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ORIGINAL ARTICLE

Physical Attractiveness and the General Factor of Personality

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Abstract Personality traits covary to form a General Factor of Personality (GFP). Using data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), the associations between the GFP and both self-reported and rater-based physical attractiveness were examined. While it was predicted that the GFP would exhibit positive associations with each measure of physical attractiveness, it was also predicted that the nature of the associations would vary. Indeed, the GFP was positively correlated with both measures of physical attractiveness, yet each measure accounted for unique variance in the GFP. Additional tests examining the relative importance of the GFP (in comparison to the individual traits), in explaining variance in attractiveness suggested that the GFP is more important in explaining variance in rater-based than self-reported attractiveness. The differences in associations were buttressed by tests using the Add Health sibling subsample. The results of genetic analyses showed that the GFP covariation with the rater-based measure of physical attractiveness was exclusively due to additive genetic factors. Nonshared environment explained the majority of the covariation between the GFP and self-reported attractiveness. The results may shed light on the proximate and ultimate nature of the GFP.

Keywords General factor of personality · Physical attractiveness · Mutation-selection balance · Response bias · Heritability

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Introduction

Personality traits correlate such that positively valenced traits are positively correlated (Figueredo et al. 2004; Musek 2007; Rushton et al. 2008). One possible explanation for this positive manifold of traits is seen in the idea of the general factor of personality or GFP. It has been proposed that the GFP functions much like emotional intelligence (Van der Linden et al. 2012, 2016b). Individuals high on the GFP may be socially-effective and can properly modulate their behavior to match the social context (Dunkel and Van der Linden 2014; Van der Linden et al. 2016a). From this view, positive traits may *actually* covary such that individuals who genuinely possess one desirable quality (e.g., conscientious) are also more likely to possess another quality (e.g., agreeable). However, the association amongst personality traits could also be a function of measurement error, such as a social-desirable response bias (Bäckström and Björklund 2016). Individuals may knowingly respond to items in a manner which overestimates their personal qualities, or they may falsely believe they possess positive qualities while in all actuality they do not. Recent findings by Davies et al. (2015) and Dunkel et al. (2016) suggest that all three factors play a role in the covariation of personality traits.

By assessing GFPs across and within personality inventories Davies et al. (2015) found that a large portion of GFP variance was explained by the response tendencies unique to individual inventories. However, these idiosyncratic response sets did not fully account for the emergence of the GFP. When Davies et al. (2015) combined scales across inventories, although substantially reduced in strength, the GFP still emerged. This result suggests that at least some portion of GFP reflects meaningful individual differences.

In line with this idea, using the Block and Block data set (Block & Block 2006), Dunkel et al. (2016) examined the ability of (1) social-effectiveness-as measured by the composite of several trained raters Q-sorts of participants, (2) socially-desirable response bias- as measured by both the Crowne and Marlowe (1960) social desirability scale and the impression management subscale of the Balanced Inventory of Desirable Responding (BIDR; Paulhus 1986), and (3) self-evaluation- as measured by both the BIDR (Paulhus 1986) subscale of self-deception and self-esteem (Rosenberg 1965), to account for variance in the GFP as measured by three separate self-report measures. The results showed that each social-effectiveness, socially-desirable response bias, and self-evaluation explained a significant amount of GFP variance. Importantly, however, relative weight analysis tended to show that social-effectiveness had the strongest association with the GFP.

GFP and General Fitness

In as far as the GFP reflects social effectiveness, one relevant question is what might underlie individual variation on this trait. For example, from an evolutionary point of view being socially effective would be associated with being more adept at securing resources, forming beneficial coalitions, and attracting superior mates. As such, it can be expected that during human evolution the GFP should consistently be selected for and over time variation should be reduced (Penke et al. 2007). Mutation-selection balance has been proposed as one of the natural selection mechanisms that may partly explain individual differences on the GFP (Van der Linden et al. 2016a). Mutation-selection balance states that while high levels of the GFP are favored, random mutations-which are almost always neutral or deleterious to the functioning of the organism-may cause deviation from the optimal. The accumulation of these mutations is called mutation load and thus measures of mutation load should be inversely associated with the GFP. For example, according to mutation-selection balance, inbreeding should be especially problematic as the mutations are more likely to be expressed. In an important study on the genetics of personality, Verweij et al. (2012) found patterns in four measures of personality suggestive of a GFP that was negatively affected by inbreeding. They concluded, "Overall, these results provide strong evidence that inbreeding affects some personality traits, consistent with being influenced by a load of mutations that tend to be rare, recessive, and deleterious, as predicted under mutation–selection balance." (p. 9).

The impact of overall mutation load on an organism's functioning is not isolated to single characteristics (e.g., personality), but should have broad effects on the organism's general fitness (Ajie et al. 2005; Hill et al. 2016; Miller 2000; Penke et al. 2007). That is, this general fitness factor, also referred to by several other names including "condition", "system integrity", and "developmental stability" (Hill et al. 2016), being the inverse of mutation load, would cause observable phenotypic characteristics to covary.

A clear indicator of general fitness is physical health which is known to correlate with the general fitness subfactors (Penke et al. 2007) of physical attractiveness (Nedelec and Beaver 2014) and general intelligence (e.g., Wraw et al. 2015). Likewise, because cognitive ability and physical attractiveness are each considered subfactors of general fitness they, therefore, should correlate (Penke et al. 2007; Prokosch et al. 2005). This proposed association has been examined several times with mixed results (e.g., Kanazawa 2011; Kleisner et al. 2014; Mitchem et al. 2015; Zebrowitz et al. 2002).

The GFP may be considered to reflect an additional subfactor of general fitness and should, therefore, exhibit significant associations with other subfactors such as general intelligence and physical attractiveness. Numerous studies have examined the relationship between the GFP and general intelligence. The results of these studies exhibit substantial variation in effect size from weak (e.g., Loehlin et al. 2015) to strong (e.g., Dunkel 2013), but with a clear tendency in the direction of positivity. Yet we know of no study that has examined the association between the GFP and physical attractiveness, hence this relationship is the focus of the current investigation.

Hypotheses

While a positive correlation between the GFP and physical attractiveness is expected several more exacting predictions are also made. First, although the GFP is assumed to be a higher order personality trait subsuming lower-order personality factors such as the Big Five, it is expected that the predicted association with physical attractiveness will primarily be at the level of the GFP, as opposed to, at the level of individual personality traits. Second, it is hypothesized that the GFP is composed of variance from various sources including a positive self-evaluative bias and social-effectiveness. The data used to test these hypotheses includes a measure of self-rated physical attractiveness and a measure of rater-based physical attractiveness. As self-rated attractiveness obviously depends on how one thinks about his/her own appearance, it is assumed that self-rated attractiveness includes an element of self-evaluative bias while the rater-based measure does not. Thus while it is predicted that each measure of physical attractiveness will be associated with the GFP, the associations should be somewhat orthogonal, with each measure accounting for unique variance in the GFP.

This difference in the measurement of physical attractiveness spills over to predictions concerning the genetic and environmental source(s) of any GFP-physical attractiveness correlation. We expect the self-rated measure to be influenced more strongly by non-genetic factors such as the non-shared environment given that the respondents' assessment of physical attractiveness may contain more response bias and is more likely based on their personal experiences. The rater's assessment of the respondent's physical attractiveness, however, is based on the participants' physical appearance (i.e., genetically-based phenotypic traits) and thus may be a better indicator of general fitness. Therefore, it is expected that the genetic factors are more influential, possibly indicating the role played by mutation load.

Method

Data Set and Participants

Data for the current study are derived from the National Longitudinal Study of Adolescent to Adult Health (Add Health; Harris et al. 2009). Details regarding the sampling procedure and data structure have been provided elsewhere (Harris et al. 2009, 2006). Briefly, the Add Health is a prospective study of a nationally representative sample of American youth who provided information at four different waves over approximately 14 years (1994–2007) with a fifth wave of data collection in progress. The first two waves were conducted when most of the respondents were between 14 and 18 years old while the third wave was conducted when the majority of the respondents were in their early 20s. Six years after the third wave, the fourth wave of data collection occurred when all respondents were at or beyond the age of 25 but younger than 34. However, only the fourth wave included measures of personality, self-rated physical attractiveness, and rater-based physical attractiveness. Consequently, the current study employs data from the fourth wave. Excluding participants with incomplete personality data, the sample size was $N = 5026$. The sample includes 2309 males (45.9%) and 2717 females (54.1%).

While the initial analyses are conducted on the full sample, the genetic analyses required the use of the sibling subsample within the Add Health. Embedded in the Add Health, the sibling subsample contains over 2000 kinship pairs. After removing cases with missing data, unknown genetic relatedness, and limiting the sample to twins, the analytical sample for the genetic analyses consisted of 260 monozygotic (MZ) twins and 410 dizygotic (DZ) twins (total genetic analyses sample $N = 670$).

Measures

Physical Attractiveness

The self-rated measure of physical attractiveness is derived from a single item wherein respondents were asked "How attractive are you?". Responses were provided on a 4-

point scale and reverse coded to match the direction of the other measures such that 1 = not all attractive, 2 = slightly attractive, 3 = moderately attractive, and 4 = very attractive. At the end of each interview and after the interviewers were separated from the respondents, the interviewer provided information about the respondent. One of the questions asked the interviewer, "How physically attractive is the respondent?". Responses were provided on a 5-point scale (1 = very unattractive, 2 = unattractive, 3 = about average, 4 = attractive, and 5 = very attractive).

GFP and Personality Traits

The Big Five personality traits of agreeableness, conscientiousness, extraversion, neuroticism, and openness were measured using a five-point Likert-type scale to rate 20 items from the Mini-International Personality Item Pool (IPIP–BF; Baldasaro et al. 2013; Goldberg 1999). The total trait scores were factor analyzed using principal axis factoring. The first unrotated factor had an Eigenvalue of .89 and explained 17.96% of the variance among the trait scales. While this Eigenvalue for the GFP is low, as noted previously (e.g., Dunkel et al. 2015) the GFP based on factor analysis correlated with an alternative unit-weighted GFP at $r = .96$. Due to this similarity, only the GFP from the factor analysis was used in the analyses.

Results

Associations between the GFP and Measures of Physical Attractiveness

The bivariate correlations among study variables can be seen in Table 1. Most pertinent to the hypotheses, there were significant positive correlations between each measure of the GFP and both the rater-based and self-report measures of physical attractiveness. Other notable findings include a significant, but only small positive association between the measures of physical attractiveness. To examine

Table 1 Bivariate Correlations among Study Variables

	PA_{Rater}	PA_{Self}	O	C	E	A	N	GFP
PA_{Rater}	---							
PA_{Self}	.06	---						
O	.05	.09	---					
C	.08	.09	.03	---				
E	.07	.16	.22	.06	---			
A	.11	.03	.28	.17	.28	---		
N	-.05	-.07	-.16	-.11	-.10	-.07	---	
GFP	.13	.14	.65	.41	.60	.75	-.30	---

Correlations $r \geq .03$ or $r \leq -.03$, $p < .05$

PA_{Rater} Rater-based physical attractiveness, *PA_{Self}* Self-report physical attractiveness, *O* openness, *C* conscientiousness, *E* extraversion, *A* agreeableness, *N* neuroticism

the unique contribution of each measure of physical attractiveness in accounting for variance in the GFP, the GFP was regressed on the self-rated and rater-based measures of physical attractiveness (total $R^2 = .03$, $p < .001$). Both self-rated ($\beta = .14$, $p < .001$) and rater-based ($\beta = .12$, $p < .001$) measures accounted for unique variance in the GFP.

Testing the Importance of the GFP Relative to the Lower Level Personality Traits

Next, to examine the relative importance of the shared variance of the Big Five traits in comparison to the unique variance of the Big Five traits two analyses were undertaken. First, partial correlations between the individual traits and the two measures of physical attractiveness while controlling for the GFP were computed. Reductions in the strength of the correlations from the bivariate to the partial while controlling for the shared variance indicate the importance of the GFP in accounting for individual differences in the measures of physical attractiveness. The results of the partial correlations can be seen in Table 2. As seen in Table 2, for rater-based physical attractiveness, when controlling for the GFP all of the associations between the individual traits and physical attractiveness were no longer significant; save for openness- with the association actually changing direction. Alternatively, the unique variance for four of the five individual traits accounted for significant variance in self-reported physical attractiveness. Note that the bivariate agreeableness and self-reported physical attractiveness association was not significant, and when controlling for the GFP the association became significant and negative.

Another way to test the relative importance of the shared versus unique variance of the traits in accounting for physical attractiveness is through hierarchical regression. Two hierarchical regressions were computed; one regression predicting rater-based physical attractiveness and one regression predicting self-reported physical attractiveness. In each regression, the GFP was entered in Step 1 and in Step 2 each of the Big Five traits were entered. The change in R^2 from Step 1 in comparison to Step 2 indicates the relative importance of the shared variance among the traits to the combined unique variance of the traits. For rater-based physical attractiveness, the Step 1 R^2 was .016, $p < .001$, and the Step 2 R^2 was .002, $p < .05$ indicating that the most of the variance accounted for by personality was due to the GFP. For self-report physical attractiveness, the Step 1 R^2 was .020, $p < .001$, and the Step 2 R^2 was .019, $p < .001$ indicating that the shared and unique variance of the personality traits accounted for an equivalent amount of variance.

Table 2 Partial Correlations between Measures of Physical Attractiveness and the Big Five Personality Traits Controlling for the GFP

	Rater-based PA	Self-report PA
Traits		
Openness	-.05	.00
Conscientiousness	.02	.04
Extraversion	-.00	.10
Agreeableness	.02	-.12
Neuroticism	-.01	-.03

Correlations $r \geq .03$ or $r \leq -.03$, $p < .05$

Genetic Analyses

In order to examine the relative influence of genetic and non-genetic factors on the covariation between the respective physical attractiveness measures and GFP two bivariate Cholesky models were produced.[1] The bivariate Cholesky model decomposes the variance in the phenotypic correlation between two measures (e.g., self-rated PA and GFP) into three latent constructs: additive genetic factors (A), shared environmental factors (C), and nonshared environmental factors (E; which also includes error), all of which account for 100% of the *covariation* between the two phenotypes. The genetic analyses were conducted using Mplus, version 7.4 and all of the measures were *z*-scored prior to the analyses.

Table 3 displays the results of the first genetic analysis. As illustrated, the covariation between the rater-based physical attractiveness measure and the GFP is due exclusively to additive genetic factors. As noted by the model fit statistics (using conventional model fit statistic parameters; see Marsh et al. 2004), the best-fitting model indicates that 100% of the phenotypic covariation is due to additive genetic factors. Table 4 displays the results of the bivariate Cholesky model for the self-report physical attractiveness measure and the GFP. As illustrated, the best fitting model is the AE model indicating that the covariation between these measures is due primarily to nonshared environmental influence and additive genetic factors (66.8% and 33.2% of the phenotypic correlations, respectively).

Discussion

Associations between the GFP and physical attractiveness were tested. Because the GFP has been found to include variance associated with both response bias and social-effectiveness it was hypothesized that the association of the GFP with physical attractiveness would, in part, be a function of how physical attractiveness is measured. Specifically, self-report and rater-based measures of physical attractiveness were predicted to account for unique variance in the GFP. Indeed, the two measures of physical attractiveness exhibited little overlap and each accounted for unique variance in the GFP; although the effect sizes were small.

Next, the relative importance of the GFP in comparison to the individual Big Five personality traits in the association of physical attractiveness with personality was examined. The results of a series of partial correlations, assessing the association between the individual traits and the two measures of physical attractiveness while controlling for the GFP, showed that the association between the rater-based measure of physical attractiveness and personality was primarily through the GFP. Alternatively, the association between personality and the self-report measure of physical

[1] The cross-twin (intraclass) correlations for the physical attractiveness (PA) and GFP measures were as follows: PA-Rater rMZ = .29 ($p < .001$), rDZ = .17 ($p < .05$); PA-Self-report rMZ = .33 ($p < .001$), rDZ = .21 ($p < .001$); GFP rMZ = .40 ($p < .001$), rDZ = .15 ($p < .05$). Additionally, prior to conducting the Cholesky models each of the constituent measures (i.e., both of the physical attractiveness items and the GFP item) were subjected to univariate decomposition analysis (i.e., ACE model). In line with the varying intraclass correlations between MZ and DZ twins, the results of the univariate decomposition analyses indicated substantial genetic influence on phenotypic variance for all of the measures (see supplemental material).

Table 3 Bivariate Cholesky models with parameter estimates and model fit statistics assessing influence of genetic and non-genetic factors on the association between rater-based physical attractiveness and GFP

Physical Attractiveness (Rater Based) & GFP

	Parameter Estimates			Model Fit Statistics									
	A	C	E	χ^2	$\Delta\chi^2$	RMSEA	ΔRMSEA	BIC	ΔBIC	CFI	ΔCFI	TLI	ΔTLI
ACE	0.21	0.00	0.01	18.96	--	0.02	--	6734.50	--	0.98	--	0.98	--
	(.09–.33)	(.00–.04)	(.00–.07)	17									
AE	0.15	0.00	0.02	19.71	0.75	0.02	0.00	6731.91	-2.59	0.98	0.00	0.99	0.01
	(.09–.22)	(.00–.00)	(.00–.08)	18									
CE	0.00	0.09	0.08	25.34	6.38	0.04	0.02	6737.55	3.05	0.93	-0.05	0.96	-0.02
	(.00–.00)	(.04–.14)	(.03–.12)	18									
A	1.00	0.00	0.00	20.01	0.30	0.01	-0.01	6728.89	-3.02	0.99	0.01	0.99	0.00
	(1.00–1.00)	(.00–.00)	(.00–.00)	19									
E	0.00	0.00	1.00	34.93*	15.22	0.05	0.03	6473.80	-258.11	0.85	-0.13	0.91	-0.08
	(.00–.00)	(.00–.00)	(1.00–1.00)	19									

95% confidence intervals are displayed in parentheses; model degrees of freedom appear below each χ^2 statistic; BIC: sample-size adjusted BIC; best-fitting model in bold; variables are z-scored; percent of covariance explained in the best fitting model: A = 100%, C = 0%, and E = 0%; $N = 670$ ($N_{MZ} = 260$; $N_{DZ} = 410$)

*$p < .05$

Table 4 Bivariate Cholesky models with parameter estimates and model fit statistics assessing influence of genetic and non-genetic factors on the association between self-report physical attractiveness and GFP

Physical Attractiveness (Self-Report) & GFP

	Parameter Estimates			Model Fit Statistics									
	A	C	E	χ^2	$\Delta\chi^2$	RMSEA	ΔRMSEA	BIC	ΔBIC	CFI	ΔCFI	TLI	ΔTLI
ACE	0.12	0.00	0.12	17.31	--	0.01	--	6881.84	--	1.00	--	1.00	--
	(.00–.26)	(.00–.05)	(.05–.19)	17									
AE	0.07	0.00	0.13	17.80	0.49	0.00	-0.01	6878.99	-2.85	1.00	0.00	1.00	0.00
	(.01–.14)	(.00–.00)	(.07–.19)	18									
CE	0.00	0.04	0.16	19.17	1.86	0.01	0.00	6880.35	-1.49	0.99	-0.01	0.99	-0.01
	(.00–.00)	(.00–.09)	(.10–.21)	18									
A	1.00	0.00	0.00	30.06	12.26	0.04	0.04	6887.92	8.93	0.91	-0.09	0.95	-0.05
	(1.00–1.00)	(.00–.00)	(.00–.00)	19									
E	0.00	0.00	1.00	20.65	2.85	0.02	0.02	6878.51	-0.48	0.99	-0.01	0.99	-0.01
	(.00–.00)	(.00–.00)	(1.00–1.00)	19									

95% confidence intervals are displayed in parentheses; model degrees of freedom appear below each χ^2 statistic; BIC: sample-size adjusted BIC; best-fitting model in bold; variables are *z*-scored; percent of covariance explained in the best fitting model: A = 35.2%, C = 0%, and E = 64.8%; $N = 670$ ($N_{MZ} = 260$; $N_{DZ} = 410$)

attractiveness was best explained by the GFP and individual trait variance. This pattern of results was confirmed using hierarchical regression.

Most importantly, analyses using the sibling subsample of the Add Health data allowed for an examination of the genetic and non-genetic factors on the covariation of the two measures of physical attractiveness with the GFP. The covariation of the GFP with self-reported physical attractiveness primarily resulted from nonshared environmental factors, with an additional third of the covariation a result of additive genetic influence. As a reminder, the nonshared environment represents experiences unique to individuals, but it also includes random and systematic measurement error. Thus, unlike the rater-based measure of physical attractiveness, the self-assessed measure incorporates the aggregated (or at least most memorable) social interactions respondents felt were related to their physical attractiveness. Evolutionary psychologists note that individuals tend to recognize their position within mating markets in part based on the reactions of others due to outward appearances such as physical attractiveness (e.g., Kurzban and Weeden 2005). This social interactive process, along with other factors that could affect self-assessments of attractiveness such as injuries, are likely captured in the substantial nonshared environmental effect observed in the genetically informed analysis.

An additional explanation for the nonshared environmental effect in the model is the fact that measurement error, including systematic self-report bias in this case, is captured by the nonshared environmental factor. Thus, to the extent that systematic bias exists in both the self-report of physical attractiveness and the items related to personality the estimate of the nonshared environmental influence could be inflated. Given that it is known that the GFP is in part due to such bias (Bäckström and Björklund 2016; Dunkel et al. 2016), this appears to be at least a partial explanation. Genetically sensitive tests of this association using different data are recommended to assess the extent of potential estimate inflation.

Alternatively, the covariation between rater-based physical attractiveness and the GFP was found to be entirely influenced by additive genetic factors. This finding may be the most significant finding because it may help shed light on the nature of the GFP. One possible reason for the covariation of socially desirable personality traits is mutation-selection balance. From this perspective random mutations affect the general fitness of the organism causing subfactors such as general intelligence, physical attractiveness, and thus possibly also, the GFP to covary. The results that the GFP and rater-based physical attractiveness covary, and that the covariation is due to genetic factors, are consistent with this account.

However, analyses looking at the covariation amongst subfactors have not reliably yielded results consistent with those predicted by a general fitness factor and mutation-selection balance (e.g., Loehlin et al. 2015; Mitchem et al. 2015). Because a direct test of mutation-selection balance has yet to be developed the findings also do not rule out other possibilities like systematic assortative mating between the GFP and physical attractiveness (Kanazawa and Kovar 2004).

Limitations

While the findings of the current study are consistent with predictions from general fitness and mutation-selection balance, the size of the association between rater-based physical attractiveness and the GFP suggests that the effect is small. The small association could also be a function of measurement (Mitchem et al. 2015).

Both the self-report and rater-based scales were composed of a single item. Additionally, while the self-report measure inquired about a participants' attractiveness, the item did not specify "physical" attractiveness. The ambiguity of the item most likely led to a further reduction in the reliability of the measure. Likewise, there was an additional factor, negatively impacting the reliability of the rater-based measure of physical attractiveness. While rater-based measures are most likely superior the number of raters is also an important factor (Connelly and Ones 2010). A clear limitation is that the ratings used in the current study were based on ratings by a single rater. In fact, the short form self-report measure of personality may also be seen as a limitation as rater-based measures of personality may also be preferential (Connelly and Ones 2010; Dunkel 2013). Thus benefits should accrue from future research which attempts to improve upon measure.

Beyond the effect size and issues of psychometrics are alternative interpretations of the findings. The raters' familiarity with aspects of the participants other than their physical appearance may have led to a "halo" effect in which more pleasant participants were also judged as more physically attractive (e.g., Lewandowski et al. 2007). This confound could have possibly inflated the association between attractiveness and the GFP.

It could be that general fitness accounts for only a small portion of the variance in the GFP and because other factors, like life history strategy (e.g., Figueredo et al. 2004) account for more variance. Likewise the physical attractiveness-GFP association has also been predicted by a conceptualization of personality trait covariation emanating from interpersonal bargaining power, itself resulting from physical attractiveness (Loehlin 2014; Lukaszewski 2013). These possible alternative influences are not mutually exclusive and a full account of the relationship between physical attractiveness and the GFP would benefit from further exploration of these other influential factors. Although, the current findings are consistent with the general fitness explanation and there is mounting evidence of importance of mutation-selection balance in accounting for individual differences (Hill et al. 2016).

References

Ajie, B. C., Estes, S., Lynch, M., & Phillips, P. C. (2005). Behavioral degradation under mutation accumulation. *Genetics, 170*, 655–660.

Bäckström, M., & Björklund, F. (2016). Is the general factor of personality based on evaluative responding? Experimental manipulation of item-popularity in personality inventories? *Personality and Individual Differences, 96*, 31–35.

Baldasaro, R. E., Shanahan, M. J., & Bauer, D. J. (2013). Psychometric properties of the mini-IPIP in a large, nationally representative sample of young adults. *Journal of Personality Assessment, 95*, 74–84.

Block, J., & Block, J. H. (2006). Venturing a 30-year longitudinal study. *American Psychologist, 61*, 315–237

Connelly, B. S., & Ones, D. S. (2010). An other perspective on personality: meta-analytic integration of observer accuracy and predictive validity. *Psychological Bulletin, 136*, 1092–1122.

Crowne, D. P., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting Psychology, 24*, 349–354.

Davies, S. E., Connelly, B. S., Ones, D. S., & Birkland, A. S. (2015). The general factor of personality: the "big one", a self-evaluative trait, or a methodological gnat that won't go away? *Personality and Individual Differences, 81*, 13–22.

Dunkel, C. S. (2013). The general factor of personality and general intelligence: evidence for substantial association. *Intelligence, 41*, 423–427.

Dunkel, C. S., & Van der Linden, D. (2014). Evidence for the general factor of personality as social-effectiveness. *Personality and Individual Differences, 64*, 147–151.

Dunkel, C. S., Nedelec, J., & Van der Linden, D. (2015). Predicting the general factor of personality: from adolescence through adulthood. *Human Ethology Bulletin, 29*, 4–12.

Dunkel, C. S., Van der Linden, D., Brown, N. A., & Mathes, E. W. (2016). Self-report based general factor of personality as socially-desirable responding, positive self-evaluation, and social-effectiveness. *Personality and Individual Differences, 92*, 143–147.

Figueredo, A. J., Vásquez, G., Brumbach, B. H., & Schneider, S. M. R. (2004). The heritability of life history strategy: the K-factor, covitality, and personality. *Social Biology, 51*, 121–143.

Goldberg, L. R. (1999). A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. J. Deary, F. De Fruyt, & F. Ostendorf (Eds.), *Personality psychology in Europe* (Vol. 7, pp. 7–28). Tilburg: Tilburg University Press.

Harris, K. M., Halpern, C. T., Smolen, A., & Haberstick, B. C. (2006). The national longitudinal study of adolescent health (add health) twin data. *Twin Research and Human Genetics, 9*, 988–997.

Harris, K. M., Florey, F., Tabor, J., Bearman, P. S., Jones, J., and Udry, J. R. (2009). *The National Longitudinal Study of adolescent health: research design*. Chapel Hill: Carolina Population Center, University of North Carolina, 2003. [WWW Document] http://www.cpc.unc.edu/projects/addhealth/design

Hill, W. D., Davies, G., Harris, S. E., Hagenaars, S. P., The neuroCHARGE Cognitive Working group, Liewald, D. C., Penke, L., Gale, C. R., & Deary, I. J. (2016). Molecular genetic aetiology of general cognitive function is enriched in evolutionary conserved regions. *bioRxiv*. doi:10.1101/063636.

Kanazawa, S. (2011). Intelligence and physical attractiveness. *Intelligence, 39*, 7–14.

Kanazawa, S., & Kovar, J. L. (2004). Why beautiful people are more intelligent. *Intelligence, 32*, 227–243.

Kleisner, K., Chvátalová, V., & Flegrtalov, J. (2014). Perceived intelligence is associated with measured intelligence in men but not women. *PloS One, 9*, e81237. doi:10.1371/journal.pone.0081237.

Kurzban, R., & Weeden, J. (2005). HurryDate: mate preferences in action. *Evolution and Human Behavior, 26*, 227–244.

Lewandowski, G. W., Aron, A., & Lee, J. (2007). Personality goes a long way: the malleability of opposite-sex physical attractiveness. *Personal Relationships, 14*, 571–585.

Loehlin, J. C. (2014). Does relative bargaining power explain the general factor of personality? *Personality and Individual Differences, 63*, 6–9.

Loehlin, J. C., Bartels, M., Boomsma, D. I., Bratko, D., Martin, N. G., Nichols, R. C., & Wright, M. J. (2015). Is there a genetic correlation between general factors of intelligence and personality? *Twin Research and Human Genetics, 18*, 234–242.

Lukaszewski, A. W. (2013). Testing an adaptationist theory of trait covariation: relative bargaining power as a common calibrator of and interpersonal syndrome. *European Journal of Personality, 27*, 328–345.

Marsh, H. W., Hau, K. T., & Wen, Z. (2004). In search of golden rules: comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling, 11*, 320–341.

Miller, G. F. (2000). *The mating mind: how sexual choice shaped the evolution of human nature*. New York: Doubleday.

Mitchem, D. G., Zietsch, B. P., Wright, M. J., Martin, N. G., Hewitt, J. K., & Keller, M. C. (2015). No relationship between intelligence and facial attractiveness in a large, genetically informative sample. *Evolution and Human Behavior, 36*, 240–247.

Musek, J. (2007) A general factor of personality: evidence for the big one in the five-factor model. *Journal of Research in Personality, 41*, 1213–1233

Nedelec, J. L., & Beaver, K. M. (2014). Physical attractiveness as a phenotypic marker of health: an assessment using a nationally representative sample of American adults. *Evolution and Human Behavior, 35*, 456–463.

Paulhus, D. L. (1986). Two-component model of socially desirable responding. *Journal of Personality and Social Psychology, 46*, 598–609.

Penke, L., Denissen, J. A., & Miller, G. F. (2007). The evolutionary genetics of personality. *European Journal of Personality, 21*, 549–587.

Prokosch, M. D., Yeo, R. A., & Miller, G. F. (2005). Intelligence tests with higher g-loadings show higher correlations with body symmetry: evidence for a general fitness factor mediated by developmental stability. *Intelligence, 33*, 203–213.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

Rushton, J. P., Bons, T. A., & Hur, Y. (2008). The genetics and evolution of a general factor of personality. *Journal of Research in Personality, 42*, 1173–1185

Van der Linden, D., Tsaousis, I., & Petrides, K. V. (2012). Overlap between general factors of personality in the big five, giant three, and trait emotional intelligence. *Personality and Individual Differences, 53*, 175–179.

Van der Linden, D., Dunkel, C. S., & Petrides, K. V. (2016a). The general factor of personality (GFP) as social-effectiveness: review of the literature. *Personality and Individual Differences, 101*, 98–105.

Van der Linden, D., Pekaar, K. A., Bakker, A. B., Schermer, J. A., Vernon, P. A., Dunkel, C. S., & Petrides, K.V. (2016b). Overlap between the general factor of personality and emotional intelligence: a meta-analysis. *Psychological Bulletin*, in press.

Verweij, K. J., Yang, J., Lahti, J., Veiiola, J., Hintsanen, M., Pulkki-Raback, L., et al. (2012). Maintenance of genetic variation in human personality: testing evolutionary models by estimating heritability due to common causal variants and investigating the effect of distant inbreeding. *Evolution, 66*, 3238–3251.

Wraw, C., Deary, I. J., Gale, C. R., & Der, G. (2015). Intelligence in youth and health at age 50. *Intelligence, 53*, 23–32.

Zebrowitz, L. A., Hall, J. A., Murphy, N. A., & Rhodes, G. (2002). Looking smart and looking good: facial cues to intelligence and their origins. *Personality and Social Psychology Bulletin, 28*, 238–249.