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The change and stability of NEO scores over six-years: Findings from the British Household Panel Survey (BHPS) and the UK Household Longitudinal Study (UKHLS)

Adrian Furnham¹ and Helen Cheng²

¹ *BI: Norwegian Business School*

² *ESRC Centre for Learning and Life Chances in Knowledge Economies and Societies, Institute of Education, University College London*

*Corresponding author E-mail: a.furnham@ucl.ac.uk

Abstract

This study investigated the change and stability of the Big-Five personality factors in all 7554 participants aged between 16 and 92 years completed a short 15 item FFM inventory twice six years apart in a large British sample. As expected, Agreeableness, Conscientiousness, and Extroversion significantly increased, whereas Neuroticism significantly decreased, and Openness remained essentially the same over the time period. Participants were divided into six age groups and the results were broadly similar. Correlational analysis showed all five personality factors were considerably stable over six years after controlling for gender and age ($r=.47$ to $r=.60$, $p<.001$). Implications and limitations are acknowledged.

Word Count:

Key Words: Big-Five personality factors (NEO); Change and Stability; Longitudinal

Introduction

There have been many studies that examine the stability of psychological characteristics over time (Huesmann, Lefkowitz, Eron & Walder, 1984; Deary, Whalley, Lemmon, Starr, & Crawford, 2000). There have also been a large number of studies of the stability of personality traits, particularly the Five Factor Model traits using different data bases and measures (Briley & Tucker-Drob, 2014).

The debate about continuity vs. change revolves around a number of issues, such as the reliability and validity of personality tests used (to account in part for measurement error); the moderator variables considered (social class, sex, education and ethnicity) ; the age at which people are measured (i.e. adolescents, adults, old age); the time span that shows most change and stability; how change is measured (such as mean level change, rank order, ipsative change); the stability of the environments of people and what, if anything, leads to change (Boyce, Wood & Powdthavee, 2013; Costa & McCrae, 1994; Cramer, 2003; Haan, Millsap & Hartka, 1986; Helson, Jones & Kwan, 2002; Loehlin & Martin, 2001; Lucas & Donnellan, 2011; Martin, Long, & Poon, 2002; McGue, Bacon, & Lykken, 1993; Roberts, Caspi & Moffitt, 2001; Roberts, Walton & Viechtbauer, 2006; Specht, Egloff, & Schmukle, 2011; Srivastava, John , Gosling & Potter, 2003).

The results have similar patterns to them though there inevitably remains many disagreements (Ardelt, 2000; Conley, 1985; McCrae & Costa, 1994). All seem to agree that there is evidence of *both* stability *and* change. From these studies it may be possible to draw the following conclusions: Personality seems most stable between the ages of 30 and 60 years, particularly using established Big Five measures to assess it; there are modest increases in Emotional Stability and Agreeableness over this period with Extraversion and Openness showing least

change (both with a slight decline) and Conscientiousness showing most change (an increase); Males seem more stable than females.

There have been many studies on the stability and change in the FFM personality scores over time using different measures, participant groups and time periods. Appendix 1 summarises 14 studies from different countries, using different measures over different time frames.

Insert Appendix 1 here.

These studies have mainly, but not exclusively, been done in Europe with N's varying from 270 to over 13,000. Most used the facet level NEO-PI-R but some the NEO-FFI. Time periods varied, as did the age of the participants. Certainly the results indicate most change before the age of 30 and least after 60 years. There was also a trend for two traits to decline over time (Extraversion and Neuroticism) and two to increase (Agreeableness and Conscientiousness) though there were some exceptions.

This Study

This study set out to investigate the stability as well as change of the Big-Five personality factors over six years, using a large longitudinal dataset in the UK. There have been relatively few studies of this kind done in the UK and fewer using brief measures. The five personality factors were examined at the factor level in the total sample and by sex, and by age group. Item level change was also examined in the total sample.

We based our hypotheses on other studies using small samples but more robust measures of personality. It is hypothesised that the mean scores of personality factors Agreeableness (A), Conscientiousness (C), Extraversion (E), and Openness (O) would have modest but significant increase (H1 - H4), and Neuroticism (N) would have a significant decrease (H5) over the six years measured in 2005 and 2011; Given the hormonal change

during teenage years, the youngest age group (16 to 20 years old) may have an increase of the scores on N over the six years (H6); Personality factors, on the whole, are stable over time in any age range after adolescent years (H7).

Method

The British Household Panel Survey (BHPS) began in 1991 and is a multi-purpose study. The wave 1 panel consists of some 5,500 households and 10,300 individuals drawn from 250 areas of Great Britain. Additional samples of 1,500 households in each of Scotland and Wales were added to the main sample in 1999, and in 2001 a sample of 2,000 households was added in Northern Ireland. As part of wave 18 BHPS participants were asked if they would consider joining the new, larger and more wide-ranging survey Understanding Society. Almost 6,700 of just over 8,000 BHPS participants invited to join did so. First interviews with BHPS participants in Understanding Society were carried out in wave 2 of the study in 2010-2011. Data on age, gender in Wave 15 collected in 2005 were used in the study.

The UK Household Longitudinal Study (UKHLS) named Understanding Society is an innovative world-leading study following the lives of 40,000 UK households to provide valuable evidence about 21st century UK life and how it is changing (Knies, 2014). Data on personality factors in Wave 3 collected in 2011 were used in the study.

Participants

The study was based on a sample of 7,554 participants (males = 3,324 and females = 4,230) who have data of age, gender, and personality factors in both time points measured in 2005 and again, in 2011 with an age range from 16 to 92 years old (mean = 39.3, SD = 11.9) in 2005. In all, 6.3% were ≤ 20 years old; 14.5% between 21 and 30; 21.7% between 31 and 40; 19.9% between 41 and 50; 17.7% between 51 and 60; and 19.9% over 60 years old in 2005.

Measures

Personality Factors. The Big Five personality traits were assessed in 2005 and again, in 2011 using a 15-item version of the BFI (John, Naumann, & Soto, 2008). Three items were used to assess each of the five dimensions.¹ Participants made their responses on a 1 (does not apply) to 7 (applies perfectly) scale. Appropriate items were reverse coded and scores were averaged within each 3-item subscale to create a composite score for each dimension. Scores were computed such that higher scores indicated higher levels of the personality dimension. In this study Cronbach's alpha was 0.58 for A, 0.56 for C, 0.55 for E, 0.67 for N, and 0.68 for O in 2005; Cronbach's alpha was 0.57 for A, 0.55 for C, 0.60 for E, 0.71 for N, and 0.66 for O in 2011. Although reliability coefficients for these five factors may appear modest by traditional standards, past research suggests that these alpha coefficients underestimate the actual reliability of these factors due to their brevity (Donnellan & Lucas, 2008).

Results

Change in the factor level

First, we looked at the change of the NEO scores in 2005 and in 2011. Table 1 shows the results.

Insert Table 1 about here

T-test showed that there were statistically significant changes for four out of the five factors: A, C, E, and N over the two time points. As expected, Agreeableness, Conscientiousness, and Extroversion significantly increased, whereas Neuroticism significantly decreased, and Openness remained the same over the period of six years for the total sample. Thus H1-H3 and H5 were confirmed. However, H4 that Openness scores would significantly increase was refuted. Openness, on the contrary, decreased over the two time points, especially for women, which although modest, was statistically significant ($p < .05$).

Change by age group

Second, we examined the change of personality factors over the six years by age group. Table 2 shows the results

Insert Table 2 about here

Table 2 shows that from age 41 to age 60 years and over, there were uniform changes in the three age groups with the pattern the same as for the total sample shown in Table 1. For all the six age groups, A and C had significant and there were significant increase on the mean scores of A, C, and E, and significant decrease on the mean scores of N, while there was no significant change on the mean scores of O. Further, from age 16 to age 40, there were also significant increase on scores of A and C. However, there were no significant change on the scores of E, N, and O. Thus, H6 that the scores of N would increase in the young age group due to the hormonal change was refuted (although there was a slight increase on the mean scores of N in this age group, the change was not significant). From age 21 to age 31, there was also no significant change on the scores of E.

Change in the item level

Third, we looked at the change of personality factors in the item level. Table 3 shows the results.

Insert Table 3 about here

Table 3 shows that for each of the three item which formed personality factors A, C, E, and N, the changes over the period of six years were all significant ($p < .05$ to $p < .001$). For Personality factor O, change on one item, active imagination, was significantly decreased ($p < .05$).

The stability of personality factors

Following this, we conducted bivariate and partial correlational analyses to examine the stability of the Big-Five personality factors over the period of six years. Results are shown in Table 4.

Inset Table 4 about here

Table 4 shows that all five personality factors were considerably stable over six years ($r=.47$ to $r=.62$, $p<.001$). The stability of personality factors remained significant after controlling for gender and age ($r=.47$ to $r=.60$, $p<.001$).

Discussion

Essentially results confirm and extend the findings in the area using a short measure of personality with a large sample. The results in Table 1 confirmed four of the five trait change hypotheses however it needs to be noted that the changes were very small. In fact when Cohen's d were calculated even the biggest effect on the full sample (for C) was modest ($d=0.18$), considered a small effect size. Indeed the biggest change when looking at the specific age groups (C for the youngest group) was $d=.058$ whereas the vast majority were $d<0.20$. In this sense though statistically significant the changes were very small. This conclusion was reinforced with the data in Table 4 which showed correlation of around $r=.60$ between E and N over the six year period.

The results from the analysis of the 6 age groups did not provide evidence of the idea that personality remains more stable in older age. Indeed, if anything the results showed the

opposite with the youngest, teenage group, showing significant changes in only two of the five traits. However what was most clear about that hypothesis was that the greatest changes were in A and C which increased and least in O which remained the same for 4 of the 6 groups. It may be that people are socialised in being more Agreeable and Conscientious or discover the behavioural benefits of exhibiting those behaviours while this is less the case for Openness.

Though the item analysis shown in Table 3 maybe considered unstable or unreliable it did indicate that people became less rude and lazy but more talkative and no different in their originality or artistic endeavours.

The questions remains as to when and why personality does (or does not) change. It has been argued that personality changes occur after trauma (major life events) or therapy though there is evidence that after significant personal changes people revert to earlier levels of well-being (Brickman, Coates & Janoff-Bulman, 1978). Most researchers have argued that some traits (i.e E) are more biologically based than others (i.e C) which can be shaped through careful conditioning. What remains unclear however is why this and many other studies (see Appendix) indicate that O seems most stable over time. It is known that O is modest correlated with IQ which has been shown to be very stable over time (Deary et al., 2000). Further, while socialisation practices encourage both A and C, they seem less directed at O.

One obvious limitation of this study was the use of a very short measure of the Big Five with inevitably smaller alphas. Ideally most researchers choose longer measures which assess traits at the domain and facet level though there is evidence the one, two and three item measures of traits yield broadly the same results (Furnham, 2008).

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Table 1. NEO mean scores and SDs at the factor level over six-years.

NEO factors	Total n=7,554					Males n=3,324					Females n=4,230				
	2005		2011		<i>t</i>					<i>t</i>					<i>t</i>
	Mean	SD	Mean	SD		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Agreeableness	16.35	2.93	16.88	2.94	15.78***	15.81	2.97	16.24	3.03	8.14***	16.77	2.81	17.38	2.76	13.57***
Conscientiousness	15.87	3.19	16.47	3.17	16.07***	15.67	3.10	16.21	3.09	9.80***	16.03	3.22	16.67	3.20	12.58***
Extraversion	13.41	3.49	13.80	3.77	10.40***	13.01	3.41	13.31	3.70	5.49***	13.76	3.50	14.18	3.77	8.29***
Neuroticism	11.04	3.92	10.60	4.18	10.74***	9.95	3.65	9.53	3.85	7.16***	11.91	3.88	11.45	4.21	8.33***
Openness	13.44	3.60	13.37	3.77	1.86	13.81	3.52	13.78	3.62	0.43	13.21	3.61	13.08	3.84	2.38*

* $p < .05$; *** $p < .001$.

Table 2. NEO mean scores and SDs at the factor level over six-years by age group.

NEO factors	2005		2011		<i>t</i>
	Mean	SD	Mean	SD	
<i>16-20 years old to 22-26 years old (n=473)</i>					
Agreeableness	15.77	2.96	16.58	2.94	5.52***
Conscientiousness	13.88	3.29	15.69	2.99	11.29***
Extraversion	14.49	3.11	14.18	3.18	1.96
Neuroticism	11.73	4.04	11.84	3.91	0.67
Openness	13.99	3.41	14.04	3.51	0.30
<i>21 years old to 30 years old (n=1,094)</i>					
Agreeableness	16.26	2.85	16.72	2.79	5.36***
Conscientiousness	15.52	2.88	16.25	2.98	8.02***
Extraversion	14.23	3.18	14.20	3.61	0.39
Neuroticism	11.48	3.81	11.19	4.10	2.61**
Openness	14.02	3.27	13.73	3.52	2.94**
<i>31 years old to 40 years old (n=1,641)</i>					
Agreeableness	16.34	2.81	16.73	2.95	5.85***
Conscientiousness	16.26	2.95	16.71	2.95	6.18***
Extraversion	13.74	3.38	13.91	3.72	2.25*
Neuroticism	11.21	3.69	10.84	4.10	4.44***
Openness	13.88	3.30	13.67	3.56	3.01**
<i>41 years old to 50 years old (n=1,505)</i>					
Agreeableness	16.38	2.82	16.81	2.89	6.04***
Conscientiousness	16.25	3.03	16.68	3.15	5.41***
Extraversion	13.31	3.50	13.61	3.82	3.96***
Neuroticism	11.20	3.86	10.80	4.14	4.74***
Openness	13.45	3.38	13.43	3.66	0.33
<i>51 years old to 60 years old (n=1,335)</i>					
Agreeableness	16.46	2.93	16.98	2.97	6.41***
Conscientiousness	16.27	3.09	16.65	3.24	4.30***
Extraversion	12.94	3.48	13.62	3.89	7.91***
Neuroticism	11.01	3.91	10.32	4.12	7.55***
Openness	13.31	3.69	13.35	3.82	0.38
<i>Over 60 years old (n=1,506)</i>					
Agreeableness	16.48	3.13	17.20	2.99	8.52***
Conscientiousness	15.60	3.48	16.23	3.44	6.59***
Extraversion	12.74	3.63	13.61	3.88	8.95***
Neuroticism	10.22	4.05	9.59	4.19	6.52***
Openness	12.61	4.06	12.62	4.15	0.10

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 3. NEO change at the item level over six-years.

Item	2005		2011		<i>t</i>
	Mean	SD	Mean	SD	
<i>Agreeableness</i>					
Big 5: Rude (-)	5.85	1.34	6.09	1.29	14.24***
Big 5: Forgiving	5.03	1.50	5.20	1.48	8.83***
Big 5: Considerate	5.47	1.24	5.59	1.25	7.79***
<i>Conscientiousness</i>					
Big 5: Thorough	5.34	1.59	5.51	1.57	7.86***
Big 5: Lazy (-)	5.20	1.63	5.47	1.58	14.44***
Big 5: Efficient	5.33	1.21	5.49	1.23	9.76***
<i>Extraversion</i>					
Big 5: Talkative	4.59	1.64	4.84	1.72	13.04***
Big 5: Sociable	4.78	1.57	4.88	1.61	5.22***
Big 5: Reserved (-)	4.04	1.56	4.08	1.70	2.13*
<i>Neuroticism</i>					
Big 5: Worries	3.85	1.75	3.71	1.85	6.87***
Big 5: Nervous	3.51	1.71	3.35	1.80	8.00***
Big 5: Relaxed (-)	3.68	1.52	3.54	1.56	7.07***
<i>Openness</i>					
Big 5: Original	4.24	1.48	4.21	1.60	1.70
Big 5: Artistic	4.32	1.67	4.31	1.75	0.30
Big 5: Active imagination	4.87	1.46	4.83	1.54	2.54*

*** $p < .001$, * $p < .05$.

(-) = item recoded.

Table 4. Correlations of the Big-Five personality factors between 2005 and 2011 for the total sample.

NEO factors	Bivariate correlations	Partial correlations controlling for gender and age
Agreeableness	.488***	.474***
Conscientiousness	.472***	.476***
Extraversion	.599***	.598***
Neuroticism	.615***	.584***
Openness	.556***	.548***

*** $p < .001$.

Appendix 1: A selection of studies looking at the stability of the big five over time.

Allemand, Zimprich & Hertzog 2007	875	4 year interval, Germany.	Personality was measured using the NEO-FFI inventory. Factor covariances were found to be equal for both age groups and at both testing occasions, indicating perfect structural continuity of personality. An average decline in N was observed. There was evidence of structural continuity and continuity of divergence in personality in midlife, whilst also evidence of mean personality change and individual differences in personality change.
Bleidorn, Kandler, Riemann, Angleitner & Spinath 2009	344 twins	10 years, Germany	The NEO PI-R was administered at each of two waves five years apart. 30-40% of individual differences in ‘true’ stability of domains and facets could be attributed to influences of the non-shared environment. N, A and C showed relatively strong genetic effects in respect to the aetiology of change, change in E and O was almost completely environmentally induced. Results also indicated that people differ reliably in their rate of change. Change was less pronounced in older individuals compared to younger.
Bourghuis, Denissen, Oberski, Sijtsma, Meeus, Branje, Koot, 2017	2,230	Dutch	This study examined Big Five trait stability, change and co-development in friendship and sibling dyads from age 12 to 22. 7 waves of longitudinal data was captured in this study. The 1-year rank-order stability of personality traits was already substantial at age 12, increased strongly from early through middle adolescence, and remained stable during late adolescence and early adulthood. Linear mean-level increases were found in girls’ C in both genders’ A and in boys’ O. A U-shaped mean-level change was also found in boys’ C and in girls’ N and E. An increased followed by a decrease was found in girls’ O.
Lockenhoff, Terracciano, Patriciano, Eaton & Costa Jr. 2009	458	USA – East Baltimore. 1993-1998, 2004-2005	Five-factor model personality traits were assessed (NEO-PI-R) twice over an average interval of 8 years. Participants who reported a recent and extremely adverse life event showed increases in the tendency to experience negative affect (N), especially anger and frustration. It is important to note that they only affected select facets of N, O, and A and that the effect sizes are comparatively small

Lucas & Donnellan, 2011	20,434	Germany (GSOEP)	Stability and change in the Big Five personality traits were assessed twice over a 4 year period. Differential stability increased relatively quickly from adolescence to age 30 or 40 and more slowly after that, peaking between the ages of 60 and 70. Support for the prediction that stability coefficients decline among the very old. This trend was evident for all five Big Five domains and cannot be explained by the effects of increased measurement error in older ages given the study's latent variable analytic strategy
McCrae, Costa, Terracciano, Parker, Mills, De Fruyt & Mervielde, 2002	2,748	USA, Belgium	Three studies were conducted to assess mean level changes in personality traits during adolescence (12-18). Versions of the Revised NEO-PI were used to assess the five major personality factors across a 4 year period. Personality factors were invariant across ages, rank-order stability of individual differences was low. N appeared to increase in girls while O increased in both boys and girls. Mean levels of E, A and C were stable.
Pullmann, Raudsepp & Allik, 2006	876	Estonia	The study examined mean-level, individual-level, and rank-order stability over a 2 year period in adolescents aged 12-18. The NEO Five-Factorial Inventory (NEO-FFI) was used to assess personality traits. From the age of 14 onwards adolescents become more Open and Emotionally Stable. Neither intelligence nor academic achievement moderate stability of personality traits in adolescence. Across the five dimensions, the average test-retest correlations were 0.51, 0.56 and 0.67, and the computed biennial stability values were 0.80, 0.83 and 0.89 for age groups 12-14, 14-16 and 16-18 years, respectively
Robins, Fraley, Roberts & Trzesniewski, 2001	270	USA	Students completed measures of the Big Five personality traits when they first entered college and then 4 years later. Analyses indicate small- to medium-sized normative (i.e., mean-level) changes, large rank-order stability correlations, high levels of stability in personality structure, and moderate levels of ipsative (i.e. profile) stability. The students in the sample became more Agreeable, Conscientious, Emotionally stable, and Open to new experiences as they progressed through college.
Schwaba & Bleidorn, 2017	9,636	Dutch	Participants (16-84 years of age) provided Big Five self-reports at five assessments across 7 years. For O, C, E, and A, individual differences in change were greatest in magnitude in emerging adulthood, lesser in magnitude in young and middle adulthood, and smallest in magnitude in

			old age. For emotional stability, individual differences in change were generally smaller and remained constant across adulthood
Schwaba, Luhmann, Denissen, Chung & Bleidorn, 2017	7,353	Dutch	Participants were assessed on the Big Five personality traits using the IPIP version of the Big-Five Inventory over a 7 year period. O remained relatively stable in emerging adulthood before declining in midlife and old age. An increase in cultural activity precipitated increases in Openness, and vice versa. These culture-openness transactions held across different age and education groups and when controlling for household income.
Small, Hertzog, Hultsch & Dixon, 2003	223	USA	Participants were assessed using the NEO-PI over a six year period. The data revealed uniformly high 6-year stability coefficients. The correlations for the original scales N, E, and O were all above .80, and the correlations of A and C longitudinally were approximately .70. Older adults were more likely to show increases in N over time, and women were more likely to show decreases in N and increases in A. Life events can be seen as attributes for personality change over time e.g. adaptation to chronic illness, loss of a spouse etc.
Specht, Egloff & Schmukle, 2011	14,718	Germany	Participants were tracked across 4 years, in each year they were asked whether one or more of a set of specific major life event had occurred since the last interview. Age had a complex curvilinear influence on mean levels of personality. The rank-order stability of N, E, O and A all followed an inverted U-shape function, reaching a peak between 40 and 60 years of age. Whereas C showed a continuously increasing rank-order stability across adulthood.
Vecchione, Alessandri, Barbaranelli & Caprara, 2012	403	Italy	This study investigated gender differences in the mean-level change of the Big Five from late adolescence to emerging adulthood (16, 18 & 20). At age 16, females scored significantly higher on A, C, and O. Males scored lower on N. In both males and females, C and O increased linearly from age 16 to age 20. Whilst E remained stable. Emotional stability increased slightly in males and remained stable in females. A increased linearly in males and showed a quadratic trend in females, first increasing and then declining over time. Females showed interindividual variability than males on the trajectories of C and ES
Wortman, Lucas &	13,134	Australia	This study evaluated mean-level differences and rank-order stability in personality traits when assessed twice over a 4

Donnellan, 2012			<p>year time span. E, N, and O declined over the life span. A increased among young cohorts, stable amongst middle-aged cohorts, and declined amongst the oldest. Cross-sectional analyses suggested an increase in C throughout the life span, though longitudinal analyses suggests a decline in late life. There was an inverted U-shaped pattern for rank-order stability, with peak stability occurring in middle age. E, Friendliness and C had evidence for age-related differences that were pronounced before 30, as opposed to after age 30</p>
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