Chapter 16

Temperament: A New Paradigm for Trait Psychology

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ANCIENT HISTORY

Temperament is an ancient concept. As early as the fifth century B.C.E., Greek physicians believed that health depended on a harmonious blend of the four "humors." Extending this view, Galen (second century C.E.) proposed that predominance of one of the humors resulted in a characteristic emotional style or temperament that formed the core, respectively, of four basic personality types (indeed, the word "temperament" derives from the Latin "to blend," so that differences in the blend of humors were equated with differences in temperament; Digman, 1994). The "sanguine" or cheerful, active temperament reflected an excess of blood; the "melancholic" or gloomy temperament reflected an excess of black bile; "choleric" or angry, violent types had an excess of yellow bile; and an excess of phlegm was associated with the "phlegmatic" or calm, passive temperament.

Two aspects of this ancient formulation remain alive in current theories of temperament: (1) biological factors underlie observable characteristics and (2) emotions are core and defining features of temperament. As is so often the case with personality-related constructs, Allport (1937) provided a definition that captures the essential features.

> Temperament refers to the characteristic phenomena of an individual's emotional nature, including his susceptibility to emotional stimulation, his customary strength and speed of response, the quality of his prevailing mood, and all peculiarities of fluctuation and intensity of mood; these phenomena being regarded as dependent on constitutional makeup and therefore largely hereditary in origin. (p. 54)

As we discuss later, researchers today investigate serotonin deficits, the noradrenergic system, or mesolimbic dopaminergic pathways rather than imbalances among the humors, but the recognition that behavior is—in part—a function of physical characteristics was a remarkable insight. Moreover, while there is still debate on a precise definition of temperament and its distinction from personality (which we will not resolve in this chapter), following Allport, there is now widespread agreement that emotional experience and emotional regulation are intrinsic to

these concepts (see Digman, 1994, for a brief history of the concept of temperament and further discussion of definitions).

A third aspect of the Greek model is humbling to admit. The observation that there were four main temperaments maps remarkably well onto the four quadrants that emerge from crossing the two primary personality dimensions, Neuroticism (or Emotional Stability) and Extraversion, of the modern theorist Hans Eysenck. Thus, the stable extravert is sanguine, the unstable extravert is choleric, the unstable introvert is melancholic, and the stable introvert is phlegmatic (Eysenck & Eysenck, 1975). Although there remains controversy regarding "What lies beyond E and N?" (Zuckerman, Kuhlman, & Camac, 1988), these two dimensions are found in all major models of temperament and personality.

A BRIEF MODERN HISTORY OF TEMPERAMENT RESEARCH

In addition to the notion that temperament reflects biologically based individual differences in emotional responding, modern temperament theories also incorporate Allport's idea that these biological differences are innate and form the foundation upon which mature personality develops. Space limitations prohibit comprehensive consideration of the variety of temperament models and measures that have been proposed, but a brief review is instructive. Since the late 1960s or so, research in childhood temperament has been dominated by the nine-dimensional structure proposed by Thomas, Chess, and Birch (1968; Thomas & Chess, 1977). Numerous spin-off measures have been developed, spanning the developmental range from birth (Medoff-Cooper, Carey, & McDevitt, 1993) through adolescence (Windle & Lerner, 1986).

Gradually accumulating research has indicated significant limitations of the model, such as the unreliability of some dimensions and, correspondingly, the replication of a smaller number of dimensions (five or perhaps seven) using factor analysis (Martin, Wisenbaker, & Huttunen, 1994). As a result, the model appears to be giving way to newer structures (e.g., Rothbart, Ahadi, & Hershey, 1994; Rothbart, Derryberry, & Posner, 1994); nevertheless, it succeeded in promoting the important view that childhood behavior was structured, measurable, and systematically related to later personality development. In addition to advances in measurement, a strength of current work in this area is the attempt to understand the phenotypic dimensions of infant and childhood temperament in terms of their underlying biological bases and also to consider their continuity and development from infancy to adult personality. In particular, considerations of infant and child data in light of Gray's (1982, 1987) and Eysenck's (1967, 1997) work has illuminated both of these efforts (e.g., Rothbart, Derryberry, & Posner, 1994).

Several researchers of adult temperament, most notably Eysenck and Strelau, derived their models from Pavlov's theory of central nervous system (CNS) properties. Not widely known in the United States, Strelau's model (1983; Strelau, Angleitner, & Ruch, 1990; Ruch, Angleitner, & Strelau, 1991; Strelau & Zawadzki, 1995) has been quite influential among European temperament researchers, and both models have spawned numerous learning-based experimental studies. The general notion of both theories is that individual differences in CNS properties (e.g., strength of excitation, arousability) influence personality, and that this linkage can be tested by observing how various conditioning parameters differ as a function of personality. Although these theories were instrumental in helping to link biological variables with dimensions of temperament, it now seems likely that they will be superseded by more sophisticated and complex models emerging in the newly developing fields of cognitive and affective neuroscience.

Gray (1982, 1987) also has offered a biological model of temperament that has notable points of overlap with Eysenck's work. Based to a large extent on pharmacological studies with animals, Gray's work has strongly influenced theorizing about dimensions of adult personality or temperament. It is noteworthy, however, that with the exception of studies of psychopathy, relatively little direct testing of his model has been carried out in people, perhaps due to difficulties in assessing the hypothesized neuropsychological systems. By contrast, Buss and Plomin (1975) articulated a temperament model that has had relatively little theoretical impact but that has been widely used in research, owing to the EASI Temperament Survey, which they developed to measure their four proposed dimensions of Emotionality, Activity, Sociability, and Impulsivity. As with other seminal work in these fields, both of these models are gradually being superseded by more recent investigations.

THE STRUCTURAL "TRAIT" APPROACH

In contrast to developmentalists and European temperament researchers, American personologists showed relatively little interest in the study of temperament as a biologically based concept through much of the 20th century. Rather, trait psychologists focused their attention on structural analyses, with the goal of creating comprehensive descriptive taxonomies of personality traits, and tended to ignore the etiology of the dimensions that they identified. This emphasis on structure led to a widespread criticism that trait psychology offered only a sterile, static description of behavior, not a true explanation for it (see Liebert & Spiegler, 1982; Mischel, 1968, 1990; Pervin, 1994). This criticism escalated with the ascendance of behaviorism during the middle part of the 20th century. Led by B. F. Skinner, behavioral theorists argued that inferred mental constructs (such as traits, habits, and instincts) were uninteresting pseudoexplanations that actually represented redundant descriptions of behavior. Skinner (1953), for instance, argued that "When we say that a man eats because he is hungry, smokes a great deal because he has the tobacco habit, fights because he has the instinct of pugnacity, behaves brilliantly because of his intelligence, or plays the piano well because of his musical ability, we seem to be referring to causes. But on analysis, these phrases prove to be merely redundant descriptions" (p. 31).

Mischel (1968) fanned the fires further when he presented evidence suggesting that trait concepts accounted for relatively little variance in—and failed to provide even a useful summary description of—behavior. Mischel's attack ignited the long-standing "person–situation debate" that continued well into the 1980s (Epstein & O'Brien, 1985; Kenrick & Funder, 1988; Mischel & Peake, 1982). Although a diversity of issues eventually was incorporated into this debate, the core controversy revolved around two central questions: First, are traits "real" in some basic psychological sense or, alternatively, do they simply reflect cognitive constructions that people impose on reality to satisfy their need for predictability and control? Second, are trait concepts useful predictors of important real-world criteria? Although critics of trait theory may remain unconvinced (e.g., Pervin, 1994), after nearly 20 years of theoretical and empirical debate, trait psychologists eventually mustered sufficient evidence to establish that the answer to both questions was "yes": Traits represent real entities that can be used to make important real-world predictions.

CONVERGENCE OF TEMPERAMENT AND STRUCTURAL APPROACHES

A key element in the resolution of the debate was the growing recognition that the major traits of personality represent basic *psychobiological* dimensions of temperament (e.g., Eysenck, 1992, 1997; Tellegen, 1985; Watson & Clark, 1993). The emergence of this recognition undoubtedly reflects several factors, three of which we highlight here. First, an explosion of research demonstrated that most personality traits have a substantial genetic component (e.g., Eysenck, 1990b; Loehlin, 1992; McCartney, Harris, & Bernieri, 1990; Plomin & Daniels, 1987; Tellegen et al., 1988); we summarize this evidence in a later section. These data indicated that underlying phenotypic descriptions of traits were more satisfying genotypic explanations of behavior.

Second, rapidly accumulating evidence in the 1980s and early 1990s established that major dimensions of personality—especially Neuroticism and Extraversion—were strongly associated with individual differences in affective experience (e.g., Meyer & Shack, 1989; Tellegen, 1985; Watson & Clark, 1984, 1992b, 1997; Watson, Wiese, Vaidya, & Tellegen, in press). This evidence provided systematic links both to the rich literature on the neurobiological basis of mood and emotion and to temperament research, as temperament had long been considered to have an emotional basis. This development thus held out promise for integrating research in the three fields of personality, mood and emotion, and temperament. Thus, the extensive data regarding the genetic and biological etiology of individual differences in each of these domains helped to establish that traits are real and represent true causes of behavior, rather than mere descriptive summaries.

Third, after decades of seemingly indifferent progress, structural research finally began to bear fruit, as researchers converged on a consensual phenotypic taxonomy of personality traits, which we describe subsequently (see also Goldberg, 1993; Watson, Clark, & Harkness, 1994). This development enabled researchers to focus more intensively on a relatively small number of

consensually recognized traits, incorporating them into more complex and sophisticated conceptual schemes and generating more detailed, systematic hypotheses, which helped to clarify the real-world correlates of these traits (e.g., Watson & Clark, 1984, 1993, 1997). Thus, the emergence of a temperament-based paradigm elevated trait psychology to the status of a more mature science, which—for the first time—shows the promise of offering a comprehensive explanation of human individual differences.

Having said this, it is noteworthy that many writers continue to offer the criticism that traits represent atheoretical descriptions of behavior (see Liebert & Spiegler, 1982; Liebert & Liebert, 1998). For instance, Westen (1996) argues that "traits are simply descriptive and provide little insight into the how and why of personality. . . . They may describe and even predict behavior, but they cannot explain it" (p. 478). Similarly, Baron (1998) argues that "the trait approach . . . seeks to describe the key dimensions of personality but does not attempt to determine *how* various traits develop or *how* they influence behavior" (p. 488; emphasis in original). Although these may be accurate characterizations of the older trait literature, they fail to recognize the extraordinary developments of the past decade. With the emergence of a temperament-based paradigm, traits now can provide legitimate causal explanations for behavior, rather than mere descriptions of it.

A STRUCTURAL MODEL FOR STUDYING TEMPERAMENT

The "Big Three" as a Structural Framework

We have noted that personologists recently converged on a consensual, phenotypic taxonomy of personality traits. One factor that facilitated this consensus was the recognition that personality traits are ordered hierarchically, so that there is no fundamental incompatibility between models emphasizing a few general "superfactors" and those that include a much larger number of narrower traits (see Digman, 1997; Jang, McCrae, Angleitner, Riemann, & Livesley, 1998; John, 1990; Watson et al., 1994). At the apex of this hierarchy are the "big" traits—such as Neuroticism and Extraversion—that comprise the superfactor models. At the next lower level of the hierarchy, these very broad dispositions can be decomposed into several distinct yet empirically correlated traits. For instance, the general trait of Extraversion can be subdivided into the more specific facets of assertiveness, gregariousness, cheerfulness, and energy (Depue & Collins, in press; Watson & Clark, 1997). These facets, in turn, can be further decomposed into even more specific constructs, including very narrow traits (e.g., talkativeness) and behavioral habits (Digman, 1997).

Of course, all these levels need to be considered in a comprehensive assessment of personality. We focus primarily on the broad higher-order superfactors, because the available data are most extensive at this level of the hierarchy. For instance, there is much more evidence regarding the genetic basis of Extraversion and Neuroticism than for any other traits (Loehlin, 1992; Viken, Rose, Kaprio, & Koskenvuo, 1994). Similarly, the biological substrates of these general traits have been studied more intensively than those of the lower-order facets (e.g., Depue, 1996; Depue & Collins, in press; Eysenck, 1997; Tellegen, 1985). Consequently, we will use these superfactors as our basic organizing framework, but will consider data related to the lower-order facets when relevant.

What are the basic superfactors that comprise the apex of this hierarchy? On this point the consensus is less than complete, because the field is divided between proponents of two distinct—but closely related—models: the Big Three (e.g., Eysenck & Eysenck, 1975; Gough, 1987; Tellegen, 1985; Watson & Clark, 1993) and the Big Five (e.g., Digman, 1990, 1997; Goldberg, 1993; John, 1990; McCrae & Costa, 1987, 1997).[1] We will center our discussion around the Big Three model for two related reasons. First, this model has long guided our thinking in this area and eventually led us to develop our own Big Three instrument, the General Temperament Survey (GTS; Clark & Watson, 1990). Second, researchers within this tradition have placed a much greater value on explicating the underlying neurobiological substrates of these superfactors (e.g., Eysenck, 1992, 1997; Tellegen, 1985); in contrast, proponents of the Big Five have focused more on the phenotypic description of personality. It must be acknowledged, however, that this gap is rapidly narrowing, as Big Five researchers recently have demonstrated great interest in the biological etiology of these dimensions (e.g., Jang, Livesley, & Vernon, 1996; Jang et al., 1998; McCrae & Costa, 1996; Riemann, Angleitner, & Strelau, 1997).

As its name suggests, the Big Three model is based on the argument that three broad superfactors—which we will call Neuroticism/Negative Emotionality (N/NE), Extraversion/Positive Emotionality (E/PE), and Disinhibition versus Constraint (DvC)—are necessary to describe the highest level of the personality hierarchy. Briefly, N/NE reflects individual differences in the extent to which a person perceives the world as threatening, problematic, and distressing. High scorers experience elevated levels of negative emotions and report a broad array of problems; whereas those low on the trait are calm, emotionally stable, and self-satisfied. E/PE involves an individual's willingness to engage the environment. High scorers (i.e., extraverts) approach life actively, with energy, enthusiasm, cheerfulness, and confidence; as part of this general approach tendency, they seek out and enjoy the company of others and are facile and persuasive in interpersonal settings. In contrast, those low on the dimension (i.e., introverts) tend to be reserved and socially aloof, and they report lower levels of energy and confidence. Finally, DvC reflects individual differences in the tendency to behave in an undercontrolled versus overcontrolled manner. Disinhibited individuals are impulsive and somewhat reckless and are oriented primarily toward the feelings and sensations of the immediate moment; conversely, constrained individuals plan carefully, avoid risk or danger, and are controlled more strongly by the longer-term implications of their behavior (see Watson & Clark, 1993; Watson et al., 1994).

This model arose from the pioneering work of Eysenck and colleagues (e.g., Eysenck, 1967, 1992, 1997; Eysenck & Eysenck, 1975). As noted earlier, Eysenck originally created a widely influential two-factor model consisting of the broad traits of Neuroticism (versus emotional stability) and Extraversion (versus introversion) which, when crossed, yielded the four Greek temperaments. Subsequent analyses of expanded pools of questionnaire items later led to the identification of a third broad dimension, labeled Psychoticism (which, despite its name, is better viewed as a measure of psychopathy or disinhibition; see Digman, 1990; Watson & Clark, 1993). A scale assessing this third superfactor was included in the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975).

Other theorists since have postulated very similar three-factor models. Tellegen (1985) proposed a scheme consisting of Negative Emotionality (cf. Neuroticism), Positive Emotionality (cf. Extraversion), and Constraint (which has a strong negative correlation with Psychoticism). We (Watson & Clark, 1993) subsequently articulated a highly similar model, with factors named Negative Temperament, Positive Temperament, and Disinhibition (versus Constraint), respectively. Furthermore, in his reformulation of the California Psychological Inventory (CPI), Gough (1987) introduced three higher-order "vectors" of Self-Realization, Internality, and Norm-Favoring, which reflect the low ends of Neuroticism, Extraversion, and Psychoticism, respectively.

Finally, Cloninger (1987) also formulated a three-dimensional model—consisting of Harm Avoidance, Reward Dependence and Novelty Seeking—that resembled these other schemes in important respects. However, the scales comprising Cloninger's Tridimensional Personality Questionnaire (TPQ; Cloninger, 1987) do not show an impressive level of convergence with the dimensions articulated by the other theorists (e.g., Heath, Cloninger, & Martin, 1994; Waller, Lilienfeld, Tellegen, & Lykken, 1991). Moreover, analyses revealed that Reward Dependence actually subsumed two unrelated factors. As a result, Cloninger (Cloninger, Svrakic, & Przybeck, 1993) revised his instrument to include four temperament factors but has not yet clearly articulated a revised theory to account for it.

With the exception of Cloninger's scheme, therefore, all of these models appear to define a single common structure. For example, Tellegen (1985) demonstrated a high degree of convergence between his factors and those of both Eysenck and Gough. Similarly, we have obtained strong correlations between our factors and those of Eysenck and Tellegen (Watson & Clark, 1993, 1997). Finally, Gough (1987) reported substantial correlations between his higher-order vectors and Eysenck's scales. To document this important point further, we administered three purported Big Three instruments—the EPQ, the CPI, and our own GTS—to a sample of 250 University of Iowa undergraduates. We then subjected the nine higher-order scales from these instruments—three for each superfactor—to a principal factor analysis (squared multiple correlations in the diagonal). As expected, three factors clearly emerged and were rotated using varimax.

The resulting factor loadings (shown in Table 16.1) clearly establish that these instruments define a common three-dimensional structure. The three factors—each of which is strongly defined by a scale from all three instruments—are easily

TABLE 16.1. Varimax-Rotated Factor Loadings of the Higher-Order Scales from the EPQ, CPI, and GTS

Scale	Factor 1	Factor 2	Factor 3
EPQ Extraversion	**.84**	−.09	−.06
GTS Positive Temperament	**.71**	−.13	−.25
CPI Internality	**−.73**	.06	−.13
GTS Negative Temperament	−.09	**.84**	.09
EPQ Neuroticism	−.16	**.81**	.07
CPI Self-Realization	.02	**−.66**	−.16
GTS Disinhibition	.19	.20	**.73**
EPQ Psychoticism	−.05	.09	**.64**
CPI Norm-Favoring	.29	−.05	**−.61**

Note. N = 250. Loadings of |.40| or greater are shown in boldface. EPQ, Eysenck Personality Questionnaire; CPI, California Psychological Inventory; GTS, General Temperament Survey.

identifiable as E/PE, N/NE, and DvC, respectively. It should be noted, however, that consistent with earlier studies in this area (e.g., Watson & Clark, 1993), the markers of the DvC dimension generally showed the weakest level of convergence. In addition, the GTS and EPQ scales showed the strongest convergence and consistently emerged as the best markers of the underlying dimensions.

Relating the Big Three to the Big Five

As noted earlier, the Big Three and Big Five models actually define similar trait structures. Although we are using the Big Three as our primary structural framework, we also can take advantage of the enormous amounts of data that have been collected using various Big Five measures. To integrate these findings into our framework, however, we need to consider the relation between these two taxonomies.

The Big Five model originally developed out of a series of attempts to understand the natural language of trait descriptors (see Block, 1995; Digman, 1990; Goldberg, 1993; John, 1990). Extensive structural analyses of these descriptors consistently revealed five broad factors: Neuroticism (versus Emotional Stability), Extraversion (or Surgency), Conscientiousness (or Dependability), Agreeableness (versus Antagonism), and Openness to Experience (or Imagination, Intellect, or Culture). This structure has proven to be remarkably robust, with the same five factors emerging in both self- and peer ratings (e.g., McCrae & Costa, 1987), in analyses of both children and adults (Digman, 1990, 1994), and across a wide variety of languages and cultures (e.g., Ahadi, Rothbert, & Ye, 1993; Jang et al., 1998; McCrae & Costa, 1997).

In brief, the available data indicate that these five factors represent an expanded and more differentiated version of the Big Three. Most notably, it now is clear that the Neuroticism and Extraversion factors of the Big Five essentially are equivalent to the N/NE and E/PE dimensions, respectively, of the Big Three (e.g., McCrae & Costa, 1985; Watson & Clark, 1992b, 1993; Watson, Clark, & Harkness, 1994). Thus, these taxonomic schemes share a common "Big Two" of N/NE and E/PE.

Furthermore, the DvC dimension of the Big Three has been shown to be a complex combination of (low) Conscientiousness and Agreeableness; that is, disinhibited individuals tend to be impulsive, carefree, reckless (low Conscientiousness), uncooperative, deceitful, and manipulative (low Agreeableness) (e.g., Digman, 1997; Eysenck, 1997; John, 1990; Watson et al., 1994). Finally, Openness appears to be largely unrelated to all of the Big Three dimensions (McCrae & Costa, 1985; Watson et al., 1994). Taken together, these data suggest that one can transform the Big Three into the Big Five by (1) decomposing the DvC dimension into component traits of Conscientiousness and Agreeableness and (2) including the additional dimension of Openness.

To clarify these relations further, we assessed 327 undergraduates (185 from Southern Methodist University [SMU], 142 from the University of Iowa; note that preliminary analyses of the SMU data were reported by Watson et al., 1994) on the GTS, the EPQ, and two Big Five instruments: the Revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 1992a) and the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991). We first subjected the higher-order EPQ and GTS scales to a principal factor analysis; three factors were clearly identifiable and were rotated using varimax. We then computed regression-based scores to assess each respondent's standing on these three dimensions. Next, we repeated this process using the BFI and NEO-PI-R domain scales; in this case, we calculated factor scores representing each of the Big

TABLE 16.2. Correlations between the Big Three and Big Five Factor Scores

	Big Three score		
Big Five score	N/NE	E/PE	DvC
Neuroticism	**.83**	**−.14**	**−.08**
Extraversion	**−.10**	**.78**	**.09**
Conscientiousness	**−.08**	**.19**	**−.54**
Agreeableness	**−.17**	**.09**	**−.50**
Openness	**.03**	**.21**	**.04**

Note: $N = 327$. Correlations of |.40| or greater are shown in **boldface**. Correlations of |.14| and greater are significant at $p < .05$, two-tailed. N/NE, Neuroticism/Negative Emotionality; E/PE, Extraversion/Positive Emotionality; DvC, Disinhibition versus Constraint.

Five traits. Finally, we computed correlations between these Big Three and Big Five factor scores.

The results are shown in Table 16.2. These data again clearly demonstrate that the two structural schemes share a common "Big Two" of N/NE and E/PE. In addition, the DvC dimension combines strong elements of both Conscientiousness and Agreeableness; indeed, taken together, these Big Five traits account for slightly more than half of the total variance in the DvC factor score. Finally, Openness was only weakly correlated (.21) with E/PE and was completely unrelated to the other Big Three superfactors.

These data regarding Conscientiousness, Agreeableness, and DvC have provoked an ongoing controversy (e.g., Digman, 1997; Eysenck, 1997; Goldberg, 1993). At one extreme, proponents of the Big Five have argued that the DvC dimension is an artificial "shotgun marriage" of two distinct and relatively independent traits. At the other extreme, Eysenck (1997) has asserted that Conscientiousness and Agreeableness represent lower-order components of the DvC superfactor. Although a comprehensive discussion of this issue is beyond the scope of our chapter, we must emphasize that neither of these extreme views offers a fully satisfactory account of the data.

The problem with Eysenck's argument is that it is impossible to subsume all of the content related to Conscientiousness and Agreeableness within a single higher-order dimension. For instance, we subjected the Agreeableness and Conscientiousness facets of the NEO-PI-R to a principal factor analysis and found no evidence of a single general factor; in fact, the Modesty and Tender-Mindedness scales both had loadings below .20 on the first unrotated factor. Furthermore, although the DvC factor score showed moderately strong negative associations with most of the facets of both Conscientiousness (e.g., $r = -.52$ with Dutifulness, −.52 with Deliberation, −.45 with Self-Discipline, −.43 with Achievement Striving) and Agreeableness (e.g., $r = -.53$ with Straightforwardness, −.40 with Altruism, −.36 with Compliance), it correlated only −.15 with Tender-Mindedness. Thus, existing measures of Conscientiousness and Agreeableness (particularly the latter) contain content that cannot easily be subsumed within the DvC dimension.

On the other hand, we have found no evidence to suggest that the DvC dimension represents an artificial, heterogeneous "shotgun marriage" of distinct elements related to Agreeableness and Conscientiousness. To examine this issue in greater detail, we subjected the 35 GTS Disinhibition items to a principal factor analysis in a very large sample ($N = 2{,}454$) of SMU undergraduates. This analysis confirmed that these items define a general factor that accounted for 73% of the common variance. Nevertheless, we also found evidence of two meaningful subfactors: The first appeared to be strongly related to (low) Conscientiousness, whereas the second seemed more relevant to (low) Agreeableness. We therefore created subscales consisting of items that were significant markers of each subfactor: The Carefree Orientation scale consists of seven positively keyed (e.g., "I don't pay much attention to where my money goes," "When I am having a good time, I don't worry about the consequences") and six negatively keyed (e.g., "I am a cautious person," "Before making a decision, I carefully consider all sides of the issue") items; whereas Antisocial Behavior includes nine positively keyed statements (e.g., "Lying comes easily to me," "I really enjoy beating the system," "The way I behave gets me into trouble").

On the basis of their content, one would expect that the Carefree Orientation and Antisocial Behavior subscales would be strongly correlated with (low) Conscientiousness and Agreeableness, respectively. We confirmed this expectation in our combined undergraduate sample. Specifically, Carefree Orientation correlated −.67 with the Conscientiousness factor score and only −.20 with the Agreeableness factor score; conversely, Antisocial Behavior correlated −.50 with Agreeableness and only −.32 with Conscientiousness (the correlations within

each pair differed significantly from one another at $p < .01$, two-tailed). These results again demonstrate that the DvC dimension subsumes content relevant to both of these Big Five traits.

More importantly, our data also demonstrate that this integration of the two domains is systematic and meaningful, rather than artificial. Specifically, the correlation between the Carefree Orientation and Antisocial Behavior subscales was .47 in the original SMU derivation sample and .50 in the combined undergraduate sample. Moreover, we found significant positive correlations between many of the NEO-PI-R Agreeableness and Conscientiousness facets in the latter sample. Indeed, by creating reduced four-facet domain scales for Agreeableness (Trust, Straightforwardness, Altruism, Compliance) and Conscientiousness (Competence, Dutifulness, Self-Discipline, Deliberation), we obtained a moderate correlation of .32 between these traits. Finally, it is noteworthy that Digman (1997) found that Agreeableness and Conscientiousness consistently combine to form a higher-order ∝ metatrait (with N/NE defining the other pole) in analyses of Big Five scales (Extraversion and Openness formed a second metatrait). These data indicate that Eysenck's (1997) argument is not without merit, and that some (though not all) content relevant to both Conscientiousness and Agreeableness can be subsumed within an even broader superfactor.

BEYOND STRUCTURAL VALIDITY

Development of a clear structural model is an important first step in the articulation of scientific concepts, but we argued earlier that trait models had begun to transcend structuralism to provide authentic explanations for human behavior. In the following sections, we present a portion of these data as illustrative offerings. The first section draws largely from our own research and presents—in overview—a systematic array of correlates for each of the Big Three. We begin by documenting the relation between mood and temperament; thereafter, we deliberately avoid data on variables whose correlations with temperament may be explained—directly or in large part—by a shared mood component (e.g., the voluminous literature on life and job satisfaction). Subsequent sections summarize (1) accumulated genetic evidence that supports the existence of these traits, (2) recent structural–functional biological models, (3) factors that affect trait stability and change, and (4) relations with psychopathology.

Correlates of the Big Three Traits

Mood

As mentioned earlier, a great deal of data link N/NE and E/PE with individual differences in affective experience, to the point that affectivity may be viewed as a core—if not *the* core—of these two dimensions. More specifically, mood also has been shown to have two major dimensions, commonly labeled negative and positive affect, respectively (see Watson & Tellegen, 1985). Negative Affect (NA) is a general dimension of subjective distress, encompassing a number of specific negative emotional states, including fear, sadness, anger, guilt, contempt, and disgust. Positive Affect (PA), by contrast, reflects the co-occurrence among a wide variety of positive mood states, including joy, interest, attentiveness, excitement, enthusiasm, and pride.

Despite the conceptual distinctiveness of these various specific negative (or positive) mood states, it is quite well established that they substantially co-occur both within and across individuals to form general (i.e., higher-order) negative (or positive) affect dimensions (Diener, Smith, & Fujita, 1995; Watson & Clark, 1992a, 1992b). These two highly robust mood dimensions have been recovered from mood ratings of widely ranging terms, formats, and time frames (e.g., from momentary mood to average mood over the past year) (Watson, 1988), as well as in diverse cultures and languages (e.g., Balatsky & Diener, 1993; Watson, Clark, & Tellegen, 1984). It is important to stress that, despite their opposite-sounding labels, these dimensions are largely orthogonal; that is, they represent independent biopsychosocial dimensions that are under the influence of different external variables (Clark & Watson, 1988, 1991) and distinct internal biological systems (Clark, Watson, & Leeka, 1989; Depue, 1996; Depue & Collins, in press).

Individuals high in N/NE report higher levels of NA in virtually any situation, from baseline conditions to highly stressful circumstances (e.g., Watson & Clark, 1984). Conversely, high E/PE individuals are more likely to report higher levels of PA across a wide variety of situations (Watson & Clark, 1992b, 1997). Indeed, as

stated earlier, the propensity to experience NA (or PA) more frequently and intensely can be considered a core feature of the N/NE (or E/PE) dimension (Tellegen, 1985; Watson & Clark, 1984, 1992b; Watson et al., in press). Although these relations have been well established in various ways by the studies cited (and many others as well), we cannot resist the temptation to present additional data to document the point using yet another method.

The data in Table 16.3 are from four longitudinal studies of college students who completed mood and activity forms repeatedly over varying lengths of time. Mood ratings were obtained using the 20-item Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). Respondents rated the extent to which they had experienced each mood term (10 each for NA and PA) on a five-point scale (*very slightly or not at all* to *very much*). The mood ratings in Table 16.3 represent respondents' mood "today" (Samples 1 and 2), "over the past few days" (Sample 3), or "over the past week" (Sample 4). In each sample, the data for each participant were averaged across the entire rating period to yield overall mean NA and PA scores. The Big Three scores are from the GTS (Studies 1 and 3) or represent factor scores calculated from the GTS and EPQ combined (Sample 2) or from the GTS, EPQ, and CPI (Sample 4). The data in Table 16.3 demonstrate that, regardless of the time frame over which it is measured or the manner in which the Big Three scores are derived, NA is strongly and consistently related to N/NE, largely unrelated to E/PE, and slightly related to DvC. Conversely, PA is strongly and consistently related to E/PE and largely unrelated to either N/NE or DvC. Clearly and simply, N/NE and E/PE define the prototype for dimensions of temperament as individual differences in affectivity.

TABLE 16.3. Correlations between the Big Three and Aggregated Mood Ratings in Four Studies

Sample	N/NE	E/PE	DvC
		Negative Affect	
1	.41	−.02	.19
2	.41	.05	.23
3	.60	−.26	.18
4	.54	−.10	.29
		Positive Affect	
1	−.14	.35	−.03
2	−.12	.44	−.09
3	−.24	.49	−.06
4	.01	.44	.12

Note. Correlations of |.30| or greater are shown in boldface. N/NE, Neuroticism/Negative Emotionality; E/PE, Extraversion/Positive Emotionality; DvC, Disinhibition versus Constraint. Sample 1, $N = 379$; mood measured daily for an average of 44 days (range = 30 to 55); Sample 2, $N = 136$; mood measured daily for an average of 48 days (range = 21 to 54). Sample 3, $N = 61$; mood measured over a minimum of 42 two-day periods (range = 39 to 45). Sample 4, $N = 115$; mood measured over an average of 13 weekly periods (range = 7 to 14). Temperament was measured using the GTS (Studies 1 and 3) or factor scores computed from the GTS, EPQ, and CPI (Studies 2 and 4).

Social Behavior

Social engagement is a primary defining characteristic of the E/PE dimension. Indeed, it seems tautological to present data demonstrating that extraverts have a higher level of social involvement than introverts. Rather, it is important to establish that social activity is associated with the Positive Emotionality component of E/PE as well as the Extraversion component. We have written extensively this topic elsewhere (e.g., Watson & Clark, 1997) and so only summarize these data here. In a series of studies, indices of social behavior were first shown to be correlated with measures of state positive affect (e.g., Clark & Watson, 1988). Second, social behavior was shown to be as highly correlated with measures of trait positive affect (e.g., the PANAS PA scale) as with more "pure" measures of Extraversion (e.g., EPQ-E). For example, number of hours spent with friends (measured daily for approximately 6 weeks) was equally correlated (approximately .30) with measures of positive temperament and social dominance. Similarly, a 15-item scale of social activity completed weekly for 13 weeks correlated equally (again, approximately .30) with the PANAS PA scale and with EPQ-E. In both cases, social activity was unrelated to either N/NE or DvC. More specific measures of social behavior, such as number of leadership roles, number of close friends or dating partners, and frequency of partying versus percent of weekend nights spend alone, showed similar patterns (see Watson & Clark, 1997). Although these nonaggregated indices of social behavior showed somewhat lower correlations with both types of E/PE measures (approximately .20),

they again were virtually uncorrelated with the other two Big Three dimensions. These types of data demonstrate that positive emotionality and social engagement are specific to, and integral parts of, the E/PE dimension.

Lifestyle: Daily Rhythms and Sleep

Biologically based diurnal and seasonal rhythms are observed in many important behaviors of plants and animals; human behavior is no exception. For example, there is strong and consistent diurnal variation in mood: PA (but not NA) shows a roughly sinusoidal curve that tracks with other bodily cycles, such as body temperature (Clark, Watson, & Leeka, 1989; Thayer, 1989). Given that mood is a core feature of temperament, it is plausible that individual differences in daily behavior might reflect underlying variations in temperament. Research examining variation in diurnal mood cycles due to temperament, however, has been quite inconsistent, suggesting that there is no simple relation between temperament and daily mood rhythms (e.g., Clark et al., 1989). However, to investigate whether temperament might influence other aspects of daily behavior, we had students in Sample 2 record the number of hours they slept each day, whereas students in Sample 4 kept a daily log of their rising and retiring times, from which we computed total hours of sleep. The Sample 4 students also completed a revised version (Smith, Reily, & Midkiff, 1989) of the Horne and Ostberg (1977) Morningness–Eveningness Questionnaire.

There was no relation between hours of sleep and either N/NE or E/PE in either study; this nonfinding is consistent with the prior literature, which has found few simple or straightforward relations between diurnal rhythms and general affective temperament. In Sample 2, amount of sleep correlated modestly with DvC ($r = .27$, $p < .01$), with those high in disinhibition sleeping longer. In Sample 4, however, when actual rising and retiring times were recorded, so that we calculated the students' sleep time rather than having them estimate it themselves, this relation disappeared.

It is noteworthy, however, that although there was no clear relation with total sleep amount, there were significant associations between temperament and *when* students slept. First, disinhibited individuals both retired later at night and arose later in the morning ($rs = .33$ and $.36$, respectively; $p < .001$). Moreover, this effect was due significantly more to the DvC Carefree Orientation subscale ($rs = .39$ and $.43$, respectively) than to Antisocial Behavior ($rs = .19$, $p < .05$ and $.14$, ns). Similarly, disinhibited individuals displayed a more characteristic "night owl" orientation on the MEQ than did those low in disinhibition ($r = -.27$), with a much stronger relation observed for Carefree Orientation ($r = -.34$) than Antisocial Behavior ($r = -.08$).

Conversely, individuals high in E/PE were more likely to be "morning larks" (MEQ $r = .34$, $p < .01$) and to record both earlier rising ($r = -.17$, $p < .07$) and retiring times ($r = -.21$, $p < .03$, respectively). Further analysis of these data using the two GTS Positive Temperament subscales yielded interesting results. The 12-item Energy subscale reflects the more purely physical aspects of the dimension that likely are tied more directly to biological parameters (e.g., "Most days I have a lot of 'pep' or vigor" and "I can work hard, and for a long time, without feeling tired"). The Positive Affectivity subscale items, by contrast, are more laden with cognitive content (e.g., "I lead a very interesting life" and "I can make a game out of some things that others consider work"). The subscales are substantially related ($r = .57$), so strongly differential correlates are relatively rare; nevertheless, both earlier rising time ($rs = -.19$ vs. $-.06$) and MEQ scores ($rs = .33$ vs. $.23$) related significantly more to the Energy than to the Positive Affectivity subscale. (Curiously, however, retiring time was equally related to Energy and Positive Affectivity.) Although these relations are not strong and the differences are not huge, they clearly suggest that sleep behavior is tied more closely to the physical, biological aspects of positive temperament.

Lifestyle: Substance Use, Sexuality, and Spirituality

We and others have previously documented the strong relation between DvC and substance use, as well as the striking *lack* of relation of substance use with both N/NE and E/PE. For example, in a large ($N = 901$) sample of college students, alcohol use correlated .44 with DvC, but $-.04$ with N/NE, and .05 with E/PE (Watson & Clark, 1993, Table 23.4). Correlations with use of marijuana, cigarettes, psychedelics, and caffeine pills ranged from .23 to .33 for DvC, but were all less than $|.10|$ for both N/NE and E/PE.

Two additional large-sample replications of these data are reported in Table 16.4, along with data from two other samples. Samples 1 and 2 used a slightly modified version of the inventory described by Watson and Clark (1993); the substance-use variables from this inventory are aggregations of multiple items that assess both frequency and quantity of use. Sample 3 participants completed an abbreviated version of the survey in which all substances other than alcohol were assessed with single items. Sample 4 is the same Sample 4 whose prospective, longitudinal data are presented in Table 16.3. The alcohol use variable is the percentage of days on which students reported drinking alcohol. Only correlations with DvC and its subscales, Carefree Orientation and Antisocial Behavior, are shown in Table 16.4, because all correlations with N/NE and E/PE hover around zero.

In the college student population, it appears that use of alcohol—which is quite widespread despite its general illegality in this age group (Wechsler, Davenport, Dowdall, Moeykens, & Castilllo, 1994)—is associated more strongly with a carefree than an antisocial lifestyle (in Big Five terms, with low Conscientiousness more than low Agreeableness). This relation emerges most clearly when the usage variable represents pure frequency of use (Sample 4). College students who "just want to have fun" turn to drink on many occasions. Similarly, cigarette use (which itself is correlated with alcohol use) is nonsignificantly more related to a carefree than an antisocial lifestyle. By contrast, use of substances that are illegal regardless of age (e.g., marijuana, psychedelics, or "any nonalcohol substance" [Sample 3]), as well as substance use–related problems, are somewhat more indicative of an antisocial lifestyle. Although few of these differences were statistically significant, the consistency of the pattern is noteworthy. However, it is unclear whether this pattern will generalize to samples that include a significant proportion of individuals with serious, chronic alcohol use, in which case stronger correlations with antisocial behavior might be expected.

Promiscuous sexual behavior has also been shown to be related to DvC (e.g., Watson & Clark, 1993; Zuckerman, Tushup, & Finner, 1976). For example, in the Watson and Clark (1993) data set, sexual behavior (e.g., number of sex partners in past year) was correlated with DvC (r = .37) but not with either N/NE or E/PE (r = –.02 and –.01, respectively). Additional data—again, only for DvC and its subscales—are reported in Table 16.5. Samples 1 through 3 are the same as those reported in Table 16.4; Sample 4 (Haig, 1997) is another large (N = 408) college sample who completed a modified version of the behavioral inventory used by Watson and Clark (1993). Once again, the pattern is clear: Disinhibited individuals have more positive attitudes toward casual sex and, concomitantly, engage more freely in a variety of sexual behaviors, including those associated with some risk. Moreover, this appears to reflect an antisocial more than simply a carefree lifestyle, which is consistent with the inclusion

TABLE 16.4. Correlations of Disinhibition and Its Subscales with Substance Use

Sample	DvC	CO	AB
		Alcohol	
1	.46	**.44**	.35
2	.44	**.40**	.33
3	.43	**.41**	.29
4	.35	**.40**	.13
		Cigarettes	
1	.25	.24	.21
2	.30	.26	.25
		Marijuana	
1	.40	.34	.34
2	.36	.26	**.38**
		Psychedelics	
1	.32	.24	**.31**
2	.25	.18	.27
		Any nonalcohol substance	
3	.24	.19	.27
		Substance use-related problems	
1	.36	.31	**.35**
2	.38	.27	.34

Note. DvC, Disinhibition versus Constraint; CO, Carefree Orientation; AB, Antisocial Behavior. Sample 1, N = 638. Sample 2, N = 827. Sample 3, N = 197. See Watson and Clark (1993) for details regarding method, which were identical for Studies 1 and 2 and slightly modified for Sample 3. Sample 4, N = 115; see text for details. The larger of the two subscale correlations is in **boldface**; if the difference between them is significant, it is also underlined.

TABLE 16.5. Correlations of Disinhibition and Its Subscales with Sexual Behavior

Sample	DvC	CO	AB
	Number of sexual partners in the past year		
1	.30	.19	**.34**
2	.30	.19	**.31**
4	.22	.14	**.20**
	Positive attitudes toward casual sex[a]		
3	.45	.28	**.45**
4	.43	.26	**.45**
	Variety of sexual partners (seven-item scale)		
3	.32	.20	**.33**
	Risky sexual behavior (four-item scale)		
3	.32	.22	**.33**

Note. DvC, Disinhibition versus Constraint; CO, Carefree Orientation; AB, Antisocial Behavior. Sample 1, $N = 638$. Sample 2, $N = 827$. Sample 3, $N = 197$. See Watson and Clark (1993) for details regarding method, which were identical for Studies 1 and 2 and slightly modified for Sample 3. Sample 4 (Haig, 1997), $N = 408$; see text for details. The larger of the two subscale correlations is in **boldface**; if the difference between them is significant, it is also underlined.

[a]Eight-item scale in Sample 3; three-item scale in Sample 4.

of "promiscuous sexual behavior" among the criteria for psychopathy (Cleckley, 1964; Hare, 1991).

Watson and Clark (1993) also reported that "perceived spirituality" was related positively to E/PE and negatively to DvC. To examine this further, Samples 3 and 4 provided additional data on religious beliefs and behaviors, shown in Table 16.6. Scores from all Big Three factors are shown, because of the established relations of these behaviors to E/PE as well as DvC. Replicating the Watson and Clark (1993) finding, all measures relating to religious behaviors or beliefs were related to both E/PE and DvC, with some mild indication that nonreligiosity reflects a more antisocial than simply a carefree lifestyle. That religious people should be more behaviorally constrained comes as no great surprise, although it might be interesting to test the generalizability of these relations in cultures with a less puritanical streak than the United States. The extent to which the relation with E/PE may be due to the social aspects of religious behavior is unknown, but is an issue that is worthy of further investigation.

TABLE 16.6. Correlations of the Big Three and DvC Subscales with Selected Lifestyle Variables

	Big Three			DvC	
Variable (No. of items)	N/NE	E/PE	DvC	CO	AB
Sample 3					
Religious behavior (10)	−.03	.14	−.32	−.28	−.27
Conservative religious beliefs (11)	−.01	.23	−.15	−.12	−.13
Sample 4					
Religious service attendance (1)	.06	.15	−.19	−.12	**−.22**
Importance of religion (1)	.02	.17	−.23	−.15	**−.25**
Reckless driving (4)	−.02	.01	.40	.26	**.36**
Thrill seeking behaviors (17)	−.14	.24	.24	.15	.17
Sample 5					
High school GPA	.01	.03	−.22	**−.25**	−.13
College GPA	.06	-.02	−.27	**−.30**	−.17

Note. DvC, Disinhibition versus Constraint; CO, Carefree Orientation; AB, Antisocial Behavior; GPA, grade point average. Sample 3, $N = 197$. See Watson and Clark (1993) for details regarding method, which were slightly modified for this study. Correlations $\geq |.15|$, $p < .05$; $r \geq |.19|$, $p < .01$. Sample 4 (Haig, 1997), $N = 408$; see text for details. Correlations $\geq |.10|$, $p < .05$; $r \geq |.13|$ $p < .01$. Sample 5, $N = 716$ for high school GPA; $N = 831$ for college GPA. The larger of the two DvC subscale correlations is in **boldface**; if the difference between them is significant, it is also underlined.

Work and Achievement

At the other end of the spectrum, a number of work- and achievement-related behaviors have been shown to have opposite associations with temperament (e.g., Barrick & Mount, 1991; Digman, 1972). For example, in Barrick and Mount's (1991) meta-analysis, Conscientiousness emerged as a significant predictor of all job performance criteria for all occupational groups, whereas E/PE was a valid predictor for two occupations involving social interaction. Watson and Clark (1993) reported that DvC scores were a stronger predictor of both first and second semester college grades than were SAT scores, even after controlling for the latter or for high school grades (the best overall predictor). In order to determine whether academic performance was differentially related to the DvC subscales, we replicated this study using a much larger sample. The results, presented at the bottom of Table 16.6, indicate that college performance is unrelated to either N/NE or E/PE but can be predicted by DvC, especially by Carefree Orientation. Thus, again not surprisingly, poor grades early in college are more likely to be obtained by those who lack discipline and prefer to live day to day rather than plan carefully for the future. The lower relation with Antisocial Behavior suggests that some students high on this dimension actually may succeed in "beating the system" whereas others do not.

Putting all of these data together, we obtain a picture that is consistent with theoretical models positing that the DvC dimension is related more to the style of affective regulation rather than the overall affective level (which is more the case with N/NE and E/PE). Disinhibited individuals experience greater reinforcement from positive stimuli and simultaneously are capable of diverting attention away from negative stimuli. This leads them to focus more strongly on the rewards than the risks of behavior and thus to engage in a wide range of pleasurable behaviors. Nonetheless, they are not immune to the negative consequences of these behaviors and so also report a greater number of behavior-related problems. The end result is a zero balance in terms of overall affective level (i.e., no strong correlation of either DvC or these various behaviors with N/NE or E/PE), but a broader range of affective experience. We return to these ideas when we discuss biological theories of the DvC dimension.

Genetic and Environmental Contributions to the Big Three Traits

We have postulated that the major traits of personality represent basic biobehavioral dimensions of temperament. We now consider data supporting this assertion. That temperament is biologically based implies that observed individual differences are substantially heritable and that they are—at least in latent form—present at birth (e.g., Buss & Plomin, 1975; Digman, 1994). That is, while biological parameters may be changed by life experiences (cf. stress reactions), our basic biological makeup is innate. Therefore, one crucial line of evidence concerns the possible hereditary basis of these traits.

After decades of neglect, the genetic basis of personality began to be researched systematically approximately 20 years ago, starting with the seminal contribution of Loehlin and Nichols (1976). Interest in this topic accelerated in the latter half of the 1980s (e.g., Plomin & Daniels, 1987; Tellegen et al., 1988) and has continued unabated. Consequently, we now have sufficient data to permit several basic conclusions. First, it is quite clear that all of the Big Three dimensions—and, indeed, virtually every trait that has ever been examined—has a substantial genetic component. Heritability estimates based on twin studies generally fall in the .40 to .60 range, with a median value of approximately .50 (Eysenck, 1990b; Finkel & McGue, 1997; Loehlin, 1992; Plomin & Daniels, 1987). Adoption studies tend to yield somewhat lower heritability estimates, but this may be due largely to their failure to assess nonadditive genetic variance (Plomin, Corley, Caspi, Fulker, & DeFries, 1998).

As stated earlier, the data are particularly extensive for N/NE and E/PE, and it is noteworthy that virtually identical findings have emerged across a wide variety of instruments, including the EPQ (e.g., Eysenck, 1990b; Viken et al., 1994), the CPI (Loehlin & Gough, 1990), the Multidimensional Personality Questionnaire (MPQ; Finkel & McGue, 1997; McGue, Bacon & Lykken, 1993; Tellegen et al., 1988), the Minnesota Multiphasic Personality Inventory (MMPI; Beer, Arnold, & Loehlin, 1998), and the NEO-PI-R (Jang et al., 1996, 1998). The data for the DvC dimension also have been quite consistent, with the exception of the unusually low heritability estimate (.18) for the CPI Norm-Favoring vector scale that was reported by Loehlin and Gough (1990). However, the exist-

ing data are inconsistent regarding the extent to which the genetic variance is additive versus nonadditive. Nevertheless, it is noteworthy that nonadditive dominance effects are found much more frequently for the E/PE dimension than for the other superfactors (Eysenck, 1990b; Heath et al., 1994; McGue et al., 1993).

Second, the evidence overwhelmingly suggests that the common rearing environment (i.e., the effects of living together in the same household) exerts virtually no effect on personality development (e.g., Beer et al., 1998; Eysenck, 1990b; Goldsmith, Buss, & Lemery, 1997; Plomin & Daniels, 1987; Tellegen et al., 1988). This finding was unanticipated and initially was met with some skepticism, but it has emerged so consistently that it now must be acknowledged as a necessary component in any model of personality development. Indeed, virtually the only supportive evidence comes from analyses of the E/PE factor; here, three different studies have reported significant shared environment effects (Beer et al., 1998; Goldsmith et al., 1997; Tellegen et al., 1988). However, this positive evidence must be weighed against a much larger number of studies that have found no effects due to the common rearing environment (e.g., Eysenck, 1990b; Finkel & McGue, 1997; Jang et al., 1996, 1998). We therefore see no reason to dispute Beer and colleagues' (1998) conclusion that "shared familial environmental variation is an unimportant source of individual differences in personality and interests" (p. 818).

In contrast, researchers consistently have reported substantial effects due to the unshared environment (i.e., idiosyncratic environmental stimuli that are experienced by a single individual but not by his or her biological relatives). A commonplace finding is that roughly half of the variance is attributable to hereditary, with the other half attributable to unique aspects of the environment (see Loehlin, 1992; Plomin & Daniels, 1987; Tellegen et al., 1988). However, this neat symmetry almost certainly represents a substantial overestimate of the unshared environmental variance. The problem—which has been frequently noted by investigators in this area (e.g., Eysenck, 1990b; Riemann et al., 1997; Tellegen et al., 1988)—is that the traditional method of estimating the unshared environment actually confounds (1) true environmental variance with (2) measurement error. In this regard, it is noteworthy that Riemann and colleagues (1997) were able to separate out these two effects by conducting combined analyses of both self- and peer ratings. Using this expanded approach, they found that nearly 70% of the variance in both N/NE and E/PE was due to genetic factors, with only roughly 30% attributable to the unshared environment.

Researchers also have become quite interested in examining how genetic and environmental influences may vary as a function of demographic variables such as sex and age. The data regarding sex have been markedly inconsistent, although several investigators have reported higher heritabilities for women than for men (for a review, see Finkel & McGue, 1997). The evidence regarding age is much more systematic, as several studies now have found that heritability estimates for both N/NE and E/PE are significantly lower in older respondents (McCartney et al., 1990; McGue et al., 1993; Pedersen, 1993; Viken et al., 1994). The causes of these age-related declines have not yet been clearly established, but it appears that they may differ across these two dimensions. Specifically, McGue et al. (1993) found that whereas the lower value for N/NE was due to a true decline in heritability, that for E/PE was attributable to the increased influence of the unshared environment (coupled with a stable genetic component).

Finally, this recent explosion of genetics research has yielded valuable evidence regarding the interesting issue of assortative mating; that is, whether or not people are attracted to—and ultimately marry—individuals who are phenotypically (and, therefore, genotypically) similar to themselves. In other words, do "birds of a feather flock together" or do "opposites attract"? Assortative mating is of keen interest to behavior geneticists because if it occurs, people actually will be more genetically similar to their first-degree relatives than the 50% that traditionally is assumed in the classic models. Generally speaking, however, there appears to be little or no assortative mating on any of the Big Three superfactors (e.g., Beer et al., 1998; Eysenck, 1990b; Finkel & McGue, 1997). Indeed, based on his review of the earlier literature, Eysenck (1990b) concluded that "mating is essentially random for personality differences" (p. 252). It is unclear whether this is because temperament is irrelevant in mating or because both axioms are true to some extent and their effects cancel out. There is evidence supporting assortative mating for more attitudinal aspects of personality (e.g., McCrae, 1996), but this is beyond our scope.

Biological Models of Temperament

Eysenck (1967) and Gray (1982, 1987) provided the seminal modern work on the biological bases of temperament and Eysenck (1990a) has continued to develop his ideas. Recent work has built on their "remarkably insightful ideas" (Depue, 1996; p. 348), incorporating the tremendous progress that has been made in the neurosciences in recent decades. Depue (1996; Depue & Collins, in press) has developed a comprehensive theory of the biological bases of the Big Three; Siever and Davis (1991) offered a strikingly similar psychobiological model arising from a psychiatric perspective on personality disorder. The major dimensions that underlie the various behavioral manifestations of personality disorder according to Siever and Davis (1991) are Anxiety/Inhibition, Affective Instability, Impulsivity/Aggression, and Cognitive/Perceptual Organization. The first three dimensions map onto N/NE, dysregulation in E/PE, and DvC in a remarkably straightforward way (see Clark, in press); their fourth dimension may prove to be related to the Big Five dimension of Openness, or perhaps the Peculiarity factor discussed by Berenbaum and Fujita (1994) in their review of personality dimensions in schizophrenia. We focus here on Depue's model and refer the interested reader to Siever and Davis (1991) and Clark (in press) for a discussion of their parallel schemes.

Depue has concentrated most on the dimension of E/PE, so we begin with a discussion of that dimension, followed by presentations of DvC and N/NE. First, however, we outline the basic characteristics of general "neurobehavioral-emotional systems" (abbreviated here as NBE systems) according to Depue. This overview is necessarily oversimplified and, with a few exceptions, we do not reference each point with original citations. Rather, we base our description on Depue (1996) and Depue and Collins (in press) and refer the interested reader to those papers for detailed references.

Similar to the overt, phenotypic systems they underlie, general NBE systems are hierarchical. At lower levels are goal-specific systems—behavior patterns that are tied to a particular stimulus context. At intermediate levels are processes (e.g., motivational, emotional, cognitive) that operate jointly in the various specific contexts and provide a general modulating influence on behavior across changing environmental contexts. Finally, the system at its most general level is the coordination of these various processes. What distinguishes one general NBE system from another are the distinctive (1) broad classes of activating stimuli, (2) "driving" motivations and emotions, (3) facilitative cognitive processes, (4) resultant behavioral patterns, and (5) neurotransmitter systems that underlie them. What distinguishes individuals from one another in this domain (i.e., what constitutes temperament) is the strength (both absolute and relative) of their sensitivity to the particular classes of stimuli that activate each of the general NBE systems.

Extraversion/Positive Emotionality

Depue suggests that positive incentive stimuli—or signals of reward—activate the neurobiological system underlying E/PE. At the most basic level, these would include such unconditioned stimuli as food, a potential mate, and safety. With increasing environmental, social, and cognitive complexity, the stimuli that signal reward also become more complex and may include conditioned stimuli such as social interaction, hobbies, or opportunities for leadership. The motivation associated with E/PE is, accordingly, positive incentive and, as we have seen, the associated emotion is positive affect. Activation of the incentive motivation thus primes the organism to seek potential rewards with positive anticipation, feelings that might be labeled excitement, desire, or hope. The most general behavioral pattern associated with E/PE is, accordingly, approach, "forward locomotion and search behavior as a means of satisfying an animal's need for food, a sex partner, social interaction, a nesting place" (Depue, 1996, p. 350). Moreover, active goal seeking increases interaction with the environment and, therefore, increases the needs (1) to evaluate what is encountered in terms of its relevance to the target goal and (2) to develop adaptive strategies in response. Thus, the cognitive processes component of the BFS supports evaluation and behavioral flexibility.

The term "temperament" typically is centered on the motivational/emotional and behavioral components of NBE systems, but it is important to recognize their integrated nature. That is, the prototypic behavior of the high E/PE individual does not occur in a contextual vacuum. Rather, that a particular class of stimuli activates incentive motivation differentially across individuals is

just as important a defining characteristic of this complex temperamental system as the resulting "extraverted" behavior.

Depue (1996) further argues that two major ascending dopamine (DA) projection systems—mesolimbic and mesocortical—underlie the facilitation of incentive motivation and, by extension, E/PE behavior. The mesolimbic system arises from the ventral tegmental area (VTA) and projects to limbic structures (amygdala, hippocampus, and nucleus accumbens [NAS]). Animal research has demonstrated that increases of DA activity in this system increase motor activity, exploratory and aggressive behavior, as well as the variety of behavior strategies employed; moreover, such increases facilitate the acquisition and maintenance of both approach and active avoidance behaviors. Conversely, lesions in this system produce major deficits in the initiation and facilitation of behavior specifically associated with incentive motivation such as sexual behavior, food hoarding, nursing, social interaction, and exploration of novel environments. The notion of "incentive motivation" is key in this regard because rote motor behaviors and nonvolitional behaviors (e.g., escape) are unaffected by such lesions.

The mesocortical system, which also originates in the VTA but projects to all areas of the cerebral cortex, modulates cognitive functions needed for behavioral flexibility and approach, and hence may be associated with E/PE. Perturbation of environmental conditions that require adaptive responding is associated with enhanced DA utilization by neurons in this system. Moreover, this system appears to play a role in spatial working memory, which would facilitate evaluation of novel environments. In summary, these DA systems working together activate the emotional response system that initiates those motor behaviors necessary for goal acquisition, and facilitates the cognitive processes that support goal acquisition by increased evaluation of the environment. Individual differences in the sensitivity of this biological system to the signals of reward that activate, in succession, incentive motivation and positive affect, approach behavior, and supportive cognitive processes, form the basis of the E/PE dimension of temperament.

Disinhibition versus Constraint

The DvC dimension is conceptualized by Depue as "reflecting the ease with which behavior is elicited by controlling stimuli" (1996, p. 360; see also Depue & Collins, in press). Thus, DvC is itself a nonaffective dimension (which is consistent with its lack of strong correlations with mood levels), but it will interact with the affective dimensions of N/NE and E/PE by affecting the links between stimulus and response. For example, individuals who are similarly sensitive to reward stimuli may still differ in their level of approach behavior because of differences on DvC. Individuals who act readily in response to stimuli are, by definition, impulsive; moreover, actions taken before full cognitive processing of information regarding the level of risk in the environment may be either reckless (danger is present) or maladaptive (e.g., fleeing from a potential reward when no true danger is present). Thus, this view of DvC is consonant with our earlier description of the dimension as reflecting individual differences in the tendency to behave in an undercontrolled versus overcontrolled manner.

In Depue's model (1996; Depue & Collins, in press), the biological basis of DvC is functional activity in CNS serotonin (5-HT) projections. The 5-HT signal exerts a tonic inhibitory influence on information flow, regardless of the type of information being conveyed. For example, both DA-mediated effects on the initiation of exploratory activity and N/NE-based warning signals are subject to its inhibitory influence. Individuals low in 5-HT are hypersensitive to sensory input so that even low-intensity stimuli may elicit a response. Consequently, each new input serves as one emotion-eliciting stimulus after another in such individuals, which is manifest as emotional lability. Moreover, chronic buffeting by stimulation is aversive and results in a tonic level of irritability, which may be the basis for the low moderate (*r*s = .20 to .30) correlation with NA. Another effect of this stimulus sensitivity is the greater influence of current, relative to future, signals of both reward and punishment. With reward signals, behavior is thus more strongly motivated by short-term than by long-term goals (e.g., fun at tonight's party rather than doing well on tomorrow's test); whereas with signals of punishment, active avoidance behavior patterns (e.g., fleeing a potentially dangerous situation or quitting a job at the first sign of difficulty) may be readily initiated rather than delaying action pending further situational assessment (e.g., that the danger is trivial or that the problems can be solved). Both of these behavior patterns describe impulsive behavior.

In addition, there is an increased magnitude of response, because negative feedback mechanisms are engaged more slowly. When DA is administered in the context of low 5-HT activity, for example, affective aggression—that is, an "attack" program that resembles incentive-reward oriented behavior—is enhanced. Similarly, in humans, low 5-HT activity is strongly associated with impulsive aggression, including arson, homicide, and suicidal behavior (Coccaro et al., 1989). Finally, low 5-HT activity is associated with increased use—and, not surprisingly, abuse—of DA-activating drugs, including alcohol, whose initial effects include increased DA release. This may seem to contradict our earlier statement about the aversiveness of chronic stimulation, but it makes sense if we assume that there also is enhancement of DA-related emotional rewards (i.e., positive affect) in low 5-HT conditions. Relatedly, primary (i.e., early onset, chronic-course, poor-outcome) alcoholism is associated with reduced 5-HT functioning.

Neuroticism/Negative Emotionality

Ironically, whereas N/NE may be the best described of the Big Three dimensions phenotypically, the least is known about its underlying neurobiology, especially in people. Thus, the formulation offered is here is speculative. Depue's neurobiological model builds on Tellegen's (1985) view that N/NE is a warning system activated under conditions of uncertainty that produce a diffuse state of NA, which motivates the organism to direct attention to scanning the environment for danger. Behavior is initially inhibited but, at the same time, the organism is prepared physiologically to deal with the danger (Cannon's [1929] fight–flight response). If uncertainty is reduced by signals of safety, NA decreases, inhibition is lifted and, if incentive conditions are present, exploratory behavior resumes.

Depue's (1996) hypothesis is that norepinephrine (NE) activity in the locus ceruleus (LC) modulates the N/NE system. In contrast to the regular firing of the 5-HT system, the LC system is more phasic, such that discharge rates are correlated with changes in vigilance and alertness, with large increases seen when threat or unexpected stimuli (and also potentially rewarding stimuli under conditions of uncertainty) are encountered. Further, peripheral (somatosensory and autonomic) stimuli provide information about the relevance of the external environment; in response to this peripheral input, LC activity increases in two ways. First, through ascending projections from the LC to the forebrain and neocortex, vigilance and scanning are activated or enhanced. Second, descending projections to the spinal cord send inhibitory signals to the autonomic nervous system, thereby modulating autonomic arousal.

It is important to note that this system does not appear to be activated by clear, unconditioned aversive signals (e.g., shock), when increased scanning would not serve an adaptive function. Rather, its critical role is in signaling the presence of stimuli that require investigation because their meaning is uncertain. Concomitantly, NE may be involved in aversive conditioning. Specifically, it has been shown that during associative learning, NE activity serves to increase the salience of relevant to irrelevant stimuli, which may work through a two-fold mechanism: NE reduces the spontaneous firing rate, which makes chance responding to irrelevant stimulus less likely and also increases the response to stronger, relevant stimuli. The net consequence is reduced uncertainty with regards to future incoming stimuli, because the distinction between relevant and irrelevant stimuli is thereby enhanced. However, if NE activity is *reduced* during the conditioning process, then the distinction between relevant and irrelevant stimuli is poorly learned and, as a consequence, the meaning of future stimuli remains highly uncertain. This creates the paradox that *low* NE activity during conditioning produces a situation in which the organism is more likely to experience frequent uncertainty, which leads, in turn, to *increased* NE activity because the LC NE system is activated by uncertainty.

Ironically, therefore, Depue (1996) has speculated that although increases in NE activity are associated with the activation of negative affect, vigilance, and scanning, it is actually more trait-like *low* NE activity that leads to the chronic uncertainty and resulting sense of apprehension that define the N/NE temperament dimension. As mentioned earlier, however, the extent to which manifest levels of N/NE "are associated with central NE reactivity is, unfortunately, completely untested" (Depue, 1996, p. 372).

The Temporal Stability of Personality

We now consider the stability of personality over time. To some readers, this discussion may seem superfluous in light of our earlier review of the

heritability evidence. Indeed, a popular misconception is that because we are born with a full complement of genes, their influence necessarily must be stable and invariant throughout the life span; this, in turn, implies that there should be a direct, positive correlation between the heritability of a trait and its temporal stability (for discussions of this point, see Pedersen, 1993; Viken et al., 1994). In actuality, however, genes can be a source of both stability and change in personality. Indeed, age-specific genes (e.g., a gene that influences temperament during adolescence but is quiescent during adulthood) generally can be expected to lead to instability in individual differences over time (McGue et al., 1993; Pedersen, 1993). Conversely, unchanging aspects of the environment (e.g., a long-term career or marriage) may well play an important role in maintaining the stability of temperament. Consequently, there is no necessary correlation between stability and heritability.

Having said that, however, we also must acknowledge that the available evidence suggests that this popular view is reasonably accurate after all: Genes do appear to be the major source of the observed stability in temperament, whereas environmental factors are primarily responsible for change (McGue et al., 1993; Pedersen, 1993; Viken et al., 1994). For instance, McGue and colleagues (1993) estimated the heritability of the stable component to be .71, .89, and .89 for N/NE, E/PE, and DvC, respectively. Note that although these values demonstrate that genetic factors are overwhelmingly responsible for phenotypic stability, they also indicate that the unshared environment has a nontrivial influence on the observed continuity of temperament. Conversely, McGue et al. (1993) found that although the unshared environment was primarily responsible for observed changes on these traits, genetic factors also played a moderate role in the instability of N/NE and DvC, and a more modest role in producing changes on E/PE. McGue et al. (1993) suggested these genetic sources of instability may well be linked to the observed declines in heritability that were discussed earlier. For example, age-specific genes may exert a significant influence on N/NE in adolescence, but then decline in importance during adulthood; this would lead to both lower heritabilities and phenotypic instability in N/NE over time.

These data establish that genes are primarily responsible for stability, but they do not address the issue of stability itself. How stable are the major dimensions of temperament over time? In discussing this issue, it is useful to distinguish three different types of stability: mean-level stability, rank-order stability, and structural stability (see Pedersen, 1993). We consider first the issue of mean-level stability, that is, whether or not average levels of a trait change systematically with age. For example, do people generally become more cautious and constrained as they grow older?

Unfortunately, most of the available data are cross-sectional, rather than longitudinal; moreover, the existing evidence is not entirely consistent. Still, the data permit some tentative conclusions. First, it is clear that N/NE scores show a significant decline with age, starting in late adolescence and continuing at least into middle adulthood (Aldwin & Levenson, 1994; Helson & Klohnen, 1998; McGue et al., 1993; Viken et al., 1994; Watson & Walker, 1996). Watson and Walker (1996), for example, reported a significant decline in N/NE scores in individuals who initially were assessed in the early years of college and then were retested 6 to 7 years later (when they were, on average, approximately 25 years old). McGue et al. (1993) reported a significant decrease in participants who were roughly 20 years old at the initial assessment and approximately 30 years old at retest. Helson and Klohnen (1998) extended these findings by demonstrating a significant decrease in N/NE between the ages of 27 and 43. After that, the evidence is less clear, but it appears that N/NE scores eventually may stabilize and show little further change (Costa & McCrae, 1992b; Helson & Klohnen, 1998). Helson & Klohnen (1998), for instance, found no further decline in N/NE between the ages of 43 and 52.

Similarly, DvC scores also decline with age (e.g., Eysenck & Eysenck, 1975; Helson & Klohnen, 1998; McGue et al., 1993). Again, most of this evidence is cross-sectional, but two recent longitudinal studies have reached the same conclusion. Specifically, McGue et al. (1993) reported a significant decline in DvC across the ages of 20 to 30, whereas Helson and Klohnen (1998) found a corresponding decrease from 27 to 43. Consistent with their findings for N/NE, however, Helson and Klohnen (1998) found no evidence of significant change between the ages of 43 and 52.

Finally, the findings regarding E/PE are markedly inconsistent and permit no clear conclusion. Cross-sectional data generally show a modest negative correlation between E/PE scores and

age, suggesting a slight decline across the life span (e.g., Costa & McCrae, 1992a; Eysenck & Eysenck, 1975); furthermore, analyses of the NEO-PI-R indicate that this effect is much stronger for the Excitement Seeking facet than for other components of the trait. Unfortunately, the longitudinal evidence paints a very different—and confusing—picture. Consistent with the cross-sectional evidence, Viken et al. (1994) reported a significant decline in E/PE from the early to middle 20s. In contrast, however, McGue et al. (1993) and Watson and Walker (1996) both found that E/PE scores did not change significantly across a similar age span. Finally, Helson and Klohnen (1998) reported a significant *increase* in E/PE scores between the ages of 27 and 43.

We turn now to the issue of rank-order stability, that is, the extent to which individuals maintain their relative position on the trait continuum over time. Here, the data are quite consistent and permit some firm conclusions. The clearest and best-replicated finding is that starting sometime around the age of 25 to 30, most personality traits show an impressive level of stability, even over lengthy time spans. Costa and McCrae (1992b), for instance, reported 24-year retest stabilities ranging from .61 to .71 (median = .65) on the 10 scales comprising the Guilford–Zimmerman Temperament Survey (Guilford, Zimmerman, & Guilford, 1976). Helson and Klohnen (1998) obtained very similar results in an examination of the Big Three. Specifically, they assessed women at the ages of 27 and 52 (i.e., a span of 25 years) and reported stability coefficients of .65 (N/NE), .62 (E/PE), and .51 (DvC). Not surprisingly, even higher stability estimates—generally falling in the .65 to .80 range—are obtained across shorter retest intervals of 6 to 12 years (see Costa & McCrae, 1988, 1992b; Viken et al., 1994). Thus, it now seems clear that individual differences become strongly stable and invariant after the age of 30.

But how stable are these temperamental characteristics *prior* to the age of 30? The available evidence indicates that lower—but still impressive—levels of stability can be observed on the Big Three traits starting around the age of 20. McGue et al. (1993) retested twins between the ages of 20 and 30 (i.e., a 10-year time span) and obtained stability coefficients of .60 (N/NE), .59 (E/PE), and .59 (DvC). Similarly, Viken et al. (1994) computed 6-year retest correlations on measures of N/NE and E/PE using two age-based twin cohorts (aged 18–23 and 24–29 at Time 1). Analyses of the younger cohort yielded moderate to strong stability correlations ranging from .48 to .60; not surprisingly, those for the older cohort were even higher, ranging from .56 to .69. Thus, strongly stable individual differences in temperament can be observed as early as late adolescence.

Finally, what about the stability of temperament in childhood and early adolescence? A thorough review of this large and complex literature is beyond the scope of our chapter. Briefly put, however, studies within this age range generally report significant rank-order stabilities that are substantially lower than those seen in adults (for discussions, see Caspi & Silva, 1995; Gest, 1997; Morison & Masten, 1991; Rubin, Hymel, & Mills, 1989). These lower stabilities likely reflect both (1) true developmental effects (i.e., temperamental characteristics actually are more fluid during this period) and (2) assessment problems (e.g., insufficient aggregation; the difficulties inherent in attempting to identify valid trait indicators at different stages of development). In this regard, it is noteworthy that Gest (1997) obtained extensive observational data relevant to the trait of behavioral inhibition (which, despite its name, appears to be a better marker of E/PE than DvC) at ages 10 and 20 (i.e., a 10-year time span). After aggregating both sets of data to produce highly reliable measures, he obtained evidence of strong stability (r = .57) across this extended time interval. These data indicate that it is possible to observe substantial stability even starting in childhood.

Next, we consider the issue of structural stability, that is, the extent to which the phenotypic structure of temperament is invariant across the life span. An extensive body of evidence—based on measures of both the Big Three and the Big Five—has established that essentially identical structures can be identified in high school student, college student, normal adult, and older adult samples (e.g., Costa & McCrae, 1992a; Digman, 1990; Eysenck & Eysenck, 1975; John, 1990; Mackinnon et al., 1995; McCrae, Costa, & Arenberg, 1980). Thus, personality structure shows impressive stability from adolescence through old age.

Fewer data exist for the pre-high school period, but the available evidence indicates that structures closely paralleling the Big Three and Big Five emerge at an early age. For instance, Digman and associates have replicated the Big Five structure in a series of studies in which teachers rated the characteristics of elementary

school children (Digman, 1997; Digman & Inouye, 1986). Similarly, several studies have examined the factor structure of the Children's Behavior Questionnaire (CBQ; Rothbart & Ahadi, 1994; Rothbart et al., 1994), a parent-report instrument that assesses temperament in children ages 3 to 8 years. These analyses consistently have identified three higher-order factors that closely resemble the Big Three: Surgency/Extraversion (i.e., E/PE), Negative Affectivity (i.e., N/NE), and Effortful Control (i.e., DvC) (see Ahadi et al., 1993; Goldsmith et al., 1997; Rothbart & Ahadi, 1994; Rothbart et al., 1994). Coupled with evidence demonstrating the broad cross-cultural robustness of these models (e.g., Ahadi et al., 1993; Jang et al., 1998), these data support McCrae and Costa's (1997) claim that "personality structure is a human universal" (p. 514).

Temperament and Psychopathology

A prominent theme of this chapter is that the emergence of a theoretical model of temperament has led to widespread progress in the field. Like any good theory, this model not only explains a range of existing data but also suggests avenues for further exploration; moreover, it has the power to change in fundamental ways how certain phenomena are conceptualized. The domain of psychopathology is one that the emerging temperamental paradigm has the potential to transform. For decades, research in personality and psychopathology developed independently, with little cross-fertilization. Eventually, however, investigators in each of these fields began to take notice of the work in the other, to note parallelisms between findings, and to ask how personality and psychopathology might be interrelated: Does personality act as a vulnerability factor for the development of psychopathology? Is personality changed by the experience of mental disorder? Does personality affect the way in which psychopathology is manifested? Widiger, Verhuel, and van den Brink (Chapter 13, this volume) ably explore many of these questions and plumb research conducted to answer them.

The paradigm we have been discussing points in particular to one of the possibilities that Widiger and associates discuss, which they label "spectrum relationships." They note that "personality and psychopathology at times fail to be distinct conditions" (p. 351) and they use the example of personality disorder (perhaps the clearest example of the identity of personality and psychopathology) as an illustration, pointing out that it may be no more "meaningful to say that Neuroticism contributes to the development of a borderline personality disorder [than] to say that Introversion contributes to the development of extreme Introversion" (p. 351). In these cases, perhaps we may invoke Occam's razor and dispense with the notion that there is a *relationship* between personality and psychopathology, which treats them as if they were separate entities in independent domains. Rather, given that associations between N/NE and a wide range of psychopathology are now quite well established (Mineka, Watson, & Clark, 1998; Watson et al., 1994; Watson & Clark, 1994), it may be most parsimonious simply to consider N/NE an inherent component of many types of psychopathology, and to recognize that what we call personality in one context shares a common origin (not only a genetic diathesis but perhaps environmental or learning-based etiologies as well) with what we call psychopathology in another.

Similarly, extensive data point to the importance of the E/PE dimension in various types of psychopathology including, for example, bipolar and unipolar depression (e.g., Clark et al., 1989; Clark, Watson, & Mineka, 1994; Depue, 1995), schizophrenia (Fowles, 1992), and eating disorder (Vitousek & Manke, 1994). Likewise, the DvC dimension has been linked with psychopathy/antisocial personality disorder and substance abuse (Sher & Trull, 1994) and eating disorder (Vitousek & Manke, 1994). Again, it may be more parsimonious to consider the temperament dimension as a component of these disorders rather than as a separable personality factor that stands in relation to them.

Adopting this view of temperament in relation to psychopathology has far-ranging implications. First, extensive comorbidity among psychological disorders has been acknowledged as a major challenge to categorical systems of diagnosis. In community-based studies, more than half of all individuals who meet criteria for one diagnosis also have at least one additional comorbid disorder (Clark, Watson, & Reynolds, 1995). In clinical samples, the rates are considerably higher, and it is very difficult to explain these data if diagnoses are conceived as distinct entities. However, if one adopts the view that a few basic temperament dimensions underlie psychopathology, the phenomenon of comorbidity is easily understood: If a person is high on N/NE, which is a component in multiple psychological

disorders, they are at increased risk for developing a broad range of disorders. Thus, the likelihood that they will develop more than one of these disorders is likewise increased. Similarly, if DvC is a major component of psychopathy and primary alcoholism, the probability that an individual will manifest neither, one, or both disorders will increase relative to an individual's level on the DvC dimension.

This analysis raises the question of the most appropriate way to conceptualize diagnoses. Clearly, it is untenable to argue that the DSM disorders represent distinct independent entities in the way that chicken pox is independent of measles. Given what appears to be a universal penchant for categorization, it is unlikely that diagnostic taxonomies will be replaced with purely dimensional systems for classifying disorders. However, it is not improbable that a systematic ordering of diagnoses could emerge from a temperament-based taxonomy, with disorders grouped into classes based in part on the primary dimensions that comprise them. Thus, for example, disorders in which a high level of N/NE is a major component (e.g., anxiety and depressive disorders, certain personality disorders) might form a higher-order category of "distress disorders" (Clark et al., 1994). Similarly, substance abuse and antisocial personality disorder might be part of a cluster of "disinhibitory psychopathology" (Sher & Trull, 1994). Finally, disorders of E/PE dysregulation might include bipolar disorder and borderline personality disorder.

The issue of diagnostic severity is a second major challenge to categorical systems of diagnosis that is addressed by adopting a temperament-based approach. Under the current system, a certain threshold of severity must be passed for an individual to receive any given diagnosis. However, in many domains of psychopathology, subclinical cases have been shown not only to exist with high prevalence but, more importantly, to represent a serious public health problem in terms of personal suffering, increased psychosocial dysfunction, and economic consequences such as unemployment, increased sick days, and lower productivity (e.g., Kessler, Zhao, Blazer, & Swartz, 1997; Klein, Lewinsohn, & Seeley, 1996; Martin, Blum, Beach, & Roman, 1996). Thus, the distinction between above-threshold and subclinical cases appears to be arbitrary and not to represent a true, natural boundary between disorder and nondisorder. This observed lack of a distinctive boundary is predicted, of course, from a temperament dimensional perspective.

In sum, the temperament-based model of personality that has emerged recently from the study of trait psychology is a powerful tool that has been fruitful in integrating diverse findings regarding personality structure and processes, the neurobiology of personality, child development, and related domains. It also has far-ranging implications for the study of psychopathology. As the recent work of Depue and Collins (in press) illustrates, full specification of this theory will prove to be extraordinarily complex. Nonetheless, we are optimistic that the broad outlines of a temperament-based paradigm have been mapped out, and that pursuing understanding the details of these temperamental systems will carry us well into the 21st century.

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NOTE

1. Digman (1997) has argued that the Big Five represent a *second* tier with two "metatraits" at an even higher level. We consider aspects of his argument subsequently.

REFERENCES

Ahadi, S. A., Rothbart, M. K., & Ye, R. (1993). Child temperament in the U.S. and China: Similarities and differences. *European Journal of Personality, 7,* 359–378.

Aldwin, C. M., & Levenson, M. R. (1994). Aging and personality assessment. In M. P. Lawton & J. A. Teresi (Eds.), *Annual review of gerontology and geriatrics* (Vol. 14, pp. 182–209). New York: Springer.

Allport, G. W. (1937). *Personality: A psychological interpretation.* New York: Holt.

Balatsky, G., & Diener, E. (1993). Subjective well-being among Russian students. *Social Indicators Research, 28,* 21–39.

Baron, R. A. (1998). *Psychology* (4th ed.). Boston: Allyn & Bacon.

Barrick, M. R., & Mount, M. K. (1991). The Big Five personality dimensions and job performance: A meta-analysis. *Personnel Psychology, 44,* 1–26.

Beer, J. M., Arnold, R. D., & Loehlin, J. C. (1998). Genetic and environmental influences on MMPI factor scales: Joint model fitting to twin and adoption data. *Journal of Personality and Social Psychology, 74,* 818–827.

Berenbaum, H., & Fujita, R. (1994). Schizophrenia and personality: Exploring the boundaries and connections between vulnerability and outcome. *Journal of Abnormal Psychology, 103,* 148–158.

Block, J. (1995). A contrarian view of the five-factor approach to personality description. *Psychological Bulletin, 117,* 187–215.

Buss, A., & Plomin, R. (1975). *A temperament theory of personality development.* New York: Wiley-Interscience.

Cannon, W. B. (1929) *Bodily changes in pain, hunger, fear and rage.* Boston: Branford.

Caspi, A., & Silva, P. A. (1995). Temperamental qualities at age three predict personality traits in young adulthood: Longitudinal evidence from a birth cohort. *Child Development, 66,* 486–498.

Clark, L. A. (in press). Mood, personality, and personality disorder. In R. Davidson (Ed.), *Emotion and psychopathology.* New York: Oxford University Press.

Clark, L. A., & Watson, D. (1991). Affective dispositions and their relation to psychological and physical health. In C. R. Snyder & D. R. Forsyth (Eds.), *Handbook of social and clinical psychology* (pp. 221–245). Elmsford, NY: Pergamon Press.

Clark, L. A., & Watson, D. (1988). Mood and the mundane: Relations between daily life events and self-reported mood. *Journal of Personality and Social Psychology, 54,* 296–308.

Clark, L. A., & Watson, D. (1990). *The General Temperament Survey.* Unpublished manuscript, University of Iowa, Iowa City, IA.

Clark, L. A., Watson, D., & Leeka, J. (1989). Diurnal variation in the positive affects. *Motivation and Emotion, 13,* 205–234.

Clark, L. A., Watson, D., & Mineka, S. (1994). Temperament, personality, and the mood and anxiety disorders. *Journal of Abnormal Psychology, 103,* 103–116.

Clark, L. A., Watson, D., & Reynolds, S. (1995). Diagnosis and classification in psychopathology: Challenges to the current system and future directions. *Annual Review of Psychology, 46,* 121–153.

Cleckley, H. (1964). *The mask of sanity* (4th ed.). St. Louis, MO: Mosby.

Cloninger, C. R. (1987). Neurogenetic adaptive mechanisms in alcoholism. *Science, 236,* 410–416.

Cloninger, C. R., Svrakic, D. M., & Przybeck, T. R. (1993). A psychobiological model of temperament and character. *Archives of General Psychiatry, 50,* 975–990.

Coccaro, E., Siever, L., Klar, H., Maurer, G., Cochrane, K., Cooper, T., Mohs, R., & David, K. (1989). Serotonergic studies in patients with affective and personality disorders. *Archives of General Psychiatry, 46,* 587–599.

Costa, P. T., Jr., & McCrae, R. R. (1988). Personality in adulthood: A six-year longitudinal study of self-reports and spouse ratings on the NEO Personality Inventory. *Journal of Personality and Social Psychology, 54,* 853–863.

Costa, P. T., Jr., & McCrae, R. R. (1992a). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual.* Odessa, FL: Psychological Assessment Resources.

Costa, P. T., Jr., & McCrae, R. R. (1992b). Trait psychology comes of age. In T. B. Sonderegger (Ed.), *Nebraska symposium on motivation: Psychology and aging* (pp. 169–204). Lincoln, NE: University of Nebraska Press.

Depue, R. (1995). Neurobiological factors in personality and depression. *European Journal of Personality, 9,* 413–439.

Depue, R. (1996). A neurobiological framework for the structure of personality and emotion: Implications for personality disorders. In J. F. Clarkin & M. F. Lenzenweger (Eds.), *Major theories of personality disorder* (pp. 347–390). New York: Guilford Press.

Depue, R., & Collins, P. F. (in press). Neurobiology of the structure of personality: Dopamine, facilitation of incentive motivation, and extraversion. *Behavioral and Brain Sciences.*

Diener, E., Smith, H., & Fujita, F. (1995). The personality structure of affect. *Journal of Personality and Social Psychology, 69,* 130–141.

Digman, J. M. (1972). High school academic achievement as seen in the context of a longitudinal study of personality. *Proceedings of the Annual Convention of the American Psychological Association, 7,* 19–20.

Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology, 41,* 417–440.

Digman, J. M. (1994). Child personality and temperament: Does the five-factor model embrace both domains? In C. F. Halverson, G. A. Kohnstamm, & R. P. Martin (Eds.), *The developing structure of temperament and personality from infancy to adulthood* (pp. 323–338). Hillsdale, NJ: Erlbaum.

Digman, J. M. (1997). Higher-order factors of the Big Five. *Journal of Personality and Social Psychology, 73,* 1246–1256.

Digman, J. M., & Inouye, J. (1986). Further specification of the five robust factors of personality. *Journal of Personality and Social Psychology, 50,* 116–123.

Epstein, S., & O'Brien, E. J. (1985). The person-situation debate in historical and current perspective. *Psychological Bulletin, 98,* 513–537.

Eysenck, H. J. (1967). *The biological bases of personality.* Baltimore, MD: University Park Press.

Eysenck, H. J. (1990a). Biological dimensions of personality. In L. A. Pervin (Ed.), *Handbook of personality: Theory and research* (pp. 244–276). New York: Guilford Press.

Eysenck, H. J. (1990b). Genetic and environmental contributions to individual differences: The three major dimensions of personality. *Journal of Personality, 58,* 245–261.

Eysenck, H. J. (1992). Four ways five factors are not basic. *Personality and Individual Differences, 13,* 667–673.

Eysenck, H. J. (1997). Personality and experimental psychology: The unification of psychology and the possibility of a paradigm. *Journal of Personality and Social Psychology, 73,* 1224–1237.

Eysenck, H. J., & Eysenck, S. B. G. (1975). *Manual of the Eysenck Personality Questionnaire.* San Diego, CA: Educational and Industrial Testing Service.

Finkel, D., & McGue, M. (1997). Sex differences and nonadditivity in heritability of the Multidimensional Personality Questionnaire scales. *Journal of Personality and Social Psychology, 72,* 929–938.

Fowles, D. C. (1992). Schizophrenia: Diathesis–stress revisited. *Annual Review of Psychology, 43,* 303–336.

Gest, S. D. (1997). Behavioral inhibition: Stability and associations with adaptation from childhood to early adulthood. *Journal of Personality and Social Psychology, 72,* 467–475.

Goldberg, L. R. (1993). The structure of phenotypic personality traits. *American Psychologist, 48,* 26–34.

Goldsmith, H. H., Buss, K. A., & Lemery, K. S. (1997). Toddler and childhood temperament: Expanded content, stronger genetic evidence, new evidence for the importance of environment. *Developmental Psychology, 33,* 891–905.

Gough, H. G. (1987). *California Psychological Inventory* [Administrator's guide]. Palo Alto, CA: Consulting Psychologists Press.

Gray, J. A. (1982). *The neuropsychology of anxiety: An enquiry into the functions of the septa-hippocampal system.* Oxford, U.K.: Clarendon Press.

Gray, J. A. (1987). *The psychology of fear and stress* (2nd ed.). Cambridge, U.K.: Cambridge University Press.

Guilford, J. S., Zimmerman, W. S., & Guilford, J. P. (1976). *The Guilford–Zimmerman Temperament Survey Handbook: Twenty-five years of research and application.* San Diego, CA: EdITS Publishers.

Haig, J. (1997). *Sexual expectations and sexual behavior.* Unpublished manuscript, University of Iowa.

Hare, R. D. (1991). *The Hare Psychopathy Checklist—Revised manual.* North Tonawanda, NY: Multi-Health Systems.

Heath, A. C., Cloninger, C. R., & Martin, N. G. (1994). Testing a model for the genetic structure of personality: A comparison of the personality systems of Cloninger and Eysenck. *Journal of Personality and Social Psychology, 66,* 762–775.

Helson, R., & Klohnen, E. C. (1998). Affective coloring of personality from young adulthood to midlife. *Personality and Social Psychology Bulletin, 24,* 241–252.

Horne, J. A., & Ostberg, O. (1977). A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *International Journal of Chronobiology, 4,* 97–110.

Jang, K. L., Livesley, W. J., & Vernon, P. A. (1996). Heritability of the Big Five personality dimensions and their facets: A twin study. *Journal of Personality, 64,* 575–591.

Jang, K. L., McCrae, R. R., Angleitner, A., Riemann, R., & Livesley, W. J. (1998). Heritability of facet-level traits in a cross-cultural twin sample: Support for a hierarchical model of personality. *Journal of Personality and Social Psychology, 74,* 1556–1565.

John, O. P. (1990). The "Big Five" factor taxonomy: Dimensions of personality in the natural language and in questionnaires. In L. A. Pervin (Ed.), *Handbook of personality: Theory and research* (pp. 66–100). New York: Guilford Press.

John, O. P., Donahue, E. M., & Kentle, R. L. (1991). *The Big Five Inventory—Versions 4a and 54.* (Technical report), Institute of Personality and Social Research, University of California, Berkeley, CA.

Kenrick, D. T., & Funder, D. C. (1988). Profiting from controversy: Lessons from the person–situation debate. *American Psychologist, 43,* 23–34.

Kessler, R. C., Zhao, S., Blazer, D. G., & Swartz, M. (1997). Prevalence, correlates, and course of minor depression and major depression in the national comorbidity survey. *Journal of Affective Disorders, 45,* 19–30.

Klein, D. N., Lewinsohn, P. M., & Seeley, J. R. (1996). Hypomanic personality traits in a community sample of adolescents. *Journal of Affective Disorders, 38,* 135–143.

Liebert, R. M., & Liebert, L. L. (1998). *Personality: Strategies and issues* (8th ed.). Pacific Grove, CA: Brooks/Cole.

Liebert, R. M., & Spiegler, M. D. (1982). *Personality: Strategies and issues* (4th ed.). Pacific Grove, CA: Brooks/Cole.

Loehlin, J. C. (1992). *Genes and environment in personality development.* Newbury Park, CA: Sage.

Loehlin, J. C., & Gough, H. G. (1990). Genetic and environmental variation on the California Psychological Inventory vector scales. *Journal of Personality Assessment, 54,* 463–468.

Loehlin, J. C., & Nichols, R. C. (1976). *Heredity, environment, and personality.* Austin, TX: University of Texas Press.

Mackinnon, A., Jorm, A. F., Christensen, H., Scott, L. R., Henderson, A. S., & Korten, A. E. (1995). A latent trait analysis of the Eysenck Personality Questionnaire in an elderly community sample. *Personality and Individual Differences, 18,* 739–747.

Martin, J. K., Blum, T. C., Beach, S. R. H., & Roman, P. M. (1996). Subclinical depression and performance at work. *Social Psychiatry, 31,* 3–9.

Martin, R. P., Wisenbaker, J., & Huttunen, M. (1994). Review of factor analytic studies of temperament measures based on the Thomas–Chess structural model: Implications for the Big Five. In C. F. Halverson, G. A. Kohnstamm, & R. P. Martin (Eds.), *The developing structure of temperament and personality from infancy to adulthood* (pp. 157–172). Hillsdale, NJ: Erlbaum.

McCartney, K., Harris, M. J., & Bernieri, F. (1990). Growing up and growing apart: A developmental meta-analysis of twin studies. *Psychological Bulletin, 107,* 226–237.

McCrae, R. R. (1996). Social consequences of experiential openness. *Psychological Bulletin, 120,* 323–337.

McCrae, R. R., & Costa, P. T., Jr. (1985). Comparison of EPI and psychoticism scales with measures of the five-factor model of personality. *Personality and Individual Differences, 6,* 587–597.

McCrae, R. R., & Costa, P. T., Jr. (1987). Validation of a five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52,* 81–90.

McCrae, R. R., & Costa, P. T., Jr. (1996). Toward a new generation of personality theories: Theoretical contexts for the five-factor model. In J. S. Wiggins (Ed.), *The five-factor model of personality: Theoretical perspectives* (pp. 51–87). New York: Guilford Press.

McCrae, R. R., & Costa, P. T., Jr. (1997). Personality trait structure as a human universal. *American Psychologist, 52,* 509–516.

McCrae, R. R., Costa, P. T., Jr., & Arenberg, D. (1980). Constancy of adult personality structure in males: Longitudinal, cross-sectional and times-of-measurement analyses. *Journal of Gerontology, 35,* 877–883.

McGue, M., Bacon, S., & Lykken, D. T. (1993). Personality stability and change in early adulthood: A behavioral genetic analysis. *Developmental Psychology, 29,* 96–109.

Medoff-Cooper, B., Carey, W. B., & McDevitt, S. C. (1993). Early Infancy Temperament Questionnaire. *Journal of Developmental and Behavioral Pediatrics, 14,* 230–235.

Meyer, G. J., & Shack, J. R. (1989). Structural convergence of mood and personality: Evidence for old and new directions. *Journal of Personality and Social Psychology, 57,* 691–706.

Mineka, S., Watson, D. B., & Clark, L. A. (1998). Psychopathology: Comorbidity of anxiety and unipolar mood disorders. *Annual Review of Psychology, 49,* 377–412.

Mischel, W. (1968). *Personality and assessment.* New York: Wiley.

Mischel, W. (1990). Personality dispositions revisited and revised: A view after three decades. In L. A. Pervin (Ed.), *Handbook of personality: Theory and research* (pp. 111–134). New York: Guilford Press.

Mischel, W., & Peake, P. K. (1982). Beyond *déjà vu* in the search for cross-situational consistency. *Psychological Review, 89,* 730–755.

Morison, P., & Masten, A. S. (1991). Peer reputation in middle childhood as a predictor of adaptation in adolescence: A seven-year follow-up. *Child Development, 62,* 991–1007.

Pedersen, N. L. (1993). Genetic and environmental continuity and change in personality. In T. J. Bouchard Jr. & P. Propping (Eds.), *Twins as a tool of behavioral genetics* (pp. 147–162). New York: Wiley.

Pervin, L. A. (1994). A critical analysis of current trait theory. *Psychological Inquiry, 5,* 103–113.

Plomin, R., Corley, R., Caspi, A., Fulker, D. W., & DeFries, J. (1998). Adoption results for self-reported personality: Evidence for nonadditive genetic effects? *Journal of Personality and Social Psychology, 75,* 211–218.

Plomin, R., & Daniels, D. (1987). Why are children in the same family so different from one another? *Behavioral and Brain Sciences, 10,* 1–16.

Riemann, R., Angleitner, A., & Strelau, J. (1997). Genetic and environmental influences on personality: A study of twins reared together using the self- and peer report NEO-FFI scales. *Journal of Personality, 65,* 449–475.

Rothbart, M. K., & Ahadi, S. A. (1994). Temperament and the development of personality. *Journal of Abnormal Psychology, 103,* 55–66.

Rothbart, M. K., Ahadi, S. A., & Hershey, K. L. (1994). Temperament and social behavior in childhood. *Merrill-Palmer Quarterly, 40,* 21–39.

Rothbart, M. K., Derryberry, D., & Posner, M. I. (1994). A psychobiological approach to the development of temperament. In J. E. Bates & T. D. Wachs (Eds.), *Temperament: Individual differences at the interface of biology and behavior* (pp. 83–116). Washington, DC: American Psychological Association.

Rubin, K. B., Hymel, S., & Mills, R. S. L. (1989). Sociability and social withdrawal in childhood: Stability and outcomes. *Journal of Personality, 57,* 237–255.

Ruch, W., Angleitner, A., & Strelau, J. (1991). The Strelau Temperament Inventory—Revised (STI-R): Validity studies. *European Journal of Personality, 5,* 287–308.

Siever, L. J., & Davis, K. L. (1991). A psychobiological perspective on the personality disorders. *American Journal Psychiatry, 148,* 1647–1658.

Sher, K. J., & Trull, T. J. (1994). Personality and disinhibitory psychopathology: Alcoholism and antisocial personality disorder. *Journal of Abnormal Psychology, 103,* 92–102.

Skinner, B. F. (1953). *Science and human behavior.* New York: Macmillan.

Smith, C. S., Reily, C., & Midkiff, K. (1989). Evaluation of three circadian rhythm questionnaires with suggestions for an improved measure of morningness. *Journal of Applied Psychology, 74,* 728–738.

Strelau, J. (1983). *Temperament–personality–activity.* London: Academic Press.

Strelau, J., Angleitner, A., & Ruch, W. (1990). Strelau Temperament Inventory (STI): General review and studies based on German samples. In J. N. Butcher & C. D. Spielberger (Eds.), *Advances in personality assessment* (Vol. 8, pp. 187–242). Hillsdale, NJ: Erlbaum.

Strelau, J., & Zawadzki, B. (1995). The Formal Characteristics of Behavior—Temperament Inventory (FCB-TI): Validity studies. *European Journal of Personality, 9,* 207–229.

Tellegen, A. (1985). Structures of mood and personality and their relevance to assessing anxiety, with an emphasis on self-report. In A. H. Tuma & J. D. Maser (Eds.), *Anxiety and the anxiety disorders* (pp. 681–706). Hillsdale, NJ: Erlbaum.

Tellegen, A., Lykken, D. T., Bouchard, T. J., Jr., Wilcox, K. J., Segal, N. L., & Rich, S. (1988). Personality

similarity in twins reared apart and together. *Journal of Personality and Social Psychology, 54,* 1031–1039.

Thayer, R. E. (1989). *The biopsychology of mood and arousal.* New York: Oxford University Press.

Thomas, A., Chess, S., & Birch, H. (1968). *Temperament and behavior: Disorders in children.* New York: New York University Press.

Thomas, A., & Chess, S. (1977). *Temperament and development.* New York: Brunner/Mazel.

Viken, R. J., Rose, R. J., Kaprio, J., & Koskenvuo, M. (1994). A developmental genetic analysis of adult personality: Extraversion and neuroticism from 18 to 59 years of age. *Journal of Personality and Social Psychology, 66,* 722–730.

Vitousek, K., & Manke, F. (1994). Personality variables and disorders in anorexia nervosa and bulimia nervosa. *Journal of Abnormal Psychology, 103,* 137–147.

Waller, N. G., Lilienfeld, S. O., Tellegen, A., & Lykken, D. T. (1991). The Tridimensional Personality Questionnaire: Structural validity and comparison with the Multidimensional Personality Questionnaire. *Multivariate Behavioral Research, 26,* 1–23.

Watson, D. (1988). The vicissitudes of mood measurement: Effects of varying descriptors, time frames, and response formats on measures of Positive and Negative Affect. *Journal of Personality and Social Psychology, 55,* 128–141.

Watson, D., & Clark, L. A. (1984). Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin, 96,* 465–490.

Watson, D., & Clark, L. A. (1992a). Affects separable and inseparable: A hierarchical model of the negative affects. *Journal of Personality and Social Psychology, 62,* 489–505.

Watson, D., & Clark, L. A. (1992b). On traits and temperament: General and specific factors of emotional experience and their relation to the five-factor model. *Journal of Personality, 60,* 441–476.

Watson, D., & Clark, L. A. (1993). Behavioral disinhibition versus constraint: A dispositional perspective. In D. M. Wegner & J. W. Pennebaker (Eds.), *Handbook of mental control* (pp. 506–527). Upper Saddle River, NJ: Prentice Hall.

Watson, D., & Clark, L. A. (Eds.). (1994). Personality and psychopathology [Special issue]. *Journal of Abnormal Psychology, 103*(1).

Watson, D., & Clark, L. A. (1997). Extraversion and its positive emotional core. In R. Hogan, J. Johnson, & S. Briggs (Eds.), *Handbook of personality psychology* (pp. 767–793). San Diego, CA: Academic Press.

Watson, D., Clark, L. A., & Harkness, A. R. (1994). Structures of personality and their relevance to psychopathology. *Journal of Abnormal Psychology, 103,* 18–31.

Watson, D., Clark, L. A., & Tellegen, A. (1984). Cross-cultural convergence in the structure of mood: A Japanese replication and comparison with U. S. findings. *Journal of Personality and Social Psychology, 47,* 127–144.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of Positive and Negative Affect: The PANAS Scales. *Journal of Personality and Social Psychology, 54,* 1063–1070.

Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin, 98,* 219–235.

Watson, D., & Walker, L. M. (1996). The long-term stability and predictive validity of trait measures of affect. *Journal of Personality and Social Psychology, 70,* 567–577.

Watson, D., Wiese, D., Vaidya, J., & Tellegen, A. (in press). The two general activation systems of affect: Structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology.*

Wechsler, J., Davenport, A., Dowdall, G., Moeykens, B., & Castillo, S. (1994). Health and behavioral consequences of binge drinking in college: A national survey of students in 140 campuses. *Journal of the American Medical Association, 272,* 1672–1677.

Westen, D. (1996). *Psychology: Mind, brain, and culture.* New York: Wiley.

Windle, M., & Lerner, R. M. (1986). Reassessing the dimensions of temperamental individuality across the life span: The Revised Dimensions of Temperament Survey (DOTS-R). *Journal of Adolescent Research, 1,* 213–229.

Zuckerman, M., Kuhlman, D. M., & Camac, C. (1988). What lies beyond E and N? Factor analyses of scales believed to measures basic dimensions of personality. *Journal of Personality and Social Psychology, 57,* 96–107.

Zuckerman, M., Tushup, R., & Finner, S. (1976). Sexual attitudes and experience: Attitude and personality correlates and changes produced by a course in sexuality. *Journal of Consulting and Clinical Psychology, 44,* 7–19.