriminates from other IAS octants). The amplitude values obtained for DOM and WRM in relation to the IAS octants are presented in Table 1. The amplitude for PAI DOM was .72 and the amplitude for PAI WRM was .63. These values indicate that both scales of the PAI are fairly well saturated with interpersonal content and discriminate from other octants as assessed by the IAS.

The angular displacement of the curve is the point at which a PAI score has its highest positive correlation with the IPC and represents the angular location of that PAI scale on the circumplex. Theoretically, the PAI scale that measures dominance should obtain an angular location value near 90° on the IAS and the PAI scale that measures warmth should obtain an angular location value near 0° (or 360°) on the IAS. The angular displacement of a given PAI score is calculated using this formula (Wiggins & Brougham, 1991):

$$\text{angular displacement} = \arctan\left(\frac{r_{xc}}{r_{wm}}\right)$$  

The resulting angular displacements for DOM and WRM in relation to the IAS are presented in Table 1. The angular location for DOM of 69° places it just within the PA (Assured-Dominant) segment of the IAS, but it is near the boundary with the NO (Gregarious-Extroverted) octant. The angular location for WRM of 8° places it well within the LM (Warm-Agreeable) segment of the IAS, off by 8° from the theoretical target value of 0°. Both values represent acceptable angular locations for the PAI interpersonal scales.

The sinusoidal curve is based on the parameters of amplitude, elevation, and displacement (see Figure 2). By applying the calculated amplitude, elevation, and displacement values to the sinusoidal formula presented earlier, it is possible to estimate correlations of the PAI scales to the IAS octants and thereby create a graphical representation of the correlations between DOM and WRM and the IAS octants (see Figure 3). In the current analysis IAS DOM and WRM scores were used to estimate these correlations because this allows for a substantial increase in reliability of measurement and a decrease in the likelihood of Type I errors (see Markay & Markay, 2006; Markay, Markay & Tinsley, 2005) than if the eight IAS octants were used separately. Theoretically, the PAI DOM scale should correspond to the PA octant and inversely to the HI octant, whereas the PAI WRM scale should correspond to the LM octant and inversely to the DE octant. As shown in Figure 3, individuals who scored high on DOM were most likely to report interpersonal styles related to the PA (Assured-Dominant) octant ($r = .63$) and were least likely to report interpersonal styles related to the HI octant ($r = -.59$). Individuals who scored high on WRM were most likely to report interpersonal styles related to the LM (Warm-Agreeable) octant ($r = .66$) and were least likely to report interpersonal styles related to the DE octant ($r = -.58$).

**STUDY 2**

**Method**

Participants. One hundred seventy normal age college students (82 male, 88 female), mostly freshmen and sophomores, were recruited to participate in this study. All participants received credit toward course requirements in exchange for participation.

Measures

PAI (Markay, 1991, 2007): The PAI was administered again in Study 2. The obtained values of alpha were .79 for DOM and .80 for WRM; again, the two scales correlated at $r = .26$. The means for DOM and WRM in Study 2 are also highly comparable to those in the college normative sample (Cohen’s $d = -.05$ for DOM and -.01 for WRM).

IIP-SC (Hopwood et al., 2008; Soldz et al., 1995): The IIP-SC is a 32-item version of the Inventory of Interpersonal Problems (IIP; Horowitz, Rosenberg, Baer, Ureno, & Villaseñor, 1988). Alden et al. (1990) used the IPC model to construct a 64-item circumplex version (IIP-C) from the original 127-item IIP of Horowitz et al. (1986). The IIP-C has been validated...
through its use in clinical assessment and treatment research as well as with normal samples (e.g., college students; Gurtman, 1996; Horowitz, Rosenberg, & Bartholomew, 1993; Pincus & Wiggins, 1990). This 64-item version was further reduced by Soldz et al. (1995) to create the short circumplex form used in this study. The IIP-SC, which has been normed for use in college students (Hopwood et al., 2008), consists of sentences that describe difficulties in relating to others (e.g., “I try to control other people too much”), and these statements are rated using a 5-point response format labeled not at all, somewhat, moderately, very, and extremely. The items are scored on eight octant scales that can be combined in a weighted formula to determine the coordinate positions on the two main axes of the circumplex. The octant scales were standardized using the sample means and standard deviations. Scores were ipsitized to remove the general distress factor within the IIP as is the commonly accepted practice when using the IIP to examine correspondence to IPC structure (Gurtman & Pincus, 2000; Horowitz et al., 1988). Alpha coefficients for the octant scales in this sample ranged from .70 (PA: Dominant) to .85 (HI: Nonassertive).

Procedure. Following informed consent, participants completed the PAI and the IIP-SC as part of a larger battery of questionnaires that were administered in a fixed order. The PAI was completed before the IIP-SC in every case. On completion of the questionnaires, participants were given a written debriefing statement and compensated with course credit.

Results and Discussion

Scores on the IPC dimensions of warmth and dominance were calculated for the IIP-SC and the PAI scales. Table 2 reports the correlations between the DOM and WRM scores of the PAI and the axis coordinates of the IIP-SC. As in Study 1, convergent validity of the PAI interpersonal scales with their respective IIP-SC axis coordinates was supported by large correlations (r_{DOM} = .53, r_{WM} = .63). However, discriminant validity was improved relative to Study 1, with near-zero correlations observed between both PAI scales and their alternate axes on the IIP-SC.

As in Study 1, the IAS DOM and WRM scales were used to compute the amplitude, angular displacement, and the estimated correlations of the eight IAS octants with the PAI interpersonal scales. Table 2 presents the elevation, amplitude, and angular displacement values resulting from these analyses. Theoretically, elevation should be minimal (e.g., close to 0) and elevation values for the PAI DOM and WRM scales again show good circumplex structure (Elevation_{DOM} = .01, Elevation_{WM} = .00). The amplitude indicates the interpersonal content of the PAI scales. The amplitude values (Amplitude_{DOM} = .54, Amplitude_{WM} = .63) again reveal good saturation of interpersonal content as assessed by the IIP-SC. The angular location obtained for PAI DOM (97°) places it near the center of the PA (Dominant-Assured) segment of the IIP-SC. The angular location for PAI WRM was identical to the hypothesized theoretical value (0°) of the LM (Warm-Agreeable) segment. Figure 4 provides a graphic summary of the parameters of the sinusoidal curve and the relations between the octant scales of the IIP-SC and the PAI scales. As shown in Figure 4, individuals who scored high on DOM were most likely to report interpersonal styles related to the PA (Dominant-Assured) octant (r = .53) and were least likely to report interpersonal styles related to the HI (Unasserted Submissive) octant (r = −.53) which is consistent with expectations. Consistent with theoretical expectations, individuals who scored high on WRM were most likely to report interpersonal styles related to the LM (Warm-Agreeable) octant (r = .63) and were least likely to report interpersonal style related to the DE (Cold-hearted) octant (r = −.63).

**TABLE 2**—Correlations and circumplex structural summary parameters between PAI Interpersonal scales and IIP-SC scores.

<table>
<thead>
<tr>
<th></th>
<th>PAI DOM</th>
<th>PAI WRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominance</td>
<td>.53*</td>
<td>.00</td>
</tr>
<tr>
<td>Nurturance</td>
<td>−.07</td>
<td>.63*</td>
</tr>
<tr>
<td>Elevation</td>
<td>.01</td>
<td>.00</td>
</tr>
<tr>
<td>Amplitude</td>
<td>.54</td>
<td>.63*</td>
</tr>
<tr>
<td>Angular displacement</td>
<td>97°</td>
<td>0°</td>
</tr>
</tbody>
</table>

*Note. n = 170; PAI = Personality Assessment Inventory; DOM = Dominant; WRM = Warm; IIP-SC = Inventory of Interpersonal Problems-Short Circumplex. *p < .05.

**FIGURE 4**—Circumplex projections of the PAI interpersonal scales on the IIPSC. Note: PAI = Personality Assessment Inventory; IIPSC = Inventory of Interpersonal Problems-Short Circumplex; PA = Dominant; BC = Vindictive; DE = Cold; FG = Socially Avioidant; HI = Nonassertive; JK = Explorative; LM = Overly Nurturant; NO = Intrusive.

**GENERAL DISCUSSION**

The constructs of the IPC are proposed to be important for enhancing clinical diagnosis and understanding treatment process; however, these constructs are absent from most multiscale inventories used in psychological assessment. The PAI includes scales to measure the two main axes of the IPC, but there has been limited research published on their validity. Two studies examined the convergent validity of the PAI interpersonal scales, DOM and WRM, using two widely used measures of the IPC, the IAS and the IIP-SC. Overall, the results supported the validity of DOM and WRM, showing high convergent correlations with the main axes of both IPC measures. Discriminant validity was excellent using the IIP-SC as the criterion measure and acceptable using the IAS. Circumplex analyses from both studies showed that DOM projects, as expected, into the PA (Dominant-Assured) segment and that WRM projects, as expected, into the
ACKNOWLEDGMENTS

This research was supported in part by a Research Support Grant from Villanova University. The authors are grateful to Aaron Pincus for comments on an earlier draft, and to Mallory Bileau, Allie Kurti, Matthew Litke, Amy Pastva, and Amanda Sizemore for assistance with data collection and management.

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