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What is This?

Hitting the Road to Adulthood: Short-Term Personality Development During a Major Life Transition

Wiebke Bleidorn[1]

Abstract

Previous research suggests that normative life transitions have the potential to trigger personality maturation. But what exactly happens during such a transitional stage? The present study examined personality trait changes in a sample of 910 German high school students during their transition from school to adult life. Despite the short observation period of three semiannual measurements, growth curve analyses revealed significant mean-level changes in personality traits. These changes occurred primarily in a positive direction, were strongest for the trait of conscientiousness, and most pronounced in those students who were directly confronted with this transitional experience. Bivariate growth curve models indicated that individual differences in personality change were substantially associated with changes in students' investments into achievement behavior. Supporting socioanalytic perspectives on personality development, these findings can be discussed with respect to process approaches to personality change assuming that consistent behavioral changes might lead to personality change in a bottom-up fashion.

"The Kids Are Alright"—A decade after Roberts, Caspi, and Moffitt (2001, p. 670) have headed their article according to the famous *The Who* movie, it is deemed to be well established that normative personality development in early adulthood reflects growth in the direction of greater maturity. In terms of the Big Five model of personality (McCrae & John, 1992), both longitudinal and cross-sectional studies suggest that individuals tend to become more agreeable, more conscientious, and less neurotic when they are hitting the road to adulthood (e.g., Klimstra, Hale, Raaijmakers, Branje, & Meeus, 2009; Robins, Fraley, Roberts, & Trzesniewski, 2001; Soto, John, Gosling, & Potter, 2011; Specht, Egloff, & Schmukle, 2011; for reviews, see Roberts, Walton, & Viechtbauer, 2006; Roberts, Wood, & Caspi, 2008). Less consistent results were reported for the traits of extraversion and openness, which generally show rather modest age trends across the life span (Soto et al., 2011). That does not mean that all "kids" change alike—There is a large body of research pointing to substantial interindividual differences in developmental trajectories. That is, personality change itself can be considered a relevant individual difference variable (e.g., Bleidorn, Kandler, Riemann, Angleitner, & Spinath, 2009; Neyer & Lehnart, 2007).

Equipped with this knowledge, the field is now moving from description to explanation to address the clearly emerging question why most (but not all) people demonstrate such pervasive personality changes in early adulthood. Genetically shaped maturation processes, such as significant neurological changes (e.g., Giedd et al., 1999), do certainly play a role but are not telling the whole story. Controlling for genetic effects, there actually were recent longitudinal behavioral genetic findings that substantiated the importance of environmental effects on both stability and change in personality (e.g., Bleidorn et al., 2009; Bleidorn et al., 2010; Kandler et al., 2010). But what are the most relevant environmental factors and life experiences that trigger personality maturation in early adulthood? And by which mechanisms do they induce changes in such stable entities like personality traits?

A prominent approach dedicated to address these questions is the social investment theory (SIT) by Roberts, Wood, and Smith (2005), which can be embedded in the larger framework of their neo-socioananalyitcal theory of personality (Roberts & Wood, 2006). The SIT proposes that age-graded life transitions

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in early adulthood have the potential to stimulate personality change, as they force individuals to invest in and commit to new social roles (e.g., entering a serious relationship, starting a job, becoming a parent). Presenting new behavioral demands and expectancies that can be formulated in trait terms (e.g., to act in an emotionally stable, agreeable, and conscientiousness way), these transitional experiences should form a reward structure for personality maturation. Individual differences in change, on the other hand, are explained by the fact that individuals usually differ in the timing and in the way they master these transitional tasks and upcoming role demands.

Evidence for the assumptions of the SIT has been provided by both longitudinal and cross-sectional research (for reviews, see Lodi-Smith & Roberts, 2007; Roberts et al., 2005; Roberts & Wood, 2006). However, though these studies have consistently supported the assumed links between social role experiences and personality maturation, their focus has been largely restricted to a relatively broad *macro-analytical* (i.e., structure-oriented) level. That is, previous studies have often followed rather heterogeneous samples of young adults over relatively long research periods, without a targeted consideration of a transitional episode that all participants experience at about the same time. Moreover, social role experiences were often operationalized by mere demographic participation in a social role (i.e., as dichotomous variables like marital status; for exceptions, see, for example, Neyer & Lehnart, 2007; Roberts, Walton, Bogg, & Caspi, 2006).

From a *micro-analytic* (i.e., process-oriented) perspective, much work still has to be done, as less is known about how these normative role experiences might get "under the skin" and induce personality change (Roberts & Jackson, 2008). According to the SIT, the nature and degree of psychological investments into the particular social institutions should be most critical for the maturational processes. That is, not whether people face a certain transition at all, but how they negotiate the upcoming demands and behavioral tasks should affect the timing, direction, and degree of personality trait change (Roberts et al., 2005).

The present study sets out to shed some further light on the processes of personality maturation during a normative life transition in early adulthood. Specifically, following a sample of German students throughout their last months in high school, this study was aimed to provide a fine-grained investigation of the dynamic interplay between social role investments and personality change during a major life transition in early adulthood.

Graduation From School As a Major Life Transition

Social role investment can be defined as investment in and commitment to adult social roles that are typically related to the domains of work, family, and community (Lodi-Smith & Roberts, 2007; Roberts et al., 2005). For example, several studies on the relations between work experiences and

personality change have shown that continuous investments into the work domain are related to increases in conscientiousness (for a review, see Roberts, 2006). In the same vein, Roberts, Caspi, and Moffitt (2003) found reciprocal links between young adults' personality traits and the nature of their work experiences. Specifically, over a period of 8 years, conscientiousness-related traits were found to be strong predictors of young adults' degree of job satisfaction and work involvement, which in turn predicted changes in their conscientiousness. In addition, relationship and family experiences seem to be closely linked with personality maturation, too. For example, the transition to the first serious partner relationship is associated with sustainable decreases in neuroticism and increases in conscientiousness (Neyer & Asendorpf, 2001; Neyer & Lehnart, 2007). The SIT focuses on these specific role domains, because their acquisition is considered to be "a universal social task of adult social living" (Lodi-Smith & Roberts, 2007, p. 69). And even though the individual timing of these role transitions can vary, it is yet clearly marked by the emerging necessity for young adults to take over full responsibility for their accomplishments in these roles.

Besides the aforementioned roles, there is another universal task that all modern societies expect their members to master during the transition out of childhood into adulthood, namely, graduation from school. The timing of this transition is certainly less variable; and during school, most students still live at their parents' homes. So, the home environment is still important for the behaviors and choices of these (very) young adults, probably limiting the scope of own decisions and responsibilities. However, school represents an arena in which students themselves have to take over duties and responsibilities. They are expected to commit to the particular role expectations and social norms to master the challenges of their everyday school life. These expectations continuously increase over school years and culminate in the final exams. Particularly during the last months before the finals, the rising goal of a successful graduation should create a salient reward structure that is likely to promote personality trait changes in the direction of psychosocial maturity. In other words, the period before graduation can be considered a very "strong situation" likely to promote personality trait changes, because it includes a press for a new way of behaving while providing clear information how to behave adaptively (Caspi & Moffitt, 1993).

Maybe even more than other educational systems, particularly the German school system is characterized by such a peak of demands and expectations just before the final exams. To enter university, German students are required to pass the *Abitur* (i.e., the final exams at the end of secondary school preparing for higher education). Given that most German universities charge no or only little tuition, the allocation of limited places in higher education is mainly based on the performance in the *Abitur*, which serves as both a school graduation certificate and a university entrance exam.

From the perspective of the student, the successful mastery of the final exams is therefore probably one of the most important life tasks during that period of time.

Given that a successful graduation requires students to be task and goal directed, to be organized, to delay gratification, to follow prescribed norms, and to use effortful strategies, the strongest personality effects can be expected for the trait of conscientiousness (Corker, Oswald, & Donnellan, 2012; Jackson et al., 2010). At a macro-analytical level, it can thus be hypothesized that committing to and investing in the student role (e.g., in terms of time, effort, skills) can initiate personality change, in particular with respect to conscientiousness. At the same time, investments themselves should be foretold by individual differences in existing personality traits, as not all individuals of a cohort will similarly engage in this task.

Without doubt, these changes will not appear suddenly overnight. And the question remains, how these transitional experiences could initiate personality maturation. In other words, which micro-analytical processes might underlie the assumed changes?

What's for Homework? A Bottom-Up Approach to Personality Maturation

The few theoretical approaches dedicated to explain how transitional experiences and situational demands can shape an individual's personality have one thing in common, as they all, implicitly or explicitly, assume that sustainable changes in traits are usually preceded by behavioral changes (Fleeson & Jolley, 2006; Roberts, 2006, 2009; Roberts & Jackson, 2008). Implicit in this consideration is that (socio)environmental experiences affect personality traits in a bottom-up fashion. This idea is exactly one of the key assumptions formulated by the sociogenomic model of personality (Roberts & Jackson, 2008). According to this approach, transitional tasks and role demands create a reward structure promoting self-regulated and consistent changes in behavior that, if extended, may cause changes in traits in terms of a bottom-up process. That is, behavioral changes (besides changes in thoughts and feelings) "take on a significant mediational role as they account for the path through which prolonged environmental effects will change neuroanatomical structures or gene expression, and thus change personality traits" (Roberts, 2009, p.141).

For example, imagine a (German) student confronted with the demands of the last year at high school. The upcoming finals bring with them a press to work harder than she did the years before. After a time of active effort to match these new demands, she might come to see herself as a hard working student, and maybe as a more conscientious person than she was a year or two before (Roberts, 2006). Over time, and with more consistent experiences, she might further internalize and generalize these changes to other domains outside

school (compare Kohn & Schooler, 1978). That is, given that our student is sufficiently committed to these new role demands, and given that she actually identifies with the relevant behavioral changes, her initial increase in conscientiousness will further stabilize over time.

In sum, anticipating the final exams with their determinative consequences for the remainder of an individual's adult life should provoke targeted and self-regulated behavioral changes (Roberts, O'Donnell, & Robins, 2004). If consistently shown, these behavioral changes might then even lead to sustainable changes in those personality traits that are most related to these particular behaviors.

The Present Study

The present study was aimed to provide a more fine-grained examination of the processes underlying personality change during a major life transition in early adulthood. Focusing on high school graduation, data were gathered from a sample of German students who provided self-reports on their Big Five personality traits and investment in achievement behavior at three semiannual measurement waves. It should be noted that students wishing to take the *Abitur* usually had to attend a 13th grade (the 13th year after kindergarten and 9th year of secondary school, respectively) in the western states of Germany.[1] In the present study, personality changes were examined in two cohorts of German students: The younger cohort was in Grade 12th at the first measurement occasion and completed the last survey a few months before their final exams. The older cohort already was in Grade 13th at the first assessment and was thus followed until they had graduated from school.

In a first step, I examined mean-level change and individual differences in change in students' personality traits by means of latent growth curve models (LGMs; for example, Duncan, Duncan, & Strycker, 2006). I expected the strongest increases in conscientiousness, whereas smaller or negligible effects were expected for the other four Big Five domains. Furthermore, effects should be more pronounced in 13th compared with 12th graders, as the older cohort already approached the final exams at the first measurement occasion. Therefore, the assumed reward structure of this transitional event was expected to be more salient for this older subsample. In contrast, for the cohort of 12th graders, the finals seemed still a long time ahead at the first measurement occasion. Hence, this subsample should have been confronted with less clear and more ambivalent role demands. I therefore expected this younger cohort to show less pronounced mean-level increases in conscientiousness.

Taking a closer look at the potential processes underlying personality change, I then investigated the developmental interplay between personality traits and students' ongoing investments in achievement behavior. Specifically, using bivariate LGMs, I examined four different aspects of the assumed dynamic transactions between students' personality
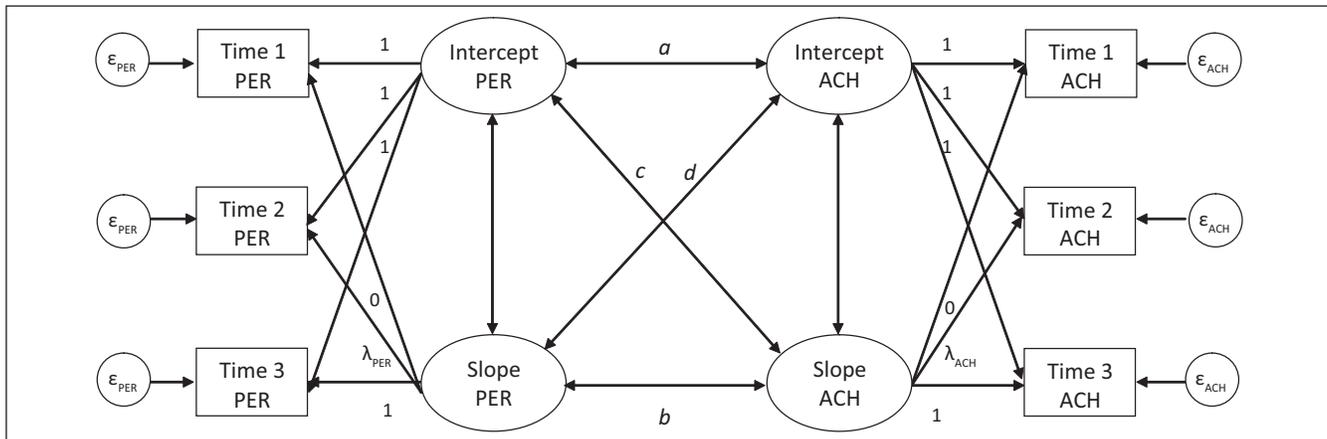
Figure 1. Bivariate latent growth curve model for personality and achievement behavior

Note: PER = Big Five personality trait; ACH = achievement behavior; λ = factor loading of the slope on T2; ε = residual variance; a = concurrent relations; b = correlated change; c = cross-lagged correlations between initial personality traits and changes in achievement behavior; d = cross-lagged correlations between initial achievement behavior and changes in personality traits. Manifest variables are indicated by rectangles and latent growth curve factors by ellipses.

traits and their investments into achievement behavior (compare Neyer & Lehnart, 2007), namely, (a) the concurrent associations at the first measurement occasion, (b) the degree of correlated change, and the two kinds of cross-lagged correlations between (c) initial personality trait levels and changes in achievement behavior, and between (d) initial investments in achievement behavior and changes in traits (see Figure 1 and the "Method" section for a detailed description of these analyses).

Again, I expected to find the strongest concurrent and longitudinal associations between achievement behavior and conscientiousness in the cohort of 13th graders. More precisely, though I expected significant concurrent links and correlated change in 12th graders, too, significant cross-lagged correlations were only expected for 13th graders. In fact, the few previous studies that have used bivariate LGMs to study personality development within the context of social roles have only found weak patterns of cross-lagged correlations. For example, focusing on personality-relationship transactions, Neyer and Lehnart (2007) reported only small to negligible effect sizes. However, in that study, the measurement occasions were chosen arbitrarily and spread out over relatively long periods of 4 to 8 years. Hence, the authors could not exclude the possibility of relevant cross-lagged correlations, which they could not detect within their study design. In contrast, measurement occasions of the present study were closely framed around the transitional event, which equally affected all participants in the present sample. In line with the SIT and bottom-up perspectives to personality development, I therefore expected significant cross-lagged correlations. That is, initial personality traits were assumed to be linked to subsequent changes in achievement behavior, whereas student's initial degree of achievement behavior should also be linked to personality trait changes.

Method

Participants and Procedure

Data for this study were collected as part of the longitudinal *Bielefelder Abituriente-Studie* (Mikolajczyk, Spallek, & Bleidorn, 2009), an interdisciplinary collaborative project in the fields of health sciences and psychology. The key purpose of this project was to study health and health behaviors in high school students during their transition from school to adult life. Students were sampled from all high schools located in Bielefeld, a city in the north-western part of Germany. Initiated in October 2009, a sample of 926 high school students (Grades 12 and 13) completed an online survey including questionnaires on several aspects of health, attitudes, education, well-being, and personality. So far, three semiannual measurement waves have been completed (in the following referred to as T1, T2, and T3). For the present analyses, data were used from all participants who provided self-reports on their personality traits and achievement behavior on at least one of the three measurement occasions (*N* = 910).

The longitudinal sample was divided into two subsamples, namely, those participants who were in the 12th grade (age: *M* = 19.5 years, *SD* = 0.76) and those who were in the 13th grade (age: *M* = 20.4 years, *SD* = 0.66) at the first measurement occasion. At T1, a total of 550 students were positively identified as being in Grade 12 (344 females). This subsample completed the first assessment during the first term of their 12th school year, the second during the second term of Grade 12 (*n* = 234; 170 females), and the third during the first term of Grade 13 (*n* = 166; 126 females; dropout = 68%). Those who were in Grade 13 at T1 (*n* = 360; 236 = females) completed the first assessment during the first term of Grade 13, the second shortly before their final exams at the end of the 13th school year (*n* = 137; 100 females), and

the last when they already had graduated from school ($n = 111$; 81 females; dropout = 69%).

In both subsamples, 90% of the students identified themselves as being born in Germany. The composition of the two subsamples did not differ with respect to their housing situation, as more than 95% of the students in both cohorts indicated that they were still living with their parents.

Measures

Personality. In each of the three surveys, participants completed the German version of the NEO-Five-Factor-Inventory (NEO-FFI; Borkenau & Ostendorf, 1993; Costa & McCrae, 1992). With a total of 60 items, the NEO-FFI is a standard measure of the five broad personality domains neuroticism, extraversion, openness, agreeableness, and conscientiousness. Averaged across waves, Cronbach's alphas were .87 for neuroticism, .79 for extraversion, .76 for openness, .75 for agreeableness, and .80 for conscientiousness (there neither were significant differences in internal consistencies between 12th and 13th graders nor across measurement waves).

Achievement behavior. Participants rated their investment into achievement behavior according to three items: (a) "Do you have the impression that you invest a lot of time and energy in studying?"(b) "How important is it for you to have high grades in school?" Participants answered these two questions by means of a 4-point Likert-type scale (ranging from "not at all" to "very much"). The third question was (c) "On an average day, how much time do you usually spend on studying and homework?" Participants' responses to this question were coded into five categories ("less than 1 hr," "1 hr," "2 hr," "3 hr," "4 hr," "5 or more hours"). These three variables were used to compute sum scores indicating participants' investment in studying and achievement behavior. Again, there were no significant differences in internal consistencies across measurement occasions. However, on average, Cronbach's alphas were somewhat larger for 12th graders ($\alpha = .67$) than for 13th graders ($\alpha = .54$).

Analyses

Univariate analyses. Univariate LGMs were fitted to examine stability and change in personality traits and achievement behavior using full information maximum likelihood (FIML) estimation in Amos 19.0 (Arbuckle, 2010). By this time, the LGM approach has been widely used to study stability and change in personality traits (e.g., Bleidorn et al., 2009; Branje, van Lieshout, & van Aken, 2004; Neyer & Lehnart, 2007). A key advantage of LGM is the possibility to model both mean-level change and individual differences in change in a straightforward and parsimonious way, while controlling for measurement error.

Specifically, observed variables were computed as a function of time (marked as a fixed interval, with T1, T2, and T3)

and represented by three types of latent variables: intercept, slope, and residuals. Intercept and slope determine the stability and change over time, separately from nonsystematic variance (residuals) specific to each measurement occasion. The intercept reflects the initial status of a variable that is stable over time. Path coefficients from the intercept to the repeated assessments were thus fixed to 1. The slope represents the rate of change. For scaling purposes, the path to T3 was fixed to 1; the path to T1 was fixed to 0. Hence, the whole observation period was used as reference time span, and path loadings on T2 were freely estimated to capture the unrestricted shape of change. In doing so, I attempted an empirical approach to represent the shape of change rather than assuming an a priori definition of curvature (Ferrer, Hamagami, & McArdle, 2004). Specifically, path loadings on T2 (λ) could be interpreted in terms of percentages of change, with path coefficients of $\lambda = .5$ indicating a linear shape of the growth curve; values of $\lambda = .5$ suggesting that the bigger amount of change occurred between T1 and T2, and values of $\lambda = .5$ indicating that change mainly occurred between T2 and T3. For example, a path coefficient of $\lambda = .3$ would indicate that 30% of the overall change occurred between T1 and T2 and 70% between T2 and T3.

Using the aforementioned fixations, the means of the two latent growth curve factors represent average initial level and average rate of change, respectively. Their variance components reflect the amount of interindividual differences in initial level and change, respectively. Assuming homoscedasticity, residuals were constrained to be equal over time. Slope and intercept were allowed to covary indicating the extent to which the initial level of a trait is related to its subsequent growth. Potential gender differences were accounted for by including gender as a time-invariant covariate, that is, both intercept and slope were predicted by gender.

To examine the differences and similarities between the two subsamples of 12th and 13th graders, I used a multigroup LGM design. Thereby, a LGM was specified in each subsample but doing so simultaneously for both groups. Using a stepwise procedure, I then tested the between-group equality of growth curve parameters by means of χ^2 difference tests. That is, the fit of a restricted model was tested against the fit of a more general model to examine the tenability of a particular equality constraint. Overall model fit of the best-fitting and most parsimonious model was then evaluated by the χ^2 test, the root mean square error approximation (RMSEA), and the comparative fit index (CFI). A nonsignificant χ^2 value, a RMSEA below .05, and a CFI higher than .95 indicate a good fit.

Bivariate analyses. Another advantage of the LGM approach is that it can be easily extended to a multivariate model to model multiple variables over time and to determine the degree of covariation in the development of pairs of traits or behaviors (Duncan et al., 2006).[2] In the present study, the developmental interplay between the five broad personality traits and students' investment into achievement behavior

Table 1. Attrition Analyses: Mean-Level Differences at T1 and Results of MCAR Tests

	Responder		Nonresponder		Effect size	MCAR statistics		
Scale	M	SD	M	SD	d	χ^2	df	p
12th graders								
Neuroticism	22.08	8.37	21.81	7.77	−.03	2.18	5	.82
Extraversion	30.38	6.44	30.36	6.48	.00	1.45	5	.92
Openness	28.99	7.05	27.62	6.46	.20	10.97	5	.06
Agreeableness	32.10	5.55	30.44	5.82	.29	10.32	5	.07
Conscientiousness	30.31	6.73	28.97	6.55	.22	7.27	5	.20
Achievement behavior	7.03	2.18	6.59	2.00	.20	6.21	5	.29
13th graders								
Neuroticism	22.85	8.35	21.88	8.29	.12	14.57	7	.04
Extraversion	28.74	6.26	29.39	6.02	−.11	16.58	7	.02
Openness	28.70	6.66	27.48	6.59	.18	9.97	7	.19
Agreeableness	32.27	5.94	30.19	5.99	.35	17.19	7	.02
Conscientiousness	30.76	6.60	30.29	6.64	.07	10.01	7	.19
Achievement behavior	6.92	2.19	6.75	2.26	.12	0.71	5	.98

Note: MCAR = missing completely at random. Responder = participants who completed each of the three assessments (12th graders: *n* = 166, 13th graders: *n* = 111); nonresponder = participants who completed the T1 assessment but did not take part at later assessments (12th graders: *n* = 384, 13th graders: *n* = 249). Mean-level comparisons refer to T1 measurements of personality traits and achievement behavior.

was examined by means of bivariate multigroup LGMs. In these models, the best-fitting univariate LGMs for personality traits and achievement behavior were combined by relating their growth curve parameters (i.e., latent intercepts and slopes, see Figure 1).

This allows to test four different effects simultaneously in one model: (a) the concurrent relations of personality traits with achievement behavior at T1 (intercept–intercept correlations), (b) the correlated change of personality and achievement behavior (slope–slope correlations), and finally, the two cross-lagged correlations (intercept–slope correlations) indicating (c) whether personality traits at T1 are linked with changes in achievement behavior and (d) whether achievement behavior at T1 is linked with changes in personality traits. Again, a multigroup approach was used to fit the bivariate LGMs simultaneously to both subsamples. As for the univariate models, overall model fit was evaluated by the χ^2 test, RMSEA, and CFI (Hu & Bentler, 1998, 1999).

Results

Attrition Analyses

Attrition effects were inspected for both cohorts by comparing personality and achievement scores at T1 between participants with data at each measurement occasion and those who completed the survey at T1 but did not take part at later assessments. Table 1 shows the means and standard deviations for responders and nonresponders as well as the *d*-metric effect size indicating the standardized mean-level differences between these groups, with a positive *d* signifying that those

who completed each assessment were higher on a particular variable than those who did not complete all three assessments. These effect sizes can be interpreted using Cohen's rule of thumb (i.e., a *d* of |.2| is considered small, a *d* of |.5| is considered medium, and a *d* equal to or greater than |.8| is considered large; Cohen, 1992).

For 12th graders, differences for the openness, agreeableness, conscientiousness, and achievement behavior scales were significant at *p* < .05. Furthermore, there also was a significant difference between responders' and nonresponders' sex, as the proportion of male 12th graders was significantly higher in the group of nonresponders, $\chi^2(1)$ = 18.35, *p* < .001, Φ = .18. However, according to Cohen's classification, all effect sizes can be considered small suggesting that results will not be seriously biased. In the subsample of 13th graders, significant attrition effects were only revealed for students' sex, $\chi^2(1)$ = 5.09, *p* < .05, Φ = .12, and agreeableness, indicating that dropout was larger for less agreeable male 13th graders. Again, effect sizes were not so large as to suspect that results would be seriously biased.

In addition, Little's (1988) missing completely at random (MCAR) tests were conducted separately for both 12th and 13th graders for all measures of interest. The MCAR test refers to the missing data typology suggested by Rubin (1976, see also Little & Rubin, 1987) that distinguishes the processes that generate missing data with respect to the information they provide about the unobserved data. According to this typology, missing values can be missing completely at random (MCAR), missing at random (MAR), or missing not at random (MNAR). In a longitudinal study with missing data arising from attrition, MCAR requires

Table 2. Means, Standard Deviations, Mean-Level Differences, and Rank-Order Stabilities for Personality Traits and Achievement Behavior

Scale	M			SD			Effect size			Rank-order stability		
	T1	T2	T3	T1	T2	T3	d_{12}	d_{23}	d_{13}	r_{12}	r_{23}	r_{13}
12th graders												
Neuroticism	21.90	22.54	22.61	7.97	7.81	8.63	.08	.01	.09	.79	.87	.73
Extraversion	30.36	29.40	29.24	6.46	6.01	6.18	−.15	−.03	−.18	.82	.86	.81
Openness	28.08	29.43	29.61	6.91	7.15	6.94	.19	.03	.22	.83	.90	.82
Agreeableness	30.99	30.83	31.51	5.78	5.81	5.67	−.03	.12	.09	.79	.85	.78
Conscientiousness	29.45	29.99	30.78	6.64	5.99	6.29	.08	.13	.20	.79	.85	.82
Achievement behavior	6.72	6.83	6.82	2.07	2.06	2.04	.05	.00	.05	.87	.91	.83
13th graders												
Neuroticism	22.20	21.64	21.68	8.31	7.44	8.10	−.07	.00	−.06	.80	.83	.80
Extraversion	29.10	29.24	28.84	6.10	6.13	5.69	.02	−.07	−.05	.83	.88	.74
Openness	27.88	29.00	29.58	6.63	6.16	6.73	.18	.09	.25	.81	.88	.74
Agreeableness	30.88	31.77	32.28	6.04	5.35	5.44	.16	.09	.24	.84	.77	.74
Conscientiousness	30.44	32.25	32.42	6.62	5.66	5.00	.30	.03	.34	.73	.78	.71
Achievement behavior	6.80	7.72	7.78	2.24	2.10	2.10	.42	.03	.45	.59	.52	.49

Note: For 12th graders, *n* = 550; for 13th graders, *n* = 360; *d*-coefficients indicate standardized mean-level differences between measurement occasions, with positive values signifying mean-level increases and negative values indicating mean-level decreases.

dropout to be independent of responses at every occasion, MAR allows dropout to depend on responses at any or all occasions prior to dropout, and MNAR means that it depends on the unobserved responses after the participant drops out (Schafer & Graham, 2002). Both MCAR and MAR are often termed as *ignorable nonresponse* and are usually considered a necessary condition for using FIML procedures for structural equation modeling with missing data.[3]

Little's MCAR test examines the assumption that missing values of a given variable are independent of all observed variables in the data set, that is, the null hypothesis that MCAR can be assumed instead of MAR. For the cohort of 12th graders, none of the six MCAR tests was significant (at *p* > .05, see Table 1) suggesting that dropout can be considered completely at random. For the cohort of 13th graders, three MCAR tests indicated a random dropout at *p* > .05 (openness, conscientiousness, and achievement behavior). The remaining three MCAR tests (for neuroticism, extraversion, and agreeableness) can be considered nonsignificant at *p* >.01.

Univariate Analyses: Stability and Change in Personality Traits and Achievement Behavior

Table 2 shows the observed means, standard deviations, mean-level differences, and rank-order stabilities for the five personality traits and students' investment into achievement behavior for both 12th and 13th graders. Already the inspection of these descriptive statistics suggested that there were differences across measurement occasions as well as between the two cohorts. Looking at the *d*-coefficients, it becomes

Table 3. Fit Indices for Best-Fitting Univariate Multigroup Latent Growth Curve Models

Scale	$\chi^2(df)$	RMSEA	90% CI	CFI
Neuroticism	8.61(13)	.00	[.00, −.02]	1.00
Extraversion	9.50(13)	.00	[.00, −.02]	1.00
Openness	12.35(15)	.00	[.00, −.03]	1.00
Agreeableness	9.21(14)	.00	[.00, −.02]	1.00
Conscientiousness	18.26(14)	.02	[.00, −.04]	1.00
Achievement behavior	12.08(11)	.01	[.00, −.04]	1.00

Note: RMSEA = root mean square error approximation; 90% CI = 90% confidence interval of RMSEA; CFI = comparative fit index. All χ^2 values were nonsignificant at *p* > .05.

apparent that mean-level differences between measurement occasions were in fact most pronounced in 13th graders' levels of conscientiousness and achievement behavior.

To provide a more critical examination of stability and change in personality traits and achievement behavior, I ran a set of six univariate multigroup LGMs. This approach had two key benefits, as it allowed me (a) to analyze mean-level and individual-level changes in one model (while controlling for measurement error), and (b) to test for differences in growth curve parameters between the two subsamples of 12th and 13th graders. Fit indices for the best-fitting and most parsimonious models are shown in Table 3.

Indicated by the varying degrees of freedom, the six models differed with respect to tenable equality constraints between the two subsamples. That is, there were more or less similarities between 12th and 13th graders' growth curve

Table 4. Results of the Best-Fitting Univariate Multigroup Latent Growth Curve Models

Scale	Intercept			Slope			λ
	M	σ^2	$r_{I,gender}$	M	σ^2	$r_{S,gender}$	
12th graders							
Neuroticism	21.87***	56.68***	.35***	0.50	14.91***	.10	0.8
Extraversion	30.35***	35.40***	.04	−0.91***	7.46***	−.18*	0.8
Openness	28.00***	40.46***	.07	0.91***	6.66***	−.14	0.9
Agreeableness	30.92***	29.44***	.19***	−0.13	5.37***	−.05	1.0
Conscientiousness	29.84***	37.86***	.04	0.40	6.96***	.08	0.9
Achievement behavior	6.74***	3.68***	.26***	−0.17*	0.75***	.17	0.7
13th graders							
Neuroticism	22.13***	56.68***	.35***	−1.07*	14.91***	.10	0.8
Extraversion	29.14***	35.40***	.04	0.29	7.46***	−.18*	0.8
Openness	28.00***	40.46***	.07	0.91***	6.66***	−.14	0.9
Agreeableness	30.92***	29.44***	.19***	−0.13	5.37***	−.05	0.3
Conscientiousness	29.84***	37.86***	.04	1.71***	6.96***	.08	0.9
Achievement behavior	6.74***	3.68***	.51***	1.06***	0.75***	−.57***	0.8

Note: $r_{I,gender}$ = correlation between intercept and gender; $r_{S,gender}$ = correlation between slope and gender; λ = loading from the latent slope parameter to the personality/behavior measure at T2; FIML = full information maximum likelihood. FIML analysis on all available data across T1, T2, and T3; for 12th graders, n = 550; for 13th graders, n = 360.
*p < .05. **p < .01. ***p < .001.
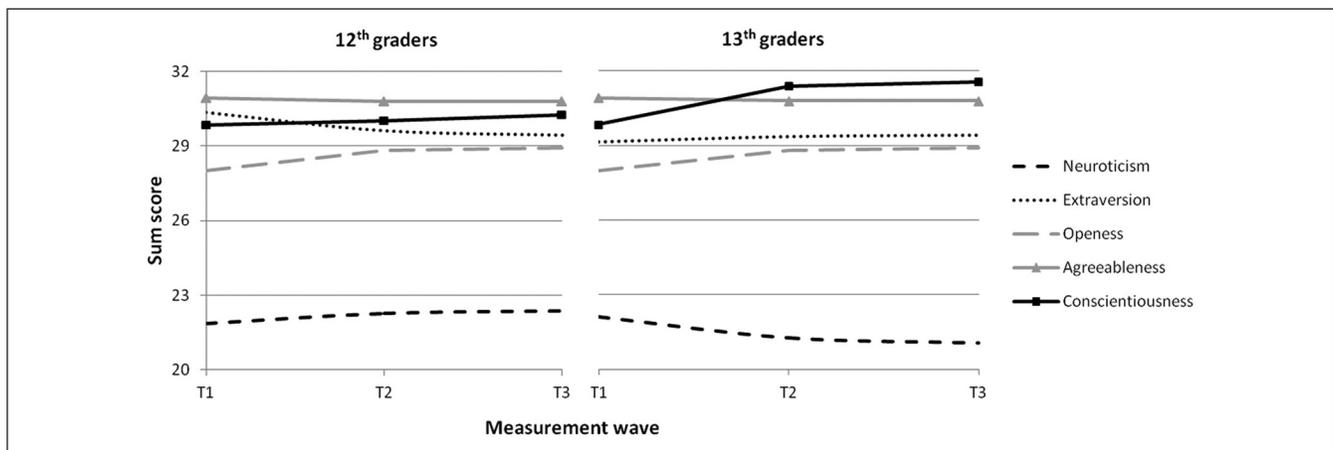
Figure 2. Estimated growth of neuroticism, extraversion, openness, agreeableness, and conscientiousness for 12th and 13th graders

parameters depending on the particular trait or behavior variable. All six models showed an excellent fit with respect to χ^2 values (all nonsignificant at p > .05), RMSEA, and CFI.

The estimated growth curve parameters for both subsamples are presented in Table 4. In addition, Figures 2 and 3 display the estimated growth curves for the five trait domains and students' achievement behavior, respectively.

Neuroticism. There were no cohort differences with respect to intercept variance and the significant gender correlation, which expectably indicated higher initial levels of neuroticism in female students. There was, however, a slight but significant cohort difference regarding the intercept mean, which

turned out to be higher for 13th compared with 12th graders. Subsamples further differed in their slope means implying that there were no significant changes in 12th graders' level of neuroticism, whereas 13th graders displayed significant decreases. Indicated by a T2 slope loading of λ > .50, these changes mainly occurred between the first two measurement occasions (see Figure 2). Both cohorts showed significant and similarly large amounts of slope variance pointing to substantial individual differences in students' individual change trajectories. As in previous studies, there were no gender differences in change rates (e.g., Bleidorn et al., 2009).
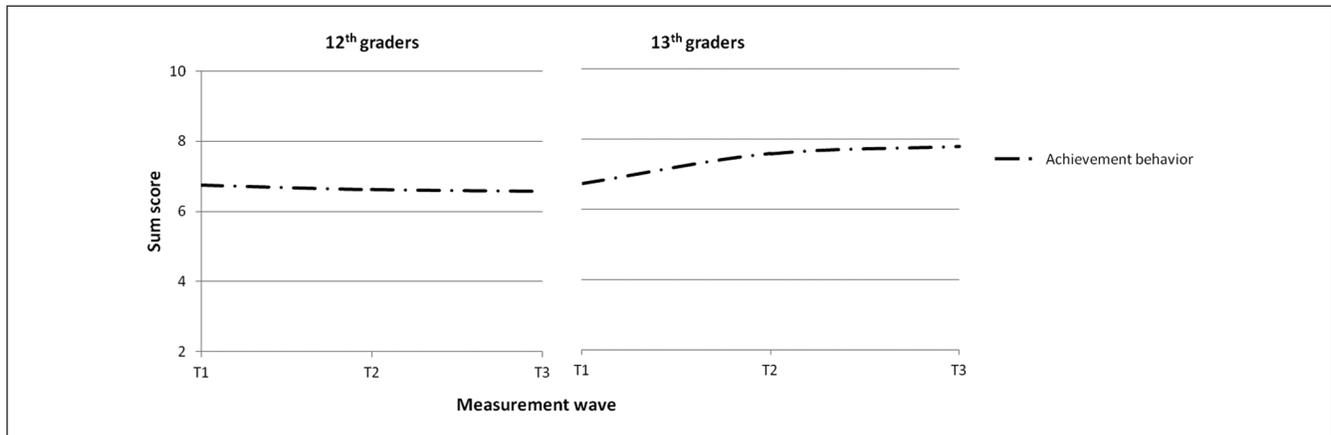
Figure 3. Estimated growth of achievement behavior for 12th and 13th graders

Extraversion. The initial level in extraversion was lower in 13th than in 12th graders, while there were no cohort differences in intercept variance. Both subsamples showed no gender differences in initial trait levels. There was a significant mean decrease in 12th graders' extraversion, which was most pronounced between the first two measurements ($\lambda >$ .50, see Figure 2). In contrast, 13th graders showed rather stable levels of extraversion. Both subsamples did not differ with respect to the significant slope variance. Furthermore, in both cohorts there was a significant correlation between gender and slope.[4] The latter suggested that decreases in 12th graders' extraversion were less pronounced in male than female students. For 13th graders, there is not such a clear directional interpretation of this effect, because of the non-significant slope mean for extraversion. Yet, given the positive trend, the negative gender correlation implied that male 13th graders showed somewhat more pronounced increases in extraversion than their female classmates.

Openness. Multigroup analyses suggested that a model in which subsamples were equated on all growth curve parameters fitted the data well. In both cohorts, male and female students likewise showed significant mean increases in openness, which were most pronounced between the first two measurement occasions ($\lambda >$ .50, see Figure 2). In addition, both 12th and 13th graders showed significant individual differences in change that were unrelated to gender differences.

Agreeableness. There also were no cohort differences in growth curve parameters for agreeableness. In both subsamples, there were significant gender differences in initial levels, suggesting female students to be more agreeable than male students at the first measurement occasion. There were no significant mean-level changes in both subsamples, but the significant slope variances implied substantial individual differences in change. No associations were revealed between change trajectories and students' gender.

Conscientiousness. Although there were no cohort differences with respect to initial trait level and variance, the best-fitted model implied a clear difference between the subsamples' change rates in conscientiousness. Although no significant mean change was indicated for 12th graders, there yet was a significant mean increase in 13th graders' level of conscientiousness. Again, changes were most pronounced between the first two measurement waves ($\lambda >$ .50, see Figure 2). Both subsamples showed similar amounts of individual differences in individual change rates, and there was no evidence for any gender differences, that is, neither for initial levels nor for change rates.

Achievement behavior. Although both cohorts showed similar initial levels and variances in achievement behavior, there yet were several differences concerning the rate of change as well as gender differences in both initial levels and change.[5] As expected, there was a significant and large increase in 13th graders' level of achievement behavior, whereas 12th graders even showed slight but significant decreases. In both subsamples, these changes were strongest between the first two measurements (both $\lambda >$ .50, see Figure 3). Both cohorts showed similar amounts of variance in individual change, but gender differences were more pronounced in 13th graders, suggesting that female students had higher initial levels and showed less change in their achievement behavior compared with their male classmates.

Bivariate Analyses: The Interplay Between Personality Traits and Achievement Behavior

Bivariate multigroup LGMs were used to examine the developmental interplay between personality traits and students' investment into achievement behavior (Figure 1). Combining the best-fitted models from univariate analyses, these models examined the concurrent and longitudinal relations between traits and investment into achievement behavior

Table 5. Results of the Unconstrained Bivariate Multigroup Latent Growth Curve Models of Change in Personality and Achievement Behavior

Scale	Fit statistics				12th grade				13th grade			
	$\chi^2(df)$	RMSEA	90% CI	CFI	Path a[a]	Path b	Path c	Path d	Path a	Path b	Path c	Path d
Neuroticism	28.88(36)	.00	[.00, −.02]	1.00	.16**	−.13	−.04	−.03	.34***	−.69*	−.10	.11
Extraversion	33.50(36)	.00	[.00, −.02]	1.00	.09	.13	−.03	−.13	.14*	.57*	−.35	−.22
Openness	33.99(38)	.00	[.00, −.02]	1.00	−.04	.15	.07	−.04	.16*	.73*	.04	−.21
Agreeableness	47.13(38)	.00	[.00, −.03]	1.00	.28***	.10	−.03	−.15	.28***	−.06	−.18	−.11
Conscientiousness	44.33(37)	.02	[.00, −.03]	1.00	.50***	.45**	−.09	−.23*	.50***	.91***	−.44*	−.30*

Note: RMSEA = root mean square error approximation; 90% CI = 90% confidence interval of RMSEA; CFI = comparative fit index; FIML = full information maximum likelihood. FIML analysis on all available data across T1, T2, and T3 (for 12th graders, n = 550; for 13th graders, n = 360).
[a]Structural coefficients refer to the paths in Figure 1. Path a = concurrent relations, path b = correlated change, path c = cross-lagged correlations between initial personality traits and changes in achievement behavior, path d = cross-lagged correlations between initial achievement behavior and changes in personality traits.
*p < .05.**p < .01.***p < .001.

simultaneously for both 12th and 13th graders. The developmental relations between personality and achievement behavior were not fixed to be equal across groups, but freely estimated to test the significance of these effects separately for each subsample. All five models showed an excellent fit according to χ^2 values (all nonsignificant at p >.05), RMSEA, and CFI. Fit statistics and parameter estimates for the transactional effects between the five traits and achievement behavior are displayed in Table 5.

Concurrent relations. As expected, most significant effects occurred in terms of concurrent relations (intercept–intercept correlations, path a in Figure 1). It still was somewhat surprising that actually all five trait domains were more or less strongly related to students' investments in achievement behavior. The revealed pattern suggested that those students who scored relatively higher on each of the five traits tended to invest more in achievement behavior at the first measurement occasion. However, as predicted, these links were strongest for conscientiousness.

Correlated change. For both cohorts, there was evidence for correlated change (slope–slope correlations, path b in Figure 1) between conscientiousness and achievement behavior. For the subsample of 13th graders, this (latent) correlation was nearly perfect indicating that those students who increased their investments in achievement also increased in conscientiousness. For 12th graders, there is not such a clear directional interpretation of this effect, because of the non-significant slope mean for conscientiousness (see Table 4). Nevertheless, also for this younger subsample, one can state that individual differences in changes of achievement behavior were related to individual differences in changes of conscientiousness.

Further correlated change effects were found in the subsample of 13th graders. In fact, individual differences in changes of all traits except agreeableness were substantially related to changes in students' achievement behavior,

suggesting that those individuals who increased their investments in achievement behavior also tended to decrease in neuroticism and increase in openness. Again, there is not such a clear directional reading of the effect for extraversion, as 13th graders showed no significant mean change in this domain.

Cross-lagged correlations. As expected, significant cross-lagged correlations (intercept–slope correlations, paths c and d in Figure 1) were exclusively revealed between achievement behavior and conscientiousness and were most pronounced in the subsample of 13th graders. Supporting the assumed dynamic transactions between investment into achievement behavior and conscientiousness, results suggested both personality effects on change in achievement behavior as well as behavioral investment effects on personality change. Specifically, those students with lower initial levels of conscientiousness showed larger increases in their investments into achievement behavior. The other way around, students showing low initial levels of achievement behavior displayed larger increases in conscientiousness. Interestingly, only the latter relationship between initial investments and later personality change was also revealed for the subsample of 12th graders.

Discussion

How can life transitions stimulate personality maturation in early adults? The present study addressed this question by examining personality changes during students' transition from school to adult life. Despite the relatively short observation period of 1 year, there were both significant mean-level changes and individual differences in changes of personality traits. These changes were strongest for conscientiousness and most pronounced in those students who were directly envisaging this transitional experience. Providing insights into the underlying mechanisms of

change, bivariate LGM revealed that individual differences in personality trait changes were substantially associated with changes in students' investments into achievement behavior. Generally supporting socioanalytic perspectives on personality development, these findings can be discussed with respect to both macro- and micro-analytical approaches to personality development.

The Macro-Analytical Perspective: Personality Change During A Major Life Transition

Results from the present univariate LGM analyses suggest that the transition from school to adult life is associated with significant mean-level changes in personality. As expected and in line with the assumptions of the SIT, these changes were most pronounced in 13th graders' level of conscientiousness. Given that increases were (a) strongest between the first two measurement waves and (b) not revealed for the subsample of 12th graders, it seems fair to assume that the rising goal of a successful graduation created a salient reward structure that promoted the observed increases in students' conscientiousness (Roberts et al., 2005). In particular, the growing press to act in a more conscientious, task-oriented, and organized way has likely induced the substantial increases in this trait domain. In other words, within sight of the nearing finals, the former rather vaguely defined student role turns into a well-defined role context with clear behavioral demands and expectancies promoting increases in students' conscientiousness.

Beyond the hypothesized changes in conscientiousness, there even was evidence for mean changes in other traits. In line with previous studies on personality development in early adulthood (e.g., Klimstra et al., 2009; Roberts, Walton, & Viechtbauer, 2006), both cohorts showed significant increases in openness. Several features of the school experience, such as the broadened range of perspective and the acquisition of (social) knowledge and skills, might advance those increases in openness to experience.

The two cohorts differed with respect to changes in extraversion and neuroticism: 13th graders were characterized by higher initial levels and larger decreases in neuroticism, whereas 12th graders showed higher initial levels and larger decreases in extraversion. These inconsistencies between cross-sectional and longitudinal age effects on trait levels for neuroticism and extraversion might at first appear paradoxical. However, looking at the mean-level trends in the subsample of 12th graders, it becomes apparent that this subsample's average neuroticism and extraversion scores at the last measurement occasion, that is at the beginning of their 13th school year, approximate those of the older cohort at that time (i.e., at their first measurement occasion). Maybe those initial (although not significant) increases and subsequent decreases in neuroticism describe a developmental pattern that typically arises on the eve of a major life transition.

In particular, the revealed decreases in 13th graders neuroticism might reflect students' increasing ability to cope adaptively with the rising workload, stresses, and demands during their last year at school.

In contrast, the significant decreases in 12th graders' extraversion are more difficult to explain, as previous research reported rather inconsistent results for this trait domain. For example, whereas Branje, van Lieshout, and Gerris (2007) found decreases in late adolescents' extraversion, Klimstra et al. (2009) reported increases, while McCrae et al. (2002) found no significant changes in this trait domain. These inconsistencies may be partly explained by the rather heterogeneous conception of the extraversion domain, as there is evidence for certain heterogeneity in the developmental paths among the more specific lower-order traits (i.e., facets) of this domain (Roberts, Walton, & Viechtbauer, 2006). For example, Bleidorn et al. (2009) found the broad extraversion domain to be relatively stable in adult twins, while there were significant but diametrically opposed mean changes in the more specific facet traits: In particular, excitement-seeking and gregariousness decreased, whereas assertiveness and activity increased over time. In view of the general developmental tasks characterizing the transition from late adolescence to early adulthood (Havighurst, 1952, 1953), one could reason that 12th graders' decreases in extraversion were primarily driven by socially desired decreases in their level of excitement-seeking. However, further research into facet-level change focusing on the period of early adulthood would be necessary to back up this assumption.

Summing up, the revealed mean-level changes in students' conscientiousness, neuroticism, extraversion, and openness are likely signifying early indicators of a prolonged process of personality maturation that usually extends over the whole period of young adulthood (Roberts et al., 2008). These normative changes notwithstanding, there also were substantial individual differences in change, in both subsamples and for each of the five trait domains.

Given that students within both cohorts are about the same age and underwent the same transitional experience, the question arises why students show such large differences in their individual rates of change. According to the SIT, a reasonable explanation results from the fact that people generally differ in the way they negotiate and master the demands and challenges of transitional experiences (Roberts et al., 2005). That is, not the transition itself but the nature and degree of psychological investments into social institutions are crucial to personality maturation (Lodi-Smith & Roberts, 2007). Leading over to the second aim of the present study, it is therefore necessary to take a closer look at the micro-level processes underlying personality development. In particular, focusing on the transition from school to adult life, the present study examined the dynamic interplay between students' investment into achievement behavior and personality change.

The Micro-Analytical Perspective: Dynamic Transactions Between Personality Traits and Investment Into Achievement Behavior

As expected, students who were faced with the challenges of graduation showed substantial increases in their investment into achievement behavior during their final year at school. Yet, in contrast to personality traits, there was a profound gender difference, suggesting that male students showed lower initial levels but increased at a faster rate, probably to make up the leeway compared with their female classmates. Also in line with hypotheses, there were no increases in 12th graders' investment into achievement behavior. This subsample even showed slight decreases, which might be due to the fact that the final exams were still a long way off and a rather abstract event for this younger group of students. In fact, other role contexts with different demands and behavioral expectancies (e.g., friends, side job, sports club) might be more relevant than school at this early stage of students' adult life.

The large individual differences observed in both initial levels and individual change rates in achievement behavior clearly justified subsequent bivariate LGM analyses to study how these differences were related to personality change. The pattern of concurrent relations revealed that the assumed links between conscientiousness and achievement behavior have already been established in the younger cohort of 12th graders. Interestingly, the positive associations with the other four trait domains were more pronounced in 13th graders suggesting that personality in general becomes an increasingly important factor for students' achievement behavior as they are approaching the final exams. The positive link with neuroticism seems at a first glance counterintuitive but might reflect that students who are more concerned about their grades and more afraid of tests tend to invest more time and energy in their homework.

The correlated change coefficients suggest that behavioral changes are closely related to personality change. Particularly interesting are the transactions revealed for neuroticism, openness, and conscientiousness as these allowed a clear directional interpretation: Compared with their classmates, those students who increased their investments into achievement behavior showed faster increases in openness and conscientiousness and decreases in neuroticism, respectively. As expected, correlated change was again strongest for conscientiousness and most pronounced in 13th graders. In fact, the nearly perfect latent correlation implies that increases in students' investment into achievement behavior go more or less hand in hand with increases in conscientiousness during the last year at school.

The codevelopment of achievement behavior and conscientiousness was not restricted to correlated change but was further expressed in significant cross-lagged correlations. Specifically, increases in investment into achievement behavior were accelerated in those students with lower initial levels of conscientiousness; likewise, those showing lower initial levels of investment into achievement behavior exhibited accelerated increases in conscientiousness. These negative cross-time links can be interpreted in terms of the so-called "maturity-stability principle" (e.g., Donnellan, Conger, & Burzette, 2007; Roberts et al., 2001) postulating that those individuals with more mature personalities typically experience less change during the transition from adolescence to adulthood. To complete this picture, it is useful to also consider the correlations between initial levels and change from the univariate LGMs (i.e., the intercept–slope correlations for conscientiousness and achievement behavior, respectively). In fact, these likewise indicate that individuals with higher initial scores changed to a less degree in both conscientiousness and achievement behavior. Hence, it seems fair to conclude that those who already show the desired behavior or personality traits associated with maturity experience less external press and have less impetus for change, whereas those scoring low on the desired dispositions have yet a longer way to go.

These findings have further implications for theoretical approaches struggling with the question how environmental interactions and transitional experiences exert their influence on an individual's personality. As hypothesized, major life transitions involving clear role demands and behavior expectancies, such as graduation from school, have the potential to initialize directional and self-regulated behavioral changes. If consistently shown, these behavioral changes go hand in hand with personality changes signifying personality maturation. In line with the sociogenomic model of personality (Roberts & Jackson, 2008) and other bottom-up approaches to personality development, these findings support the general assumption that much of development is likely to start with behavioral changes, typically in response to situations or in pursuit of goals (see also, Caspi & Moffitt, 1993; Fleeson & Jolley, 2006).

This further implies that environments will not affect personality traits directly (except they entail major physiological changes) but typically act on a person's behavior, thoughts, and feelings (Roberts, 2009). This is in line with previous research suggesting that environments will most likely affect personality change in a rather slow, incremental fashion (Caspi & Moffitt, 1993; Roberts, 2009; Roberts et al., 2008).

Given that the present study focused on a relative short circumscribed period in early adulthood, the question remains how stable the observed personality changes actually are. Do they reflect sustainable trait changes or rather temporary adaptations likely to fade out after school is out? According to socioanalytic approaches, one can assume that the sustainability of the observed effects depends on the degree to which students actually identify with these changes. That is, an effectual identification with, and commitment to, the social institution is assumed to be the most crucial factor deciding whether students effectively internalize role expectancies

and perceive their behavioral changes as self-regulated. Only on that condition, students should be prone to generalize these changes to other domains outside the school context, which should finally lead to relatively persistent changes in their personality traits (Kohn & Schooler, 1978; Roberts, B. W., Walton, K., Bogg, T., & Caspi, A., 2006; Roberts et al., 2005). However, this assumption merits further scrutiny in future studies following young adults over longer time periods after graduation.

Limitations and Future Directions

The present study is distinguished by its fine-meshed and intensive longitudinal examination of personality changes in a large sample of young adults, all confronted with the same transitional experience. Although this design comes certainly close to laboratory settings, one should bear in mind its quasiexperimental nature. That is, conclusions regarding causal links between personality traits and achievement behavior can only be drawn under usual reservations.

Second, as mentioned above, the sustainability of the revealed changes has to be examined in future longitudinal studies with more extended time frames. Third, the sample was drawn from the student population in one specific part of the world and was further affected by a relatively large attrition rate. To examine the generalizability of the effects, it would thus be desirable to compare the present findings with those of future longitudinal studies with lower dropout rates preferably conducted in other countries and societies.

Finally, the present study was limited by its exclusive use of self-report measures. Thus, possible effects of social desirability and response sets cannot be ruled out. However, the distinct pattern of results for the two subsamples of 12th and 13th graders speaks against a notable influence of response biases.

Conclusion

Taking a closer look at the processes underlying personality maturation during the transition from school to adult life, this study was aimed at shedding some further light on the pathways by which major life experiences can influence personality change. The present findings suggest that particularly during their last year at high school, students show substantial personality changes that are likely indicating the beginning of a prolonged process of personality maturation. These changes are closely related to changing investments into one's achievement behavior pointing to a bottom-up process of personality change. That is, personality maturation is likely to start with behavioral changes in response to changing role demands, which typically accompany normative life transitions.

Connecting the periods of adolescence and adulthood, graduation from school is certainly one of the first transitional experiences in an individual's life calling for personality changes in the direction of greater maturity. In fact, this transition probably marks the first time in a young person's life at which he or she has to assume full responsibility for a life task that has fundamental consequences for the remainder of his or her adult life. It thus seems appropriate to close with one of the most famous mottoes of many schools all over the world: *Non scholae, sed vitae discimus*[6]; we do not learn for school, but for life!

Notes

1. By this time most states in Germany are in the process of shortening the university-bound secondary school system in Germany from nine to eight years.
2. Besides bivariate latent growth curve models (LGMs), there are alternative models, such as cross-lagged panel models or latent difference score (LDS) models (for an overview, see McArdle, 2009), which are also suited to model the developmental interplay between two variables over time. The main advantage of bivariate LGMs over cross-lagged panel models is that LGMs also account for intraindividual change in absolute values (i.e., the mean structure of the variables). The rather new LDS approach offers a very flexible way to model cross-lagged dynamic effects between two variables over time. However, it does not allow for clear-cut interpretation of the correlations between two growth curves (i.e., the correlated change between two variables).
3. Full information maximum likelihood (FIML) uses all the available data for each participant and is particularly recommended for longitudinal modeling with missing data, because missing information can be partially recovered from earlier or later measurement waves. FIML estimates have been shown to be consistent and efficient when missings are missing at random (MAR). Some authors suggest that even departures from MAR would not effectively invalidate FIML estimates which can still be assumed superior to other missing data procedures, such as listwise or pairwise deletion methods (Schafer & Graham, 2002).
4. To interpret the gender–slope correlations appropriately, it is necessary to consider the direction of both the correlation and the slope. If the slope is negative, positive correlations with gender suggest larger changes in males, whereas negative correlations point to more pronounced changes in females. If slopes are positive, positive correlations suggest larger changes

in females; negative correlations point to more pronounced changes in males.

5. For achievement behavior, residual variances were not fixed to be equal across groups as this resulted in a significant decrease in model fit. This suggests that there is some residual situation-specific variance between groups which cannot completely be explained by the linear LGM.

6. This aphorism is the inversion of the original quotation (*Non vitae, sed scholae discimus*) by the Roman philosopher Lucius Annaeus Seneca and was actually directed against the Roman philosopher schools at that time.

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