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# The genetics and evolution of the general factor of personality

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ABSTRACT

Three studies tested the hypothesis that a general factor of personality (GFP) underlies diverse individual differences including altruism, the Big Five factors of Openness, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability, and the EAS temperament traits of Emotional Stability, Activity, and Sociability. In Study 1, 214 university students completed 36 personality scales. In Study 2, 322 pairs of monozygotic (MZ) and dizygotic (DZ) twins completed 29 5-point rating scales plus questionnaires. In Study 3, 575 pairs of 2- to 9-year-old Korean twins were rated by their mothers on 25 temperament scales. Factor analyses revealed a hierarchical organization with GFP at the apex and the Big Five and/or EAS temperament scales intermediate. The twin data show GFP has an early age of onset with 50% of the variance attributable to non-additive (dominance) genetic influence and 50% to unique, non-shared environmental influence. We discuss a life history matrix encompassing brain size, maturational speed, and longevity, plus emotional intelligence and the personality disorders, and suggest natural selection acted directionally to endow people with more cooperative and less contentious personalities than their archaic ancestors, or nearest living relatives, the chimpanzees.



## 1. Introduction

Twenty years ago, Rushton (1985, 1990) conjectured that "one basic dimension—*K*—underlies much of the field of personality" (1985, p. 445). He proposed that human social behavior is best understood as being part of a life-history—a suite of traits genetically organized to meet the trials of life—survival, growth, and reproduction. Building on Wilson (1975) theory of *r-K* reproductive strategies, which explains how animals colonize islands and reach population equilibrium, Rushton postulated that diverse personality traits covaried with altruism, intelligence, attachment styles, reproductive strategies, growth, longevity, and fecundity. Animals can adopt either of two strategies: produce a large number of fast maturing offspring but devote little parental care to ensure their survival (the *r*-strategy), or invest in a few slower-maturing, high quality offspring and devote considerable parental care to rearing them and ensuring that a much larger proportion survives (the *K*-strategy). Rushton dubbed his proposal "Differential *K* Theory" in order to emphasize that all humans were at the *K*-end of the continuum when compared against other species.

Research has confirmed many predictions from differential *K* theory. Among university students, Bogaert and Rushton (1989) found correlations between self-reported delinquency, sex guilt, mating effort (sexual permissiveness), general intelligence, and an aggregate *r-K* battery of items assessing family size, maturational speed, longevity, altruism, and reproductive effort. The results held when three separate measures of family background were statistically controlled. Although the average correlation between single indices of *K* was low, aggregate measures were predictive of a general factor on which single items loaded an average of +0.31.

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Additional support comes from a study by Rowe, Rodgers, Meseck-Bushey, and St. John (1989), who found that among adolescents, 36 to 49 percent of the variance in level of sexual intimacy engaged in by one sibling was predicted by the amount of delinquency engaged in by the other. Similarly, Rowe and Flannery (1994) found that high scores on measures of sexuality and delinquency loaded positively on measures of impulsivity, deceitfulness, and rebelliousness and negatively on parental affection and encouragement of achievement. Rowe, Vazsonyi, and Figueredo (1997) found that differences in delinquency correlated with mating effort (e.g., number of sexual partners) both within individuals and across siblings.

Figueredo, Vásquez, Brumbach, and Schneider (2004) provided further evidence for the *r-K* perspective by analyzing the National Survey of Midlife Development in the US (MIDUS), a nationally representative sample of 50,000 households that included 309 MZ and 333 DZ twin pairs aged 25- to 74-years. From 2000 questions, they grouped 253 into 30 life-history scales (e.g., quality of family relationships and altruism toward kin), medical symptoms (physical and psychological health), personality traits (the Big Five), and social background (e.g., financial security). The results showed a substantially heritable "Super-*K*" dimension comprising three lower-order (also heritable) factors (a lower-order *K* factor, a "co-vitality" health factor, and a general personality factor). In another analysis of the MIDUS data, Figueredo, Vásquez, Brumbach, and Schneider (2007) replicated these findings using a sub-sample of 2095 non-twin parents who by middle-age had chosen their life niches to marry (or not), to bear and raise offspring (or not), and to create social networks. In both studies, controlling for "social privilege" (by regressing out level of education, race, and family income) accounted for less than 10% of the variance and did not change the pattern of factor loadings.

Figueredo et al. (2006) also developed a 20-item Mini-*K* scale in which respondents stated their agreement with items such as "I do not give up until I solve my problems," and "I am closely connected to and involved in my community." Significant correlations were found between Mini-*K* and measures of delinquency, risk taking, impulsivity, and poor health. Rushton, Vernon, and Bons (2007) made a first attempt to find the genes underlying the *K* factor by examining whether polymorphisms of the brain regulator genes *MCPH1* and *ASPM* were associated with the Mini-*K* scale and measures of altruism and intelligence. Although the Mini-*K* scale correlated with altruism ($r = .25$, $P < .05$) and intelligence ($r = .23$, $P < .05$), no relationship was found between the genes and any of the criteria.

The issue of personality structure was recently brought to theoretical center stage by Musek (2007) who marshaled compelling evidence for what he dubbed "The Big One"—a general factor extracted from the Big Five (Goldberg, 1990). Following Costa and McCrae (1992), the Big Five consist of Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (Emotional Stability). Each factor is composed of six lower-level personality traits or facets. These are: for *Openness to Experience* (Fantasy, Aesthetics, Feelings, Actions, Ideas, and Values); *Conscientiousness* (Competence, Order, Dutifulness, Achievement Striving, Self-Discipline, and Deliberation); *Extraversion* (Warmth, Gregariousness, Assertiveness, Activity, Excitement Seeking, and Positive Emotions); *Agreeableness* (Trust, Straightforwardness, Altruism, Compliance, Modesty, and Tender-Mindedness); and *Neuroticism* (Anxiety, Hostility, Depression, Self-Consciousness, Impulsiveness, and Vulnerability). Reverse keying the Neuroticism factor gives loadings on the Big One of Calm, Gentle, Optimistic, Confident, Cautious, and Robust.

Musek (2007) analyzed data from three samples of differently-aged subjects across several assessment methods including self-reports and observer ratings: the Big Five Inventory, the Big Five Observer, the Positive Affect and Negative Affect Schedule, the Satisfaction with Life Scale, the Self-Liking and Competence Scale, and the International Personality Item Pool. Factor analyses yielded first, a Big Two model composed of *Stability* (Conscientiousness, Agreeableness, and low-Neuroticism) and *Plasticity* (Openness and Extraversion), followed by a higher-order factor that explained 60 percent of the source variance. Individuals high on this dimension can be characterized as being emotionally stable, agreeable, conscientious, extraverted, and intellectually open as opposed to neurotic, disagreeable, careless, introverted, and closed-minded. Further, they expressed a sense of well-being, satisfaction with life, and self-esteem. Musek described the Big One as an optimum blend of all societally valued personality dimensions close to the evaluative factor of affective meaning reported by Osgood, Suci, and Tannenbaum (1957).

Although Musek (2007) did not cite the work on *r-K* life history theory, he conjectured that the general factor would be "deeply embedded in our evolutionary, genetic and neurological endowment" (p. 1228). On the other hand, Penke, Denissen, and Miller (2007) and 22 peer commentators discussed the evolutionary genetics of personality in detail. They concluded that whereas genetic variation in *cognitive ability* came about through *unidirectional selection*, genetic variation in *personality* was due to *environmentally contingent balancing selection*. Intelligence was seen as conferring fitness across all environments while personality traits conferred enhanced fitness to particular niches. For example, although low agreeableness typically brings about interpersonal difficulties, it might prove advantageous in a harsh social environment. Other hypotheses raised included: *negative frequency-dependent balancing selection*, a variant of balancing selection which occurs when intense competition within a niche favors individuals who opt out of the competition (Figueredo & Gladden, 2007); *stabilizing selection*, which favors middling rather than extreme scores (MacDonald, 2005); *sexual selection* for more charming mates (Miller, 2007); and *neutral selection*, which in effect, is no selection at all (Campbell, 2007).

In this paper, following Rushton (1985, 1990, 2004b), we hypothesize that a process of *unidirectional selection* has operated on a general factor of personality just as it has on one for cognitive ability. Neither Penke, Denissen, and Miller (2007) nor any of the commentators referred to directional selection or to a general factor in personality. Perhaps it is only after a super-factor such as *r-K* has been is identified, with a clearly defined positive and negative pole (analogous to the high and low ends of the general factor of mental ability), that it becomes possible to see how unidirectional selection might occur for personality.

The position to be presented here grows directly out of Darwin's (1871) view that natural selection endowed modern humans with larger brains, increased levels of general and social intelligence, and a more ethical and prosocial personality than "primeval man and his ape-like progenitors" (p. 159). Darwin wrote of increased levels of human qualities such as "courage, sympathy, and faithfulness," and a "need for approval by others," with a concomitant decrease in the frequency of "selfish and contentious people" who "will not cohere, and without coherence nothing can be effected" (p. 159). Darwin described how moral and inter-personal skills go hand in hand with the greater intelligence modern people posses.

Directional selection is indicated when traits manifest *non-additive genetic variance*, i.e., dominance effects. Non-additive genetic variance implies that a trait has been under recent natural selection, which is expected for a Darwinian fitness character and indicates the presence of advantageous alleles that suppress less advantageous alleles (Falconer, 1989; Fisher, 1954; Jensen, 1998; Penke et al., 2007). Dominant alleles cumulate more rapidly. While it is well known that most traits are heritable, it is less well known that both personality traits and IQ show non-additive genetic variance (Bouchard & McGue, 2003; Jensen, 1998; Penke et al., 2007).

In this article, we report three factor analytic studies, including two of twins, to examine the hypotheses that: (1) a general factor of personality (GFP) underlies multifarious individual differences, and (2) the GFP shows non-additive genetic variance. We use a wide range of tests and the twin data to explore the "genetic and environmental architecture" of the GFP. Since one of the samples consists of 2- to 9-year-old South Korean twins, we also test whether the GFP has an early onset and is consistent across cultures.

To simplify, it is assumed that monozygotic (MZ) twin pairs share 100 percent of their genes, while dizygotic (DZ) twin pairs share, on average, only 50 percent of their genes. When the twins are reared together, they are assumed to share environmental influences. Thus, the comparison of MZ and DZ twin similarities and differences allows for the estimation of genetic and environmental influences (Bouchard & McGue, 2003; Falconer, 1989; Plomin, DeFries, McClearn, & McGuffin, 2001). The total genetic variance ($h^2$, broad heritability) can be estimated as $2^*(\mathrm{MZ}r - \mathrm{DZ}r)$, i.e., doubling the difference between the MZ and DZ similarities; the *shared* environmental influences that make family members similar to one another can be estimated by $\mathrm{MZ}r - h^2$; and the *non-shared* environmental influences that are experienced uniquely and make family members different from one another by $1 - \mathrm{MZ}r$. Further, the genetic variance can be separated into additive (A) and non-additive (allelic interaction) or dominance (D) components, i.e., by $\mathrm{D} = h^2 - 2\mathrm{DZ}r$ and $\mathrm{A} = h^2 - \mathrm{D}$ (because non-additive genetic variance lowers correlations between direct line relatives such as DZ twins). Finally, bivariate heritabilities can be estimated using the correlations across twins and across traits to generate a genetic variance–covariance matrix (the *G* matrix).

## 2. The University Of Western Ontario Undergraduate Sample

### 2.1. Method

The data for this study were made available to us from a study by Ashton, Jackson, Helmes, and Paunonen (1998) who found a correspondence to the Big Five in personality tests measuring 36 trait dimensions constructed agnostically as regards the factor structure of personality (see Table 1 for a list of the traits, their descriptions, and test–retest reliabilities). The sample of undergraduates available ($N = 214$; 53% female) had completed all 20-scales of the Personality Research Form (PRF: Jackson, 1967, 1984) and all 15-scales of the Jackson Personality Inventory (JPI: Jackson, 1970, 1994), as well as the PRF Desirability scale. The PRF was constructed as a measure of most of the traits regarded by Murray (1938) to be a comprehensive list of human psychological needs. The JPI was developed to reflect interpersonal, cognitive, and value orientations not represented in the PRF. Both questionnaires have been widely used in basic and applied research. Here, we first followed Ashton, Jackson, Helmes, and Paunonen (1998) and extract the Big Five, and then Musek (2007) and extract the Big Two, and finally the Big One.

### 2.2. Results and discussion

All 20 PRF content scales, all 15 JPI content scales, and the PRF Desirability scale were factor analyzed by principal components. The eigenvalues of the first ten factors (i.e., components) were 7.1, 4.5, 4.1, 3.0, 2.1, 1.4, 1.2, 1.1, 0.9, and 0.8, respectively. The first five factors, which accounted for 58 percent of the scales' variance, were rotated to an orthogonal varimax solution and the Big Five emerged. These results directly replicated those by Ashton et al. (1998).

The Big Five factors were then re-constituted using standard-score aggregates of the 36 original scales and factor analyzed by principal components to a single factor solution that explained 37 percent of the source variance. The weightings of the Big Five on that general factor were Openness (0.61), Conscientiousness (0.59), Extraversion (0.64), Agreeableness (0.50), and Neuroticism (−0.69; positively keyed as Emotional Stability). Additionally, a hierarchical principal axes factor analysis was performed using an oblique rotation and the Big Two second-order factors extracted comprising Stability (Conscientiousness, Agreeableness, and Emotional Stability) and Plasticity (Openness and Extraversion). These, in turn, yielded the general factor of personality, which accounted for 74 percent of the source variance (47% of the Big Five variance) (see Fig. 1). These results replicated Musek's (2007) study, which used direct measures of the Big Five.

Alternative analyses also found evidence for the general factor. For example, after correcting for reliability by replacing the unities in the diagonal with each trait's reliability (Table 1), the Big Five accounted for 63 percent of the reliable variance

**Table 1**
Traits and trait definitions (Positively and Negatively Keyed) for the Personality Research Form (PRF) and Jackson Personality Inventory (JPI) and alternate form reliabilities (decimals omitted)

| Personality scale | Reliability |
|---|---|
| PRF—Abasement (+ Is humble; accepts blame and criticism even if undeserved. – Often holds others in contempt; is arrogant or condescending.) | 79 |
| PRF—Achievement (+ Strives to achieve difficult goals; sets high standards for self. – Does the minimum necessary to get by; has little ambition.) | 86 |
| PRF—Affiliation (+ Enjoys being with others; is sociable and outgoing. – Minimizes social contacts; is aloof or withdrawn.) | 88 |
| PRF—Aggression (+ Is easily angered; likes to fight and get even. – Dislikes arguing or fighting; is even-tempered.) | 87 |
| PRF—Autonomy (+ Is independent and self-reliant; resists constraints on freedom. – Likes to be dependent on and governed by others.) | 86 |
| PRF—Change (+ Likes new and different experiences; dislikes routine. – Dislikes change; prefers routine and predictability.) | 80 |
| PRF—Cognitive Structure (+ Always plans ahead to eliminate uncertainty; dislikes ambiguity. – Avoids schedules, timetables, and lists; may be neglectful.) | 78 |
| PRF—Defendence (+ Is defensive; retaliates against criticism. – Is slow to take offense; is receptive to criticism.) | 72 |
| PRF—Dominance (+ Enjoys leading, directing, and influencing others. – Avoids having positions of authority or power; prefers to follow.) | 92 |
| PRF—Endurance (+ Is persistent; works long hours; rarely takes breaks. – Gives up easily on tasks or problems; is lazy.) | 89 |
| PRF—Exhibition (+ Likes to have an audience and to be the center of attention. – Avoids attention; is easily embarrassed.) | 89 |
| PRF—Harmavoidance (+ Seeks safety and security; avoids risky activities. – (Enjoys physically risky activities; is adventurous and daring.) | 91 |
| PRF—Impulsivity (+ Tends to act on the "spur of the moment;" is impulsive. – Does not behave on impulse; thinks before acting.) | 87 |
| PRF—Nurturance (+ Gives comfort and assistance to others in need; is nurturant. – Reluctant to assist others; is hard-hearted.) | 85 |
| PRF—Order (+ Keeps belongings and surroundings neat and organized. – Is messy, untidy, or disorganized.) | 92 |
| PRF—Play (+ Likes to have fun; enjoys parties, games, etc. – Is serious, rarely celebrates, and puts business before pleasure.) | 80 |
| PRF—Sentience (+ Enjoys sensations (sights, sounds, smells, textures, and tastes. – Is insensitive to sensual pleasure in his/her environment.) | 77 |
| PRF—Social Recognition (+ Is concerned about reputation, image; seeks high social status. – Is unmindful of social recognition; unpretentious.) | 91 |
| PRF—Succorance (+ Seeks the sympathy, advice, protection, and love of others. – Avoids the emotional support of others.) | 91 |
| PRF—Understanding (+ Is intellectually curious about many things; reads widely. – Does not reflect on intellectual matters; is shallow.) | 85 |
| PRF—Desirability (+ Presents self as a good or admirable person; conceals faults. – Is unconcerned with presenting a favorable image; admits to vices.) | 82 |
| JPI—Anxiety (+ Often feels nervous or tense; is easily upset and worried. – Rarely worries about things; is usually calm and relaxed.) | 83 |
| JPI—Breadth of Interest (+ Has a wide variety of interests and hobbies. – Finds many things boring; has a narrow range of interests. | 82 |
| JPI—Complexity (+ Enjoys thinking about complicated or abstract problems or issues. – Prefers problems and issues that are simple and straightforward.) | 73 |
| JPI—Conformity (+ Conforms to others' standards; is susceptible to group pressure. – Resists others' opinions and social norms.) | 82 |
| JPI—Energy Level (+ Has a high level of energy; enjoys being active and busy. – Lacks stamina; is often tired and likes to sleep.) | 77 |
| JPI—Innovation (+ Is innovative; likes to improvise; enjoys creating and inventing. – Is uncreative and unoriginal; prefers tried-and-true methods.) | 87 |
| JPI—Interpersonal Affect (+ Shows empathy and compassion; is emotionally attached to others. – Does not worry about others' problems; shows no pity.) | 83 |
| JPI—Organization (+ Is organized and methodical in daily and work activities. – Is disorganized, irregular, and unsystematic in behavior.) | 79 |
| JPI—Responsibility (+ Is morally responsible; is a conscientious and upright citizen. – Is irresponsible, negligent, even unscrupulous.) | 70 |
| JPI—Risk Taking (+ Enjoys taking risks in social, political, and financial situations. – Avoids risky situations; is cautious with investments.) | 84 |
| JPI—Self Esteem (+ Is socially confident and bold; has high self-esteem. – Feels awkward and self-conscious in social situations.) | 84 |
| JPI—Social Adroitness (+ Is subtly manipulative and cunning in social interactions. – Is straightforward; does not use flattery or undue tact.) | 65 |
| JPI—Social Participation (+ Enjoys participating in social activities; is outgoing. – Prefers to be alone; avoids social activities.) | 84 |
| JPI—Tolerance (+ Is tolerant of people who are different; is not prejudiced. – Prejudges those who are different; is narrow-minded.) | 60 |
| JPI—Value Orthodoxy (+ Favors traditional values and customs; is conservative. – Is critical of traditional values; has liberal attitudes.) | 81 |

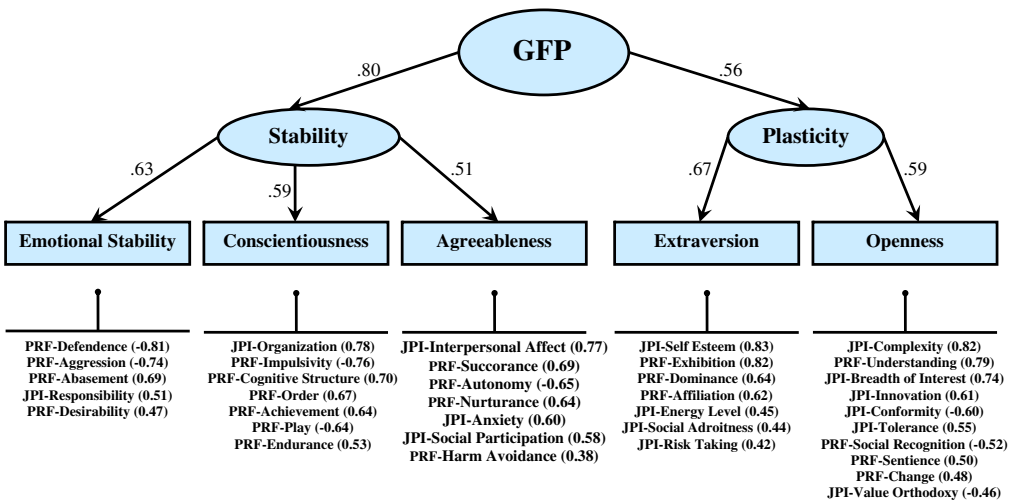


**Fig. 1.** The general factor of personality extracted from 36 scale scores from the Personality Research Form (PRF) and Jackson Personality Inventory (JPI).

and the Big One accounted for 23 percent of their reliable variance. A principal axis factoring procedure that estimated initial commonalities using squared multiple correlations produced a Big Five that accounted for 85 percent of the common reliable variance and a GFP that accounted for 29 percent of the common reliable variance.

## 3. The University of London Twin Study

### 3.1. Method

The data for this study were gathered in 1983 and 1984 from the adult twin register at the University of London, Institute of Psychiatry, as part of a larger twin mailing. Some results have been published previously (Rushton, 1996, 2004a; Rushton & Bons, 2005; Rushton, Fulker, Neale, Nias, & Eysenck, 1986). Questionnaires containing 236 items assessing demographic, attitudinal, and personality information were mailed to approximately 1400 twin pairs, along with their spouses and best friends. The present paper analyzes the returns from 322 pairs of twins ($N = 644$ individuals): 174 monozygotic (MZ) twin pairs (131 sister pairs, 43 brother pairs), and 148 dizygotic (DZ) twin pairs (82 sister pairs, 28 brother pairs, 38 opposite-sex pairs). The overall return rate, representativeness to the general population, and greater response rate of women and MZ twins compared to men and DZ twins, are similar to those found in other volunteer twin samples (Bouchard & McGue, 2003). Respondents came mostly from middle-class family backgrounds, had some postsecondary education, and enjoyed an above-average level of income and residence. Their ages ranged from 18- to 75-years (Mean = 32; $SD = 13$).

#### 3.1.1. Self-Rating Scales

Twenty of the twenty-nine scales are based on the same Personality Research Form used in Study 1 plus nine other widely used scales (Rushton, Murray, & Paunonen, 1983). The ratings were made on 5-point scales using the trait names and brief descriptions shown in Table 2, which also reports the split-half reliabilities (mean = 0.79; based on a peer-rating study by Rushton et al., 1983). As single-item scales, they show excellent reliability and validity (e.g., Murray, Rushton, & Paunonen, 1990; Rushton et al., 1983).

**Table 2**
Twenty-nine traits and trait definitions, the inter-rater reliability, and the MZ and DZ Twin Intra-Class Correlations (decimals omitted)

| Personality trait and trait definition | Reliability | MZ twin correlation ($N$ pairs = 174) | DZ twin correlation ($N$ pairs = 148) |
|---|---|---|---|
| Meek (Mild mannered; subservient.) | 73 | 37 | 11 |
| Ambitious (Aspiring to accomplish difficult tasks; striving, competitive.) | 88 | 39 | 22 |
| Sociable (Friendly, outgoing, enjoys being with people.) | 74 | 50 | 15 |
| Aggressive (Argumentative, threatening, enjoys combat and argument.) | 84 | 32 | 07 |
| Independent (Avoids restraints; enjoys being unattached.) | 80 | 26 | 03 |
| Changeable (Flexible, restless, likes new and different experiences.) | 77 | 32 | 14 |
| Seeks Definiteness (Dislikes ambiguity or uncertainty in information; wants all questions answered completely.) | 84 | 34 | 18 |
| Defensive (Suspicious, guarded, touchy.) | 72 | 23 | 06 |
| Dominant (Attempts to control environment; forceful, decisive.) | 87 | 22 | 00 |
| Enduring (Willing to work long hours; persevering, steadfast, unrelenting.) | 90 | 22 | 00 |
| Attention Seeking (Enjoys being conspicuous, dramatic, colorful.) | 88 | 35 | 07 |
| Harm Avoiding (Careful, cautious, pain-avoidant.) | 84 | 32 | 16 |
| Impulsive (Spontaneous, hasty, impetuous, and uninhibited.) | 89 | 42 | 00 |
| Supporting (Gives sympathy and comfort; helpful, indulgent.) | 84 | 36 | 08 |
| Orderly (Neat and organized; dislikes clutter, confusion, lack of organization.) | 77 | 49 | 07 |
| Fun Loving (Playful, easygoing, light-hearted; does many things "just for fun.") | 88 | 43 | 13 |
| Aesthetically Sensitive (Sensitive to sounds, sights, tastes, smells.) | 80 | 29 | 24 |
| Approval Seeking (Desires to be held in high esteem; obliging, agreeable.) | 76 | 27 | 14 |
| Seeks Help and Advice (Desires and needs support, protection, love, advice.) | 80 | 25 | 00 |
| Intellectually Curious (Seeks understanding; reflective, intellectual.) | 78 | 49 | 14 |
| Anxious (Tense, nervous, uneasy.) | 60 | 42 | 06 |
| Intelligent (Bright, quick, clever.) | 89 | 52 | 24 |
| Liberal (Progressive, seeks change, modern, adaptable.) | 81 | 24 | 09 |
| Show Leadership (Takes initiative and responsibility for getting things done.) | 86 | 40 | 08 |
| Objective (Just, fair, free of bias.) | 78 | 21 | 03 |
| Compulsive (Meticulous, perfectionistic, concerned with details.) | 69 | 33 | 09 |
| Authoritarian (Rigid, inflexible, dogmatic, opinionated.) | 70 | 18 | 07 |
| Extraverted (Has many friends; craves excitement; fond of practical jokes; is carefree, easygoing, optimistic.) | 90 | 39 | 23 |
| Neurotic (A worrier; overly emotional; anxious, moody, and often depressed.) | 61 | 40 | 00 |
| Mean | 79 | 34 | 11 |

*3.1.2. Eysenck Personality Questionnaire (EPQ: Eysenck & Eysenck, 1975)*

The EPQ consists of 90 items that measure Psychoticism, Extraversion, Neuroticism, plus a Lie scale. Participants endorse as true or false statements such as (positively keyed for the P scale) "Do you enjoy practical jokes that can sometimes really hurt people?" and (negatively keyed for the P scale) "Do good manners and cleanliness matter much to you?" The Cronbach alphas were: 0.62 for Psychoticism, 0.86 for Extraversion, 0.71 for Neuroticism, and 0.75 for Lie.

*3.1.3. Social Responsibility Questionnaire (SRQ: Berkowitz & Daniels (1964))*

The SRQ has 22-items that ask for agreement using 5-point scales ranging from 1 (strongly disagree) to 5 (strongly agree) with positively keyed items such as "I am the kind of person people can count on" and negatively keyed ones such as "Letting your friends down is not so bad because you cannot do good all the time for everybody." The validity of the scale has been shown by its ability to predict civic behavior such as voting in elections, joining voluntary organizations, and helping others (Berkowitz & Daniels, 1964). Cronbach's alpha for the scale was 0.71.

*3.1.4. Self-Report Delinquency Scale (Rushton (1996))*

This scale contains 20 items such as "I have taken an illegal drug." It also included five violence items such as "I have taken a weapon (like a knife) out with me in case I needed it in a fight." Respondents check each item on a 5-point scale ranging from 0 = never to 4 = very often. Cronbach's alpha for the 20-item scale showed reliabilities of 0.81 and 0.60 for the five violence items.

*3.2. Results and discussion*

Missing data (which constituted less than 2% of the items) were replaced using the sex-specific item mode for the entire sample ($N$ = 986 individuals). The means and standard deviations of the personality scales were similar to previously published research. The first 29 self-ratings (corrected for unreliability with the scale reliabilities from Table 2) were factor analyzed by principal components. The eigenvalues of the first ten factors were 6.2, 3.8, 2.7, 2.4, 1.9, 1.3, 1.0, 1.0, 0.9, and 0.8, respectively. The first five factors, which accounted for 51 percent of the scales' reliable variance, were rotated to an orthogonal solution and the Big Five emerged. The Big Five factors were then reconstituted using standard-score aggregates of the 29 original scales and factored by principal components to a single factor solution that explained 39 percent of the source variance (54% of the reliable variance). The weightings of the Big Five on the general factor were Openness (0.77), Conscientiousness (0.53), Extraversion (0.63), Agreeableness (0.79), and Neuroticism (−0.41; keyed positively as Emotional Stability). This model is depicted in Fig. 2.

Alternative factoring procedures also yielded a GFP. For example, a principal axis factor analysis that estimated initial commonalities using squared multiple correlations yielded a Big Five solution that accounted for 100 percent of the common reliable variance and a GFP that accounted for 40 percent of the common reliable variance. Using a hierarchical factor analysis (uncorrected data) going from the Big Five to the Big Two to the Big One yielded a GFP that accounted for 73 percent of its source variance.

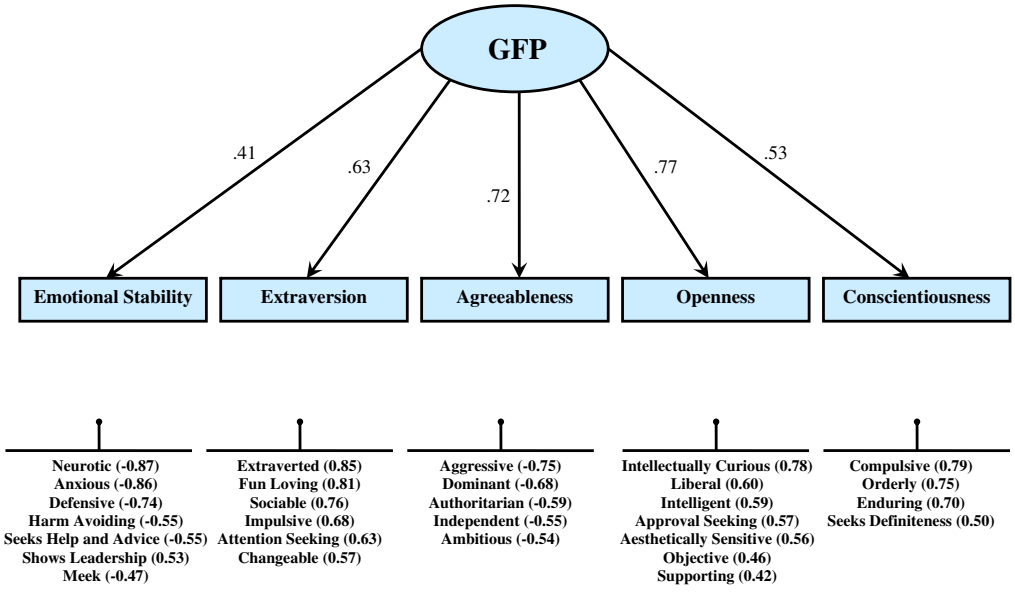


**Fig. 2.** The GFP extracted from the Big Five made up of 29 Self-Rating Scales.

An independently derived Altruism Composite was created from the Social Responsibility Questionnaire, the Self-Report Delinquency Scale, and the remaining four self-rating scales (Tough Minded, Altruistic, Social Responsibility, and Integrity). This composite correlated with factor scores from the General Factor of Personality $r = .56$ ($P < .001$, $N = 644$). Thus, a very broad-based single factor of personality is revealed.

Several alternate methods of combining items and scales, or carrying out the analyses, did not change the results. For example, the GFP was found to account for 38 percent of the reliable variance when a hierarchical principal axes analysis was performed using an oblique rotation and the Big Two second-order factors extracted comprising Stability (Emotional Stability, Conscientiousness, Agreeableness) and Plasticity (Extraversion, Openness). Similarly, the GFP emerged when the altruism and delinquency scales were combined with other questionnaires and factor analyzed directly with the 29 self-rating scales.

### 3.3. Heritability analyses

Table 2 gives the intraclass correlations for the 174 pairs of MZ twins and the 148 pairs of DZ twins on each of the 29 self-rating scales, with a minimum set at zero. The opposite-sex pairs were included in these analyses with adjustments made for age and sex. The 174 pairs of MZ twins were more similar ($r = .34$) on the self-rating scales than were the 148 pairs of DZ twins (.09). Using the Falconer (1989) formula $2^{*}(MZr - DZr)$, these correlations yield a broad heritability of 50 percent. Higher heritabilities were found for the Big Five factors (mean = 61%; range = 44% to 74%). For the GFP itself, calculated using factor scores, the MZ$r$ = 0.55 and the DZ$r$ = 0.14, indicating evidence of genetic dominance and a heritability of 82 percent. Factor analyses performed on the *genetic* variance–covariance matrices (the *G* matrix) found a higher-order *genetic* GFP, which accounted for 32 percent of the genetic variance among the Big Five lower-order factors. (Going directly from the lower order traits to the Big One accounted for 28% of the genetic variance among those traits.)

Model fitting is more powerful than correlational analysis because all data are weighted appropriately. The genetic and environmental origins of the GFP were examined by structural equation models fit to the age- and sex-corrected variance–covariance matrices using the computer program AMOS 7 statistical package included in SPSS 14.0 (SPSS, 2006). This was done first for both sexes combined, and then separately for males and females. The total phenotypic variance can be partitioned into four sources: additive genetic influence (A); non-additive genetic influence or dominance (D); the common environment shared by a pair of twins (CE); and each twin's unique non-shared environment (E). It is not possible to estimate C and D simultaneously or test an ACDE model with data only from twins reared together because the estimation of C and D both rely on the same information (i.e., the difference between the MZ and DZ twin correlations). If the DZ correlation is greater than half of the MZ correlation, the ACE model is the correct model and the estimate of D in the ADE model is always zero. However, if the DZ correlation is *less* than half of the MZ correlation, as is the case in these data, the ADE model is the correct model and the estimate of C in the ACE model is zero.

The fit of each model, as well as of competing models, was assessed using the chi-square statistic, Akaike's Information Criterion (AIC), a fit index that reflects both the fit of the model and its parsimony, and RMSEA, the root mean square error of approximation. All three have been used in the structural equation modeling and behavior genetic literatures. Among competing models, the one with the lowest chi-square value relative to its degrees of freedom, the lowest AIC, and the lowest RMSEA, is considered the best fitting. Table 3 shows the results of these analyses. For the total sample, the DE model gave the best fit, with D = 55 percent, and E = 45 percent. (Although the ADE model had a marginally better fit, the DE model was the most parsimonious.) The DE model was also the best fit for both sexes examined separately.

**Table 3**
Model-fitting for parameter estimates of genetic and environmental influence on the GFP

| Sample tested | *N* twin pairs | Model tested | Parameter estimates | | | Goodness of fit | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | D | E | $\chi^2$ | *df* | *p* | AIC | RMSEA |
| Males and females combined | 322 | ADE | 2 | 53 | 45 | 1.1 | 3 | ns | 7.10 | 0.00 |
| | | AE* | 52 | — | 48 | 3.9 | 4 | ns | 7.88 | 0.00 |
| | | DE* | — | 55 | 45 | 1.1 | 4 | ns | 5.10 | 0.00 |
| | | E | — | — | 100 | 64.9 | 5 | < 0.01 | 66.94 | 0.19 |
| Males | 71 | ADE | 0 | 53 | 47 | 0.4 | 3 | ns | 6.4 | 0.00 |
| | | AE* | 51 | — | 49 | 1.5 | 4 | ns | 5.52 | 0.00 |
| | | DE* | — | 53 | 47 | 0.4 | 4 | ns | 4.40 | 0.00 |
| | | E | — | — | 100 | 14.9 | 5 | < 0.01 | 16.89 | 0.17 |
| Females | 213 | ADE | 7 | 46 | 47 | 1.6 | 3 | ns | 7.65 | 0.00 |
| | | AE* | 50 | — | 50 | 2.9 | 4 | ns | 6.91 | 0.00 |
| | | DE* | — | 52 | 48 | 1.7 | 4 | ns | 5.68 | 0.00 |
| | | E | — | — | 100 | 42.2 | 5 | < 0.01 | 44.24 | 0.19 |

*Note*. Dashes indicate that data are not applicable. *, best fitting model; A, the magnitude of additive genetic influences; D, the magnitude of dominance genetic influences; E, the magnitude of unique environmental influences. AIC, Akaike information criterion. RMSEA, root mean square error of approximation.

**Table 4**
Age- and sex-adjusted twin correlations and cross-twin cross-trait correlations for the Prosocial Scale and the EAS scales

| | MZ twins ($N$ = 150 pairs) | | | |
|---|---|---|---|---|
| | PS 1 | Sociability 1 | Emotionality 1 | Activity 1 |
| PS 2 | 0.56 | | | |
| Sociability 2 | 0.17 | 0.48 | | |
| Emotionality 2 | 0.11 | 0.01 | 0.35 | |
| Activity 2 | 0.00 | 0.29 | 0.04 | 0.51 |
| | DZ twins ($N$ = 425 pairs) | | | |
| | PS 1 | Sociability 1 | Emotionality 1 | Activity 1 |
| PS 2 | 0.27 | | | |
| Sociability 2 | 0.03 | 0.04 | | |
| Emotionality 2 | 0.01 | 0.04 | 0.13 | |
| Activity 2 | 0.00 | 0.10 | 0.04 | 0.12 |

*Note*. PS 1 and PS 2, prosocial scores for twins 1 and 2 in each pair; Sociability1 and Sociability 2, sociability scores for twins 1 and 2; Emotionality 1 and 2, emotionality scores for twins 1 and 2; Activity 1 and 2, activity scores for twins 1 and 2. The double entry method was used to compute correlations.

## 4. South Korean 2- to 9-year-old Twins

### 4.1. Method

Data on 575 pairs of 2- to 9-year-old Korean twins were gathered between 2002 and 2006 as part of the ongoing South Korean Twin Study (Hur, Shin, Jeong, & Han, 2006). Some of the results have been published previously (Hur & Rushton, 2007). As part of a scheduled telephone interview, the mothers rated their children on the Korean versions of the Prosocial Scale of the Strengths and Difficulties Questionnaire (Ahn, Jun, Han, Noh, & Goodman, 2003) and the EAS Temperament Survey (Buss & Plomin, 1984). On five 3-point items, the Prosocial scale assessed sharing, helping, and being kind. On twenty 5-point rating scales, the EAS assessed Emotionality (the tendency to become upset easily; reverse keyed to reflect emotional stability), Activity (the tempo, energy, and vigor of behavior), and Sociability (the preference to be with other people). Both the Prosocial and EAS scales are reliable and valid for children as young as 24 months, have factor structures that do not vary substantially with age, and are generalizable across cultures (Ahn et al., 2003; Mathiesen & Tambs, 1999).

Zygosity was determined from chorion type in prenatal records and the mothers' responses to questionnaires about physical similarity. The final sample of 575 twin pairs comprised 90 male monozygotic twin pairs, 60 female monozygotic pairs, 105 male dizygotic pairs, 113 female dizygotic pairs, and 207 opposite-sex pairs. The higher number of DZ than MZ pairs is due to the number of assisted pregnancies (Hur & Kwon, 2005).

### 4.2. Results and discussion

The internal consistency reliabilities were .71 for Emotionality, .72 for Activity, .85 for Sociability, and .65 for Prosocial behavior. Each scale's scores were approximately normally distributed (mean skewness, −.12). The age- and sex-adjusted phenotypic correlations between the Prosocial scale and the EAS temperament traits all reached statistical significance (viz., .21 with Sociability, .18 with Emotional Stability, and .10 with Activity; after corrections for unreliability, .28, .26, and .15, respectively), as did most of the EAS scales with each other (mean $r$ = .20; after correction for unreliability, .26). A general factor accounted for 30 percent of the source variance in the four scales (42% of the reliable variance).

Table 4 shows the correlations for the MZ twins on the four traits were consistently higher than those for the DZ twins. With a minimum correlation set at zero, the simple heritabilities from the formula $2^{*}(\mathrm{MZ}r - \mathrm{DZ}r)$ range from 44 to 96 percent (mean = 69%). Table 4 also shows the DZ correlations are less than half the MZ correlations indicating, as in Study 2, the presence of genetic dominance. Moreover, the MZ cross-twin cross-trait correlations are greater than the corresponding DZ cross-twin cross-trait correlations, indicating that relationships among the Prosocial and EAS scales are largely mediated by common genetic factors. A *genetic* matrix was calculated by placing the univariate heritabilities (as calculated above) in the diagonal and then each of the bivariate heritabilities (using the same formula) placed elsewhere in the matrix. A principal axis factor analysis revealed a higher-order *genetic* GFP, which accounted for 32 percent of the source variance among the four lower-order scales (47% of the reliable variance).

## 5. General discussion

Using scales developed independently of (and agnostic to) any debate over the underlying structure of personality, three studies provide converging evidence that a single General Factor of Personality (GFP) exists at the very top of the hierarchy. A second level consists of the Big Five factors and/or EAS temperament traits. It, in turn, is followed by third and fourth levels composed of 30 or so traits and scales and then dozens of particular items. The results were robust across studies despite marked methodological differences, age ranges, and population variations (e.g., self-reports vs. other-reports; young children

vs. adults; Caucasians vs. South Koreans), as well as homogeneity of scores in some scales, other uncertain scale properties, and a lack of power due to small *N*s in some analyses.

The two twin studies found that the GFP is about 50 percent attributable to non-additive (dominance) genetic effects. Further analyses indicated a higher-order *genetic* GFP. It accounted for 32 percent (Study 2) and 47 percent (Study 3) of the reliable genetic variance among the Big Five and EAS factors. The 50 percent non-genetic variance between the twins is idiosyncratic and non-shared, coming mainly from unique environmental sources rather than from those that are shared within the family. The *shared environment* (also called *common* or *between-family environment*) includes all those variables that individuals reared in the same family have in common (e.g., parental socioeconomic position and child-rearing style), which differ from one family to another; they make children growing up together similar. The *non-shared environment* (also called *specific* or *within-family environment*) includes all those variables that are unique to each individual (e.g., an illness or chance friendship that happens to one sibling and not the other); they make children growing up together different. The present results are in accord with other behavior genetic studies of personality.

The fact that the GFP can be detected as early as two years of age and that by adulthood there is little or no influence from the shared family environment is typical of what is found in the behavior genetic literature and provides a constraint on theories of personality development (Bouchard & McGue, 2003; Harris, 2006). Indeed, the hierarchical factor structure of the GFP appears directly analogous to that of *g*, the well-established general factor of mental ability (Jensen, 1998; Lubinski, 2004; Spearman, 1904; Spearman, 1927). This is true at both the phenotypic and genotypic levels. In both the cognitive and personality domains, multiple genetic influences are found both within and across factors, indicating substantial genetic pleiotropy, that is, the same genes influence several systems and cause overlap across diverse facets and factors (Jang et al., 2006; Plomin & Spinath, 2004).

The finding that the genetic influences on the GFP are of the non-additive rather than the additive variety suggests the GFP has been under recent natural selection, as expected for a Darwinian fitness character (Falconer, 1989; Fisher, 1954; Jensen, 1998; Penke et al., 2007). Non-additive genetic effects (i.e., dominance) are routinely found for general intelligence and particularly for its *g* component (Jensen, 1998). For general intelligence clear unidirectional selection has been underway for at least five million years of hominid evolution, as evidenced by increasing brain size (Rushton, 2004b). We suggest that a similar process has been operating for the GFP.

The GFP, with a well-defined positive and negative pole (the positive pole being more cooperative and prosocial; the negative pole more antagonistic and inefficient) indicates how unidirectional selection for personality might occur. People prefer as mates, fellow workers, and leaders those who are agreeable, cooperative and emotionally stable (Miller, 2007; Ones, Viswesvaran, & Dilchert, 2005). Consequently, those at the high end of the GFP likely enjoyed greater reproductive success. Moreover, people better able to co-operate in groups likely won competitions (and wars) more frequently than people who could not (Alexander, 1979; Geary, 2005). It is reasonable to suppose that unidirectional selection toward more efficient and cooperative personalities was a driving force leading from the archaic hominid to the modern personality.

Evidence for unidirectional selection comes from inbreeding depression effects. Inbreeding depression occurs when recessive (i.e., non-dominant) alleles combine and cause children to score lower on a trait than they would otherwise. Inbreeding depression has been found for both IQ and the GFP. For IQ, the offspring of cousin marriages show lower scores while the offspring of out-group marriages show higher scores (Jensen, 1998; Mingroni, 2007). For the GFP, an Italian study found inbred families were lower in extraversion and openness to experience (Camperio Ciani, Capiluppi, Veronese, & Sartori, 2007). A Dutch study found the offspring of parents who came from the same region in the Netherlands (and so were more likely to be inbred) scored lower on sensation seeking than those of parents from different regions (Rebello & Boomsma, 2007).

What neurological substrates might evolution lay down to increase the GFP and improve inter-personal efficiency? One straightforward possibility is adding neural tracts in the frontal cortex, which is responsible for self-control and forward planning. A large body of evidence now supports the "social brain-social complexity" hypothesis. For example, across species of primates, there is a strong positive correlation between the size of the neocortex (relative to body size) and the larger the group size, which is a function of how many individuals in a group can be recognized and how much information can be processed (Dunbar & Shultz, 2007; Geary, 2005; Rushton & Ankney, 2007). It has been well known since the famous case of Phineas T. Gage that damage to the frontal cortex, reduces conscientiousness and disinhibits aggressive, impulsive, and anti-social behavior (Lykken, 1995), and also lowers fluid intelligence and judgment (Geary, 2005; Jung & Haier, 2007).

### 5.1. Construct validity of the general factor

Some research has suggested that higher order factors are artifacts emerging from evaluative bias (Biesanz & West, 2004; Saucier & Goldberg, 2001). Indeed, one reviewer of an earlier draft of this article argued that we had "wandered into a conceptual minefield." Some of these concerns have been addressed by Figueredo et al. (2004) and Musek (2007) and we do not presume the last word has been written. However, we believe we have provided a coherent hypothesis to organize disparate data and make testable predictions that has the potential to integrate large parts of personality psychology with evolutionary biology and behavioral genetics.

Overlap and redundancy among measures is common. Consequently, personality researchers have increasingly become "lumpers" rather than "splitters" in the debate over broad versus specific traits. For example, in 12 studies ($N = 15{,}000$) of four widely researched traits—self-esteem, neuroticism, locus of control, and generalized self-efficacy—Judge, Erez, and Bono

(1998) found an average corrected inter-correlation of 0.60. Further, they found that a single factor explained 71 percent of the variance in these traits, indicating a broad dimension of Emotional Stability. Subsequently, Judge, Erez, Bono, and Thoresen (2002) examined 75 studies of the same traits and found an average correlation of 0.60. Moreover, each of the traits showed moderate to strong correlations with the other Big Five dimensions (i.e., 0.14 to 0.33 with Openness and Agreeableness, and 0.26 to 0.43 with Conscientiousness and Extraversion).

Overlap is apparent at the genetic as well as at the phenotypic level. For example, in a study of 1209 MZ twin pairs and 701 DZ twin pairs from Canada, Germany, and Japan, Jang et al. (2006) found that the same genes influence several systems across diverse facets and factors. Similarly, a study of 943 twin pairs by Weiss, Bates, and Luciano (2008) reported that heritable differences in subjective well-being (happiness) were entirely accounted for by a common genetic factor that influenced all the Big Five factors (in the direction of Emotional Stability, Extraversion, Openness, Agreeableness, and Conscientiousness). There were also unique genetic components found leading from each of the Big Five dimensions to happiness. As in the case with cognitive ability, an integration of broad and narrow traits can be achieved through combining them hierarchically (Lubinski & Dawis, 1992).

Construct validity for the GFP comes from research in occupational psychology, where aggregating traits enhances predictive power. Meta-analyses of the Big Five have found that each trait shows generalizable if small relations to job performance (Barrick & Mount, 1991; Tett, Jackson, & Rothstein, 1991). The magnitude of the average correlation (0.24) is increased to about 0.40 when prediction is based on job analyses, or when longer tenured samples are studied, or when particular scales are applied to particular jobs (Hogan & Holland, 2003; Hough & Oswald, 2000; Sackett & Lievens, 2008). Of great relevance are the studies demonstrating that job performance is better predicted using composite "Integrity" scales comprising Conscientiousness + Agreeableness + Emotional Stability (Ones et al., 2005). Extraversion and Openness might be added. For example, one study of hundreds of expatriates from Britain, Australia, New Zealand, the US, Japan, and Korea working in Hong Kong and elsewhere in the world found that "Expatriates who are emotionally stable, who are outgoing and agreeable, and who are high in openness to experience seem to function better than others" (Shaffer, Harrison, Gregersen, Black, & Ferzandi, 2006, p. 122). Broad generalizability has also been found on the criterion side of the equation. For example, a meta-analysis of 90 years of empirical studies found a single underlying factor of good job performance (Viswesvaran, Schmidt, & Ones, 2005).

Aggregating the Big Five traits might also enhance prediction of other important variables such as mortality, divorce, and occupational achievement. A review of prospective longitudinal studies found personality was as effective a predictor of these and other outcomes as was SES and IQ (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). For example, just as students with higher IQ tend to obtain better grades and achieve across a range of indicators (Kuncel, Hezlett, & Ones, 2004), those higher on the GFP can be expected to enjoy better social relationships and live longer. Thus, during interpersonal conflict, emotionally stable people are less likely to overreact, agreeable people to minimize negative affect, sociable people to have learned better coping mechanisms, conscientious people to follow rules of polite discourse, and those open to experience to behave less rigidly.

Compatible with the GFP are the findings by De Raad and Barelds (2008). They administered 2365 personality items to 1466 Dutch participants who provided self- or other-ratings. A hierarchical structure emerged that organized from one to eight factors to go beyond the Big Five and incorporate the sixth dimension of Honesty–Humility identified by Ashton and Lee (2001), and other factors such as Hedonism, and Pathology and Violence. De Raad and Barelds labeled the first big factor *Virtue*, as expressed through items such as *sensible*, *honest*, *friendly*, *good*, *decent*, *keeps promises*, *balanced*, *polite*, and *reasonable* versus *puffed with pride*, *cantankerous*, *childish*, *unjust*, *unsensible*, and *unsympathetic*. According to De Raad and Barelds, the factor described a civilized, trustworthy, and polite person versus an unreliable, difficult to deal with, and obtuse person. This might capture some of Darwin (1871) progressive trend from our archaic ancestors and nearest relative, the chimpanzee, to civilized modern people.

### 5.2. Emotional Intelligence (EI) and the Personality Disorders (PD)

Because the general factor of personality defines clear positive and negative poles (analogous to the two poles of the general factor of mental ability), it may aid in understanding the socially "advantaged" versus the socially "challenged." Those with high scores on the GFP may have higher levels of emotional intelligence (EI) whereas those with low scores may be more likely to suffer from a personality disorder. Research on EI can be traced back to Darwin's (1872) work on the expression of emotion as an evolutionary adaptation that enhances survival. Thorndike (1920) used the term social intelligence to describe the skill of understanding and managing people. Currently, high scorers on EI tests are described as relating well to people, adapting to and coping with immediate surroundings, remaining optimistic and expressing positive emotions, and better understanding themselves and others (Bar-On, Maree, & Elias, 2007; Goleman, 1995; Salovey & Grewal, 2005). Moreover, EI tests predict academic grades, performance in the work place, leadership, happiness, and health (Brackett & Mayer, 2003; Day, Therrien, & Carroll, 2005).

Because most EI tests turn out to be a blend of the Big Five personality factors with some contribution from general intelligence (Sackett & Lievens, 2008), we suggest that the GFP is related to EI through its loadings on the positive poles of the Big Five. For example, when Brackett and Mayer (2003) examined the relation of the Big Five to several EI tests, they found the Mayer–Salovey–Caruso Emotional Intelligence Test (MSCEIT) correlated with Openness (0.25) and Agreeableness (0.28), as well as with Verbal Ability (0.32); the Self-Report EI Test (SREIT) correlated with Openness to Experience (0.43), Conscientiousness (0.25), Extraversion (0.32), and Emotional Stability (0.19); and the Emotional Quotient Inventory (EQ-i)

correlated with Openness (0.16), Conscientiousness (0.48), Extraversion (0.37), Agreeableness (0.27), and Emotional Stability (0.57).

At the other end of the spectrum, we suggest the personality disorders relate to the GFP through its loadings at the negative poles of the Big Five. For example, Saulsman and Page (2004, 2005) examined the relation of the Big Five to 10 personality disorders described by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) of the American Psychiatric Association (1994). These are often grouped into three clusters. Cluster A ("odd, eccentric" disorders) includes the schizoid, schizotypal, and paranoid personality disorders. Cluster B ("dramatic, erratic" disorders) contains the borderline, histrionic, narcissistic, and antisocial personality disorders. Cluster C ("anxious, fearful" disorders) comprises the avoidant, dependent, and obsessive–compulsive personality disorders. The majority of the disorders were found to be significantly related to low Extraversion, low Agreeableness, and low Emotional Stability.

Similar results are found when, rather than using the DSM-IV categories, personality disorders are assessed dimensionally with tests such as the Minnesota Multiphasic Personality Inventory (MMPI), the Millon Clinical Multiaxial Inventory (MCMI), and the Personality Diagnostic Questionnaire (PDQ) (Costa & Widiger, 2002). Thus, Clark and Livesley (2002) examined 18 personality disorder scales and 22 symptom check-list clusters. They found low Emotional Stability correlated with negative affects and affective instability, problems of identity and self-esteem, and with dependence and mistrust in relationships; low Extraversion correlated with social avoidance and isolation, difficulty in forming close relationships, restricted emotional expression, and anhedonia (feelings of emptiness, boredom, and pessimism); low Agreeableness correlated with anger, hostility, rejection of others, and unstable and exploitative relationships; while low Conscientiousness correlated with passive opposition to cooperation, impulsivity, and antisocial behavior.

## 6. Conclusion

No single factor is likely to explain all manifestations of complex behavior and we are not suggesting otherwise. Reality is multi-dimensional. Nor does a general factor invalidate the utility or theoretical importance of lower-order factors. It is an empirical question as to which level provides the best predictor for a given criterion. The personality facets that exist *below* the Big Five factors and are closest to the behavior expressed, are sometimes better predictors than the higher order traits (Ashton, 1998; Paunonen, 1998; Paunonen & Ashton, 2001; Sackett & Lievens, 2008). On average, however, aggregation across traits distills what they have in common and enhances their construct validity (Rushton, Brainerd, & Pressley, et al., 1983).

Similarly, although the evidence suggests that Emotional Intelligence and the Personality Disorders may be linked to opposite poles of the same GFP continuum, it would be a mistake to oversimplify. Excessive Extraversion can lead to boorish behavior and narcissism, excessive Emotional Stability to insensitivity to others, and excessive Openness to Experience to bizarre thinking (Widiger & Lowe, 2007). It is also worth noting there are many niches where one type of personality is more advantageous than another (e.g., for occupations in accounting vs. sales; research psychology vs. counseling). When combined with high IQ and high ego strength (i.e., Conscientiousness), personality disorders may also enhance creativity, including scientific creativity (Eysenck, 1995; Post, 1994).

The theory and evidence presented here agrees with and extends the viewpoint of Darwin (1871), Alexander (1979), Geary (2005), and Wilson (1975), that social competition and reproductive dynamics have helped direct human evolution. They confirm a theoretical suggestion made by Rushton (1985, 1990, 2004b) that a broad heritable dimension underlies much of the field of human individual differences and they extend the evidence for that heritable dimension provided by Figueredo et al. (2004, 2007) and Musek (2007). We suggest that a life history perspective provides increased coherence to the study of human behavior, and makes unique predictions not easily derivable from other approaches.

In a competitive world, there are always rewards (personal and professional) for more efficient persons—those who are more level-headed, agreeable, friendly, dependable, and open. We close by noting Tolstoy's (1875/1918) famous opening in *Anna Karenina*, "All happy families resemble one another, but each unhappy family is unhappy in its own way." Perhaps a similar principle applies to individuals: "All happy [or efficient] people resemble one another; each unhappy [inefficient] person is unhappy [inefficient] in his or her own way."

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