Contents:

Personality and occupational markers of 'solid citizenship' are associated with having fewer children

Adam M. Perkins [a,*], Renata Cserjesi [b], Ulrich Ettinger [c], Veena Kumari [d], Nicholas G. Martin [e], Rosalind Arden [f]

[a] Department of Psychological Medicine, Institute of Psychiatry, King's College London, London, United Kingdom
[b] Clinical Psychology Department, Psychological Sciences Research Institute at the Catholic University of Louvain, Belgium
[c] Department of Psychology, University of Bonn, Bonn, Germany
[d] Department of Psychology, Institute of Psychiatry, King's College London, London, United Kingdom
[e] Queensland Institute of Medical Research, Brisbane, Australia
[f] MRC Social, Genetic & Developmental Psychiatry Centre, Institute of Psychiatry, King's College London, London, United Kingdom

ABSTRACT

Investigating associations between personality and reproductive fitness may reveal the adaptive significance of human behavioural traits. What we dub 'solid-citizenship' personality characteristics such as self-control, diligence and responsibility may repay study from an evolutionary perspective as they protect against negative life-outcomes. We explored associations between reproductive fitness and personality questionnaire markers of solid citizenship in 4981 women from four Australian samples. We also examined relations between reproductive fitness and army discharge status, an applied measure of solid citizenship, in 15,283 Vietnam War-era military veterans. In two Australian samples there were significant negative associations between reproductive fitness and personality measures of solid citizenship. Similarly, in the US study honourably discharged servicemen on average fathered significantly fewer children than non-honourably discharged servicemen. Since personality is genetically influenced, our results suggest that genetic variants for solid citizenship may be decreasing in frequency in some populations, in line with other modern findings but in contrast to historical analyses. Causes for this change may include relatively more conscientious women using contraception to prioritise their careers over reproduction and the availability of systematic welfare provisioning.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

Soon after the publication of the Origin of Species (Darwin, 1859), the fallacy emerged that evolution by natural selection had effectively ceased among people in the post-industrial world (e.g., Tait, 1869). This mistake arose primarily because infant mortality and infection, both of which may drive natural selection, were in decline. However inter-individual variation in reproductive fitness (i.e., offspring number) can also shape human evolution, as heritable attributes that are positively associated with reproductive fitness will increase in frequency and vice versa (Stearns, Byars, Govindaraju, & Ewbank, 2010). Since personality has a heritable basis (e.g., Bouchard, 1994), examining associations between reproductive fitness and personality characteristics potentially provides a snapshot of contemporary evolution of human behaviour patterns.

Associations have already been found between reproductive fitness and self-report questionnaire scores that measure 'solid citizenship' personality characteristics, such as long-term planning, achievement, responsibility, persistence and high aspiration: characteristics that approximate to the high end of the conscientiousness dimension in the parlance of modern personality researchers (e.g., McCrae & Costa, 2008). However, the direction of these reproduction-personality associations varies between studies: for example, Jokela, Hintsa, Hintsanen, and Keltikangas-Järvinen (2010) found that high reproductive fitness was associated with low persistence in 1535 Finns. Congruent with this result, in a sample of 8373 US women conscientiousness was negatively associated with offspring number, even when controlling for educational level and parental socio-economic status (Jokela, Alvergne, Pollet, & Lummaa, 2011). In contrast, two other studies have found reproductive fitness was positively associated with social responsibility in 99 US women (Bogg & Roberts, 2004) and with conscientiousness in 2900 Dutch women (Dijkstra & Barelds, 2009).

Understanding more about the contemporary evolution of solid citizenship personality characteristics would be of societal value

* Corresponding author. Address: Department of Psychological Medicine, Box P074, Institute of Psychiatry, King's College London, 103 Denmark Hill, London SE5 8AZ, United Kingdom. Tel.: +44 (0)20 7848 5305.
E-mail address: adam.perkins@kcl.ac.uk (A.M. Perkins).

as, when measured in childhood, they have been shown to be longitudinally protective against a host of undesirable life outcomes (e.g., financial mistakes, occupational failure, disease, premature death, single-parenthood, unhealthy/abusive interpersonal relationships and criminality; Friedman & Martin, 2011; Moffitt et al., 2011). The aim of this article was to clarify the relationship between reproductive fitness and solid citizenship using two different sources of evidence. First we tested associations between reproductive fitness and personality questionnaire scores in 4981 Australian women (Study 1). Second we tested associations between reproductive fitness and an occupational measure of solid citizenship (military discharge status) in 15,283 men who served in the US military in the Vietnam War era (Study 2).

2. Study 1: personality questionnaire scores and reproductive fitness in Australian females

2.1. Method

2.1.1. Participants

Participants were from a cohort of twins and their relatives who participated in a series of health and lifestyle surveys conducted in Australia over the past three decades. In four of these surveys personality and reproduction data were recorded, making them suitable for use in the present research. Religious persuasions and educational level were also recorded. Following the methods of Kirk et al. (2001), only women aged ⩾45 years at the time when they last reported their number of offspring were included as participants in our research. These inclusion criteria were adopted owing to the greater certainty that women have in their number of offspring compared to males and the previous finding that reproduction in Australian females during the era in question has effectively ceased by the age of 45 (typically fewer than 0.5% of female survey respondents reproduced past the age of 45; Kirk et al., 2001). Participants provided written consent and the use of these already existing data for current purposes had approval from the local ethics committee (for sample descriptions and personality questionnaires see Table 1).

2.1.2. Statistical analyses

We explored relationships among our key measures using correlations and multiple regressions. To avoid non-independent sampling among twins we used the robust sandwich estimator (significance level set at 5%) to estimate standard errors implemented in Stata 10 (Stata Corporation, College Station, TX). The robust sandwich estimator (Binder, 1983) provides robust standard errors (and therefore robust confidence intervals and *p*-values) which give accurate assessments of the sample-to-sample variability of the parameter estimates even when the model is mis-specified, such as if observations are non-independent, i.e., cluster-correlated. Using robust regression the parameter estimate may not be unbiased but the 95% confidence interval will be accurate, giving 95% confidence that the true parameter estimate lies within its range.

3. Results

Tables 2–5 show means, standard deviations and inter-correlations for relevant variables in each sample. In Sample 1 (older Australian twins), reproductive fitness was significantly positively correlated with psychoticism and Catholic faith and negatively correlated with education level. Sample 2 (relatives of older Australian twins) showed the same pattern of correlations between reproductive fitness, Catholicism and education level but also a modest negative association with neuroticism. Sample 3 (relatives of young Australian twins) showed a mildly significant negative association between extraversion and reproductive fitness. In Sample 4 (participants in a nicotine study), reproductive fitness was significantly positively correlated with neuroticism and catholic faith and significantly negatively correlated with education level, conscientiousness and openness to experience.

Table 6 shows the results in each sample of regression analysis of effects on reproductive fitness of personality and societal variables, while taking into account relatedness. This pattern of findings broadly confirms the correlational results reported above, with one difference: in Sample 3 (relatives of young Australian twins), regression analysis revealed a modest negative effect of education level on reproductive fitness that was not detected in correlation. Regression analysis also revealed that overall the amount of variance in reproductive fitness accounted for by personality, religion or education level across all four samples was on average 4.25%.

4. Study 2: work record and reproductive fitness in US males

4.1. Method

4.1.1. Participants

Participants in the Vietnam Experience Study (VES; U.S. Department of Health & Centers for Disease Control, 1989) were

Table 1
Descriptions of samples in Study 1.

Sample	1	2	3	4
Number of participants	2450	1371	646	514
Mean age	61.34 (SD 9.43)	61.10 (SD 9.22)	52.30 (SD 5.19)	61.94 (SD 8.74)
Earliest/latest birth year	1893/1945	1894/1945	1910/1946	1910/1958
Median year of birth	1933	1928	1939	1940
Survey dates	1980–82, 1988–90, 1993–95	1989	1990	2001
Participant type	Old twins	Sample 1 relatives (parents, sibs, spouses)	Parents of young twins	Relatives of other twins
Personality measures	EPQ (90 item)[a]	EPQ (48 item)[b]	EPQ (48 item)[b]	NEO-FFI (60 item)[c]
Education level	Recorded[d]	Recorded[e]	Recorded[e]	Recorded[e]
Religion	Recorded[f]	Recorded[f]	Not-recorded	Recorded[f]

[a] Eysenck Personality Questionnaire (EPQ) divides the personality factor space into the three major dimensions of extraversion, neuroticism and psychoticism. EPQ-psychoticism has substantial face validity as a proxy (inverse) measure of conscientiousness as high scorers on psychoticism are typically irresponsible, reckless, and lacking in dependability (Eysenck & Eysenck, 1975).
[b] A revised short form EPQ containing 48 items was used in these samples (Eysenck, Eysenck, & Barrett, 1985).
[c] NEO-FFI (60 item; Costa & McCrae, 1989) measures extraversion, neuroticism, agreeableness, conscientiousness and openness to experience.
[d] A two-point scale was used: 0 = non university education and 1 = university education.
[e] A four-point scale was used: 1 = basic schooling, 2 = high school/apprenticeship, 3 = higher education (not university) and 4 = university education.
[f] A pseudo-ordinal scale was used: 1 = no religion, 2 = non-catholic christian, 3 = non-christian religion and 4 = Catholic.

Table 2
Means, standard deviations and intercorrelations between reproductive fitness and personality/demographic variables in Study 1, Sample 1 (older Australian twins).

Variable	Mean	1	2	3	4	5	6	7
1. Fitness	2.78 (1.68)	–						
2. Age at final survey	61.34(9.43)	−.022	–					
3. Education level	–	−.086**	−.104**	–				
4. Catholic religion	–	.123**	−.030	.007	–			
5. Psychoticism	z scored	.069**	−.140**	.057**	.038	–		
6. Extraversion	z scored	−.005	−.055**	.020	.059**	.095**	–	
7. Neuroticism	z scored	−.016	−.109**	−.071**	.014	.058*	−.139**	–

Note: N = 2450. Z score is used here for personality variables to allow scores from different versions of the EPQ to be compared.
* *p* < .05.
** *p* < .01.

Table 3
Means, standard deviations and intercorrelations between reproductive fitness and personality/demographic variables in Study 1, Sample 2 (relatives of older Australian twins).

Variable	Mean (SD)	1	2	3	4	5	6	7
1. Fitness	3.83 (1.72)	–						
2. Age	61.10 (9.22)	.191**	–					
3. Education level	–	−.151**	−.169**	–				
4. Catholic religion	–	.207**	−.022	−.061	–			
5. Psychoticism	1.51 (1.29)	.036	−.041	.091**	.026	–		
6. Extraversion	5.92 (3.44)	−.017	−.045	.056*	−.013	.072**	–	
7. Neuroticism	4.52 (3.01)	−.062*	−.025	−.080**	.003	−.141**	−.210**	–

Note: N = 1371.
* *p* < .05.
** *p* < .01.

Table 4
Means, standard deviations and intercorrelations between reproductive fitness and personality/demographic variables in Study 1, Sample 3 (relatives of young Australian twins).

Variable	Mean (SD)	1	2	3	4	5	6
1. Fitness	4.11 (1.50)	–					
2. Age	52.30 (5.19)	.370**	–				
3. Education level	–	−.069	.027	–			
4. Psychoticism	1.60 (1.36)	.043	−.005	.059	–		
5. Extraversion	6.37 (3.33)	−.085*	−.018	.112**	.076	–	
6. Neuroticism	4.88 (3.13)	.051	−.013	−.116**	−.076	−.214**	–

Note: N = 646.
* *p* < .05.
** *p* < .01.

Table 5
Means, standard deviations and intercorrelations between reproductive fitness and personality/demographic variables in Study 1, Sample 4 (participants in Australian nicotine study).

Variable	Mean (SD)	1	2	3	4	5	6	7	8	9
1. Fitness	4.17 (1.87)	–								
2. Age	61.94 (8.49)	.418**	–							
3. Education level	–	−.174**	−.150**	–						
4. Catholic religion	–	.151**	−.013	.027	–					
5. Agreeableness	45.78 (6.27)	−.055	−.027	.131**	−.004	–				
6. Conscientiousness	47.34 (6.04)	−.104*	−.065	.035	.009	.182**	–			
7. Openness	38.12 (6.42)	−.114**	−.136**	.360**	−.031	.237**	−.023	–		
8. Extraversion	39.15 (6.33)	−.073	−.042	.114**	.022	−.009	.351**	.069	–	
9. Neuroticism	31.62 (7.91)	.095*	.018	−.215**	.034	−.391**	−.253**	−.191**	−.250**	–

Note: N = 514.
* *p* < .05.
** *p* < .01.

a random sample of men who served in the U.S. Army between 1965 and 1971: the era of the Vietnam War. At time of interview the men were on average 37.44 years old (SD 2.50; range 30–47). The VES was prompted by concerns that the herbicide Agent Orange used in Vietnam had harmed the health of US servicemen there. The study contrasted the physical and psychiatric health of Vietnam veterans with U.S. Army veterans from territories where Agent Orange was not used, such as Korea, Germany or the USA. A particularly prominent concern relating to the use of Agent Orange in the Vietnam War was that it may have harmed reproductive health of the servicemen: offspring numbers were therefore recorded, making the cohort useful for the present research. Military employment history was available on all participating veterans.

Table 6

Regression of predictor variables onto reproductive fitness in all four samples of Study 1, taking into account twin relatedness (bold font indicates statistically significant associations).

Sample	1 (N = 2450)		2 (N = 1371)		3 (N = 646)		4 (N = 514)	
	t	P (R² %)	t	P (R² %)	t	P (R² %)	t	P (R² %)
Education level	**−4.61**	**<0.000 (1.56)**	**−3.53**	**<0.000 (2.45)**	**−2.24**	**0.025 (0.68)**	**−4.28**	**<0.000 (3.49)**
Catholic religion	**3.71**	**<0.000 (1.32)**	**3.78**	**<0.000 (5.00)**	–	–	**3.14**	**0.002 (1.40)**
Psychoticism	**3.08**	**0.002 (0.42)**	1.83	0.067	1.31	0.192	–	–
Extraversion	−0.33	0.739	−0.82 0.412		**−2.54 0.011 (0.90)**		−1.51 0.133	
Neuroticism	−0.90	0.366	**−2.24**	**0.025 (0.33)**	1.47	0.141	1.40	0.162
Openness	–	–	–	–	–	–	**−2.47**	**0.014 (1.15)**
Conscientiousness	–	–	–	–	–	–	**−2.95**	**0.003 (1.30)**
Agreeableness	–	–	–	–	–	–	−1.21	0.225

Table 7

Comparison of mean reproduction and MMPI clinical scale scores by military discharge status in Study 2 (Vietnam era veterans).

Variable	Military discharge status		
	Honourable discharge	Non-honourable discharge	
	Mean (SD)	Mean (SD)	t
1. Reproductive fitness (number of children)	1.79 (1.33)	1.98 (1.51)	2.93[**]
2. Months unemployed (in previous 3 years)	3.73 (7.85)	10.01 (11.38)	−13.37[**]
2. Age at interview	37.54 (2.44)	35.08 (2.71)	−21.90[**]
3. Cognitive ability	56.20 (59.57)	41.18 (22.17)	14.37[**]
1. Hypochondriasis	56.31 (12.33)	60.09 (15.46)	3.19[**]
2. Depression	61.28 (14.06)	64.13 (15.83)	2.35[**]
3. Hysteria	57.68 (9.44)	58.53 (11.31)	0.98
4. Psychopathic deviate	60.42 (11.52)	67.07 (12.43)	7.47[**]
5. Masculinity/femininity	58.79 (9.39)	58.90 (9.47)	0.15
6. Paranoia	56.79 (10.57)	59.99 (11.64)	3.92[**]
7. Psychasthenia	59.00 (12.56)	62.85 (14.08)	3.57[**]
8. Schizophrenia	58.56 (14.87)	65.06 (17.27)	4.91[**]
9. Hypomania	57.42 (10.94)	64.64 (11.75)	8.53[**]
10. Social introversion	54.55 (10.91)	54.69 (10.70)	0.16

Note: Section 1: HD *N* = 14,680; Non-HD *N* = 603. Section 2: HD *N* = 4284; Non-HD *N* = 175.
[*] *p* < .05.
[**] *p* < .01.

In the original study, 18,313 men were selected from military records using a random sample method, 15,288 of whom were located and interviewed by telephone; 4462 of these men then took part in a physician-administered battery of physiological and psychological tests completed over several days. These tests included the Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1940). Although discharge type had a larger impact on participation rates than other factors (men with honourable discharges were more likely to participate), the distribution of discharge type was not notably different in the examination sample from the entire sample. Comprehensive details of the study can be found in Health Status of Vietnam Veterans Volumes I–V (U.S. Department of Health & Human Services, Centers for Disease Control, 1989).

4.1.2. Measures

We explored relationships between type of military discharge (derived from army records), reproductive fitness and personality. There are seven categories of military discharge reported in the dataset (including honourable). Since the very large majority of men receive honourable discharges (96.1% overall), we concatenated all the non-honourable categories into one discharge type for our analyses, labelling this as non-honourable discharge. Importantly in the context of the present research, the Centers for Disease Control researchers collected census information on number of months of unemployment experienced by the participants in the previous 3 years. Scores on the Minnesota Multiphasic Personality Inventory (MMPI-1; Hathaway & McKinley, 1940) were extracted for 4459 of the Vietnam era veterans in our sample. This

questionnaire contains 10 clinically criterion keyed scales (Table 7) that do not conform to the 3/5 factor structure found in typical modern personality questionnaires. Nevertheless, since it is plausible that clinical dysfunction in personality will reduce employability these MMPI data were examined with a view to providing a general assessment of whether men who failed to achieve an honourable discharge from the military had detectably divergent personality traits in comparison to honourably discharged men.

4.1.3. Statistical analyses

We conducted independent samples *t*-tests to establish whether discharge type was associated with significant differences in reproductive fitness, unemployment, age and cognitive ability in the 15,283 men who went on to be interviewed over the telephone and for whom there were data (603 or 3.9% of these men were non-honourably discharged). Independent samples *t*-tests were also used to test for differences in MMPI scores between discharge groups in the subset of 4462 men who attended testing sessions. Finally, to determine if the effect of discharge status on reproductive fitness and unemployment remained even when controlling for age and intelligence, we conducted univariate ANCOVAs with age at interview and standard military cognitive ability scores (AFQT) as covariates.

5. Results

Table 7 shows non-honourably discharged men fathered significantly more children and also experienced significantly greater

unemployment in the 3 years prior to interview than honourably discharged men. Non-honourably discharged men were also significantly younger and less intelligent than the honourably discharged men. In the subset of 4459 men for whom MMPI scores were available, those who were not honourably discharged scored significantly higher on seven out of the 10 MMPI scales, most notably on the psychopathic deviate and hypomania scales (Table 7). Univariate ANCOVA showed that the effect of discharge status on reproductive fitness remained significant even when controlling for age and cognitive ability: F (1,14,922) = 14.5, p = <.000, $\eta p2$ = 0.001. Age and cognitive ability themselves also each accounted for a further 1% of the variance in reproductive fitness: F (1,14,922) = 21.688, p = <.000, $\eta p2$ = 0.001. F (1,14,922) = 12.676, p = <.000, $\eta p2$ = 0.001. Adjusted R Squared for this model was .003 or 3% of the variance in reproductive fitness. A stronger effect of discharge status was observed on unemployment, with non-honourably discharged men having very much worse employment histories than honourably discharged men even when controlling for age and cognitive ability: F (1,14,896) = 280.0, p = <.000, $\eta p2$ = 0.018. Age and cognitive ability also affected employment chances: F (1,14,896) = 93.6, p = <.000, $\eta p2$ = 0.006, F (1,14,896) = 14.6, p = <.000, $\eta p2$ = 0.001. Adjusted R Squared for this model was .031 or 31% of the variance in risk of unemployment.

6. Discussion

Results suggest that what we dub 'solid citizenship', whether indexed by self-report personality questionnaire or achieving an honourable discharge from the US military, is negatively associated with reproductive fitness. Our findings are consistent with those of two studies that found a negative association between reproductive fitness and scores on conscientiousness-type personality questionnaires (Jokela et al., 2010, 2011) and contradict two other studies showing an opposite association (Bogg & Roberts, 2004). Therefore, the balance of the evidence suggests there is a slight but significant tendency for solid citizens to have fewer offspring, at least in populations of the type surveyed here. This finding contrasts with historical analyses: for example, the most occupationally successful British citizens up to the late 1800's typically raised twice as many children to adulthood as average citizens and the least occupationally successful citizens typically failed to raise any children to adulthood (Clark, 2007). Since occupational success is associated with high scores on solid citizenship personality traits such as conscientiousness (e.g., Barrick, Mount, & Judge, 2001) and personality traits have a genetic basis (Bouchard, 1994), our results could plausibly be interpreted in the light of these historical data as meaning that genetic variants for solid citizenship personality characteristics were once favoured by natural selection, but over the last century or so this trend has gradually reversed (at least in developed nations of the type studied here).

The downstream societal consequences of this putative shift in the personality profile of the human population are likely to be complex. On the one hand creativity is associated with relatively low levels of conscientiousness (Batey, Chamorro-Premuzic, & Furnham, 2010), but on the other hand so are numerous undesirable life outcomes, such as occupational failure, ill health, marital discord and law-breaking (Barrick et al., 2001; Friedman & Martin, 2011; Hampson, Andrews, Barckley, Lichtenstein, & Lee, 2000; Moffitt et al., 2011; Ozer & Benet-Martinez, 2006).

The causal mechanisms of this apparent transformation of solid citizenship attributes from fitness boost to fitness penalty over the last century or so are also likely to be complex. One credible mechanism is the emergence of effective contraceptive technology over this time period as the higher a person's level of conscientiousness,

the more diligent they are likely to be in the use of contraception, with concomitant evolutionary effects on the personality profile of the population. Amongst women the emancipation of the female workforce over the last 100 years or so has been cited as an environmental change that could also reduce the evolutionary fitness of solid citizen personality traits: Jokela (2012) found that for women born in the 1920s there was no significant relationship between reproductive fitness and conscientiousness but that the negative association seen in modern studies emerged gradually up to the final cohort of women, born in the 1960s. Jokela (2012, p.839) suggested this change is caused by "the fact that an increasing proportion of women have been able to pursue careers outside the domestic sphere (Brewster & Rindfuss, 2000). This may have led to more trade-offs between work and family, and resulting postponement of parenthood, especially in highly conscientious women, who tend to pursue achievement in the labour market (cf. Elder & MacInnis, 1983)."

Jokela's theory explains the results of our first study (which contained only female participants) but does not explain why we found that men who were relatively less solid citizens (as indexed by a failure to achieve an honourable military discharge status) tended to father more children than more responsible men (i.e., those who were honourably discharged). Data pertaining to the employment history of the Vietnam-era US veterans is relevant here: non-honourably discharged men not only fathered more children on average than honourably discharged men but also experienced on average more than three times the amount of unemployment in the 3 years up to interview, despite the interviews taking place around 15 years after military discharge. Since this finding persisted even when controlling for individual differences in cognitive ability, it points to an irresponsible personality profile amongst the non-honourably discharged men as, despite their seemingly chronic difficulty in holding down a job, the non-honourably discharged men nevertheless went ahead and fathered more children than the occupationally more successful honourably discharged men. As these non-honourably discharged men evidently found women willing to be fertilised by them despite their relatively poor economic performance, it seems that contemporary women (who shape the characteristics of the next generation through mate choice) may be less focussed than women in earlier eras on finding a mate with good economic prospects (e.g., Austen, 1813; Clark, 2007). One plausible reason for this could be that since around the time of the Second World War in developed nations, such as the USA, Australia and the UK, there has been a systematic welfare safety net to pay for the raising of a woman's children if her mate abandons her or is a poor provider.

It therefore seems likely to us that in addition to the female employment emancipation factor identified by Jokela (2012), welfare policies that buffer the reproductive penalty of occupational failure may have contributed to a gradual lowering of the fitness value of genetic variants for solid citizenship personality characteristics over the last century or so. This theory is congruent with data showing that people with personality profiles that predispose them not to be solid citizens are more likely than average to end up claiming welfare (e.g., Vaughn et al., 2010) and studies showing that increases in generosity of welfare payments lead to rises in reproduction rates in welfare claimants (e.g., Brewer, Ratcliffe, & Smith, 2011; Moffitt, 1998). A similar point has already been made with regard to intelligence by Herrnstein and Murray (1994) who argued that as people of relatively low intelligence are more likely than average citizens to end up unemployed and claiming welfare, welfare policies that encourage unemployed people to reproduce will increase the fitness of genetic variants for low intelligence.

In conclusion, our results provide support for previous findings (e.g., Jokela et al., 2010, 2011) that the human personality profile in developed countries such as the USA may be gradually evolving by

natural selection towards lower levels of personality traits that predispose an individual to be a solid citizen. Causes and effects of these changes are likely to be complex but, as solid citizenship personality traits exert important long term effects on life outcomes (e.g., Friedman & Martin, 2011; Moffitt et al., 2011), any changes in their frequency in the population deserve close scrutiny.

Acknowledgments

References

Austen, J. (1813). *Pride and prejudice*. London: T. Egerton.
Barrick, M. R., Mount, M. K., & Judge, T. A. (2001). Personality and performance at the beginning of the new millennium: What do we know and where do we go next? *International Journal of Selection and Assessment, 9*, 9–30.
Batey, M., Chamorro-Premuzic, T., & Furnham, A. (2010). Individual differences in ideational behavior: Can the big five and psychometric intelligence predict creativity scores? *Creativity Research Journal, 22*, 90–97.
Binder, D. A. (1983). On the variances of asymptotically normal estimators from complex surveys. *International Statistical Review, 51*, 279–292.
Bogg, T., & Roberts, B. W. (2004). Conscientiousness and health behaviors. *Psychological Bulletin, 130*, 887–919.
Bouchard, T. J. (1994). Genes, environment, and personality. *Science, 264*, 1700–1701.
Brewer, M., Ratcliffe, A., & Smith, S. D. (2011). Does welfare reform affect fertility? Evidence from the UK. *Journal of Population Economics, 25*, 245–266.
Brewster, K. L., & Rindfuss, R. R. (2000). Fertility and women's employment in industrialized nations. *Annual Review of Sociology, 26*, 271–296.
Clark, G. (2007). *A farewell to alms*. Princeton, NJ: Princeton University Press.
Costa, P. T., & McCrae, R. R. (1989). *The NEO-PI/NEO-FFI manual supplement*. Odessa, FL: Psychological Assessment Resources.
Darwin, C. (1859). *The origin of species by means of natural selection*. London: Murray.
Dijkstra, P., & Barelds, D. P. H. (2009). Women's well-being: The role of individual differences. *Scandinavian Journal of Psychology, 50*, 309–315.
Elder, G. H., & MacInnis, D. J. (1983). Achievement imagery in women's lives from adolescence to adulthood. *Journal of Personality and Social Psychology, 45*, 394–404.
Eysenck, H. J., & Eysenck, S. B. G. (1975). *Manual of the eysenck personality questionnaire*. London: Hodder and Stoughton.
Eysenck, S. B. G., Eysenck, H. J., & Barrett, P. (1985). A revised version of the psychoticism scale. *Personality and Individual Differences, 6*, 21–29.
Friedman, H. S., & Martin, L. R. (2011). *The longevity project: Surprising discoveries for health and long life from the landmark eight-decade study*. New York: Hudson Street Press.
Hampson, S. E., Andrews, J. A., Barckley, M., Lichtenstein, E., & Lee, M. E. (2000). Conscientiousness, perceived risk, and risk-reduction behaviors: A preliminary study. *Health Psychology, 19*, 247–252.
Hathaway, S. R., & McKinley, J. C. (1940). A multiphasic personality schedule (Minnesota): I. Construction of the schedule. *Journal of Psychology, 10*, 249–254.
U.S. Department of Health and Human Services, Centers for Disease Control, 1989. *Health Status of Vietnam Veterans Volumes I-V*.
Herrnstein, R. J., & Murray, C. (1994). *The bell curve*. New York: Free Press.
Jokela, M. (2012). Birth-cohort effects in the association between personality and fertility. *Psychological Science, 23*, 835–841.
Jokela, M., Alvergne, A., Pollet, T. V., & Lummaa, V. (2011). Reproductive behavior and personality traits of the five factor model. *European Journal of Personality, 25*, 487–500.
Jokela, M., Hintsa, T., Hintsanen, M., & Keltikangas-Järvinen, L. (2010). Adult temperament and childbearing over the life course. *European Journal of Personality, 24*, 151–166.
Kirk, K. M., Blomberg, S. P., Duffy, D. L., Heath, A. C., Owens, I. P., & Martin, N. G. (2001). Natural selection and quantitative genetics of life-history traits in Western women: A twin study. *Evolution, 55*, 423–435.
McCrae, R. R., & Costa, P. T. (2008). The five-factor theory of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 159–181). New York: Guilford Press.
Moffitt, R. (1998). The effect of welfare on marriage and fertility. In R. Moffitt (Ed.), *Welfare, the family and reproductive behaviour: Research perspectives* (pp. 50–97). Washington: National Academy.
Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R., Harrington, H. L., et al. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences, 108*, 2693–2698.
Ozer, D. J., & Benet-Martinez, V. (2006). Personality and the prediction of consequential outcomes. *Annual Review of Psychology, 57*, 401–421.
Stearns, S. C., Byars, S. G., Govindaraju, D. R., & Ewbank, D. (2010). Measuring selection in contemporary human populations. *Nature Reviews Genetics, 11*, 611–622.
Tait, L. (1869). Has the law of natural selection by survival of the fittest failed in the case of man? *Dublin Quarterly Journal of Medical Science, 47*, 102–113.
Vaughn, M. G., Fu, Q., Beaver, D., DeLisi, M., Perron, B., & Howard, M. (2010). Are personality disorders associated with social welfare burden in the United States? *Journal of Personality Disorders, 24*, 709–720.