Personality and Individual Differences 121 (2018) 140–146

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

Genetic and environmental etiology of stability and changes in self-esteem linked to personality: A Japanese twin study

Chizuru Shikishima[a,*], Kai Hiraishi[b], Yusuke Takahashi[c], Shinji Yamagata[d], Susumu Yamaguchi[e], Juko Ando[b]

[a] Department of Psychology, Teikyo University, Tokyo, Japan
[b] Faculty of Letters, Keio University, Tokyo, Japan
[c] The Hakubi Center for Advanced Research, Graduate School of Education, Kyoto University, Kyoto, Japan
[d] Faculty of Arts and Science, Kyushu University, Fukuoka, Japan
[e] The University of Tokyo, Tokyo, Japan

ARTICLE INFO

Keywords:
Self-esteem
Personality
Twin
Behavioral genetics
Genetic innovation
Longitudinal study

ABSTRACT

This study used a behavioral genetic approach to examine the genetic and environmental etiology of stability and changes in self-esteem in relation to personality. Multiple genetic analyses were conducted on a longitudinal dataset of self-esteem and Big Five personality scores among young adult Japanese twins over the course of a decade. There were 1221 individuals for whom data were available on both self-esteem and the Big Five personality test at Time 1 and 365 at Time 2. The mean interval between the two times was 9.95 years. Genetic effects on self-esteem were robust, and the same genes were responsible for the stability of self-esteem in individuals over time. Nearly half of the variance in self-esteem was explained by a new genetic factor arising during the decade, suggesting that genetic innovation of self-esteem occurred in early adult life. The genetic and environmental covariance structure between personality and self-esteem in individuals was constant over a decade, providing evidence that the stability of self-esteem was largely attributable to personality. However, genetics for self-esteem independent of personality still contributed to stability over time, differentiating the concept of self-esteem from personality as a trait in terms of its genetic and environmental etiological levels.

1. Introduction

Individual differences in self-esteem have been examined in several ways, such as changes over a lifetime, in relation to personality, and through underlying genetic and environmental influences. In an effort to integrate these approaches, we chose to examine them all simultaneously by using a longitudinal dataset of self-esteem and Big Five personality scores in twins over the course of a decade to explore the genetic and environmental etiology of stability and changes in self-esteem in relation to personality.

Many studies have used a longitudinal approach to examine stability and changes in self-esteem in individuals over time (e.g., Conley, 1984; Block & Robins, 1993; Robins, Hendin, & Trzesniewski, 2001). Conley (1984) compared consistency over an adult lifetime in intelligence, personality and self-opinion (including self-esteem), and noted that all three were very stable over short intervals (up to 5 years), but self-opinion was less stable in the longer term. Conley used a hierarchical longitudinal consistency model in which personality, as a higher-order construct, brought a temporal consistency to self-opinion, as a lower-order construct. A meta-analysis, however, of 168 test–retest correlation coefficients of self-esteem found that the estimated population correlation of the 10 items of the Rosenberg (1965) Self-Esteem Scale (RSES), controlling for time interval and age, was 0.5 (Trzesniewski, Donnellan, & Robins, 2003). Trzesniewski and colleagues emphasized the continuity of self-esteem over time, except after late adulthood, and noted that it was as stable as personality traits over much of the life span. Another meta-analysis of test–retest correlation coefficients for each of the Big Five dimensions from longitudinal studies estimated that population correlations, controlling for time interval and age, ranged from 0.46 to 0.55 (Roberts & DelVecchio, 2000), the same as for self-esteem.

The etiological causes underlying individual differences in self-esteem have been identified using the behavioral genetic approach (Neiss, Sedikides, & Stevenson, 2002). Behavioral genetics clarifies the genetic and environmental factors that cause individual differences in behaviors, by examining the observed resemblance between family members (Plomin, DeFries, Knopik, & Neiderhiser, 2013). The most common approach is the classical twin design, comparing similarities between

* Corresponding author at: Department of Psychology, Teikyo University, 359 Otsuka, Hachioji, Tokyo 192-0395, Japan.
E-mail address: shiki@main.teikyo-u.ac.jp (C. Shikishima).

http://dx.doi.org/10.1016/j.paid.2017.09.013
Received 29 April 2017; Received in revised form 30 August 2017; Accepted 6 September 2017
Available online 26 September 2017

identical (MZ) twins and fraternal (DZ) twins. Studies using this design have reported substantial genetic influences on scores for the RSES across cultures; analyses on American (Kendler, Gardner, & Prescott, 1998; Roy, Neale, & Kendler, 1995), Finnish (Raevuori et al., 2007), German (Stieger, Kandler, Tran, Pietschnig, & Voracek, 2017) and Japanese (Kamakura, Ando, & Ono, 2007) twin data suggested that approximately 30–60% of individual differences in the RSES scores among adolescents or adults were explained by genetic factors. The rest was explained by environmental factors unique to each individual and not shared between twin siblings (i.e., non-shared environmental factors). These estimates are very similar to those for personality traits. Genetic factors typically explain 30–50% of phenotypic variance in personality traits measured by self-report questionnaires, with the rest explained by non-shared environmental factors (Loehlin, 1992; Plomin et al., 2013).

The etiological causes of stability and changes in self-esteem in individuals have been examined using a longitudinal behavioral genetic approach. Analyzing Japanese adolescent and young adult twins' RSES data across two time points (mean intervals of 1.3 years), Kamakura et al. (2007) found that 49% of the phenotypic variance in self-esteem at Time 2 was explained by genetic factors that also contributed to self-esteem at Time 1, suggesting that stability of self-esteem was largely due to common genetic effects across time. The remaining 35% of the phenotypic variance at Time 2 was entirely explained by non-shared environmental factors unique to Time 2, suggesting that changes in self-esteem were because of non-shared environmental effects, not new genetic effects that arose over the course of development (i.e., genetic innovation). Raevuori et al. (2007) conducted a longitudinal behavioral genetic study among Finnish adolescent twins, with the RSES administered at 14 and 17 years old. They reported that the genetic correlation of self-esteem between the two time points did not reach unity (0.78 for boys and 0.46 for girls), suggesting the presence of genetic innovation during the teenage years.

These results are similar to those for personality traits. Previous studies have shown that the stability of personality during adulthood was largely because of genetic factors (e.g., Kandler et al., 2010; Takahashi et al., 2007), although genetic influence on personality change has also been observed (e.g., Blonigen, Carlson, Hicks, Krueger, & Iacono, 2008; McGue, Bacon, & Lykken, 1993).

Self-esteem measured through a questionnaire is correlated with personality (Bono & Judge, 2003; Erdle, Gosling, & Potter, 2009; Schmitt & Allik, 2005). Previous studies among adults have indicated that correlation coefficients between self-esteem, as measured by the RSES, and the Big Five personality dimensions, as measured by the NEO Five Factor Inventory or NEO-PI-R (Costa & McCrae, 1992), range from approximately − 0.60 to just over − 0.70 for neuroticism, from 0.30 to approximately 0.40 for extraversion, around 0.10 to 0.20 for openness to experiences, around 0.20 for agreeableness, and from approximately 0.20 to 0.40 for conscientiousness in the US (Kwan, Bond, & Singelis, 1997; Robins et al., 2001; Judge, Erez, & Bono, 2002), Hong Kong (Kwan et al., 1997), and Estonia (Pullmann & Allik, 2000).

To our knowledge, however, only a few behavioral genetic studies, all using an American twin sample, have analyzed RSES and personality data simultaneously to clarify their associations at etiological genetic and environmental levels. Neiss et al. (2005) reported that overlaps among self-esteem, executive self, and negative affectivity in adults was mainly because of common genetic factors. Roberts and Kendler (1999) also identified common genetic factors in neuroticism, self-esteem, and major depression in females. Both studies also reported genetic effects unique to self-esteem.

Previous studies therefore suggest that adult self-esteem and personality are both stable over time, as a result of common genetic factors. Self-esteem and personality are significantly correlated, again because of a common genetic factor. These previous studies have two main limitations, however. First, the longitudinal behavioral genetic studies on self-esteem had a relatively short interval, so the etiology of stability and change over a longer period remains unclear. Second, behavioral genetic studies on the association between personality and self-esteem were all cross-sectional, so longitudinal etiological relationships between the two constructs remain unclear.

The purpose of this study was therefore two-fold. First, we wanted to explore the etiology of stability and changes in self-esteem over a decade in adulthood. The longer interval might allow a genetic contribution to changes in self-esteem (i.e., genetic innovation) to appear, and therefore provide more convincing evidence of the influence of genetic factors on self-esteem, or enable us to confirm that changes in self-esteem are solely because of environmental effects. Second, with measures of Big Five personality dimensions, we examined longitudinal associations between personality and self-esteem. This enabled us to examine the extent to which individual differences in self-esteem are rooted in stable genetic and environmental influences on personality. Decay in the predictive power of personality traits after a decade would imply that the genetic and environmental basis of self-esteem changes from personality traits to other psychological traits, or to self-esteem itself (i.e., emergence or increment of genetic and environmental influence unique to self-esteem). Alternatively, personality traits might be the genetic and environmental basis of self-esteem, regardless of age or time.

We used longitudinal and multivariate genetic analysis. This allowed us to decompose the phenotypic covariance among variables into its genetic and environmental components. We decomposed the genetic and environmental components of self-esteem at the first time point into (a) those also linked to personality and (b) those specific to self-esteem. At the second time point, we decomposed the genetic and environmental components of self-esteem into (a′) those also linked to personality, (b′) those independent of personality but linked to self-esteem at the first time point, and (c) those specific to self-esteem at the second time point. The presence of (c) indicates genetic or environmental origin of the change in self-esteem. The presence of (b) or (b′) suggests a genetic or environmental basis of self-esteem that is independent of personality. Comparison of (a) and (a′) would show to what extent individual differences in self-esteem are rooted in stable genetic and environmental influences on personality.

2. Methods

2.1. Participants

The Keio Twin Study (KTS) recruited 14–30-year-old Japanese volunteer twin participants through population-based registries in some parts of the Tokyo area in 1998–2011 (for a detailed description of the sample and surveys, see Shikishima, Ando, Ono, Toda, & Yoshimura, 2006 and Ando, Fujisawa, Shikishima, Hiraishi, Yamagata, Neiderhiser, & Ando, 2013). The researchers issued comprehensive postal surveys, including the self-esteem measure, in 1999–2005 (Time 1) and in 2012 (Time 2). In total, 1317 individuals responded to the questionnaire at Time 1 and 1186 at Time 2. A total of 382 individuals responded to both. The number of effective twin pairs according to zygosity and sex is presented in Table 1. The age of the survey respondents ranged from 15 to 33 years (M = 21.20 and SD = 4.43) for Time 1 and from 20 to 47 years (M = 26.62 and SD = 4.96) for Time 2. The interval between Times 1 and 2 ranged from 6 to 14 years (M = 9.95 and SD = 1.94).

Among the respondents, 1221 participants with Time 1 self-esteem scores and 365 individuals with Time 2 self-esteem scores also responded to the Big Five personality test included in the other postal survey conducted by the KTS in 1998–2004, administered at approximately the same time as the Time 1 self-esteem questionnaire. The respective number of twin pairs across variables is presented in Table 1 according to zygosity and sex. In total, 357 individuals (91 female MZ, 29 male MZ, 20 female DZ, 1 male DZ, and 10 opposite-sex DZ complete twin pairs) responded to all the surveys. Their age range was 15 to 32 (M = 21.23 and SD = 4.46) at Time 1 and 24 to 40 (M = 31.32 and