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## Interpersonal Development, Stability, and Change in Early Adulthood

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### Abstract

**Objective**—This goal of this research was to explore the development of the interpersonal system mapped by the interpersonal circumplex in early adulthood (Ages 18-22).

**Method**—This study uses the Longitudinal Study of Personality Disorders sample (N = 250; 53% Female). Participants completed the Revised Interpersonal Adjective Scales (Wiggins, Trapnell, & Phillips, 1988) in their freshman, sophomore, and senior years of college. Estimates of structural, rank-order, mean, individual, and ipsative stability were calculated for the broad interpersonal dimensions of Dominance and Affiliation, and also the lower-order octant scales. Additionally, the interpersonal profile parameters of differentiation and prototypicality were calculated at each wave and explored longitudinally, and also used as predictors of interpersonal stability.

**Results**—We found excellent structural and high rank-order and ipsative stability in the interpersonal scales over this time period. Mean increases on the Affiliation axis, but not on the Dominance axis, were found to mask differential rates of change among the octant scales, along with significant individual variation in the rates of change. Interpersonal differentiation and prototypicality were related to higher stability in overall interpersonal style.

**Conclusions**—Results point to evidence of both stability and nuanced change, illuminating some of the features of the structural variables that can be derived from interpersonal circumplex profiles.

### Keywords

Interpersonal Circumplex; Personality Development; Individual Growth; Personality Stability; Personality Change

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In recent decades, there has been much empirical investigation and ensuing debate on whether, and if so when and how personality changes or develops across the life-span (Costa & McCrae, 1997; Roberts, Wood, & Caspi, 2008). It now seems to be incontrovertible that in adulthood personality traits are highly stable, while not being entirely so, and the level of stability depends, in part, on how stability is defined. In adulthood, rates of mean change in broad personality traits are modest (Roberts, Walton, & Viechtbauer, 2006), individual differences in these traits are generally maintained (Roberts, Caspi, & Moffit, 2001; Roberts

& Delvecchio, 2000), and individuals appear to mostly preserve their intraindividual profile over time (i.e., ipsative stability; Donnellan, Conger, & Burzette, 2007; Roberts et al., 2001). However, high stability is not stasis, and both normative and idiosyncratic development and change occurs. For example, individuals demonstrate significant interindividual heterogeneity in intraindividual trajectories around the population's mean rate of change (Mroczek & Spiro, 2003; Vaidya, Gray, Haig, Mroczek, & Watson, 2008), rank-order stability coefficients are significantly different from unity (Roberts & Delvecchio, 2000), and there is a consistent minority of individuals whose profile changes drastically over time (Donnellan et al., 2007; Roberts et al., 2001; Robins, Fraley, Roberts, & Trzesniewski, 2001). Thus, the accumulation of findings points to a nuanced picture of personality development and change. Research that describes the basic rates and patterns of stability and change in personality is important because it serves as a necessary base from which to launch further excursions that investigate the determinants and consequences of such stability and change.

Although there is evidence for development throughout the life span, early adulthood has been identified as a time of marked personality development (Roberts et al., 2006). These years, which bracket the transition from adolescence to adulthood, have been the focus of much theoretical and empirical interest (Arnett, 2000). This maturational period, which includes the college years, has been recognized for its unique developmental challenges (Arnett, 2000; Rindfuss, 1991). Of primary importance for individuals in our society during this period is learning how to effectively get ahead while getting along (Hogan, 1983, 1996). During this time many leave home for the first time, move in with new people, take their first jobs, attend college, begin their first serious romances, incur debt, and become ultimately responsible for their behaviors. Each of these activities is associated with, if not driven by interpersonal functioning. As such, interpersonal development, stability, and change during this time period are essential targets of investigation.

The rapid accumulation of studies of personality development in early adulthood over the last decade reflects the importance of this time period (e.g., Donnellan et al., 2007; Robins et al., 2001; Vaidya et al., 2008). However, a notable absence from this literature has been the Interpersonal Circumplex (IPC) model of personality (see Figure 1). Despite its prominence in the broader personality literature (e.g., Horowitz & Strack, 2010; Pincus & Ansell, in press), to date no study has used the IPC to investigate the long-term development, stability, and change of personality in any age group. This absence is not trivial, given that longitudinal investigations of Extraversion and Agreeableness, the most interpersonal of the Big Five traits, have thus far demonstrated equivocal mean change findings (reviewed below), especially in early adulthood. The IPC is a theoretical and geometric model (Leary, 1957) that organizes interpersonal functioning around the meta-concepts of Agency (Assertiveness/Power/Dominance) and Communion (Nurturance/Love/Affiliation; Wiggins, 1991) at multiple-levels of personality expression ranging from the neurobiological, trait, motivational, social-cognitive, and behavioral (see Pincus & Wright, 2010). As traits, Dominance and Affiliation can be understood as rotational variants of Extraversion and Agreeableness (McCrae & Costa, 1989; Pincus, 2002).

Modern IPC measures divide the full breadth of interpersonal content in to eighths, assigning a scale to each octant of the circle (see Figure 1). This offers a balance of fidelity and reliability, allowing for relatively fine discriminations of interpersonal content, while also providing sufficiently reliable measurement. The associations among octants, when represented in correlations, gives rise to a circulant pattern (i.e., circumplex) first defined by Guttman (1954). The relationship between any two scales diminishes as the angle between them grows, with the highest correlation occurring among adjacent scales, and the lowest correlation occurring between scales at 180° (i.e., opposite sides of the circle). The measure

used in the current study, the Revised Interpersonal Adjective Scales (IAS-R; Wiggins, Trapnell, & Phillips, 1988) was constructed such that its eight scales possess a circumplex structure, with scales at 90° being approximately orthogonal, and those at 180° being strongly negatively correlated. The octants can be understood as marking the poles of bipolar dimensions or “axes”, allowing for a separate study of each end of these continua. The octants on the primary vertical and horizontal axes are associated with pure Dominance and Affiliation, respectively, whereas the axes marking the diagonals are blends (e.g., Introversion is both submissive and cold). Finally, the two broad orthogonal domains of Dominance and Affiliation are derived from a weighted combination of the octants based on their geometric locations on the circle (Wiggins, Phillips, & Trapnell, 1989).

Most of the work on personality development has either used, or been summarized within, the framework of the Big Five traits (e.g., Roberts et al., 2006). Mean change of Extraversion has been associated with inconsistent results, with some investigators finding increases, and others finding stability in scores over time (e.g., Schuerger, Zarrella, & Hotz, 1989; Vaidya et al., 2008). These results have been clarified by separating Extraversion into subcomponents of social dominance and vitality, with the former increasing and the latter not (Roberts et al., 2006). Relatedly, some studies find robust increases in Agreeableness over the college years (Neyer & Lehnart, 2007; Robins et al., 2001; Vaidya et al., 2008). Yet others have found decreases in agreeableness (Neyer & Asendorpf, 2001) or in similar variables (e.g., Social Closeness; Donnellan et al., 2007; Roberts et al., 2001). And, as might be expected given the equivocal nature of individual study results, the meta-analytic result has been one of no change in this time period (Roberts et al., 2006). These ambiguous results for agreeableness might be clarified by a more fine-grained analysis of Affiliation, as has been the case for Extraversion.

In fact, the vast majority of the research on personality development has been limited to broad trait domains, with investigations of the facets of these domains lagging far behind. The few studies that have examined facet-level change generally do not speak to change in early adulthood. For example, Bleidorn, Kandler, Riemann, Angleitner, and Spinath (2009) studied development of 30 trait facets in adults primarily in their 30's, whereas Terracciano, McCrae, Brant, and Costa, (2005) examined primarily older-adults, but similar in-depth investigations do not exist in the early adult age-group.<sup>1</sup> A recent cross-sectional study (Soto, John, Gosling, & Potter, 2011) measured yearly Big Five traits and a small number of associated facets from childhood through adulthood. However, study design limits the conclusions to mean differences and structural stability despite the impressively large sample. Other studies are limited by the use of large time scales (e.g., 5-10 year increments; Bleidorn et al., 2009; Jackson et al., 2009), creating a tradeoff in fidelity between traits and time. What little work has been done at a more detailed level of analysis has proven illuminating, as most traits subsume facets that develop at differing rates. Given the limited information available about interpersonal trait development at the facet level in early adulthood, and the demonstrated utility of this level of analysis in other age groups, it is important to conduct further rigorous investigations of development, stability, and change in the interpersonal traits in early adulthood.

We draw our sample from the Longitudinal Study of Personality Disorders (LSPD; Lenzenweger, 2006), a large, prospective multiwave study of personality, temperament, and personality pathology. Three waves of data have been collected thus far charting the

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<sup>1</sup>The Terracciano et al. (2005) study applied a sophisticated hierarchical linear modeling approach to studying mean and individual change over the adult years. However, although their sample including individuals 20 years-old and older, the majority of the sample was older adults (mean age = 65.5 years) and the results were presented in graphs and discussed for ages 30-90, but did not provide any detail on the early adulthood age-group.

development of basic personality and its disorder across the college years (i.e., 18-22). This is the only sample we are aware of that has assessed the participants using a well-validated IPC based measure, the IAS-R. The IAS-R provides an assessment of Dominance and Affiliation at the broad domain level and the more specific component parts of such domains as assessed by the octants of the IPC. Therefore, the current paper answers the call for more detailed investigations of personality development that focus on lower-order personality traits (Roberts et al., 2008; Roberts et al., 2006). Additionally, as will be described below, the current investigation uses person specific parameters based on the geometric structure of the IPC in a new approach to studying personality stability and change.

Five complementary approaches to measure stability and change in personality development have been routinely employed (e.g., Donnellan et al., 2007; Lenzenweger, 1999; Roberts et al., 2001; Robins et al., 2001). *Structural stability* refers to the stability in the pattern of covariation in variables across time. In other words, do the variables of interest relate to each other in the same way at each time point of the study? This is generally seen as a prerequisite for conducting further analyses of development and change over time. No prior research has investigated the structural stability of the IAS-R over time periods of multiple years.

*Rank-order stability* reflects the maintenance of individual differences over time. This is assessed using the correlation between scores at two time points, and prior meta-analytic results have found rank-order stability values of  $r = .54$  for the age-group investigated here (i.e., 18-21.9 years-old; Roberts & Delvecchio, 2000). Differential stability appears to vary by age-group investigated (with stability increasing with age; Roberts & Delvecchio, 2000; Vaidya et al., 2008), by personality trait (Roberts et al., 2001), and by population of interest (e.g., borderline personality disorder is associated with less stability; Hopwood et al., 2009).

*Absolute or normative stability* refers to changes in mean level over time. Changes in the average level of personality dimensions over time are distinct from changes in differential stability. Absolute change refers to the group change, irrespective of the individual shuffling that may occur. Significant mean change in personality traits is thought to map maturational and basic developmental processes be they biological, socialized, or a combination of the two. As reviewed above, mean change in personality traits associated with interpersonal functioning has been equivocal in the age group charted here and requires more empirical investigation. It is difficult to predict whether domain level Dominance or Affiliation will demonstrate mean change, as they are very broad variables that blend content such as social dominance, gregariousness, warmth, arrogance, and agreeableness. It may be that Affiliation will increase, as higher warmth and communion are associated with increased functional maturity (Roberts et al., 2001, 2003). However, the more detailed analysis of the IPC octant scales likely will shed light on some of the past equivocal results associated with Agreeableness reviewed above.

One of the important contributions of this study is the ability to chart change among lower-order personality constructs. We expect that there will be congruent but opposite change in the octants which isolate the poles of Dominance, such that Assured-Dominance will increase, and Unassuredness-Submissiveness will decrease. In contrast, we do not expect Gregariousness-Extraversion to increase and Aloof-Introversion is expected to remain stable as well, as these are conceptually akin to the social vitality variables that have previously demonstrated considerable stability. We expected to find that Arrogant-Calculating declines and Unassuming-Ingenuous increases. This would also be associated with increased functional maturity and less antagonistic, brash, and self-centered behavior (Hogan & Roberts, 2004). Pure warmth and affiliation, marked by the octants of Warm-Agreeable and, inversely, Cold-Hearted, remain somewhat of a question. Warmth is an aspect of social

vitality, which is not expected to change; yet affiliating with others would seem to follow the principle of increased maturity.

*Individual stability* examines the variation in individual trajectories of change over time. This provides a quantification and statistical test of the individual level heterogeneity in trajectories, and determines if there is significant variability in trajectories. Individual stability has been assessed in a number of ways. However, individual growth curve (IGC) modeling offers the most sophisticated approach to charting the variability in individual trajectories, but requires more than two assessment points (Singer & Willett, 2003). Given that the LSPD has had three assessment points, we will examine heterogeneity in linear rates of change. Past studies have found significant interindividual variability in rates of personality change over time (Mroczek & Spiro, 2003; Vaidya et al., 2008) and we anticipate finding similar results here.

*Ipsative stability* assesses the stability of an individual's personality profile across time. As such, it is a person-centered approach to change, capturing intraindividual (i.e., within-person) variability or stability in personality organization. Most commonly, ipsative stability has been measured using Cronbach & Gleser's (1953)  $D^2$  statistic (see also Osgood & Suci, 1952) or the q-correlation (i.e., the product-moment correlation of individual profiles) across time-points. These approaches provide similar but slightly different information. The  $D^2$  statistic is a direct index of total difference between an individual's profiles at two time-points, is unbounded on the upper end, and is calculated as the sum of the squared differences between individual scales in the profile. Therefore it is a gross measure of the difference between two profiles, sensitive to changes in elevation, scatter, and shape. In contrast, the q-correlation controls for mean level and scatter in the profiles, providing a measure of consistency in the patterning (shape) of two profiles. Regardless of the method, it is common to find high levels of ipsative stability in personality profiles across time on the average (Donellan et al., 2007; Robins et al., 2001), and similar results are expected with the IPC scales.

IPC based measures are interesting in that they provide a framework for investigations based on circumplex structure. Although often summarized with the primary dimensions of Dominance and Affiliation, the IPC's circumplex structure arises from a specific pattern of multivariate relationships among the more fine-grained octant-level interpersonal variables. This feature can be contrasted with other personality models and measures, which do not define any specific structure among the component scales. Take for example the NEO Personality Inventory Revised (Costa & McCrae, 1992) facet scales; although they are expected to be correlated within a factor, there is no more specific facet-level structure offered. The same is true of other models and measures such as the HEXACO (Ashton & Lee, 2004). The nature of circumplex scales allows for interesting investigations based on the pattern of an individual's interpersonal profile.

The Structural Summary is an approach to summarizing circumplex data that builds on the structure described above (Gurtman & Balakrishnan, 1998; Wright, Pincus, Conroy, & Hilsenroth, 2009). Just as the pattern of correlations among circumplex scales is expected to result in a circular array, an individual's scores are also expected to conform to this pattern. Taking an individual's highest scale score, the predicted pattern of scores on the remaining scales would be slightly lower for scales measuring conceptually related content and decreasing as the angular distance increases. To illustrate, envision an individual who describes themselves as highly dominant; they are unlikely to also describe themselves as submissive at the trait level. To the extent that they describe themselves as dominant, however, they are likely to describe themselves with similar but slightly lower levels of related features, such as arrogance or gregariousness (i.e., adjacent octants). If the

prototypical predicted pattern of scores were perfectly met, their profile would be precisely sinusoidal in form (see Figure 2). This is because the scales conceptually and semantically constrain most individuals' patterns of responses.

Figure 2 illustrates how such a curve can be reduced to three structural parameters, *angular displacement*, *elevation*, and *amplitude*. The quantitative derivation of these parameters has previously been well summarized and is not repeated here for reasons of space (see Gurtman & Pincus, 2003 and Wright et al., 2009 for accessible reviews). Nevertheless, the interpretation of these parameters merits some discussion. A profile's *angular displacement* refers to the location on the IPC associated with an individual's predominant interpersonal "theme" or "typology" (Leary, 1957; see also Kiesler, 1996). *Elevation* represents the average score across scales, and is anticipated to be zero in IPC measures without a substantive first factor, like the IAS-R, because opposing scale scores should cancel each other out in calculation of the average. Individual profiles on the IAS-R with an elevation are most likely produced by specific response styles (e.g. acquiescence). *Amplitude* refers to how differentiated the profile is. It captures how much an individual discriminates, social-cognitively, between interpersonal content in describing their interpersonal style. Stated otherwise, it is the degree to which someone endorses that their interpersonal style is distinct. As can be seen in Figure 2, amplitude is the distance between the elevation (i.e., mean score), and the peak of the curve (i.e., the predominant interpersonal theme of the profile). Finally, the degree to which an individual's observed profile of scores matches a perfect cosine curve predicted from the structural summary parameters, or goodness-of-fit between the observed and predicted cosine curve is labeled,  $R^2$ . Conceptually this statistic captures how *prototypical* an individual's profile is, regardless of its specific theme.

Amplitude is identical, mathematically, to vector length (VL), which was originally used to summarize an interpersonal profile (e.g., Leary, 1957; Wiggins et al., 1989). Amplitude/VL, is highly relevant in the current context because it has long been associated with predictions about stability/rigidity in interpersonal behavior (see e.g., Tracey, 2005; Tracey & Rohlfing, 2010). Specifically, amplitude, which is associated with a more extreme profile (Wiggins et al., 1989), has been hypothesized to predict rigidity or a narrower sampling of interpersonal behaviors over time (Tracey, 2005). However, results from studies that have investigated this have been equivocal (Tracey 2005; Tracey & Rohlfing, 2010; Erickson, Newman, & Pincus, 2009). Although the current study is not examining stability in behavioral acts, related hypotheses can be associated with these structural variables as they pertain to longer-term interpersonal stability. In particular, a related hypothesis in this context would be that individuals with more differentiated and prototypical interpersonal profiles show less change in interpersonal style over time. This type of analysis will be the first of its kind; however it stands to reason that those individuals who begin the study with distinct and well-defined IPC profiles are more likely to maintain their interpersonal style over time.

In addition, differentiation and prototypicality, as variables, can be subjected to some of the standard change analyses described above—namely, mean and individual stability. Most meaningful, perhaps, will be the results from the mean change in each of these parameters. This will test whether, as individuals mature, their interpersonal profile becomes more or less differentiated and prototypical. It is easy to imagine that as people mature they become surer of themselves and who they are, and thus their differentiation and prototypicality increase. On the other hand, it may be that as individuals mature they become more aware of their multi-faceted nature, they view and describe themselves in less certain terms, and thus differentiation and prototypicality decrease. These contrasting hypotheses will be tested.

In summary, this study will be the first to examine the development, stability, and change in interpersonal style in early adulthood using the IPC framework. We will explore the

standard approaches to measuring personality development, but will expand beyond these by including analyses of structure, stability, and change using unique interpersonal profile parameters.

## Methods

### Participants

The 258 participants in the LSPD (Lenzenweger, 1999) were drawn from a population consisting of 2,000 first-year undergraduate students. Extensive detail concerning the initial participant selection procedure and sampling is given elsewhere (Lenzenweger, 2006). The 258 participants consisted of 121 males (47%) and 137 females (53%). The mean age of the participants at entry into the study was 18.88 years ( $SD = 0.51$ ). Participants were subsequently assessed at their second (age  $M = 19.83$ ;  $SD = 0.54$ ) and fourth (age  $M = 21.70$  years;  $SD = 0.56$ ) years of college. Of the initial 258 participants, 250 completed all three assessment waves and are included in these analyses. Six left the study, and two died in automobile accidents. Of these individuals 53% were female, 3.6% were African-American, 4.8% Hispanic/Latino, 72% Caucasian, 17.2% Asian/Pacific-Islander, 0.8% Native-American, and 1.6% Other.

### Procedure

**Structure of the LSPD Data**—As noted above, the LSPD has a prospective multiwave longitudinal design with participants evaluated at three points in time (i.e., first, second, and fourth years in college). At each wave, participants completed self-report measures of personality. The mean time between entry into the study (T1) and Wave II (T2) and Wave III (T3) was 0.95 years ( $SD = 0.14$ ) and 2.82 years ( $SD = 0.23$ ), respectively. The LSPD data are balanced, in that all participants have three waves of data, and are time structured such that each participant was assessed repeatedly on the same three wave schedule, although the time between assessments varies from case to case.

### Measures

**Revised Interpersonal Adjective Scales (IAS-R; Wiggins et al., 1988)**—This study uses the 64-item IAS-R which consists of eight scales assessing the eight octants of the IPC, which in turn can be converted into scores for the two primary domains of the IPC, Dominance and Affiliation, using standard scale weights (see Wiggins et al., 1989). Participants responded to each trait descriptive adjective (e.g., dominant, coldhearted) on an 8-point scale at each wave of the LSPD. Internal consistency ( $\alpha$ ) for the octant scales at each wave of assessment was high (Mean  $\alpha = .89$ ; range = .82-.92).

## Analysis and Results

### Structural Stability

To test for structural stability among the interpersonal scales over time, we used multi-group structural equation modeling to compare two models. The baseline model was estimated with individual latent factors for each octant scale that were defined by fixing the loading of the observed scales to 1.00 and the error variance to 0.00 and allowing the factor correlations to be freely estimated within and across each wave of data collection. This creates a pattern of factor correlations that are equivalent to the manifest matrix within each wave, and a fully saturated model (i.e.,  $df = 0$ ;  $\Delta\chi^2 = 0.00$ ;  $p = 1.00$ ). In the second, more constrained model, factor correlations and variances were fixed to be invariant across time-points. A non-significant chi-square change ( $\Delta\chi^2$ ) between the baseline and constrained models would be indicative of structural stability. This represents a highly stringent test of structural stability as all corresponding correlations and factor variances are tested for

equivalence across each of the three time points. The resulting change in model fit indicated that the IAS-R was structurally invariant across all three time-points ( $df = 72$ ;  $\Delta\chi^2 = 64.82$ ;  $p = .71$ ).

### Rank-Order Stability

Rank-order stability was assessed using the correlations between time-points on the interpersonal scales. Results are summarized in the three rightmost columns of Table 1. In general, each octant scale showed considerable rank-order stability regardless of the time between assessment points (range of  $r$ 's = .68 - .86). Stability decreased as a function of time between assessment points, with the relationship between T1 and T2 scores, the shortest time distance, being the highest. The most stable octants in terms of rank-order were Aloof-Introverted and Gregarious-Extraverted, the poles of the Introverted-Extraverted axis of the IPC. The least stable were Cold-Hearted and Unassuming-Ingenuous, but this was only relatively so, even these octants demonstrated considerable stability in individual differences. The domains of Dominance and Affiliation exhibited even higher differential stability between study waves

### Mean and Individual Level Stability

Mean-level and individual-level stability were studied using an individual growth curve (IGC) approach within a multilevel modeling framework. ANOVA is an unattractive approach for investigating mean change in this sample due to the variability in assessment timing for each individual. Multi-level models are unencumbered by this limitation, and treat time as a continuous variable. IGC analyses allow for the investigation of within-person change over time in personality traits (Singer & Willet, 2003). In this analytical framework, measurement occasions (Level 1) are treated as nested within individuals (Level 2). Therefore, each individual has a trajectory of change over time. The Level 1 model contains two important estimated growth parameters—the intercept and slope. The individual intercept parameter represents the mean elevation of the slope at the origin of the time scale. The individual slope parameter represents the rate of change per unit of time. IGC modeling allows the coefficients for these two parameters to vary randomly if there is significant interindividual variation in intercept and slope in the sample. That is to say, each individual is allowed to take on his or her own values for intercept and slope, which in turn can be explained by introducing between-person predictors at Level 2 in the model. The general equation in multi-level format for the models estimated is given here:

$$\begin{aligned} \text{Level 1 Model: } Y_{it} &= \beta_{0i} + \beta_{1i}(\text{Time}_{it}) + \epsilon_{it} \\ \text{Level 2 Model: } \beta_{0i} &= \gamma_{00} + u_{0i} \\ &\beta_{1i} = \gamma_{10} + u_{1i} \end{aligned}$$

where,  $Y_{it}$  is the outcome score (i.e., personality trait score) for individual  $i$  at time  $t$ ;  $\beta_{0i}$  is the intercept parameter of the hypothesized growth trajectory for individual  $i$ ;  $\beta_{1i}$  is the slope parameter for individual  $i$  (that is, the rate of change [yearly] in level of personality trait over time);  $\text{Time}_{it}$  is the time at which assessment  $t$  of subject  $i$  took place, measured in years, and centered on each individual subject's age at entry into the study; and  $\epsilon_{it}$  is a level 1 residual, or the unexplained portion of the outcome, across all occasions of measurement, for individual  $i$  in the population. It is assumed to be normally distributed with a mean of zero and a variance defined by  $\sigma_{\epsilon}^2$ .  $\gamma_{00}$  is the average intercept ( $\beta_{0i}$ ) (i.e., the mean score at the start of the study);  $\gamma_{10}$  is the average slope ( $\beta_{1i}$ ; i.e., rate of change);  $u_{0i}$  and  $u_{1i}$  are the level 2 residuals that represent the deviation in individual values in intercept and slope. Their variances are represented by  $\sigma_0^2$  and  $\sigma_1^2$ , and their covariance by  $\sigma_{01}$ .



Of importance for interpreting the results of IGC models are the fixed and random (i.e., variance) coefficients. The fixed coefficients ( $\gamma_{00}$  and  $\gamma_{10}$ ) can be interpreted straightforwardly in much the same way as basic multiple regression coefficients. These test whether the mean of the coefficients (i.e., intercept and rate of change) are significantly different from zero. The random effects test whether significant variability remains unexplained in the outcome variable (i.e., is there significant interindividual heterogeneity in intercept and slope). Additionally, the covariance between the intercept and slope is reported, but it is not a focus in this study. In our analyses, the models were fitted employing full maximum likelihood estimation using HLM-6 (Raudenbush, Bryk, Cheong, Congdon, & Du Toit, 2004).

The results of the growth curve analyses are summarized in Table 2. In addition to reporting raw parameters and significance values, we report effect sizes in the  $r$  metric (where  $r = \sqrt{(t^2) / (t^2 + df)}$ ) see Rosenthal & Rosnow, 1991), and model fit using the deviance or -2 times the log-likelihood (-2LL). Prior to all analyses scales were standardized using the original IAS-R sample (Wiggins et al., 1988), thus all values are in standard units. The fixed effects for the intercept serve to compare this sample to Wiggins' original IAS-R sample. On average, the current sample is more Affiliative, but no more Dominant than the original sample. This is mentioned only briefly here, as these are provided as descriptive statistics for the interested reader. The main focus is on the fixed and random effects associated with the slope. At the broadest level of analysis, the sample showed mean increases in Affiliation, but no mean change in Dominance. As noted above, these dimensions suffer from the same difficulties as other scales that have given previous equivocal results, namely they are quite broad. By examining the results of the octant scales the full and clearer picture emerges.

Four of the octant scales demonstrate mean change over the course of the study. To summarize, Assured-Dominance increases while Unassured-Submissiveness decreases and Unassuming-Ingenuousness increases while Arrogant-Calculatingness decreases. The results for Assured-Dominance accord well with prior findings of an increase in social dominance. However, a more nuanced picture emerges when considering that there is no change in the Gregarious-Extraverted octant, as expected, but there are significant declines in the Arrogant-Calculating octant. Each of these octants is adjacent to Assured-Dominance and contains considerable dominant content, but this is moderated by the affiliative content of the scale resulting in very different mean trajectories. The inverse of these processes can be found on the other side of the IPC with the decrease in the Unassured-Submissive octant, but increase in the Unassuming-Ingenuous octant, while Aloof-Introversion remains stable. Thus, through early adulthood individuals become more assertive, self-assured, and confident, while also becoming less boastful, cocky, and argumentative. Finding opposite patterns of mean growth in these adjacent octants is particularly interesting because these variables are strongly conceptually and empirically related cross-sectionally. Despite being highly related, each of these lower-order scales demonstrates a distinct maturational/developmental trend. It is worth noting that although the mean changes catalogued in Table 2 appear modest, these capture rate of change *per year*, and thus they do not represent the total change over the study.<sup>2</sup> Further, mean change says nothing about the variability in that change, which we turn to next.

The intercept and slope variance components in Table 2 represent the variability of residuals around the mean parameters. For all of the octants and two dimensions of the IPC there is significant variability in intercept and slope, indicating that there is rich interindividual

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<sup>2</sup>All IGC analyses were re-run using gender and age of entry to the study as level 2 predictors and neither was found to predict rate of change in any scale.

heterogeneity in the trajectories of interpersonal development. The modest (and often nonexistent) mean change exhibited at the group level should be understood in the context of notable variability at the individual level. There are those for whom the yearly change is starkly different. For example, the SD associated with a variance of .03 would be .17, which when taken over 3 years would be over one half of a scale's SD of change (i.e., .51). It follows that 32% of the sample is changing over .5 SDs over three years. Thus, at the individual level there is significant variability in trajectories and considerable instability in interpersonal style for some.<sup>3</sup>

### Ipsative Stability/Change

To measure ipsative stability, we employed  $D^2$  and the q-correlation to the profile of octant scales. Descriptive statistics for each between time-point can be found in Table 3. Values of  $D^2$  are difficult to directly interpret because they are not standardized or bounded. However, these will be used below in correlational analyses. In contrast, q-correlations ( $r_q$ ) are readily interpretable in the same way as all product moment correlations. The values in Table 3 demonstrate that on the average there is high stability in individual profile patterns, although there is considerable range in stability. Only a small minority of these correlations were negative ( $r_{q12} = 2.4\%$ ;  $r_{q23} = 3.2\%$ ;  $r_{q13} = 2.0\%$ ), and the majority exceeded  $r_q = .80$  ( $r_{q12} = 72.6\%$ ;  $r_{q23} = 68.4\%$ ;  $r_{q13} = 57.2\%$ ). Note that there is a gradual trend towards less stability as the distance between measurement occasions increases. However, on the whole, there is a great deal of stability in interpersonal profiles.

### Interpersonal Profile Structure Summaries and Interpersonal Stability

The structural summary parameters of interpersonal style (i.e., angular displacement), elevation, differentiation/distinctiveness (i.e., amplitude/vector length) and prototypicality (i.e., goodness-of-fit to a cosine curve) were calculated for each individual (see Gurtman & Balakrishnan, 1998 for a summary of the methods). Table 3 contains the descriptive statistics for the sample at each time point. As is readily seen in the table, at each time point the range of angular locations spans the entire circumference of the circle although the mean is in the Warm-Agreeable octant. It is worth noting that follow-up analyses that applied the structural summary methodology to the sample as a whole indicated that there was significant variability around this mean (see Wright et al., 2009 for group based methods). The average elevation was very close to 0, as expected. Additionally, the average differentiation suggests that individuals generally have distinct interpersonal profiles (i.e., 1.37 SDs between the mean and peak scores), but the range indicates that there are those for whom their profile is flat and undifferentiated, and others who are remarkably differentiated. The full range of possible prototypicality was observed, with the median ranging between .82 and .76. By convention, a prototypicality value of .70 has been considered “adequate” fit and a value of .80 has been called a “good” fit to a cosine curve (Gurtman & Pincus, 2003). These results suggest that on the whole individuals have prototypical profiles, but there is a slight decrease in the prototypicality of interpersonal profiles over time. To test the pattern of growth in differentiation and prototypicality, differentiation and prototypicality parameters were subjected to IGC analyses. The results of these analyses can be found on the bottom of Table 2. On the average there was mean stability in differentiation, but significant interindividual heterogeneity in trajectories was found. There was a small average decrease in prototypicality of profiles over the course of the study, but with significant variability in individual trajectories. Finally, Table 3 reports the median angular

<sup>3</sup>Note that significant individual stability can occur in the context of high differential stability, as it does here, even if the differential stability = 1.00. This is because differential stability captures changes in interindividual positioning or rank-order. It is possible for individuals to change in the same direction at differing rates or in opposite directions without their longitudinal paths crossing, thereby retaining their relative ranking.

difference or shift in individual profiles between each wave. This statistic, although descriptive, captures change in the theme of an individual's profile, or a summary of multivariate change in content over time. The median values ranged between 17°-20° suggesting that half of the profiles changed by less than 40% of an octant's width of content over these large spans of 1, 2, and 3 years.

### Predicting Development, Stability, and Change

In order to test whether the structure of an individual's interpersonal profile (i.e., profile differentiation and prototypicality) is related to development and stability we adopted a number of approaches. First, to determine if either differentiation or prototypicality was related to linear growth in the interpersonal scales we estimated a series of conditional growth models with each variable included as a Level 2 predictor of rate of change in the IAS-R scales. With the exception of the model for growth in the Warm-Agreeable octant, neither differentiation nor prototypicality was significant predictors of the rate in structured individual growth. Individuals with more prototypical profiles showed a decreased rate of growth in the Warm-Agreeable octant across time ( $\gamma_{11} = -.18, p = .02$ ). Given that this is the sole significant result and is a small effect, it is difficult to place much confidence in its meaning. Furthermore, it was anticipated that these variables would be unrelated to structured (i.e., linear) change. Next we tested whether profile differentiation and prototypicality were related to the stability in the overall interpersonal profile. To test this, we correlated amplitude and  $R^2$  with the measures of ipsative stability,  $D^2$  and  $q$ -correlations. Results are summarized in Table 4. In order to control for the inherent dependency in scores that would result from using the same time-point's measurement in calculating both differentiation and prototypicality and ipsative stability, we limit these correlations to predicting ipsative stability between the other two time-points. Therefore, the amplitude and  $R^2$  parameter was never calculated from the same scores as are included in the calculation of ipsative stability. Interestingly, both differentiation and prototypicality were consistently correlated with the  $q$ -correlations, but not  $D^2$ . Individuals with more differentiated and prototypical profiles had higher  $q$ -correlations between assessments. What differentiates  $q$ -correlations from  $D^2$  is that the former is a pure measure of the stability in the pattern of a profile, or stated otherwise, the idiographic relationship between scales, whereas the latter captures net change. Thus, those individuals with more differentiated and prototypical profiles maintain their idiographic profile more over time, regardless of changes in level or extremity.

As a final set of analyses, we explored the relationship between Dominance and Affiliation and stability by correlating the domain scores with measures of ipsative stability. The results can be found at the bottom of Table 4. Results suggest that on the whole, specific interpersonal content is unrelated to these types of change, although some results suggest that higher warmth may be related to higher stability, but the effects are inconsistent and modest.

### Discussion

We investigated the development, stability, and change in interpersonal aspects of personality traits across the early adulthood years. Although a number of recent studies have begun to focus on personality development during this time-period, none have used the IPC as the organizing framework nor have there been any that are so focally interpersonal. We studied development at both the broad domain level and more specific octant level using a suite of approaches that have become standard in the personality stability literature. Examining the developmental processes in the more fine-grained octant level represents a contribution to a very limited body of work that has investigated personality stability and change at the lower-order level. Moreover, we capitalized on the precise geometric structure

of the IPC to study profile parameters that influence stability in interpersonal style over large temporal distances. These are among the most novel of the results and provide insight into the substantive nature of the person-centered variables that can be derived from an individual's IPC profile. As is common in comprehensive longitudinal analyses of personality traits, we found evidence for both stability and change appear in the interpersonal traits. Conclusions regarding levels of stability and change depend in part on how they are operationalized. We discuss each analytic approach in turn, highlighting the importance of the findings in each.

### Rank-Order Stability

On the whole, it appears that rank-order stability in interpersonal functioning is very high during the “college years.” Past meta-analytic results that have reported findings in the context of the Big Five traits are consistent with these results, showing that Extraversion and Agreeableness are the most differentially stable of the traits (Roberts & DelVecchio, 2000). However, the average 3-year stability coefficient from the current results ( $r = .78$ ) exceeds those reported by Roberts and DelVecchio ( $r = .54$ ) for the college years in their meta-analysis, and other reported stability coefficients for Extraversion and Agreeableness of .63-.72 and .59-.60 respectively (Robins et al., 2001; Vaidya et al., 2008). Although it is unclear why the differential stability found here for interpersonal traits is higher than that for similar variables (i.e., Extraversion and Agreeableness) as measured by similarly reliable instruments, one possibility might be the relative lack of affective content of the IAS-R. Vaidya and colleagues (2008) demonstrated that affective traits are much less stable over similar time periods than personality traits. It bears mentioning that the affective traits in that study were measured using self-rated adjectives, just as in this study. Thus, it may be that individual differences in interpersonal style are maintained, even as other aspects of personality are associated with more “shuffling of the deck.” Alternatively, it may be that is higher due to the relatively stable environment throughout the course of the study. Namely, all participants were enrolled in college throughout the course of the study, which may have prevented wide variability in the types of life experiences that might impinge upon rank-order stability. Nevertheless, it is notable that prior work has found lower stability in university students as well. Unfortunately, this issue cannot be definitively resolved in this sample, but these results based on analyses using an IPC based trait measure lend strong support to the notion that interpersonal style is among the most stable aspects of personality.

### Normative or Mean Change

An attractive feature of this investigation was that this study was not limited to the broad domain level of personality traits, but also examined the component parts of Dominance and Affiliation. Indeed, there is currently a dearth of lower-order trait research during the early adulthood years. Perhaps the type of development for which this is the most illuminating is in mean change. As reviewed in the introduction, there have been equivocal results associated with the more interpersonal traits in past domain-level work. In the current study, we found that the mean level of the broad domain of Dominance remained stable over the course of the study, whereas there was an increase in domain level Affiliation. However, a much more nuanced picture of mean change was evident at the octant level. First, we replicated past results that have found mean increases in social dominance (i.e., mean increases in Assured-Dominant and decreases in Unassured-Submissive octants), but stability in social vitality (i.e., mean stability in Gregarious-Extraverted and Aloof-Introverted octants). Pure warmth (i.e., Warm-Agreeable and Cold-Hearted octants) was remarkably stable, while there was an increase in warm-submissive aspects of interpersonal functioning (i.e., mean increases in Unassuming-Ingenuous and decreases in Arrogant-Calculating octants).

On the surface, the domain level results would seem to be contradicted by the octant level findings. Specifically, how is it that domain Dominance is stable whereas octant level Assured-Dominance and Unassured-Submissiveness show significant change? Similarly, how is it that domain level Affiliation increases whereas the poles of the IPCs horizontal axis maintain their level over time? What is occurring here, from a quantitative perspective, is that the domain-level change obscures the more fine-grained and important differences in the rates of change in specific octants. Recall that the domains of the IPC are very broad variables, comprised of octant sets that have opposite change. In the case of domain level Dominance, pure dominance increases, but cold-dominance or arrogance decreases, thereby cancelling each other's change on average all while extraversion remains stable. In the case of domain level Affiliation, the increase in interpersonal cooperativeness and a decrease in arrogance are the drivers of this change.

This more fine-grained and nuanced change is highly informative, and an important revelation of the normative interpersonal developmental process. Past work (Donnellan et al., 2007; Roberts et al., 2006) has noted that the general trend in mean change during this time period is associated with functional maturity. The octant-level change is highly consistent with this premise. For example, individuals become more assured and confident, on the average, but decrease in how self-serving, boastful, argumentative, and disagreeable they are. It is easy to see how this relative reorganization allows for more effective agentic functioning across important adult situations. Yet, extraverted and gregarious as opposed to introverted and aloof behavior do not demonstrate mean change, suggesting that they are not clearly related to increased functional maturity. It is interesting that we found no average increases in how neighborly, friendly, charitable, and sympathetic individuals are. As individuals mature in young adulthood, they seem to maintain how distant or close they like others to be. At the same time, they appear to increase in their ability to cooperate and go along with others, even as their unassuredness decreases. Increases in cooperativeness are also likely to promote effective functioning across situations. These results highlight the importance of sub-domain or facet-level trait investigations of personality development.

### Individual Stability

Regardless of the content of the scales, all octants demonstrated significant heterogeneity in individual rates of change. This suggests that although there are those who are developing in a manner that is consistent with personality maturation, others are not, instead taking trajectories that are perhaps better described as “regression” in the case of those who are changing in the opposite direction, or “stagnation” for those who do not change at all (see also Wright, Pincus, & Lenzenweger, in press). The determinants of these trajectories are of high interest for future research. We must note that this sample captures the change in the early part of young adulthood for those individuals enrolled in college; therefore all results must be interpreted in this context. Undoubtedly there are a many important typical adulthood experiences that the majority of these individuals have not encountered or experienced (e.g., marriage, having children) that might have important effects on their interpersonal functioning.

### Ipsative Stability

Structural, rank-order, and mean stability analyses are variable focused in nature. Although IGC models are able to capture individual growth across time, they are still limited in that they focus on one trait at a time. Ipsative stability is a person centered approach that moves beyond this to capture the stability in an individual's entire profile over time. The resulting q-correlations suggest that individuals are highly stable at the level of their interpersonal profile. Taken in the context of the univariate individual level change, this would suggest

that what changes are occurring across octants within an individual allow for the relative maintenance of the individual's profile's pattern.

### IPC Profile Differentiation and Prototypicality

Up to this point, this discussion of the results has focused on the standard approaches to change, giving little attention to the unique features of the IPC structural model. The theme or primary content of an interpersonal profile is parsimoniously summarized using the angle on the circle associated with the Cartesian coordinates of an individual's standing on the Dominance and Affiliation axes. As noted above, the IPC further offers a way to quantify the relative structure of an individual's interpersonal profile via the constructs of differentiation and prototypicality. Differentiation is a social-cognitive variable that captures the degree to which an individual distinguishes between interpersonal content when communicating their interpersonal style. It is the degree to which an individual specifies themselves as a certain type as opposed to other types. It is as if those with highly differentiated profiles are saying, "This is what I am like, not that!" Related but distinct, prototypicality captures whether an individual's profile follows the conceptual and semantic pattern associated with normative responses to an IPC-based measure. Prototypicality captures the degree to which an interpersonal profile is patterned in a way that is consistent throughout given the theme, or whether there are idiosyncratic peaks and valleys that defy the standard patterning. As noted above, a prototypicality value of .70 has been considered "adequate" fit and a value of .80 has been called a "good" fit to a cosine curve (Gurtman & Pincus, 2003). Conceptually this value can be interpreted as 80% of the variance in the scores across the octant scales can be explained by the three structural summary parameters of elevation, amplitude, and angular displacement. Like most cutoffs on continuous variance distributions, the value of .80 is rationally specified as opposed to being empirically derived. Yet this value serves as a useful touchstone for profiles that exhibit substantial prototypicality.

As a gross measure of the multivariate change in an individual's profile, we calculated angular change between each time point in the study. The median values suggested that half of the profiles changed by less one half of an octant's width of interpersonal content between study waves. On the other hand, based on the range of angular change, there were those who literally "did a 180°" and had their profile's change entirely between waves. As the angular change is associated with the change in the profile, this begins to give a sense of how much change was being captured by the standard ipsative statistics reported above. To further capture the determinants of stability, differentiation and prototypicality parameters were evaluated as predictors of ipsative change. Interestingly, both differentiation and prototypicality were associated with stability in the structure of one's profile (i.e.,  $r_q$ ), but not absolute degree of change (i.e.,  $D^2$ ).<sup>4</sup> These results are all the more important when taken in the context of the long offered, but rarely tested, hypothesis that amplitude/VL is predictive of interpersonal rigidity (Leary, 1957; Tracey, 2005; Tracey & Rohlfsing, 2010). However, the original articulations of this hypothesis referred to amplitude/VL as a summary of act counts, in which case it would be a direct summary of the breadth of interpersonal behaviors sampled across situations. Although this was translated in to the same hypothesis as it pertains to a profile on an IPC measure, past work that has used the amplitude/VL parameter

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<sup>4</sup>An anonymous reviewer questioned whether that these findings could potentially suffer quantitative confound related to a restriction in range of octant profile scores. Specifically, as amplitude is a measure of profile variability or range, those profiles with higher amplitude might, by definition, have a greater chance of being more highly correlated over time, thus giving rise to this pattern of results. However, prototypicality is not synonymous with profile range or variability in profile scores, rather, it is a quantification of the patterning of the profiles. Profiles with high ranges, but violate the pattern of a cosine wave, will result in low prototypicality scores, and profiles with very little range but a precise patterning will have high prototypicality scores. Therefore, because the pattern of correlations between the cosine curve parameters and the change variables are consistent across differentiation and prototypicality, we can be confident in the robustness of the results.

as predictors of behavior measured repeatedly has not found support for the assertion (Erickson et al., 2009). Here the findings are not related to stability in individual behaviors, but rather stability in one's profile over the long term. We feel that this highlights the social-cognitive nature of the parameter, with those individuals that distinguish more between interpersonal content in their self-description demonstrating increased stability. These initial results suggest that these structural variables *are* associated with change over time, and beckon new investigations in to what other aspects of functioning they might be related to.

In the growth models, differentiation did not evidence significant mean change, suggesting that individuals do not describe themselves with more distinctiveness on average over the course of the college years. What mean change in prototypicality occurred might suggest that individuals begin to view themselves in slightly more idiosyncratic and individualized terms—there is a minor trend for profiles to deviate more from the normative prototypical profile curve. These interpretations come with the very large caveat that these are the first explorations in to the longitudinal nature of these variables, and it would be important to replicate these findings before drawing firm conclusions.

For those readers interested in circumplex structure and measurement, the mean change findings of the octants listed above also point to an interesting picture of how the octants relate to each other. Oftentimes, the octants that are blends of the two primary dimensions (e.g., Arrogant-Calculating) are treated as just that, blends, not being unique constructs in their own right. However, the results of this study would suggest that these are not merely blends that are reducible to the two primary dimensions of Dominance and Affiliation. Instead, the continuous dimension of interpersonal style that forms the circumference of the IPC is more of a qualitative one, with marked shifts occurring as it is circumnavigated. There are fundamental differences in these constructs that emerge when measured longitudinally. This is not to say that these variables do not share close conceptual and empirical relationships, but rather that interesting differences emerge in the “blends” that create a new recipe, not merely a sum of the interpersonal flavors. Moving from the longitudinal pattern of adjacent octants to those that oppose each other, a very consistent pattern emerges. Because the IPC's structure allows for the separate measurement of the opposing poles of its component dimensions, we were able to examine whether stability and change were consistent across these “axes.” For those axes that had octants with significant change (i.e., Arrogant vs. Unassuming and Dominant vs. Submissive), inverse patterns of growth occur across each pole. Each of these poles is remarkably well linked with its opposite, and the mean development is highly similar for each pair for all axes, with some exhibiting change and others not.

## Limitations

As with all studies, a number of limitations remain to be addressed in future investigations. Notably, these results have very little to say about the mechanisms involved in the development of interpersonal style over this time-period. Emerging results from other studies have pointed to the influence of both genetics and environment in the development of personality traits during this same time period (Hopwood et al., 2011). The higher-order traits of Agency/Dominance and Communion/Affiliation are presumed to be associated with individual differences in basic neurobiological structure and functioning, linked with incentive reward systems (i.e., dopaminergic), and affiliative neuroendocrine functioning (e.g., vasopressin and oxytocin; Depue & Collins, 1999; Depue & Lenzenweger, 2005; Depue & Marrone-Strupinsky, 2005). It would seem to be a safe assumption that the influences are multiple and complex, with basic socialization and biological maturation each playing a role in orchestrating the harmonics of development. Relatedly, this sample both covered the college years and was enrolled in college throughout the course of this study, which possibly influenced the findings to some degree. Thus, these results do not span the

full breadth of emerging adulthood, which penetrates deeply in to the 20's, and the fact that all were enrolled in the same college may have had a homogenizing effect on the daily experiences.

Additionally, we must always be mindful about our substantive methodological approach to personality. Here we have adopted a trait approach to personality, with individuals providing self-ratings of interpersonal style. Although similar pictures emerge when the perceptions of others are included (see Donnellan et al., 2007 or Jackson et al., 2009), important differences may emerge when these results are augmented with a second rater's perception of an individual's style. Are our own perceptions more stable than the manner in which others perceive us? Moreover, this has focused on only one level of functioning. Interpersonal theory explicitly states that functioning occurs at multiple levels (e.g., biological, motivational, cognitive, behavior; Pincus & Wright, 2010). Here only one of these is captured—self-representation—but future studies would be wise to capture more of these levels of functioning.

### Future Directions

We are unaware of parameters in any other personality model that are conceptually akin to the IPC's differentiation and prototypicality. To the extent that these prove interesting, it may be worth developing similar parameters for other measures and models. One approach might be to break dimensions in to their polar scales and quantify how much they follow a similar pattern across the poles in much the same way as is done here. Emotional functioning is also often measured using a circumplex model, might it be that these parameters also serve to offer insight in to the trajectories an individual charts in their emotional functioning across time? It may be that these variables are not merely structural parameters, but have substantive interpretability as well. We would be eager to investigate the substantive interpretation of these variables. It may be that they have implications for identity, basic self-construal, and social cognition more generally.

The early adult years are interesting because they are a time of high-growth, but it is clear that individuals continue to develop and change across other eras of the lifespan (Roberts et al., 2008). A fourth wave of data collection for the LSPD is currently in the planning phases, with the hopes that these same individuals, who are now in their mid-thirties, will provide us with the insight into longer term stability of interpersonal functioning, extending beyond early adulthood.

### Conclusion

The current study was the first to examine the development, stability, and change of the interpersonal system as mapped by the IPC in any age group. The results using standard articulations of stability and change are highly consistent with the results of others studies following individuals during early adulthood. However, this investigation probed beyond the broad domain level to study change in the lower-order interpersonal traits, a level of analysis that is needed to fully understand the highly-nuanced development of personality. Finally, approaches that capitalize on the circumplex structure of interpersonal variables were brought to bear on these issues of development and shed new light on stability, change, and the structure of personality.

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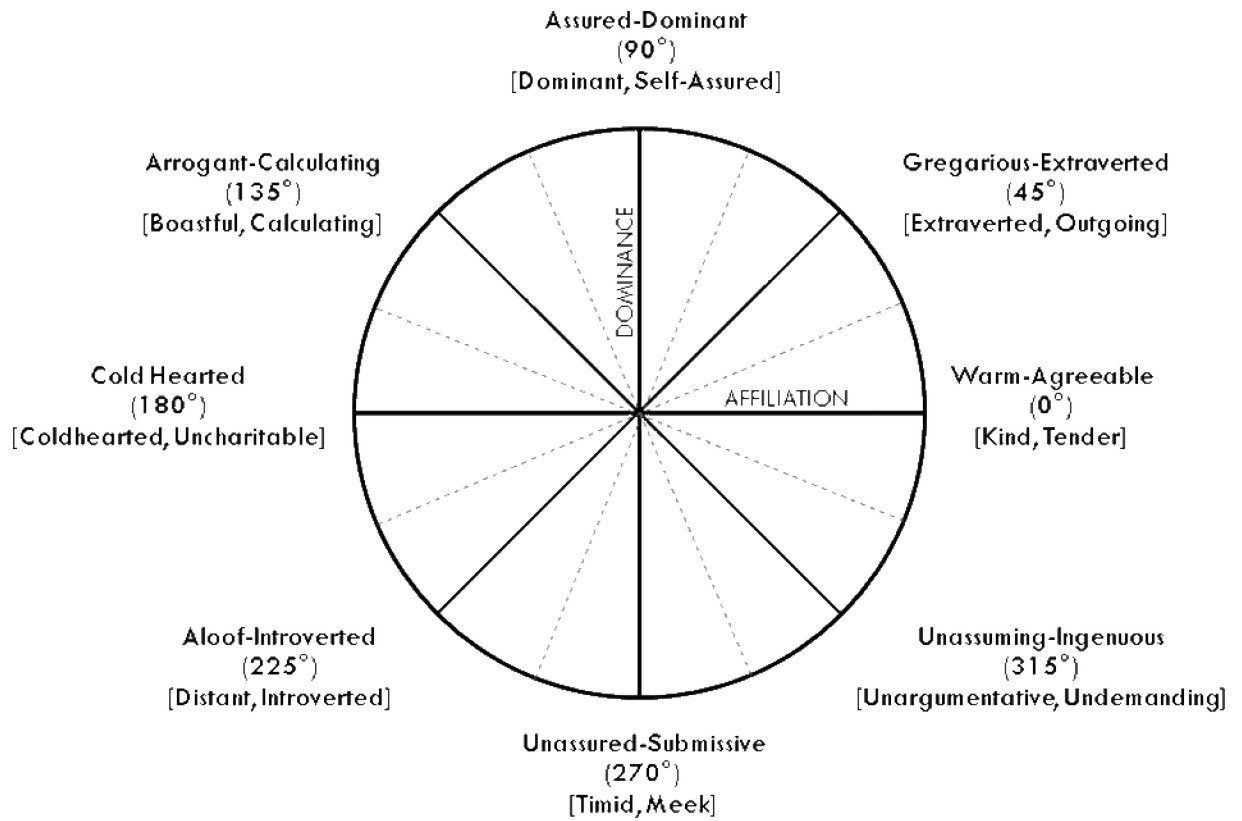
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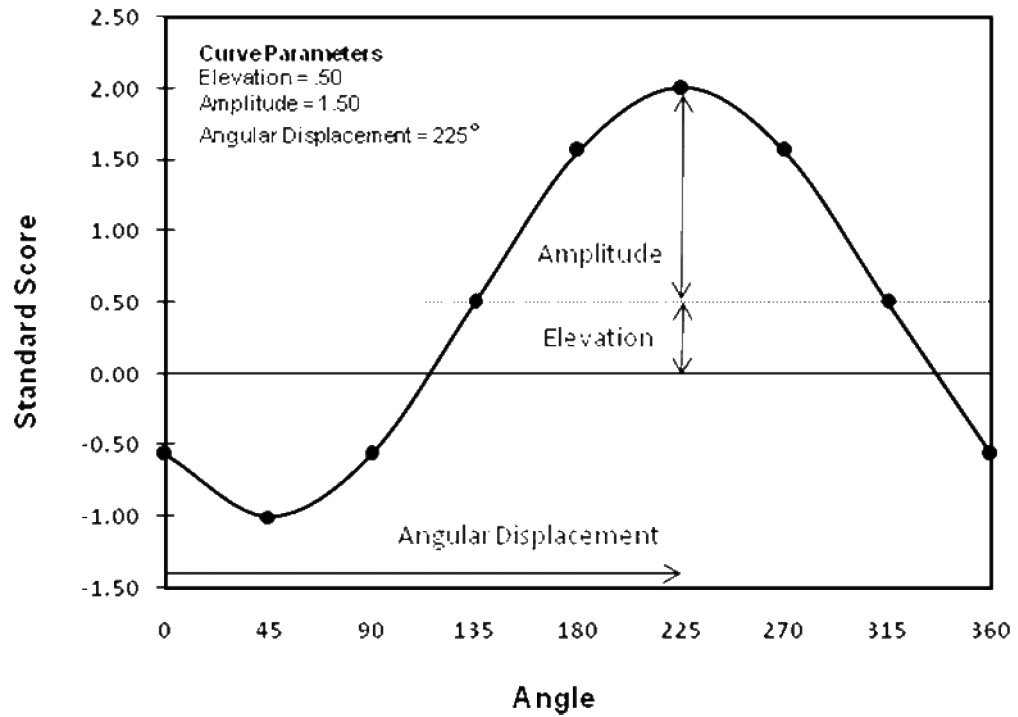
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**Figure 1.** The Interpersonal Trait Circumplex. Scale labels for each octant are provided, followed by the associated angle (in parentheses), and sample adjectives (in brackets).



**Figure 2.** Example of Structural Summary Parameters of an Interpersonal Profile. This Example is of a curve with perfect prototypicality, with all scale scores (represented by black dots) conforming to an ideal cosine curve.

**Table 1**  
 Mean Values and Rank Order Stability Coefficients for the Interpersonal Scales

	Time 1	Time 2	Time 3	r <sub>12</sub>	r <sub>13</sub>
<i>IPC Dimensions</i>					
Dominance (DOM)	-0.03 (1.17)	-0.09 (1.13)	-0.04 (1.09)	0.88	0.78
Affiliation (LOV)	0.60 (1.27)	0.75 (1.23)	0.75 (1.25)	0.85	0.78
Mean <i>r</i>	--	--	--	0.87	0.78
<i>IPC Octants</i>					
Assured-Dominant	0.00 (1.09)	0.01 (1.05)	0.10 (1.00)	0.82	0.71
Arrogant-Calculating	-0.64 (1.17)	-0.89 (1.13)	-0.91 (1.16)	0.80	0.77
Cold-hearted	-0.31 (1.03)	-0.37 (1.00)	-0.40 (0.96)	0.78	0.73
Aloof-Introverted	-0.46 (1.32)	-0.51 (1.05)	-0.45 (1.10)	0.84	0.80
Unassured-Submissive	-0.29 (1.11)	-0.37 (1.09)	-0.49 (1.05)	0.83	0.78
Unassuming-Ingenuous	0.71 (1.26)	0.91 (1.30)	0.93 (1.28)	0.76	0.69
Warm-Agreeable	0.18 (1.12)	0.24 (1.13)	0.23 (1.10)	0.79	0.71
Gregarious-Extraverted	0.34 (1.27)	0.35 (1.20)	0.37 (1.21)	0.86	0.80
Mean <i>r</i>	--	--	--	0.81	0.76

Note. N = 250. Standard deviations presented in parentheses. All correlations significant at  $p < .01$ .

Table 2

## Growth Models for the Interpersonal Scales

	Elevation (Intercept) of Individual Trajectory			Rate of Change (Slope) of Individual Trajectory			Variance Components									
	Fixed Effect	<i>p</i>	ES <i>r</i>	Fixed Effect	<i>p</i>	ES <i>r</i>	Residual	<i>p</i>	Intercept	<i>p</i>	Slope	<i>p</i>	Covariance	<i>p</i>	-2LL	
<i>IPC Dimensions</i>																
Dominance	-0.05	0.47	0.05	0.00	0.99	0.00	0.15	0.00	1.24	0.00	0.04	0.00	-0.09	0.00	1643	
Affiliation	<b>0.64</b>	<b>0.00</b>	<b>0.46</b>	<b>0.04</b>	<b>0.02</b>	<b>0.15</b>	0.23	0.00	1.37	0.00	0.03	0.00	-0.05	0.04	1859	
<i>IPC Octants</i>																
Dominant	-0.01	0.89	0.01	<b>0.04</b>	<b>0.05</b>	<b>0.13</b>	0.20	0.00	1.00	0.00	0.03	0.00	-0.08	0.00	1696	
Arrogant	<b>-0.71</b>	<b>0.00</b>	<b>0.53</b>	<b>-0.08</b>	<b>0.00</b>	<b>0.27</b>	0.26	0.00	1.08	0.00	0.03	0.00	-0.04	0.11	1854	
Cold	<b>-0.32</b>	<b>0.00</b>	<b>0.31</b>	-0.03	0.10	0.10	0.21	0.00	0.86	0.00	0.03	0.00	-0.07	0.00	1685	
Introverted	<b>-0.49</b>	<b>0.00</b>	<b>0.41</b>	0.01	0.57	0.04	0.17	0.00	1.07	0.00	0.03	0.00	-0.06	0.01	1677	
Submissive	<b>-0.30</b>	<b>0.00</b>	<b>0.26</b>	<b>-0.07</b>	<b>0.00</b>	<b>0.24</b>	0.19	0.00	1.06	0.00	0.03	0.00	-0.07	0.00	1705	
Unassuming	<b>0.77</b>	<b>0.00</b>	<b>0.53</b>	<b>0.06</b>	<b>0.01</b>	<b>0.18</b>	0.41	0.00	1.24	0.00	0.03	0.00	-0.04	0.20	2088	
Warm	<b>0.20</b>	<b>0.01</b>	<b>0.18</b>	0.01	0.55	0.04	0.28	0.00	1.01	0.00	0.02	0.00	-0.04	0.06	1831	
Extraverted	<b>0.33</b>	<b>0.00</b>	<b>0.26</b>	0.01	0.49	0.04	0.20	0.00	1.39	0.00	0.04	0.00	-0.09	0.00	1832	
<i>Structural Summary</i>																
Differentiation	<b>1.37</b>	<b>0.00</b>	<b>0.90</b>	-0.00	0.94	0.00	0.11	0.00	0.35	0.00	0.01	0.00	-0.03	0.00	1145	
Prototypicality	<b>0.73</b>	<b>0.00</b>	<b>0.96</b>	<b>-0.01</b>	<b>0.01</b>	<b>0.16</b>	0.02	0.00	0.03	0.00	0.002	0.00	-0.001	0.29	-306	

Note.  $N = 250$ . Due to space issues, only one of the octant descriptors are listed; octants are listed counter-clockwise starting at 90°; -2LL = -2 log likelihood, also known as the deviance, an index of fit. Tabled values represent the final estimates of the fixed effects with robust standard errors. The fixed effects and variance component parameters were tested to determine if they differ from zero. ES *r*, effect size *r*. .10 = small effect, .24 = medium effect, .37 = large effect (Rosenthal & Rosnow, 1991, p. 446). For all models -2LL statistics are based on 6 estimated parameters. Model estimation was done using full maximum likelihood with the HLM-6 program. Significant fixed effects values ( $p < .05$ ) bolded.



Table 3

Descriptive Statistics for Ipsative and Circular Variables.

	Minimum	Maximum	Range	Mean	SD
<i>Ipsative Statistics</i>					
$D^2_{12}$	0.32	32.25	31.92	4.08	3.80
$D^2_{23}$	0.17	71.78	71.61	4.93	6.03
$D^2_{13}$	0.53	74.53	73.99	5.67	6.70
$r_{q12}$	-0.39	1.00	1.38	0.80	0.24
$r_{q23}$	-0.79	0.99	1.79	0.79	0.25
$r_{q13}$	-0.94	0.99	1.94	0.74	0.29
<i>Structural Summary Variables</i>					
$\theta$ Time 1	0°	360°	360°	4°	69° <sup>a</sup>
$\theta$ Time 2	0°	359°	359°	357°	63° <sup>a</sup>
$\theta$ Time 3	1°	360°	359°	4°	65° <sup>a</sup>
Elevation Time 1	-0.66	0.92	1.59	-0.06	0.23
Elevation Time 2	-1.33	0.53	1.86	-0.08	0.24
Elevation Time 3	-0.78	0.64	1.42	-0.08	0.23
Amplitude Time 1	0.05	4.50	4.46	1.37	0.67
Amplitude Time 2	0.06	4.18	4.11	1.37	0.67
Amplitude Time 3	0.07	3.77	3.70	1.37	0.65
$R^2$ Time 1	0.00	0.99	0.99	0.82 <sup>b</sup>	0.21
$R^2$ Time 2	0.01	0.99	0.98	0.78 <sup>b</sup>	0.24
$R^2$ Time 3	0.01	1.00	0.99	0.76 <sup>b</sup>	0.24
<i>Angular Change</i>					
$\Delta \theta_{12}$	0°	163°	163°	17° <sup>b</sup>	30°
$\Delta \theta_{23}$	0°	177°	177°	17° <sup>b</sup>	33°
$\Delta \theta_{13}$	0°	177°	177°	20° <sup>b</sup>	32°

Note.  $N = 250$ .  $D^2$  = Cronbach's  $D^2$  statistic;  $r_q$  = q-correlation;  $\theta$  = Angle in Degrees;  $\mathcal{R}^2$  = Goodness-of-fit/Prototypicality of curve.

Numerical subscripts after  $D$ ,  $r_q$ , and  $\Delta\theta$  statistics indicate the two related time points.

Amplitude is equivalent to vector length.

<sup>a</sup>Values reported are for angular variance, not standard deviation.

<sup>b</sup>These scores are skewed, and thus the median is provided.

**Table 4**

Correlations of structural summary statistics and IPC dimensions with D<sup>2</sup> and q-correlations.

	D <sup>2</sup>			r <sup>q</sup>		
	D <sup>2</sup> <sub>12</sub>	D <sup>2</sup> <sub>13</sub>	D <sup>2</sup> <sub>23</sub>	r <sub>q12</sub>	r <sub>q13</sub>	r <sub>q23</sub>
<i>Differentiation</i>						
AMP Time1	--	--	0.13*	--	--	0.22*
AMP Time2	--	0.10	--	--	0.36*	--
AMP Time3	-0.04	--	--	0.30*	--	--
<i>Prototypicality</i>						
R <sup>2</sup> Time 1	--	--	0.04	--	--	0.12
R <sup>2</sup> Time 2	--	0.00	--	--	0.32*	--
R <sup>2</sup> Time 3	-0.10	--	--	0.23*	--	--
<i>Axes</i>						
DOM Time 1	--	--	0.04	--	--	-0.06
LOV Time 1	--	--	-0.11	--	--	0.14*
DOM Time 2	--	-0.03	--	--	0.01	--
LOV Time 2	--	-0.08	--	--	0.09	--
DOM Time 3	0.04	--	--	-0.05	--	--
LOV Time 3	-0.04	--	--	0.16*	--	--

Note. DOM = Dominance; LOV = Affiliation.  
 Numerical subscripts indicate the two time points being compared.  
 \*  $p < .001$ . No asterisk denotes  $p > .05$ .