Delineating the Structure of Normal and Abnormal Personality: An Integrative Hierarchical Approach

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Increasing evidence indicates that normal and abnormal personality can be treated within a single structural framework. However, identification of a single integrated structure of normal and abnormal personality has remained elusive. Here, a constructive replication approach was used to delineate an integrative hierarchical account of the structure of normal and abnormal personality. This hierarchical structure, which integrates many Big Trait models proposed in the literature, replicated across a meta-analysis as well as an empirical study, and across samples of participants as well as measures. The proposed structure resembles previously suggested accounts of personality hierarchy and provides insight into the nature of personality hierarchy more generally. Potential directions for future research on personality and psychopathology are discussed.

In recent years, there has been increasing consensus that normal and abnormal personality variation can be treated within a single, unified structural framework (Eysenck, 1994; O'Connor, 2002; Widiger & Costa, 1994). A variety of studies have indicated, for example, that personality structure is essentially the same in clinical and nonclinical samples (O'Connor, 2002), that normal and abnormal personality are strongly related at the etiologic level (Jang & Livesley, 1999; Markon, Krueger, Bouchard, & Gottesman, 2002), and that abnormal personality can be modeled as extremes of normal personality variation (O'Connor & Dyce, 2001).

Despite consensus about the possibility of describing normal and abnormal personality within a single structural framework, however, there is less consensus about what this structural framework might be. Although there is emerging consensus about the superordinate structure of normal personality (Goldberg, 1993), less consensus exists about a similar structure of abnormal personality (Livesley, 2001). Delineating a unified superordinate structure across normal and abnormal domains of personality has been even more challenging. Empirical results have supported a variety of conclusions, and validity has been demonstrated for multiple structural models (e.g., Jang & Livesley, 1999; Markon et al., 2002; O'Connor, 2002).

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Here, we argue that abnormal and normal personality variation is best described within a single integrative hierarchy. We demonstrate that this hierarchical structure replicates across a meta-analytic dataset and empirical sample, replicates across different sets of measures, and is consistent with previous integrative analyses of superordinate personality structure.

Structural Models of Abnormal Personality

Many models of personality structure, including those of Eysenck (1947; Eysenck & Eysenck, 1976) and Cloninger (1987; Cloninger, Svrakic, & Przybeck, 1993), were formulated with an explicit goal of describing both normal and abnormal trait variation. Other prominent models, such as the Big Five, were developed without explicit attention to any distinction between normal and abnormal personality. In either type of model, single structures are explicitly or implicitly assumed to account for both normal and abnormal personality, with abnormal personality variation representing extremes on the same continua as the normal personality.

Various models have been developed to explain abnormal personality characteristics. One particularly successful approach has been iterative structural modeling of characteristics and symptoms of various personality disorders. The rationale of this approach, similar to that of the lexical hypothesis (Allport, 1937; Allport & Odbert, 1936) and others (Tellegen, 1985, 2000), is to first collect a representative sample of traits or symptoms used to describe individuals with personality disorder. Subordinate-level traits are then delineated by factor analysis of these symptoms or traits, and superordinate traits are delineated by factor analysis of the subordinate-level traits (Clark, 1990; Livesley, 1986, 1987).

This general approach was used in the development of two inventories, the Dimensional Assessment of Personality Pathology (DAPP; Livesley & Jackson, in press) and the Schedule for Nonadaptive and Adaptive Personality (SNAP; Clark, 1993). Although

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the subordinate factor structures of the two instruments are not identical, analyses have demonstrated that they are extremely similar (Clark, Livesley, Schroeder, & Irish, 1996; see also Harkness, 1992). The superordinate structures of the two instruments are perhaps even more similar. Joint factor analyses of the DAPP and SNAP primary scales suggest that responses can best be modeled by an orthogonal five-factor model: a factor reflecting traits such as affective instability and negative temperament, a factor reflecting detachment and restricted expression, a factor reflecting callousness, manipulativeness, and aggression, a factor reflecting submissiveness and dependency, and a factor reflecting impulsivity and disinhibition (Clark et al., 1996).

In contrast to the domain of normal personality, where consensus about "Big Trait" models has developed—especially with regard to the Big Five model (Goldberg, 1993)—consensus about trait structure in the domain of abnormal personality is still emerging. Where consensus exists, it seems to have focused on a "Big Four" model of abnormal personality (Widiger, 1998). Meta-analytic investigations of the structure of personality disorder, for example, indicate that abnormal personality possesses a four-factor structure similar to the Big Five, but lacking an equivalent of Openness (O'Connor & Dyce, 1998). Independent factor analyses of the DAPP demonstrate a similar four-factor structure (Livesley, Jang, & Vernon, 1998), and this four-factor structure appears in other investigations as well (e.g., Austin & Deary, 2000).

Relationships Between Normal and Abnormal Personality Structure

Perhaps one of the greatest points of consensus regarding personality structure is that abnormal personality generally represents extremes on continua in common with normal personality. Measures of normal personality often discriminate well between different personality disorders and other forms of psychopathology (Krueger, Caspi, Moffitt, Silva, & McGee, 1996; Trull & Sher, 1994), and joint factor analyses between measures of abnormal and normal personality suggest common factors accounting for responses to the instruments (DiLalla, Gottesman, Carey, & Vogler, 1993; Schroeder, Wormworth, & Livesley, 1992). Such findings, consistent with the assumptions of Eysenck (1947), Cloninger (1987), and others, have led most to conclude that normal and abnormal personality may be modeled by a single structural model.

Despite this theoretical consensus, attempts to empirically map abnormal personality structure onto normal personality structure have been inconclusive. Structural analyses of instruments explicitly designed to measure features of personality disorder typically reveal factor structures highly similar to, but not completely isomorphic with, those of instruments designed to measure features of normal personality. Often traits relevant to abnormal personality description constitute a subset of those relevant to normal personality description (Livesley et al., 1998; O'Connor & Dyce, 1998); occasionally, additional personality disorder traits are suggested (Clark et al., 1996; Reynolds & Clark, 2001); and, occasionally, the domains of normal and abnormal personality seem to parallel one another (DiLalla et al., 1993). Inconsistencies in hypothesized structure across normal and abnormal personality have complicated attempts to develop a comprehensive structural model of personality.

Although analyses of relationships between normal and abnormal personality have been conducted with numerous models (Cloninger et al., 1993; DiLalla et al., 1993; Schroeder et al., 1992), the five-factor model demonstrates promise as a potential integrating framework (Costa & Widiger, 1994; Lynam & Widiger, 2001; Widiger, 1998) and is an important example in this regard. As with other normal personality models, the five-factor model discriminates reasonably well between different forms of abnormal personality (Reynolds & Clark, 2001). Moreover, joint factor analyses of five-factor instruments and instruments designed to measure abnormal personality generally show that factors common to both types of instruments account for variance in each (Schroeder et al., 1992).

However, these joint factor analyses, together with independent factor analyses of abnormal personality inventories, suggest that the five-factor model is only partially isomorphic with structural models of abnormal personality. Joint factor analyses of the DAPP and NEO Personality Inventory (NEO-PI), for example, suggest that together the two instruments are best modeled by five orthogonal factors, but that only four of the five factors are reasonably isomorphic with traditional Big Five dimensions (Schroeder et al., 1992). As described earlier, when the DAPP is factor analyzed independently, only four orthogonal factors are observed, without an equivalent of NEO Openness (Livesley et al., 1998). This Big Four factor structure is observed in other analyses of personality disorder characteristics (O'Connor & Dyce, 1998) and complicates attempts to use the five-factor model as a model of abnormal personality. As mentioned before, joint factor analyses of the SNAP and DAPP suggest the two instruments are together best modeled by a five-factor structure, but that this five-factor model does not correspond exactly to the five-factor structure often observed in normal personality inventories. Again, an equivalent of Openness is missing, replaced with a factor reflecting traits such as dependency and submissiveness (Clark et al., 1996).

Perhaps the most comprehensive examination of structural continuity between normal and abnormal personality to date is the meta-analytic investigation of O'Connor (2002). O'Connor's work demonstrates well the current conundrum regarding structural relationships between normal and abnormal personality: Substantial evidence supports the notion of structural continuity between normal and abnormal personality, but the nature of the structure is not entirely clear. Reviewing work on 37 different personality inventories, O'Connor demonstrated that the dimensionality of personality measures was generally similar in clinical and nonclinical samples. However, the dimensionality of any given inventory nevertheless varied across inventories, from one to six.

Hierarchy in Normal and Abnormal Personality Structure

Hierarchical models have become increasingly important in understanding normal and abnormal personality structure, as well as relationships between the two. Hierarchy has emerged as an important feature of normal range personality structure, even at the most superordinate levels (Costa & McCrae, 1995; Hogan & Roberts, 1996; John, Hampson, & Goldberg, 1991). Meta-analyses, for example, have demonstrated replicable, structured superordinate relationships among Big Five measures (Digman, 1997). Issues of hierarchy are also essential in understanding the differential validity of personality measures, as superordinate and

subordinate measures both demonstrate important patterns of validity (Ashton, Jackson, Paunonen, Helmes, & Rothstein, 1995; Jang et al., 2001; Jang, McCrae, Angleitner, Reimann, & Livesley, 1998; Ones & Viswesvaran, 1996; Paunonen, 1998; Saucier & Ostendorf, 1999). Finally, hierarchy has been shown to be important in understanding relationships between normal and abnormal personality variation (Ben-Porath & Waller, 1992). Subordinate factors of five-factor models, for example, have demonstrated greater predictive validity with regard to abnormal personality and other forms of psychopathology than the Big Five factors themselves (Reynolds & Clark, 2001).

Given the general importance of hierarchy in understanding personality variation, it is likely of similar importance in delineating the joint structure of normal and abnormal personality. It is possible, for example, that different levels of a common hierarchical structure are of differential importance in understanding normal versus abnormal personality structure. The four factors often identified in studies of abnormal personality structure, for example, may exist in a hierarchical relationship with the Big Five factors of normal personality structure. These four may also be identifiable within the normal range, but not as prominently as the Big Five. Conversely, it is possible that factors that occupy superordinate positions of a hierarchy in the normal range become less important in the abnormal range, and thus come to occupy subordinate positions in the hierarchy. Under such a conceptualization, the factors of personality do not change in an absolute sense as one traverses from the normal to abnormal range, but do change in prominence as different aspects of their hierarchical organization become more or less important (Harkness, 1992).

Constructive Replication and the Modeling of Normal and Abnormal Personality Structure

As many have noted (e.g., Lykken, 1968; Shadish, 1996), robust scientific models are developed through a process of constructive replication (Lykken, 1968), where the validity of model features is generalized across variations in method. In this process, replication is not simply a means of verification, but a means of theory and model development. The importance of replication to model development has been noted by many prominent personality theorists (Costa & McCrae, 1992a; Eysenck, 1991) and has proved invaluable in the development of many prominent personality models, including the Big Five (Goldberg, 1993; John, Angleitner, & Ostendorf, 1988). Identification of model features that replicate across samples of measures and participants is critical to integrating various models into a comprehensive account of personality structure.

We adopted a constructive replication approach in the current studies in order to delineate a hierarchy that would account for variation across the domains of normal and abnormal personality. In an attempt to delineate the joint structure of normal and abnormal personality, we examined factor structures of normal and abnormal personality measures in two studies, a meta-analysis and an empirical study. In the meta-analysis, correlations from multiple studies were integrated into a single meta-analytic correlation matrix, which was then structurally modeled (Becker, 1996; Hafdahl, 2002; Shadish, 1996). In the second study, we replicated the meta-analytic findings in a single sample using a second set of measures. Our goal in these two studies was to identify factors of normal and abnormal personality that replicate across samples of individuals and measures, and to delineate their hierarchical relationships.

To generalize our findings to a broad set of theoretical and descriptive perspectives in the normal as well as abnormal range, we included measures of a variety of major personality models. In addition to measures of the Big Five, we included measures representing Big Three trait theory, including those of Eysenck (1947, 1952, 1963; Eysenck & Eysenck, 1976) and Tellegen (2000; Tellegen & Waller, in press), as well as measures representing another personality system in widespread use, that of Cloninger (1987; Cloninger et al., 1993). We focused on the DAPP (Livesley & Jackson, in press) and SNAP (Clark, 1993) as measures of abnormal personality because of the large body of research associated with these two instruments, and because of their "bottom-up" approach to describing abnormal personality.

Method

Study 1: Meta-Analysis

Measures and samples. Numerous models of normal and abnormal personality structure have been proposed, many of which have associated inventories. Various criteria were thus used to limit the number of models and inventories considered for inclusion in the meta-analysis. First and most important, instruments were selected in an attempt to represent major personality theories and measures in widespread use. Second, empirically derived inventories such as the Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1983) were eliminated from consideration so as to eliminate interpretive difficulties associated with item overlap in scales. Finally, some inventories (e.g., the 16PF; Cattell, 1979) were considered but were not included because correlations with a sufficiently broad range of other instruments, representing the abnormal as well as normal range, could not be located in a thorough search of the literature. The goal was to identify a set of inventories that was as comprehensive as possible while still being complete in the sense that correlations between all of their scales were represented.

Ultimately, five inventories were used in the present investigation: the DAPP (Livesley & Jackson, in press), the Eysenck Personality Questionnaire (EPQ and EPQ—Revised [EPQ–R]; Eysenck & Eysenck, 1975; Eysenck, Eysenck, & Barrett, 1985), the Multidimensional Personality Questionnaire (MPQ; Tellegen, 1985, 2000), variants of the NEO-Personality Inventory (NEO-PI, NEO-PI—Revised [NEO–R], and NEO-Five-Factor Inventory [NEO-FFI] ; Costa & McCrae, 1985, 1992c), and the Temperament and Character Inventory (TCI) and its predecessor (Tridimensional Personality Questionnaire [TPQ]; Cloninger, 1987; Cloninger et al., 1993). These instruments are widely used in current normal and abnormal personality research, are associated with an extensive literature on interrelationships between their scales, and represent a broad spectrum of postulated personality traits.

To locate reports containing correlations between scales of these instruments, we used the names of these instruments, their abbreviations, and other phrases (*Eysenck*, *Cloninger*, *Tellegen*, *Big Five*) as keywords in a PsycINFO search. A previous meta-analysis of five-factor inventories (Digman, 1997) was also searched for references. In addition, when inter-inventory correlations could not be located, inventory developers were contacted to request information on possible unpublished data examining relationships between inventories. For those studies reporting incomplete correlation matrices, authors were contacted via e-mail when possible to request missing correlations. Finally, it should also be emphasized that none of the data in Study 2 were used in any of the analyses of Study 1.

In all, 77 samples of correlations were identified from 52 different studies. Of these, 43 were located from published reports in the literature,

4 were located from dissertations, and 5 were from unpublished data sources. Thirty-five of the samples included correlations between EPQ scales; 4 included correlations between DAPP scales, 8 included correlations between MPQ scales, 21 included correlations between NEO scales, and 36 included correlations between TCI scales. Fifty-two of the samples included correlations between scales of a single inventory, and 25 included correlations between some combinations of inventories. We believe that this sample of studies is representative of existing literature on structural relationships between normal and abnormal personality inventories.

Meta-analytic estimation of the correlation matrix. Because most of the included inventories have undergone revisions over time, and different versions were used across studies, assumptions regarding the isomorphism of different scale versions were necessary. In general, scales of earlier and later versions of an instrument were considered isomorphic if revisions were not associated with a change in postulated factor structure and scales of early and later versions were highly correlated. For example, scales of the EPQ and EPQ—R were considered to be measuring the same factors, as were scales of the NEO-FFI, NEO-PI, and NEO-PI–R. In contrast, because Cloninger's instrument revisions coincided with a revision in structural theory, scales of the TPQ and TCI were not generally considered isomorphic, with the exception of the Harm Avoidance and Novelty Seeking scales. These two factors remained essentially unaltered across earlier and later models, as did corresponding scales in the two instruments (Cloninger, 1987; Cloninger et al., 1993). Similarly, eight samples used the TPQ but scored the inventory to estimate Persistence and Reward Dependence scores as in the TCI. For these samples, Persistence and Reward Dependence were treated as isomorphic with TCI versions of the scales.

To meta-analytically estimate the correlation matrix, we did not correct sample correlations for unreliability or range restriction. A variety of factors motivated this decision. First, small variations in inventory usage (e.g., foreign language translations, unknown scoring methods) often made artifact correction unreasonable or questionable. Second, information about possible study artifacts was missing at substantially different rates for different versions of inventories, calling into question the validity of using artifact distribution correction methods (Hunter & Schmidt, 1990). Third, given the structural modeling goals of the meta-analysis, the utility of artifact correction was not entirely clear. Finally, structural analyses were attempted on correlation matrices estimated by means of artifact correction. Although conclusions based on these correlation matrices did not differ substantively, correcting for artifacts did worsen the non-positive-definite nature of the meta-analytic correlation matrix (explained below).

Because of assumed sample heterogeneity resulting from participant population and inventory version, a random effects model (Hedges & Vevea, 1998) was used for each meta-analytic correlation estimate. In such a model, each sample correlation can be thought of as possibly estimating a different subpopulation correlation; the meta-analytic correlation then represents an estimate of the overall population correlation, over different subpopulation correlations. To estimate each population correlation in this way, we used a univariate random effects model with a routine written in R (Ihaka & Gentleman, 1996), treating each sample as independent and weighting for sample size. Again, other meta-analytic methods were used, including a fixed effect model, simple mean sample correlation and median sample correlation, and conclusions did not differ substantively.

In total, 946 correlations between 44 scales were meta-analytically estimated (the L scale of the EPQ was not included because it was used inconsistently across samples, and is not a major component of Eysenck's structural theory). The largest total sample size for any meta-analytically estimated correlation was 52,879, for correlations among EPQ scales. The smallest total sample size for any meta-analytically estimated correlation was 158, for correlations between the MPQ scales and EPQ scales. Similarly, the most samples used to meta-analytically estimate a correlation was 31, for the correlation between TCI/TPQ Harm Avoidance and Novelty Seeking. The fewest samples used to meta-analytically estimate a correlation was 1, for the correlations between the DAPP scales and EPQ scales, EPQ Extraversion and the TCI character scales, and EPQ Psychoticism and TCI Self-Transcendence.

As the resulting meta-analytic correlation matrix was non-positive definite, it was smoothed with a least squares smoothing procedure (Knol & ten Berge, 1989). The least squares smoothed matrix represents the best approximation to the raw matrix in a least-squares sense, under the constraint that the smoothed matrix is positive definite. Analyses as reported here were also completed on the principal component smoothed matrix, ridge smoothed matrix, and the unsmoothed matrix, but results did not differ substantively. The resulting smoothed meta-analytic correlation matrix is available on request.

Study 2

In addition to the meta-analysis of the first study, we also conducted a study of relationships between various normal and abnormal personality inventories in a sample of university students. As a slightly different set of measures was included in the second study, generalizability of results across measures could be examined. Use of a sample of data also allowed for use of different statistical methods that could not be applied to the meta-analytic correlation matrix, generalizing results across statistical approaches.

Participants. Participants in the second study have been described previously (Clark & Watson, 1999; Watson, Clark, & Harkness, 1994). The sample included 327 students recruited from introductory psychology classes; 185 were students at Southern Methodist University and 142 were students at the University of Iowa.

Inventories. Data were collected on scales of four inventories: the NEO-PI–R (Costa & McCrae, 1992c), EPQ-R (Eysenck & Eysenck, 1975; Eysenck et al., 1985), SNAP (Clark, 1993), and Big Five Inventory (BFI; John, Donahue, & Kentle, 1991; John & Srivastava, 1999). The SNAP temperament scales were scored with item sets that did not overlap with other scales. In contrast to the meta-analysis, which examined relationships between the domain scales of the NEO, in the second study, relationships between the 30 NEO-PI–R facet scales were examined. As in the meta-analysis, the L scale of the EPQ-R was not included in analyses. In total, 53 scales were included in the analyses.

Although portions of this dataset have been reported previously (Clark & Watson, 1999; Watson et al., 1994), those reports focused entirely on a subset of superordinate level scales (i.e., the NEO-PI–R domain scores and the three SNAP temperament scales). The analyses reported in this paper are therefore new.

Analyses. Exploratory factor analyses were performed with M+ (Muthén & Muthén, 2001). Unweighted least squares (ULS) estimation was used with the meta-analytic correlation matrix obtained in Study 1, and maximum likelihood estimation was used with the correlation matrix obtained from Study 2. Maximum likelihood estimation was not possible with the meta-analytic correlation matrix because of substantial variability in the sample sizes estimating each correlation.

Two methods were used to evaluate the fit of the exploratory factor models and to determine which factor solutions to use in subsequent analyses: eigenvalue Monte Carlo p values (i.e., parallel analysis; Horn, 1965), and replicability of factor solutions across studies. Monte Carlo p values were calculated for eigenvalues of the meta-analytic correlation matrix by generating random simulated meta-analytic datasets under the null model. Each simulated meta-analytic dataset comprised a set of correlations from random samples with the same sample sizes as those included in the actual meta-analysis. Each sample in each simulated meta-analytic dataset was generated randomly from a bivariate Wishart distribution with zero correlation. Meta-analytic correlation matrices were estimated for each simulated meta-analytic dataset by means of the procedures described above, and the eigenvalues of these matrices were calculated. This process was repeated 1,000 times to simulate the process of conducting the meta-analysis under a null model.

Table 1
Observed Eigenvalues and Monte Carlo p Values

	Eigenvalue no.							
Eigenvalue and *p*	1	2	3	4	5	6	7	8
Study 1								
Observed eigenvalue	11.070	5.371	3.983	3.477	2.165	1.446	1.343	1.227
Monte Carlo *p*	.000	.000	.000	.000	.000	.973	1.000	1.000
Study 2								
Observed eigenvalue	10.323	6.019	5.390	4.833	3.275	1.743	1.362	1.222
Monte Carlo *p*	.000	.000	.000	.000	.000	.000	1.000	1.000

Note. Table includes observed eigenvalues of the meta-analytic correlation matrix of Study 1 and the empirical correlation matrix of Study 2. The *p*s were calculated by Monte Carlo methods as described in the text.

Factor replicability across studies was evaluated by visual inspection, and by calculating correlations between factor loading estimates across studies. Factor comparisons were restricted to measures that were replicated across studies, as the two studies included overlapping but nonidentical sets of measures. In particular, factor loading congruence calculations were restricted to the three EPQ variables and Big Five variables in each study, that is, the NEO in the meta-analysis, and the BFI in Study 2.

In order to explore hierarchical relationships between factors at different levels of abstraction, we calculated expected correlations between factor scores for factors at each level of the hierarchy. Because meta-analytic datasets do not include raw data, factor scores cannot be calculated directly. Therefore, traditional Pearson correlations between factor scores cannot be calculated either. Expected correlations between factor scores can be calculated without any raw data (McDonald, 1985, p. 168–169), however, allowing for the analysis of meta-analytic correlation matrices. Given that factor scores are calculated with the regression method (Bollen, 1989, p. 305; McDonald, 1985), expected factor correlations can be calculated with factor loading matrices, any known factor intercorrelations, and the observed correlation matrix. Expected factor correlations can be calculated even when factors are assumed a priori to be uncorrelated (McDonald, 1985), because information about factor relationships is contained in relative patterns of the loading matrices (cf. Yung, Thissen, & McLeod, 1999).[1]

Results

Monte Carlo *p* values are presented in Table 1, together with observed eigenvalues for comparison. These *p* values indicate that the first five components of the meta-analytic correlation matrix were significant, as were the first six components of the correlation matrix calculated in Study 2. However, inspection of factor loading estimates from exploratory factor models comprising two to six factors suggested that only two-, three-, four-, and five-factor models replicated well across the two studies. These conclusions were supported by correlations between loading patterns, presented in Table 2.

As is evident from Table 2, the sixth factor of the six-factor models did not replicate across the two studies. The sixth factor of the meta-analysis comprised very small loadings—the largest absolute value of a loading being .396—and was essentially uninterpretable. The largest loadings of this factor were on DAPP Submissiveness and Oppositionality, in the positive direction, and on MPQ Stress Reaction, in the negative direction. Although loadings associated with the sixth factor of Study 2 were larger than those of Study 1, they were also relatively small in an absolute sense, the largest absolute loading being .539. The sixth factor of Study 2 seemed to reflect paranoid mistrust, having largest loadings on SNAP Eccentricity, Mistrust, and Manipulativeness. On the basis of content and preliminary correlations, it appeared to be hierarchically related to the fifth factor of the five-factor solution.

For these three reasons—the lack of significance of a sixth factor in the meta-analysis, the failure to replicate the sixth factor across the two studies and samples of measures, and its relationship to a similar factor of the five-factor solution—only factor solutions including two to five factors were examined further.

Although factor solutions replicated relatively well across studies, congruence coefficients for the two-factor varimax solution were nevertheless slightly lower than for other varimax factor solutions. We obtained improved replication of the two-factor model by rotating the meta-analytic loading estimates to the loadings of Study 2, using loadings on the variables that both studies had in common as targets (i.e., partially specified target criterion; Jennrich, 2002). The factor loading congruence coefficients obtained after this rotation were .97 and .98. As is explained below, the two-factor model loading patterns of Study 2 closely resembled loading patterns reported by Digman (1997); by rotating the meta-analytic loading matrix to that of Study 2, we achieved consistency not only with that of Study 2, but also with that reported in Digman's (1997) meta-analysis (see Bushman, Cooper, & Lemke, 1991 for a discussion of rotation in the context of meta-analysis). For this reason, the targeted rotated two-factor solution was used throughout the remainder of the paper.[2]

Study 1

Factor loading and uniqueness estimates from the exploratory factor models are presented in Tables 3 through 6. The loading

[1] Results from Study 2, in which empirical estimates of factor correlations were available, indicate that expected factor correlations approximate empirical correlations very closely. The root mean square difference of the expected and empirically estimated correlations was .044, and the median absolute difference was .036. The maximum absolute difference between expected and empirical correlations was .092, involving a correlation not relevant to the current analyses. For consistency in the text, the factor correlations reported for Study 2 are expected correlations.

[2] The two-factor varimax solution was similar to the targeted rotated solution. The targeted rotation generally had the effect of rotating one varimax factor away from Negative Emotionality content, and the other varimax factor toward Negative Emotionality content.

patterns of the meta-analytic two-factor model, presented in Table 3, resemble the superordinate two-factor solution reported by Digman (1997). The first factor, for example, resembles Digman's α, having large positive loadings on scales such as DAPP Cognitive Distortion, DAPP Affective Instability, MPQ Aggression, and NEO Neuroticism, and large negative loadings on scales such as MPQ Control, NEO Agreeableness, NEO Conscientiousness, and TCI Self-Determination. The second factor, similarly, resembles Digman's β in that it has large positive loadings on scales such as EPQ Extraversion, NEO Extraversion, and MPQ Social Potency, and large negative loadings on scales such as DAPP Social Avoidance and TCI Harm Avoidance. The second factor differs from Digman's β, however, in having more modest loadings from scales such as NEO Openness.

The three-factor model, presented in Table 4, strongly resembles standard three-factor models presented in the literature. The first factor, for example, strongly resembles a Negative Emotionality factor, with large positive loadings on scales such as DAPP Anxiety, EPQ Neuroticism, MPQ Stress Reaction, and NEO Neuroticism. The second factor resembled a general Disinhibition factor, with large positive loadings on scales such as DAPP Stimulus Seeking, DAPP Conduct Problems, MPQ Aggression, and TCI Novelty Seeking, and large negative loadings on scales such as MPQ Control, NEO Agreeableness, NEO Conscientiousness, and TCI Cooperativeness. Finally, the third factor resembled a reversed Positive Emotionality factor, with large negative loadings on scales such as EPQ Extraversion, NEO Extraversion, MPQ Well-Being, and TCI Reward Dependence, and large positive loadings on scales such as DAPP Restricted Expression, DAPP Intimacy Problems, and DAPP Social Avoidance.

The four-factor model, presented in Table 5, is consistent with four-factor models frequently reported in the literature on abnormal personality. The four-factor model is also similar to the three-factor model, differing from the latter in that the Disinhibition factor of the three-factor model bifurcates into a Disagreeable Disinhibition factor and an Unconscientious Disinhibition factor. The first and third factors of the four-factor model are nearly identical in content to the Negative Emotionality and reversed Positive Emotionality factors of the three-factor model. The second factor of the four-factor model resembles a Disagreeable Disinhibition factor, comprising large positive loadings on scales such as DAPP Callousness, DAPP Rejection, DAPP Conduct Problems, and MPQ Aggression, and large negative loadings on scales such as NEO Agreeableness and TCI Cooperativeness. The fourth factor of the four-factor model resembles an Unconscientious Disinhibition factor, comprising large negative loadings on scales such as DAPP Compulsivity, MPQ Achievement, MPQ Control, NEO Conscientiousness, and TCI Persistence.

The five-factor model, presented in Table 6, strongly resembles the Big Five factor structure commonly described in the literature, including Neuroticism, Agreeableness, Extraversion, Conscientiousness, and Openness factors. The model is similar to the four-factor model, differing from the latter in that the Positive

Table 3
Two-Factor Exploratory Model: Meta-Analysis

Measure	I	II	θ
EPQ Neuroticism	0.593	−0.422	0.471
EPQ Extraversion	0.032	0.774	0.400
EPQ Psychoticism	0.445	0.215	0.755
NEO Neuroticism	0.631	−0.500	0.352
NEO Extraversion	−0.121	0.701	0.494
NEO Conscientiousness	−0.509	0.068	0.737
NEO Agreeableness	−0.563	0.000	0.683
NEO Openness	0.070	0.323	0.890
DAPP Submissiveness	0.325	−0.482	0.663
DAPP Cognitive Distortion	0.709	−0.269	0.424
DAPP Identity Disturbance	0.641	−0.540	0.297
DAPP Affective Instability	0.698	−0.178	0.481
DAPP Stimulus Seeking	0.573	0.478	0.443
DAPP Compulsivity	−0.153	−0.101	0.966
DAPP Restricted Expression	0.287	−0.482	0.685
DAPP Callousness	0.653	0.058	0.571
DAPP Oppositionality	0.692	−0.201	0.481
DAPP Intimacy Problems	0.068	−0.276	0.920
DAPP Rejection	0.515	0.298	0.646
DAPP Anxiety	0.619	−0.461	0.405
DAPP Conduct Problems	0.649	0.185	0.545
DAPP Suspiciousness	0.614	−0.209	0.579
DAPP Social Avoidance	0.474	−0.645	0.358
DAPP Narcissism	0.614	0.107	0.611
DAPP Insecure Attachment	0.455	−0.148	0.771
DAPP Self Harm	0.462	−0.214	0.741
MPQ Well-Being	−0.300	0.532	0.627
MPQ Social Potency	0.142	0.617	0.599
MPQ Achievement	−0.184	0.196	0.928
MPQ Social Closeness	−0.224	0.333	0.839
MPQ Stress Reaction	0.543	−0.439	0.513
MPQ Alienation	0.513	−0.148	0.714
MPQ Aggression	0.532	0.143	0.697
MPQ Control	−0.477	−0.191	0.736
MPQ Harm Avoidance	−0.308	−0.280	0.826
MPQ Traditionalism	−0.228	−0.159	0.923
MPQ Absorption	0.306	0.137	0.887
TCI Harm Avoidance	0.266	−0.731	0.396
TCI Novelty Seeking	0.417	0.508	0.568
TCI Persistence	−0.034	0.086	0.991
TCI Reward Dependence	−0.152	0.159	0.952
TCI Self Determination	−0.665	0.327	0.451
TCI Cooperativeness	−0.547	0.077	0.696
TCI Self-Transcendence	0.152	0.123	0.962

Note. Loadings rotated using targeted rotation criterion (see text for explanation). Root-mean-square residual = .119. EPQ = Eysenck Personality Questionnaire; DAPP = Dimensional Assessment of Personality Pathology; MPQ = Multidimensional Personality Questionnaire; TCI = Temperament and Character Inventory.

Table 2
Factor Loading Congruences

	No. of factors in model				
Factor	2	3	4	5	6
I	.896	.986	.978	.977	.975
II	.831	.936	.904	.926	.906
III	—	.959	.972	.986	.990
IV		—	.908	.933	.941
V			—	.853	.881
VI				—	.240

Note. Values shown in table are absolute values of correlations between varimax-rotated factor loadings in each study for the three Eysenck Personality Questionnaire variables and the five Big Five measures in each study. Factor numbers correspond to factors of the meta-analytic correlation matrix of Study 1.

Table 4
Three-Factor Exploratory Model: Meta-Analysis

Measure	I	II	III	θ
EPQ Neuroticism	0.819	0.029	0.009	0.329
EPQ Extraversion	−0.285	0.287	−0.703	0.342
EPQ Psychoticism	0.067	0.572	0.035	0.668
NEO Neuroticism	0.858	0.047	0.102	0.251
NEO Extraversion	−0.292	0.076	−0.759	0.334
NEO Conscientiousness	−0.294	−0.437	−0.180	0.690
NEO Agreeableness	−0.248	−0.570	−0.207	0.571
NEO Openness	−0.029	0.106	−0.371	0.850
DAPP Submissiveness	0.637	−0.169	0.094	0.557
DAPP Cognitive Distortion	0.751	0.255	−0.008	0.371
DAPP Identity Disturbance	0.753	0.172	0.320	0.301
DAPP Affective Instability	0.738	0.250	−0.133	0.375
DAPP Stimulus Seeking	0.127	0.660	−0.319	0.447
DAPP Compulsivity	0.083	−0.310	−0.134	0.879
DAPP Restricted Expression	0.364	0.071	0.469	0.643
DAPP Callousness	0.303	0.635	0.127	0.489
DAPP Oppositionality	0.611	0.370	0.080	0.483
DAPP Intimacy Problems	0.043	0.079	0.426	0.810
DAPP Rejection	0.200	0.513	−0.219	0.649
DAPP Anxiety	0.878	0.010	0.010	0.229
DAPP Conduct Problems	0.266	0.653	−0.013	0.502
DAPP Suspiciousness	0.547	0.327	0.112	0.582
DAPP Social Avoidance	0.690	0.005	0.401	0.363
DAPP Narcissism	0.545	0.314	−0.359	0.475
DAPP Insecure Attachment	0.575	0.064	−0.181	0.632
DAPP Self Harm	0.421	0.241	0.156	0.741
MPQ Well-Being	−0.378	−0.081	−0.539	0.560
MPQ Social Potency	−0.153	0.320	−0.548	0.574
MPQ Achievement	−0.122	−0.158	−0.300	0.870
MPQ Social Closeness	−0.112	−0.245	−0.584	0.586
MPQ Stress Reaction	0.721	0.057	0.122	0.462
MPQ Alienation	0.423	0.308	0.105	0.715
MPQ Aggression	0.174	0.587	0.070	0.620
MPQ Control	−0.133	−0.544	−0.003	0.686
MPQ Harm Avoidance	0.031	−0.465	0.055	0.780
MPQ Traditionalism	0.061	−0.391	−0.088	0.836
MPQ Absorption	0.289	0.127	−0.333	0.789
TCI Harm Avoidance	0.632	−0.231	0.403	0.384
TCI Novelty Seeking	−0.017	0.586	−0.306	0.563
TCI Persistence	0.063	−0.129	−0.263	0.911
TCI Reward Dependence	0.095	−0.351	−0.562	0.552
TCI Self Determination	−0.645	−0.306	−0.189	0.454
TCI Cooperativeness	−0.237	−0.570	−0.327	0.512
TCI Self-Transcendence	0.263	−0.069	−0.435	0.737

Note. Loadings rotated to varimax criterion. Root-mean-square residual = .092. EPQ = Eysenck Personality Questionnaire; DAPP = Dimensional Assessment of Personality Pathology; MPQ = Multidimensional Personality Questionnaire; TCI = Temperament and Character Inventory.

Emotionality factor of the four-factor model bifurcates into an Extraversion factor and an Openness factor. The first, second, and fourth factors of the five-factor solution are similar to the Negative Emotionality, Disagreeable Disinhibition, and Unconscientious Disinhibition factors of the four-factor model. The third factor resembles an Extraversion factor, having large positive loadings on scales such as EPQ Extraversion, MPQ Social Closeness, and NEO Extraversion, and large negative loadings on scales such as DAPP Restricted Expression and DAPP Intimacy Problems. The fifth factor resembles an Openness factor, having large positive loadings on MPQ Absorption, NEO Openness, and TCI Self-Transcendence.

Correlations between subordinate and superordinate factors are given in Figure 1. The values in Figure 1 are the largest expected correlations between each subordinate factor and its superordinate factors (e.g., the largest correlation between the Neuroticism factor of the five-factor solution and the four factors of the four-factor solution).[3] As is evident from the figure, the Neuroticism factor of the five-factor solution is essentially equivalent to the Negative Emotionality factor of the four- and three-factor solutions. The Agreeableness and Conscientiousness factors of the five-factor solution, similarly, are essentially equivalent to the Disagreeable Disinhibition and Unconscientious Disinhibition factors of the four-factor solution, which, in turn, are most correlated with the Disinhibition factor of the three-factor solution. The Extraversion and Openness factors of the five-factor solution are most correlated with the Positive Emotionality factor of the four-factor solution, which appears to be essentially equivalent to the Positive Emotionality of the three-factor solution, and similar to Beta of the two-factor solution. Finally, the Negative Emotionality and Disinhibition factors of the three-factor solution both are most highly correlated with Alpha of the two-factor solution.

Study 2

Factor loading and uniqueness estimates from the exploratory factor models of Study 2 are presented in Tables 7 through 10. As was suggested by factor congruences presented in Table 2, the factors in Study 2 were extremely similar in content to those of Study 1. As in Study 1, the five-factor model is readily recognizable as the Big Five, the four factors of the four-factor solution are similar to four-factor models reported in the literature on abnormal personality, and the three-factor solution is similar to three-factor models described by Eysenck (Eysenck & Eysenck, 1975) and others. Finally, the two-factor model is similar in content to Big Two identified by Digman (1997), although Alpha has slightly less Negative Emotionality content than in Study 1 and in Digman's meta-analysis, and Beta again has more modest relationships with Openness measures than in Digman's meta-analysis.

Hierarchical relationships between the factors are also extremely similar to those in Study 1. This hierarchy is represented in Figure 2, which presents correlations between subordinate and superordinate factors as in Figure 1. As in Study 1, the Neuroticism factor of the five-factor solution is essentially equivalent to the Negative Emotionality factor of the four- and three-factor solutions. The Agreeableness and Conscientiousness factors of the five-factor solution are essentially equivalent to the Disagreeable Disinhibition and Unconscientious Disinhibition factors of the four-factor solution, which are most correlated with the Disinhibition factor of the three-factor solution. The Extraversion and Openness factors of the five-factor solution are correlated with the Positive Emotionality factor of the four-factor solution, which appears to be essentially equivalent to the Positive Emotionality and Beta factors of the three- and two-factor solutions, respec-

[3] In both studies, correlations not shown in the figure were generally small, usually near zero, with the exception of correlations between the factors of the three-factor models and those of the two-factor models. However, the pattern of cross-correlations involving three-factor and two-factor models did not replicate across studies, whereas the primary correlations did.

Table 5
Four-Factor Exploratory Model: Meta-Analysis

Measure	I	II	III	IV	θ
EPQ Neuroticism	0.808	0.085	0.068	−0.074	0.330
EPQ Extraversion	−0.259	0.256	−0.719	−0.053	0.348
EPQ Psychoticism	0.059	0.510	−0.026	0.253	0.672
NEO Neuroticism	0.864	0.032	0.104	0.132	0.225
NEO Extraversion	−0.254	0.041	−0.771	−0.088	0.331
NEO Conscientiousness	−0.327	−0.244	−0.009	−0.715	0.323
NEO Agreeableness	−0.198	−0.651	−0.248	0.026	0.475
NEO Openness	−0.008	0.072	−0.391	0.021	0.842
DAPP Submissiveness	0.657	−0.204	0.085	0.124	0.504
DAPP Cognitive Distortion	0.738	0.285	0.025	0.020	0.373
DAPP Identity Disturbance	0.729	0.202	0.344	0.078	0.303
DAPP Affective Instability	0.730	0.283	−0.095	−0.018	0.377
DAPP Stimulus Seeking	0.131	0.603	−0.368	0.186	0.449
DAPP Compulsivity	0.058	−0.094	0.053	−0.713	0.477
DAPP Restricted Expression	0.322	0.158	0.534	−0.082	0.579
DAPP Callousness	0.252	0.731	0.178	−0.058	0.367
DAPP Oppositionality	0.631	0.266	−0.005	0.410	0.363
DAPP Intimacy Problems	0.006	0.137	0.460	−0.036	0.769
DAPP Rejection	0.163	0.643	−0.144	−0.246	0.479
DAPP Anxiety	0.871	0.053	0.060	−0.037	0.233
DAPP Conduct Problems	0.247	0.635	−0.038	0.161	0.509
DAPP Suspiciousness	0.505	0.473	0.220	−0.241	0.414
DAPP Social Avoidance	0.662	0.069	0.453	−0.025	0.351
DAPP Narcissism	0.540	0.363	−0.309	−0.114	0.468
DAPP Insecure Attachment	0.579	0.084	−0.150	−0.035	0.634
DAPP Self Harm	0.406	0.244	0.155	0.095	0.742
MPQ Well-Being	−0.361	−0.055	−0.507	−0.230	0.557
MPQ Social Potency	−0.161	0.395	−0.498	−0.265	0.500
MPQ Achievement	−0.151	0.040	−0.152	−0.650	0.530
MPQ Social Closeness	−0.053	−0.331	−0.638	0.029	0.479
MPQ Stress Reaction	0.714	0.072	0.142	0.055	0.462
MPQ Alienation	0.397	0.361	0.142	−0.028	0.691
MPQ Aggression	0.144	0.610	0.070	0.066	0.598
MPQ Control	−0.156	−0.378	0.156	−0.586	0.465
MPQ Harm Avoidance	0.039	−0.436	0.088	−0.124	0.785
MPQ Traditionalism	0.060	−0.309	−0.009	−0.289	0.817
MPQ Absorption	0.290	0.172	−0.286	−0.148	0.783
TCI Harm Avoidance	0.638	−0.259	0.393	0.165	0.344
TCI Novelty Seeking	0.010	0.443	−0.447	0.436	0.414
TCI Persistence	0.039	0.076	−0.107	−0.643	0.568
TCI Reward Dependence	0.162	−0.435	−0.608	0.010	0.415
TCI Self Determination	−0.645	−0.254	−0.149	−0.270	0.425
TCI Cooperativeness	−0.196	−0.593	−0.324	−0.124	0.490
TCI Self-Transcendence	0.266	0.016	−0.350	−0.308	0.712

Note. Loadings rotated to varimax criterion. Root-mean-square residual = .063. EPQ = Eysenck Personality Questionnaire; DAPP = Dimensional Assessment of Personality Pathology; MPQ = Multidimensional Personality Questionnaire; TCI = Temperament and Character Inventory.

tively. Finally, the Negative Emotionality and Disinhibition factors of the three-factor solution both are most highly correlated with Alpha of the two-factor solution.

Although hierarchical relationships between the factors were extremely similar to those in Study 1, there were some differences in the magnitudes of relationships between factors across the two studies. For example, in Study 1, the correlation between Disagreeable Disinhibition and Disinhibition was larger than the correlation between Unconscientious Disinhibition and Disinhibition (.93 vs. .32). In Study 2, in contrast, this pattern was reversed somewhat (.49 vs. .87). Similarly, the correlation between Openness and Positive Emotionality was larger in Study 1 (.48) than in Study 2 (.26).

Discussion

The trait hierarchy identified here is remarkable in its replicability across samples of individuals and measures. This structure replicates across different samples as well as measures, and is identifiable using multiple methodological approaches, including meta-analytic and sample-based maximum-likelihood methods. Although there were some differences in results across the current two studies—which is expectable given the studies' different methodologies—these differences were minor relative to the similarities in hierarchical structure observed across studies. Most important, perhaps, is the fact that the entire hierarchy, not one single level of it, replicates well: It is not only the Big Five, Big

Table 6
Five-Factor Exploratory Model: Meta-Analysis

Measure	I	II	III	IV	V	θ
EPQ Neuroticism	0.808	0.162	−0.021	0.082	−0.008	0.314
EPQ Extraversion	−0.295	0.252	0.658	−0.042	0.288	0.332
EPQ Psychoticism	0.032	0.439	−0.044	−0.345	0.110	0.673
NEO Neuroticism	0.867	0.067	−0.077	−0.114	−0.019	0.224
NEO Extraversion	−0.288	0.022	0.678	0.014	0.345	0.338
NEO Conscientiousness	−0.327	−0.128	0.059	0.741	0.009	0.324
NEO Agreeableness	−0.179	−0.696	0.201	0.048	0.093	0.432
NEO Openness	−0.074	−0.130	0.066	−0.158	0.710	0.444
DAPP Submissiveness	0.668	−0.191	−0.079	−0.077	−0.011	0.505
DAPP Cognitive Distortion	0.704	0.242	−0.151	−0.092	0.281	0.336
DAPP Identity Disturbance	0.719	0.189	−0.383	−0.096	0.033	0.291
DAPP Affective Instability	0.705	0.307	0.060	−0.037	0.164	0.377
DAPP Stimulus Seeking	0.067	0.485	0.166	−0.350	0.439	0.418
DAPP Compulsivity	0.049	0.037	−0.008	0.722	0.039	0.473
DAPP Restricted Expression	0.304	0.101	−0.653	0.059	0.086	0.461
DAPP Callousness	0.218	0.749	−0.185	−0.049	0.033	0.354
DAPP Oppositionality	0.612	0.181	−0.091	−0.463	0.154	0.346
DAPP Intimacy Problems	−0.014	0.060	−0.579	0.008	0.070	0.657
DAPP Rejection	0.120	0.701	0.137	0.133	0.142	0.437
DAPP Anxiety	0.861	0.092	−0.072	0.034	0.087	0.236
DAPP Conduct Problems	0.209	0.586	−0.037	−0.275	0.157	0.511
DAPP Suspiciousness	0.476	0.518	−0.233	0.170	0.077	0.416
DAPP Social Avoidance	0.659	0.059	−0.494	0.030	0.013	0.317
DAPP Narcissism	0.504	0.398	0.266	0.030	0.237	0.459
DAPP Insecure Attachment	0.590	0.180	0.246	0.045	−0.050	0.554
DAPP Self Harm	0.388	0.203	−0.223	−0.139	0.104	0.728
MPQ Well-Being	−0.390	−0.079	0.403	0.176	0.310	0.551
MPQ Social Potency	−0.208	0.411	0.426	0.150	0.300	0.494
MPQ Achievement	−0.202	0.044	−0.004	0.587	0.409	0.446
MPQ Social Closeness	−0.032	−0.270	0.726	0.012	0.013	0.399
MPQ Stress Reaction	0.727	0.142	−0.061	−0.029	−0.114	0.433
MPQ Alienation	0.388	0.407	−0.102	−0.006	−0.046	0.671
MPQ Aggression	0.128	0.660	−0.008	−0.138	−0.095	0.520
MPQ Control	−0.136	−0.253	−0.058	0.661	−0.126	0.462
MPQ Harm Avoidance	0.088	−0.323	0.085	0.244	−0.307	0.727
MPQ Traditionalism	0.094	−0.173	0.166	0.381	−0.218	0.741
MPQ Absorption	0.235	0.069	0.043	0.040	0.568	0.614
TCI Harm Avoidance	0.679	−0.201	−0.274	−0.063	−0.287	0.338
TCI Novelty Seeking	−0.028	0.323	0.311	−0.551	0.285	0.413
TCI Persistence	−0.004	0.118	0.008	0.584	0.314	0.547
TCI Reward Dependence	0.168	−0.407	0.601	0.029	0.157	0.420
TCI Self Determination	−0.635	−0.225	0.178	0.297	−0.028	0.425
TCI Cooperativeness	−0.192	−0.640	0.236	0.172	0.215	0.422
TCI Self-Transcendence	0.220	−0.032	0.160	0.235	0.505	0.615

Note. Loadings rotated to varimax criterion. Root-mean-square residual = .052. EPQ = Eysenck Personality Questionnaire; DAPP = Dimensional Assessment of Personality Pathology; MPQ = Multidimensional Personality Questionnaire; TCI = Temperament and Character Inventory.

Four, Big Three, or Big Two that replicate, but also their hierarchical relationships with one another.

The hierarchical framework presented here is important for numerous reasons. First, it provides a common superordinate structure for normal and abnormal personality. Second, it integrates a variety of models that have been proposed in the literature and supports previous integrative models that have been proposed. Finally, the results presented here help to clarify the nature of hierarchy in personality structure.

Comparisons Between the Current Results and Previous Findings

In integrating and supporting major Big Trait models of personality structure, our results resemble previous integrative, hierarchical accounts of normal and abnormal personality structure. In particular, the hierarchical structure proposed here resembles those proposed by Digman (1997) and Zuckerman and colleagues (Zuckerman, Kuhlman, & Camac, 1988; Zuckerman, Kuhlman, Thornquist, & Kiers, 1991).

Digman (1997). The current hierarchical framework resembles the model of personality hierarchy proposed by Digman (1997). The two superordinate factors identified here, in the meta-analysis as well as the empirical study, have some content comparable to the Big Two identified by Digman. The Big Two of Digman include one superordinate factor, Alpha, comprising reversed Neuroticism content as well as Agreeableness and Conscientiousness content, and another factor, Beta, comprising Extraversion and Openness content. The Big Two identified here, with

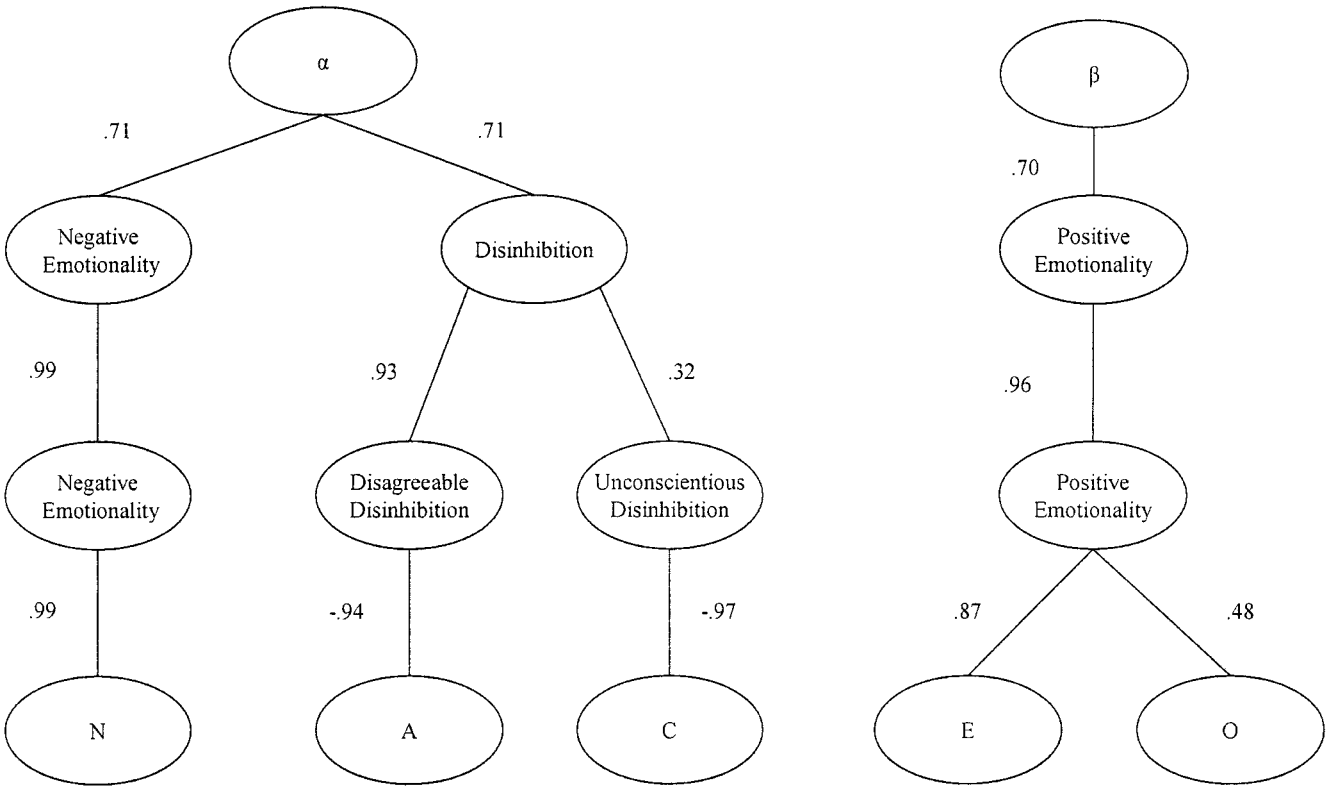

Figure 1. Study 1: Correlations between subordinate and superordinate factors. N = Neuroticism; A = Agreeableness; C = Conscientiousness; E = Extraversion; O = Openness.

negligible reversals of sign, are similar to those of Digman in their content.

Despite these similarities, our results do emphasize different interpretations of Beta than are suggested by Digman (1997). For example, our results indicate that Openness is not as strongly related to Positive Emotionality and Beta as in Digman's meta-analysis. Our results also suggest that Beta may be characterized by nonnegligible negative loadings of Negative Emotionality in addition to positive loadings from Positive Emotionality traits.

The hierarchical framework proposed here also extends Digman's (1997) model in explicitly relating the Big Two to the Big Three and Big Four models of personality structure. In his meta-analysis, Digman conjectured that "to his eye," factors of the Big Three "belong at the Big Five level" (Digman, 1997, p. 1251). Our results indicate, in contrast, that the Big Three factors occupy a distinct level of the hierarchy, are in fact superordinate to the Big Five, and do not belong at that level. Our results indicate the Big Two are related to the Big Three in that Alpha comprises Negative Emotionality and Disinhibition content, and that Beta is essentially isomorphic with Big Three Positive Emotionality.

We believe that differences between our account and Digman's (1997) account of personality hierarchy can be attributed to two explanations. First, Digman modeled only five variables, making it impossible to recover any more than two factors. In a standard exploratory factor model with five observed variables, it is not possible to model more than two factors because of lack of model identification. Similar techniques such as principal component analysis may suffer from related problems because of empirical underidentification. A number of studies (e.g., Little, Lindenberger, & Nesselroade, 1999; Velicer & Fava, 1998) have demonstrated that estimates of factor loading patterns can be distorted in exploratory analyses with too few variables per factor, especially when the variables are not broadly representative of the content domain. Digman failed to recover the Big Three and Big Four because it was impossible to recover them by using the methodological approach he adopted.

Second, it is important to note that our selection of measures is much broader and more comprehensive than the collection of measures included in Digman (1997), which were limited to measures of the Big Five. Not only were more measures of normal personality included in the present two studies than in Digman, but measures of abnormal personality were also included. It is possible that differences in Beta content as identified by Digman and Beta content as identified here are due to the greater representativeness of personality measures in our studies. Traditional Big Five measures, for example, may tend to emphasize shared features of Openness and Extraversion; with a broader sample of Openness measures, the relative independence of Openness appears to be more clearly defined. Similarly, it is possible that greater representativeness of Negative Emotionality measures in the present two studies more clearly delineates the relationship between Negative Emotionality traits and Beta.

Our results, based on a broader selection of measures and more flexible exploratory methods, indicate that there are replicable

Table 7
Two-Factor Exploratory Model: Study 2

Measure	I	II	θ
EPQ Neuroticism	0.468	−0.227	0.729
EPQ Extraversion	−0.031	0.805	0.351
EPQ Psychoticism	0.560	0.116	0.673
BFI Neuroticism	0.391	−0.265	0.777
BFI Extraversion	−0.079	0.742	0.443
BFI Conscientiousness	−0.580	0.138	0.645
BFI Agreeableness	−0.545	0.085	0.695
BFI Openness	−0.058	0.315	0.898
NEO Anxiety	0.230	−0.221	0.898
NEO Hostility	0.590	−0.139	0.633
NEO Depression	0.522	−0.361	0.597
NEO Self-Consciousness	0.337	−0.377	0.744
NEO Impulsivity	0.427	0.088	0.810
NEO Vulnerability	0.482	−0.309	0.672
NEO Warmth	−0.419	0.519	0.555
NEO Gregariousness	−0.072	0.558	0.684
NEO Assertiveness	−0.155	0.647	0.558
NEO Activity	−0.233	0.604	0.581
NEO Excitement Seeking	0.106	0.487	0.752
NEO Positive Emotion	−0.328	0.542	0.599
NEO Trust	−0.493	0.224	0.707
NEO Straightforwardness	−0.534	−0.232	0.661
NEO Altruism	−0.514	0.236	0.680
NEO Compliance	−0.505	−0.093	0.737
NEO Modesty	−0.222	−0.394	0.796
NEO Tenderness	−0.127	0.068	0.979
NEO Competence	−0.555	0.319	0.590
NEO Order	−0.360	−0.041	0.869
NEO Dutifulness	−0.624	0.034	0.609
NEO Achievement	−0.428	0.237	0.761
NEO Discipline	−0.623	0.184	0.578
NEO Deliberateness	−0.560	−0.198	0.647
NEO Fantasy	0.266	0.187	0.894
NEO Aesthetics	0.022	0.130	0.983
NEO Feelings	0.027	0.242	0.941
NEO Actions	0.006	0.239	0.943
NEO Ideas	−0.133	0.216	0.936
NEO Values	−0.091	0.047	0.989
SNAP Negative Temperament	0.475	−0.140	0.755
SNAP Mistrust	0.524	−0.078	0.719
SNAP Manipulativeness	0.708	0.209	0.455
SNAP Aggression	0.576	0.066	0.664
SNAP Self Harm	0.535	−0.215	0.668
SNAP Eccentric Perceptions	0.366	0.093	0.857
SNAP Dependency	0.287	−0.070	0.913
SNAP Positive Temperament	−0.289	0.662	0.479
SNAP Exhibitionism	0.201	0.618	0.578
SNAP Entitlement	0.124	0.437	0.793
SNAP Detachment	0.215	−0.538	0.664
SNAP Impulsivity	0.641	0.248	0.528
SNAP Propriety	−0.282	0.126	0.905
SNAP Workaholism	−0.234	0.106	0.934
SNAP Disinhibition	0.649	0.244	0.519

Note. Loadings rotated to varimax criterion. Root-mean-square residual = .139. EPQ = Eysenck Personality Questionnaire; BFI = Big Five Inventory. SNAP = Schedule for Nonadaptive and Adaptive Personality.

hierarchical features between the Big Two and Big Five. These hierarchical features are important in that they constitute major structural accounts of normal and abnormal personality. Our results suggest that Digman's (1997) account of hierarchy between the Big Two and Big Five "compresses" features of hierarchy involving Neuroticism, Agreeableness, and Conscientiousness. As will be discussed, we contend that those intermediate features of superordinate personality hierarchy are important for theoretical as well as empirical reasons.

Table 8
Three-Factor Exploratory Model: Study 2

Measure	I	II	III	θ
EPQ Neuroticism	0.873	−0.086	0.021	0.230
EPQ Extraversion	−0.094	0.743	−0.052	0.437
EPQ Psychoticism	0.053	0.088	−0.625	0.598
BFI Neuroticism	0.780	−0.154	0.048	0.366
BFI Extraversion	−0.191	0.678	−0.051	0.501
BFI Conscientiousness	−0.232	0.220	0.596	0.542
BFI Agreeableness	−0.285	0.019	0.403	0.756
BFI Openness	−0.038	0.354	0.061	0.869
NEO Anxiety	0.769	−0.098	0.231	0.346
NEO Hostility	0.648	−0.021	−0.230	0.526
NEO Depression	0.750	−0.272	−0.134	0.346
NEO Self-Consciousness	0.675	−0.293	0.043	0.456
NEO Impulsivity	0.455	0.125	−0.220	0.729
NEO Vulnerability	0.655	−0.276	−0.161	0.469
NEO Warmth	−0.179	0.471	0.328	0.638
NEO Gregariousness	−0.070	0.477	−0.004	0.767
NEO Assertiveness	−0.202	0.675	0.089	0.495
NEO Activity	−0.014	0.686	0.292	0.443
NEO Excitement Seeking	0.033	0.481	−0.116	0.754
NEO Positive Emotion	−0.170	0.508	0.237	0.657
NEO Trust	−0.394	0.137	0.260	0.758
NEO Straightforwardness	−0.173	−0.262	0.467	0.684
NEO Altruism	−0.200	0.209	0.426	0.735
NEO Compliance	−0.332	−0.169	0.327	0.754
NEO Modesty	−0.028	−0.426	0.199	0.778
NEO Tenderness	0.064	0.060	0.151	0.970
NEO Competence	−0.194	0.421	0.582	0.446
NEO Order	0.004	0.053	0.495	0.752
NEO Dutifulness	−0.168	0.119	0.672	0.506
NEO Achievement	0.029	0.391	0.609	0.475
NEO Discipline	−0.266	0.268	0.628	0.464
NEO Deliberateness	−0.108	−0.127	0.644	0.557
NEO Fantasy	0.193	0.186	−0.211	0.884
NEO Aesthetics	0.090	0.154	0.024	0.967
NEO Feelings	0.308	0.319	0.161	0.778
NEO Actions	−0.193	0.162	−0.172	0.907
NEO Ideas	−0.103	0.263	0.110	0.908
NEO Values	−0.022	0.044	0.068	0.993
SNAP Negative Temperament	0.884	0.019	0.021	0.217
SNAP Mistrust	0.550	0.031	−0.225	0.646
SNAP Manipulativeness	0.317	0.222	−0.615	0.472
SNAP Aggression	0.380	0.154	−0.380	0.687
SNAP Self Harm	0.469	−0.171	−0.316	0.651
SNAP Eccentric Perceptions	0.423	0.185	−0.140	0.768
SNAP Dependency	0.398	−0.071	−0.111	0.824
SNAP Positive Temperament	−0.106	0.710	0.287	0.402
SNAP Exhibitionism	0.130	0.629	−0.142	0.567
SNAP Entitlement	0.084	0.498	−0.054	0.742
SNAP Detachment	0.205	−0.431	−0.066	0.768
SNAP Impulsivity	0.077	0.175	−0.773	0.366
SNAP Propriety	0.204	0.235	0.515	0.638
SNAP Workaholism	0.208	0.271	0.489	0.644
SNAP Disinhibition	0.074	0.177	−0.773	0.366

Note. Loadings rotated to varimax criterion. Root-mean-square residual = .106. EPQ = Eysenck Personality Questionnaire; BFI = Big Five Inventory; SNAP = Schedule for Nonadaptive and Adaptive Personality.

Table 9
Four-Factor Exploratory Model: Study 2

Measure	I	II	III	IV	θ
EPQ Neuroticism	0.849	−0.067	0.035	0.189	0.238
EPQ Extraversion	−0.089	0.807	−0.057	−0.071	0.333
EPQ Psychoticism	−0.083	0.043	−0.403	0.545	0.532
BFI Neuroticism	0.798	−0.101	−0.004	0.065	0.348
BFI Extraversion	−0.202	0.706	−0.022	−0.024	0.460
BFI Conscientiousness	−0.258	0.099	0.695	−0.062	0.436
BFI Agreeableness	−0.117	0.121	0.106	−0.704	0.465
BFI Openness	−0.086	0.282	0.160	0.100	0.878
NEO Anxiety	0.832	−0.036	0.118	−0.108	0.281
NEO Hostility	0.538	−0.065	−0.038	0.537	0.417
NEO Depression	0.749	−0.225	−0.162	0.145	0.340
NEO Self-Consciousness	0.719	−0.234	−0.057	−0.030	0.425
NEO Impulsivity	0.456	0.190	−0.231	0.110	0.691
NEO Vulnerability	0.704	−0.174	−0.275	0.004	0.398
NEO Warmth	−0.043	0.605	0.110	−0.565	0.301
NEO Gregariousness	0.013	0.614	−0.148	−0.292	0.515
NEO Assertiveness	−0.301	0.589	0.295	0.240	0.418
NEO Activity	−0.052	0.625	0.397	0.031	0.448
NEO Excitement Seeking	0.033	0.520	−0.096	0.006	0.719
NEO Positive Emotion	−0.078	0.590	0.094	−0.401	0.476
NEO Trust	−0.252	0.242	0.019	−0.594	0.525
NEO Straightforwardness	−0.001	−0.175	0.164	−0.666	0.499
NEO Altruism	−0.043	0.315	0.172	−0.647	0.451
NEO Compliance	−0.174	−0.085	0.036	−0.655	0.532
NEO Modesty	0.102	−0.345	−0.047	−0.451	0.665
NEO Tenderness	0.179	0.155	−0.046	−0.401	0.781
NEO Competence	−0.220	0.312	0.680	−0.074	0.386
NEO Order	−0.028	−0.045	0.584	0.021	0.656
NEO Dutifulness	−0.141	0.043	0.659	−0.247	0.483
NEO Achievement	−0.035	0.256	0.794	0.100	0.293
NEO Discipline	−0.286	0.149	0.720	−0.094	0.368
NEO Deliberateness	−0.078	−0.196	0.606	−0.224	0.538
NEO Fantasy	0.208	0.230	−0.249	−0.003	0.842
NEO Aesthetics	0.102	0.154	−0.002	−0.062	0.962
NEO Feelings	0.341	0.348	0.113	−0.115	0.737
NEO Actions	−0.161	0.209	−0.239	−0.125	0.858
NEO Ideas	−0.149	0.186	0.208	0.082	0.893
NEO Values	0.034	0.082	−0.028	−0.206	0.949
SNAP Negative Temperament	0.852	0.034	0.061	0.223	0.220
SNAP Mistrust	0.441	−0.023	−0.051	0.454	0.596
SNAP Manipulativeness	0.183	0.196	−0.393	0.572	0.446
SNAP Aggression	0.210	0.067	−0.069	0.703	0.453
SNAP Self Harm	0.420	−0.157	−0.256	0.279	0.656
SNAP Eccentric Perceptions	0.345	0.138	−0.017	0.294	0.775
SNAP Dependency	0.475	0.052	−0.264	−0.160	0.676
SNAP Positive Temperament	−0.124	0.661	0.347	−0.058	0.423
SNAP Exhibitionism	0.076	0.627	−0.046	0.181	0.566
SNAP Entitlement	−0.019	0.416	0.140	0.316	0.707
SNAP Detachment	0.096	−0.575	0.122	0.406	0.480
SNAP Impulsivity	0.013	0.226	−0.670	0.345	0.381
SNAP Propriety	0.219	0.202	0.498	−0.134	0.645
SNAP Workaholism	0.136	0.138	0.660	0.163	0.500
SNAP Disinhibition	−0.012	0.208	−0.639	0.406	0.384

Note. Loadings rotated to varimax criterion. Root-mean-square residual = .067. EPQ = Eysenck Personality Questionnaire; BFI = Big Five Inventory; SNAP = Schedule for Nonadaptive and Adaptive Personality.

Zuckerman et al. (1988). The hierarchical framework presented here also bears resemblance to the hierarchical model suggested by Zuckerman et al. (1988). Although our results differ from theirs in that they did not identify Openness in the five-factor level of their hierarchy, it is important to note that the authors admit that they "did not include scales that would be relevant to this factor" (p. 103). Moreover, as Costa and McCrae (1992a, 1992b) have noted, the fact that Openness was not targeted at all makes the similarities between the Big Five and the five-factor structure identified by Zuckerman et al. all the more striking.

The three-factor level of the hierarchy identified by Zuckerman et al. (1988)—consisting of an Extraversion-Sociability (E-Sy) factor, a Neuroticism-Emotionality (N-Emot) factor, and a Psychoticism—Impulsive Unsocialized Sensation Seeking (P-

Table 10
Five-Factor Exploratory Model: Study 2

Measure	I	II	III	IV	V	θ
EPQ Neuroticism	0.836	−0.093	0.038	0.203	0.102	0.239
EPQ Extraversion	−0.093	0.827	−0.021	0.000	0.058	0.304
EPQ Psychoticism	−0.102	−0.008	−0.406	0.543	0.090	0.522
BFI Neuroticism	0.802	−0.088	0.000	0.076	0.000	0.344
BFI Extraversion	−0.207	0.716	0.009	0.034	0.056	0.440
BFI Conscientiousness	−0.259	0.087	0.700	−0.063	−0.029	0.431
BFI Agreeableness	−0.108	0.156	0.106	−0.696	0.058	0.466
BFI Openness	−0.151	0.125	0.128	0.081	0.669	0.492
NEO Anxiety	0.831	−0.028	0.123	−0.091	0.056	0.282
NEO Hostility	0.540	−0.066	−0.024	0.552	−0.109	0.387
NEO Depression	0.745	−0.234	−0.165	0.145	0.045	0.340
NEO Self-Consciousness	0.722	−0.222	−0.058	−0.028	−0.005	0.425
NEO Impulsivity	0.450	0.179	−0.221	0.133	0.097	0.690
NEO Vulnerability	0.733	−0.100	−0.263	0.020	−0.194	0.345
NEO Warmth	−0.042	0.625	0.131	−0.517	0.122	0.309
NEO Gregariousness	0.040	0.717	−0.109	−0.228	−0.174	0.389
NEO Assertiveness	−0.319	0.549	0.316	0.277	0.088	0.412
NEO Activity	−0.073	0.574	0.418	0.074	0.167	0.457
NEO Excitement Seeking	0.018	0.486	−0.082	0.041	0.186	0.720
NEO Positive Emotion	−0.090	0.570	0.107	−0.364	0.225	0.473
NEO Trust	−0.237	0.291	0.029	−0.575	−0.034	0.527
NEO Straightforwardness	0.015	−0.130	0.153	−0.680	−0.018	0.497
NEO Altruism	−0.049	0.304	0.172	−0.635	0.219	0.424
NEO Compliance	−0.163	−0.057	0.025	−0.666	0.034	0.525
NEO Modesty	0.108	−0.331	−0.070	−0.482	0.058	0.639
NEO Tenderness	0.165	0.121	−0.061	−0.408	0.302	0.696
NEO Competence	−0.243	0.247	0.682	−0.068	0.186	0.375
NEO Order	−0.015	−0.025	0.599	0.026	−0.184	0.606
NEO Dutifulness	−0.146	0.024	0.657	−0.252	0.038	0.482
NEO Achievement	−0.050	0.207	0.802	0.111	0.076	0.294
NEO Discipline	−0.287	0.136	0.725	−0.093	−0.020	0.365
NEO Deliberateness	−0.072	−0.185	0.600	−0.239	−0.077	0.537
NEO Fantasy	0.167	0.127	−0.277	−0.010	0.521	0.608
NEO Aesthetics	0.046	0.007	−0.044	−0.093	0.683	0.521
NEO Feelings	0.303	0.248	0.098	−0.114	0.523	0.550
NEO Actions	−0.187	0.159	−0.259	−0.134	0.321	0.752
NEO Ideas	−0.218	0.018	0.172	0.053	0.664	0.479
NEO Values	0.009	0.019	−0.051	−0.226	0.333	0.835
SNAP Negative Temperament	0.840	0.008	0.072	0.247	0.085	0.221
SNAP Mistrust	0.409	−0.116	−0.059	0.455	0.236	0.553
SNAP Manipulativeness	0.164	0.147	−0.382	0.591	0.083	0.449
SNAP Aggression	0.196	0.019	−0.060	0.712	0.003	0.451
SNAP Self Harm	0.404	−0.201	−0.266	0.272	0.131	0.634
SNAP Eccentric Perceptions	0.293	−0.006	−0.041	0.289	0.534	0.543
SNAP Dependency	0.501	0.124	−0.245	−0.130	−0.168	0.629
SNAP Positive Temperament	−0.150	0.602	0.363	−0.017	0.249	0.421
SNAP Exhibitionism	0.066	0.614	−0.020	0.233	0.093	0.556
SNAP Entitlement	−0.045	0.348	0.148	0.339	0.193	0.703
SNAP Detachment	0.058	−0.709	0.084	0.348	0.249	0.303
SNAP Impulsivity	−0.002	0.195	−0.664	0.361	0.111	0.378
SNAP Propriety	0.223	0.211	0.517	−0.104	−0.042	0.625
SNAP Workaholism	0.105	0.048	0.655	0.162	0.235	0.475
SNAP Disinhibition	−0.022	0.187	−0.626	0.426	0.036	0.390

Note. Loadings rotated to varimax criterion. Root-mean-square residual = .043. EPQ = Eysenck Personality Questionnaire; BFI = Big Five Inventory; SNAP = Schedule for Nonadaptive and Adaptive Personality.

ImpUSS) factor—is nearly identical in content to the three-factor level of the hierarchy presented here. The three factors of their model strongly resemble the factors identified here as Positive Emotionality, Negative Emotionality, and Disinhibition, respectively.

Similarities with the Zuckerman et al. (1988) model become more striking when hierarchical relationships between the three- and five-factor structure are considered. The P-ImpUSS factor of their model comprises two subordinate factors, Impulsive Unsocialized Sensation Seeking and Aggressive Sensation Seeking, paralleling the bifurcation of Disinhibition in the current model into Conscientiousness and Agreeableness, respectively. N-Emot is isomorphic across three- and five-factor levels in the Zuckerman et al. model, as is Negative Emotionality and Neuroticism in the

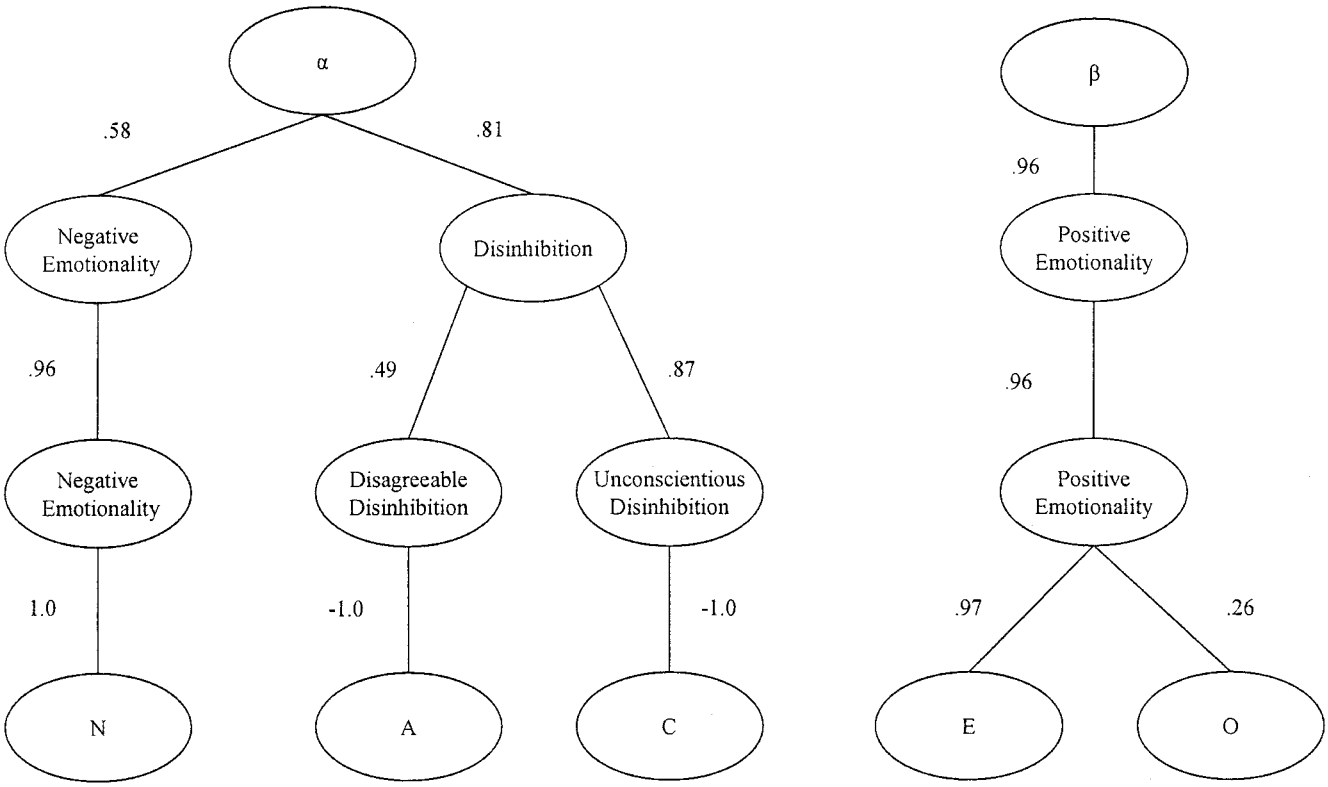

Figure 2. Study 2: Correlations between subordinate and superordinate factors. N = Neuroticism; A = Agreeableness; C = Conscientiousness; E = Extraversion; O = Openness.

current model. Finally, the bifurcation of E-Sy in the Zuckerman et al. account into Sociability and Activity mimics the bifurcation of Positive Emotionality in the current model into Extraversion and Openness.

Parallels between the current hierarchical framework and those of Zuckerman et al. (Zuckerman et al., 1988, 1991) extend further. In a later paper, for example, Zuckerman et al. (1991) report a four-factor solution strongly resembling the four-factor solution reported here. Their four-factor model, for example, includes E-Sy and N-Emot of their three-factor model and Impulsive-Unsocialized and Aggressive Sensation Seeking of their five-factor model, without Activity. In comparison, the four-factor model presented here includes Positive Emotionality and Negative Emotionality of the three-factor model, and Conscientiousness and Agreeableness (or alternatively, Unconscientious and Disagreeable Disinhibition) of the five-factor model, without Openness.

Implications for Understanding Personality Hierarchies

Perhaps the most important feature of the current results is the replicability of superordinate factor relationships and hierarchy, above and beyond the factors themselves. Results of the current studies demonstrate that it is not just the Big Trait factors themselves that replicate, but also their hierarchical structure. The identification of this hierarchical structure provides insights into the nature of personality hierarchies more generally.

Personality hierarchy is unbalanced. One fundamental distinction in describing any type of hierarchy is whether the hierarchy is balanced or unbalanced (Diestel, 2000). In the current context, a balanced hierarchy can be defined as one in which every object at a given level of the hierarchy is at the same level of abstraction. In contrast, an unbalanced hierarchy is one in which objects at a given level of the hierarchy differ in their level of abstraction.

In examining the hierarchy shown in Figures 1 and 2, it becomes evident that superordinate personality hierarchy is an unbalanced hierarchy. The current results indicate, for example, that the Big Five are not equally abstract, and that Neuroticism in particular exists at a different level of abstraction than the other Big Five traits. Similarly, among Big Three traits, Positive Emotionality exists at a different level of abstraction than other traits; Positive Emotionality is, in particular, less abstract than Disinhibition.

The idea that superordinate personality hierarchy is unbalanced is not new. Guastello (1993), for example, noted that uncertainties regarding the Big Five have tended to surround certain traits more than others, and that certain traits are more reliable and replicable than others (Caruso, 2000; Egan, Deary, & Austin, 2000). Guastello (1993) suggested that "there is an internal pecking order within the Big Five," and that "the architecture of the Big Five is lopsided: the 'third floor' does not extend to all wings of the castle" (p. 1298).

Recognizing superordinate personality hierarchy as being unbalanced is important for a variety of reasons. First and foremost,

it helps to resolve some of the controversies about different Big Trait models. For example, historical disputes between Big Three and Big Five advocates (Costa & McCrae, 1992a, 1992b; Eysenck, 1992a, 1992b) can arguably be framed in part by questions over why traits such as Neuroticism appear in some factor solutions with Agreeableness and Conscientiousness, and in other factor solutions with the superordinate trait Disinhibition. If personality hierarchy is assumed to be balanced, such observations are somewhat of a paradox: Neuroticism must exist at either one level of abstraction or the other, and its appearance in both levels cannot be real. If personality hierarchy is recognized as being unbalanced, however, the paradox disappears: Neuroticism continues throughout both levels of the hierarchy, whereas other traits coalesce and separate.

The unbalanced nature of personality hierarchy potentially has methodological implications as well, including implications for psychometric analysis and measure construction. Commonly used methods for latent variable analysis, such as exploratory factor analysis, for example, often assume that observed variables can be accounted for by a discrete number of latent traits at a single level or discrete levels of abstraction. It is unclear how efficiently such methods recover complex trait hierarchy. Findings that factor analytic methods often distort latent structure when traits are highly correlated (Bacon, 2001; Gerbing & Hamilton, 1996; Tay Lim, 2000) indicate that complex hierarchical features may be difficult to model with traditional methods. Novel methods for delineating trait hierarchy (Bacon, 2001) may be more promising in this regard.

Personality structure is not simple. A second important feature of personality structure emphasized by the current results is that personality does not completely conform to simple structure. The variance in any given subordinate trait or measure is not likely to completely be accounted for by any single superordinate trait. Numerous studies have noted that personality traits do not conform to simple structure (e.g., Church & Burke, 1994); our results are consistent with this trend, and extend previous findings by outlining its manifestation in superordinate personality hierarchy.

The simple hierarchical structure represented by Figures 1 and 2 is somewhat of an abstraction in this regard. Although the hierarchy depicted in the figures accurately represents prominent features of personality structure, certain secondary relationships between traits are not represented. These secondary relationships might provide important insight into the expression and structure of personality traits.

Disagreeable Disinhibition, for instance, has secondary relationships with Negative Emotionality in addition to its primary association with Disinhibition. In Tables 4 and 8, it is evident that traits conceptually and empirically related to Agreeableness, such as DAPP Callousness; NEO Hostility; and SNAP Mistrust, Manipulativeness, and Aggression have secondary relationships with Negative Emotionality as well as with Disinhibition. This pattern of relationships has been observed in previous studies (Tellegen, 1985, 2000) and suggests that Agreeableness shares a moderate amount of variance with Negative Emotionality in addition to the variance shared with Conscientiousness. Some of the variance Agreeableness shares with Negative Emotionality may reflect the influence of the superordinate trait Alpha. However, patterns of cross-loadings may also suggest other interpretations. It is possible, for example, that different facets of Disagreeableness may relate differentially to Negative Emotionality versus Disinhibition. Aspects of Disagreeableness related to attributional style, as is reflected in scales such as SNAP Mistrust, may be more strongly related to Negative Emotionality than aspects of Disagreeableness related to behavioral patterns, as is reflected in scales such as MPQ Aggression.

Subordinate trait variance not shared with a parent trait is also sometimes unique to that subordinate trait, not shared with superordinate traits. Openness represents an important example in this regard. Although it is clear from factor intercorrelations and loading patterns that Openness shares nonnegligible variance with Extraversion—a result supported by other studies (Digman, 1997)—the results also clearly indicate that most of the variance in Openness is unique. That is, the hierarchical relationship between Openness and Beta is only partial: Openness is not subsumed by Beta, but rather, is associated with it. The placement of Openness in personality hierarchy has historically been a point of disagreement, with some arguing that Openness is independent of other traits (Costa & McCrae, 1992a, 1992b), and others arguing that it is subordinate to other traits (Eysenck, 1992a, 1992b). Our results suggest that the two arguments are in a sense both correct, in that Openness is hierarchically related to superordinate constructs, but only moderately so. Given previous studies suggesting that Openness may share more variance with Extraversion (Digman, 1997), the degree and nature of relationship between Openness and superordinate constructs remains an important topic for future research.

Personality structure is pervasively hierarchical. A third important feature of personality hierarchy emphasized by the current results is that personality structure is pervasively hierarchical, even to very superordinate trait levels. The idea that personality hierarchy extends to very superordinate levels has historically not always been a point of consensus. Often it seems to be assumed that personality hierarchy extends downward from a set of basic, or "root," traits, often traits of one of the Big Trait models (e.g., Costa & McCrae, 1995; Eysenck, 1991). Under this paradigm, a limited number of superordinate traits provide fundamental information about an individual's personality, and subordinate traits refine this information with details.

The model presented here could be treated within the same paradigm, as the hierarchy does descend downward from the Big Two traits. However, the abstractness of the Big Two, considered together with the continuity of hierarchy throughout the superordinate range, suggests an alternative perspective. Under this perspective, hierarchy serves not to refine information provided by basic, or core, traits, but rather, provides possible levels of description, each of which becomes more or less appropriate depending on the theoretical and empirical context (see Lubinski, 2000 for a similar perspective on individual differences in cognitive functioning).

Implications for the Study of Normal and Abnormal Personality

The availability of a coherent structure providing different levels of description and explanation, depending on context, has great utility in clarifying the nature of normal and abnormal personality. Recognition of hierarchical features throughout various ranges of abstraction is likely to be critically important to understanding

relationships between normal and abnormal patterns of behavior. Many parallels between normal and abnormal personality might otherwise be lost if these hierarchical features were not recognized.

The Big Two, Three, and Four. Numerous studies on general psychopathology, for example, have indicated that common psychological disorders can be explained in terms of two broad latent dimensions (Achenbach, 1966; Krueger, 1999). The first of these dimensions, often referred to as Internalizing, comprises disorders such as major depression, generalized anxiety disorder, and somatization problems (Achenbach, 1966; Krueger, 1999; Krueger, Chentsova-Dutton, Markon, Goldberg, & Ormel, 2003). The second of these dimensions, often referred to as Externalizing, comprises disorders such as antisocial personality disorder, conduct disorder, and substance use disorders (Achenbach, 1966; Krueger, 1999). This two-dimensional structure appears across numerous cultures and diagnostic systems (Krueger et al., 2003), shows stability longitudinally and developmentally (Achenbach, 1966; Vollebergh et al., 2001), and accounts for genetic and environmental relationships between disorders (Kendler, Prescott, Myers, & Neale, 2003).

The structure of common mental disorders has parallels to that portion of the personality hierarchy involving the Big Two and Big Three trait structure. Negative Emotionality, for example, is related, conceptually as well as empirically, to Internalizing, as is Disinhibition to Externalizing (Krueger et al., 1996; Trull & Sher, 1994). It is possible that the personality processes underlying individual differences in Internalizing are linked to those underlying Negative Emotionality, and that those underlying Externalizing are linked to those underlying Disinhibition.

These parallels between structures of psychopathology and personality might be unrecognized if features of personality hierarchy between the Big Two and Big Five were not recognized. Relationships between dimensions of psychopathology and the Big Five would likely be recognized—for example, Agreeableness and Conscientiousness would both be negatively correlated with Externalizing (Miller, Lynam, Widiger, & Leukefeld, 2001). However, direct parallels between the hierarchical structures of psychopathology and personality might be obscured. Without recognizing that Agreeableness and Conscientiousness are themselves correlated to form a superordinate trait of Disinhibition, theoretical and empirical relationships between Disinhibition and Externalizing might be unrecognized.

Conversely, however, focusing on the uppermost two levels of superordinate personality hierarchy, to the exclusion of the Big Four, might equally lose parallels with the structure of psychopathology. Emerging results indicate that Externalizing comprises two subfacets, one of which includes aggressive, overt phenomena, the other of which includes nonaggressive, covert phenomena (Achenbach, 1993; Greenbaum & Dedrick, 1998; Tackett, Krueger, Sawyer, & Graetz, 2003). These subfacets have important parallels with the Big Four dimensions of Disagreeable and Unconscientious Disinhibition and, equivalently, the Big Five dimensions of Agreeableness and Conscientiousness. Just as neglecting features of personality hierarchy involving the Big Two and Big Three might miss parallels with the structure of psychopathology, so might neglecting features of hierarchy involving the Big Four and Big Five.

Parallels between the structure of psychopathology and the three most superordinate levels of personality hierarchy are extended when Beta and Positive Emotionality are considered. Factor analyses including rare as well as common forms of psychopathology indicate that, in addition to the Internalizing and Externalizing factors accounting for common psychopathology, a third factor related to psychosis accounts for many rare forms of psychopathology (Wolf et al., 1988). Traits related to Positive Emotionality, such as Extraversion, have been negatively associated with psychosis and related characteristics such as schizoid traits (Berenbaum & Fujita, 1994). It is possible that traits related to Positive Emotionality explain many of the symptoms of psychosis, especially negative symptoms. Lack of Positive Emotionality has been associated with Internalizing phenomena as well, explaining the differential expression of depression versus anxiety (Mineka, Watson, & Clark, 1998; Watson, Clark, & Carey, 1988). Finally, Positive Emotionality traits have been positively associated with various pathological personality characteristics, such as narcissistic personality traits (Costa & Widiger, 1994).

The Big Five. Current results indicate that the Big Five traits occupy an important, unique position in the hierarchy, in that the other Big Trait models can be derived from the Big Five in some way. Although our results indicate that there are important, replicable features of hierarchy above the Big Five, these features can be reconstructed from the Big Five. The Big Five in this sense represent a set of "building blocks" for superordinate personality structure, a set of traits that provide basic information about superordinate personality. In the current results, each of the Big Five provided information about normal as well as abnormal personality traits, suggesting that the five-factor level represents an important focus for research on psychopathology and personality. Our results reinforce the position that the Big Five represent a crucial level of analysis for normal personality research and extend this position to include psychopathology research as well.

The relative independence of Openness from other Big Traits, moreover, suggests that it represents an important source of information only partially captured by superordinate trait models. Delineating exactly what information Openness contributes to the description of psychopathology and abnormal personality represents an important issue for research. Unlike some previous investigations, the results of the current studies indicate that Openness is not entirely defined by normal personality measures (see Widiger, 1998 for a discussion of this issue). SNAP Eccentric Perceptions, for example, loads on this fifth factor, as does DAPP Stimulus Seeking. The constructs represented by these measures are important in psychopathology research; their manifestation at the five-factor level of the hierarchy indicates that special attention should be paid to that level, and to Openness in particular.

Subordinate traits. Levels of the hierarchy below the Big Five, not explicitly considered here, also deserve careful consideration. The focus on superordinate levels of the hierarchy in this paper should not be construed as an implication that subordinate levels of the hierarchy are unimportant. As has been noted, primary traits generally demonstrate greater predictive validity than higher order traits (Reynolds & Clark, 2001), and provide important sources of information in understanding the nature of psychopathology. The importance of subordinate traits is highlighted by the relatively large uniqueness of some measures in our studies (e.g., MPQ Traditionalism, NEO Actions, SNAP Entitlement). These results indicate that there are aspects of normal and abnormal personality that are only partially captured by superordinate traits. Future

research should continue to explore the nature of subordinate personality structure (Harkness, 1992), and how this subordinate structure contributes to our understanding of psychopathology above and beyond superordinate traits.

Conclusions

Here, we have proposed a hierarchy accounting for the joint superordinate structure of normal and abnormal personality. The results of two studies, including a meta-analysis and an empirical study, indicate that this hierarchy replicates across samples as well as across measures. This hierarchical structure bears a strong resemblance to other hierarchical accounts of personality structure and coherently integrates Big Trait models currently in use. The replicability of the hierarchy provides insight into trait hierarchies more generally, and suggests that personality hierarchy is both pervasive and complex in nature. Recognition of trait hierarchy will likely be critical to understanding individual differences in personality, psychopathology, and other domains. As parallels between personality and psychopathology continue to be elaborated, it will be increasingly important to understand how different features of hierarchy contribute to description and explanation of various forms of behavior.

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