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Empirical and Theoretical Status of the Five-Factor Model of Personality Traits

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Progress sometimes seems elusive in psychology, where old methods such as the Rorschach endure despite decades of criticism (Costa and McCrae, 2005), and where new research is often based on passing fads (Fiske and Leyens, 1997) rather than cumulative findings. It is remarkable, therefore, when clear progress is made, and there are few more dramatic examples than the rise to dominance of the Five-Factor Model (FFM) of personality traits in the past quarter century. Before that time, trait psychology had endured a Thirty Years' War of competing trait models, with Guilford, Cattell, and Eysenck only the most illustrious of the combatants. The discovery of the FFM by Tupes and Christal (1961/1992) in the midst of that war was largely ignored, but its rediscovery 20 years later quickly led to a growing acceptance. Today it is the default model of personality structure, guiding not only personality psychologists, but increasingly, developmentalists (Kohnstamm et al., 1998), cross-cultural psychologists (McCrae and Allik, 2002), industrial/organizational

psychologists (Judge et al., 1999), and clinicians (J.A. Singer, 2005).

This chapter has two parts. The first is an overview of the FFM and associated research findings, and may appeal primarily to the general reader. The second half, 'Challenges to the FFM', contains more detailed and technical accounts of current controversies, and is addressed chiefly to personality researchers.

ORIGINS AND ACCOMPLISHMENTS OF THE FFM

The FFM is the most widely accepted solution to the problem of describing trait structure—that is, finding a simple and effective way to understand relations among traits. Trait adjectives (such as *nervous*, *energetic*, *original*, *accommodating*, and *careful*) describe individual differences that usually show a bell-shaped distribution: For example, a few people are very energetic, most people are

somewhat energetic, and a few are lethargic. There are thousands of such terms in the English language, and many other traits have been identified by psychologists (such as ego strength, tolerance of ambiguity, and need for achievement). It was recognized long ago that these traits overlap: Someone who is described as nervous is also likely to be described as worried, jittery, anxious, apprehensive, and fearful. Beyond semantic similarity, psychologists realized that some classes of traits were closely related. For example, there is a clear difference between being sad and being scared, but people who are frequently sad are also frequently scared.

To summarize trait information in a manageable number of constructs, psychologists used factor analysis, a statistical technique that in effect sorts variables into groups of related traits that are more or less independent of the other groups. For example, *sad* and *scared* would define the high pole of a factor (or dimension) called 'neuroticism' (N), because it was first observed in psychiatric patients diagnosed with a neurosis. The opposite pole of the same dimension would be defined by traits such as *calm* and *stable*. A completely different factor, 'extraversion' (E), contrasts *warm*, *outgoing*, and *cheerful* with *reserved*, *solitary*, and *somber*. Just as any place on Earth can be specified by the three dimensions of latitude, longitude, and altitude, so anyone's personality can be characterized in terms of the five dimensions of the FFM.

N and E factors have been familiar to psychologists since the mid-twentieth century. The former is central to many forms of mental disorder, and thus well known to clinical psychologists and psychiatrists. The latter is the most easily observed factor, and 'extravert' has long been part of popular speech. The remaining factors are 'openness to experience' (O; also called 'intellect', or 'openness vs. closedness'), which describes imaginative, curious, and exploratory tendencies as opposed to rigid, practical, and traditional tendencies; 'agreeableness'

(A), which contrasts generosity, honesty, and modesty with selfishness, aggression, and arrogance; and 'conscientiousness' (C; or 'dependability', 'constraint', or 'will to achieve'), which characterizes people who are hardworking, purposeful, and disciplined rather than laid-back, unambitious, and weak-willed.

Psychologists took several decades to identify the FFM, chiefly because they differed in their ideas of what variables should be included in their factor analyses. Many approaches were offered, but the breakthrough came from lexical researchers, who argued that traits are so important in daily life that people will have invented names for all the important ones. A search of an unabridged dictionary should yield an exhaustive list of traits, and it was in analyses of such traits that the FFM was discovered. Although there had been previous indications that five factors were necessary and sufficient, the case was clearly made for the first time by two Air Force psychologists, Ernest Tupes and Ray Christal, who published a technical report in 1961. It was known to a few personality psychologists but had little influence until researchers returned to the lexical approach around 1980, again searching the dictionary and again finding five factors (Goldberg, 1983). Researchers who work in the lexical tradition, focusing on lay trait vocabularies in different languages, generally call the factors the 'Big Five' and distinguish them from the dimensions of the FFM, which are not based on lay terminology. These labels, however, are used interchangeably by many psychologists.

Lexical researchers initially had a limited impact on the field as a whole because most psychologists relied on questionnaires that measured traits (and related concepts like preferences and needs). Most of these questionnaires had been developed to operationalize particular theories of personality and were thought to be more scientific than lay terms. For example, Jung's (1923/1971) theory of psychological types was the basis of the Myers-Briggs Type

Indicator (MBTI; Myers and McCaulley, 1985), a widely used measure of four dimensions, from which introvert versus extravert, sensing versus intuiting, thinking versus feeling and perceiving versus judging preferences were scored.

The dominance of the FFM came as a result of empirical studies showing that the traits assessed by psychological questionnaires were closely related to the lexical Big Five factors (McCrae, 1989). It is not surprising that the 'introvert versus extravert' dimension of the MBTI corresponded to the lexical E factor, but it was very revealing that 'sensing versus intuiting' was in fact O, 'thinking versus feeling' was A, and 'perceiving versus judging' was C (McCrae and Costa, 1989a). Scales from many other questionnaires were also found to match up with lexical factors, and it became clear that in creating their scientific questionnaires, personality psychologists had rediscovered and formalized what had long been implicit in lay conceptions of personality.

Research accomplishments

The widespread acceptance of the FFM in the 1990s led to systematic research on a variety of topics, allowing important advances in our understanding of personality trait psychology. One of the first issues resolved by research on the FFM concerned consensual validation. As a result of influential critiques (e.g. Mischel, 1968), it was widely believed in the 1970s that personality traits were cognitive fictions—beliefs people held about themselves and others around them that had no basis in fact. Because traits assessed by personality tests were relatively poor predictors of specific behaviors in laboratory tests, some researchers concluded that all trait attributions were illusory. However, single behaviors in the artificial setting of a psychological laboratory are not very meaningful criteria for judging the reality of traits. Much more important criteria are provided by the views of significant others in

one's life. If there is substantial agreement across different raters, and if raters agree with self-reports, it is likely that the agreement is based on the common perception of real psychological characteristics in the target.

This was a crucial issue in the early 1980s, especially because two of the five factors, A and C, are highly evaluative. It was easy to argue that rating someone as being high on these factors merely meant that one liked them; rating oneself as high on A and C could be nothing more than socially desirable responding. However, studies in which self-reports were compared to peer and spouse ratings showed moderately high agreement on all five factors (Funder et al., 1995; McCrae and Costa, 1987), suggesting that all reflected real characteristics of the individual.

The reality of traits was also demonstrated by studies of their heritability (Bouchard and Loehlin, 2001). Identical twins, who share all their genes, resemble each other much more than fraternal twins do, whether or not they were raised in the same family. About half the observed variation in trait scores appears to be genetically based, and this is true for all five factors (Jang et al., 1996). Recent work has shown that the five-factor structure itself is genetically based (Yamagata et al., 2006), presumably meaning that traits like orderliness and deliberation go together because they are both influenced in part by the same genes. So far the actual genes involved have not been identified, probably because a large number of genes affect each trait, so the effect of any single gene is very small and correspondingly hard to detect.

Longitudinal studies, in which personality is assessed twice many years apart, show that individual differences are very stable (Roberts and DelVecchio, 2000). A person who is artistically sensitive, intellectually curious, and politically liberal at age 30 is likely to be artistically sensitive, intellectually curious, and politically liberal—relative to his or her age peers—at age 80. There is strong evidence for stability over periods as long as 40 years; all five factors are roughly

equally stable; and both self-reports and observer ratings show stability (Costa and McCrae, 1992b; Terracciano et al., 2006). Although rank-order is stable, there are gradual changes in the mean level of traits from adolescence to old age. People in general decrease in N, E, and O, and increase in A and C as they age (Terracciano et al., 2005). Thus, older men and women tend to be less active and adventurous than their grandchildren, but more emotionally stable and mature.

Cross-cultural studies once required researchers to travel to foreign lands and master new languages in order to gather personality data, and consequently they were rare. Today, almost every nation in the world has psychologists who speak English and are trained in modern methods of psychological research, and email makes it possible to collaborate from the convenience of one's own office. As a result, there has been a surge of cross-cultural research on personality (e.g. Schmitt et al., 2007). The first questionnaire designed to operationalize the FFM, the Revised NEO Personality Inventory (NEO-PI-R; Costa and McCrae, 1992a), has been translated into over 40 languages and used to assess personality in countries around the world, from the Congo to Iceland to Iran. This research was based on the assumption that the traits assessed by the NEO-PI-R would be found everywhere, and that assumption has been supported by dozens of studies. In country after country, factor analysis of the NEO-PI-R has yielded the five factors familiar to American psychologists (McCrae et al., 2005c). The FFM appears to be a universal aspect of human nature, probably because it is genetically based, and all human beings share the same human genome.

Many other properties of traits have also been shown to be universal. Some psychologists have argued that traits are less important than relationships in collectivistic countries like Japan, and consequently trait ratings would be less reliable and valid. But studies of cross-observer agreement in collectivistic

cultures show correlations as high as those in the United States (McCrae et al., 2004). So far, there are no longitudinal studies of personality in non-Western nations, so we cannot determine whether traits are equally stable around the world. However, cross-sectional studies of age differences show the same trends everywhere: N, E, and O decline, and A and C increase as people age (McCrae et al., 1999). In the United States, women score a little higher than men on measures of N and A, and the same is true of women in Malaysia, Peru, and Burkina Faso (McCrae et al., 2005c).

Long before the FFM was formulated, psychologists studied personality traits because they were useful in predicting important outcomes (Ozer and Benet-Martínez, 2006). It is true that traits are usually poor predictors of any single behavior; otherwise, people would be automatons. But traits endure over long periods of time, and the small influence they exert on single behaviors is compounded across a lifetime. Traits are good predictors of patterns of behavior (McCrae and Costa, 2003).

The most important outcomes of N are those related to well-being and mental health. Individuals high in N tend to be unhappy, regardless of their life situation, and they are more susceptible than others to psychiatric disorders such as depression (Bagby et al., 1997) and many of the personality disorders (Trull and McCrae, 2002). E is associated with popularity and social success, with enterprising self-promotion, and ultimately, with higher lifetime income (Soldz and Vaillant, 1999). Extraverts are also likely to be happier than introverts. O is a predictor of creative achievement, whereas closedness predicts political conservatism and religious fundamentalism (McCrae, 1996). Agreeable people are more likely to be desired as mates (Buss and Barnes, 1986) and have better marital relations (Donnellan et al., 2004), whereas antagonistic men and women are more likely to commit crimes and abuse drugs (Brooner et al., 2002). C is the most consistent predictor of job performance

(Barrick and Mount, 1991); it is not surprising that employees who are punctual, hard-working, and systematic are usually more productive. C is also associated with a number of positive health habits, like safe driving, exercise, and a sensible diet; in consequence, conscientious people are more likely to be healthy and live longer (Weiss and Costa, 2005).

Clinical utility

Most instruments that assess the FFM are intended for use in personality research, but the NEO-PI-R and the structured interview for the five-factor model (SIFFM; Trull and Widiger, 1997) were also designed to be used in clinical practice. The NEO-PI-R, which offers norms, profile sheets, and computer administration and interpretation, has been widely adopted by clinical psychologists and psychiatrists and is becoming a standard part of routine clinical assessment (see Archer and Smith, in press; Weiner and Greene, 2008).

By 1991, Miller had identified a number of ways in which the NEO-PI-R could be used to facilitate clinical practice: It can provide a rapid understanding of the client and thus foster rapport; it can help the clinician anticipate potential problems (such as resistance and poor motivation to change); it can help in the selection of optimal forms of treatment; it can predict likely treatment outcomes. Singer (2005) has updated this list, showing how feedback to the client can help raise self-awareness, and how the joint interpretation of personality profiles from couples can help them understand each other.

There has been extensive research on personality disorders and the FFM (Costa and Widiger, 2002), and that, too, has clinical applications. NEO-PI-R computer software (Costa et al., 1994) can compare a client's profile to personality disorder prototypes and formulate hypotheses about which disorders might characterize the client. For example, a client who scores high on N2: angry hostility

and low on A1: trust, A2: straightforwardness, and A4: compliance, might warrant a diagnosis of paranoid personality disorder. The clinician would, of course, need to confirm this diagnosis by evaluating *DSM-IV* criteria.

A new approach to personality disorder diagnosis has also been proposed (McCrae et al., 2005a) in which clinicians proceed from the personality profile directly to an assessment of problems in living. After assessing FFM traits, clinicians would consult a list of problems relevant to the traits that characterize the client, and determine if they are in fact problematic for this client. For example, an individual high in agreeableness may be gullible and easily taken advantage of. If so, and if the clinician believes that this causes clinically significant personal distress or impairment, then a diagnosis of high agreeableness-related personality disorder would be appropriate.

Theoretical context

The FFM is a model of the structure of traits, and thus a basis for organizing research findings. But it is not a theory of personality; it does not explain how traits function in daily life, or how individuals understand themselves, or how people adapt to the cultures in which they find themselves. The wealth of new findings about traits has inspired a number of personality psychologists to formulate new theories of personality. In 1996, Wiggins edited a book in which he invited prominent FFM researchers to put their findings in theoretical contexts, from evolutionary to socio-analytic. Other views have since been offered as part of a new generation of personality theories (Cervone, 2004a; Mayer, 2005; McAdams and Pals, 2006; Sheldon, 2004).

Five-factor theory (FFT; McCrae and Costa, 1996, in press) shares features with many of these models, and has proven particularly useful in understanding the functioning of traits across cultures. The major

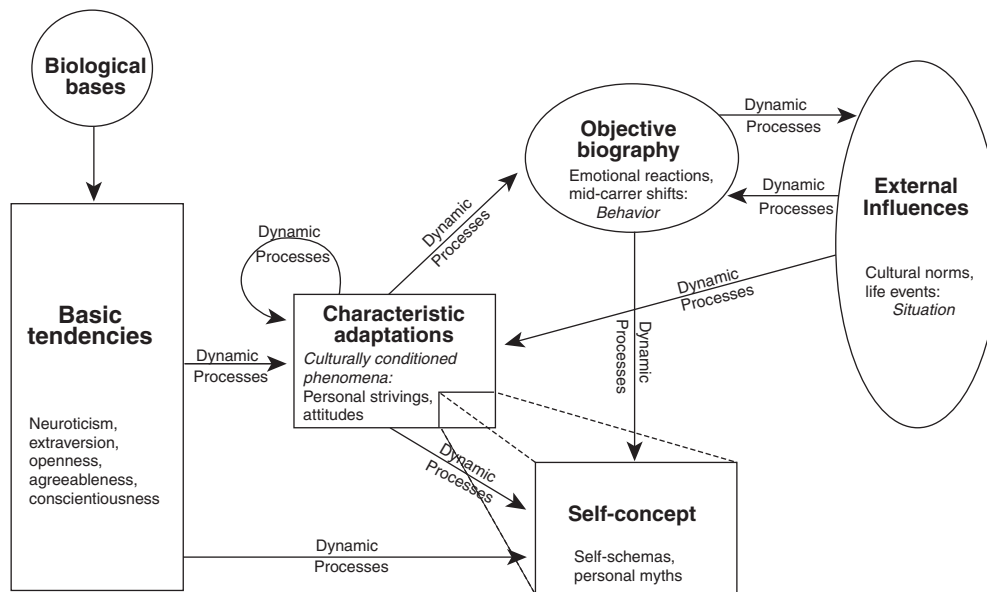


Figure 13.1 A schematic representation of the personality system. 'Biological bases' (such as genes) and 'external influences' (such as cultural norms) are inputs to the system. Personality traits are found in the category of 'basic tendencies', which are influenced by biological bases, but not external influences. Causal paths are indicated by arrows, and show that, over time, traits interact with the environment to produce 'characteristic adaptations' (such as attitudes), and these in turn interact with the situation to produce the output of the system, the 'objective biography'. The 'self-concept' is a subset of characteristic adaptations of particular importance to self theorists. Adapted from McCrae and Costa (1996)

components in the theory are represented schematically in Figure 13.1. The central elements, in rectangles, are *basic tendencies* and *characteristic adaptations* (of which the *self-concept* is a part). The distinction between these two is central to the theory; it holds that personality traits (as well as other characteristics such as intelligence and musical ability) are biologically based properties of the individual that affect the rest of the personality system, but are not themselves affected by it. Personality traits are thus conceptualized in the tradition of temperaments (McCrae et al., 2000).

In contrast, *characteristic adaptations* are acquired from the interaction of the individual's *basic tendencies* and a range of *external influences*. A man may speak Hindi because he was born with the capacity for

human speech and grew up in India; in the same way, a woman may smile at strangers because she was born agreeable and raised in America, where smiling at strangers is appropriate behavior. Characteristic adaptations include a vast range of psychological mechanisms: habits, interests, values, skills, knowledge, beliefs, attitudes, and the internalized aspect of roles and relationships. All of these are thought to be shaped to some extent by basic personality traits, and it is because of this pervasive influence that traits are correlates of so many psychological characteristics. At the same time, all these features depend on learning and experience in particular social and cultural environments, so the specific ways in which traits are expressed is likely to vary across cultures. In Saudi Arabia, women do not speak to men

who are not close relations (Cole, 2001), so Saudi women who are extraverted are likely to be especially talkative among their female friends.

Although in principle it might seem that cultures could dictate any sort of behavior as the appropriate way to express traits, in fact the range of variation is fairly circumscribed (cf. Baumeister, 2005). Antagonistic behavior, for example, is recognizable anywhere. As a result, fairly direct translations of personality questionnaires yield serviceable measures that retain most of the psychometric properties of the original (Schmitt et al., 2007). One fortunate consequence of this fact is that it makes possible an important test of FFT. According to FFT, personality traits reflect only biological bases; because all humans share the same genome, FFT predicts that the structure of personality should be the same everywhere. That prediction, which would have evoked profound skepticism from a generation of personality-and-culture researchers (M. Singer, 1961), has now been strongly supported at both the phenotypic (McCrae et al., 2005c) and genotypic (Yamagata et al., 2006) levels. This is powerful evidence in favor of FFT.

The most controversial aspects of FFT concern two postulates about the origin and development of traits. As the arrows in Figure 13.1 suggest, FFT asserts that traits are influenced only by biology (which includes genetics, but also physical disease, malnutrition, intrauterine hormonal environment, etc.). Neither life experiences nor culture are supposed to affect traits, a radical position that is supported mostly by a conspicuous lack of compelling evidence for environmental effects (McCrae and Costa, in press). For example, Roberts et al. (2002) reported that divorce led to decreases in dominance in women, whereas Costa et al. (2000) found that among women divorce led to *increases* in E, which includes dominance. Without replication is it difficult to trust either of these findings.

FFT acknowledges that trait levels change over lifespan, but attributes the change to intrinsic maturation rather than life experience.

If that account is correct, then the same pattern of personality change should be seen in different cultures, and the same pattern of age differences should be seen in nations with very different recent histories. In one study we compared Chinese, many of whom had lived through the Cultural Revolution and other social upheavals, with Americans of the same birth cohorts. Despite the profound differences in life history of these two groups, the pattern of age differences was remarkably similar (Yang et al., 1998).

Although this finding is consistent with FFT, it is susceptible to alternative explanations. Roberts et al. (2005b) have proposed social investment theory as a way to account for similar patterns of personality development. Higher levels of A and C are useful attributes for responsible adults to have, whereas E and O are not as important after the individual has found his or her way into the adult world. Consequently, they argued, societies everywhere encourage high A and C and discourage high E and O in adults. Members of each culture invest in this social vision and change their traits accordingly. That is certainly a possibility; what are needed are designs that would allow researchers to compare conflicting predictions from these two theories to see which better accounts for the facts.

CHALLENGES TO THE FFM

The success of the FFM as a description of personality trait structure does not mean that it has gone unchallenged. In fact, its prominence has made it the target of numerous critiques, some from those who advocate alternative structures (Ashton et al., 2004; De Raad and Peabody, 2005), some from those who see limitations in any factor model (Block, 2001; Cervone, 2004a). We have addressed the issue of alternative structures elsewhere (McCrae and Costa, in press); briefly, we argued that six-factor models added nothing that could not be subsumed by

the FFM. In the remainder of this chapter, we consider three other current controversies about the FFM: the nature of higher-order factors, the specification of facets, and the status of trait explanations.

Higher-order factors

The *structure* postulate of FFT states that personality trait structure is hierarchical, and that the five factors 'constitute the highest level of the hierarchy' (McCrae and Costa, 2003: 190). Yet in 1997, Digman showed that in many global measures of the FFM, the five factors were not independent, but co-varied to define two very broad factors, which he called α (or socialization) and β (or personal growth). α contrasted N with A and C, whereas β combined E and O. Such factors can be found in the NEO-PI-R if domain scores are factored, and they also appear in larger samples of personality instruments (Markon et al., 2005). These factors have attracted sporadic interest in the past decade. DeYoung et al. (2002) proposed a neurobiological model for β , which they called plasticity, and Jang and colleagues (Jang et al., 2006) presented evidence that α and β are heritable.

There are two substantive explanations for associations among the five factors. One is that there are shared causal structures that influence different factors. For example, a set of genes or a neurological structure might have effects on both E- and O-related traits in general. This interpretation is the basis of the work of DeYoung and colleagues (2002) and Jang and colleagues (2006). Less interesting, but also possible, is that the associations reflect the particular choice of facets to define each factor. For example, the NEO-PI-R N domain includes N5: impulsiveness, which reflects an inability to control impulses, and which is, not surprisingly, also related to low C. The NEO-PI-R does not have a perfectionism scale, but such a scale would probably be related to N and high C (cf. Hill et al., 1997). The negative correlation between

NEO-PI-R N and C would be decreased, perhaps substantially, by substituting a perfectionism facet for the impulsiveness facet. Although the selection of facets surely is one influence on the correlation among domain scales, the fact that different instruments, with different item and subscale compositions, often yield higher order factors akin to α and β (Digman, 1997; Markon et al., 2005) suggests the need for a deeper explanation.

That explanation, however, need not be substantive. McCrae and Costa (in press) have argued that α and β may be evaluative biases, akin to the (low) *negative valence* and *positive valence* factors identified by Tellegen and Waller (1987). People who are prone to describe themselves (or others) in highly positive terms such as *remarkable*, *flawless*, and *outstanding* are also more likely to describe themselves (or others) as higher in E and in O. Thus, β might result from a positive valence bias. Such a bias would probably not be shared by others, so multimethod assessments would yield uncorrelated E and O factors. This is precisely what Biesanz and West (2004) found in a study of self-reports and peer- and parent ratings. They concluded that 'observed correlations among Big Five traits are the product of informant-specific effects' (2004: 870) and that 'theoretical frameworks that integrate these traits as facets of a broader construct may need to be reexamined' (2004: 871).

Yet some studies do show significant cross-observer correlations among domains. For example, McCrae and Costa (1987) reported a correlation of $r = 0.25$, $p < 0.001$, between self-reported O and peer-rated E. One way to integrate this small body of literature is by assuming that there are both substantive and artifactual explanations for the intercorrelations among domains, substance predominating in some studies and instruments, artifact in others.

This argument assumes that agreement across observers is necessary and sufficient to infer substantive causes. That is a very attractive argument, the basis of claims that personality traits show consensual validation

(Woodruffe, 1985). But alternative interpretations are possible. Two raters may agree about a target because both subscribe to the same unfounded stereotype; indeed, researchers in social perception often distinguish between mere consensus and true accuracy (Funder and West, 1993). One stereotype that observers may share is that extraverts are open to experience. Then raters who correctly perceived a target to be high in E might inflate their estimates of O; across raters, this would generate a positive correlation between these two factors that might be mistaken for consensual validation.

Multimethod assessments are thus not foolproof as ways of separating substance from artifact, but they are far more informative than mono-method assessment. One way to analyze cross-observer data is by examining the joint factor structure (cf. McCrae and Costa, 1983), and for this chapter we conducted new analyses that compared factor structures for substantive and artifactual models of α and β .

We factored data from 532 adults for whom both self-reports and observer ratings were available on the NEO-PI-3 (McCrae et al., 2005b), a slightly simplified version of the NEO-PI-R. When analyzed separately, parallel analysis indicated five factors, and the familiar structure was seen in both self-reports and observer ratings. When analyzed jointly, however, parallel analysis indicated ten factors, suggesting that there is considerable method variance in scores. We first examined a five-factor solution, rotating the factors toward maximal alignment with a 60×5 target matrix formed by doubling the normative structure (see McCrae et al., 1996). The results showed acceptable fit for N, E, A, and C factors (factor congruence coefficients = 0.89 to 0.98), but not for O (congruence coefficient = 0.71), which was poorly defined in the observer rating facets.

We next tested a seven-factor model, adding two columns to the target matrix reflecting a substantive interpretation of α and β . In these models, each facet would be expected to have its primary loading on

a joint N, E, O, A, or C factor, and a secondary loading on a joint α or β factor. If α and β are substantive factors, they should affect both self-reports and observer ratings and be jointly defined. For this analysis we created a new, 60×7 target matrix in which the first five columns were unchanged from the previous analysis. In the sixth column we entered -0.5 for the 12 N facets and $+0.5$ for the 24 A and C facets to define a sixth factor, α ; in the seventh column we entered $+0.5$ for the 24 E and O facets to define the seventh factor, β . We extracted seven factors and rotated them to best fit the new target. This improved the fit for the five original factors, giving congruence coefficients of 0.90–0.94. However, neither α nor β were well defined, with congruence coefficients of only 0.76 and 0.82. Despite Procrustes rotation, which finds the best possible fit to the target, α was defined exclusively by observer rating facets; the largest loading from any self-report facet was 0.22. β was defined by ten observer rating facets (loadings = 0.34–0.63) and, weakly, by three self-report facets (loadings = 0.30–0.35). Thus, α and β do not appear as cross-method factors when seven factors are extracted.

Finally, Table 13.1 shows the results of a model in which (low) negative valence and positive valence artifacts were targeted within method. Target loadings for these factors were defined as for α and β , except that only self-report facets were targeted in the sixth and seventh factors, and only observer ratings were targeted in the eighth and ninth factors. All five joint substantive factors are well defined in this solution, and although the factor congruence coefficients for negative and positive valence are not high (probably because many of the untargeted facets have real non-zero loadings on the factors), the informant-specific factors are clearly recognizable. These analyses suggest that it is primarily within-method artifact that contributes to the emergence of higher-order α and β factors. The 'FFT structure' postulate withstands this test.

Table 13.1 Loadings for substantive and method factors in a joint analysis of NEO-PI-3 self-reports and observer ratings

NEO-PI-3 facet	Substantive factor					Method factor				
	<i>N</i>	<i>E</i>	<i>O</i>	<i>A</i>	<i>C</i>	<i>NV_S</i>	<i>PV_S</i>	<i>NV_R</i>	<i>PV_R</i>	<i>VC</i>
<i>Self-Reports</i>										
N1: Anxiety	0.71	-0.04	-0.10	-0.00	-0.00	-0.33	0.05	0.13	0.06	0.96
N2: Angry hostility	0.51	0.01	-0.01	-0.47	0.01	-0.40	-0.17	-0.03	-0.14	0.95
N3: Depression	0.65	-0.09	-0.03	0.04	-0.18	-0.44	-0.09	-0.05	-0.06	0.98
N4: Self-consciousness	0.59	-0.28	-0.03	0.17	-0.09	-0.36	-0.15	0.08	0.01	0.94
N5: Impulsiveness	0.37	0.32	0.05	-0.08	-0.22	-0.49	0.03	-0.06	-0.09	0.97
N6: Vulnerability	0.59	-0.08	-0.16	0.14	-0.28	-0.48	0.06	-0.03	0.15	0.96
E1: Warmth	-0.11	0.66	0.08	0.38	0.04	0.19	0.30	-0.02	-0.03	0.95
E2: Gregariousness	-0.09	0.57	-0.09	0.14	-0.08	-0.09	0.45	-0.15	0.21	0.92
E3: Assertiveness	-0.24	0.38	0.19	-0.46	0.21	0.08	0.18	-0.06	0.04	0.90
E4: Activity	-0.04	0.42	0.02	-0.29	0.39	0.06	0.29	-0.08	0.06	0.95
E5: Excitement seeking	-0.07	0.38	0.11	-0.39	-0.10	-0.14	0.35	-0.00	0.15	0.93
E6: Positive emotions	-0.10	0.53	0.19	0.13	0.11	0.24	0.49	-0.02	-0.03	0.94
O1: Fantasy	0.22	0.07	0.47	-0.12	-0.24	-0.03	0.41	0.11	-0.03	0.98
O2: Aesthetics	0.09	0.04	0.55	0.22	0.05	0.05	0.44	-0.08	0.03	0.98
O3: Feelings	0.27	0.41	0.42	0.04	0.17	0.15	0.35	0.06	-0.16	0.94
O4: Actions	-0.36	0.13	0.45	0.10	0.02	-0.03	0.32	-0.22	0.09	0.88
O5: Ideas	-0.09	-0.06	0.67	-0.09	0.11	0.15	0.34	0.06	0.04	0.97
O6: Values	-0.08	0.13	0.51	0.12	0.04	-0.02	0.24	0.03	-0.10	0.84
A1: Trust	-0.31	0.18	0.12	0.63	0.09	0.12	0.17	-0.16	-0.02	0.85
A2: Straightforwardness	0.01	-0.08	0.05	0.63	0.22	0.28	-0.23	-0.11	-0.10	0.90
A3: Altruism	-0.00	0.43	0.12	0.49	0.19	0.38	0.06	0.09	-0.08	0.96
A4: Compliance	-0.18	-0.18	-0.09	0.71	-0.09	0.23	0.08	0.00	0.12	0.93
A5: Modesty	0.09	-0.10	0.05	0.67	0.09	-0.04	-0.32	-0.15	-0.11	0.60
A6: Tender-mindedness	0.10	0.27	0.24	0.53	0.11	0.03	0.15	-0.14	-0.28	0.71
C1: Competence	-0.28	0.15	0.20	-0.13	0.47	0.63	0.04	0.07	-0.09	0.94
C2: Order	0.05	-0.05	-0.27	-0.07	0.64	0.18	0.21	-0.12	0.15	0.85
C3: Dutifulness	-0.04	0.08	0.08	0.19	0.53	0.52	-0.14	0.09	-0.09	0.93
C4: Achievement striving	-0.05	0.15	0.06	-0.27	0.56	0.41	0.21	0.09	0.02	0.93
C5: Self-discipline	-0.19	0.01	-0.06	-0.02	0.63	0.49	0.08	0.01	0.06	0.97
C6: Deliberation	-0.07	-0.27	-0.03	0.08	0.38	0.60	0.03	0.13	0.07	0.92
<i>Observer Ratings</i>										
N1: Anxiety	0.79	-0.03	-0.04	0.07	0.00	0.06	0.06	-0.15	0.11	0.91
N2: Angry hostility	0.45	0.09	0.08	-0.37	0.11	-0.06	-0.18	-0.57	-0.18	0.90
N3: Depression	0.70	-0.14	0.01	0.01	-0.17	0.07	-0.05	-0.37	0.07	0.98
N4: Self-consciousness	0.66	-0.28	-0.10	0.08	-0.15	0.07	0.16	-0.25	0.06	0.93
N5: Impulsiveness	0.35	0.28	0.06	-0.28	-0.29	0.02	-0.14	-0.50	0.05	0.97
N6: Vulnerability	0.64	-0.07	-0.09	-0.03	-0.33	0.10	0.19	-0.39	0.10	0.95
E1: Warmth	-0.09	0.65	0.07	0.34	-0.04	0.08	-0.05	0.36	0.24	0.85
E2: Gregariousness	-0.03	0.65	-0.03	0.06	-0.17	-0.09	0.15	0.01	0.39	0.93
E3: Assertiveness	-0.28	0.46	0.25	-0.29	0.29	-0.18	-0.19	-0.06	0.09	0.84
E4: Activity	-0.04	0.44	0.05	-0.11	0.50	-0.22	0.02	-0.08	0.25	0.89
E5: Excitement seeking	-0.09	0.34	0.09	-0.43	-0.14	-0.05	0.11	-0.07	0.42	0.93
E6: Positive emotions	-0.00	0.57	0.16	0.11	0.05	0.05	0.06	0.28	0.45	0.93
O1: Fantasy	0.17	0.10	0.32	-0.06	-0.32	0.13	0.14	-0.03	0.53	0.92
O2: Aesthetics	0.18	-0.07	0.57	0.25	0.08	-0.03	0.17	-0.12	0.43	0.94
O3: Feelings	0.33	0.49	0.35	0.10	0.18	0.11	-0.11	0.05	0.32	0.94
O4: Actions	-0.29	0.07	0.38	-0.01	-0.01	-0.14	0.00	-0.08	0.58	0.92
O5: Ideas	-0.09	-0.14	0.67	-0.03	0.18	0.06	0.01	0.13	0.29	0.95
O6: Values	-0.10	0.07	0.44	0.08	-0.02	0.00	-0.03	0.22	0.26	0.85

Table 13.1 Loadings for substantive and method factors in a joint analysis of NEO-PI-3 self-reports and observer ratings—cont'd

NEO-PI-3 facet	Substantive factor					Method factor				
	<i>N</i>	<i>E</i>	<i>O</i>	<i>A</i>	<i>C</i>	<i>NV_S</i>	<i>PV_S</i>	<i>NV_R</i>	<i>PV_R</i>	<i>VC</i>
A1: Trust	-0.25	0.22	0.00	0.55	-0.10	0.01	0.03	0.34	0.24	0.91
A2: Straightforwardness	0.01	-0.07	-0.05	0.50	0.09	0.11	-0.06	0.55	-0.12	0.94
A3: Altruism	0.00	0.40	0.15	0.45	0.11	0.15	-0.09	0.58	0.10	0.92
A4: Compliance	-0.17	-0.18	-0.11	0.52	-0.19	0.15	0.17	0.51	0.20	0.87
A5: Modesty	0.14	-0.10	0.00	0.57	0.03	0.08	-0.21	0.36	-0.01	0.91
A6: Tender-mindedness	0.18	0.31	0.21	0.56	0.10	0.05	-0.09	0.17	0.14	0.87
C1: Competence	-0.26	0.12	0.21	0.11	0.59	-0.03	-0.14	0.51	-0.06	0.96
C2: Order	0.08	-0.03	-0.24	0.04	0.70	-0.19	0.13	0.01	0.20	0.75
C3: Dutifulness	-0.06	0.07	0.01	0.24	0.61	-0.03	-0.07	0.47	-0.04	0.97
C4: Achievement striving	-0.14	0.14	0.12	-0.10	0.69	-0.14	-0.02	0.29	0.15	0.95
C5: Self-discipline	-0.14	0.08	-0.06	0.13	0.74	-0.15	-0.01	0.35	0.09	0.95
C6: Deliberation	-0.20	-0.26	-0.02	0.23	0.48	0.02	0.05	0.48	-0.07	0.99
<i>Factor congruence</i>										
<i>Five-factor solution</i>	0.98	0.89	0.71	0.96	0.97					0.91
<i>Seven-factor solution</i>	0.93	0.94	0.90	0.94	0.93	0.76	0.82			0.89
<i>Nine-factor solution</i>	0.97	0.97	0.94	0.96	0.96	0.82	0.78	0.85	0.80	0.92

Note $n = 532$. These are Procrustes-rotated principal components. The last lines report congruences with the target matrix for factors and total matrix. Joint factor loadings over 0.40 in absolute magnitude are given in boldface. Method factor loadings over 0.30 in absolute magnitude are given in boldface italic. NV_S = self-report negative valence (reflected). PV_S = self-report positive valence. NV_R = observer rating negative valence (reflected). PV_R = observer rating positive valence. VC = variable congruence coefficient. Data from McCrae, et al. (2005b).

A system of facets

As Digman and Inouye noted, 'If a large number of rating scales is used and if the scope of the scales is very broad, the domain of personality descriptors is almost completely accounted for by five robust factors' (1986: 116). At one level, this is good news, because it means that the FFM is robust and does not depend on the particular selection of traits one uses to assess it. At another level this is bad news, because it means the FFM offers little guidance about which facets should be included in a comprehensive assessment of personality. There is growing evidence that facet scales offer incremental validity over the five factors in predicting a variety of criteria (Paunonen and Ashton, 2001; Reynolds and Clark, 2001) and that facets within a domain may show different developmental trajectories (Terracciano et al., 2005). Thus, a full understanding of personality traits requires a system in which the most important facet-level traits are assessed. As yet, however, there is no

consensus on which specific traits should be included in this system, or even how we should go about identifying them.

Facets for the NEO-PI-R were selected based on reviews of the literature and on a series of item analyses (Costa and McCrae, 1995). Our goal was to include traits that reflected the variables that psychologists have considered important in describing people and predicting behavior, and that were minimally redundant. A rather similar rational approach was taken by Watson and Clark (1997) for the E domain. They also identified six facets on the basis of a review of existing personality inventories. Four of these corresponded to four NEO-PI-R E facets: ascendance to E3: Assertiveness, energy to E4: Activity, venturesomeness to E5: Excitement Seeking (and Openness to Actions), and positive affectivity to E6: Positive Emotions. Their affiliation facet combined E1: Warmth and E2: Gregariousness. To this set they added ambition, which 'plays an important role in Tellegen's and Hogan's models, [but] is omitted from all of the others'

(1997: 775). In the NEO-PI-R, the construct of ambition is included as C4: Achievement Striving, a definer of C with a small (0.23) secondary loading on E (Costa and McCrae, 1992a).

More recently, Roberts and colleagues have made systematic empirical attempts to map the facets of C. In a study of trait-descriptive adjectives, they began with a list of adjectives that were related either solely or primarily to the lexical C factor, but which might also have secondary loadings on other factors (Roberts et al., 2004). This broad selection strategy led to the identification of eight factors, five of which correspond conceptually to NEO-PI-R C facets: reliability (\approx NEO-PI-R C3: Dutifulness), orderliness (C2: Order), impulse control (C6: Deliberation), decisiveness (C1: Competence), and industriousness (C4: Achievement Striving). Their remaining factors were punctuality, formality, and conventionality; these had the lowest correlations with the overall lexical C factor ($r = 0.34\text{--}0.39$), and, as the authors noted, formality and conventionality 'may be more strongly related to ... openness to experience', (2004: 175), with formality a form of high O and conventionality a form of low openness to values.

In a subsequent study they factored scales from seven personality inventories, including the NEO-PI-R (Roberts et al., 2005a). They identified 36 scales conceptually related to C and interpreted six factors. Here the correspondence with the NEO-PI-R system was less clear. Their order factor was defined by C2: Order, and their self-control factor was defined by C6: Deliberation, but their industriousness factor had loadings on all four remaining NEO-PI-R C facets, and their responsibility, traditionalism, and virtue scales were not defined by any NEO-PI-R variables. They interpreted this to mean that the NEO-PI-R definition of C (like those of other inventories) was too narrow.

That study, however, had limitations. The personality instruments were administered on different occasions over a period of years, so correlations within instrument may have been inflated relative to correlations across instru-

ments by time-of-measurement effects. That might account for the clumping of NEO-PI-R scales on the industriousness factor. Some scales were taken from the California Psychological Inventory (CPI; Gough, 1987), where item overlap between scales makes factor analysis inappropriate. The responsibility and virtue factors were defined chiefly by CPI scales, and may represent little more than item overlap. Finally, this study illustrates the dangers of attempting to define the facets of any single domain in isolation, because the resulting factors had serious problems of discriminant validity. Traditionalism had almost as strong a relation to O ($r = -0.42$) as to C ($r = 0.44$), and virtue was more strongly related to both A ($r = 0.54$) and N ($r = -0.59$) than to C ($r = 0.51$). It is hard to justify its designation as a facet of C.

We are not aware of attempts by other investigators to define facets for O or A, but Endler et al. (1997) reported item factor analyses of NEO-PI-R N items suggesting that a different set of facets might better be scored from this item pool. They found factors corresponding to N1: Anxiety, N2: Angry Hostility, and N5: Impulsiveness, but the remaining three factors distributed items from the other facets into new combinations. McCrae et al. (2001) attempted to replicate Endler and colleagues' findings and to determine whether they were attributable to acquiescence, which tends to create factors with items keyed in one direction. After controlling for acquiescence, McCrae and colleagues found that varimax-rotated item factors showed a one-to-one correspondence with the a priori scales, with correlations ranging from 0.68 to 0.92. It thus appeared that the division of NEO-PI-R N items into the established facets was justified.

The issue that Endler and colleagues (1997) raised warrants more attention than it has so far been given. McCrae and colleagues (2001) also examined the factor structure of A items, and Costa and McCrae (1998) factored C items, but there have been no recent item analyses of E and O. To address these issues, we conducted new analyses on two data sets. The first ($n = 1,135$)

is from a study of adolescents aged 14–20 and adults aged 21–90 who completed the NEO-PI-3 (McCrae et al., 2005b); both self-report and observer-rating data were available. The second ($n = 12,156$) is from a study of observer ratings of personality conducted in 51 cultures (McCrae et al., 2005d) using translations of the NEO-PI-R into over 20 languages.

The first question that might be asked is if the items have been assigned to the correct domain. To test this, we factored the 240 items, extracting five varimax-rotated factors, and correlated the resulting factor scores with the a priori domain scales. Note that no attempt was made to control for effects of acquiescence, because the distinctions between domains should be sufficiently strong to override them. Convergent correlations ranged from 0.87 to 0.94 for the NEO-PI-3 data; the largest discriminant correlation was 0.32. In the international sample, convergent correlations ranged from 0.84 to 0.95; the largest discriminant correlation was 0.33. The item factors in the NEO-PI-R and NEO-PI-3 thus correspond very closely to the five domains.

Similar analyses, conducted separately for sets of 48 items within domain, are reported in Table 13.2. Here, the first three data columns show correlations between facets and varimax-rotated factor scores. With a few exceptions (e.g. N4: Self-consciousness in form S data; A6: Tender-mindedness in the international data), item factors could be clearly matched to a corresponding facet. However, the distinction between some facets is relatively subtle, and acquiescent responding can distort results. A more accurate account is provided by orthogonal validimax rotation (McCrae and Costa, 1989b), in which the factors are rotated to maximize convergent and discriminant validity with the facet scales. The last three data columns in Table 13.2 report these correlations; the smallest convergent correlation in each domain is larger than the largest discriminant correlation, and the median convergent correlation is a substantial 0.84. It is clear that, across samples, methods of measurement,

and languages of administration, the conceptual distinctions drawn among NEO-PI-R facets are reflected in the empirical structure of the items.

This small literature on studies that have attempted to articulate facets for FFM domains suggests to us that the system used in the NEO-PI-R is reasonable, with similar facets identified in rational analyses by other investigators and in empirical studies of adjectives and (to a lesser extent) of questionnaire scales. It is clearly not the case that these 30 scales exhaust the full range of traits related to each of the factors; punctuality is a good example of a marker of C that is not included. But an analysis of personality that incorporates NEO-PI-R facets and their combinations can lead to detailed information that goes far beyond the five factors.

One major contribution of the FFM is that it has become a common framework for research by psychologists from many fields, with the result that information can be readily shared and cumulative progress can be made: The developmentalist interested in impulse control can learn from the I/O psychologist studying job performance, because both understand the connection of their constructs to C. The advantages of a common framework would of course apply also to studies conducted at the facet level, so in an ideal world, all psychologists and psychiatrists would utilize the same set of facet constructs. The NEO-PI-R facet system provides one such set, and there are as yet no real alternatives that cover the full FFM. We already know a great deal about the NEO-PI-R facets: their discriminant validity (McCrae and Costa, 1992), heritability (Jang et al., 1998), longitudinal stability and developmental course (Terracciano et al., 2005; Terracciano et al., 2006), consensual validity (McCrae et al., 2005b), universality (McCrae et al., 2005c), and utility in understanding Axis I (Quirk et al., 2003) and Axis II (Widiger and Costa, 2002) mental disorders. Personality research must move beyond the broad factors of the FFM, and the facets of the NEO-PI-R provide a proven system for doing so (see Costa and McCrae, Vol. 2).

Table 13.2 Convergent and discriminant validity of within-domain item factors

Facet Scale	Varimax factor			Validimax factor		
	Form S ^a	Form R ^a	Form R ^b	Form S ^a	Form R ^a	Form R ^b
N1: Anxiety	0.78	0.90	0.80	0.79	0.85	0.80
N2: Angry hostility	0.86	0.94	0.94	0.89	0.90	0.91
N3: Depression	0.85	0.76	0.84	0.69	0.75	0.80
N4: Self-consciousness	0.07	0.74	0.51	0.55	0.74	0.67
N5: Impulsiveness	0.68	0.76	0.91	0.79	0.83	0.92
N6: Vulnerability	0.62	0.65	0.76	0.72	0.72	0.77
Largest ADC	0.77	0.38	0.44	0.48	0.35	0.30
Mdn ADC	0.20	0.19	0.19	0.22	0.25	0.20
E1: Warmth	0.26	0.86	0.83	0.75	0.85	0.78
E2: Gregariousness	0.89	0.82	0.73	0.83	0.83	0.80
E3: Assertiveness	0.92	0.94	0.93	0.90	0.92	0.91
E4: Activity	0.71	0.79	0.69	0.83	0.86	0.85
E5: Excitement seeking	0.90	0.93	0.92	0.90	0.92	0.87
E6: Positive emotions	0.91	0.88	0.72	0.77	0.88	0.76
Largest ADC	0.70	0.35	0.50	0.42	0.31	0.38
Mdn ADC	0.13	0.14	0.10	0.15	0.13	0.11
O1: Fantasy	0.92	0.92	0.90	0.92	0.90	0.88
O2: Aesthetics	0.89	0.82	0.82	0.87	0.85	0.80
O3: Feelings	0.84	0.90	0.59	0.86	0.91	0.73
O4: Actions	0.57	0.81	0.82	0.52	0.84	0.86
O5: Ideas	0.83	0.93	0.93	0.86	0.92	0.93
O6: Values	0.74	0.93	0.64	0.83	0.93	0.74
Largest ADC	0.49	0.30	0.42	0.35	0.26	0.32
Mdn ADC	0.16	0.12	0.15	0.17	0.10	0.14
A1: Trust	0.91	0.91	0.82	0.90	0.90	0.89
A2: Straightforwardness	0.82	0.77	0.84	0.84	0.82	0.84
A3: Altruism	0.86	0.80	0.75	0.84	0.79	0.65
A4: Compliance	0.83	0.79	0.84	0.88	0.82	0.84
A5: Modesty	0.92	0.90	0.87	0.92	0.90	0.88
A6: Tender-mindedness	0.88	0.92	0.12	0.87	0.90	0.57
Largest ADC	0.31	0.42	0.71	0.25	0.31	0.47
Mdn ADC	0.14	0.19	0.21	0.15	0.20	0.20
C1: Competence	0.60	0.65	0.05	0.69	0.70	0.63
C2: Order	0.89	0.92	0.84	0.89	0.90	0.85
C3: Dutifulness	0.75	0.68	0.77	0.77	0.67	0.72
C4: Achievement striving	0.86	0.75	0.69	0.84	0.82	0.73
C5: Self-discipline	0.67	0.12	0.57	0.66	0.64	0.61
C6: Deliberation	0.86	0.85	0.87	0.85	0.80	0.84
Largest ADC	0.41	0.66	0.62	0.37	0.40	0.38
Mdn ADC	0.22	0.23	0.24	0.26	0.26	0.26

Note Tabled values are correlations between facets and best matched item factors. ADC = absolute discriminant correlation.
^aNEO-PI-3 data from McCrae, Martin, & Costa, 2005, $n = 1,135$. ^bNEO-PI-R data from McCrae et al. (2005d), $n = 12,156$.

Causal explanation

We turn at this point from data to philosophy of science, returning to an issue we have addressed earlier (McCrae and Costa, 1995). Proponents of the social-cognitive approach to personality have long disputed the claim that traits provide causal explanations (Mischel

and Shoda, 1994). A common statement is that trait explanations are circular: We observe sociable behavior, infer a trait of sociability, and 'explain' the behavior by the trait. If that were the end of the story, trait explanations would indeed be circular and trivial. But there is a vast literature showing that when we have assessed sociability

(ideally from much more than a single act), we have learned something from which we can make novel predictions about, for example, the person's cheerfulness a year from now, and the sociability of her identical twin. These are non-trivial and non-circular predictions that suggest that traits have real causal status (McCrae and Costa, 1995).

Recently, however, Cervone (2004a, 2004b) has advanced a new critique of trait explanations, based on a philosophical analysis of the latent variables that are central to structural equation modeling, confirmatory factor analysis, and several other statistical methods (Borsboom et al., 2003). The authors of that article were deeply versed in both the statistical and the philosophical literature on this topic and offered a thoughtful analysis. They came to two major conclusions. The first was that latent variables, such as the factors of the FFM, imply a realist ontology—that is, they are based on the assumption that there is something real in the world that gives rise to individual differences in observed variables; they are not mere fictions or social constructions. That is entirely in keeping with FFT, which postulates real basic tendencies underlying personality development and expression.

Their second major conclusion is odd. They argued that latent variables have causal standing when construed as between-subjects accounts: extraversion, for example, can apparently explain why Americans are more likely to make new friends than Koreans (Allik and McCrae, 2004). But Borsboom and colleagues (2003) denied that traits can provide causal explanations for the behavior of individuals. Cervone (2004b) interpreted this to mean that traits, although useful for making some kinds of predictions, do not explain the behavior of individuals; they are at best descriptive.

In brief, the argument of Borsboom and colleagues (2003) is that causation, by definition, implies that the cause, x , and the effect, y , must co-vary. Such co-variation can be observed across individuals, but on any one occasion cannot be observed in a single individual, because the individual does not vary.

No variation, no co-variation, no causation. Borsboom and colleagues admitted that some individual difference variables, such as height, can be considered causes of individuals' behavior, but claim that assuming that the same will hold for variables like extraversion is 'little more than an article of faith; the standard measurement model [for latent variables] has virtually nothing to say about characteristics of individuals' (2003: 206).

To the trait psychologist, Borsboom and colleagues's (2003) conclusion is counterintuitive. The statement that John went to a party because he was an extravert may or may not be correct, but it does not seem to be nonsensical, which is the implication of their argument. Where, then, did their argument go wrong? Borsboom and colleagues argued that causation means the co-variation of cause and effect, but that definition confounds the evidence of causation with the phenomenon itself. Intuitively, causation means that one circumstance or event made a later event occur. In order to *demonstrate* that there is a causal connection, there must be co-variation—indeed, in the absence of experimental manipulation even co-variation is weak evidence of causation. But a cause does not cease to exist merely because it cannot be shown to be a cause. Merely observing that John is an extravert and that John goes to a party does not in itself prove that he went to the party because he was an extravert, but it certainly does not preclude that possibility.

McCrae and Costa (1999: 146–147) explored the relation of co-variation to causation in a thought experiment in which a new utopia was peopled with clones of an adjusted extravert. If traits were 100% heritable, there would be no individual differences among its residents, differences in personality scores would be entirely due to error, and it would be impossible to demonstrate with the usual correlational studies the stability or behavioral consequences of traits. Yet the clones would still talk loudly, laugh often, and otherwise act like adjusted extraverts, because their basic tendencies (indirectly) cause this kind of behavior.

Borsboom and colleagues (2003) suggested that causal attributions at the level of the individual might be justified by evidence that there is a corresponding within-subject latent variable, seen, for example, in intraindividual factor analyses conducted within individuals across occasions. Can personality states (Fleeson, 2001) be characterized by the FFM? This is an intriguing question, and some empirical efforts have been made to answer it (e.g. Borkenau and Ostendorf, 1998). They show only limited evidence of a similar structure for personality states when analyzed at the level of the individual.

However, a moment's reflection shows that the structure, and thus the causes, of state perturbation in personality is irrelevant to the causes of personality traits. FFM traits are very largely heritable (Jang et al., 1996), meaning that they are themselves caused by genes (their biological basis). It is most unlikely that these same genes would be the cause of transient variations in personality states. Thus, even evidence that the intraindividual structure of states perfectly paralleled the FFM would not speak to the causal source of behavior. The mechanisms that account for fluctuation in personality are surely different from those that account for stable individual differences.

Borsboom and colleagues noted that their conclusion is not surprising in view of the fact that 'the within-subjects causal interpretation of between-subjects latent variables rests on a logical fallacy' (2003: 212), a charge raised by Lamiell (1987) and repeated by Rorer, who asserted, 'There is no way to get from the relation between two traits or characteristics in the population to the relation between those traits within an individual' (1990: 711). This is a troubling prospect to the trait psychologist until it is recognized that there is actually no fallacy in trait explanations, because in trait explanations, characteristics of the group are not being attributed to individuals. This is obscured by the term 'relation' in Rorer's quote, which seems to refer to the same thing at two levels. It does not. The relation at the level of the

population is one of correlation, whereas the relation at the level of the individual is one of causation.

How does one get from correlation at the group level to causation at the individual level? By scientific inference. The logic is straightforward: if E causes party-going in individuals, then in the general population, people who are more extraverted should go to more parties. They do. Therefore, E may cause party-going in individuals. This is an inductive, not a rigorous deductive argument, so it may be incorrect, but that is a fate it shares with all scientific propositions, and one that scientists have learned to deal with by testing alternatives and seeking corroborating evidence.

Thus, the study of associations at the group level can assuredly tell us about characteristics of individuals, and does provide a legitimate basis for trait explanations (McCrae and Costa, 1995). A trait explanation is, however, a very abstract explanation, admitted by Borsboom and colleagues (2003) as an 'elliptical explanation' in which 'the position on the latent variable is shorthand for whatever process leads to person's response' (2003: 214), a position they consider 'uninformative'. That is surely a value judgment, and one not shared by many clinicians (J.A. Singer, 2005) and their clients (Mutén, 1991), who find that trait explanations are an important first step in understanding the origins of problems in living.

Borsboom and colleagues (2003) and Cervone (2004b) are correct in implying that the five-factor structure of personality is not to be found in the mind (or brain) of any individual. 'Personality structure' is an ambiguous term that can be applied within or across people, but with very different meanings (McCrae, 2005). They are also correct in asserting that if one wishes to understand the processes that lead to the flow of behavior and experience in individual persons, trait psychology is a limited guide. McCrae and Costa (in press) also recognized this, and offered FFT as a schematic representation of what goes on. FFT is not a detailed account

of any particular behavior, but it provides an outline of where one ought to look for detailed explanations. For example, if FFT is correct, then the search for the origins of traits (and trait-related behavior) should neglect non-shared environmental influences (Reiss et al., 2000) and concentrate perhaps on molecular genetics.

Following Borsboom and colleagues (2003), Cervone (2004b) argued that FFT cannot in principle be a useful framework for explaining behavior because the whole category of basic tendencies offer mere descriptions rather than causal explanations, and so cannot be a legitimate link in a causal chain. But if Borsboom and colleagues are wrong in their argument, so is Cervone. The distinction he wishes to draw between explanation and description is better seen as a distinction between proximal and distal causes, and thus between mechanistic and trait explanations.

In a French-language article, Cervone (2006) offered an analogy: If a car breaks down, one might attribute this either to the unreliability of that model or to the failure of a fuel pump. The latter is clearly a more useful explanation at the moment, because it points directly to an intervention. But Cervone wished to argue that 'unreliability' cannot be a cause of breakdown, because 'it does not make reference to anything in the car that causally contributed to the car's breaking down' (English version courtesy D. Cervone). It can only be a description of a class of cars, useful as a buying guide perhaps, but not explanatory.

In fact, unreliability can be seen under the hood, if one knows where to look. It is seen in the poor design, in the shoddy workmanship, in the flimsy materials used to construct the car. Any good mechanic could point these out, even without knowing the performance history of that model. Unreliability is an elliptical explanation, pointing to unspecified features that provide a more mechanistic explanation, but it is no less an explanation for being abstract. The two kinds of explanations are not in competition; they are different levels of explanation, useful in

different circumstances. FFT was intended to indicate, at least roughly, how they work together. The work of social-cognitive personality psychologists may be most helpful in filling in the details.

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REFERENCES

- Allik, J. and McCrae, R.R. (2004) 'Toward a geography of personality traits: Patterns of profiles across 36 cultures', *Journal of Cross-Cultural Psychology*, 35: 13–28.
- Archer, R.P. and Smith, S.R. (eds) (in press) *A Guide to Personality Assessment: Evaluation, Application, and Integration*. Mahwah, NJ: Erlbaum.
- Ashton, M.C., Lee, K., Perugini, M., Szarota, P., De Vries, R.E., Di Blass, L., Boies, K. and De Raad, B. (2004) 'A six-factor structure of personality descriptive adjectives: Solutions from psycholexical studies in seven languages', *Journal of Personality and Social Psychology*, 86: 356–66.
- Bagby, R.M., Bindseil, K., Schuller, D.R., Rector, N.A., Young, L.T., Cooke, R.G., Seeman, M.V., McCay, E.A. and Joffe, R.T. (1997) 'Relationship between the Five-Factor Model of personality and unipolar, bipolar and schizophrenic patients', *Psychiatry Research*, 70: 83–94.
- Barrick, M.R. and Mount, M.K. (1991) 'The Big Five personality dimensions and job performance: A meta-analysis', *Personnel Psychology*, 44: 1–26.
- Baumeister, R.F. (2005) *The Cultural Animal: Human Nature, Meaning, and Social Life*. New York: Oxford University Press.
- Biesanz, J.C. and West, S.G. (2004) 'Towards understanding assessments of the Big Five: Multitrait-multimethod analyses of convergent and discriminant validity across measurement

- occasion and type of observer', *Journal of Personality*, 72: 845–76.
- Block, J. (2001) 'Millennial contrarianism: The five-factor approach to personality description 5 years later', *Journal of Research in Personality*, 35: 98–107.
- Borkenau, P. and Ostendorf, F. (1998) 'The Big Five as states: How useful is the Five-Factor Model to describe intraindividual variations over time?', *Journal of Research in Personality*, 32: 202–21.
- Borsboom, D., Mellenbergh, G.J. and van Heerden, J. (2003) 'The theoretical status of latent variables', *Psychological Review*, 110: 203–19.
- Bouchard, T.J. and Loehlin, J.C. (2001) 'Genes, evolution, and personality', *Behavior Genetics*, 31: 243–73.
- Bronner, R.K., Schmidt, C.W. and Herbst, J.H. (2002) 'Personality trait characteristics of opioid abusers with and without comorbid personality disorders', in P.T. Costa Jr. and T.A. Widiger (eds), *Personality Disorders and the Five-Factor Model of Personality* (2nd edition). Washington, DC: American Psychological Association, pp. 249–68.
- Buss, D.M. and Barnes, M. (1986) 'Preferences in human mate selection', *Journal of Personality and Social Psychology*, 50: 559–70.
- Cervone, D. (2004a) 'The architecture of personality', *Psychological Review*, 111: 183–204.
- Cervone, D. (2004b) 'Personality assessment: Tapping the social-cognitive architecture of personality', *Behavior Therapy*, 35: 113–29.
- Cervone, D. (2006) 'Systèmes de personnalité au niveau de l'individu: ver uns évaluation de l'architecture sociocognitive de la personnalité [Personality systems at the level of the individual: assessing social-cognitive personality architecture]', *Psychologie Française*, 51: 357–76.
- Cole, D.P. (2001) 'Saudi Arabia', in M. Ember and C.R. Ember (eds), *Countries and their Cultures* (Vol. 4). New York: Macmillan, pp. 1927–39.
- Costa, P.T. Jr., Herbst, J.H., McCrae, R.R. and Siegler, I.C. (2000) 'Personality at midlife: Stability, intrinsic maturation, and response to life events', *Assessment*, 7: 365–78.
- Costa, P.T. Jr. and 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. and McCrae, R.R. (1992b) 'Trait psychology comes of age', in T.B. Sonderegger (ed.), *Nebraska Symposium on Motivation: Psychology and aging*. Lincoln, NE: University of Nebraska Press, pp. 169–204.
- Costa, P.T. Jr. and McCrae, R.R. (1995) 'Domains and facets: Hierarchical personality assessment using the Revised NEO Personality Inventory', *Journal of Personality Assessment*, 64: 21–50.
- Costa, P.T. Jr. and McCrae, R.R. (1998) 'Six approaches to the explication of facet-level traits: Examples from Conscientiousness', *European Journal of Personality*, 12: 117–34.
- Costa, P.T. Jr. and McCrae, R.R. (2005) 'A Five-Factor Theory perspective on the Rorschach', *Rorschachiana*, 27: 80–100.
- Costa, P.T. Jr., McCrae, R.R. and PAR Staff. (1994) *NEO Software System [Computer software]*. Odessa, FL: Psychological Assessment Resources.
- Costa, P.T. Jr. and Widiger, T.A. (eds) (2002) *Personality Disorders and the Five-Factor Model of Personality* (2nd edition). Washington, DC: American Psychological Association.
- De Raad, B. and Peabody, D. (2005) 'Cross-culturally recurrent personality factors: Analyses of three factors', *European Journal of Personality*, 19: 451–74.
- DeYoung, C.G., Peterson, J.B. and Higgins, D.M. (2002) 'Higher-order factors of the Big Five predict conformity: Are there neuroses of health?', *Personality and Individual Differences*, 33: 533–52.
- Digman, J.M. (1997) 'Higher-order factors of the Big Five', *Journal of Personality and Social Psychology*, 73: 1246–56.
- Digman, J.M. and Inouye, J. (1986) 'Further specification of the five robust factors of personality', *Journal of Personality and Social Psychology*, 50: 116–23.
- Donnellan, M.B., Conger, R. and Bryant, C.M. (2004) 'The Big Five and enduring marriages', *Journal of Research in Personality*, 38: 481–504.
- Endler, N.S., Rutherford, A. and Denisoff, E. (1997) 'Neuroticism: How does one slice the PI(e)?', *European Journal of Personality*, 11: 133–45.
- Fiske, S.T. and Leyens, J.-P. (1997) 'Let social psychology be faddish or, at least, heterogeneous', in C. McGarty and S.A. Haslam (eds), *The Message of Social Psychology: Perspectives on Mind in Society*. Malden, MA: Blackwell Publishing, pp. 92–112.

- Fleeson, W. (2001) 'Toward a structure- and process-integrated view of personality: Traits as density distributions of states', *Journal of Personality and Social Psychology*, 80: 1011–27.
- Funder, D.C., Kolar, D.C. and Blackman, M.C. (1995) 'Agreement among judges of personality: Interpersonal relations, similarity, and acquaintanceship', *Journal of Personality and Social Psychology*, 69: 656–72.
- Funder, D.C. and West, S.G. (eds) (1993) 'Viewpoints on personality: Consensus, self-other agreement and accuracy in personality judgment.', *Journal of Personality*, 61(4):
- Goldberg, L.R. (1983) 'The magical number five, plus or minus two: Some considerations on the dimensionality of personality descriptors', Paper presented at a Research Seminar, Gerontology Research Center, Baltimore, MD.
- Gough, H.G. (1987) *California Psychological Inventory Administrator's Guide*. Palo Alto, CA: Consulting Psychologists Press.
- Hill, R.W., McIntire, K. and Bacharach, V.R. (1997) 'Perfectionism and the Big Five factors', *Journal of Social Behavior and Personality*, 12: 257–70.
- Jang, K.L., Livesley, W.J., Ando, J., Yamagata, S., Suzuki, A., Angleitner, A., Ostendorf, F., Riemann, R. and Spinath, F. (2006) 'Behavioral genetics of the higher-order factors of the Big Five', *Personality and Individual Differences*, 41: 261–72.
- Jang, K.L., Livesley, W.J. and Vernon, P.A. (1996) 'Heritability of the Big Five personality dimensions and their facets: A twin study', *Journal of Personality*, 64: 575–91.
- Jang, K.L., McCrae, R.R., Angleitner, A., Riemann, R. and 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: 1556–65.
- Judge, T.A., Higgins, C.A., Thoresen, C.J. and Barrick, M.R. (1999) 'The Big Five personality traits, general mental ability, and career success across the life span', *Personnel Psychology*, 52: 621–52.
- Jung, C.G. (1971) *Psychological Types*, (H.G. Baynes, trans., revised by R.F.C. Hull) Princeton, NJ: Princeton University Press. (Original work published 1923).
- Kohnstamm, G.A., Halverson, C.F. Jr. Mervielde, I. and Havill, V.L. (eds) (1998) *Parental Descriptions of Child Personality: Developmental Antecedents of the Big Five?* Mahwah, NJ: Lawrence Erlbaum Associates.
- Lamiell, J.T. (1987) *The Psychology of Personality: An Epistemological Inquiry*. New York: Columbia University Press.
- Markon, K.E., Krueger, R.F. and Watson, D. (2005) 'Delineating the structure of normal and abnormal personality: An integrative hierarchical approach', *Journal of Personality and Social Psychology*, 88: 139–57.
- Mayer, J.D. (2005) 'A tale of two visions: Can a new view of personality help integrate psychology?', *American Psychologist*, 60: 294–307.
- McAdams, D.P. and Pals, J.L. (2006) 'A new Big Five: Fundamental principles for an integrative science of personality', *American Psychologist*, 61: 204–17.
- McCrae, R.R. (1989) 'Why I advocate the Five-Factor Model: Joint analyses of the NEO-PI and other instruments', in D.M. Buss and N. Cantor (eds), *Personality Psychology: Recent Trends and Emerging Directions*. New York: Springer-Verlag, pp. 237–45.
- McCrae, R.R. (1996) 'Social consequences of experiential openness', *Psychological Bulletin*, 120: 323–37.
- McCrae, R.R. (2005) 'Personality structure', in V.J. Derlega, B.A. Winstead and W.H. Jones (eds), *Personality: Contemporary Theory and Research* (3rd edition). Belmont, CA: Wadsworth Group, pp. 192–216.
- McCrae, R.R. and Allik, J. (eds) (2002) *The Five-Factor Model of Personality Across Cultures*. New York: Kluwer Academic/Plenum Publishers.
- McCrae, R.R. and Costa, P.T. Jr. (1983) 'Joint factors in self-reports and ratings: Neuroticism, Extraversion, and Openness to Experience', *Personality and Individual Differences*, 4: 245–55.
- McCrae, R.R. and Costa, P.T. Jr. (1987) 'Validation of the Five-Factor Model of personality across instruments and observers', *Journal of Personality and Social Psychology*, 52: 81–90.
- McCrae, R.R. and Costa, P.T. Jr. (1989a) 'Reinterpreting the Myers-Briggs Type Indicator from the perspective of the Five-Factor Model of personality', *Journal of Personality*, 57: 17–40.
- McCrae, R.R. and Costa, P.T. Jr. (1989b) 'Rotation to maximize the construct

- validity of factors in the NEO Personality Inventory', *Multivariate Behavioral Research*, 24: 107–24.
- McCrae, R.R. and Costa, P.T. Jr. (1992) 'Discriminant validity of NEO-PI-R facets', *Educational and Psychological Measurement*, 52: 229–37.
- McCrae, R.R. and Costa, P.T. Jr. (1995) 'Trait explanations in personality psychology', *European Journal of Personality*, 9: 231–52.
- McCrae, R.R. and 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*. New York: Guilford, pp. 51–87.
- McCrae, R.R. and Costa, P.T. Jr. (2003) *Personality in Adulthood: A Five-Factor Theory Perspective* (2nd edition). New York: Guilford.
- McCrae, R.R. and Costa, P.T. Jr. (in press) 'The Five-Factor Theory of personality', in O.P. John, R.W. Robins and L.A. Pervin (eds), *Handbook of Personality: Theory and Research* (3rd edition). New York: Guilford.
- McCrae, R.R., Costa, P.T. Jr., Lima, M. P., Simões, A., Ostendorf, F., Angleitner, A., Marušić, I., Bratko, D., Caprara, G.V., Barbaranelli, C., Chae, J.-H. and Piedmont, R.L. (1999) 'Age differences in personality across the adult life span: Parallels in five cultures', *Developmental Psychology*, 35: 466–77.
- McCrae, R.R., Costa, P.T. Jr., Martin, T.A., Oryol, V.E., Rukavishnikov, A.A., Senin, I.G., Hřebíčková, M. and Urbánek, T. (2004) 'Consensual validation of personality traits across cultures', *Journal of Research in Personality*, 38: 179–201.
- McCrae, R.R., Costa, P.T. Jr., Ostendorf, F., Angleitner, A., Hřebíčková, M., Avia, M.D., Sanz, J., Sánchez-Bernardos, M.L., Kusdil, M.E., Woodfield, R., Saunders, P.R. and Smith, P.B. (2000) 'Nature over nurture: Temperament, personality and lifespan development', *Journal of Personality and Social Psychology*, 78: 173–86.
- McCrae, R.R., Herbst, J.H. and Costa, P.T. Jr. (2001) 'Effects of acquiescence on personality factor structures', in R. Riemann, F. Ostendorf and F. Spinath (eds), *Personality and Temperament: Genetics, Evolution, and Structure*. Berlin: Pabst Science Publishers, pp. 217–31.
- McCrae, R.R., Löckenhoff, C.E. and Costa, P.T. Jr. (2005a) 'A step towards DSM-V: Cataloging personality-related problems in living', *European Journal of Personality*, 19: 269–70.
- McCrae, R.R., Martin, T.A. and Costa, P.T. Jr. (2005b) 'Age trends and age norms for the NEO Personality Inventory-3 in adolescents and adults', *Assessment*, 12: 363–73.
- McCrae, R.R., Terracciano, A. and 78 Members of the Personality Profiles of Cultures Project. (2005c) 'Universal features of personality traits from the observer's perspective: Data from 50 cultures', *Journal of Personality and Social Psychology*, 88: 547–61.
- McCrae, R.R., Terracciano, A. and 79 Members of the Personality Profiles of Cultures Project. (2005d) 'Personality profiles of cultures: Aggregate personality traits', *Journal of Personality and Social Psychology*, 89: 407–25.
- McCrae, R.R., Zonderman, A.B., Costa, P.T. Jr., Bond, M.H. and Paunonen, S.V. (1996) 'Evaluating replicability of factors in the Revised NEO Personality Inventory: Confirmatory factor analysis versus Procrustes rotation', *Journal of Personality and Social Psychology*, 70: 552–66.
- Miller, T. (1991) 'The psychotherapeutic utility of the Five-Factor Model of personality: A clinician's experience', *Journal of Personality Assessment*, 57: 415–33.
- Mischel, W. (1968) *Personality and Assessment*. New York: Wiley.
- Mischel, W. and Shoda, Y. (1994) 'Personality psychology has two goals: Must it be two fields?', *Psychological Inquiry*, 5: 156–8.
- Mutén, E. (1991) 'Self-reports, spouse ratings, and psychophysiological assessment in a behavioral medicine program: An application of the Five-Factor Model', *Journal of Personality Assessment*, 57: 449–64.
- Myers, I.B. and McCaulley, M.H. (1985) *Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator*. Palo Alto: Consulting Psychologists Press.
- Ozer, D.J. and Benet-Martínez, V. (2006) 'Personality and the prediction of consequential outcomes', *Annual Review of Psychology*, 57: 401–21.
- Paunonen, S.V. and Ashton, M.C. (2001) 'Big Five factors and facets and the prediction of behavior', *Journal of Personality and Social Psychology*, 81: 524–39.

- Quirk, S.W., Christiansen, N.D., Wagner, S.H. and McNulty, J.L. (2003) 'On the usefulness of measures of normal personality for clinical assessment: Evidence of the incremental validity of the Revised NEO Personality Inventory', *Psychological Assessment*, 15: 311–25.
- Reiss, D., Neiderhiser, J.M., Hetherington, E.M. and Plomin, R. (2000) *The Relationship Code: Deciphering Genetic and Social Influences on Adolescent Development*. Cambridge, MA: Harvard University Press.
- Reynolds, S.K. and Clark, L.A. (2001) 'Predicting dimensions of personality disorder from domains and facets of the Five-Factor Model', *Journal of Personality*, 69: 199–222.
- Roberts, B.W., Bogg, T., Walton, K.E., Chernyshenko, O.S. and Stark, S.E. (2004) 'A lexical investigation of the lower-order structure of Conscientiousness', *Journal of Research in Personality*, 38: 164–78.
- Roberts, B.W., Chernyshenko, O.S., Stark, S.E. and Goldberg, L.R. (2005a) 'The structure of Conscientiousness: An empirical investigation based on seven major personality questionnaires', *Personnel Psychology*, 58: 103–39.
- Roberts, B.W. and DelVecchio, W.F. (2000) 'The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies', *Psychological Bulletin*, 126: 3–25.
- Roberts, B.W., Helson, R. and Klohnen, E.C. (2002) 'Personality development and growth in women across 30 years: Three perspectives', *Journal of Personality*, 70: 79–102.
- Roberts, B.W., Wood, D. and Smith, J.L. (2005b) 'Evaluating Five-Factor Theory and social investment perspectives on personality trait development', *Journal of Research in Personality*, 39: 166–84.
- Rorer, L.G. (1990) 'Personality assessment: A conceptual survey', in L.A. Pervin (ed.), *Handbook of Personality: Theory and Research*. New York: Guilford, pp. 693–720.
- Schmitt, D.P., Allik, J., McCrae, R.R., Benet-Martínez, V., Alcalay, L., Ault, L. et al. (2007) 'The geographic distribution of Big Five personality traits: Patterns and profiles of human self-description across 56 nations', *Journal of Cross-Cultural Psychology*, 38: 173–212.
- Sheldon, K.M. (2004) *Optimal Human Being: An Integrated Multi-Level Perspective*. Mahwah, NJ: Erlbaum.
- Singer, J.A. (2005) *Personality and Psychotherapy: Treating the Whole Person*. New York: Guilford Press.
- Singer, M. (1961) 'A survey of culture and personality theory and research', in B. Kaplan (ed.), *Studying Personality Cross-Culturally*. Evanston, IL: Row, Peterson. pp. 9–90.
- Soldz, S. and Vaillant, G.E. (1999) 'The Big Five personality traits and the life course: A 45-year longitudinal study', *Journal of Research in Personality*, 33: 208–32.
- Tellegen, A. and Waller, N. G. (1987, August). 'Reexamining basic dimensions of natural language trait descriptors'. Paper presented at the Annual Convention of the American Psychological Association, New York.
- Terracciano, A., Costa, P.T. Jr. and McCrae, R.R. (2006) 'Personality plasticity after age 30', *Personality and Social Psychology Bulletin*, 32: 999–1009.
- Terracciano, A., McCrae, R.R., Brant, L.J. and Costa, P.T. Jr. (2005) 'Hierarchical linear modeling analyses of NEO-PI-R scales in the Baltimore Longitudinal Study of Aging', *Psychology and Aging*, 20: 493–506.
- Trull, T. J. and McCrae, R.R. (2002) 'A five-factor perspective on personality disorder research', in P.T. Costa Jr. and T. A. Widiger (eds), *Personality Disorders and the Five-Factor Model of Personality* (2nd edition). Washington, DC: American Psychological Association, pp. 45–57.
- Trull, T.J. and Widiger, T.A. (1997) *Structured Interview for the Five-Factor Model of Personality (SIFFM): Professional Manual*. Odessa, FL: Psychological Assessment Resources.
- Tupes, E.C. and Christal, R.E. (1992) 'Recurrent personality factors based on trait ratings', *Journal of Personality*, 60: 225–51. (Original work published 1961).
- Watson, D. and Clark, L.A. (1997) 'Extraversion and its positive emotional core', in R. Hogan, J. Johnson and S.R. Briggs (eds), *Handbook of Personality Psychology*. New York: Academic Press, pp. 767–93.
- Weiner, I.B. and Greene, R.L. (2008) *Handbook of Personality Assessment*. New York: John Wiley.

- Weiss, A. and Costa, P.T. Jr. (2005) 'Personality predictors of cardiovascular disease and all-cause mortality', *Psychosomatic Medicine*, 67: 715–23.
- Widiger, T.A. and Costa, P.T. Jr. (2002) 'Five-Factor Model personality disorder research', in P.T. Costa Jr. and T.A. Widiger (eds), *Personality Disorders and the Five-Factor Model of Personality* (2nd edition). Washington, DC: American Psychological Association, pp. 59–87.
- Wiggins, J.S. (ed.) (1996) *The Five-Factor Model of Personality: Theoretical Perspectives*. New York: Guilford.
- Woodruffe, C. (1985) 'Consensual validation of personality traits: Additional evidence and individual differences', *Journal of Personality and Social Psychology*, 48: 1240–52.
- Yamagata, S., Suzuki, A., Ando, J., Ono, Y., Kijima, N., Yoshimura, K., Ostendorf, F., Angleitner, A., Riemann, R., Spinath, F.M., Livesley, W.J. and Jang, K.L. (2006) 'Is the genetic structure of human personality universal? A cross-cultural twin study from North America, Europe, and Asia', *Journal of Personality and Social Psychology*, 90: 987–98.
- Yang, J., McCrae, R.R. and Costa, P.T. Jr. (1998) 'Adult age differences in personality traits in the United States and the People's Republic of China', *Journal of Gerontology: Psychological Sciences*, 53B: P375–83.