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Is variability in mate choice similar for intelligence and personality traits? Testing a hypothesis about the evolutionary genetics of personality

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ABSTRACT

This study tests the hypothesis presented by Penke, Denissen, and Miller (2007a) that condition-dependent traits, including intelligence, attractiveness, and health, are universally and uniformly preferred as characteristics in a mate relative to traits that are less indicative of condition, including personality traits. We analyzed between-culture mean standard deviations of preference ratings and rankings provided by nearly 10,000 people in 37 cultures for 18 characteristics in a potential mate. Contrary to the hypothesis, preferences for traits indicating agreeableness and conscientiousness were not more variable than preferences for intelligence, and preferences for traits indicating low neuroticism were more uniform than preferences for intelligence. Discussion addresses implications of these results for hypotheses about the evolutionary genetics of intelligence and personality.

Why is there genetic variation in personality? There are three mechanisms of selection that could explain maintenance of this variation (Penke, Denissen, & Miller, 2007a; see also Nettle, 2006): *selective neutrality*, in which mutations have a negligible effect and are invisible to selection; *mutation-selection balance*, in which selection counteracts mutations but is unable to eliminate all of them; and *balancing selection*, in which selection maintains genetic variation. Penke et al. (2007a) argue that the maintenance of genetic variation in personality traits results from balancing selection produced by environmental heterogeneity. Stated differently, particular personality traits such as extraversion can have a positive effect on reproductive success in some environments and a negative effect on reproductive success in other environments. Evidence supporting this hypothesis includes the discovery that an allele associated with extraversion and novelty-seeking is present at higher frequencies in environments that favor these traits, such as among migrants, but at lower frequencies among peoples who are more sedentary (Chen, Burton, Greenberger, and Dmitrieva, 1999; Eisenberg, Campbell, Gray, and Sorenson, 2008; see Buss, 2009, for a review). Maintenance of this genetic variation occurs because the trait's net fitness effects are neutral or nearly neutral when averaged across environments.

Penke et al. (2007a) hypothesize that genetic variation in intelligence, in contrast to that for personality traits, results from mutation-selection balance. Intelligence, and other cognitive abilities including reading, math, and language skill, is the product of many pleiotropic polymorphisms (Haworth, Dale, and Plomin, 2009; Plomin and Kovas, 2005), which are alleles that affect multiple phenotypic traits. The more genetic loci that affect a trait, the greater the probability that any one of these genes will experience a copying error (mutation), and as more mutations accumulate it will be difficult for selection to remove the genetic variation. The result is that traits with large mutational target sizes (the number and size of genes subject to mutation) are balanced in a state between mutation and selection. Support for the hypothesis that genetic variation in intelligence is a consequence of mutation-selection balance comes from recent work suggesting that new mutations arise

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frequently and are indeed detrimental to intelligence (e.g., Hamdan et al., 2011; Lynch, 2010).

Penke et al. (2007a) argue that traits resulting from mutation-selection balance will display condition-dependence, an indication of the organism's quality, because they are affected by larger parts of the genome and, therefore, are sensitive to the operation of a larger number of processes. Traits that are condition-dependent, such as intelligence, health, and attractiveness, are hypothesized to be reliable indicators of phenotypic and genotypic quality. Consequently, high values of these traits should be universally sought in mates, in contrast to traits that are hypothesized to be less reliable indicators of condition, including personality traits. Thus, the argument is that preferences for personality traits, and other less condition-dependent traits, should be for moderate values, on average, and highly variable compared to preferences for condition-dependent traits that are universally sought. Although the current study asked people about the desirability of characteristics in a mate and not about the quality of each trait that they desire, how important a trait is and the quality desired of it in a mate are positively correlated (Sprecher and Regan, 2002), and thus this study can provide a reasonable initial test of the hypothesis.

Previous research on mate preferences has investigated the desirability of intelligence and personality traits, finding consistent support for the desirability of intelligence, although whether certain personality traits are only moderately preferred is less clear (e.g., Botwin, Buss, and Shackelford, 1997; Buss et al., 1990; Figueredo, Sefcek, and Jones, 2006; Li, Bailey, Kenrick, and Linsenmeier, 2002). Here, we test the Penke et al. (2007a) hypothesis regarding *variability* in preferences for a mate's intelligence relative to other (less condition-dependent) characteristics. Their argument is primarily to contrast the forms of selection that maintain genetic variation in intelligence compared to personality traits and, therefore, our analysis similarly compares the standard deviations in preferences for intelligence to all other mate preference traits surveyed — although the hypothesis makes predictions about variation in preferences for additional condition-dependent traits, including health and attractiveness, compared with traits less likely to indicate condition, such as personality traits.

We use two different instruments to test this hypothesis. The first instrument investigates how important people rate 18 characteristics in a mate, incorporating four of the Big Five personality dimensions (Goldberg, 1993), including neuroticism (measured by preferences for emotional stability, maturity), conscientiousness (dependable character; refinement/neatness; ambition/industriousness), agreeableness (pleasing disposition), and extraversion (sociability). However, the remaining Big Five factor – openness to experience – is not represented. In addition, the intelligence trait in this instrument is confounded with a mate's education level ("Education/intelligence"). To overcome these limitations, we also tested the hypothesis using a second mate preference instrument, which includes 2 traits representing openness to experience (creative and artistic; exciting personality), as well as an isolated measure of intelligence. Between these two mate preference instruments, we can evaluate the Penke et al. (2007a) hypothesis about the variability of preferences for traits indicating condition compared to personality traits. Thus, variance in importance ratings for intelligence, good looks, and health are predicted to be lower than the variance for other (less condition-dependent) traits—in particular, traits representing the Big Five dimensions.

Using mean standard deviations of mate preference ratings of 18 traits, and rankings of 13 traits, provided by nearly 10,000 participants in 37 cultures (see Buss, 1989), we compared variation across cultures in preference ratings for intelligence with preference ratings for a variety of other mate preference characteristics.

1. Method

1.1. Participants

Participants included 4499 men and 5310 women residing in 37 cultures located on six continents and five islands. The representativeness of the sample varied by country — in general, rural, less educated, and lower socioeconomic status populations are underrepresented, though there are a number of exceptions. The full sample represents tremendous geographical, religious, political, and cultural diversity. Sample mean age for men ranged from 17.0 to 30.0 years, with a grand mean age of 23.3 years. Sample mean ages for women ranged from 17.0 to 30.0 years, with a grand mean age of 22.6 years (see Buss, 1989, for additional details).

1.2. Materials and procedure

The first instrument to assess mate preferences was adapted from Hill (1945). Participants rated the importance of 18 mate preference characteristics (see Table 1) on the following 4-point scale: *3 points = indispensable*, *2 = important*, *1 = desirable, but not very important*, and *0 = irrelevant or unimportant*. Instructions were provided to each collaborator for translating the instrument into the appropriate language for their sample (see Buss, 1989, for additional details). The second instrument (see Table 2) asked participants to rank the desirability of 13 traits (originally derived from a factor analysis of a larger number of traits; see Buss and Barnes, 1986; Buss et al., 1990), placing the most desirable trait at rank 1, and so on down to the least desirable trait, at rank 13. We analyzed the mean standard deviation for each country of each trait's rank and rating using *t*-tests, because we are comparing means.

2. Results

Because we conducted many statistical tests, we control for alpha inflation by setting α to a conservative .001. As displayed in Table 1, variation among the rating data for several personality traits is not consistent with the Penke et al. (2007a) hypothesis. Preferences for two traits representing Big Five factors were not more variable than preferences for education/intelligence: dependable character (conscientiousness) and pleasing disposition (agreeableness). Preferences for one of the Big Five factors – emotional stability, maturity – were more uniform than those for education/intelligence, also contrary to the hypothesis. Mutual attraction/love was more uniformly preferred than education/intelligence, which was not predicted by the hypothesis. In addition, analyses indicate that preferences for good looks, a condition-dependent trait predicted to be as uniformly preferred as education/

Table 1
Tests of differences between standard deviations of preference *ratings* for education/intelligence and other mate preferences.

Mate preference	Mean			
	Standard deviation	Rating	t-value	Cohen's d
Mutual attraction/love	0.41	2.84	−10.06*	−1.65
Emotional stability, maturity (N)	0.57	2.58	−6.03*	−0.78
Dependable character (C)	0.61	2.51	−1.53	−0.29
Pleasing disposition (A)	0.63	2.48	−1.32	−0.26
Education/intelligence	0.66	2.35		
Health	0.69	2.31	1.90	0.27
Sociability (E)	0.70	2.21	3.59*	0.40
Good looks	0.74	1.69	5.90*	0.88
Refinement, neatness (C)	0.75	1.99	5.85*	0.78
Ambition/industriousness (C)	0.78	2.00	7.68*	1.09
Good cook/housekeeper	0.80	1.54	7.38*	1.18
Good financial prospects	0.83	1.46	11.36*	1.70
Desire for home, children	0.84	2.17	8.67*	1.22
Favorable social status	0.85	1.31	13.16*	1.99
Similar educ. background	0.88	1.67	14.87*	2.00
Chastity	0.90	0.93	9.81*	1.65
Similar political views	0.92	0.97	12.93*	2.35
Similar religious background	1.02	1.11	17.84*	2.96

All tests are paired-means *t*-tests. *SD* = *Standard deviation*. *df* = 73, except for pleasing disposition and sociability. *SD* for Venezuela are missing for these two characteristics, so *df* = 71 for sociability and pleasing disposition. Letters after the characteristic indicate which of the Big 5 personality traits it signifies: N = Neuroticism; C = Conscientiousness; A = Agreeableness; and E = Extraversion. † $p<.01$, *$p<.001$, two-tailed.

intelligence, were more variable than preferences for education/intelligence. Variance in preferences for a few traits supported the hypothesis: health (condition-dependent) preferences were not more variable than those for education/intelligence; and preferences for refinement, neatness and ambition/industriousness, both representing the Big Five factor conscientiousness, were more variable than preferences for education/intelligence. Desirability of the remaining attitude and status characteristics were also more variable than preferences for education/intelligence, which, although they are not clearly representative of particular Big Five factors, is consistent with the Penke et al. (2007a) hypothesis that traits not indicative of condition should be more variably preferred.

Table 2
Tests of differences between standard deviations of preference *rankings* for intelligence and other mate preferences.

Mate preference	Mean			
	Standard deviation	Rank	t-value	Cohen's d
Kind and understanding (A)	2.14	2.63	2.79†	−0.42
Intelligence	2.32	4.12		
Healthy	2.55	5.51	−4.50*	0.61
Good earning capacity	2.56	8.89	−4.41*	0.69
Good housekeeper	2.60	8.26	−5.97*	0.78
Good heredity	2.62	9.48	−4.97*	0.79
College graduate	2.65	9.10	−5.74*	0.89
Physical attractiveness	2.79	6.44	−8.87*	1.28
Wants children	2.86	7.86	−11.39*	1.73
Exciting personality (E or O)	2.88	4.85	−10.07*	1.42
Easygoing (N)	2.90	6.31	−9.85*	1.52
Creative and artistic (O)	3.02	7.16	−14.57*	2.18
Religious	3.22	10.33	−9.29*	1.48

Tests are paired-means *t*-tests. *SD* = *Standard deviation*. *df* = 73. Letters after the characteristic indicate which of the Big 5 personality traits it signifies: N = Neuroticism; C = Conscientiousness; A = Agreeableness; O = Openness to experience; and E = Extraversion. † $p<.01$, *$p<.001$, two-tailed.

Table 2 indicates a similar pattern among the ranking data, wherein one particular personality trait is desired more uniformly than intelligence, and the other personality traits are more variably preferred than intelligence. In this instrument, a mate who is kind and understanding – a measure of agreeableness – was marginally more uniformly desired ($p<.01$) than intelligence. This instrument did not have a measure of conscientiousness, but the measures of neuroticism, possibly extraversion, and openness to experience were not as uniformly preferred as intelligence — in support of the Penke et al. (2007a) hypothesis. However, health, physical attractiveness, and good heredity – three condition-dependent measures – were also significantly more variably preferred than intelligence, contrary to the hypothesis.

3. Discussion

Penke et al. (2007a) hypothesized that, if contemporary genetic variation in intelligence results from mutation-selection balance, and thus indicates condition, high values of intelligence – and other likely condition-dependent traits, including attractiveness and health – will be universally and uniformly sought in a mate. If genetic variation in personality traits is maintained by balancing selection, in contrast, people should prefer moderate values of these traits, on average, and these preferences should be highly variable. We tested these predictions by comparing variability in preferences for intelligence to variability in preferences for traits representing the Big Five personality dimensions, as well as for additional condition-dependent traits.

Five of the 17 rated traits (and only one of the 12 ranked traits) were preferred more uniformly or not more variably than intelligence, and it may thus appear that there is general support for the hypothesis — that is, men's and women's preferences for many personality traits are indeed more variable than are their preferences for intelligence. However, the results with respect to a few key personality traits do not support the hypothesis — in particular, rated preferences for emotional stability, maturity (neuroticism) are more uniform than preferences for education/intelligence, ranked preferences for kind and understanding (agreeableness) are marginally more uniform than intelligence, and rated preferences for dependable character (conscientiousness) and pleasing disposition (agreeableness) are not more variable than preferences for intelligence. Thus, although only six traits total were preferred in a pattern contrary to the hypothesis, four of these were personality traits — which challenges the hypothesis that these traits result from balancing selection and are variably desired in a mate.

Penke et al. (2007a) include mental health as a trait likely to indicate condition, as genetic variation in mental disorders may also be a consequence of mutation-selection balance (Keller and Miller, 2006) and, therefore, mental health should be uniformly preferred. Given that neuroticism is a Big Five factor closely linked to personality disorders (Saulsman and Page, 2004), our

finding that people more uniformly preferred emotional stability, maturity than education/intelligence may be construed as supporting the hypothesis. However, neuroticism (emotional stability, maturity) is a dimension of personality, and Penke et al. propose that personality disorders may reflect traits that were adaptive in particular ancestral environments. That is, personality traits are favored by balancing selection if appropriate niches exist where they might be useful, and personality disorders may reflect an instance in which an appropriate niche is not available presently. Additionally, Penke et al. suggest that personality disorders are only condition-dependent to the extent that they interact with (and reveal) intelligence. Thus, given that the hypothesis predicts uniformly high and relatively invariant preferences for personality traits related to mental health only to the extent that they reflect intelligence, the uniform preference for emotional stability, maturity does not support this hypothesis.

Dependable character, pleasing disposition, kind and understanding, and emotional stability, maturity are personality traits desired in a mate (Buss et al., 1990) and, as the current study indicates, these are traits that people uniformly desire (in the case of emotional stability, maturity) or are not more variable in desiring than intelligence (as with dependable character, kind and understanding, and pleasing disposition). These results are contrary to the hypothesis that values of personality traits should be moderately desired, on average, and highly variable, compared to preferences for condition-dependent traits such as intelligence. If genetic variation in personality traits is a consequence of balancing selection produced by environmental heterogeneity, our result that people from 37 different nations more uniformly desired particular personality traits than intelligence indeed contradicts this hypothesis.

Intelligence was the second-most uniformly desired trait out of 13 in the ranking data, and education/intelligence was the fifth most uniformly-desired trait out of 18 in the rating data. Although intelligence is preceded in both instruments by personality traits—contradicting the prediction that personality traits should be more variably preferred — the results indicate general support for men and women being invariably attracted to high values of intelligence, as expected if intelligence results from mutation-selection balance. Measures of other traits expected to indicate condition – physical attractiveness and health – were more variably preferred than intelligence in both instruments. This is contrary to the hypothesis, given that these predicted condition-dependent traits were not uniformly desired. That health and attractiveness were more variably desired than intelligence suggests that either these are not condition-dependent traits, or that the value of condition-dependence is contingent on the trait (e.g., intelligence may be a better, or perhaps more useful, indicator of condition). Future research should examine the costs and benefits of different classes of traits indicating condition in mating.

There are several implications of the importance of some personality traits, and the relative unimportance of some predicted condition-dependent traits, for the hypothesis that personality traits result from balancing selection (e.g., Nettle, 2006; Penke et al., 2007a). Some personality traits are desired as uniformly as intelligence and, in the case of emotional stability and perhaps also kind and understanding, are even more uniformly desired than intelligence. Some personality traits therefore may be condition-dependent, as would be the case if genetic variation in personality was a result of mutation-selection balance and not balancing selection. That is, the current results may indicate that both intelligence and some personality traits are the result of mutation-selection balance — consistent with the hypothesis that some personality traits, conscientiousness and agreeableness, in particular, may have been sexually selected as costly (and thus honest) indicators of low mutation load (Miller, 2007). There is a second possible explanation for the uniform value of particular personality traits, relative to intelligence: traits that indicate condition may not be the *only* universally and uniformly sought traits in a mate. Indeed, kindness (agreeableness) appears to be a necessity, not a luxury, in mate preferences (Li et al., 2002) — consistent with men and women ranking kind and understanding less variably than intelligence. Penke et al. (Penke, Denissen, and Miller, 2007b) note that agreeableness should be an important mate characteristic in long-term relationships – about which this study as well as Li et al. (2002) inquired – because this is a desired characteristic in social relationships generally, as are honesty and trustworthiness. The consistency with which people value emotional stability relative to the variability in preferences for intelligence suggests that this personality trait also may be valued because it indicates a cooperative partner. A refinement of the hypothesis, then, may be that personality traits *can* be favored by sexual selection if displaying particularly desirable personality traits increases mating opportunities (e.g., if it is perceived as a moral virtue; Miller, 2007).

One limitation of the current research is that the tests indicating no significant differences between intelligence and other traits are only a first step toward indicating uniform importance in preferences; future research should probe the hypothesis for predictions that would test directly evidence for uniform preferences. We note in closing that this cross-cultural dataset, including preference ratings and rankings from nearly 10,000 people in 37 cultures, provides an initial test of whether different selection mechanisms are responsible for personality traits and intelligence (Penke et al., 2007a). Is variability in mate choice similar for intelligence and personality traits? According to these data, for some personality traits it is, but for others it is not.

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