PERSONALITY PROCESSES AND INDIVIDUAL DIFFERENCES

Developmental Structure of Personality and Interests: A Four-Wave, 8-Year Longitudinal Study

Kevin A. Hoff  
University of Illinois at Urbana-Champaign

Q. Chelsea Song  
Purdue University

Sif Einarsdóttir  
University of Iceland

Daniel A. Briley and James Rounds  
University of Illinois at Urbana-Champaign

Personality traits and vocational interests capture different aspects of human individuality that intersect in certain ways. In this longitudinal study, we examined developmental relations between the Big 5 traits and RIASEC vocational interests over 4 timepoints from late adolescence to young adulthood (age 16–24) in a sample of Icelandic youth (N = 485) well-representative of the total student population. Results showed that interests and personality traits were similarly stable over time, but showed different patterns of mean-level change. There was evidence of personality maturation but a lack of cumulative changes in interest levels. For the most part, gender differences in developmental trends were minimal. In addition, latent growth curve analyses revealed broad and specific correlated changes between personality and interests. Changes in general factors of personality and interests were moderately related (r = .32), but stronger correlated changes were found among specific personality–interest pairs that share situational content. Overall, results reveal how interests and personality are related across different types of continuity and change. While there was little correspondence between group-level changes, substantial correlated change occurred at the individual level. This means that when a person’s personality changes, their interests tend to change in predictable ways (and vice versa). Integrative theories that link different aspects of psychological functioning can benefit by incorporating these findings.

Keywords: personality and interest development, continuity and change, correlated change, gender differences, longitudinal

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Individuals differ in their personality and interests with substantial consequences for major life outcomes (Nye, Su, Rounds, & Drasgow, 2012, 2017; Ozer & Benet-Martínez, 2006; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Stoll et al., 2017). Vocational interests refer to enduring preferences for what people like to do, and personality traits refer to how people think, feel, and behave across situations (McCrae & Costa, 2008; Rounds & Su, 2014). Both aspects of psychological functioning have been the focus of considerable developmental research that documents changes in mean-levels and retest stability over time (e.g., Hoff, Briley, Wee, & Rounds, 2018; Low, Yoon, Roberts, & Rounds, 2005; Roberts & DelVecchio, 2000; Roberts, Walton, & Viechtbauer, 2006). Yet, few longitudinal studies have examined interests and personality traits together. Little is known about developmental relations between interests and personality, and how they change together over time.

The current study addresses this gap by examining continuity and change in interests and personality from late adolescence to young adulthood (age 16–24) in an Icelandic sample. Using four waves of longitudinal data collected over an 8-year period, we analyze continuity and change in three ways. First, we compare the rank-order stability of RIASEC vocational interests (Holland, 1997) to the Big Five personality traits. Next, we compare patterns of mean-level change and examine gender differences in developmental trends. Third, we use a series of latent growth curve models to estimate...
intercorrelations between personality and interests in terms of levels and slopes, that is, correlated change. These models examine the extent to which personality and interest dimensions are related within and between individuals over time (Allemand & Martin, 2017). By taking an integrative perspective, our study describes the developmental structure of two important domains of human individuality (Lubinski, 2000; Sackett, Lievens, Van Iddekinge, & Kuncel, 2017).

Empirical and Theoretical Relations Between Interests and Personality

Previous studies on the relation between vocational interests and personality have primarily focused on cross-sectional correlations among Holland’s (1997) RIASEC categories and the Big Five traits. Three meta-analyses on this topic led to similar conclusions (Barrick, Mount, & Gupta, 2003; Larson, Rottinghaus, & Borgen, 2002; Mount, Barrick, Scullen, & Rounds, 2005). In all three meta-analyses, four of the 30 possible personality–interest pairs had robust, positive correlations (with r’s exceeding .25): extraversion-social, extraversion-enterprising, openness-artistic, and openness-investigative. Consensus theories also showed moderate, positive correlations with conventional interests (r = .19 in Barrick et al., 2003 and in Mount et al., 2005; r = .25 in Larson et al., 2002). In contrast, agreeableness and emotional stability were generally not strongly correlated with RIASEC interest dimensions. Overall, these findings suggest that three of the Big Five traits are associated with vocational interests in cross-sectional studies of college students and adults.

Beyond cross-sectional associations, it is also important to consider developmental relations between interests and personality. Several influential theories have argued that interests and personality traits change together over the course of development (e.g., Ackerman, 1996; Corno et al., 2002; Hogan, 1983; Kandler, Zimmermann, & McAdams, 2014; Roberts & Wood, 2006; Schmidt, 2014; Snow, Corno, & Jackson, 1996; Wrzus & Roberts, 2017). Although these integrative theories differ in their focus, they all predict some degree of correlated change between interests and personality. Correlated change refers to similarity in how individuals change in different attributes. Positive correlated change between a personality trait (e.g., extraversion) and interest category (e.g., enterprising) indicates that individuals tend to change in the same direction in these two domains, while negative correlated change indicates that changes occur in the opposite direction. The magnitude and direction of correlated change between different pairs of interests and personality traits depends on the extent to which they are affected by similar developmental processes (Allemand & Martin, 2017).

Wrzus and Roberts’ (2017) theoretical model of developmental processes (TESSERA [Triggering situations, Expectancy, States/States Expressions, and ReActions]) specifically addresses the issue of correlated change between personality and motivational variables (including interests). According to the model, triggering situations are the key link between personality and interest development. Triggering situations may include daily events, repeated experiences in certain contexts, or major life transitions. The assumption is that situations that repeatedly trigger changes in states lead to long-term changes in traits that share those situations. For example, if a person recurrently experiences enjoyment from engaging in leadership roles, they may gradually become more extraverted over time while also becoming more interested in leadership activities (i.e., enterprising interests). On the other hand, if a person experiences neutral or negative emotion while engaged as a leader, their extraversion and enterprising interest levels will likely remain unchanged or decrease over time.

Importantly, triggering situations are only expected to produce correlated changes in personality and interest dimensions that share common situations or activities. Table 1 provides an overview of the six RIASEC interest categories and their shared situations with Big Five traits. Most interest categories share common activities and/or environments with at least one personality trait. For example, investigative and artistic interests are similar to openness in that they involve an appreciation for the arts and science. Social and enterprising interests are similar to extraversion in that they capture situations with a high degree of interpersonal interaction. Conventional interests and conscientiousness both involve structured routines and work environments.

To the extent that correlated change is found, causal processes associated with common situations are likely shared between the relevant interest and personality dimensions (Wrzus & Roberts, 2017). These causal processes could reflect common situational effects (i.e., experiencing enjoyment during social interactions

<table>
<thead>
<tr>
<th>Interest category</th>
<th>Brief description (example occupations)</th>
<th>Big Five cross-sectional correlate (r)</th>
<th>Shared situational content and activities/characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Realistic</td>
<td>Working with hands, tools, and materials (farmer, carpenter)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Investigative</td>
<td>Scientific and research pursuits (biologist, veterinarian, chemist)</td>
<td>Openness (.25)</td>
<td>Appreciation for science, intellectual curiosity</td>
</tr>
<tr>
<td>Artistic</td>
<td>Self-expression and creativity typically associated with the performing, written, and visual arts (actor, writer)</td>
<td>Openness (.41)</td>
<td>Appreciation for arts, openness to new ideas and lifestyles</td>
</tr>
<tr>
<td>Social</td>
<td>Helping, nurturing, and mentoring (counselor, teacher, child and family social worker)</td>
<td>Extraversion (.29)</td>
<td>Helping others in socially oriented environments</td>
</tr>
<tr>
<td>Enterprising</td>
<td>Selling, managing, and social influence typically in a business context (managers, salespersons)</td>
<td>Extraversion (.40)</td>
<td>Influencing or leading others in socially oriented environments</td>
</tr>
<tr>
<td>Conventional</td>
<td>Ordered and systematic manipulation of data with clear standards (accountant, bank teller, inspectors)</td>
<td>Conscientiousness (.19)</td>
<td>Organized and structured tasks, goals, and environments</td>
</tr>
</tbody>
</table>

Note. Interest categories are based on Holland’s (1959, 1997) RIASEC Model. Cross-sectional correlations are based on meta-analytic estimates from Mount, Barrick, Scullen, and Rounds (2005; Table 3, p. 463).
increases both extraversion and enterprise interests), situation selection (i.e., either extraversion, enterprise interests, or other personal factors influence the types of situations a person seeks out), or directional effects across domains (i.e., increasing extraversion causes increases in enterprise interests, or vice versa). Of course, certain interest categories and personality traits do not share common situations. Realistic interests that involve working with hands, tools, and machines have little in common with any of the Big Five traits. Emotional stability and agreeableness capture broad behavioral tendencies that cut across many contexts, but do not overlap considerably with any single interest category. In these dimensions, we would expect relatively low correlated change.

Studying correlated changes between interests and personality offers a unique perspective into how people change in terms of what they like to do and how they think and behave across situations. Both aspects of psychological functioning are highly stable over time (Low et al., 2005; Roberts & DelVecchio, 2000), but represent different aspects of human individuality. Two large-scale longitudinal studies showed that interests and personality traits measured at the end of secondary school contribute unique variance in predicting career and life outcomes 10 years later (Stoll et al., 2017; Su, 2012). These findings highlight the importance of studying how interests and personality traits develop and change—both separately and in relation to each other—during the formative years of adolescence and young adulthood.

Previous Research on Interest and Personality Development

Most longitudinal research on interest and personality development has focused on rank-order stability and mean-level change. Meta-analyses have summarized longitudinal studies in each area to reveal how groups of people change and remain the same in their interests and personality over time (Hoff et al., 2018; Low et al., 2005; Roberts & DelVecchio, 2000; Roberts et al., 2006). However, only tentative comparisons can be made across domains because the meta-analyses on interests and personality traits were based on different samples. Few studies have measured both constructs longitudinally, resulting in a lack of knowledge about how interests and personality develop in relation to each other. Next, we summarize existing research on rank-order stability, mean-level change, and correlated change while pointing out limitations that we aim to address in the current study.

Rank-order stability. Rank-order stability captures the extent to which the relative ranking of individuals within a group remains the same over time (when individuals are “rank-ordered” in terms of their interest or personality levels). Meta-analyses have summarized studies on the rank-order stability of interests (Low et al., 2005) and personality traits (Roberts & DelVecchio, 2000). Both meta-analyses found that stability generally increases throughout adolescence and young adulthood. This finding has been labeled the cumulative continuity principle. For both interests and personality traits, the relative ranking of individuals within a group becomes increasingly stable with age (Roberts & Mroczek, 2008). From the TESSERA framework, cumulative continuity can be explained as resulting from increasingly stable environments and self-selected experiences that stabilize personality traits with age (Roberts & Caspi, 2003; Wrzus & Roberts, 2017).

The comparative stability between interests and personality traits is less clear. Low, Yoon, Roberts, and Rounds (2005) compared meta-analytic stability estimates for vocational interests with personality traits using data from Roberts and DelVecchio (2000). Results indicated that interests were more stable throughout adolescence and young adulthood. This finding suggests that vocational interests may stabilize before personality, contrary to certain assumptions from personality theories (McCrae & Costa, 1999, 2008). However, it is important to note that Low et al.’s (2005) comparisons were indirect in that they were based on estimates from different meta-analytic data sets. In other words, stability levels were compared across different people at similar ages.

Mean-level change. Mean-level change reflects variations in a group’s average trait levels over time, or how people change on average across the life span. Research on mean-level changes in personality has led to two important findings. First, mean-levels of the Big Five traits tend to increase during young adulthood, particularly conscientiousness, agreeableness, and emotional stability (Roberts et al., 2006). This finding has been labeled the maturity principle (Roberts & Mroczek, 2008) because it describes increases in traits associated with social maturity. Openness to experience also increases sharply during late adolescence, but plateau during young adulthood (Roberts et al., 2006). Another major finding is that mean-level changes in personality traits are often associated with social role transitions, such as becoming more invested in work (Hudson, Roberts, & Lodi-Smith, 2012; Lodi-Smith & Roberts, 2007; Nye & Roberts, 2013). Young adulthood is defined by a variety of social role transitions that require adapting to new triggering situations where maturity is valued (e.g., graduating secondary school, starting full-time work). These normative transitions help explain why most personality change occurs during young adulthood (Bleidorn, Hopwood, & Lucas, 2018; Wrzus & Roberts, 2017).

Compared with personality traits, mean-level changes in vocational interests are smaller and more gradual. Hoff, Briley, Wee, and Rounds’ (2018) meta-analysis found that interests change differently during adolescence and young adulthood. Mean-levels of vocational interests decrease in almost every RIASEC category during early adolescence, but then recover during late adolescence. In contrast, young adulthood is marked by a gradual increase in people-oriented interests (i.e., social, enterprising, and artistic). This normative increase may reflect a maturation process similar to personality. During young adulthood, people become more socially mature in their personality, while also becoming more interested in people-oriented activities and environments. However, it is noteworthy for the present study (of Icelandic students) that Hoff et al.’s (2018) findings were based on U.S. samples only.

Gender differences. Gender differences are important to consider when examining mean-level change because men and women differ in initial levels of certain interest categories and personality traits. In general, there are larger gender differences in interests compared with personality traits (Lippa, 1998, 2010; Su & Rounds, 2015; Su, Rounds, & Armstrong, 2009). The largest gender differences in the Big Five personality traits are moderate in magnitude (d = .40 in emotional stability; d = −.34 in agreeableness; negative effect sizes indicate stronger female mean scores; Lippa, 2010). In contrast, gender differences in realistic (d = .84) and social interests (d = −.64) are among the largest of any psychological variable (Su et al., 2009). In Iceland, almost...
identical patterns of gender differences in interests have been detected compared with estimates from U.S. samples; the only exception is that Icelandic men have stronger conventional interests compared with women (Einarsdóttir, 2001; Einarsdóttir & Rounds, 2013; Scheving-Thorsteinsson, 2009).

Longitudinal research shows that the size of certain gender differences changes with age, but only to a small extent. Hoff et al. (2018) found that gender differences in realistic and social interests increased drastically during early adolescence, then gradually declined throughout late adolescence and young adulthood. These findings suggest that early adolescence is the lifetime peak of gendered vocational interests. However, the declines in gender differences during young adulthood identified by Hoff et al. (2018) were relatively small in magnitude compared to estimates of the overall size of differences in realistic and social interests (Su et al., 2009). Thus, there are still likely to be larger gender differences in vocational interests in middle and late adulthood. Similarly, research on personality has shown that the magnitude of gender differences in the Big Five traits is relatively consistent across the life span and in different cultures (Costa, Terracciano, & McCrae, 2001; De Bolle et al., 2015; Lippa, 2010; Roberts et al., 2006; Schmitt, Realo, Voracek, & Allik, 2008).

Correlated changes in personality and interests. Whereas rank-order stability and mean-level change are group-level measures, correlated change occurs at the individual-level. Previous studies have examined correlated changes within personality and interest domains, but not between (e.g., Allemand, Zimprich, & Martin, 2008; Klimstra, Bleidorn, Asendorpf, Van Aken, & Denissen, 2013; Schultz, Connolly, Garrison, Leveille, & Jackson, 2017). In a review of seven studies on correlated change within personality, Allemand and Martin (2017) concluded there is moderate correlated change between the Big Five traits, with an average change coefficient of $\Delta r = 0.25$. This suggests that changes in the Big Five traits co-occur to some extent. However, correlated changes appear to be stronger among certain combinations of traits. For example, Klimstra, Bleidorn, Asendorpf, Van Aken, and Denissen (2013) found that correlated changes are more likely to occur in Big Five traits associated with similar developmental processes, such as social investment (i.e., conscientiousness, emotional stability, and agreeableness).

A recent study by Schultz, Connolly, Garrison, Leveille, and Jackson (2017) examined correlated changes between RIASEC interests in a sample of 442 adults across two waves of measurement over a 20-year span (from age ~25 to ~45 years). The results indicated statistically significant correlated change in 13 of 15 pairings of RIASEC categories (e.g., investigative-artistic), and effect sizes were of similar magnitude to studies conducted within personality. However, the direction of several change correlations diverged from expectations based on the relations among RIASEC categories (Holland, 1997). For example, changes in social interests were negatively correlated with changes in artistic interests, but positively correlated with changes in realistic interests. This is surprising because levels of social and artistic interests are typically positively correlated, whereas levels of social and realistic interests are either uncorrelated or negatively related (Rounds & Tracey, 1993; Tay, Su, & Rounds, 2011). It is worth noting that RIASEC scales were not directly measured in this study, and were instead computed by averaging empirically derived occupational scales from the Strong Vocational Interest Blank (Strong, 1943).

Overall, these correlated-change studies suggest that personality and interests are shaped by specific and general developmental processes. Specific processes such as situation selection or social investment may explain why correlated changes are stronger among trait pairs that encompass similar situations (e.g., Klimstra et al., 2013). Yet there is also evidence of a general change factor that makes correlated change more likely across all trait categories, even those that contain less similar situational content (Allemand & Martin, 2017; Schultz et al., 2017). It is therefore important to consider the extent to which changes co-occur in all interest categories and personality traits. Research on cognitive aging also supports the existence of a general change factor, as changes in different cognitive abilities are typically positively correlated with each other (e.g., Baltes & Lindenberger, 1997; Kievit et al., 2017; Tucker-Drob, Briley, Starr, & Deary, 2014). To date, however, few longitudinal studies have explicitly modeled change within general factors of interests or personality. We address this limitation in the current study by estimating correlated change among general factors, which we use as a comparison point for interpreting the strength of correlated change among specific pairs of personality traits and interests.

The Current Study

In this longitudinal study, we investigate three types of continuity and change in vocational interests and personality traits: rank-order stability, correlated change, and mean-level change. Our Icelandic sample is somewhat unique from the primarily North American samples included in previous meta-analyses on interest and personality development (Hoff et al., 2018; Low et al., 2005; Roberts & DelVecchio, 2000; Roberts et al., 2006). When applicable, we consider relevant aspects of the Icelandic culture and education system when discussing hypotheses and results. Nonetheless, we generally did not expect to find substantially different results due to characteristics of our sample, consistent with previous longitudinal research from other Northern European countries (e.g., Bleidorn et al., 2013; Borghuis et al., 2017; Rantanen, Metsäpelto, Feldt, Pulkkinen, & Kokko, 2007).

Our first set of analyses compare the rank-order stability of interests and personality across the four waves of measurement (from age 16 to 24). As mentioned, meta-analytic comparisons—of different people at similar ages—suggest that RIASEC interests are more stable than the Big Five traits during adolescence and young adulthood (Low et al., 2005; cf., Roberts & DelVecchio, 2000). Yet both interests and personality traits become increasingly stable with age (i.e., cumulative continuity; Roberts & Caspi, 2003). We therefore proposed the following hypothesis:

**Hypothesis 1:** Vocational interests will show higher rank-order stability levels than personality traits across all four time-points.

Our second set of analyses examine mean-level change and consider gender differences in developmental trends. Based on meta-analyses of mean-level change in personality (Roberts et al., 2006) and interests (Hoff et al., 2018), we expected positive mean-level changes in some, but not all, trait categories. For personality traits and interests, respectively, we proposed the following hypotheses:
Hypothesis 2a: Among the Big Five, mean-levels of emotional stability, agreeableness, openness, and conscientiousness will increase from age 16 to 24.

Hypothesis 2b: Among RIASEC vocational interests, mean-levels of people-oriented interest categories will gradually increase over time (i.e., social, artistic, enterprising), while things-oriented interests will remain constant (i.e., realistic, investigative, conventional).

For gender differences, we expected to find mean intercept differences in Big Five traits and RIASEC categories consistent with previous research in Iceland (Einarsdóttir & Rounds, 2013). We did not expect gender differences in patterns of mean-level change (i.e., no slope differences). Although past research has shown that the size of gender differences in interests can change with age, much of this change occurs during the transition from early to late adolescence (Hoff et al., 2018), and would therefore not be captured in our study. We therefore proposed the following hypothesis:

Hypothesis 2c: Men and women will show similar patterns of change, but will have different levels of certain interests and personality traits. Specifically, men will score higher on emotional stability, and realistic, investigative, and conventional interests. Women will score higher on agreeableness, and social and artistic interests.

Third, we apply latent-growth curve modeling to estimate correlations between changes in personality and changes in interests (i.e., correlated change). We also estimated correlated change among general factors of interests and personality. Correlated change among general factors provides a baseline estimate of the degree to which changes co-occur in all interest and personality dimensions. Importantly, we used this estimate as a comparison point for interpreting the magnitude of change correlations between specific interests and personality traits. Based on cross-sectional relations and the degree of situational similarity in different personality and interest domains (see Table 1), we proposed the following hypothesis:

Hypothesis 3: The magnitude of correlated changes in five specific personality-interest pairs (extraversion-social, extraversion-enterprising, openness-artistic, openness-investigative, conscientiousness-conventional) will be stronger than correlated changes among general factors. For the other 25 specific pairings of Big Five traits and RIASEC interests, correlated changes will be of similar magnitude, or weaker than, correlated change among general factors.

Although not our primary focus, we also examined level–level and level–change correlations between RIASEC interests and the Big 5. Level–level correlations represent cross-sectional associations between interests and personality traits. We expected strong, positive level–level correlations in the same five personality-interest pairs identified above, consistent with previous meta-analyses (Barrick et al., 2003; Larson et al., 2002; Mount et al., 2005). Level–change correlations illustrate associations between intercept values and slopes. When estimated within trait domains, level–change correlations are often negative, potentially signaling the presence of ceiling effects (Allemand, Schaffhuser, & Martin, 2015; Wille, Hofmans, Feys, & De Fruyt, 2014). This means that individuals with higher levels of a given trait show less growth in that trait over time compared with the average individual, possibly because they have less room for growth. Vocational interests and personality are both trait-like constructs, so we expected the vast majority of level-change correlations between the Big Five traits and RIASEC interests to be negative. In other words, we expected individuals with higher levels of interest or personality to show less growth in the opposite trait domain over time.

Method
The study was reviewed by the Icelandic Data Protection Authority in four submissions. It was initially submitted to the Data Protection Authority on June 10, 2005 (submission number S2655: Pröun netvæddrar áhagönnunar fyrir grunn- og framhaldsskólanema; Development of an On-Line Interest Inventory for Compulsory and Upper-Secondary Education Students). It was reviewed again on September 3, 2012 and March 10, 2014 (submission numbers S5676 and S7024 with the same title: Pröun persónuleika, starfsdøgu og lífsmarkmiða meðal íslenska ungmennna; Personality, Interest and Life Goal Development Among Icelandic Youth). The use of educational testing and registration data to describe the sample was reviewed on June 23, 2011 (submission number S5238: Spár samræmi í starfsdøgu á námsvæði fyrir um brothvarf úr framhaldsskóla; Does Interest Major Congruence Predict Dropout From Upper Secondary Education?).

Participants
The participants were 485 students born in 1990 contacted during their last year of compulsory education in Iceland (tenth grade, 47% female, average age = 15.3). The sample is well-representative of the Icelandic student population as a whole, although students from outside the capital city (Reykjavik) are slightly overrepresented. Close to 48% of the sample reported they had grown up in the capital area, compared with 60% of the overall population in 2006 (Statistics Iceland, 2012). Information on participants’ national exams scores indicates that the sample represents Icelandic students in terms of academic achievement. Exam results are reported on a standardized scale of 0–60 with an overall mean of 30 (SD = 10). In this sample, the means for math, Icelandic, and English were 30.1 (SD = 9.24, N = 460), 30.5 (SD = 8.95, N = 467), and 30.3 (SD = 9.29, N = 452), respectively. The scores were normally distributed with skewness of .13 for math, −.01 for Icelandic, and −.10 for English.

Participants were contacted again 2, 6, and 8 years later. At Time 2 (N = 188, 56% female, average age = 17.7), almost 95% of respondents reported enrollment in upper secondary school, and 13% were working full-time. Participants reported a variety of educational and work-related statuses at Times 3 and 4. At Time 3 (N = 237, 54% female, average age = 21.7), 61% were still...
enrolled in some form of education and 50% were working full-time. At Time 4 (N = 211, 56% female, average age = 23.7), 57% were still enrolled in some form of education and 40% were working full-time.

**Procedure**

The data was first collected in 2006 as a part of the standardization of the Icelandist Interest Inventory (Bendill–I; Einarsdóttir & Rounds, 2007). Forty schools were randomly chosen from a list provided by the Ministry of Education of all compulsory education schools offering tenth grade in Iceland. Administrators of 21 schools from six of the eight geographic regions in Iceland accepted the request for participation. They informed parents and offered them the chance to decline participation. A contact person assigned by each school (usually the career counselor) administered the measures online to students in groups following a detailed procedure and with the aim of collecting data from all tenth grade students in each school. Participants were asked to provide a national identification number and were told they might be contacted later for future studies. At Times 2, 3, and 4, participants were contacted through telephonic and e-mail to be recruited for the study.

**Measures**

**Personality.** Big Five personality traits were measured using the Icelandic version of the NEO-FFI (Costa & McCrae, 1992; Jónsson & Bergþórsson, 2004). The measure contains 60 total items, 12 for each Big Five trait (i.e., emotional stability, extraversion, openness, agreeableness, and conscientiousness). The five-factor structure of this measure has been previously validated in Icelandic samples. Participants self-reported their personality traits using 5-point Likert scales. Table 2 reports the means, standard deviations, Cronbach’s alpha, and Omega composite reliabilities for all personality and interest scales at each timepoint. The internal consistency reliability (alpha) of the personality scales ranged from .65 to .85 at Time 1, .71 to .88 at Time 2, .76 to .88 at Time 3, and from .72 to .86 at Time 4. We also calculated Revelle’s omega total reliabilities as an alternative to Cronbach’s alpha (McNeish, 2017, p. 8; Revelle, 2008, 2016). Omega total reliabilities ranged from .70 to .88 at Time 1, .76 to .91 at Time 2, .80 to .91 at Time 3, and .79 to .90 at Time 4.

**Interests.** Vocational interests were assessed using the Icelandist Interest Inventory (I and II; Einarsdóttir & Rounds, 2007, 2013). The inventory contains 114 items designed to capture Holland’s (1997) six RIASEC categories (i.e., realistic, investigative, artistic, social, enterprising, and conventional). Each RIASEC scale contained 17–22 items reflecting the structure of the Icelandist labor market. Half of the items (57) refer to occupational activities (e.g., design a computer program, assist people with disabilities, cut fish in a machine), while the other half refer to (upper secondary) school subjects (e.g., natural sciences, electronics, literature, use of tools). Participants responded to items on 5-point scales ranging from 1 (strongly dislike) to 5 (strongly like). A randomization test of the RIASEC correlation matrix (Rounds, Tracey, & Hubert, 1992) resulted in a CI = .69, indicating a good fit to Holland’s structural model (Einarsdóttir & Rounds, 2013). Cronbach’s alphas ranged from .91 to .93 at Time 1, .90 to .94 at Time 2, .91 to .95 at Time 3, and from .91 to .94 at Time 4. Revelle’s omega total reliabilities ranged from .93 to .95 at Time 1, .93 to .95 at Time 2, .93 to .96 at Time 3, and .93 to .96 at Time 4.

In addition to personality and interests, the longitudinal study also included measures of life goals and self-efficacy beliefs that were not the focus of this article.

**Missing Data**

To examine whether there was a pattern to the missing data, we first categorized participants into three groups based on whether they responded at all four timepoints (i.e., *returners*), responded at only the first timepoint (i.e., *stayers*), or responded at the first timepoint and at least once more (i.e., *leavers*). Among the 485 participants, 95 were stayers, 242 were leavers, and 148 were returners. We then conducted independent sample t-tests and cal-

<table>
<thead>
<tr>
<th>Personality traits</th>
<th>Time 1 (age 16)</th>
<th>Time 2 (age 18)</th>
<th>Time 3 (age 22)</th>
<th>Time 4 (age 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>α</td>
<td>ω</td>
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<tr>
<td>Emotional stability</td>
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</tr>
<tr>
<td>Enterprising</td>
<td>47.25</td>
<td>13.55</td>
<td>.92</td>
<td>.94</td>
</tr>
<tr>
<td>Conventional</td>
<td>51.38</td>
<td>14.52</td>
<td>.92</td>
<td>.94</td>
</tr>
</tbody>
</table>

**Note.** There were 12 items for each Big Five scale. The number of items per RIASEC scale ranged from 17 to 22 (17 items for realistic, 19 for investigative, 22 for artistic, 18 for social, 17 for enterprising, and 21 for conventional). α = Cronbach’s alpha; ω = Revelle’s omega total coefficient. Gender and home location were included as auxiliary variables in these analyses.
calculated Cohen’s $d$ for each pair of missing groups for all measure-
ment aspects (i.e., Big Five traits, RIASEC interest categories). Of
the 33 total pairs analyzed, only three comparisons had statistically
significant mean differences: stayers versus returners in social
interests ($t$-test $p = .038$, Cohen’s $d = -.240$); stayers versus
leavers in realistic interests ($t$-test $p = .023$, Cohen’s $d = .299$);
and stayers versus leavers in social interests ($t$ test $p = .005$,
Cohen’s $d = -.354$). We also tested for differences between
stayers, returners, and leavers across gender and home location
(capital area vs. noncapital area). Chi-square tests indicated that
both gender $\chi^2(2, N = 485) = 19.54, p < .01$ and home location
$\chi^2(2, N = 485) = 8.98, p = .01$ were significant predictors of
missing data groups. Women and participants from the capital area
were more likely to stay in the study. Based on these results, we
included gender and home location as auxiliary variables in all
applicable models (Collins, Schafer, & Kam, 2001).

Full-information maximum-likelihood (FIML) technique was
implemented for all analyses through the “lavaan” package in R
(3.3.2 (Rosseel, 2012; R Core Team, 2013). The FIML method
directly estimates parameters using all observed variables (Enders,
2001). The FIML technique is recommended for treating missing
data in longitudinal modeling because it is unbiased under
missing-completely at-random (MCAR) and missing-at-random
(MAR) situations and provides more efficient (e.g., smaller sam-

Data Analysis

Measurement invariance. We tested whether factor loadings
and intercepts were invariant across time and gender for each
personality trait and interest category following the procedure
described by Widaman, Ferrer, and Conger (2010). We first cre-
ated three parcels for each trait category using the item-to-
construct balance technique (Little, Cunningham, Shahar, & Wida-
man, 2002). Next, we compared fit statistics for a series of
increasingly restricted models to establish invariance across time.
In the baseline model (configural invariance), the same pattern of
factor loadings was specified at each timepoint. In the next two
models, factor loadings (metric invariance) and intercepts (scalar
invariance) were set to be invariant across time. When scalar
invariance was not supported, we tested for partial scalar invari-
ance by freeing the intercept constraint for the parcel with the
largest residual value at a single timepoint.

After establishing scalar or partial scalar invariance across time
for each variable, we tested for longitudinal measurement invari-
ance across gender using a similar model comparison approach.
In the first model (configural invariance), we specified the same
pattern of factor loadings for men and women. In the second and
third models, we set factor loadings (metric invariance) and inter-
cepts (scalar invariance) to be equal across gender. When longi-
itudinal scalar invariance was not supported across gender, we
established partial invariance by freeing the parcel with the largest
residual value at a single timepoint for either males or females.

Rank-order stability. Rank-order stability was assessed from
Time 1 to Time 4 and between adjacent timepoints (i.e., T1–T2,
T2–T3, and T3–T4) using Pearson correlations. We then tested
whether stability estimates differed across personality and inter-
ests. Power analyses were conducted using GPower 3.1 (Faul,
Erdfelder, Buchner, & Lang, 2009) with the smallest (most con-
servative) sample size from the four timepoints ($N = 188$). Power
analyses revealed a statistical power of 99% to detect a medium
relation ($r = .3$) with confidence intervals that do not include
zero (Cohen, 1992).

Mean-level change. Mean-level change was examined
through comparisons of average scale scores at each timepoint.
The difference between two mean scores was estimated using the
standardized mean difference, Cohen’s $d$. Power analyses using
the smallest sample size ($N = 188$) revealed a statistical power of
78% to detect a small effect size ($d = .2$) and over 99% to detect
a medium effect size ($d = .5$) with confidence intervals that do not
include zero (Cohen, 1992).

In addition to estimating the standardized difference scores, we
also conducted latent growth curve modeling to A) formalize the
description of mean-level change through $d$-value calculations, and
B) estimate gender differences in levels and changes in personality
and interests. Specifically, for each of the Big Five traits and
RIASEC vocational interests, we modeled the influence of gender
on the intercept and slope variables. Gender was dummy coded
with females coded as 0 and males coded as 1. The path coefficient
for the link between gender and the intercept/slope variable illus-
trates the magnitude and direction of gender differences in the
level/change of that trait category, standardized with respect to the
personality or interest scale. For example, a statistically significant
positive coefficient between gender and an intercept variable in-
dicates that men have higher levels of a certain personality trait or
interest compared with women.

Correlated changes. We used latent growth curve modeling
to estimate correlated change between personality and interests.
The latent growth curve model differs from traditional stability
and mean-level change analyses in that it takes into account individual
variances and incorporates latent variables (e.g., McArdle, 2009).
We chose to use linear growth models over quadratic models
because the linear models required estimating fewer parameters
and afforded more power to detect correlated change with our
sample size and missing data. In addition, past work on personality
and interests primarily identified linear growth trends during this
age period (Hoff et al., 2018; Roberts et al., 2006), with nonlinear
trends primarily occurring during earlier age periods (Soto &
Tackett, 2015). Prior to estimating correlated change, we used
growth curve modeling to check the results of mean-level change
analyses based on $d$-values while taking into account individual
variances. Then, parallel growth processes were modeled to ex-
amine correlated change.

First, interests and personality traits were modeled as a function
of time (i.e., T1 to T4) with three types of latent variables:
intercept, slope, and residuals. By doing so, the values of the
intercept and slope represent levels and changes separate from
random error (i.e., residuals). The intercept reflects the level of the
trait at the first timepoint, whereas the slope represents the average
rate of change over time. As Times 2, 3, and 4 were each separated
from Time 1 by 2, 6, and 8 years, respectively, the path to Time 1
was fixed to 0; the path to Time 2 was fixed to 1 (i.e., 2/2); the path
to Time 3 was fixed to 3 (i.e., 6/2); and the path to Time 4 was
fixed to 4 (i.e., 8/2).

Saturated growth curve models with all level–level, level–
change, and change–change correlations were estimated sepa-
rately for all 30 pairings of interests and personality traits. These
models included within-wave correlations between residuals, as
illustrated in Figure 1. To evaluate statistical power to detect correlated change, Monte Carlo simulations were conducted using Mplus Version 8 (Muthén & Muthén, 1998-2017). We evaluated statistical power post hoc for the five hypothesized interest-personality pairs described in Table 1. Because these power analyses were conducted post hoc, we estimated model parameters using the actual data, then used the estimated parameters as true parameters to simulate 1,000 new data sets (e.g., Hertzog, Lindenberger, Ghisletta, & von Oertzen, 2006). We chose to use actual data to remove uncertainty about specifying key parameters (e.g., slope variances) in the Monte Carlo simulations. Power is represented by the proportion of cases in the 1,000 simulated data sets with a statistically significant change–change correlation. The results revealed a statistical power of 53% to detect the smallest observed correlation \( r = .20 \) among the hypothesized pairs, and 100% power to detect the other four change–change correlations \( r = .42 \) and greater. Because the amount of slope variance for the hypothesized pairs was not dramatically different compared to most other analyzed traits, these power estimates should be generally representative of the other correlated change effect sizes. Overall, these results indicate sufficient statistical power for the purpose of our correlated change analyses.

We also estimated correlated change among general factors of personality and interests, which was used as the primary comparison point for interpreting the magnitude of correlations among specific personality traits and interests. Little empirical data is available to guide our expectations for the magnitude of change–change associations for personality and interests. To provide some grounding, we tested the extent to which abstract, general sources of variation in personality and interest were correlated. Put differently, we were less interested in testing whether change–change associations were different from zero, and instead, we estimated a relevant effect size of broad interest and personality change for comparison purposes. Figure 2 displays the path diagram for the general factor model of personality estimated from the growth curves for each Big Five personality trait. We estimated a general factor of levels using the level of each trait as indicators, and we estimated a general factor of change using the slope of each trait as indicators. Although not pictured in Figure 2, the same higher-order model structure was used to estimate the general factor of interests. We chose to model general factors using a higher-order approach because it enabled us to identify the amount of variability in levels and change shared across personality traits or interest categories. The general factors capture differing amounts of variance in specific traits primarily because traits vary in the extent to which they are correlated with each other.

The general factor of personality accounted for most of the variance in levels and changes in extraversion and conscientiousness, and to lesser extents, agreeableness and emotional stability. For levels of personality traits, estimates of variance accounted for ranged from 14% for agreeableness to 69% for extraversion, with an average of 38%. For changes, variance accounted for ranged from 19% for agreeableness to 100% for extraversion, with an average of 52%. The general interest factor accounted for between 13% (for social) and 100% (for enterprising and conventional) of the variance in levels of RIASEC categories, with an average of 55%. For changes in interests, the general factor accounted for between 30% (for social) and 100% (for enterprising and conventional) of the variance in slopes, with an average of 77%.

The general factor personality model fit well (RMSEA = .06; CFI = .97), whereas the general interest factor model fit the data poorly (RMSEA = .12; CFI = .64). Although the fit of general factor models was not central to our analyses, we performed additional sensitivity analyses and tested alternative models to ensure the robustness of our results. We examined various models by modifying the variances of intercepts and slopes estimated for RIASEC dimensions. We eventually retained the full model for subsequent analyses because there was no evidence that the alternative models exhibited better model fit, and none of these sub-models altered our interpretations.

The overall fit indices reported for evaluating the latent growth curve models are \( \chi^2 \), RMSEA, CFI, SRMR, and TLI. \( \chi^2 \) statistic is often referred to as indicator of “lack of fit” (Mulaik et al., 1989) and is related to degrees of freedom. Some have suggested that a model with an RMSEA below .05 has “good” fit, and an RMSEA below .08 has “acceptable” fit (McDonald & Ho, 2002). Generally,
a model is regarded as acceptable when CFI values are greater than .90 (e.g., Hu & Bentler, 1999). For all sets of analyses, we report standard errors or 95% confidence intervals around effect sizes as an indicator of precision. Tables S5–S7 in the online supplemental materials report correlation matrices for all personality and interest variables at each timepoint.

Results

Measurement Invariance

We tested for measurement invariance across time using the procedure outlined by Widaman, Ferrer, and Conger (2010). Fit statistics for the invariance models across timepoints are shown in Tables S1 and S2 of the online supplementary materials. To summarize, agreeableness, realistic, artistic, enterprising, and conventional interests were consistent with scalar invariance across time, as indicated by negligible changes in the fit statistics of the scalar and metric invariance models (i.e., \( \Delta \text{RMSEA} < .02 \)). Emotional stability, extraversion, openness, conscientiousness, investigative, and social interests were partially consistent with scalar invariance. In each of these trait categories, partial scalar invariance was found by freeing a single parcel at Time 1. That only one intercept was required to be freed was consistent with a generally acceptable measurement model fit toward generally acceptable measurement properties. Interestingly, the parcel that was required to be freed was at the first timepoint. Younger participants tend to engage in more acquiescent response sets (Mõttus et al., in press; Soto, John, Gosling, & Potter, 2008), which may provide a psychometric explanation for the lack of full scalar invariance concentrated around the first measurement occasion.

Next, we tested for longitudinal measurement invariance across gender using a similar model comparison approach. The fit statistics for each gender invariance model are shown in Tables S3 and S4 of the online supplementary materials. Results supported (partial) longitudinal scalar invariance across gender for all personality traits and four of the six interest categories (exceptions: artistic and conventional). Partial scalar invariance across gender was found by freeing two parcels for males at Time 1 for artistic interests and one parcel for males at Time 1 for conventional interests. We therefore suggest caution in interpreting gender differences in these two interest categories. To reduce model complexity given our relatively modest sample size, we used scale sum scores for all remaining analyses.

Rank-Order Stability

We compared the rank-order stabilities of vocational interests and personality traits across each timepoint (i.e., from age 16–18, 18–22, and 22–24) and over the entire 8-year period (i.e., age 16–24). Table 3 displays the rank-order stability coefficients and 95% confidence intervals for the Big Five traits and RIASEC interests. Figure 3 displays this information graphically. The horizontal dotted lines in Figure 3 represent the average stability coefficients for the Big Five traits and RIASEC interests, respectively, at each timepoint. All rank-order stability coefficients were statistically significant, and there were no gender differences in stability levels. Note that both interests and personality traits became increasingly stable with age, which is consistent with the cumulative continuity principle (Roberts & Mroczek, 2008).

Hypothesis 1 predicted that vocational interests would be more stable than the Big Five traits. This hypothesis was not supported. The average stability levels of the Big Five traits and RIASEC interests were very similar from ages 16–18 (\( r = .49 \) for personality and interests), 18–22 (\( r = .63 \) for personality; \( r = .66 \) for interests), 22–24 (\( r = .71 \) for personality; \( r = .74 \) for interests), and across the entire study (\( r = .41 \) for personality; \( r = .38 \) for interests). Thus, there were no notable differences in the overall stability levels of interests and personality traits. There were also few differences in the stability levels of specific Big Five traits and interest categories. Most notably, extraversion (\( r = .29, 95\% \text{ CI } [.18, .41] \)) was the least stable personality trait from age 16 to 24, while openness was the most stable (\( r = .57, 95\% \text{ CI } [.48, .65] \)).
Table 3

<table>
<thead>
<tr>
<th>Rank-Order Stabilities of Personality Traits and Vocational Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 16–18 (T1–T2)</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Personality traits</td>
</tr>
<tr>
<td>Emotional stability</td>
</tr>
<tr>
<td>Extraversion</td>
</tr>
<tr>
<td>Openness</td>
</tr>
<tr>
<td>Agreeableness</td>
</tr>
<tr>
<td>Conscientiousness</td>
</tr>
<tr>
<td>Big Five average</td>
</tr>
<tr>
<td>Vocational interests</td>
</tr>
<tr>
<td>Realistic</td>
</tr>
<tr>
<td>Investigative</td>
</tr>
<tr>
<td>Artistic</td>
</tr>
<tr>
<td>Social</td>
</tr>
<tr>
<td>Enterprising</td>
</tr>
<tr>
<td>Conventional</td>
</tr>
<tr>
<td>RIASEC average</td>
</tr>
</tbody>
</table>

Note. *r* = rank-order stability (correlation coefficient); 95% CI = 95% confidence interval. Big Five average and RIASEC average represent the mean stability coefficient for all personality and interest categories, respectively, across each measurement wave. Gender and home location were included as auxiliary variables in these models.

Table 4

<table>
<thead>
<tr>
<th>Personality traits</th>
<th>Age 16–18 (T1–T2)</th>
<th>Age 18–22 (T2–T3)</th>
<th>Age 22–24 (T3–T4)</th>
<th>Age 16–24 (T1–T4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emotional stability</td>
<td>.53 [.44, .62]</td>
<td>.70 [.62, .78]</td>
<td>.71 [.64, .78]</td>
<td>.45 [.35, .54]</td>
</tr>
<tr>
<td>Extraversion</td>
<td>.34 [.22, .45]</td>
<td>.54 [.41, .67]</td>
<td>.67 [.59, .75]</td>
<td>.29 [.18, .41]</td>
</tr>
<tr>
<td>Openness</td>
<td>.53 [.44, .62]</td>
<td>.79 [.73, .85]</td>
<td>.81 [.75, .86]</td>
<td>.57 [.48, .65]</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>.48 [.38, .58]</td>
<td>.55 [.44, .66]</td>
<td>.64 [.55, .72]</td>
<td>.36 [.25, .47]</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>.57 [.48, .66]</td>
<td>.63 [.45, .66]</td>
<td>.74 [.67, .81]</td>
<td>.38 [.28, .48]</td>
</tr>
<tr>
<td>Big Five average</td>
<td>.49</td>
<td></td>
<td></td>
<td>.41</td>
</tr>
</tbody>
</table>

and these confidence intervals did not overlap. Apart from this distinction, the stability coefficients for each trait category were not statistically different from one another in the vast majority of comparisons. Overall, these results suggest that both interests and personality traits become increasingly stable with age, but neither construct is more stable than the other.

Mean-Level Change

We estimated mean-level changes in interests and personality traits by computing standardized difference scores (i.e., *d*-values) across each timepoint. Table 4 displays the *d*-values for the Big Five traits and RIASEC interests from age 16–18, 18–22, 22–24, and across the entire study from age 16–24. Figure 4 displays this information graphically, with cumulative *d*-values representing trajectories of change from age 16 to 24. Hypothesis 2a predicted that personality traits would show evidence of maturation, with increases in mean-levels of emotional stability, conscientiousness, agreeableness, and openness (Roberts et al., 2006). Hypothesis 2b predicted mean-level increases in interest categories that involve people (social, artistic, and enterprising interests), but not things (realistic, investigative, and conventional; Hoff et al., 2018).

Results provided moderate support for personality maturation, and no evidence of increasing levels of people-oriented interests. Among the Big Five traits, agreeableness increased the most from age 16 to 24 (*d* = .49, 95% CI [.32, .65]), followed by openness (*d* = .28, 95% CI [.12, .44]) and conscientiousness (*d* = .20, 95% CI [.03, .36]). Emotional stability levels remained constant (*d* = .02, 95% CI [.16, .16]), while extraversion levels decreased over the full study (*d* = -.26, 95% CI [.43, -.10]), despite an increase of *d* = .11 from age 16 to 18.

Compared with personality traits, mean-level changes in vocational interests were smaller in magnitude and less consistent in direction. The greatest positive changes were found in investigative interests (*d* = .15, 95% CI [.01, .31]), while artistic interests showed the largest declines (*d* = -.09, 95% CI [.25, .07]). The other four interest categories showed little cumulative change (*d*’s less than or equal to |.1|). Together, the mean-level change results suggest that Icelandic youth became more agreeable and open to experience from age 16 to 24, and slightly more conscientious. Yet these increases were not accompanied by consistent changes in vocational interests (apart from a slight increase in investigative interests). In addition, the results suggest a strong trend of decreasing extraversion levels from age 18 to 24.

Growth curve models. Next, we formalized the description of personality and interest development using growth curve models. Table 5 reports intercept and slope parameters for each personality trait and interest category. We found statistically significant variance in the intercept and slope for all but one variable. This means that although we estimated relatively little mean-level change for interests, there was still variability in how individuals changed. Some individuals showed greater increases than the dominant trend, while others changed in the opposite direction. The only exception was the slope variance of artistic interests (*r*² = 3.99, SE = 2.44), which was not statistically different from zero. Nonsignificant slope variance indicates that participants more or less changed in a similar manner in artistic interests. Associations with slopes of artistic interests are likely estimated imprecisely given the relatively small amount of variance. We now turn to possible correlates of variability in change.

Gender differences in mean-level changes. Gender differences in mean-level changes were examined using latent growth curve modeling. Generally, the models displayed good fit (RMSEA = .00–.09; CFI = .92–1.00). Table 6 displays the standardized parameter estimates for gender differences in the intercepts and slopes of each Big Five trait and RIASEC category (standardized with respect to the personality and interest scales, but not gender). Gender was dummy-coded in these models such that females were coded as 0 and males were coded as 1. Because of this, positive values indicate that males score higher and negative values indicate that males score lower. For example, in the
slope column of Table 6, positive values indicate that men showed a more positive mean-level slope trajectory than women. This would imply that men increased more than women in a given trait (e.g., if the general mean-level trend was positive), or that men decreased less than women (if the general mean-level trend was negative).

Results of the gender analyses were mostly consistent with our expectations based on previous research. There were statistically significant gender differences in the intercepts of three Big Five traits and five RIASEC categories. Consistent with our expectations, men scored higher on emotional stability ($b = .78$, 95% CI [.56, 1.00]), and realistic ($b = 1.10$, 95% CI [.90, 1.29]), investi-

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*Figure 3.* Rank-order stabilities of personality and interests. Dotted lines represent the average stability coefficients for Big Five traits and RIASEC interests, respectively. Error bars denote 95% confidence intervals. For Big Five Personality Traits (top), E.S. = Emotional Stability; E = Extraversion; O = Openness to Experience; A = Agreeableness; C = Conscientiousness. For RIASEC Vocational Interests (bottom), R = Realistic; I = Investigative; A = Artistic; S = Social; E = Enterprising; C = Conventional. See the online article for the color version of this figure.
negative ($b = .48$, 95% CI [.24, .73]), and conventional interests ($b = .65$, 95% CI [.40, .89]). Women scored higher on extraversion ($b = -.54$, 95% CI [−.83, −.25]), agreeableness ($b = -.56$, 95% CI [−.80, −.33]), and social ($b = -1.32$, 95% CI [−1.55, −1.09]) and artistic interests ($b = -.52$, 95% CI [−.79, −.25]). In addition, there were statistically significant slope differences in two Big Five traits and one RIASEC category. Women showed a more positive slope trajectory than men in

---

Table 4

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Mean-Level Changes in Personality Traits and Vocational Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 16–18 (T1–T2)</td>
</tr>
<tr>
<td></td>
<td>$d$ [95% CI]</td>
</tr>
<tr>
<td>Personality traits</td>
<td></td>
</tr>
<tr>
<td>Emotional stability</td>
<td>$-.04$ [−.21, .13]</td>
</tr>
<tr>
<td>Extraversion</td>
<td>$.11$ [−.05, .28]</td>
</tr>
<tr>
<td>Openness</td>
<td>$-.02$ [−.19, .15]</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>$.19$ [0.02, .36]</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>$.01$ [−.16, .18]</td>
</tr>
<tr>
<td>Vocational interests</td>
<td></td>
</tr>
<tr>
<td>Realistic</td>
<td>$.02$ [−.15, .19]</td>
</tr>
<tr>
<td>Investigative</td>
<td>$.01$ [−.16, .18]</td>
</tr>
<tr>
<td>Artistic</td>
<td>$.21$ [−.04, .38]</td>
</tr>
<tr>
<td>Social</td>
<td>$.16$ [−.01, .33]</td>
</tr>
<tr>
<td>Enterprising</td>
<td>$.09$ [−.08, .25]</td>
</tr>
<tr>
<td>Conventional</td>
<td>$.07$ [−.10, .24]</td>
</tr>
</tbody>
</table>

Note. $d$ = standardized mean difference, negative values indicate decreases over time; 95% CI = 95% confidence interval. Gender and home location were included as auxiliary variables in these models.
Correlated Changes in Interests and Personality Traits

Our third set of analyses investigated correlated changes among personality traits and vocational interests (i.e., change–change correlations), using the estimate of correlated change among general factors as a comparison point. Although not our primary focus, we also estimated level–level and level–change correlations across domains. Hypothesis 3 predicted strong, positive correlated change in five of the 30 pairings of specific Big Five traits and RIASEC interests: extraversion-social, extraversion-enterprising, openness-artistic, openness-investigative, and conscientiousness-conventional. In the other 25 personality-interest pairings, we expected correlated changes to be weaker than, or roughly equal to, the estimate of correlated change among general factors.

Table 7 displays intercorrelations among intercepts (i.e., level–level), among slopes (i.e., change–change), and between intercepts and slopes (i.e., level–change). Figure 5 displays this information graphically. Note that horizontal dotted lines in Figure 5 represent the correlations among general factors of interest or personality scale; positive coefficients indicate higher intercepts or more positive slopes among men compared to women (and vice versa for negative b coefficients). df = 7 for all models presented in this table. Home location was included as an auxiliary variable in these models.

Table 5
Latent Growth Curve Results Modeling Levels and Changes of Personality Traits and Vocational Interests

<table>
<thead>
<tr>
<th>Intercepts</th>
<th>Slopes</th>
<th>Fit Indices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personality traits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional Stability</td>
<td>[.03, .13]</td>
<td>[.16, .66]</td>
</tr>
<tr>
<td>Extraversion</td>
<td>[.43, .10]</td>
<td>[.87]</td>
</tr>
<tr>
<td>Openness</td>
<td>[.52, .09]</td>
<td>[.67]</td>
</tr>
<tr>
<td>Agreeableness</td>
<td>[.68, .09]</td>
<td>[.95]</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>[.27, .12]</td>
<td>[2.45]</td>
</tr>
</tbody>
</table>

Vocational interests

| Realistic | \[.81, .10\] | \[9.09\] | .18 | .08 | 19.49 | .94 | .93 | .04 |
| Social | \[.28, .25\] | \[9.72\] | .19 | .08 | 14.92 | .94 | .93 | .04 |
| Enterprising | \[.17, .23\] | \[9.09\] | .18 | .09 | 23.32 | .92 | .90 | .04 |
| Conventional | \[.09, .26\] | \[9.61\] | .22 | .05 | 10.21 | .97 | .96 | .03 |

Note. Bolded values indicate statistically significant variance (p < .05), df = 5 for all models presented in the table. Gender and home location were included as auxiliary variables in these models.

Correlated Changes in Interests and Personality Traits

Our third set of analyses investigated correlated changes among personality traits and vocational interests (i.e., change–change correlations), using the estimate of correlated change among general factors as a comparison point. Although not our primary focus, we also estimated level–level and level–change correlations across domains. Hypothesis 3 predicted strong, positive correlated change in five of the 30 pairings of specific Big Five traits and RIASEC interests: extraversion-social, extraversion-enterprising, openness-artistic, openness-investigative, and conscientiousness-conventional. In the other 25 personality-interest pairings, we expected correlated changes to be weaker than, or roughly equal to, the estimate of correlated change among general factors.

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Table 7

Correlations Among Levels and Changes in Personality Traits and Vocational Interests

<table>
<thead>
<tr>
<th>Parameter estimates and SEs from full level and change correlation matrix</th>
<th>Emotional Stab.</th>
<th>Extraversion</th>
<th>Openness</th>
<th>Agreeableness</th>
<th>Conscientiousness</th>
<th>General P. Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level–Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Realistic</td>
<td>.18 (.09)</td>
<td>-.20 (.12)</td>
<td>-.04 (.10)</td>
<td>-.18 (.10)</td>
<td>.01 (.09)</td>
<td>-.02 (.09)</td>
</tr>
<tr>
<td>Investigative</td>
<td>.25 (.10)</td>
<td>-.05 (.14)</td>
<td>.44 (.09)</td>
<td>.07 (.11)</td>
<td>.29 (.10)</td>
<td>.32 (.10)</td>
</tr>
<tr>
<td>Artistic</td>
<td>.03 (.11)</td>
<td>-.03 (.15)</td>
<td>.82 (.08)</td>
<td>.05 (.12)</td>
<td>-.04 (.11)</td>
<td>-.06 (.15)</td>
</tr>
<tr>
<td>Social</td>
<td>-.24 (.10)</td>
<td>.47 (.12)</td>
<td>.19 (.10)</td>
<td>.08 (.11)</td>
<td>.10 (.10)</td>
<td>.16 (.11)</td>
</tr>
<tr>
<td>Enterprising</td>
<td>.29 (.10)</td>
<td>.51 (.12)</td>
<td>-.10 (.11)</td>
<td>-.22 (.11)</td>
<td>.42 (.09)</td>
<td>.52 (.09)</td>
</tr>
<tr>
<td>Conventional</td>
<td>.33 (.11)</td>
<td>.25 (.13)</td>
<td>-.18 (.12)</td>
<td>-.18 (.12)</td>
<td>.33 (.10)</td>
<td>.39 (.10)</td>
</tr>
<tr>
<td>General I. Factor</td>
<td>.25 (.07)</td>
<td>.38 (.10)</td>
<td>.17 (.09)</td>
<td>-.12 (.08)</td>
<td>.37 (.07)</td>
<td>.38 (.06)</td>
</tr>
</tbody>
</table>

| Change–Change                                                             |                |             |          |               |                  |                  |
| Realistic                                                                 | .01 (.20)      | .28 (.20)   | -.37 (.24) | -.22 (.18)    | .17 (.15)        | .11 (.12)        |
| Investigative                                                             | -.16 (.25)     | -.02 (.27)  | .09 (.25) | -.16 (.22)    | .01 (.18)        | -.02 (.15)       |
| Artistic                                                                  | -.04 (.31)     | -.12 (.35)  | .88 (.24) | .26 (.29)     | -.10 (.24)       | -.33 (.38)       |
| Social                                                                    | -.03 (.19)     | .19 (.19)   | .09 (.21) | .10 (.18)     | -.03 (.15)       | .02 (.12)        |
| Enterprising                                                              | .27 (.18)      | .60 (.18)   | -.06 (.20) | -.15 (.17)    | .53 (.12)        | .48 (.12)        |
| Conventional                                                              | .16 (.20)      | .63 (.20)   | -.31 (.22) | -.23 (.19)    | .35 (.14)        | .37 (.12)        |
| General I. Factor                                                         | .09 (.12)      | .50 (.13)   | .24 (.17) | -.10 (.12)    | .36 (.10)        | .32 (.09)        |

| Level–Change                                                              |                |             |          |               |                  |                  |
| Realistic                                                                 | .03 (.12)      | -.16 (.16)  | .33 (.13) | .02 (.13)     | -.16 (.12)       | -.09 (.11)       |
| Investigative                                                             | .04 (.15)      | -.29 (.19)  | .07 (.16) | -.12 (.17)    | -.22 (.14)       | -.25 (.14)       |
| Artistic                                                                  | -.21 (.20)     | .06 (.27)   | .12 (.21) | -.10 (.20)    | -.07 (.19)       | .08 (.29)        |
| Social                                                                    | -.03 (.11)     | -.23 (.15)  | -.04 (.12) | -.09 (.12)    | -.07 (.12)       | -.07 (.11)       |
| Enterprising                                                              | -.19 (.11)     | -.23 (.14)  | .04 (.12) | -.03 (.12)    | -.28 (.11)       | -.30 (.11)       |
| Conventional                                                              | -.30 (.17)     | -.36 (.15)  | .13 (.13) | -.10 (.14)    | .21 (.12)        | -.31 (.12)       |
| General I. Factor                                                         | -.13 (.08)     | -.36 (.11)  | -.08 (.10) | -.05 (.09)    | -.25 (.08)       | -.30 (.08)       |

| Level–Change                                                              |                |             |          |               |                  |                  |
| Realistic                                                                 | -.28 (.15)     | -.18 (.16)  | .12 (.17) | -.09 (.14)    | -.26 (.12)       | -.25 (.10)       |
| Investigative                                                             | -.10 (.17)     | .05 (.19)   | .12 (.19) | -.08 (.15)    | -.29 (.12)       | -.23 (.11)       |
| Artistic                                                                  | -.05 (.18)     | -.12 (.19)  | .08 (.21) | -.14 (.16)    | -.23 (.13)       | -.16 (.15)       |
| Social                                                                    | -.30 (.17)     | -.15 (.18)  | -.01 (.19) | .10 (.16)     | .05 (.14)        | .04 (.13)        |
| Enterprising                                                              | -.16 (.17)     | -.26 (.17)  | .05 (.19) | .15 (.16)     | -.29 (.12)       | -.26 (.12)       |
| Conventional                                                              | -.26 (.17)     | -.29 (.17)  | .21 (.19) | .17 (.16)     | -.29 (.12)       | -.32 (.11)       |
| General I. Factor                                                         | -.17 (.11)     | -.29 (.11)  | -.18 (.15) | .05 (.11)     | -.33 (.09)       | -.29 (.08)       |

Note. Standard errors are shown in parentheses. Bolded coefficients have confidence intervals that do not include zero. General P. Factor = General Personality Factor; General I Factor = General Interests Factor. Gender and home location were included as auxiliary variables in these models.

.88, 95% CI [.41, 1.35]; conscientiousness-conventional, r = .35, 95% CI [.20, .65]). However, openness-investigative (r = .09, 95% CI [.40, .58]) and extraversion-social (r = .19, 95% CI [.19, .57]) showed nonsignificant change relations that were weaker than the correlation among general change factors (r = .32, 95% CI [.16, .49]). Nonetheless, levels of openness-investigative (r = .44, 95% CI [.25, .62]) and extraversion-social (r = .47, 95% CI [.23, .71]) were still strongly related, as were levels of the other three hypothesized pairs (level–level correlations ranged from r = .33 for conscientiousness-conventional to r = .82 for openness-artistic).

In the other 25 personality-interest pairings, there were a few notably strong change correlations that exceeded the .32 baseline change correlation among general factors of change. Conscientiousness and enterprising interests showed strong, positive relations in terms of changes (r = .33, 95% CI [.30, .77]) and levels (r = .42, 95% CI [.24, .60]). Changes in extraversion and conscientiousness interests were strongly correlated (r = .63, 95% CI [.23, 1.03]), but their levels were only moderated associated (r = .28, 95% CI [.01, .54]). Two other personality-interest pairings were notable because they showed moderately strong negative change–change correlations. Openness-realistic (r = -.37, 95% CI [−.83, .10]) and openness-conventional (r = -.31, 95% CI [−.73, .11]) both diverged from the general trend of positively correlated slopes, although their confidence intervals included zero.

Level–change correlations are also reported in Table 7. These correlations reflect the extent to which personality levels are related to interest changes, and vice versa for interest levels and personality changes. In both sets of analyses, the vast majority of level–change correlations were negative. This implies that in general, individuals with higher personality trait levels at Time 1 experienced less growth in their interest scores over time (with the same effect for interest levels and personality trait changes). These cross-domain ceiling effects were
most notable for conscientiousness and extraversion compared to the other Big Five traits. Higher levels of extraversion ($r = -.36, 95\% CI [-.57, -.15]$) and conscientiousness ($r = -.25, 95\% CI [-.41, -.09]$) were associated with more negative changes in the general interest factor. There was also a negative correlation between general personality levels and general changes in interests ($r = -.30, 95\% CI [-.45, -.14]$).

**Discussion**

The current study investigated the longitudinal development of personality and interests over four waves of measurement from late adolescence to young adulthood (ages 16–24) with a sample of Icelandic youth. We focused on three types of continuity and change: rank-order stability, mean-level change, and cross-domain correlated change. Personality traits and interests both became increasingly stable across the four timepoints, consistent with the cumulative continuity principle (Roberts & Caspi, 2003). This finding is noteworthy because the retest interval between Times 2–3 was twice as long as between Times 1–2 and 3–4. Although rank-order stability typically decreases over longer periods of time (Fraley & Roberts, 2005), increasing age appeared to outweigh these effects. In addition, there were essentially no differences in the average stability levels of personality and interests. Unlike meta-analytic comparisons of different samples (Low et al., 2005; Roberts & Delvecchio, 2000), our
results suggest that vocational interests and personality traits are equally stable when measured within the same sample.

Our second set of analyses focused on mean-level change while considering the potential for gender differences. We hypothesized mean-level increases among personality traits associated with social maturity (Roberts et al., 2006), and among interests that involve people (Hoff et al., 2018). Results revealed evidence of increasing personality maturity, as mean-level increases were found in agreeableness, openness, and conscientiousness from age 16 to 24. Emotional stability levels remained constant, while extraversion levels decreased. In general, the greatest mean-level changes in personality occurred from age 18–22 (Times 2–3), which could be expected because this retest interval was twice as long as the others. Longer retest intervals are typically associated with greater mean-level change (Fraley & Roberts, 2005). For the interest categories, there was very little cumulative change in mean-levels. This finding differs somewhat from the meta-analysis of U.S. samples (Hoff et al., 2018). In addition, gender differences were found in changes in emotional stability and conscientiousness, indicating that women increased more than men in both of these traits. This means that the gender gap in emotional stability decreased over time (women started lower), while the gender gap in conscientiousness increased (there were no differences in starting levels). The only significant gender difference in interest changes occurred in artistic interests, indicating that men increased slightly more than women in this category.

Our third set of analyses examined correlated change between the Big Five traits and RIASEC interests. We hypothesized strong, positive correlated change in five specific personality-interest pairings based on previous cross-sectional research and the shared situations embedded in these trait categories (Mount et al., 2005; Wrzus & Roberts, 2017). We also estimated correlated change among general factors of personality and interests (e.g., Anusic & Schimmack, 2016; De Fruyt et al., 2006). Interests and personality traits change together in meaningful ways, but these relations may not be observable when comparing group means in a single study. Consistent with our findings, meta-analyses have shown that mean-level changes in interests are smaller in magnitude and occur more gradually than personality (Hoff et al., 2018; Roberts et al., 2006).

A critical question raised by the current study is why correlated changes occur between certain personality traits and interests. Wrzus and Roberts’ (2017) TESSERA model of developmental processes provides a framework for addressing this question. Their model emphasizes the shared situational content across personality traits and other individual differences. According to their model, situations that repeatedly trigger short-term changes in states lead to long-term changes in traits through self-reflection and association. For example, a student who repeatedly experiences success/enjoyment in art or design courses will eventually learn to associate these situations with positive emotions. Over time, reflective and associative processes will gradually lead to increases in openness to experience and corresponding artistic interests. Importantly, this basic framework—emphasizing situational similarity—can be applied to a variety of causal mechanisms that may influence personality, interests, or other relevant individual differences (e.g., biology or life experiences, Bleidorn et al., 2018; DeYoung & Gray, 2009; Specht et al., 2014; Tucker-Drob & Briley, in press).

An alternative but not mutually exclusive perspective is that correlated change results from directional influences from personality to interests, or vice versa. McCrae and Costa’s (1999, 2008) five-factor theory is an example of this perspective because it argues that personality traits (which are closely linked to biology in their model) cause the development of interests and other contextualized variables (i.e., characteristic adaptations). For example, a person who increases in openness may develop stronger artistic interests as a way to express their openness levels. However, the reverse causality may also be true: becoming interested in
artistic pursuits may lead to higher levels of openness. A reasonable deduction is that interests and personality are reciprocally influential across development. Causal processes that lead to changes in one domain also likely affect the other domain, but only when trait categories are similar in some way. Abilities that share common situations with interests and personality are also important to consider (Ackerman, 1996; Ackerman & Heggestad, 1997; Pässler, Beinicke, & Hell, 2015; Su, Stoll, & Rounds, in press; Ziegler, Schroeter, Lüdtke, & Roemer, 2018).

Most pairs of interests and personality traits that changed together share some degree of situational content, even those not included in our five hypothesized pairs. For example, conscientiousness and enterprising interests share a common focus on getting ahead in work and business contexts. Strong correlated change may have occurred in these two dimensions because conscientious behaviors, particularly those related to achievement striving, are often rewarded in work settings and can help individuals achieve positions of influence (Nye & Roberts, 2013). In a less direct manner, conventional interests and extraversion are also related through business contexts, where higher levels of extraversion can be advantageous. Openness, realistic, and conventional interests are divergently related in that many activities that comprise realistic and conventional interests involve systematic work routines in structured environments (e.g., filing paperwork, organizing goods, using industrial equipment). These types of activities oppose the situations embedded in openness (see also Hogan, 1983).

The general factor correlations also indicate some degree of situational commonality shared by all personality traits and interest categories. Broad developmental mechanisms may lead to general changes in interest and personality because certain situations are relevant across trait categories. For example, social skills are valued in almost all interpersonal and work settings. Students interested in pursuing a field of study or occupation, regardless of the actor’s perspective, not from an observer’s point of view (Branje, 2009). The general factor model results should also be interpreted with some caution due to the high level of collinearity between intercept and slope factors among RIASEC dimensions. We tested alternative models to ensure the robustness of the general interest factor model, but future work could further investigate differing approaches to modeling the general interest factor (e.g., Schermer & Goffin, 2018; Tracey, 2012). We also did not find scalar measurement invariance for all variables. However, deviations from scalar invariance were minor and tended to be concentrated at the youngest wave, raising the possibility that age-related response sets might play a role. Future research is needed that replicates our results in different countries, contexts, and age periods. Future longitudinal studies could also benefit by including more frequent retest intervals. Examining change more precisely across life transitions may reveal more about the events in-between assessments that affect development (e.g., Denissen, Luhmann, Chung, & Bleidorn, 2018). It is also important for future studies to examine correlated change with other constructs. Studying correlated change with abilities can help test some of the causal mechanisms proposed by developmental theories that integrate personality, interests, and abilities (e.g., Ackerman, 1996; Gottfredson, 1981, 2005; Roberts & Wood, 2006; Schmidt, 2014; Wrizus & Roberts, 2017). Work attitudes, such as job satisfaction and organizational commitment, are also important to consider as they may play a role in personality maturation (Hudson et al., 2012; Wille et al., 2014). More broadly, future studies can benefit by viewing interests and personality as interrelated developmental constructs.
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**Correction to Amodio and Devine (2006)**

In the article, “Stereotyping and Evaluation in Implicit Race Bias: Evidence for Independent Constructs and Unique Effects on Behavior,” by David M. Amodio and Patricia G. Devine (Journal of Personality and Social Psychology, 2006, Vol. 91, No. 4, 652–661. [http://dx.doi.org/10.1037/0022-3514.91.4.652](http://dx.doi.org/10.1037/0022-3514.91.4.652), the reported sign of a statistical coefficient was reversed, due to a transcription error, and should read as \( \beta = .32, t(28) = 1.79, p = .08, r = .32 \) (p. 656). All other effects were replicated in reanalysis, and the main results and theoretical conclusions of the article remain unchanged. More information, including an analysis replication report, datasets, and analysis scripts, may be found at [https://osf.io/3chzy/](https://osf.io/3chzy/).

The online version of this article has been corrected.

[http://dx.doi.org/10.1037/pspi0000241](http://dx.doi.org/10.1037/pspi0000241)