

A Meta-Analysis of Personality in Scientific and Artistic Creativity

Gregory J. Feist

Department of Psychology
College of William & Mary

*Theory and research in both personality psychology and creativity share an essential commonality: emphasis on the uniqueness of the individual. Both disciplines also share an emphasis on temporal consistency and have a 50-year history, and yet no quantitative review of the literature on the creative personality has been conducted. The 3 major goals of this article are to present the results of the first meta-analytic review of the literature on personality and creative achievement, to present a conceptual integration of underlying potential psychological mechanisms that personality and creativity have in common, and to show how the topic of creativity has been important to personality psychologists and can be to social psychologists. A common system of personality description was obtained by classifying trait terms or scales onto one of the Five-Factor Model (or Big Five) dimensions: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Effect size was measured using Cohen's *d* (Cohen, 1988). Comparisons on personality traits were made on 3 sets of samples: scientists versus nonscientists, more creative versus less creative scientists, and artists versus nonartists. In general, creative people are more open to new experiences, less conventional and less conscientious, more self-confident, self-accepting, driven, ambitious, dominant, hostile, and impulsive. Out of these, the largest effect sizes were on openness, conscientiousness, self-acceptance, hostility, and impulsivity. Further, there appears to be temporal stability of these distinguishing personality dimensions of creative people. Dispositions important to creative behavior are parsed into social, cognitive, motivational, and affective dimensions. Creativity, like most complex behaviors requires an intra- as well as interdisciplinary view and thereby mitigates the historically disciplinocentric attitudes of personality and social psychologists.*

The disciplines of personality psychology and creativity share an essential commonality: They both emphasize the uniqueness of the individual. The essence of a creative person is the uniqueness of his or her ideas and behavior, whereas *personality psychology* is the study of what makes a person unique from others (i.e., individual differences). Both disciplines also focus on the consistency and stability—or lack thereof—of such uniqueness. It is not surprising, therefore, that from early on in the history of the discipline, personality psychologists have turned their attention to a group of individuals whose most salient characteristic is their individuality and uniqueness, namely, creative people (Barron, 1955; Cattell & Drevdahl, 1955; Gough & Woodworth, 1960;

Guilford, 1950; MacKinnon, 1960; Maslow, 1959; Rogers, 1959; Taylor & Barron, 1963). In this sense, one might argue that consistent creative behavior could serve as a prototype for the study of personality. As pointed out by Woodman (1981), creativity has been a topic of thought for just about every major personality theorist in the 20th century: Freud, Jung, Rank, Fromm, Maslow, Rogers, May, Kelly, Cattell, Eysenck, and even Skinner wrote about creativity.

Novices to the study of creativity are often surprised when told that for the last 30 years or more, creativity researchers have been nearly unanimous in their definition of the concept (e.g., Amabile, 1996; Feist, 1993; Guilford, 1950; MacKinnon, 1970; Rothenberg & Hausman, 1976; Simonton, 1988; Sternberg, 1988): *Creative thought or behavior* must be both novel—original and useful—adaptive. It is easy to see why originality per se is not sufficient—there would be no way to distinguish eccentric or schizophrenic thought from creative thought. To be classified as *creative*, thought or behavior must also be socially useful or adaptive. Usefulness, however, is

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Requests for reprints should be sent to Gregory J. Feist, Department of Psychology, College of William and Mary, Williamsburg, VA 23187-8795. E-mail: gifeis@facstaff.wm.edu.

not meant in merely a pragmatic sense, for behavior or thought can be judged as useful on purely intellectual or aesthetic criteria.

Having briefly defined personality and creativity, the question still remains which group or groups of people offer the most insight into the creative process. Although creativity can and does apply to any domain in life, it is especially important in the arts and sciences. Whereas some activities would still exist if they were not infused with creativity, the arts and sciences would not—creativity is their *sine qua non*. The essence of each enterprise is solving problems in novel and adaptive ways. It is because of this that artists and scientists have been the most commonly studied populations (along with children) in the literature on creativity.

Moreover, if one is to make any inference about the unique personality characteristics of creative artists and scientists, one must have relevant comparison groups, which are most often group norms. One way to explain the logic behind this investigation is to use statistical and methodological terms. The question of what role personality plays in artistic and scientific creativity requires a *between-groups* perspective—comparing the personalities of artists and scientists to nonartists and nonscientists. If there were no systematic differences in personality between artists and scientists and their nonartists and nonscientists peers, then it is clear that personality would not be able to explain any of the observed differences in creativity between the groups. Demonstrating that differences between the groups do exist, therefore, is a necessary first step in establishing a personality–creativity relation. A major purpose of this article is to review the empirical evidence on this between-groups question—more specifically by means of quantifying effect sizes from all empirical studies published on the topic.

However, it is equally clear that a *within-groups* perspective is also needed, for the simple reason that not all work in science and art is equally creative. There is much variability from person to person within these professions. Moreover, I believe within-group variability is more pronounced in science than in art. Scientific investigations can range from the very routine, rote, and prescribed to the revolutionary and highly creative breakthrough. In fact, as Kuhn (1970) argued, much of science is the relatively mundane “normal” kind, and only rarely does some individual produce truly “revolutionary science.” Granted, some art can be rather derivative and somewhat technical, yet anyone who makes a living at art has to be more than one step above a technician. Scientists, on the other hand, can make a living being little more than technicians. In other words, there is institutional support (albeit not much) for relatively noncreative science, but there is no institu-

tional support for relatively noncreative art. Noncreative art does not survive. Therefore, in addition to the between-groups comparison of scientists to nonscientists, I will also add the within-groups perspective by comparing the personality traits of creative scientists with their less creative peers.

In summary, the primary purpose of this article is to review the research on personality and creativity and to demonstrate that creativity research dovetails closely with major issues in the field of personality and therefore can be a showcase for the usefulness of a personality perspective. More specifically, the three major goals of this article are to first present the results of a meta-analytic review of the entire literature, to present possible theoretical and conceptual connections between personality and creative behavior, and lastly to show how personality theory can be used to integrate empirical research on personality and creativity.

Previous Literature Reviews

This review of the literature on personality and creativity was preceded by two categories of review: trend analyses and qualitative reviews. Analyses of the trends in the creativity literature have been conducted in the United States (Feist & Runco, 1993; Wehner, Csikszentmihalyi, & Magyari-Beck, 1991), Japan (Onda, 1986), and in the former Soviet Union (Ansari & Raina, 1980; Matyuskin, 1984; Ponomarev, 1986). There also have been traditional qualitative reviews of the creativity literature (Barron & Harrington, 1981; Dellas & Gaier, 1970; Freeman, Butcher, & Christie, 1971; Gilchrist, 1972; Mumford & Gustafson, 1988; Stein, 1968). For example, Barron and Harrington (1981) concluded their section on personality with the following:

The empirical work of the past 15 years on the personality characteristics of creative people brought few surprises. In general, a fairly stable set of core characteristics (e.g., high valuation of esthetic qualities in experience, broad interests, attraction to complexity, high energy, independence of judgment, autonomy, intuition, self-confidence, ability to resolve antinomies or to accommodate apparently opposite or conflicting traits in one's self-concept, and finally a firm sense of self as “creative”) continued to emerge as correlates of creative achievement and activity in many domains. (p. 453)

Although such trend analyses and qualitative reviews of the creativity literature are useful, they are limited because they are not quantitative and therefore give little information about the magnitude of effects, and because they generally gloss over domain differences and discuss creativity in art, science, and

everyday life as if it were the same and subject to the same psychological processes. This article, however, attempts to overcome both of these shortcomings by focusing on a quantitative review of the empirical work on personality and creativity in science and in art separately. To my knowledge, this is the first meta-analysis of the creativity literature in general and creativity and personality in specific. Only by summarizing the literature quantitatively and thereby determining the size of the effects can the field begin to make cumulative progress. Indeed, it is a sign of the strength and health of the field of personality and creativity that it has progressed to the point at which a meta-analysis can be conducted.

The primary research questions to be addressed by the meta-analysis stem from individual difference and temporal stability perspectives: First, do personality traits consistently distinguish artists from nonartists and scientists from scientists? If so, what is the magnitude of these effects? In addition, because scientists may vary more than artists in terms of their creativity, it is also important to ask whether personality traits distinguish the most from the least creative scientists. Together, these questions tap into the individual difference component of personality. Second, do the traits that distinguish creative from less creative people when they are young continue to do so when they are older? This question taps into the temporal consistency component of personality.

Methods

Meta-Analysis

Many psychometricians have argued that the cumulative progress of a field is better served by garnering quantitative effect sizes from multiple studies than by reviewing qualitatively the results of single or even multiple studies (and their overreliance on statistical significance; Cohen, 1988; Cooper & Hedges, 1994; Loftus, 1991; Lykken, 1968; Meehl, 1967; Rosenthal & Rosnow, 1991; Schmidt 1996). Indeed, some have gone so far as to argue that statistical significance tests should be banned and stopped altogether (Schmidt, 1996). This is neither the time nor the place to debate the pros and cons of significance testing, but suffice it to say that this article is an attempt to demonstrate the value of quantitative research synthesis.

Common personality metric. One problem immediately arises when attempting to summarize on the same metric myriad personality findings using different scales and items: How does one standardize the di-

mensions of personality? Fortunately, the field of personality has recently witnessed a relatively well agreed upon standardization of the basic dimensions of personality, and these have been labeled the *Five-Factor Model* (FFM) or the *Big Five*. The FFM is based on factor-analytic studies of personality structure that consistently extract five major factors of personality (Costa & McCrae, 1995; Digman, 1990; Goldberg & Rosolack, 1994; John, 1990; McCrae & John, 1992). The five factors have various labels, depending on the specific researcher, but one of the more common labeling systems, and the one adapted here, is the following: Extraversion (E), Agreeableness (A), Conscientiousness (C), Neuroticism (N), and Openness (O; Costa & McCrae, 1995).

For this article, I used empirical findings from the literature to classify a trait term or scale onto one of the FFM dimensions.¹ Based on reported correlations, I used the strongest effect sizes to classify personality items or scales into one and only one of the five factors. For example, if an item or scale correlated .20 with E but .40 with O, it was classified as an O dimension. Furthermore, the minimum correlation coefficient required to place an item or scale on a five-factor dimension was .25. If an item or scale correlated less than .25 with any dimension it was not categorized. Finally, each factor was further divided into its positive and negative dimension, so there were 10 categories in which each item or scale could be placed (see Table 1). In short, the FFM provides a useful heuristic for standardizing the scales of various personality inventories, a necessary condition for conducting a meta-analysis.

The FFM, however, is not without its limitations and drawbacks (Block, 1995; McAdams, 1992). For instance, the technical procedures applied in factor analyses may be ambiguous and the lexical foundations on which the FFM rests may be questionable (Block, 1995). Furthermore, because the FFM is so broad in scope, it may gloss over smaller yet distinct important dimensions of personality, and therefore some factors may need to be divided into smaller components. For instance, the most obvious factor for which a further division is useful is E. More specifi-

¹I am grateful to Robert McCrae for his recommendations and assistance in gathering the empirical literature on the FFM correlates for classification of traits and scales. The studies used for these empirically based classifications were: Gerbing and Tuley (1991); Gough and Bradley (1995); McCrae (1991); McCrae and Costa (1985); McCrae, Costa, and Busch (1986); McCrae, Costa, and Piedmont (1993); Piedmont, McCrae, and Costa (1991). The personality inventories used in the classification were the Adjective Check List, Sixteen Personality Factor Questionnaire, California Psychological Inventory, Eysenck Personality Questionnaire, Eysenck Personality Inventory, Minnesota Multiphasic Personality Inventory, NEO Personality Inventory, and the Edwards Personal Preference Inventory.

Table 1. Five Factor Model Trait Terms and Their Empirical Personality Inventory Scale and Item Correlates

| Factor label | Abbreviation | Empirical Correlates (Scales and Items) ^a |
|---------------------------|--------------|---|
| Neuroticism | N+ | Anxious, defensive, depressed, emotional, excitable, guilt-prone, hypochondria, insecure, labile, neurotic, psychasthenia, schizophrenia, shrewd, succorant, tense, worrying |
| | N- | Achievement via conformance, adjusted, calm, ego-strength, good impression, guilt-free, happy, intellectual efficiency, personal adjustment, personal soundness, psychologically minded, stable, well-being |
| Extraversion ^b | E+ | Achieving, active , adventurous (parmia), ambitious, assertive, autonomous, capacity for status, confident, cyclothymic, dominant, energetic , enthusiastic, exhibitionistic , expressive , extraverted , gregarious , hypomanic, impulsive, independent, initiative, <u>leader(ship)</u> , <u>need for recognition</u> , <u>power (oriented)</u> , positive emotion, <u>self-accepting</u> , <u>self-assured</u> , <u>self-confident</u> , <u>self-esteem</u> , self-sufficient, sensation seeking, sociable , social presence , surgent |
| | E- | <u>Abasement</u> , <u>deferent</u> , <u>dependent</u> , depressed, internality , introverted, radical, reflective, reserved, social introversion , <u>submissive</u> , <u>unambitious</u> , unsociable , unadventurous |
| Openness | O+ | Aesthetic, achievement via independence, change, creative, curious, flexible, humorous, imaginative, intelligent, open, open-minded, original, sensitive, sophisticated, wide interests |
| | O- | Conventional, inflexible, rigid, socialized |
| Agreeableness | A+ | Affiliative, agreeable, communality, cooperative, easy-going, empathic, feminine, friendly, generous, intraceptive, nurturing, nurturing parent, peaceful, supportive, warm |
| | A- | Aggressive, argumentative, cynical, egotistical, exploitative, headstrong, hostile, masculine, psychoticism, suspicious |
| Conscientiousness | C+ | Careful, cautious, conscientious, controlled, endurance, fastidious, orderly, persevering, reliable, responsible, self-controlled |
| | C- | Direct expression of needs, psychopathic deviant |

^aSee Footnote 1 for studies on which the classifications were based. ^bExtraversion can be divided further into two subfactors, confidence-dominance and sociability.

cally, when examining the content of the E dimension, it was clear that two somewhat distinct subdimensions appeared, namely confidence-dominance-achieving (underlined in Table 1) and sociability (bold in Table 1). These two dimensions are no doubt related to one another: Being sociable and outgoing often is accompanied by confidence and leadership qualities. However, the achievement drive and sociability components are not synonymous. One can be quite ambitious and confident without being sociable and vice-versa. When studying highly creative people (who are often very ambitious-confident but not necessarily sociable), it is necessary that these two components be separated. Therefore, for purposes of this meta-analysis, the E dimension was broken down into sociability and confidence subdimensions.

A final limitation of the FFM is that scales and items from particular personality inventories do not always map cleanly onto the FFM, and therefore, those scales are lost or ignored in an FFM analysis. For instance, the Sixteen Personality Factor Questionnaire (16PF; Cattell, Eber, & Tatsuoka, 1970) Factor A (warmth) loads on A and on E, and the Eysenck Personality Questionnaire (EPQ; H. J. Eysenck & Eysenck, 1975) psychoticism (P) scale

loads on A, C, and O and therefore would not be included in the FFM meta-analysis. Because this was the case, meta-analytic results are presented not only in terms of the FFM, but also in terms of the three personality inventories most often used in investigations of the creative personality: the California Psychological Inventory (CPI; Gough, 1987), the 16PF, and the EPQ.

Measure of effect size. Effect size was measured using Cohen's *d*, the difference between two means divided by the average standard deviation (Cohen, 1988), because of its ease of calculation and its intuitive interpretability (standard deviation units). Furthermore, Cohen has also provided convenient heuristics for interpreting the magnitude of *d* in the context of social science effect sizes: .20 is considered a small effect, .50 medium, and .80 large. All one needs to calculate *d* are descriptive statistics of the target and comparison groups, and if those are not available, *d* can be calculated quite readily from test statistics such as *t* or *r*, as well as from significance levels (Rosenthal, 1994). Because the distributions of *d* were not always normal, the median will be the primary reported measure of central tendency. For these analyses, effect sizes were calculated so that positive

values always denoted higher scores for the more creative groups and negative values denote higher scores for the comparison groups.

Procedures for meta-analysis. First, the targeted samples (scientists and artists) included in the meta-analysis had to be defined. *Scientists* were defined as any sample from junior high school on through adulthood that showed special talent in science, majored in science, or that worked professionally in academic or commercial science. Science was not limited to the natural and biological sciences, but included the social sciences (i.e., anthropology, psychology, sociology), invention, engineering, and mathematics. *Artists* were defined as students majoring in or studying art, or anyone earning an income in any of the following domains: writing, painting, photography, cinematography, dance, music, or poetry. Recall, that to make between- and within-group comparisons on personality traits, three sets of analyses were made: scientists versus nonscientists, more creative versus less creative scientists, and artists versus nonartists. To demonstrate that personality meaningfully covaries with artistic creativity, I included studies in the review only if they compared the personality characteristics of artists to nonartists.

In addition, I focused on published studies rather than dissertations or unpublished data (although unpublished data were used in a few instances), and therefore, this meta-analysis is not exhaustive. The primary initial source of studies was PsycINFO (American Psychological Association, 1967–present) dating back to 1967; books, chapters, and journal articles were searched. In addition to this database, articles on personality and creativity were cross-referenced from the reference sections of relevant chapters, books, and articles. There was no explicit year restriction, although in practice the publication years ranged from 1950 to 1995. Finally, for the citation search, general and broad keywords were chosen. For example, the chain *creativity science personality* resulted in 59 citations between 1967 and 1996, whereas *creativity scientists personality* resulted in 51 citations (many of which overlapped with the first chain). Similarly, *creativity art personality* resulted in 128 citations, whereas *creativity artists personality* resulted in 90. There were

many reasons why these citation totals were immediately narrowed: (a) only empirical citations could be included, (b) empirical studies had to publish either descriptive or inferential statistics or *p* values for effect sizes to be calculated, and (c) citations that were duplications of other published sources could not be included. For instance, if a reference by the same author appeared two or more times (in an article and in a book chapter, for example) using the same data set, then it could only be included once. For number of studies and total sample sizes see Table 2.

Results

Personality and Scientific Creativity

Scientists and nonscientists: FFM. The descriptive statistics of the 26 studies comparing personalities of scientists to nonscientists are presented in Table 3. The two strongest effect sizes (medium in magnitude) were for the positive and negative poles of C. From Table 1, it can be seen that C+ consists of scales and items such as *careful*, *cautious*, *conscientious*, *fastidious*, and *self-controlled*, whereas C– consists only of two scales and items: *direct expression of needs* and *psychopathic deviate*. Although the C– dimension comprised only five comparisons, it is clear that relative to nonscientists, scientists are roughly a half a standard deviation higher on conscientiousness and controlling of impulses. In addition, O– had a median *d* of .30, whereas E– had a median effect size of .26. O– consists of terms such as *conventional*, *rigid*, and *socialized*, whereas E– included terms such as *deferent*, *reserved*, *introverted*, and *dependent*. Finally, examining the effect sizes of the two subcomponents of E (confidence and sociability), the confidence component had a small positive effect, and the sociability component a near zero negative effect. In short, the FFM dimensions of openness, confidence–dominance (E), and conscientiousness appear to be the clearest factors differentiating scientists from nonscientists.

It is also important to determine whether these effect sizes are related to or moderated by publication date or the gender and age of the participants. Calcula-

Table 2. Descriptive Statistics for Studies and Samples^a

| Comparison | Number of Studies | Number of Samples | Number of Females | Number of Males | Number of Mixed Gender | Total N |
|--|-------------------|-------------------|-------------------|-----------------|------------------------|---------|
| Scientists Versus Non-Scientists | 26 | 26 | 1,069 | 2,457 | 1,326 | 4,852 |
| Creative Versus Less Creative Scientists | 28 | 30 | 135 | 3,546 | 237 | 3,918 |
| Artists Versus Non-Artists | 29 | 39 | 1,329 | 1,884 | 1,184 | 4,397 |

^aSamples were defined as unique independent groups and each study could therefore report results of more than one sample.

Table 3. Descriptive Statistics for Effect Sizes (*d*) Comparing Personality Dimensions of Scientists to Nonscientists and Creative Scientists to Less Creative Scientists and Artists to Nonartists

| FFM Dimension | Scientists Versus Nonscientists (26 Studies) | | | Creative Versus Less Creative Scientists (28 Studies) | | | Artists Versus Nonartists (29 Studies) | | |
|---------------|--|--------------------|---------------|---|---------------------|---------------|--|-----------------|---------------|
| | Number of Comparisons | Median <i>d</i> | Mean <i>d</i> | Number of Comparisons | Median <i>d</i> | Mean <i>d</i> | Number of Comparisons | Median <i>d</i> | Mean <i>d</i> |
| N+ | 57 | -.07 | -.11 | 30 | .12 | .11 | 85 | .11 | .05 |
| N- | 61 | .15 | .20 | 36 | .09 ^{bcc-} | .17 | 43 | -.24 | -.31 |
| E+ | 125 | .14 ^{c-} | .13 | 116 | .39 ^{a-} | .36 | 142 ^{a+c+} | .15 | .15 |
| Co | 62 | .17 ^{c-} | .20 | 42 | .40 | .39 | 42 | .21 | .17 |
| So | 51 | -.06 ^{c-} | -.02 | 23 | .00 | .15 | 35 | .02 | .02 |
| E- | 41 | .26 | .28 | 19 | .12 ^{bcc-} | .15 | 6 | -.01 | -.19 |
| O+ | 57 | .11 | .12 | 44 | .31 | .40 | 69 | .47 | .44 |
| O- | 8 | .30 | .30 | 8 | -.16 ^{c-} | -.15 | 24 ^{c+} | -.43 | -.40 |
| A+ | 43 | .16 | .06 | 40 | -.04 | -.01 | 45 ^{a+} | -.13 | -.19 |
| A- | 15 | -.08 | -.06 | 24 | .19 | .15 | 18 ^{a-} | .21 | .23 |
| C+ | 51 | .51 ^{a+} | .44 | 44 | .14 | .17 | 50 | -.49 | -.60 |
| C- | 5 | -.48 | -.49 | 4 | .30 | .15 | 2 | .75 | .75 |

Note: N = neuroticism; E = extraversion; Co = confidence-dominance; So = sociability; O = openness; A = agreeableness; C = conscientiousness.

^aModerated by study date (+ = positive relation; - = negative relation). ^bModerated by gender (♂ = males were higher; ♀ females were higher).

^cModerated by age group (+ = positive relation; - = negative relation).

lating moderating influences is one of the advantages that quantitative reviews of literature have over qualitative reviews. In many cases, effect sizes from studies could be calculated on the male and female participants separately. However, there were some instances when the authors listed the gender breakdown of the sample but only gave descriptive or inferential statistics on the whole sample. Therefore, gender was coded as the percentage of participants who were male, with values ranging from 0.00 in all female samples to 1.00 in all male samples. Furthermore, age groups were coded on a 4-point continuum: 0 = junior high; 1 = high school; 2 = college; 3 = adult.

Correlating effect sizes for the scientist-nonscientist comparisons with publication date, gender, and age revealed only two moderating influences on the FFM: effect sizes on C+ were positively related to publication date, $r(43) = .58$, $p \leq .001$, whereas E+ was negatively related to age group, $r(103) = -.43$, $p < .001$. In other words, the scientist-nonscientist difference in conscientiousness was greater for the more recent studies. Also, E distinguished scientists from nonscientists more for younger participants than for older ones. Furthermore, both subcomponents of E, confidence-dominance and sociability, are negatively related to age group, $r(63) = -.63$, $p < .001$ and $r(53) = -.38$, $p < .01$, respectively.

Scientists versus nonscientists: CPI. As mentioned earlier, because the FFM glosses over some important yet more specific personality dimensions, I also included meta-analytic results on the most commonly administered personality inventories on the target (scientists) and comparison (nonscientists)

samples: the CPI, the 16PF, and EPQ.² Presented as median effect sizes in Figure 1, the CPI scales that most clearly differentiated scientists from nonscientists were Achievement via Independence (Ai; $d = .71$), Achievement via Conformance (Ac; $d = .58$), Psychological Mindedness (Py; $d = .51$), and Sociability (Sy; $d = .49$). Quoting from Gough's *CPI: Administrator's Guide* (1987), a person who scores high on Ai has a "strong drive to do well; [and] likes to work in settings that encourage freedom and individual initiative" (p. 7). The same drive is characteristic of a person who scores high on Ac, but he or she "likes to work in settings where tasks and expectations are clearly defined" (p. 7). From this it can be inferred that scientists prefer settings that are structured and yet allow for individual initiative, an appealing characteristic of most scientific occupations.

Scientists versus nonscientists: 16PF. The magnitude of effect sizes were relatively small when comparing scientists to nonscientists using the 16PF, with none greater than .42 in magnitude (see Figure 2). In fact, only five scales had median effect sizes in the small to medium range (between .20 and .50): Factor O (Insecurity; $d = -.42$), Factor M (Imagination; $d = -.40$), Factor E (Dominance; $d = .38$), Factor L (Suspiciousness; $d = .30$), and Factor Q₃ (Self-Discipline; $d = .26$). This pattern, however, is similar to the one given by the FFM and the CPI.

²Scales were only included on the figures if they had a minimum of five comparisons between target and comparison group. Because there were fewer than five studies using the 16PF and EPQ comparing creative and less creative scientists, no meaningful generalizations could be drawn from their effect sizes.

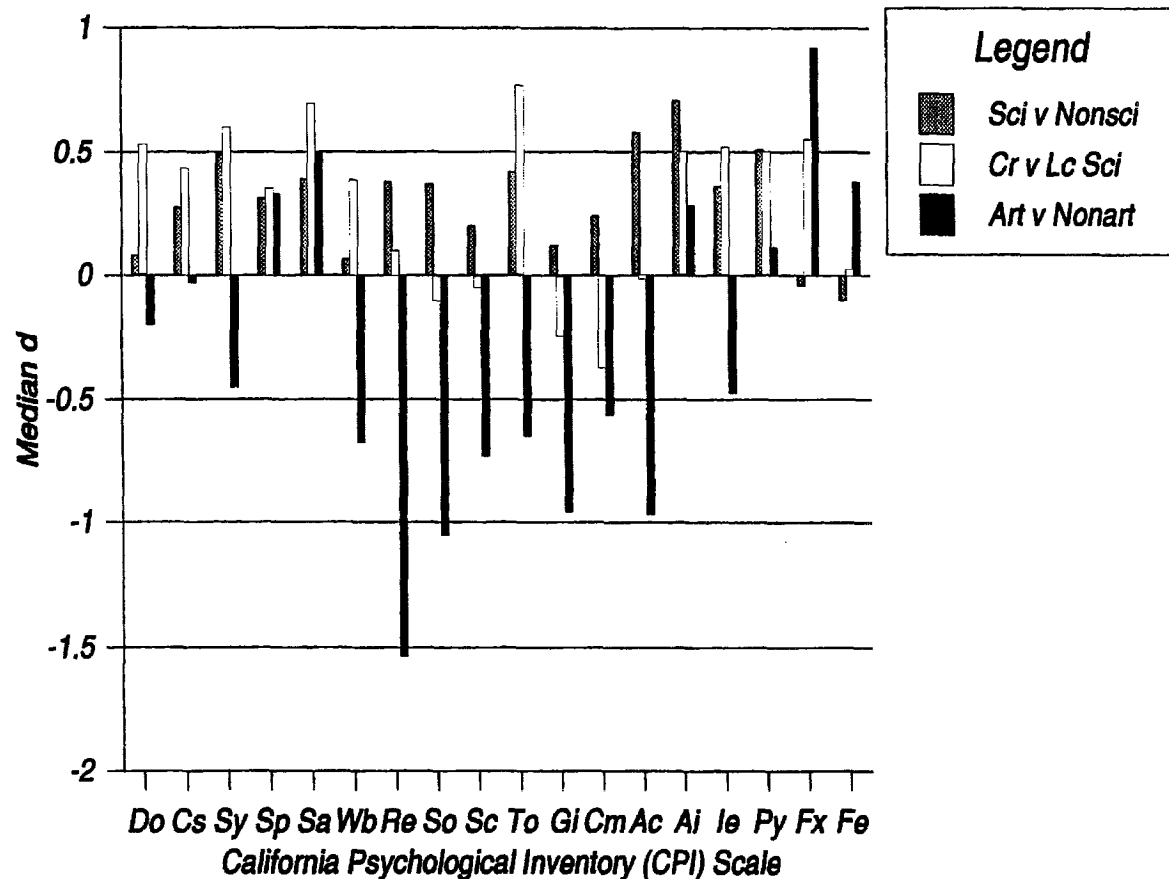


Figure 1. Personality comparisons of scientists versus nonscientists, creative versus less creative scientists, and artists versus nonartists: Median effect sizes (d) on the California Psychological Inventory. Do = Dominance; Cs = Capacity for Status; Sy = Sociability; Sp = Social Presence; Sa = Self-Acceptance; Wb = Well being; Re = Responsibility; So = Socialization; Sc = Self-Control; To = Tolerance; Gi = Good Impression; Cm = Communality; Ac = Achievement via Conformity; Ai = Achievement via Independence; Ie = Intellectual Efficiency; Py = Psychological Mindedness; Fx = Flexibility; Fe = Femininity.

Relative to nonscientists, scientists are confident, secure, conventional, dominant, skeptical and disciplined.

Scientists versus nonscientists: EPQ. Finally, as seen in Figure 3, scientists are moderately more extraverted ($d = .33$) and moderately more prone to psychoticism ($d = .45$) than nonscientists. Again, the finding on extraversion is surprising only if one fails to distinguish the confident-dominant dimension from the sociability dimension. Indeed, according to H. J. Eysenck (1990), Factor E is comprised of characteristics such as *assertive, dominant, surgent, active, and sensation seeking* in addition to those of *sociable, lively, carefree, and venturesome*. Interestingly, scientists were also almost a half a standard deviation higher than nonscientists on P, which is formed by the traits of *aggressive, cold, egocentric, impersonal, impulsive, antisocial, unempathic, creative, and tough-minded* (H. J. Eysenck, 1990).

Creative scientists versus less creative scientists: FFM. As seen in Table 3, the traits that most strongly distinguish creative from less creative scientists were E+ (median $d = .39$), and O+ (median $d = .31$; see Table 3). Moreover, all of the effect of E+ came from the confidence component, and there was no effect for the sociability component. Scales and items from E+ (confidence) were *achieving, ambitious, confident, dominant, self-accepting, and self-esteem*, whereas scales and items of O+ were *aesthetic, creative, curious, flexible, imaginative, intelligent, and open*. Although only based on four comparisons, the C- dimension also had a modest effect size differentiating creative from less creative scientists ($d = .30$). Creative scientists were approximately a third of a standard deviation higher than less creative scientists on direct expression of needs and psychopathic deviance. In short, creative scientists are more aesthetically oriented, ambitious, confident, deviant, dominant, expressive, flexible, intelligent,

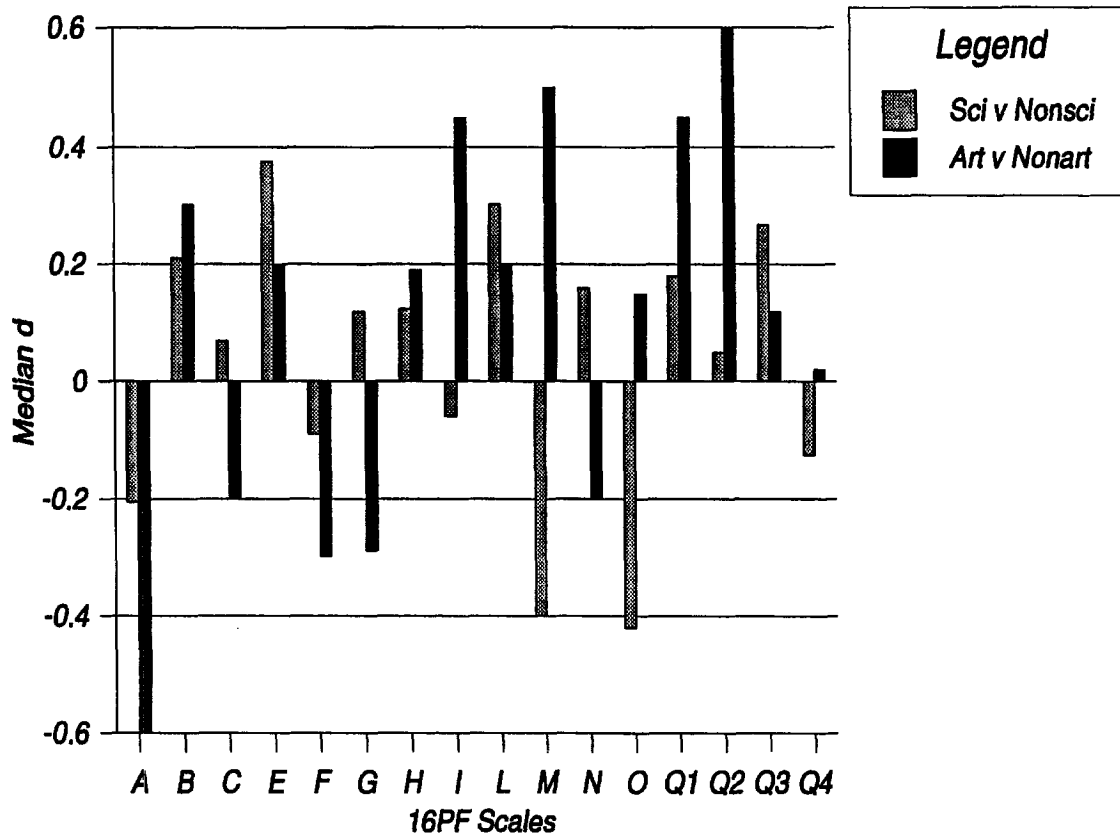


Figure 2. Personality comparisons of scientists versus nonscientists, creative versus less creative scientists, and artists versus nonartists: Median effect sizes (d) on the Sixteen Personality Factor. A = Warmth; B = Intelligence; C = Emotional Stability; E = Dominance; F = Impulsivity; G = Conformity; H = Boldness; I = Sensitivity; L = Suspiciousness; M = Imagination; N = Shrewdness; O = Insecurity; Q₁ = Radicalism; Q₂ = Self-Sufficiency; Q₃ = Self-Discipline; Q₄ = Tension.

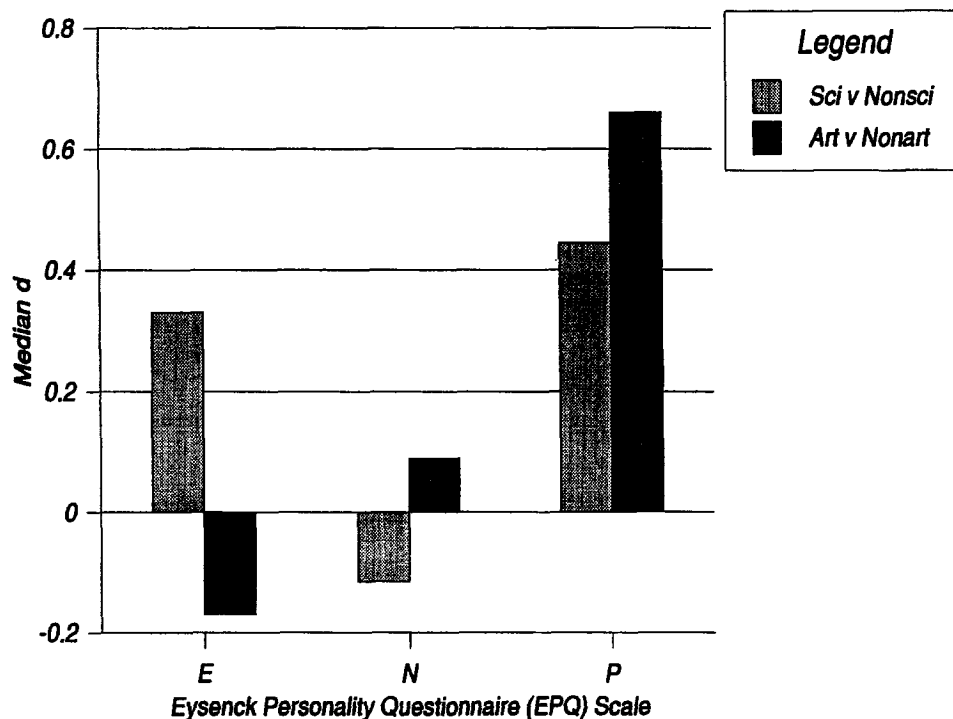


Figure 3. Personality comparisons of scientists versus nonscientists, creative versus less creative scientists, and artists versus nonartists: Median effect sizes (d) on the Eysenck Personality Questionnaire. E = Extraversion; N = Neuroticism; P = Psychoticism.

and open to new experiences than their less creative peers.

Again, effect sizes were moderated by some of the study variables. For instance, effect sizes for male participants were larger on N-, $r(34) = .36, p < .05$, and smaller on E-, $r(19) = -.59, p < .01$, and younger scientists tended to be more conventional, O-, $r(8) = -.86, p < .01$, more emotionally stable, N-, $r(34) = -.34, p < .05$, and less introverted, E-, $r(19) = .56, p < .01$. Finally, studies published earlier tended to report greater effects on E+, $r(19) = -.21, p < .01$. In other words, the ability of extraversion to distinguish creative from less scientists diminished across time.

Creative scientists versus less creative scientists:

CPI. Eight of the 18 CPI scales yielded median effect sizes greater than or equal to .50 (see Figure 1): Tolerance (To; $d = .77$), Self-acceptance (Sa; $d = .69$), Sociability (Sy; $d = .60$), Flexibility (Fx; $d = .55$), Dominance (Do; $d = .53$), Intellectual Efficiency (Ie; $d = .52$), Achievement via Independence (Ai; $d = .50$), and Psychological Mindedness (Py; $d = .50$). This pattern of scores on the CPI suggests a personality structure that is tolerant and open-minded, self-accepting, outgoing, confident, ambitious, persistent, and is a good judge of character.

Personality and Artistic Creativity

Artists versus nonartists: FFM. Examining the personality characteristics that distinguish artists from nonartists (see Table 3), it can be seen that the dimensions of C+ ($d = -.49$), O+ ($d = .47$), and O- ($d = -.43$) have the highest median effect sizes (excluding C- for too few comparisons). Put into more specific trait or scale language, artists, compared to nonartists, were less cautious, conscientious, controlled, orderly, and reliable; they were more aesthetic, creative, curious, imaginative, open to experience, sensitive, and original; and finally, they were less conventional, rigid, and socialized. Artists were roughly a half a standard deviation higher on openness and a half a standard lower on conscientiousness than nonartists.

Effect sizes comparing artists to nonartists were moderated by publication date and age. Specifically, more recent studies tended to report smaller effects on A-, $r(18) = -.65, p < .01$, and E+, $r(142) = -.24, p < .01$, and a larger effect on A+, $r(45) = .30, p < .05$. Moreover, older samples of artists tended to have stronger effects on E+, $r(142) = .19, p < .05$, and O-, $r(24) = .49, p < .05$. This last finding suggests that as artists get older they become more conventional and

less open and radical. There were no moderating effects for gender.

Artists versus nonartists: CPI. As seen in Figure 1, the comparisons of artists to nonartists yielded a striking pattern of results on the CPI. Nine of the 18 scales resulted in at least medium effect sizes ($d \geq .50$), and all but one of these were negative in direction: Responsibility (Re; $d = -.154$), Socialization (So; $d = -.105$), Achievement via Conformance (Ac; $d = -.97$), Good Impression (Gi; $d = -.96$), Flexibility (Fx; $d = .92$), Self-control (Sc; $d = -.73$), Well-being (Wb; $d = -.67$), Tolerance (To; $d = -.64$), and Communitarity (Cm; $d = -.56$). The most striking thing about this pattern of results is how low artists are on the socialization-control scales of Re, So, Sc, To, Gi, Wb, and Cm. Such a strong pattern of results suggest personalities that are conflicted, impulsive, nonconformist, rule-doubting, skeptical, fiercely independent, and not concerned with obligations or duties. The only CPI scales on which artists were higher than norms were Fx and Sa, suggesting that although they are conflicted and rebellious, artists seek change, were easily bored, and yet see themselves as talented and worthy people.

Artists versus nonartists: 16PF. As shown in Figure 2, the Factor scores that most strongly distinguish artists from nonartists were Factor A (Warmth; $d = -.60$), Factor Q₂ (Self-Sufficiency; $d = .60$), Factor M (Imagination; $d = .50$), Factor I (Sensitivity; $d = .45$), and Q₁ (Radicalism; $d = .45$). Other medium effect sizes included Factors B (Intelligence; $d = .30$), F (Impulsivity; $d = -.30$), and G (Conformity; $d = -.29$). Again, the picture painted by the 16PF is consistent with that of the FFM and the CPI: Artists, compared to nonartists, are hostile, independent, open to experience, sensitive, radical, intelligent, and nonconforming. The only real surprise is the low impulsivity score of artists on Factor F. However, this may be explained as a matter of semantics. Cattell, Eber, and Tatsuoka (1970) labeled Factor F *impulsivity*, but the low dimension is anchored by terms such as *prudent*, *sober*, *serious*, so it may be more accurate to say that artists are more sober and serious than nonartists rather than less impulsive. Furthermore, the high pole of the factor is anchored by terms such as *happy-go-lucky* and *heedless*, characteristics that are generally not associated with artists.

Artists versus nonartists: EPQ. A similar portrait of the artist is painted by the EPQ (see Figure 3). The only EPQ scale that distinguished artists from

nonartists was the P scale ($d = .66$), which suggests that artists are more aggressive, cold, egocentric, impulsive, antisocial, creative, and tough-minded than most people.

Longitudinal Investigations Into Temporal Precedence of Personality and Creativity

Granted the usefulness of cross-sectional correlational data, the important issue that longitudinal studies can address that cross-sectional ones cannot is whether the distinguishing traits of creative people measured at an earlier time in life continue to distinguish them from their peers later in life. Showing that traits such as *independence*, *self-confidence*, *openness*, *impulsivity*, *hostility*, and *dominance* distinguish highly creative people from less creative people early in life may not necessarily mean these traits precede creativity, but such a demonstration is consistent with temporal precedence.

Indeed, Rosenthal and Rosnow (1991) argued that there are three criteria for establishing causality: covariation, temporal precedence, and ruling out extraneous variable explanations. A truism taught to every introductory psychology student is "correlation does not imply causation." However, if correlation does not imply causation, it is equally true that correlation is a prerequisite for causation (Rosenthal & Rosnow, 1991). Correlative evidence is not irrelevant for establishing a causal connection between two variables; it is simply not sufficient evidence. The second criterion—temporal precedence—is that *X* must precede *Y* in time, if it is ever to be a cause of *Y*. The third and final criterion for causality is that extraneous variable explanations must be ruled out. One does this in an experimental design by holding all but the independent variable constant. Such constancy of extraneous variables is precisely what is missing in correlational designs, and it is for this reason that they are not sufficient for causation and have been criticized accordingly by experimentalists. However, if experimental designs best address the third criterion (ruling out extraneous variable explanations), then one could argue that correlational designs address the first criterion (covariation) and longitudinal designs the second criterion (temporal precedence).

To return to the issue at hand, personality and creativity, if certain traits do not distinguish younger creative people from their less creative peers, but do so later, then they clearly cannot precede creativity. In short, we can rule out (falsify) the hypothesis that they are temporally prior to creative achievement if we can demonstrate that they only distinguish creative groups later but not earlier in life. Can we falsify the hypothesis? Are there any longitudinal

studies that find distinguishing traits appear only after creative achievement, but not before or during? The answer appears to be no. Every longitudinal study has found that the same traits that distinguish creative people later in life also distinguish them earlier in life (Albert, 1994; Camp, 1994; Dudek & Hall, 1991; Feist, 1995a; Getzels & Csikszentmihalyi, 1976; Helson, 1987; Helson, Roberts, & Agronick, 1995; Perleth & Heller, 1994; Schaefer, 1973; Stohs, 1990; Terman, 1954). For instance, the stability of personality traits that distinguish creative people was reported by Dudek and Hall (1991). Studying three groups of architects, they concluded that: "It is evident that Group III [the less creative architects] retained its social conformity and Group I [the creative architects] its spontaneity and independence over the 25 years" (p. 218). In addition, Helson et al. (1995) found that creative women at age 52 were consistently rated by observers at age 21 and age 43 as being aesthetically oriented, interesting, driven, rebellious, independent; and as not being conventional, conservative, or submissive. Moreover, Schaefer (1973) conducted a 5-year follow-up investigation of creative young adults who were originally tested in adolescence. The adolescent sample consisted of 100 participants in each of the following four criterion groups: creative art/writing boys, creative science boys, creative art girls, and creative writing girls. There were also 100 participants in four matched control groups. Roughly half of each sample participated in a replication 5 years later. Three scales distinguished the creative sample from the comparison sample at both ages, namely, autonomy, self-control, and nurturance. Taken in total, longitudinal studies of the creative personality over time suggest that the personality structure of highly creative people tends to remain relatively stable. This is true especially for the dispositions toward independence and autonomy. If any change occurs, it tends to be a decrease in personality differences with age.

Discussion

The most striking outcome of the meta-analysis was that regardless of which measure or taxonomy was used to assess personality or creativity, a consistent and clear portrait of the creative personality in science and art has emerged: Creative people are more autonomous, introverted, open to new experiences, norm-doubting, self-confident, self-accepting, driven, ambitious, dominant, hostile, and impulsive. Out of these, the largest effect sizes are on openness, conscientiousness, self-acceptance, hostility, and impulsivity. Yet, creative people in art and science do not completely share the same unique personality profiles: Artists are distinguished more by their emo-

tional instability, coldness, and their rejecting group norms than are scientists. For example, a number of large effect sizes ($d \geq .80$; see Cohen, 1988) distinguished artists from nonartists on the CPI socialization scales of Responsibility, Socialization, Good Impression, and Achievement via Conformance. Creative scientists exhibited very small effects on these socialization scales. Finally, less creative scientists, compared with the effect sizes of their more creative peers in science and in art, are more conscientious, conventional, and closed-minded, with effect sizes being in the medium range (ds between .30 and .40).

Conceptual Integration of Personality and Creativity

Another way to think about these findings is to integrate them by parsing dispositions into various psychological categories, namely, social, cognitive, motivational, and affective (see Table 4). By so doing, dispositions are organized into related clusters. Whether a trait is social or not is determined by the extent to which it concerns one's attitudes or interactions towards others. For instance, the tendency to question social norms and to be relatively independent of group influence are social dispositions that are commonly found in creative people. Also, having a greater than normal desire to remove oneself from social interaction and being overstimulated by novel social situations (introversion) is frequently observed in highly creative people, especially in the arts and sciences. Indeed, I have argued elsewhere that one overarching principle of creative thought and behavior is its relatively asocial or even antisocial orientation (Feist, in press-b). To be creative, one must be able to spend time alone and away from others. The process of creating usually requires solitude (Storr, 1988). One cannot write a novel, compose a symphony, or paint a painting when socializing. Of course, social interaction may be an impetus for a novel, symphony, or painting, but its execution is almost always a solitary event.

Creative people have a stronger than usual need to focus their attention and energies inward and to be

separate and unique from others. Indeed, anyone who thwarts or questions these goals may be aggressed against. In this sense, the observed levels of hostility in creative people may be a defense of their creations against others who either inadvertently detract from time spent creating or who criticize or misinterpret their heretofore novel solution or product. Recall that originality is a necessary (but not sufficient) ingredient in the definition of creativity. To be original is to be unique and different from others—whether consciously and willfully or not. It is much easier to be different and develop one's own individual perspective when alone. Desiring to spend time alone and away from social influence could also be related to developing confidence and faith in one's beliefs and attitudes. Finally, independence in creative people goes along with sticking to one's beliefs in the face of doubt and skepticism by others. Submissiveness and expressed creativity make unlikely bed partners.

Although not exclusively cognitive, openness, flexibility, and imagination can be categorized as cognitive dispositions because they each involve latent response tendencies toward processing information (see Table 4). The disposition of openness involves first and foremost a response style of approach or avoidance to novel ideas, people, or situations. As others, such as McCrae (1987), have argued, openness is closely related to having a flexible cognitive style when approaching problems, that is, being able to "think outside the box" and not being tied to any one perspective (functional fixedness). Openness and flexibility in turn are related to having the imagination to think of how things could be, not just how they are. By being receptive to different perspectives, ideas, people, and situations, open people are able to have at their disposal a wide range of thoughts, feelings, and problem-solving strategies, the combination of which may lead to novel and useful solutions or ideas.

The third dispositional dimension is motivation. Creative people in general also tend to be motivated by ambition and a need to work and do well (see Table 4). It is one thing to have to social and cognitive dispositions that make creative behavior more likely, but one still has to have the perseverance, drive, and

Table 4. *Summary of Dispositional Dimensions That Distinguish Artists and Scientists*

| Artists' Traits | | | | Scientists' Traits | | |
|-----------------|-------------|--------------|-------------|--------------------|-----------|--------------|
| Social | Cognitive | Motivational | Affective | Social | Cognitive | Motivational |
| Norm-Doubting | Open | Driven | Anxious | Dominant | Open | Driven |
| Nonconforming | Imaginative | Ambitious | Emotionally | Arrogant | Flexible | Ambitious |
| Independent | | Impulsive | Sensitive | Hostile | | |
| Hostile | | | | Self-confident | | |
| Aloof | | | | Autonomous | | |
| Cold | | | | Introverted | | |
| Introverted | | | | | | |

discipline to actually carry out the work. If an idea or piece of work is to fill a societal void and be useful, the second criterion of creativity, one must go beyond the first stage of creativity, idea generation, and into the second stage, expression. As Reichenbach (1938) long ago argued, there is the stage of discovery (idea generation) and the stage of justification (carrying out the idea). Ideas without the drive and discipline to be crafted and expressed in a socially useful manner are void of their potential impact and power. Therefore, the most creative people, by definition, are those who have had the drive and motivation to express their ideas in a socially acceptable medium, even if they may have been generations ahead of their time. By this argument, there are no doubt untold thousands of people who may have had very original and novel ideas, but who lacked the disciplined motivation to fully carry out the insight, and these people are forgotten to history. In some sense, there may appear to be an irony or paradox here: The most creative people are those who often prefer to be away from other people, but who master expressing their ideas in media that others can understand and appreciate. This is precisely what makes the creative act inherently social—it must be expressed in a social context and ultimately be understood by others if it is to be creative by the definition given earlier, namely, be both novel and useful.

The final category of disposition that systematically covaries with creative behavior, at least in the arts, is that of affective dispositions (see Table 4). More specifically, relatively high levels of anxiety and emotional sensitivity appear to be common among creative artists. The essence of much artistic creativity, whether visual, verbal, or musical, is the expression of deep emotion, of experiences that move and touch. Being sensitive to these internal affective states appears to almost be a prerequisite for being creative in these domains. Indeed, a vast literature now exists on the connection between artistic creativity and being sensitive to one's affective states (i.e., bipolar disorder in particular; see Andreasen, 1987; Andreasen & Glick, 1988; Bowden, 1994; Feist, *in press-a*; Jamison, 1993; Ludwig, 1995; Richards, Kinney, Lunde, Benet, & Merzel, 1988; Shaw & Runco, 1994). Given the elevated levels of affective disorders in the artistic professions, as Ludwig (1995) concluded, there does appear to be a "price of greatness."

The primary function of traits is to lower thresholds for trait congruent behavior (Brody & Ehrlichman, 1998; Ekman, 1984; M. W. Eysenck, Mogg, May, Richards, & Mathews, 1991; Rosenberg, *in press*). For instance, being high in trait hostility functionally lowers one's threshold for anger or aggressive behavior. Furthermore, to the extent that two or more dispositions consistently covary, they could

function to lower a particular behavioral threshold. This line of reasoning suggests that the reported pattern of personality traits may well function to make creative behavior more likely. More specifically, withdrawing from others, being open to ideas and experience, being confident in one's abilities, and having a greater than normal desire to achieve recognition, may each be lowering the threshold for finding and solving problems novelly and adaptively. Of course, the direction of causality may also go the other direction: Having a disposition to solve problems creatively might lower the thresholds for withdrawing from social contact, being open to uncommon ideas, and to being confident in one's ideas. Or more likely, that the path of causality may be a more complex nonrecursive (bi-directional) one. Until more systematic longitudinal research has been done, the direction of influence will remain unknown.

To combine the dispositional dimensions and the function of traits arguments, I present in Figure 4 a tentative model for the paths from specific biological processes and mechanisms to psychological dispositions to creative thought and behavior (cf. Feist, 1993; Feist & Gorman, 1998; Helmreich, Spence, Beane, Lucker, & Matthews, 1980). Although growing literatures do exist on creativity and its relation to the first two components (genetics and temperament; H. J. Eysenck, 1995; Karlson, 1991; Katzko & Monks, 1995; Nichols, 1978; Reznikoff, Domino, Bridges, & Honeyman, 1973; Saklofske & Zeidner, 1995; Vernon, 1989), any in-depth discussion of them is beyond the scope of this article. Suffice it to say that current evidence suggests genetic and temperamental factors explain small to moderate amounts of direct variance in creative behavior, as well as indirect variance via social, cognitive, motivational, and affective dispositions. As seen in Figure 4 and elaborated in Table 4, the general line of reasoning is as follows: Having relatively low thresholds for arousal both at the central and peripheral nervous systems (see Eysenck's model in the following), introverted people are likely to withdraw from overly arousing social stimulation. In so doing, their threshold for doubting social norms and being relatively little influenced by groups is lowered as is their tendency towards having an intrinsic orientation and being motivated by intrinsic interests. Furthermore, lack of concern for social niceties may lower a person's thresholds for being arrogant and hostile towards others, just as having faith in one's own perceptions and attitudes may lower a person's threshold for being self-confident. Coincident with these social dispositions are cognitive dispositions towards openness, flexibility, and fluency of ideas. Creative people are able to approach solutions in novel and original ways and are not as likely to be functionally fixated as less creative people.

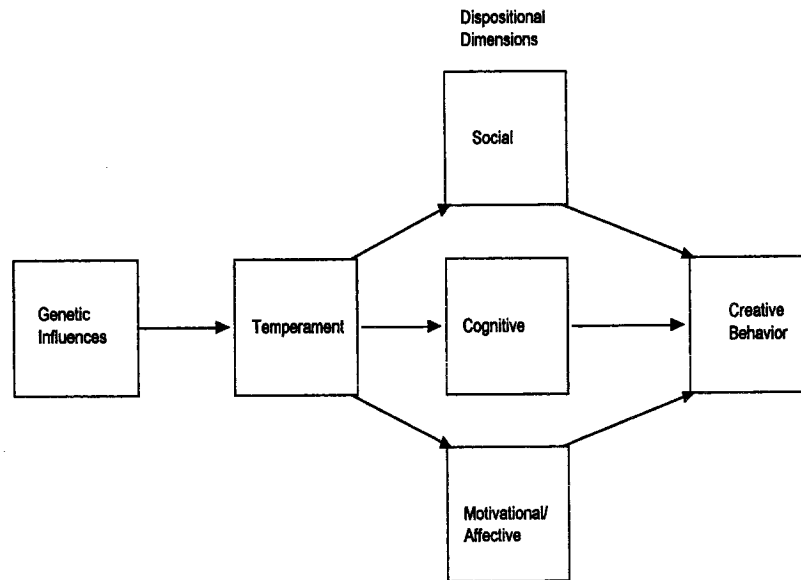


Figure 4. Model of the plausible mechanisms underlying the influence of personality on creative behavior.

Three important qualifications are necessary concerning this line of reasoning. First, it is tentative and speculative. Although based on current empirical findings, the paths of influence from genetic disposition and temperament to personality dispositions to creative behavior are long, precarious, and in need of much more prospective, longitudinal, and, wherever possible, experimental research. Second, this line of argument is not intended to fit each of the different varieties of creative behavior equally well; it is a generalization and therefore necessarily is more applicable to some forms of creativity than others. Finally, the temporal flow is not as linear as the model may suggest. Granted, genetic and temperamental mechanisms are logically prior to personality and creative behavior, but any temporal sequence between dispositions and creative behavior may be as bi-directional as it is linear.

Extant Models of the Creative Personality

Other researchers have recently proposed their own models concerning personality and creative behavior, and therefore a quick review of some of the major ones may be in order. Perhaps the most ambitious and inclusive theory of personality and creativity is the one recently offered by H. J. Eysenck (1993, 1995). Eysenck argued for a causal theory of creativity that begins with genetic determinants, hippocampal formation (dopamine and serotonin), cognitive inhibition, and psychoticism, which in turn leads to trait creativity and ultimately creative achievement. The most appealing aspect of this

model, although speculative in parts, is that it is testable. What is of particular interest in Eysenck's model are the relations between genetic and neurochemical processes and trait creativity (i.e., personality), which is the direct precursor to creative achievement. For instance, a key component implicated in Eysenck's biologically based model is cortical arousal. High arousal is associated with a narrowing of attention, whereas low arousal is associated with a widening of attention. What makes such a link plausible is the research of Eysenck as well as others who have found that creativity depends on a wide attentional focus and an expansion of cognitive searching to the point of overinclusion, a defining characteristic of psychoticism (H. J. Eysenck, 1995; Isen, Daubman, & Nowicki, 1987; Jamison, 1993; Mendelsohn, 1976). From these speculations it may follow that creative thinking is related to low cortical arousal. Colin Martindale and his colleagues have established a research program that has tested this idea systematically and has consistently found support for it (Martindale, 1981; Martindale & Armstrong, 1974; Martindale & Greenough, 1973; Martindale & Hasenfus, 1978; Martindale, Hines, Mitchell, & Covello, 1984). For example, as measured by stress, high arousal reduces creative solutions to problems (Martindale & Greenough, 1973), and as measured by an electroencephalograph (percentage time spent in alpha states) low arousal was related to more creative problem solving (Martindale & Armstrong, 1974). However, low cortical arousal is evident only during the inspiration stage and not throughout creative insight or during baseline measures. In fact, creative individuals tend to have higher resting arousal

levels (Martindale & Armstrong, 1974), which is consistent with the high cortical arousal of introversion and its relation to creativity (H. J. Eysenck, 1990, 1995).

There is evidence, however, that it is not merely psychoticism that is most strongly associated with creativity, but psychoticism tempered by high ego-strength or ego-control. Paradoxically, creative people appear to be simultaneously very labile and unstable and yet can be rather controlled and stable (Barron, 1963; H. J. Eysenck, 1995; Feist, in press-a; Fodor, 1995; Richards et al., 1988; Russ, 1993). As Barron (1963) argued over 30 years ago:

Thus the creative genius may be at once naïve and knowledgeable, being at home equally to primitive symbolism and to rigorous logic. He is both more primitive and more cultured, more destructive and more constructive, occasionally crazier and yet adamantly saner, than the average person." (p. 224)

Moreover, recent evidence suggests that various forms of mental illness are more common among creative artists than creative scientists (Ludwig, 1995).

To the extent that psychoticism and creative achievement are related, there may be other common pathways that make their association likely. For instance, Woody and Claridge (1977) wrote "that both [psychoticism and creativity] may tap a common factor associated with the willingness to be unconventional or engage in mildly antisocial behavior" (p. 247). As mentioned earlier, radical, unconventional, asocial, or even antisocial behaviors are probably more common among artists than scientists, but these traits are nonetheless elevated in creative scientists relative to norms (Bachtold, 1976; Barton & Cattell, 1972; Getzels & Csikszentmihalyi, 1976; Helson, 1971; Rushton, 1990; Rushton, Murray, & Paunonen, 1983; Wilson & Jackson, 1994). Whether unconventionality is antecedent to or consequent of creativity is in need of further empirical scrutiny.

From a different theoretical tradition, Russ (1993) proposed a model that conceptually integrates much of the known empirical findings concerning the relation between creativity and affective dispositions. For instance, she hypothesized that access to affect-laden thoughts (primary process thought and affective fantasy) and openness to affective states leads to the divergent thinking abilities of free association, breadth of attention, and fluidity of thought, as well as to the transformation abilities of shifting sets and cognitive flexibility. These paths are essentially the same as Eysenck (1995) proposed connecting affective states, overinclusive thinking, and creativity. Furthermore, Russ suggested that taking affective pleasure in challenge and being intrinsically motivated often results in an increased sensitivity to problems and problem

finding. Being sensitive, open, and flexible in thought in turn are important personality dispositions related to creativity. In short, both Eysenck and Russ have developed theoretical models based on empirical findings that suggest psychological mechanisms underlying the connection between affective states, affective traits, cognitive dispositions, and creative ability and achievement.

Yet another integrative model of personality and creativity comes from Mansfield and Busse (1981; cf. Helmreich et al., 1980). Not only did their model include paths between personality and creativity, but it also included developmental antecedents as precursors of personality. Based on empirical findings, they suggested that particular developmental antecedents precede personality characteristics, which in turn precede the creative process. The developmental antecedents associated with creative people are low emotional intensity of parent-child relationship, parental fostering of autonomy, parental intellectual stimulation, and apprenticeship. These, in turn, are antecedent to the personality traits of *autonomy, flexibility and openness, need to be original, commitment to work, need for professional recognition*, and finally *aesthetic sensitivity*. Lastly, Mansfield and Busse proposed that these traits facilitate the crucial stages involved in creative achievement: selection of the problem, extended effort working on the problem, setting constraints, changing constraints, and finally verification and elaboration. One interesting, yet difficult to support, assumption of their model is that personality precedes the development of creativity.

Finally, as mentioned previously, the field of personality psychology has recently witnessed the widespread adoption of the FFM (Digman, 1990; McCrae & John, 1992). Although few researchers have directly examined the relation between creativity and all of the dimensions of the FFM (Dollinger & Clancy, 1993; McCrae, 1987; Mumford, Costanza, Threlfall, Baughman, & Reiter-Palmon, 1993), enough work has accumulated on separate FFM dimensions and creativity that we can summarize the consistent trends. The FFM dimension with the most empirical support in relation to creativity is openness to experience. Are there theoretical explanations that account for the association? McCrae (1987) suggested there were three possible reasons for the link. First, open people may be more fascinated with the open-ended, creative, problem-solving tasks, and they may simply score higher on such tasks. Second, open people may have developed cognitive skills associated with creative, divergent thinking, namely, flexibility and fluidity of thought. Third, open people have an interest in sensation seeking and more varied experiences, and this experiential base may serve as the foundation for flexibility and fluency of thinking. Again, more research is needed to determine the validity of these conjectures.

Although the strongest evidence exists for the relation between openness and creativity, research has also supported a connection between each of the other four FFM dimensions and creativity: neuroticism (Andreasen & Glick, 1988; Bakker, 1991; Hammond & Edelman, 1991; Kemp, 1981; MacKinnon, 1978; Marchant-Haycox & Wilson, 1992); conscientiousness, or more precisely, lack of conscientiousness (Drevdahl & Cattell, 1958; Getzels & Csikszentmihalyi, 1976; Kemp, 1981; Shelton & Harris, 1979; Walker, Koestner, & Hum, 1995); introversion (Bachtold & Werner, 1973; Busse & Mansfield, 1984; Chambers, 1964; Cross, Cattell, & Butcher, 1967; Helson, 1977; Helson & Crutchfield, 1970; MacKinnon, 1978; Pufal-Struzik, 1992; Roco, 1993; Rossman & Horn, 1972; Rushton, Murray, & Paunonen, 1987; Zeldow, 1973); and lack of agreeableness (Barton & Cattell, 1972; Dudek, Bernèche, Bérubé, & Royer, 1991; H. J. Eysenck, 1995; Feist, 1993, 1994; Getzels & Csikszentmihalyi, 1976; Hall & MacKinnon, 1969; Helmreich, Spence, & Pred, 1988; Helson & Crutchfield, 1970; Lacey & Erickson, 1974; McDermid, 1965). Yet, it would be misleading to conclude that all who have explored the relation between the FFM and creativity have found each personality dimension to relate to creativity (Dollinger & Clancy, 1993; Feist, 1989; McCrae, 1987; Woody & Claridge, 1977). Many of these null or negative results, however, were conducted on general population samples and not on creative artists or scientists. Therefore, it may be that the five factors are more consistently related to artistic and scientific creativity than to everyday creativity. Future research must be conducted, however, before one can have more confidence in such a conclusion.

Future Directions and the Possibility of Integrating Personality and Social Psychology

By providing the first quantitative review of the personality and creativity literature, this article has aimed to demonstrate the viability and vitality of the consistent association between the two constructs. Furthermore, quantitative research synthesis is a first step towards demonstrating consensus (or lack thereof) for any new or established area of investigation. Yet, if this meta-analysis has begun to establish covariation and its magnitude between personality and creativity, researchers still do not know a tremendous amount about the causal role personality plays in creativity. The field has more recently begun to investigate the issue of temporal precedence, but ruling out extraneous variable explanations is for the most part unanswered. Even the research investigating temporal stability and temporal precedence leaves

much to be desired. For instance, no one has begun systematic investigation of creative potential and ability in young children and followed them through adolescence and adulthood. Such research has been conducted on intelligence and giftedness (see for example Terman, 1925, and Subotnik & Arnold, 1994), but not creativity per se. How stable is creativity from early childhood to adulthood? Are creativity and intelligence always distinct or do they diverge only after a certain age? How do the dispositions towards originality interact with the other psychological processes important to creative achievement—namely, development, cognition, or social influence? Finally, do other psychological processes account for the correlations between personality and creativity? Only once these questions are examined systematically and empirically can the theoretical models of the creative person be evaluated, tested, and modified (H. J. Eysenck, 1993, 1995; Feist & Gorman, 1998; Helmreich et al., 1980; Mansfield & Busse, 1981).

Empirical research over the last 45 years makes a rather convincing case that creative people behave consistently over time and situation and in ways that distinguish them from others. It is safe to say that in general a "creative personality" does exist and personality dispositions do regularly and predictably relate to creative achievement in art and science. Furthermore, to the extent that dispositional and situational factors play an important role in creative behavior, the topic of creativity can be an important tie that binds personality and social psychologists. More specifically, the results of this meta-analysis make it clear that one's dispositions towards social interaction and ability to express one's ideas in a social context play a critical role in the expression of creative behavior. To the extent that the dispositions one brings to social situations do in fact lower the threshold for creativity, the question of creative behavior, much like aggression, conformity, and prosocial behavior, presents social and personality psychologists an important challenge: to move beyond their historically *disciplinocentric* (i.e., the belief in the superiority of one's own discipline and the uselessness of others; Feist, 1995b) view of each other.

A simple listing of a few trait terms that consistently relate to creative behavior in and of itself is not all that telling. Discovering the consistent and robust patterns in the literature on personality and creativity has more important implications than simply a cataloging of trait correlates. It suggests something about the underlying organization and structure of personality, the function of traits, and where to look for the underlying physiological (genetic and temperamental) and psychological mechanisms linking these particular traits to creative behavior. One purpose of this meta-analysis was to provide the raw mate-

rial—the empirical consensus—so that future researchers can make educated guesses as to where to begin their search for the potential underlying physiological and psychological mechanisms of highly creative behavior.

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