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## The *K*-factor: Individual differences in life history strategy

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### Abstract

Until recently, variations in life history strategy were studied exclusively at the species level. Although this domain of study has been extended to examine systematic differences in life history strategy among various human ethnic groupings, more recent evolutionary theories of human development and related behavioral genetic work imply substantial within-group individual variation in life history strategy. We constructed a latent variable model identifying a single common factor, denoted as *K*, which underlies a variety of otherwise disparate life history parameters. This “*K*-Factor” loaded 0.36 on childhood attachment to the biological father,  $-0.36$  on childhood attachment to any non-biological father figure, 0.38 on adult romantic partner attachment,  $-0.51$  on mating effort,  $-0.58$  on Machiavellianism, and  $-0.41$  on risk propensity. The bivariate correlations of the *K*-factor with higher-order personality factors were statistically significant,  $-0.24$  with “Big Neuroticism” and  $-0.67$  with “Big Psychoticism”, and approached significance, correlating 0.12, with “Big Extraversion”. The *K*-factor appears to be an underappreciated individual difference variable of major importance to human development.

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## 1. Introduction

Individual differences in personality present a recurring, as yet unresolved, theoretical problem for Evolutionary Psychology. Some argue that individual differences are unlikely to be the result of complex adaptations, but are instead a product of selection-irrelevant genetic variation, the random effects of sexual recombination, and non-adaptive phenotypic plasticity in response to environmental differences in development (e.g. [Tooby & Cosmides, 1990](#)). Others argue that individual differences in personality are a central aspect of the “adaptive landscape” in which humans evolved ([Buss, 1991](#)). Still others argue that individual differences evolved to reduce competition among conspecifics by filling a diverse range of social and environmental niches through frequency-dependent selection in social species ([Figueredo, 1995](#); [Figueredo & King, 2001](#); [Figueredo et al., in press](#); [MacDonald, 1998](#)).

We investigate the possibility that individual differences in personality are related to sets of behavioral strategies that increase individual reproductive success within a given environmental context ([MacDonald, 1998](#)). More specifically, [Rushton \(1985, 1987, 1990, 1995, 2004\)](#) proposed “Differential *K* Theory” to help systematize individual and group differences in life histories, social behavior, and physiological functioning. [Rushton \(1985\)](#) suggested that the life history analyses might usefully be extended to human differences beyond those between-species differences and within-species individual differences then being examined in non-human animals. While earlier attempts were successful in explaining behavioral and biological differences at the level of human ethnic groupings, they were much less so at the level of individual differences in personality. We provide further empirical support for the hypothesis that an individual’s personality is related to an integrated life history strategy.

## 2. Personality and Life History Theory

There is a wealth of literature indicating that individual differences in personality are real, measurable, and evolutionarily important (see [Figueredo et al., in press](#), for a recent review). A number of independent studies have confirmed the relations among behavioral strategies and personality characteristics identified in seminal reviews of the literature on behavioral genetics and individual differences by [Bogaert and Rushton \(1989\)](#); [Rushton \(1985, 1987, 1990, 1995, 2004\)](#), and [Rushton and Bogaert \(1988\)](#). For example: (1) Extraverts are more likely than Introverts to use a strategy reflecting less restricted sexuality ([Eysenck, 1976](#)); (2) Neuroticism is correlated with behavioral inhibition and avoidance behavior ([MacDonald, 1995](#)); (3) Conscientiousness relates to the use of long-term strategies, desire for control, dependability, and behaviors that reflect those preferences ([Friedman et al., 1993](#); [Schwartz et al., 1995](#)); and (4) Impulsive Sensation Seeking is related to strategies that focus on risk taking ([Zuckerman & Kuhlman, 2000](#)). Furthermore, individual differences in personality correlate with a diverse array of biological characteristics including longevity and fertility (See [Figueredo et al., in press](#), for an expanded review). For example, analyses of longitudinal data ([Friedman et al., 1993](#); [Schwartz et al., 1995](#)) indicate that Conscientiousness is associated with greater longevity, whereas, in males, Neuroticism is associated with a greater risk of mortality throughout life.

Recurring throughout these studies are consistent relations among personality characteristics and life history traits. Life History Theory (McArthur & Wilson, 1967; Wilson, 1975), a mid-level theory derived from general evolutionary theory, describes an individual's total bioenergetic and material resources as allocated between *Somatic Effort*, resources devoted to the continued survival of the individual organism and *Reproductive Effort*, resources devoted to the production and support of offspring. *Reproductive Effort* consists of *Mating Effort*, resources devoted to obtaining and retaining sexual partners, and *Parental Effort*, resources devoted to enhancing the survival of offspring.

Life History Theory may be illustrated by contrasting the behavioral strategies exhibited by *r*-selected species, which invest more heavily in reproduction, with *K*-selected species, which invest heavily in longevity (Pianka, 1970). By this theory, *r*-selected species evolved under unstable and unpredictable conditions, leading to a strategy focusing on the *production* of genetically similar individuals (offspring quantity). Rabbits, for example, exhibit rapid sexual development, high fertility, low parental investment, high infant mortality, low interbirth interval, short lives, generally small size, less group cohesion, and less competition for resources because, historically, they evolved under unstable conditions where short-term strategies paid off. Conversely, *K*-selected species evolved under stable and predictable conditions, leading to a strategy focusing on the *survival* of genetically similar individuals (offspring quality); thus they do not generally exceed the carrying capacity of their environment. Elephants, for example, exhibit slow, delayed sexual development, low fertility, high parental investment, low infant mortality, high interbirth interval, greater longevity, generally large size, high group cohesion, and intense competition for resources because, historically, they evolved in stable environments where long-term strategies paid off.

Although traditionally applied to differences between species, researchers have recently used Life History Theory to predict that individuals *within* species will vary systematically in *r*-selected and *K*-selected strategies. Rushton (1985) reviewed studies examining individual differences in life history strategy within species such as dandelions (Gadgil & Solbrig, 1972), field mice (Krebs, Gaines, Keller, Myers, & Tamarin, 1973), American shad (Leggett & Carscadden, 1978), and flies and milkweed bugs (Taylor & Condra, 1980). As predicted by Life History Theory, each species exhibited individual differences in allocation of bioenergetic resources as adaptations to environmental conditions. Applying the model to humans, Rushton (1985, 1987, 1990, 1995, 2004) predicted that family structure, intelligence, sexual behavior, and personality will intercorrelate to produce an overarching life history strategy. Hence, individuals with a high-*K* life history strategy will manifest greater general health, developmental stability, consistency in their mental and physical functioning, and investment in genetically related individuals (a focus on Somatic effort over Reproductive effort and Parental effort over Mating effort). Conversely, individuals with a low-*K* life history strategy will allocate resources preferentially to Mating Effort over Parental Effort and Reproductive Effort over Somatic Effort.

In this view, natural selection acts to combine psychosocial traits into meaningful functional composites. These composites may be composed of situation-specific behavioral signatures (Mischel & Shoda, 1995; Mischel, Shoda, & Mendoza-Denton, 2002). Hence, Life History Theory predicts that multivariate correlational techniques will detect functional behavioral composites and that a single multivariate construct will underlie individual behavioral signatures.

It has long been apparent that variables relating to parental behavior correlate with the behavior and well-being of offspring. Parental divorce, for example, correlates with the personal likelihood of divorce; age of menarche correlates with age at first sexual intercourse, pregnancy, and child-birth (Ellis, 2004). Belsky, Steinberg, and Draper (1991) proposed that early childhood exposures to familial and ecological stressors (including biological father absence from, and non-biological surrogate father presence in, the family home) promotes insecure attachment between mothers and offspring, early onset of menarche, and promiscuous sexual activity (see Ellis, 2004 for review). In addition, these children are said to develop either an aggressive, non-compliant behavior style in the case of male children, or anxious and depressed affect in the case of female children.

Unfortunately, most of the studies to date have used either univariate analyses or measured variable path models to test such specific causal hypotheses. These analyses do not fully capture the wider pattern of intercorrelations predicted by theory. In response, we use a multivariate, latent variable approach to assessing predicted relations among many sexual, reproductive, parental, and social behaviors. In this study, we hypothesized that childhood attachment to and parental investment from the biological or non-biological father figure, adult attachment to romantic partners, mating effort, Machiavellianism, and risk-taking attitudes will form an intercorrelated overarching *K*-factor. Although these indicators are not exhaustive of relevant life history traits, they provide an adequate initial sampling of this domain.

### 3. Method

#### 3.1. *Research participants*

Two-hundred and twenty-two University of Arizona Psychology undergraduates, 18 years of age or older, voluntarily completed mass-administered questionnaires. Those recruited from Introductory Psychology courses did so in partial fulfillment of a course requirement for research participation.

#### 3.2. *Procedures*

Participants completed a battery of questionnaires assessing cognitive and behavioral indicators of life history strategy (e.g., investment from parents, romantic commitment and attachment, attitudes towards dating, interpersonal conflict, risk-taking). Participants also completed several personality inventories. The participants were then orally debriefed, provided with a written debriefing form, and given the opportunity to ask questions.

#### 3.3. *Measures*

Several questionnaires assessed behavioral indicators of life history strategy and aspects of personality. Behavioral indicators of life history strategy refer to items such as early childhood attachment to fathers, promiscuity, and risk taking. We avoided making specific associations to particular personality inventories by administering three major personality inventories independently.

### 3.4. Indicators of life history strategy

#### 3.4.1. Attachment to and investment from the Biological Father/Adult Father Figure (adapted from Fine, Worley, & Schwebel, 1985; Kays, 1997)

Investment from and attachment to the biological father or adult father figure was measured as the emotional closeness a child felt toward either the biological father or surrogate father figure (20 items each). Responses were on a seven-point scale ranging from 0 (not at all) to 6 (a great deal/extremely). The Biological-Father scale was identical to the Father-Figure scale except that “adult male” replaced “biological father.” Participants identified “this adult male” as a step-father, mother’s boyfriend/fiancé, a blood relative, an unrelated friend, or another individual. Sample items from the Biological-Father scale are: “Growing up, how well did *your biological father* understand your needs, feelings, and behaviors?” and “How much would you like to be like *your biological father*?” Cronbach’s alpha in our sample was 0.98. A sample item for the Father-figure scale is: “Growing up, how much did you respect *this adult male*?” Cronbach’s alpha in our sample was 0.98.

#### 3.4.2. Multi-Item measure of Adult Romantic Attachment (Brennan, Clark, & Shaver, 1998)

The Adult Romantic Attachment scale (36 items) measured the security and emotional closeness a person *generally* experiences in relationships. The scale ranged from –3 (strongly disagree) to 0 (neutral/mixed) to +3 (agree strongly). Sample items are: “I worry about being abandoned” and “I find it relatively easy to get close to my partner.” Cronbach’s alpha in our sample was 0.93.

#### 3.4.3. The Mating Effort Scale (Rowe, Vazsonyi, & Figueredo, 1997)

Mating effort is the energy or resources an individual invests to attract potential sexual partners and/or maintain relationships with current sexual partners. The Mating Effort Scale (10 items) measured the participants’ personal estimates of these behaviors. The scale ranged from –2 (strongly disagree) to 0 (neither agree nor disagree) to +2 (strongly agree). Sexually appropriate statements were given for each item. Sample items are: “I think girls find me naturally attractive” and “I would rather date several boys at once than just one boy”. We found Cronbach’s alpha equal to 0.67.

#### 3.4.4. Machiavellianism Scale (short form) (Christie & Geis, 1970)

Machiavellianism is the degree to which an individual employs cunning, sly, or crafty methods to obtain the things he or she desires. This scale (10 items) ranged from –2 (strongly disagree) to 0 (neutral/no opinion) to +2 (strongly agree). Sample items are: “You should only act when your action is morally right” and “Anyone who trusts anyone else is asking for trouble”. Cronbach’s alpha in our sample was 0.54.

#### 3.4.5. Risk-Taking Questionnaire (adapted from Eadington, 1976; Kidd & Holton, 1993)

Participants endorsed general statements concerning risk taking (gambling) and attitudes toward risk (breaking rules). The original scale (20 items) plus two risk-sensitive mating items that we added ranged from 1 (disagree very much) to 3 (neutral) to 5 (agree very much). Sample items are: “A little recklessness is good for people” and “I stay away from situations that are likely to be dangerous”. The two additional items constructed by the present authors were: “I would not date someone too attractive for fear of losing them” and “I would approach someone very attractive even if it were a long shot”. Cronbach’s alpha in our sample was 0.89.

### 3.5. Personality Inventories

#### 3.5.1. NEO Five Factor Inventory (Costa & McCrae, 1992)

The NEO-FFI consists of 60 items measuring five personality factors: Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Participants endorsed items on a five point scale ranging from  $-2$  (strongly disagree) to  $0$  (neutral) to  $+2$  (strongly agree). Cronbach's alphas in our sample for each factor in the scale were: 0.71 for Openness to Experience, 0.84 for Conscientiousness, 0.79 for Extraversion, 0.75 for Agreeableness, and 0.79 for Neuroticism.

#### 3.5.2. The Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975)

The EPQ has 90 items that measure three factors of personality, including Psychoticism, Extraversion, and Neuroticism, and a measure of social desirability, called the Lie Scale. Items required participants to endorse certain statements as true or false. "True" endorsements were scored as one; "false" endorsements were scored as zero. Cronbach's alphas in our sample for each factor in the scale were: 0.62 for Psychoticism, 0.86 for Extraversion, 0.71 for Neuroticism, and 0.75 for the Lie Scale.

#### 3.5.3. Zuckerman–Kuhlman Personality Questionnaire (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993)

The ZKPQ is a 99-item scale measuring five personality factors: Impulsivity/Sensation-Seeking, Neuroticism/Anxiety, Aggression/Hostility, Activity, and Sociability. Participants endorsed statements as true or false. "True" endorsements were scored as one; "false" endorsements were scored as zero. The Cronbach's alphas in our sample for each factor in the scale were: 0.80 for Impulsivity/Sensation-Seeking, 0.83 for Neuroticism/Anxiety, 0.57 for Aggression/Hostility, 0.75 for Activity, and 0.81 for Sociability.

### 3.6. Statistical analyses

All statistical analyses used SAS version 8.2 (SAS Institute, 1999). Factor analyses used PROC FACTOR, with initial communality estimates using squared multiple correlations and principal axis estimation. We used subjective scree plots and proportions of variance accounted for to determine the optimal number of factors to be retained. All Cronbach's alphas and bivariate correlations used PROC CORR. General linear models used PROC GLM.

## 4. Results

### 4.1. Common factor models

A principal-axis factor analysis of the hypothesized indicators of the  $K$ -factor produced a single common factor that explained 92% of the reliable variance. Table 1 displays the factor pattern for the  $K$ -factor.

A principal-axis factor analysis of the personality factors was used to construct higher-order common factors that cut across the three personality inventories applied to the same sample. This

Table 1  
Factor pattern (Standardized Regression Coefficients) for *K*-factor

Scale	<i>K</i> -Factor loading
Biological Father Attachment/Investment	0.36
Other Father Figure Attachment/Investment	−0.36
Adult Romantic Partner Attachment	0.38
Mating Effort	−0.51
Machiavellianism	−0.58
Risk Taking	−0.41

Table 2  
Factor pattern (Standardized Regression Coefficients) for higher-order personality factors

Scale	Big N	Big E	Big P
Neuroticism (NEO-FFI)	<b>0.81</b>	−0.07	0.04
Neuroticism (EPQ)	<b>0.87</b>	0.03	−0.02
Neuroticism/Anxiety (ZKPQ)	<b>0.88</b>	0.05	0.03
Extraversion (NEO-FFI)	−0.10	<b>0.80</b>	−0.10
Extraversion (EPQ)	−0.10	<b>0.79</b>	0.10
Sociability (ZKPQ)	0.17	<b>0.78</b>	−0.05
Conscientiousness (NEO-FFI)	−0.23	−0.02	− <b>0.49</b>
Agreeableness (NEO-FFI)	0.00	0.28	− <b>0.62</b>
Psychoticism (EPQ)	−0.12	−0.06	<b>0.66</b>
Impulsivity/Sensation Seeking (ZKPQ)	−0.08	0.36	<b>0.62</b>
Aggression/Hostility (ZKPQ)	0.16	0.04	<b>0.58</b>

Table 3  
Bivariate correlations among higher-order personality factors

Factor	Big N	Big E	Big P
Big N	1.00	−0.34	0.22
Big E	−0.34	1.00	−0.06
Big P	0.22	−0.06	1.00

produced three common factors, Big N (Neuroticism), Big E (Extraversion), and Big P (Psychoticism), accounting for virtually 100% of the reliable variance, replicating Zuckerman et al.'s (1993) result. Table 2 displays the rotated factor pattern under an oblique (Promax) rotation (salient factor loadings highlighted in boldface). Table 3 displays the inter-factor correlations.

#### 4.2. Bivariate correlations

The bivariate correlations of the *K*-factor with the higher-order personality factors were statistically significant for Big N ( $-0.24$ ,  $p < 0.0002$ ) and Big P ( $-0.67$ ,  $p < 0.0001$ ) and approached significance for Big E ( $0.12$ ,  $p = 0.0641$ ). The high and negative correlation of the *K*-factor with Big P supported Zuckerman and Brody's (1988) prediction that Psychoticism is more relevant to *K* than

Neuroticism or Extraversion. The bivariate correlation of the *K*-factor with Sex was  $-0.24$  ( $p < 0.0004$ ), denoting generally lower *K*-factor scores for males. The lower mean on the *K*-factor for males is consistent with well-documented sex differences in reproductive strategy (e.g., Trivers, 1972). The *K*-factor was, however, not significantly related to Age ( $r = -0.10$ ,  $p = 0.1441$ ) in this restricted age-range sample.

### 4.3. *Alternative hypotheses*

#### 4.3.1. *Statistically controlling for ethnicity*

To address the possibility that the factor patterns and bivariate correlations among the *K*-factor and higher-order personality factors were contaminated by spurious effects of ethnicity in our racially diverse sample, we (1) regressed each component variable on ethnicity using the general linear model, (2) exported regression residuals to a new data file, and (3) repeated all the factor analyses and bivariate correlations on the residualized data.

The factor patterns and bivariate correlations were virtually unaffected by residualization on ethnicity. Although several indicators of the *K*-factor showed statistically significant differences by ethnicity, the proportion of variance explained by ethnicity was typically small ( $R^2 < 0.10$ ). Factor loadings for the residualized indicators of the *K*-factor were: 0.36 for Attachment to and investment from the biological father,  $-0.33$  for Attachment to and investment from any father figure other than the biological father, 0.38 for Adult Romantic Partner Attachment,  $-0.52$  for the Mating Effort Scale,  $-0.58$  for the Machiavellianism Scale, and  $-0.44$  for the Risk Taking Questionnaire. The *K*-factor accounted for 96% of the reliable variance in these residualized indicators. The bivariate correlations of the residualized *K*-factor with the residualized higher-order personality factors were  $-0.22$  for Big N ( $p < 0.0008$ ), 0.09 for Big E ( $p = 0.1644$ ), and  $-0.68$  for Big P ( $p < 0.0001$ ). The correlations of the residualized with the unresidualized forms of each factor were all statistically significant and close to unity: 0.99 for the *K*-factor, 0.97 for Big N, 0.99 for Big E, and 0.99 for Big P. These results indicate our findings were not the spurious result of ethnic differences in an ethnically diverse sample.

#### 4.3.2. *Statistically controlling for social desirability*

To address the possibility that the factor patterns and bivariate correlations among the *K*-factor and higher-order personality factors were contaminated by spurious effects of self-presentation due to social desirability bias, we took the same precautions as for ethnicity. We regressed each component variable on the Eysenck Lie Scale using the general linear model, exported the regression residuals to a new data file, and repeated all factor analyses and bivariate correlations on the residualized data.

As with ethnicity, the factor patterns and bivariate correlations were minimally attenuated by residualization on social desirability. Although several indicators of the *K*-factor and the higher-order personality factors showed statistically significant effects of social desirability, the proportion of variance explained by social desirability was still relatively small ( $R^2 < 0.15$ ). Factor loadings for the residualized indicators of the *K*-factor were: 0.35 for Attachment to and investment from the biological father,  $-0.37$  for Attachment to and investment from any father figure other than the biological father, 0.34 for Adult Romantic Partner Attachment,  $-0.47$  for the Mating Effort Scale,  $-0.54$  for the Machiavellianism Scale, and  $-0.33$  for the Risk Taking



Questionnaire. The *K*-factor accounted for 91% of the reliable variance in these residualized indicators. The bivariate correlations of the residualized *K*-factor with the residualized higher-order personality factors were:  $-0.23$  for Big N ( $p < 0.0004$ ),  $0.14$  for Big E ( $p = 0.0314$ ), and  $-0.60$  for Big P ( $p < 0.0001$ ). Again, the correlations of the residualized with the unresidualized forms of each factor were all statistically significant and close to unity:  $0.91$  for the *K*-factor,  $0.99$  for Big N,  $0.99$  for Big E, and  $0.87$  for Big P. These results indicate our findings were not the spurious result of self-presentation due to social desirability bias.

## 5. Discussion

As predicted by Life History Theory, our various indicators of Life History Strategy converged reasonably well on a single multivariate construct, which we called the *K*-factor, supporting the prediction that natural selection acts to combine certain psychosocial traits into meaningful functional composites. The *K*-factor loaded positively on childhood attachment to and parental investment from the biological father, negatively on childhood attachment to and parental investment from any non-biological father figure, positively on adult attachment to romantic partners, negatively on mating effort, negatively on Machiavellianism, and negatively on risk-taking propensity. Life History Theory correctly predicted the directions of these factor loadings (cf., Belsky et al., 1991; Chisholm, 1996; Ellis, 2004; Rowe, 2000; Rushton, 1985).

The *K*-factor correlated significantly with traditional personality factors aggregated across three different personality inventories, and, as predicted by Zuckerman and Brody (1988), correlated negatively with Psychoticism. These results were the spurious products of neither ethnic differences nor individual differences in self-presentation due to social desirability bias, but were primarily based on real variation in life history strategy and personality.

Tooby and Cosmides (1990) specified several criteria that must be met to show evidence for frequency-dependent selection of personality traits. To qualify as alternative adaptive strategies, alternative phenotypes must exhibit: (1) heritable individual differences; (2) component personality traits that covary in a predictable, adaptive manner; and (3) evidence of functional design as logically coherent and coordinated adaptations. To support claims of frequency-dependent selection, the fitness of an alternative phenotype must vary inversely to its relative frequency in the population: The rarer a particular phenotype with respect to its alternatives, the higher its relative fitness must be.

Because finding *direct* evidence for frequency-dependent selection continues to present a challenge, we pursued the second-best strategy by collecting *indirect* evidence. If personality variation correlates with reproductively relevant traits subject to frequency dependent selection, then a direct investigation of the relevance of frequency dependent selection to personality variation in humans is warranted. Fitting personality variation into an overall pattern of reproductively relevant traits fulfills one of the Tooby and Cosmides (1990) conditions for frequency dependent selection.

A source of inter-individual variation held to be subject to frequency-dependent selection is a plurality of alternative reproductive strategies. An array of comparative studies describes the coexistence of alternative phenotypes (and perhaps genotypes) of both male and female conspecifics that pursue divergent sexual and reproductive strategies (e.g., Buss & Greiling, 1999; Gangestad & Simpson, 2000; Rowe, 1996). Indeed, many game-theoretical models conclude that

alternative or conditional strategies can be held in a perpetual state of balanced polymorphism by frequency-dependent selection (Tooby & Cosmides, 1990).

The present results support the idea that individual differences in reproductive life history strategy are relevant to inter-individual variation in personality within a single species. Moreover, if, as predicted by theory, alternative life history strategies are subject to frequency-dependent selection, then these results imply (although they do not conclusively demonstrate) that the personality correlates of reproductive strategy must themselves be (at least indirectly) subject to frequency-dependent selection.

One methodological limitation is that this study relies exclusively on self-report, including retrospective report of childhood experiences. Therefore, more research will be needed to support this theoretical prediction, but the present study provides a first step in that direction.

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