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The Sixteen Personality Factor Questionnaire (16PF)

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INTRODUCTION

The Sixteen Personality Factor Questionnaire (16PF) is a comprehensive measure of normal-range personality found to be effective in a variety of settings where an in-depth assessment of the whole person is needed. The 16PF traits, presented in Table 7.1, are the result of years of factor-analytic research focused on discovering the basic structural elements of personality (Cattell, R.B., 1957, 1973).

In addition to discovering the sixteen normal-range personality traits for which the instrument is named, these researchers identified the five broad dimensions – a variant of the ‘Big Five’ factors (Cattell, R.B., 1957, 1970). From the beginning, Cattell proposed a multi-level, hierarchical structure of personality: the second-order global measures describe personality at a broader, conceptual level, while the more precise primary factors reveal the fine details and nuances that make each person unique, and are more powerful in predicting actual behavior. In addition, this factor-analytic structure includes a set of third-order factors, also discussed in this chapter.

Due to its scientific origins, the 16PF Questionnaire has a long history of empirical

research and is embedded in a well-established theory of individual differences. This questionnaire’s extensive body of research stretches back over half a century, providing evidence of its utility in clinical, counseling, industrial-organizational, educational, and research settings (Cattell, R.B. et al., 1970; H.E.P. Cattell and Schuerger, 2003; Conn and Rieke, 1994; Krug and Johns, 1990; Russell and Karol, 2002). A conservative estimate of 16PF research since 1974 includes more than 2,000 publications (Hofer and Eber, 2002). Most studies have found the 16PF to be among the top five most commonly used normal-range instruments in both research and practice (Butcher and Rouse, 1996; Piotrowski and Zalewski, 1993; Watkins et al., 1995). The measure is also widely used internationally, and since its inception has been adapted into over 35 languages worldwide.

HISTORY AND DEVELOPMENT OF THE 16PF QUESTIONNAIRE

The history of the 16PF Questionnaire spans almost the entire history of standardized

Table 7.1 16PF Scale Names and Descriptors

<i>Descriptors of Low Range</i>	<i>Primary Scales</i>	<i>Descriptors of High Range</i>
Reserved, Impersonal, Distant	Warmth (A)	Warm-hearted, Caring, Attentive To Others
Concrete, Lower Mental Capacity	Reasoning (B)	Abstract, Bright, Fast-Learner
Reactive, Affected By Feelings	Emotional Stability (C)	Emotionally Stable, Adaptive, Mature
Deferential, Cooperative, Avoids Conflict	Dominance (E)	Dominant, Forceful, Assertive
Serious, Restrained, Careful	Liveliness (F)	Enthusiastic, Animated, Spontaneous
Expedient, Nonconforming	Rule-Consciousness (G)	Rule-Conscious, Dutiful
Shy, Timid, Threat-Sensitive	Social Boldness (H)	Socially Bold, Venturesome, Thick-Skinned
Tough, Objective, Unsentimental	Sensitivity (I)	Sensitive, Aesthetic, Tender-Minded
Trusting, Unsuspecting, Accepting	Vigilance (L)	Vigilant, Suspicious, Skeptical, Wary
Practical, Grounded, Down-To-Earth	Abstractedness (M)	Abstracted, Imaginative, Idea-Oriented
Forthright, Genuine, Artless	Privateness (N)	Private, Discreet, Non-Disclosing
Self-Assured, Unworried, Complacent	Apprehension (O)	Apprehensive, Self-Doubting, Worried
Traditional, Attached To Familiar	Openness to Change (Q1)	Open To Change, Experimenting
Group-Orientated, Affiliative	Self-Reliance (Q2)	Self-Reliant, Solitary, Individualistic
Tolerates Disorder, Unexacting, Flexible	Perfectionism (Q3)	Perfectionistic, Organized, Self-Disciplined
Relaxed, Placid, Patient	Tension (Q4)	Tense, High Energy, Driven
<i>Global Scales</i>		
Introverted, Socially Inhibited	Extraversion	Extraverted, Socially Participating
Low Anxiety, Unperturbable	Anxiety Neuroticism	High Anxiety, Perturbable
Receptive, Open-Minded, Intuitive	Tough-Mindedness	Tough-Minded, Resolute, Unempathic
Accommodating, Agreeable, Selfless	Independence	Independent, Persuasive, Willful
Unrestrained, Follows Urges	Self-Control	Self-Controlled, Inhibits Urges

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personality measurement. Instead of being developed to measure preconceived dimensions of interest to a particular author, the instrument was developed from the unique perspective of a scientific quest to try to discover the basic structural elements of personality.

Raymond Cattell's personality research was based on his strong background in the physical sciences; born in 1905, he witnessed the first-hand awe-inspiring results of science, from electricity and telephones to automobiles, airplanes, and medicine. He wanted to apply these scientific methods to the uncharted domain of human personality with the goal of discovering the basic elements of personality (much as the basic elements of the physical world were discovered and organized into the periodic table). He believed that human characteristics such as creativity, authoritarianism, altruism, or leadership skills could be predicted from these fundamental personality traits (much as water was a weighted combination of the elements of

hydrogen and oxygen). For psychology to advance as a science, he felt it also needed basic measurement techniques for personality. Thus, through factor analysis – the powerful new tool for identifying underlying dimensions behind complex phenomena – Cattell believed the basic dimensions of personality could be discovered and then measured.

Over several decades, Cattell and his colleagues carried out a program of comprehensive, international research seeking a thorough, research-based map of normal personality. They systematically measured the widest possible range of personality dimensions, believing that 'all aspects of human personality which are or have been of importance, interest, or utility have already become recorded in the substance of language' (Cattell, R.B., 1943: 483). They studied these traits in diverse populations, using three different methodologies (Cattell, R.B., 1973): observation of natural, in-situ life behavior or L-data (e.g. academic grades, number of traffic accidents, or social contacts); questionnaire

or Q-data from the self-report domain; and objective behavior measured in standardized, experimental settings or T-data (e.g. number of original solutions to problem presented, responses to frustrations). Eventually, this research resulted in the 16 unitary traits of the 16PF Questionnaire shown in Table 7.1.

From the beginning, Cattell's goal was to investigate universal aspects of personality. Thus, his University of Illinois laboratory included researchers from many different countries who later continued their research abroad. Ongoing collaborative research was carried out with colleagues around the world, for example, in Japan (Akira Ishikawa and Bien Tsujioka), Germany (Kurt Pawlik and Klaus Schneewind), India (S. Kapoor), South Africa (Malcolm Coulter), England (Frank Warburton, Dennis Child), and Switzerland (Karl Delhees).

Since its first publication in 1949, there have been four major revisions – the most recent release being the 16PF fifth edition (Cattell, R.B. et al., 1993). The main goals of the latest revision were to develop updated, refined item content and collect a large, new norm sample. The item pool included the best items from all five previous forms of the 16PF plus new items written by the test authors and 16PF experts. Items were refined in a four-stage, iterative process using large samples. The resulting instrument has shorter, simpler items with updated language, a more standardized answer format, and has been reviewed for gender, cultural, and ethnic bias and ADA (Americans With Disabilities Act) compliance. Psychometric characteristics are improved, hand scoring is easier, and the standardization contains over 10,000 people.

Because of its international origins, the 16PF Questionnaire was quickly translated and adapted into many other languages. Since its first publication in 1949, the instrument has been adapted into more than 35 languages worldwide. These are not simply translations, as many questionnaires provide, but careful cultural adaptations, involving new norms and reliability and validity

research in each new country. Introduction of Web-based administration in 1999 allowed international test-users easy access to administration, scoring, and reports in many different languages, using local norms

CATTELL'S THEORY OF PERSONALITY

Primary and secondary-level traits

From its inception, the 16PF Questionnaire was a multi-level measure of personality based on Cattell's factor-analytic theory (Cattell, R.B., 1933, 1946). Cattell and his colleagues first discovered the primary traits, which provide the most basic definition of individual personality differences. These more specific primary traits are more powerful in understanding and predicting the complexity of actual behavior (Ashton, 1998; Judge et al., 2002; Mershon and Gorsuch, 1988; Paunonen and Ashton, 2001; Roberts et al., 2005).

Next, these researchers factor-analyzed the primary traits themselves in order to investigate personality structure at a higher level. From this, the broader 'second-order' or global factors emerged – the original Big Five. These researchers found that the numerous primary traits consistently coalesced into these broad dimensions, each with its own independent focus and function within personality, as described in Table 7.2. More recently, a similar set of Big Five factors has been rediscovered by other researchers (Costa and McCrae, 1992a; Goldberg, 1990), but using forced, orthogonal factor definitions. The five global factors also have been found in factor analyses of a wide range of current personality instruments (as Dr. Herb Eber, one of the original 16PF authors, used to say, 'These broad factors validate across very different populations and methods because they are as big as elephants and can be found in any large data set!').

Thus, these five 'second-order' or global factors were found to define personality at a

Table 7.2 16PF global factors and the primary trait make-up

Global Factors	
Extraversion/Introversion	(A) Warm-Reserved (F) Lively-Serious (H) Bold-Shy (N) Private-Forthright (Q2) Self-Reliant-Group-oriented
High Anxiety/Low Anxiety	(C) Emotionally Stable-Reactive (L) Vigilant-Trusting (O) Apprehensive-Self-assured (Q4) Tense-Relaxed
Tough-Mindedness/Receptivity	(A) Warm-Reserved (I) Sensitive-Unsentimental (M) Abstracted-Practical (Q1) Open-to-Change/Traditional
Independence/Accommodation	(E) Dominant-Deferential (H) Bold-Shy (L) Vigilant-Trusting (Q1) Open-to-Change/Traditional
Self-Control/Lack of Restraint	(F) Lively-Serious (G) Rule-conscious/Expedient (M) Abstracted-Practical (Q3) Perfectionistic-Tolerates disorder

Primary Factors

higher, more theoretical level of personality. However, because of their factor-analytic origins, the two levels of personality are essentially inter-related. The global factors provide the larger conceptual, organizing framework for understanding the meaning and function of the primary traits. However, the meanings of the globals themselves were determined by the primary traits which converged to make them up (see Table 7.2).

For example, the Extraversion/Introversion global factor was defined by the convergence of the five primary scales that represent basic human motivations for moving toward versus away from social interaction. Similarly, the four primary traits that merged to define Tough-Mindedness versus Receptivity describe four different aspects of openness to the world: openness to feelings and emotions (Sensitivity – I), openness to abstract ideas and imagination (Abstractedness – M), openness to new approaches and ideas (Openness-to-Change – Q1), and openness to people (Warmth – A).

Cattell's hierarchical structure is based on the idea that all traits are inter-correlated in the real world (for example, intelligence and anxiety, although conceptually quite distinct, are usually strongly inter-correlated). Because the basic 16PF primary traits were naturally inter-correlated, they could be factor-analyzed to find the secondary-level global traits. Thus, the data itself determined the definitions of the primary and global factors (in contrast to the forced orthogonal definitions of factors in the currently popular Big Five models).

Thus, the global traits provide a broad overview of personality, while the primary traits provide the more detailed information about the richness and uniqueness of the individual. For example, two people may have the same score on global Extraversion but may have quite different social styles. Someone who is warm and supportive (A+) but shy and modest (H–) may have the exact same Extraversion score as someone who is socially bold and gregarious (H+) but emotionally aloof and detached (A–). However, the first person is

likely to come across as warm, modest, and concerned about others, while the second is likely to seem bold, talkative, and attention seeking (less concerned about others). Thus, although both may seek social interaction to an equal degree, they do so for very different reasons and are likely to have a very different impact on their social environment.

The primary and global levels of 16PF traits combine to provide a comprehensive, in-depth understanding of an individual's personality. For example, although knowing someone's overall level of Self-Control/conscientiousness is important, successfully motivating that person to accomplish a particular goal depends on also knowing whether their self-control is motivated more by strong obedience to societal standards (Rule-Consciousness – G+), by a temperamental tendency to be self-disciplined and organized (Perfectionism – Q3+), or by a practical, focused perceptual style (low Abstractedness – M–). Thus, the 16PF Questionnaire can provide an in-depth, integrated understanding of an individual's whole personality.

The super factors of personality: third-order factors

From the beginning, Cattell's comprehensive trait hierarchy was three-tiered: A wide sampling of everyday behaviors were factor-analyzed to find the primary factors; these primary traits were factor-analyzed, resulting in the five second-order, global traits; and then the global factors were factor-analyzed into third-order traits at the highest, most abstract level of personality organization (Cattell, R.B., 1946, 1957, 1973). Factor analysis of secondary factors to find third-order factors was practiced first in the ability domain (e.g. Spearman, 1932), but a few personality theorists have also looked at this highest level of personality structure (e.g. Eysenck, 1978; Hampson, 1988; Digman, 1997; Peabody and Goldberg, 1989).

Because factor-analytic results at each level depend on the clarity of the traits being

factor-analyzed, early attempts to find third-order traits were less reliable. However, several independent studies have recently used large-scale samples to investigate the third-order factor structure of the 16PF (H.E.P. Cattell, 1996; Dancer and Woods, 2007; Gorsuch, 2007; Lounsbury et al., 2004). H.E.P. Cattell (1996) applied a common factor analysis to the global traits of the 16PF Fifth Edition norm sample ($n = 2,500$), and found two well-defined third-order factors. Richard Gorsuch (pers. comm., 12 February 2007) applied a common factor analysis to the 16PF global scores of 11,000 subjects, and found two very similar third-order factors. Most recently, Dancer and Woods (2007) found very similar results working with a sample of 4,405 working adults, and this factor pattern is presented in Table 7.3.

Each of these independent studies found the same two-factor solution. The first factor, factor I, involves human activities that are directed outward toward the world. This includes both Extraversion (movement toward social engagement, 'communion' or 'attachment'), as well as Independence (mastery/dominance of the social and non-social environment). Thus, third-order factor I encompasses tendencies to move assertively outward into the world toward both social connection and toward exploration/mastery of the environment, and might be called active outward engagement.

Third-order factor II involves internal types of processes and events. It includes first the age-old dimension of instinctual impulsivity versus self-restraint (global

Self-Control or conscientiousness); but also the dimensions of internal perceptual sensitivity, reactivity, and creativity – openness to feelings, imagination, esthetics, and new ideas (global Receptivity/openness versus Tough-Mindedness). Note that higher levels of Self-Control/conscientiousness are related to *lower* levels of openness/Receptivity: Thus, highly conscientiousness, self-controlled people also tend to be tough-minded and less open to emotions and new ideas. Conversely, those who are more impulsive and undisciplined also tend to be more creative and open to feelings and ideas (and to experience life more vividly). This third-order factor is well illustrated in the contrasting styles of having a conscientious focus on concrete, objective, practical tasks, versus occupations that focus on abstract, imaginative, and innovative ideas. Thus, superfactor II might be called self-disciplined practicality versus unrestrained creativity.

The fifth global factor, Anxiety/neuroticism, then loads on both of these third-order factors. This suggests that the distress described by Anxiety could arise either in the inward/outward engagement domain or in the more internalized unrestrained creativity/self-disciplined practicality domain. Additionally, high levels of distress may affect either of these areas. This is consistent with the wide range of outward and inward human capacities that can potentially become unbalanced, or can be affected by stress.

These results are consistent with Cattell's original belief that these third-order factors may not represent personality traits in the usual sense, but might reflect some broad, abstract level of sociological or biological influences on human temperament (Cattell, R.B., 1957; 1973). For example, there may be some biological/neurological structure that affects outward engagement versus inhibition (superfactor I), or affects impulse control/restraint and perceptual sensitivity/reativity (superfactor II). Definition and understanding of these third-order factors await further investigation.

Table 7.3 Varimax rotated factor loadings of the second-order factors of the 16PF5 questionnaire ($n = 4,405$)

	<i>Rotated factor I</i>	<i>Rotated factor II</i>
Extraversion	0.821	
Independence	0.669	
Anxiety	-0.638	-0.522
Self-control		0.816
Tough-mindedness		0.737

Comparison of the 16PF global scales with other five-factor models

For over 50 years, the 16PF has included the broad, second-order dimensions currently called 'the Big Five' (Cattell, R.B., 1946; Krug and Johns, 1986). In fact, Cattell located three of these five factors in his earliest studies of temperament (1933) – which Digman (1996) called 'the first glimpse of the Big Five'. Four of the five current traits were already described in Cattell's 1957 book. All five traits have been clearly identified and scorable from the questionnaire since the release of the fourth edition around 1970. Although Cattell continued to believe that there were more than five factors, so have many other prominent psychologists (Block, 1995; Fiske, 1994; Hogan et al., 1996; Jackson et al., 2000; Lee et al., 2005; Ostendorf, 1990; Saucier 2001).

The 16PF scales and items also played an important role in the development of the other Big Five factor models (e.g. Costa and McCrae, 1976, 1985; Norman, 1963; McKenzie et al., 1997; Tupes and Christal, 1961). For example, the first NEO manual (Costa and McCrae, 1985: 26) describes the development of the questionnaire as beginning with cluster analyses of 16PF scales, which these researchers had been using for over 20 years in their own research. However, this origin, or even acknowledgement of the existence of the five 16PF global factors, does not appear in any current accounts of the development of the Big Five (Costa and McCrae, 1992a; Digman, 1990; Goldberg, 1990).

Furthermore, when the 16PF correlation matrix, which was used in the original development of the Big Five, is re-analyzed using more modern, rigorous factor-analytic

methods, Costa and McCrae's results do not replicate (McKenzie, 1998). Instead, appropriate factoring (see R.B. Cattell, 1978; Gorsuch, 1983) of the original matrix produces the five 16PF global factors, rather than the three orthogonal NEO factors that Costa and McCrae chose to use.

A range of studies comparing the five 16PF global factors and the set of NEO Big Five factors show a striking resemblance between the two (Carnivez and Allen, 2005; H.E.P. Cattell, 1996; Conn and Rieke, 1994; Gerbing and Tuley, 1991; Schneewind and Graf, 1998). These studies show strong correlational and factor-analytic alignment between the two models: Between the two extraversion factors, between anxiety and neuroticism, between self-control and conscientiousness, between tough-mindedness/receptivity and openness-to-experience, and between independence and dis-agreeableness. In fact, the average correlation between the 16PF global factors and their respective NEO five factors are just as high as those between the NEO five factors and the Big Five markers which the NEO was developed to measure (H.E.P. Cattell, 1996; Goldberg, 1992). The alignments among the Big Five models are summarized in Table 7.4.

However, there are important differences between the two models. Although proponents of the other five-factor models have done much in the last decade to try to bring about a consensus in psychology about the existence of five global factors, their particular set of traits have been found to be problematic. In the development process, the NEO Big Five factors were forced to be statistically uncorrelated or orthogonal for reasons of theoretical and statistical simplicity. However, few have found this as a satisfactory approach for defining the basic dimensions

Table 7.4 Alignments among the three main five-factor models

<i>16PF (Cattell)</i>	<i>NEO-PI-R (Costa and McCrae)</i>	<i>Big Five (Goldberg)</i>
Extraversion/Introversion	Extraversion	Surgency
Low Anxiety/High Anxiety	Neuroticism	Emotional stability
Tough-Mindedness/Receptivity	Openness	Intellect or culture
Independence/Accommodation	Agreeableness	Agreeableness
Self-Control/Lack of Restraint	Conscientiousness	Conscientiousness or dependability

of human personality. For example, Big Five supporter Jack Digman (1997) stated: 'The apparent orthogonality of the Big Five is a direct result of the general employment of varimax rotation, a procedure that imposes rather than finds independent factors.' Additionally, Loewinger writes:

There is no reason to believe that the bedrock of personality is a set of orthogonal ... factors, unless you think that nature is constrained to present us a world in rows and columns. That would be convenient for many purposes, particularly given the statistical programs already installed on our computers. But is this realistic? (1994: 6)

The decision to impose orthogonal locations had fundamental effects on the resulting factors and their meanings. In his analysis of this basic issue of factor analysis, Child states:

Oblique solutions can spread the common variance between and within factors; orthogonal rotation can only spread variance between factors. That is why it is so important to carry out an oblique solution, to allow no escape of important variance ... Unfortunately, the orthogonal compromise disguises both the relationship between domains and the number of factors which could possibly be present in hyperspace. (1998: 353–354)

In contrast to the orthogonal definitions that were fundamental to the development of the NEO factors, recent studies have found that the NEO five factors are actually substantially inter-correlated (Carnivez and Allen, 2005; Goldberg, 1992; Smith et al., 2001). Even the latest NEO-PI-R manual (Costa and McCrae, 1992: 100) shows neuroticism and conscientiousness to inter-correlate – 0.53, and extraversion and openness to inter-correlate 0.40. Goldberg's Big Five markers also show substantial inter-correlations. These inter-correlations contradict the original premise on which the NEO Big Five factors were defined.

The forced orthogonal factor locations of the five-factor model have had substantial effects on the meanings of the traits. For example, although the basic traits of dominance (or agency) and warmth (or communion) have long been seen as two of the most fundamental dimensions of human personality

(Wiggins, 2003), the five-factor model has no factor that centrally includes either dominance or warmth. Rather factor analyses of the NEO-PI-R show that the central traits of dominance and warmth are widely dispersed and spread thinly among several of the five factors, particularly extraversion and agreeableness (H.E.P. Cattell, 1996; Child, 1998; Conn and Rieke, 1994; Costa and McCrae, 1992).

However, in the 16PF Questionnaire, the Independence global factor is organized around traits of assertiveness and influence in the world (high scorers are dominant, independent-minded and innovative, low scorers are deferential, cooperative, and agreeable). Thus, the 16PF global Independence factor is defined around traits of dominance or 'agency', while in the NEO model, the basic trait of dominance is split and relegated to small roles in several factors including extraversion and disagreeableness (where dominance is centered in a negative, hostile context).

In a similar way, factor-analyses of the NEO-PI-R have found that the basic trait of warmth (or communion) is also divided, with low loadings on several factors including extraversion and agreeableness (H.E.P. Cattell, 1996; Child, 1998; Conn and Rieke, 1994; Smith et al., 2001). However, in the 16PF, Warmth plays a central role in Extraversion, the factor that focuses on the basic dimensions of interpersonal relating. Additionally, these factor analyses of the NEO-PI-R indicate that the openness trait (called 'intellect' in Goldberg's model) tends to focus more on cognitive or intellectual curiosity, rather than equally measuring the whole domain, which includes openness to feelings, emotions, and aesthetics. Also, the Big Five factor 'conscientiousness' appears to be narrower in content than 16PF Self-Control and doesn't include the whole domain of human methods for self-control and self-restraint versus impulsivity (Roberts et al., 2005).

Thus, the imposed orthogonality of the NEO has had multiple impacts on its factor definitions. Furthermore, researchers

have found that when oblique methods are used on the NEO-PI-R items, allowing the data itself to determine factor definitions, the resulting factor definitions are different, and show more clarity and simple structure than do the current NEO-PI-R factors (Child, 1998).

However, the biggest difference between the two approaches is the method of development of the primary level traits. In the 16PF Questionnaire, the first-order primary trait definitions are based on decades of scientific research, and have been confirmed in a wide range of independent studies (see the section on Validity). In contrast, the NEO-PI primary-level personality facets were decided by consensus among a small group of psychologists (who selected what they felt should appear in each NEO domain). Child (1998) comments:

It does seem miraculous that the personality domains divided exactly into six facets. Of course, as the NEO PI-R is a "top-down" theory, the researchers can choose whatever number they wish before tying up the parcel. The snag with this procedure is its arbitrary nature and proneness to creating factors or traits to fit a theory. (1998: 352)

This method of selecting the fundamental facets of personality raises some basic questions about the NEO model. First of all, this arbitrary approach to choosing the facets leaves them open to debate by every other psychologist who happens to conceptualize personality differently (e.g. Gough, 1987; Hogan et al., 1996; Wiggins, 2003). More importantly, these facets are now used to define and calculate scores on the basic Big Five factors, which have resulted in changed definitions of the Big Five domains themselves.

Additionally, many correlational and factor-analytic studies have found the underlying factor structure of the NEO facets inconsistent and confusing, and that the domains do not actually hold together (Child, 1998; Church and Burke, 1994; Conn and Rieke, 1994; Loewinger, 1994; Parker et al., 1993; Roberts et al., 2005; Smith et al., 2001). These researchers have found that a large proportion of the NEO facets actually correlate

just as well with other Big Five domains than their own (even the test authors stated that the 1992 revision of the NEO was prompted by the fact that the facets for neuroticism and extraversion did not cohere psychometrically (McCrae and Costa, 1992)). For example, Roberts et al. (2005) found that three of the six conscientiousness facets do not adhere to that domain, but are as strongly related to other Big Five domains as they are to conscientiousness.

Overall, the strong correlations of many facets with theoretically unrelated domains and facets bring into question the definition of the Big Five factors. This lack of adherence of the NEO facets to their assigned domains is inconsistent with the basic model of the questionnaire (and probably a result of the non-empirical origins of the facets). Thus, a number of important issues have been raised about the integrity of the NEO model, as a result of both the arbitrary choice of facet trait meanings and orthogonal global factor definitions.

Another important distinction between the 16PF and other questionnaires is the contextualized nature of its items. For example, items on the NEO-PI-R involve a high degree of transparent self-rating or self-assessment of traits (e.g. 'I'm an even-tempered person'; 'I am dominant, forceful, and assertive'; 'I am known as a warm and friendly person'). Although this type of transparent item may do well in research settings, in most assessment situations where there are strong motivational components, these items tend to be vulnerable to distortion. For example, various studies have found that the basic factor structure of the NEO-PI-R is different in job applicant samples, thus bringing into question the validity of the questionnaire in settings where motivation and social desirability are issues (Schmit and Ryan, 1993; Smith et al., 2001). In contrast, 16PF items tend to be more indirect and involve more contextualized questions about actual behavior or experience (e.g. 'When I find myself in a boring situation, I usually "tune out" and daydream about other things'; 'I hardly ever feel hurried or

rushed as I go about my daily tasks'; 'I sometimes feel that I need my friends more than they need me').

Furthermore, there is substantial research indicating that self-ratings are different from observer ratings in their factor structure, and that they are only moderately correlated with actual behavior (e.g. Paunonen, 1993; Peabody and Goldberg, 1989). This suggests that much of the variance or meaning in self-ratings is not explained by the actual trait value, but rather is substantially affected by self-perception or self-image. For example, self-ratings do not capture the important dimensions of personality that are outside of a person's awareness or inconsistent with their self-image. Therefore, indirect questions that ask about actual everyday behavior (as 16PF items do) tend to measure personality more accurately, than asking a person to rate themselves on the trait – particularly where social desirability is involved or when no validity scales are available on the instrument.

BASIC FEATURES OF THE 16PF QUESTIONNAIRE

First published in 1949, the 16PF Questionnaire has had four major revisions, in 1956, 1962, 1968, and the fifth edition in 1993 (Cattell, R.B. et al.). The latest edition contains 185 multiple-choice items, with a three-point answer format. Item content is non-threatening, asking about daily behavior, interests, and opinions. The short ability scale items (Factor B) are grouped together at the end of the questionnaire with separate instructions. The questionnaire is written at a fifth grade reading level, and meant for use with people 16 years and older.

The instrument provides scores on the 16 primary scales, 5 global scales, and 3 response bias scales. All personality scales are bipolar (have clear, meaningful definitions at both ends), and are given in 'stens' (standard-

ized-ten scores) ranging from 1 to 10, with a mean of 5.5 and a standard deviation of 2.0. The latest standardization includes over 10,000 people and was published in 2001.

Because the questionnaire is un-timed and has simple, straightforward instructions, administration requires minimal supervision in either individual or group settings. Administration time is about 35–50 minutes for paper-and-pencil format, and about 25–40 minutes for computer administration. Easy scoring procedures are provided for paper-and-pencil, computer, or Internet formats. The publisher provides various scoring services (mail-in, fax, software, and Internet) and a range of interpretive reports for different applications. Detailed instructions for administration and scoring can be found in numerous places (H.E.P. Cattell and Schuerger, 2003; Russell and Karol, 2002).

The questionnaire is available in many different languages (international translations exceed 35 languages worldwide). Unlike many commercially available personality measures, recent 16PF translations are culturally adapted, with local norms and reliability and validity information available in individual manuals. Internet administration also allows use of international norms for scoring, plus reports in over a dozen different language groups.

The 16PF traits are also measured in parallel versions for younger age ranges. For example, the 16PF Adolescent Personality Questionnaire measures the 16PF traits in 12–18 year olds (Schuerger, 2001). A shorter (20-minute) version of the questionnaire, consisting of a subset of somewhat-shortened scales, was developed for use in employee selection settings – the 16PF Select (Cattell, R.B. et al., 1999). The 16PF Express (Gorsuch, 2006) provides a very short, 15-minute measure of all the traits (with four or five items per factor). The 16PF traits also appear in the PsychEval Personality Questionnaire (PEPQ; Cattell, R.B. et al., 2003), a comprehensive instrument which

includes both normal and abnormal personality dimensions.

USES AND APPLICATIONS

Because of its strong scientific background, the 16PF Questionnaire is used in a wide range of settings, including industrial/organizational, counseling and clinical, basic research, educational, and medical settings. The instrument's ability to provide comprehensive, objective information in an efficient manner makes it a particularly powerful tool for industrial/organization applications, such as employee selection, promotion, development, coaching, or outplacement counseling. The questionnaire is also widely used in career counseling settings.

Although the 16PF Questionnaire is a measure of normal-range personality, it can be used in counseling/clinical settings to provide an in-depth, integrated picture of the whole person. Many experts have promoted the use of normal-range measures in clinical settings (e.g. Butcher and Rouse, 1996; Costa and McCrae, 1992b). For example, 16PF dimensions have proven useful in efficiently developing a comprehensive picture of the whole person (including strengths and weaknesses), facilitating rapport and empathy, helping clients develop greater self-awareness, identifying relevant adjustment issues, choosing appropriate therapeutic strategies, and planning developmental goals (H.B. and H.E.P. Cattell, 1997; Karson et al., 1997).

Information about questionnaire interpretation can be found in numerous 16PF resource books. These include the test manuals, clinically oriented interpretive books (e.g. H.B. Cattell, 1989; Karson et al., 1997; Meyer, 1996), resource books for I/O settings (e.g. Schuerger and Watterson, 1998; Lord, 1999; Watterson, 2002); and comprehensive interpretive guidebooks (e.g. H.E.P. Cattell and Schuerger, 2003; H.E.P. Cattell, 2007), plus computer-generated interpretive reports.

RELIABILITY AND HOMOGENEITY

Test-retest reliability

Test-retest reliabilities (measuring temporal consistency or stability) are documented in the *16PF Fifth Edition Technical Manual* (Conn and Rieke, 1994). For the 16PF primary scales, test-retest reliabilities average 0.80 over a two-week interval (ranging from 0.69 to 0.87), and 0.70 over a two-month interval (ranging from 0.56 to 0.79). The five global scales of the 16PF Questionnaire show even higher test-retest reliabilities (they have more items); they average 0.87 for a two-week interval (ranging from 0.84 to 0.91), and 0.78 for a two-month interval (ranging from 0.70 to 0.82).

International 16PF editions also show strong test-retest reliabilities. For example, two-week test-retest reliabilities for the Norwegian edition average 0.80 for primary scales and 0.87 for global scales (IPAT, 2004b); for the German edition, primary scale reliabilities average 0.83 over a one-month interval (Schneewind and Graf, 1998); for the Danish edition, primary scale reliabilities average 0.86 over a two-week interval (IPAT, 2004c); and for the French edition, one-month reliabilities average 0.73 (IPAT, 1995).

Internal consistency

Internal consistency indicates the degree of inter-relatedness or homogeneity of the items in a scale, and is thus a good estimate of reliability for narrowly defined scales. Internal consistency estimates for the 16PF primary scales on a diverse sample of 4,660, range from 0.66 to 0.86, with a mean of 0.75 (Conn and Rieke, 1994). Normal internal consistency estimates are not appropriate for the global scales, because of their heterogeneous nature as weighted composites of primary scales. However, recently developed equations (F. Drasgow, pers. comm., January 2005)

for estimating internal consistency in heterogeneous composites were applied, and average 0.87 over the five global scales (S. Bedwell, pers. comm., February 2007).

Internal consistency for international versions of the instrument also meets professionally accepted standards. For example, Cronbach alphas averaged 0.74 in the German edition (Schneewind and Graf, 1998), 0.72 in the French edition (Rolland and Mogenet, 1996), 0.75 in the Japanese edition (IPAT, 2007), 0.69 in the Chinese edition (Jia-xi and Guo-peng, 2006), and 0.73 in the Spanish-American or Pan-Spanish edition (H.E.P. Cattell, 2005).

Too much homogeneity?

Test developers often select items to maximize the internal consistency of a scale by deleting heterogeneous items. Cattell and others (Cattell, R.B. and Tsujioka, 1964; Rosnowski, 1987) have questioned this practice because it can lead to seemingly highly reliable scales which actually measure only a very narrow, homogeneous segment of the target construct, or measure it only in a narrow group of people.

In fact, personality scales can be too homogeneous. Lord (1980: 9) shows how, for dichotomous items, a single scale cannot maximize both internal consistency reliability and validity. Reliability may be defined as:

$$\rho_{xx'} = \frac{n}{n-1} \left(1 - \frac{\sum \sigma_i^2}{\sum \sum \sigma_i \sigma_j \rho_{ij}} \right) \quad (7.1)$$

where n is the number of items on the scale, $\rho_{xx'}$ is the internal consistency reliability, ρ_{ij} is the correlation of items i and j , and σ_i and σ_j are the standard deviations of items i and j . Validity may be defined as:

$$\rho_{xc} = \frac{\sum \sigma_i \rho_{ic}}{\sqrt{\sum \sum \sigma_i \sigma_j \rho_{ij}}} \quad (7.2)$$

where ρ_{xc} is the criterion-related validity of the scale, ρ_{ic} is the criterion correlation of item i , and other terms are as defined in Equation 7.1. The term involving a ratio of numbers of items in Equation 7.1 approaches one quickly and can be ignored. The remainder of Equation 7.1 looks quite like Equation 7.2; both equations contain ratios of sums with similar denominators. The denominator is maximized when the items are highly correlated (and a large denominator leads to a small ratio). The key difference between the two equations is that the ratio is subtracted from 1 in Equation 7.1.

Thus, opposite conditions lead to maximization of Equations 7.1 and 7.2. Equation 7.1 shows that internal consistency is maximized when items are highly correlated, and Equation 7.2 shows that criterion-related validity is maximized when items are uncorrelated. In practical terms, this means it is mathematically impossible to simultaneously maximize reliability and validity of a scale. Therefore, test developers must choose between making very homogeneous scales that reliably predict only a narrow set of behaviors versus creating more heterogeneous scales that measure more comprehensive scale content. Because the predictive validity of a scale is the ultimate measure of its worth, internal consistency reliability should not be the main criterion used in scale development.

FACTORIAL VALIDITY

One important source of validity for the 16PF Questionnaire has been factor-analytic studies of the structure of the primary and global traits across diverse samples of people (e.g. Boyle, 1989; Carnivez and Allen, 2005; H.E. Cattell, 1996; Cattell, R.B. et al., 1970; Cattell, R.B. and Krug, 1986; Chernyshenko et al., 2001; Conn and Rieke, 1994; Dancer and Woods, 2007; Gerbing and Tuley, 1991; R. Gorsuch, pers. comm., February 2007; Hofer et al., 1997; Krug and Johns, 1986;

McKenzie et al., 1997; Ormerod et al., 1995). These studies have used exploratory and confirmatory factor analysis to confirm the number, identity, and independence of the primary factors; and to confirm the number, identity, and primary factor make-up of the global factors.

For example, Dancer and Woods (2007) factor-analyzed the primary traits in a sample of 4,414 business employees and found strong support for the 16PF global factor structure. R. Gorsuch (pers. comm., February 2007) factor-analyzed the primary traits to find the global traits on a sample of 11,000 test-takers, and then applied a common factor analysis to the globals to confirm the third-order factors. Hofer et al. (1997) used confirmatory factor analysis and structural equation modeling tests of factorial invariance to study the measurement properties of the questionnaire across six large, diverse, samples ($n = 30,732$), and concluded that 'the factor structure of the 16PF holds remarkably well across radically different samples of people, across gender, and across different forms of the 16PF' (266).

Factor analyses of international editions have also confirmed the structure of the 16PF primary and global traits. For example, factor analyses have confirmed the factor structure in the German edition (Schneewind and Graf, 1998), the French edition (Rolland and Mogenet, 1996), the Japanese edition (IPAT, 2007), the Chinese edition (Jia-xi and Guo-peng, 2006), the Castilian Spanish edition (Prieto et al., 1996), the Italian edition (Argentero, 1989), the South African edition (Van Eeden and Prinsloo, 1997; Schepers and Hassett, 2006); the Norwegian edition (IPAT, 2004b); and the Dutch edition (IPAT, 2004a).

CONSTRUCT VALIDITY

Construct validity of the 16PF scales has been demonstrated by their correlations with scales on other instruments. *The 16PF Fifth*

Edition Administrator's Manual (Russell and Karol, 2002) and the *16PF Fifth Edition Technical Manual* (Conn and Rieke, 1994) present correlations between the 16PF primary and global scales and a range of other measures of normal, adult personality. These include the California Psychological Inventory (Gough, 1987), the Myers-Briggs Type Indicator (Myers and McCaulley, 1985), the NEO-PI-R (Costa and McCrae, 1992a), the Personality Research Form (Jackson, 1989), the Coopersmith Self-Esteem Inventory (Coopersmith, 1981), the Holland occupational themes, as well as other measures of creativity, leadership, and social skills. These results consistently validate the meanings of the 16PF scales.

There are numerous independent studies showing strong relationships between the 16PF scales and other questionnaire scales; for example, Boyle (1989) studied relationships with the Eysenck and Comrey scales; Dancer and Woods (2007) investigated relationships with the FIRO-B; and many studies have investigated the relationships between the 16PF scales and the NEO-PI scales (Carnivez and Allen, 2005; H.E.P. Cattell, 1996; Conn and Rieke, 1994; Gerbing and Tuley, 1991).

International 16PF editions have also shown strong relationships with other instruments. For example, the Japanese 16PF manual (IPAT, 2007) provides inter-correlations with the OPQ and the SPI (a Myers-Briggs type measure); the German edition provides inter-correlations and multi-level factor analyses with the NEO-PI-R, the PRF, and the Locus of Control Inventory (Schneewind and Graf, 1998); the Dutch Manual provides inter-correlations with the MBTI as well as with peer-ratings of personality (IPAT, 2004a); the French edition (IPAT, 1995) provides inter-correlations with the CPI, the Gordon Personality Inventory, and the MBTI; and Schepers and Hassett (2006) provide correlational, factor-analytic, and canonical correlations between the South African 16PF and the Locus of Control Inventory.

PREDICTIVE VALIDITY

For over half a century, the 16PF Questionnaire has proven useful in understanding and predicting a wide range of important behaviors, thus providing a rich source of information for test users. For example, the instrument has been effective in predicting such diverse areas as creativity (Guastello and Rieke, 1993b), social skills and empathy (Conn and Rieke, 1994), marital compatibility (Russell, 1995), and leadership potential (Conn and Rieke, 1994), as well as over a hundred occupational profiles (Cattell, R.B. et al., 1970; Conn and Rieke, 1994; Schuerger and Watterson, 1998; Walter, 2000).

The 16PF Questionnaire has been particularly productive in the domain of basic personality measurement research. For example, in studies of underlying personality structure (Roberts et al., 2005), research into measurement equivalence across cultures (Ellis and Mead, 2000); studies into differences between peer-ratings and self-reports (IPAT, 2004a), and studies of response bias (Christiansen et al., 1994) and social desirability (Seisdedos, 1996). The instrument has also been useful in social and cognitive psychology, for example, in studies of social perception and judgments (Rohmer and Louvet, 2004), attributional style (Wang and Zhang, 2005), cognitive style and decision-making (Bisset, 2000), and cult membership (Kintlerova, 2000).

The measure has also been productive in educational settings, for example, in predicting academic achievement (Schuerger, 2001), characteristics of college drop-outs (Sanchez et al., 2001), choice of college major or specialization (Hartung et al., 2005), and university sports participation (Arora, 2005). The instrument has also been useful in medical studies, for example, of treatment issues in end-stage liver disease (Bonaguidi, 1996) and illnesses such as coronary artery disease (Miller et al., 1996) or cancer (Nair et al., 1993). Because of space limitations, this review will focus on two broad areas of use: organizational applications, such as employee selection and career development, and counseling and clinical uses.

Employee selection, promotion, and development

The 16PF Questionnaire has proven itself invaluable in making a range of organizational decisions, such as employee hiring, promotion, development, coaching, outplacement, and retirement counseling. There is an extensive body of research demonstrating the 16PF Questionnaire's ability to predict a wide variety of occupational profiles (Cattell, R.B. et al., 1970; Conn and Rieke, 1994; Guastello and Rieke, 1993a, 1993b; Russell and Karol, 2002; Schuerger and Watterson, 1998; Walter, 2000). Additionally, the 16PF has been useful in predicting many important job-related dimensions, for example, creativity (Guastello and Rieke, 1993b), leadership styles (Watterson, 2002), team roles and team climate (Burch and Anderson, 2004; Fisher et al., 1998), social skills (Conn and Rieke, 1994), job training success (Tango and Kolodinsky, 2004), and job satisfaction (Lounsbury et al., 2004). International versions have also been effective in predicting important work dimensions, for example, punctuality, job preparedness, and ability to work alone in the Netherlands (IPAT, 2004a); call-center customer service performance in Britain (Williams, 1999); and leadership effectiveness ratings in Norwegian managers (Hetland and Sandal, 2003).

Note that almost all research results are linear and assume that 'more is better' on personality dimensions, which may not be the case. For example, although police officers as a group generally score above average on Rule-Consciousness (G+); higher on-the-job performance is often predicted by *lower* scores on Rule-Consciousness within this above average group – probably because extremely G+ people may be rigidly rule-bound (Adcox et al., 1999). Therefore, job performance results need to be taken in the context of the group's general score range, and curvilinear relationships should be considered.

Meta-analytic job performance evidence

Over two decades, a large body of evidence has shown that various Big Five measures of personality are valid predictors of job performance (Hough and Ones, 2001; Hurtz and Donovan, 2000; Salgado, 1997; Tett et al., 1991). Indeed, the 16PF Questionnaire shows even greater ability to predict occupational outcomes through its more fine-grained primary traits, which are more powerful in capturing important variance about specific behaviors (Ashton, 1998; Judge et al., 2002; Mershon and Gorsuch, 1988; Paunonen and Ashton, 2001; Gorsuch, 2006).

Managers, executives, and leaders

The 16PF Questionnaire has a long history of identifying the personality traits of successful supervisors, managers, executives, and other leaders (Cattell, R.B. et al., 1970; Cattell, R.B. et al., 1999; Cattell, R.B. and Stice, 1954; Christiansen et al., 1994; Conn and Rieke, 1994; Guastello and Rieke, 1993a; Johns et al., 1980; Roy, 1995; Schuerger and Watterson, 1998; Walter, 2000; Watterson, 2002). These studies consistently indicate that three clusters of traits are important for managerial success. First, effective managers tend to be higher on Global Independence and its primary traits of Dominance (E+), Social Boldness (H+), and Openness-to-Change (Q1+). Second, leaders tend to be below average on Anxiety and its traits of Apprehension (O-) and Emotional Stability (C+). Third, leaders tend to be above average on Extraversion and its traits of Warmth (A+), Social Boldness (H+), Liveliness (F+), and Group-Orientedness (Q2-). Leaders also tend to be above average on Reasoning Ability (B+), and somewhat above average on self-control traits.

Many of these studies also predicted important differences in management style and behaviors. For example, top-level executives whose roles involve developing long-term,

innovative goals, tend to score higher on Openness-to-Change (Q1+), Abstractedness (M+), Reasoning Ability (B+); average (below other managers) on Extraversion traits such as Warmth (A), Forthrightness (N), and Group-Orientedness (Q2); and average to below on Rule-Consciousness (G-) (H.B. Cattell, 1989; Walter, 2000; Watterson, 2002). On the other hand, managers who are in applied manufacturing and operations roles tend to score below average on Abstractedness (M-) and Sensitivity (I-), and above average on Rule-Consciousness (G+) and Perfectionism (Q3+). Many studies have predicted other aspects of managerial style such as achievement motivation or supervision style, such as task-oriented versus relationship-oriented focus (Clark and Clark, 1990; Dutta, 1995; Guastello and Rieke, 1993a; Hinton and Barrow 1976; Johns et al., 1980; Roy, 1995; Walter, 2000).

Similar results have also been found in international samples, such as German managers, executives, and consultants (Schneewind and Graf, 1998); Norwegian managers and executives (IPAT, 2004b); middle- and senior-level British managers (Bartram, 1992; Singh, 1989; Williams, 1999); high-performing Japanese managers (IPAT, 2006); autocratic versus democratic styles of managers in India (Singh and Kaur, 2001); and predictions of management level and income in Dutch samples (IPAT, 2004a).

Entrepreneurship

Aldridge (1997) studied the personalities of entrepreneurs and found them to be significantly below average on anxiety traits – low on Apprehensiveness (Self-Assured (O-)) and above average on Emotional Stability (C+). They were also above average on Independence and its traits of Dominance (E+), Social Boldness (H+), and Openness-to-Change (Q1+). They were also higher on Self-Reliance (Q2+), Rule-Consciousness (G+), and Reasoning Ability (B+), and low on Sensitivity (Utilitarian (I-)).

H.B. Cattell confirmed many of these results in her applied research (H.B. Cattell, 1989; H.B. Cattell and H.E.P. Cattell, 1997), identifying traits that distinguished entrepreneurs from other executives: innovative thinking (Openness-to-Change (Q+)); ability to step back and focus on the 'big picture' (Abstractedness (M+)); and a preference for working independently (Self-Reliance (Q2+)). Aldridge (1997) and Fraboni and Saltstone (1990) also found that entrepreneurs tended to be less sociable than regular managers (low Warmth (A-), and low Trust (L+)), and prefer to work independently (Self-Reliance (Q2+)). Many of these results have also been confirmed in international samples, for example, Norwegian entrepreneurs (IPAT, 2004b). Thus, the traits that particularly distinguish entrepreneurs from other business managers include traits that cluster around qualities of innovation and self-reliance.

Sales

Many studies have identified a similar 16PF profile for effective salespeople (e.g. Cattell, R.B. et al., 1970; Guastello and Rieke, 1993b; Rieke and Russell, 1987; Schuerger and Watterson, 1991; Tucker, 1991; Walter, 2000). Salespeople tend to be high on Extraversion and its traits of Warmth (A+), Social Boldness (H+), Liveliness (F+), and Group-Orientedness (Q2-). They also tend to be low on Anxiety and its sub-traits of Apprehensiveness (Self-Assured (O-)), Vigilance (Trusting (L-)), and high on Emotional Stability (C+). They also tend to be somewhat above average on Independence and its traits of Social Boldness (H+) and Dominance (E+); and somewhat above average on Rule-Consciousness (G+) and Reasoning Ability (B+). Thus, salespeople tend to be generally similar to managers; however, salespeople tend to be even higher on the traits of Extraversion (especially F+, H+, and A+) and lower on Anxiety traits (more Self-Assured (O-), and are Stable (C+)). This profile has also been validated in numerous international

samples, for example in several groups of British salespeople (Williams, 1999), German salespeople (Schneewind, 1998), and Norwegian salespeople (IPAT, 2004b).

Social/helping occupations

16PF profiles have also been identified for social or helping occupations such as teaching, counseling, customer service, human resource personnel, ministers/priests, nurses, and physical therapists (e.g. Cattell, R.B. et al., 1970; H.B. Cattell and H.E.P. Cattell, 1997; Phillips et al., 1985; Roy, 1995; Schuerger and Watterson, 1998; Walter, 2000). People in social/helping occupations tend to be above average on Extraversion, and particularly on Warmth (A+); they also tend to be below average on Tough-Mindedness (in the Receptive/open direction) – above average on Sensitivity (I+) and Open-to-Change (Q1+). They also tend to be below average on Anxiety: Relaxed (Q4-), Self-Assured (O-), Trusting (L-), and Emotionally Stable (C+); and above average on Self-Control traits of Perfectionism (Q3) and Rule-Consciousness (G+). These results have been validated in various international samples, such as British counselors of adolescents (Lee, 1994) and customer service personnel (Williams, 1999).

Police, security, and protective service personnel

The 16PF Questionnaire has a long history of predicting the personality profiles of effective police officers, prison guards, firefighters, and other protective service and security personnel (e.g. Adcox et al., 1999; Cattell, R.B. et al., 1970; Cattell, R.B. et al., 1999; H. Eber, pers. comm., 10 February 2007; Hofer et al., 1997; IPAT, 2003; Jones et al., 2006; Schuerger and Watterson, 1998; Walter, 2000). These studies indicate that protective service officers tend to be calm and resilient under stress (low Anxiety, Emotionally Stable (C+); Self-Assured (O-); and Trusting (L-)).

They also tend to be responsible, self-disciplined, and task-focused (high self-control; Rule-Conscious, G+; Perfectionistic, Q3+; Practical, M-; and Serious, F-). They also tend to be tough and pragmatic (high on Tough-Mindedness; Unsentimental (I-); Practical (M-); and Traditional (Q1-)). Additionally, protective service personnel are consistently bold and fearless (high on Social Boldness (H+), but not on other Extraversion traits), and somewhat above average on Dominance (E+).

These results have been confirmed across very large samples. For example, Herb Eber's sample of 30,700 police officers confirms all 12 of the trait findings noted above (H. Eber, pers. comm., 10 February, 2007). Additional trait patterns have been found to be associated with particular job roles and functions, for example, officers who work alone versus in community-patrol situations, those who perform investigative roles, or those who work on high-stress assignments tend to show particular trait profiles.

Scientific, technology, and research personnel

Distinct 16PF profiles have also been found for scientific or technological professions such as computer scientists, physicists, engineers, and research and development personnel (Cattell, R.B. et al., 1970; Schuerger and Watterson, 1998; Walter, 2000). In addition to being high on Abstract Reasoning (B+), they tend to be high on Independence and its traits of Dominance (E+) and Openness-to-Change (Q1+); low on Extraversion Traits of Reserved (A-), Serious (F-), and Self-Reliant (Q2+); and below average on Anxiety traits of Self-Assured (O-), Relaxed (Q4-), and Emotionally Stable (C+). These results have been confirmed in international samples, for example, groups of Norwegian researchers, engineers, and computer programmers (IPAT, 2004b), British engineers (Williams, 1999), and German technical professionals (Schneewind and Graf, 1998).

Creativity

Many studies have examined the relationship between 16PF scores and creativity. Conn and Rieke (1994) summarized much of this research, and these results have been confirmed in recent American and international samples (e.g. Joy and Hicks, 2004; Jurcova, 2000; Roy, 1995, 1996). Consistent predictors of creativity include high scores on Independence and its primary scales Dominance (E+), Social Boldness (H+), and Openness-to-Change (Q1+); low scores on Tough-Mindedness (in the Receptive or open direction) and its traits of Openness-to-Change (Q1+), Sensitivity (I+), and Abstractedness (M+); and somewhat below average scores on Self-Control (unrestrained). These results have been confirmed in international samples, for example in Norwegian artists (IPAT, 2004b) and in Korean, American, Finnish, and Slovak students (Shaughnessy et al., 2004).

Career development counseling and coaching

The 16PF Questionnaire is widely used in career development planning, counseling, and coaching, both inside and outside organizations, to help clients understand their strengths and limitations, and plan self-development goals and effective career paths (Carson, 1998; Cattell, R.B. et al., 1970; H.E.P. Cattell and Schuerger, 2003; Conn and Rieke, 1994; Krug and Johns, 1990; Lowman, 1991; Schuerger, 1995; Schuerger and Watterson, 1998; Watterson, 2002). In addition to using the numerous 16PF occupational profiles to determine person-job fit, the questionnaire has been useful because of its long history of predicting the six Holland RIASEC occupational dimensions (Schuerger and Watterson, 1998; Schuerger and Sfiligoj, 1998). There is also empirical evidence of the relationship between 16PF scores and important career outcomes such as career satisfaction (Lounsbury et al., 2004) and job-training success (Tango and Kolodinsky, 2004).

Counseling and clinical uses

The 16PF Questionnaire was developed as a measure of *normal* adult personality, and cannot be used to diagnosis psychiatric disorders (e.g. Lally, 2003). However, 16PF dimensions have proven quite useful in counseling and clinical settings; for example, in quickly developing a picture of the individual's overall personality functioning (including strengths and weaknesses), in facilitating the development of empathy and rapport, helping the client gain greater self-awareness, planning developmental goals, anticipating the course of therapy, selecting optimal therapeutic interventions, and identifying relevant adjustment issues (H.B. Cattell, 1989; Karson et al., 1997; Meyer, 1996; Russell, 1995; Schuerger, 2001).

16PF scores have also been successful in predicting a diverse range of behaviors of interest to clinicians; for example, effects of group therapy (Wang and Li, 2003), war-related stress (Poikolainen, 1993), alienation (Yi-Hui et al., 2004), types of substance abuse (Carey et al., 1995), suicidal tendencies (Ferrero et al., 1997), delinquency (Junmai, 2005), law-breaking tendencies (Low et al., 2004), and excessive Internet use (Xiaoming, 2005).

One source of useful clinical information has been the qualitative research carried out in clinical settings (H.B. Cattell, 1989; H.B. Cattell and H.E.P. Cattell, 1997; Karson et al., 1997). For example, H.B. Cattell studied over 1,100 clients who were assessed or treated over a 20-year period, and found that specific 16PF score combinations were related to distinct patterns of thinking, feeling, and behavior. She found that score combinations predicted individuals' capacity for insight and introspection, difficulties in establishing trust and rapport, sensitivity to power dynamics in relationships, effective treatment modalities, and capacity for successful termination.

The 16PF Questionnaire has proven particularly useful in marital or couples counseling, where it provides information about how

the two partners' unique traits combine and interact (Russell, 1995). In particular, 16PF research has predicted various aspects of marital satisfaction as a function of absolute or relative levels of personality traits. For example, Krug (1976) found that different types of marital dissatisfaction were related to large score differences between partners on certain traits. He also found that dissatisfaction in wives was related to particular personality traits in husbands, while husbands' dissatisfaction was related to largely different traits in wives.

Russell (1995) studied 321 couples and found that several aspects of marital satisfaction were related to higher levels of particular 16PF traits. She also found that several 16PF traits predicted greater consensus between the partners on important topics, and that better problem-solving communication was related to another set of traits. She also found that 16PF traits predicted more traditional gender roles in relationships. Craig and Olson (1995) also studied 145 marital therapy clients, and found that five different 16PF trait clusters represented different marital types that required different types of therapeutic goals.

SUMMARY

The 16PF Questionnaire is a comprehensive and widely used measure of normal, adult personality which was developed from factor-analytic research into the basic structural elements of personality. First published in 1949, and now in its fifth edition, the questionnaire is based on Cattell's multi-level personality theory, and measures 16 primary factors, 5 global or second-stratum factors (the original Big Five), and 2 third-stratum factors. Although this chapter could not review the decades of research on the 16PF Questionnaire, a summary of reliability studies indicates that the questionnaire provides reliable information, and a selection of validity studies illustrates how the instrument is used effectively in a variety of contexts.

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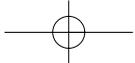
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