Maturation or Disruption? Conscientiousness Development in the Transition into Adolescence

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Abstract

Research to date has shown longitudinal changes in conscientiousness during early and middle adolescence, but most studies have been conducted in Western countries. The present study aimed to examine the pattern of mean-level conscientiousness change at the transition into early adolescence among a Chinese sample using curve of factors (CUFFS) models. Four waves of data from 661 Chinese children aged 8 years old at baseline in the China Family Panel Studies were used. Parents were asked to rate their children's level of conscientiousness every two years. On average, mean-level conscientiousness showed a decelerating increase. Girls had higher average conscientiousness levels than boys, but they did not differ in change patterns. The inconsistency between the current study and previous research indicates that conscientiousness development may depend, in part, on cultural factors.

Keywords: conscientiousness, personality development, adolescence, Chinese

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Previous research highlights the importance of conscientiousness during adolescence. More conscientious youth tend to have better academic achievement (Trautwein et al., 2009), stronger career aspirations (Roberts & Robins, 2000), and experience more-positive changes in social relationships during their transition into early adulthood (Parker et al., 2012). The benefits of being conscientious can also be life-long, with more-conscientious students reporting greater occupational success and health outcomes 40 years later even after controlling for childhood IQ and parental socioeconomic status (Spengler et al., 2015; Spengler et al., 2016). Given these short- and long-term benefits of conscientiousness early in life, promoting lifelong health and success requires a deep understanding of how conscientiousness develops during adolescence.

Research focusing on personality development during adulthood generally suggests a maturational trend from early to middle adulthood, with increases in conscientiousness, agreeableness, and emotional stability (Caspi et al., 2005). Studies with younger populations, however, have documented a temporary decline in conscientiousness during the transition into adolescence, partially supporting the disruption hypothesis (Soto & Tackett, 2015). This hypothesis describes temporary dips in several dimensions of personality, such as conscientiousness, agreeableness, and openness, that accompany biological and psychosocial changes from late childhood into early adolescence (Soto & Tackett, 2015).

Because most of the above evidence comes from Western samples, it remains unclear whether the previously observed pattern of change can be generalized to youth living in non-Western contexts. The present study addresses this gap in the literature by examining conscientiousness development from ages 8 to 14 years among a nationally representative

sample of Chinese youth. We argue that, contrary to what is anticipated by the disruption hypothesis about changes in conscientiousness levels, there will be an increase in conscientiousness across the transition into adolescence among the Chinese sample.

Conscientiousness Development in the Transition to Adolescence

Best known as one of the Big Five personality traits (Goldberg, 1993), conscientiousness describes individual differences in "the propensity to follow socially prescribed norms for impulse control, to be goal directed, to plan, and to be able to delay gratification and to follow norms and rules" (Roberts et al., 2009, p. 369). Although the five factor theory of personality states that personality traits are highly stable after early adulthood in terms of both mean levels and rank ordering (Costa & McCrae, 1994), it is now well-known that conscientiousness develops across the life span (Roberts et al., 2006). The maturity principle in personality development indicates an overall positive trend of normative conscientiousness development from late adolescence to middle age (Caspi et al., 2005), for example.

Contrary to the increases seen in adulthood, research targeting early adolescence (e.g., De Fruyt et al., 2006; Soto et al., 2011; Tackman et al., 2017; Van den Akker et al., 2014) generally suggests a temporary dip in mean levels of conscientiousness during the transition to adolescence (among other dimensions of personality; i.e., the disruption hypothesis; Soto & Tackett, 2015). For example, a cross-sectional study by Soto et al. (2011) found a curvilinear trend for age differences in conscientiousness. Mean levels of conscientiousness during adolescence were lower than the levels observed in childhood and early adulthood. Another longitudinal study also suggests that self-reported mean-level conscientiousness decreased from 10 to 13 followed by an increase (Tackman et al., 2017). Similarly, longitudinal studies with parent reports suggest a drop in conscientiousness during early adolescence (De Fruyt et al., 2006; Van den Akker et al.,

2014).

The temporary dip in conscientiousness during adolescence found in these studies may be related to academic motivation, which is considered as an important predictor for conscientiousness (Eisenberg et al., 2014). Despite the new responsibilities children take as they enter secondary school, young people may not have enough motivation to adjust themselves to changes in school work, resulting in a decline in their propensity to work hard and follow rules (Van den Akker et al., 2014). Consistent with this explanation, adolescents in the United States have reported declines in school engagement during middle school (Qu & Pomerantz, 2015).

Although this body of research has provided support for the disruption hypothesis, findings from some studies suggest that this hypothesis requires further validation. For example, a longitudinal study by Luan and colleagues (2017) reported an increase in self-rated conscientiousness from age 11.5 to 17.5 among Dutch adolescents, although their parents in that study reported no change in mean-level conscientiousness. Another study shows increases in all facets of mother-reported conscientiousness, though only among girls (Brandes et al., 2021). This inconsistency across studies indicates the need for more investigation into the disruption hypothesis versus the maturity principle, which would anticipate steady increases in conscientiousness from childhood to adulthood, during the transition into adolescence. In particular, replication across cultural contexts is critical for the disruption hypothesis to be better supported. Indeed, findings with Russian children have shown no disruption in conscientiousness during adolescence (Slobodskaya & Akhmetova, 2010), suggesting a need for more studies in non-Western contexts.

Potential Variations in Conscientiousness Development across Cultures

Existing research on the development of conscientiousness largely focuses on youth in

Western contexts. Therefore, it remains unclear whether trends observed among Western youth apply to youth living in different cultural settings. For instance, the social investment principle (Roberts et al., 2005) suggests that age-graded social roles are a major driver for personality development. The expectations and contingencies associated with social roles create a reward system that enables role investment, which in turn drives changes in personality. Based on this perspective, culture-specific age-appropriate social roles likely lead to differential patterns of conscientiousness development among youth living in different cultural contexts.

During the transition into early adolescence, school is the most important social institution for most people. Thus, how school systems promote expectations for conscientiousness, such as via self-control, compliance, and being goal-oriented, will affect changes in students' conscientiousness levels during this age period (Jackson & Hill, 2019). In the Chinese culture, for instance, it is common for teachers to perceive non-conforming behaviors as negative, which can encourage compliance in the classroom (Chan & Chan, 1999). For middle school students in China (often aged between 12 to 15), there are also increased expectations for industriousness and planfulness as compared to when they were in primary school because students take an extremely competitive entrance examination at the end of middle school (i.e., Zhongkao; Wu, 2015). Results of that examination determine a young person's eligibility to continue their studies in public high schools. These high expectations placed on youth during early adolescence may require increased investment in schoolwork among Chinese students, even years before they take the exam. Indeed, Chinese youth have been found to perceive the teen years as a time of increased school engagement when compared to earlier years, and Chinese youth report greater school engagement than their counterparts in the United States (Qu et al., 2016). In parallel, it is highly possible that Chinese youth experience an earlier

increase in conscientiousness as compared to children in countries with different educational contexts.

In addition to role expectations in the school context, the influence of societal and cultural values on conscientiousness development can be expressed through parental socialization beliefs and practices. For example, some parenting practices common in the Chinese culture may lead to the earlier development of guilt, which is central to the emotional component of conscientiousness (Jackson & Hill, 2019). The anticipation of guilt in guilt-provoking situations, such as when plans are not completed, may motivate people to behave in more conscientious ways in order to avoid the undesirable outcomes (Jackson & Hill, 2019). Chinese parenting practices have been found to focus more on shame and guilt induction compared to parents in North America (Helwig et al., 2014). As a result, Chinese youth may be more likely to experience as well as anticipate feelings of guilt in a given situation and thus preemptively act in more conscientious ways that would prevent such feelings.

Parental control with a strong emphasis on social norms and moral ideas in the Chinese culture (Fung, 1999) can also promote children's conformity to social norms and rules. Consistent with the emphasis on compliance, self-control from an earlier age is also among the socialization goals for Chinese parents (Chen et al., 2003). Evidence also indicates that Chinese parents place more emphasis on conscientiousness than Western parents and report a growing concern about their children's conscientiousness as they transition into adolescence (Zhang et al., 2002). These parenting practices, which reflect Chinese culture's consistent appreciation for efforts and compliance (Chang et al., 2011), may contribute to an earlier increase in conscientiousness development among Chinese youth.

Evidence of cross-cultural variation in childhood self-regulation also suggests a potential

maturational trend whereby conscientiousness develops earlier among Chinese adolescents. As a self-regulatory dimension of temperament, effortful control early in life is perceived as an important precursor to conscientiousness later in life (Eisenberg et al., 2014). This component of temperament includes "inhibitory control, the ability to focus and shift attention, and sensitivity to, and pleasure in, low intensity stimuli" (Rothbart et al., 2007, p. 3) and is considered critical for many other forms of self-regulation, such as executive functioning (Eisenberg et al., 2014; Rothbart et al., 2007). Previous studies have documented the link between measures of children's self-regulation, such as effortful control and delay of gratification, and conscientiousness traits in adolescence and adulthood (e.g., Deal et al., 2005; Shoda et al., 1990). Compared to children in the West, Chinese children were rated by their parents to be more persistent in orienting, and the cross-cultural differences increased with age (Gartstein et al., 2006). In a different study, Chinese children showed greater committed, internally driven compliance than their Canadian counterparts, indicating a higher level of self-control (Chen et al., 2003).

Advantages in childhood self-regulation may contribute to an increase in children's conscientiousness as they transition into adolescence, even above the continuing influence of the school and home environments. For example, due to the important role self-regulation plays in academic motivation (Eisenberg et al., 2014), students with higher self-regulation may be less likely to experience a drop in academic motivation when transitioning into adolescence. As noted earlier, this drop in motivation may explain the conscientiousness "disruption" observed during this period (Van den Akker et al., 2014).

The transition into adolescence might also be an important period for studying gender differences in conscientiousness development. Across cultures, girls are more conscientious than boys during this age period (De Bolle et al., 2015; de Haan et al., 2017; Soto, 2016; Van den

Akker et al., 2014). Boys have shown more pronounced declines than girls during late childhood (Soto, 2016), but other studies reported the opposite or no gender difference in the magnitude of change during a similar age period (Soto et al., 2011; Van den Akker et al., 2014). Researchers have also found differences in change directions between adolescent girls and boys, but how they differ has been inconsistent across studies (Branje et al., 2017; de Haan et al., 2017; Klimstra et al., 2009). The conflicting results may indicate that gender differences are a function of the interaction between age, developmental differences between girls and boys, and the gender roles of a culture (De Bolle et al., 2015). Therefore, another aim of the current study is to investiage whether and how Chinese girls and boys differ in their conscientiousness development.

Current Study

The present study aims to examine the development of conscientiousness from late childhood to early adolescence using four waves of nationally representative parent-report data collected in Mainland China with a validated measure having shown significant convergence across reporters (Barbaranelli et al., 2003). We hypothesized that levels of conscientiousness would increase over time (Hypothesis 1a), thus implying that the predicted changes in conscientiousness by the disruption hypothesis does not manifest among youth in Mainland China in the same way that it manifests in many studies on Western youth. Regarding the shape of change in conscientiousness, previous studies on conscientiousness development generally suggest that changes are not linear though the exact patterns may differ (e.g., de Haan et al., 2013; Lüdtke et al., 2011). We therefore expected non-linear changes in mean-level conscientiousness as well (Hypothesis 1b). Based on the social investment principle and the school system of China discussed earlier, we hypothesized that children's conscientiousness would increase and then plateau (i.e., a decelerating increase) as they spent more years in school.

We also expected significant between-person differences in initial conscientiousness levels (Hypothesis 2a) and rates of change (Hypothesis 2b) as a result of the complex interplay between individual and contextual influences. We expected that gender would explain some of the between-person variance in mean-level conscientiousness, such that the intercept for conscientiousness would be higher among girls (Hypothesis 3). Although we tested the possibility that gender would similarly predict rates of conscientiousness development, we did not have reason to hypothesize a specific effect.

We modeled the development of conscientiousness using curve of factors (CUFFS) models. CUFFS models combine two levels of latent structures, where the first-order structure is a measurement model of the factor being considered and the second-order structure is a latent growth model (McArdle, 1988). CUFFS models have three key strengths that make them especially suited for examining the development of conscientiousness during adolescence. First, having four waves of data allowed us to examine mean-level changes in a way sensitive to the nonlinearity suggested by previous research (e.g., de Haan et al., 2013). Second, compared to approaches using composite scores for conscientiousness in previous studies (e.g., Durbin et al., 2016), CUFFS models examine changes in the latent construct of conscientiousness, allowing assessment of continuity in the construct's structure and respondents' interpretations of items (i.e., testing invariance). Third, the multilevel nature of CUFFS models allows researchers to examine interindividual differences in conscientiousness levels and changes over time by allowing for random intercepts and slopes that vary across participants.

Methods

Participants

This study used four waves of data (2010, 2012, 2014, and 2016) from the China Family

Panel Studies (Xie et al., 2017), a national social survey project that aimed to document China's social changes at the individual, family, and community levels. This project was approved by the Peking University Biomedical Ethics Committee (approval number: IRB00001052-14010). Data on children who were 8 years old in 2010 (i.e., the 2002 birth cohort) were used in the current study. These children were selected because they had four assessments of parent-report conscientiousness data and because their ages from 2010 to 2016 roughly correspond to the period from late childhood to early adolescence. Six hundred and sixty-one children who had data in at least one of the four waves were included (43.88% females). 84.15% were Han Chinese, and 63.57% were from rural areas of China. The average total family income for the sample was about 4,932 U.S. dollars in 2009 (China's Household Income per Capita in 2009 was 2,760.771 U.S. dollars). 7.19% of the fathers and 6.32% of the mothers completed 2- or 3- year college or higher. Among the 661 children whose parents provided data in at least one wave, 549 had data in Wave 1, 502 in Wave 2, 487 in Wave 3, and 430 in Wave 4. Of these, 305 had data in all waves, 155 in three, 82 in two, and 119 in one. Our data met the assumption of missing completely at random (MCAR) as the Little's MCAR test (1988) was not statistically significant (χ^2(df = 1097) = 1119.869, p = .309). Missingness was handled by full information maximum likelihood in the following analyses.

Procedure

Families in the China Family Panel Studies were selected from 25 provinces in Mainland China (Xie et al., 2017). The outcome variable of the current study is from the child questionnaires of this project, which consist of a self-report for 10- to 15-year-olds and an other-report completed by the main guardian of children who were between 0-15 years old. Conscientiousness is the only trait among the Big Five that was measured by the child

questionnaire. In Wave 1, the China Family Panel Studies used computer-assisted personal interviewing, and Wave 2 added computer-assisted telephone interviewing to track participants who could not be reached in person. In 2010, 8,789 child questionnaires were completed. For the baseline survey, the response rates are 81.25% and 84.14% at the household level and individual level respectively. In 2012, the response rates are 79.4% and 74.1% at the household level and individual level respectively. In 2014, the response rates are 77.9% and 72.8% at the household level and individual level respectively.

Measures

Conscientiousness

Seven items from a parent-report conscientiousness scale were used during interviews to measure children's conscientiousness. At each time point, parents were asked to rate on a five-point Likert-type scale (1 = disagree a lot; 2 = disagree; 3 = neither agree nor disagree; 4 =agree; 5= agree a lot) how much they agreed with seven positively phrased statements about their child. Observations with the answer "I don't know" were coded as missing. Items came from the Conscientiousness scale of a larger questionnaire designed to measure the Big Five during late childhood (BFQ-C; Barbaranelli et al., 2003). Items were adapted to the Chinese context and translated into simplified Chinese (Xie et al., 2017; English and Chinese items provided in the Appendix). For each wave, the internal consistency reliability for the current sample is 0.77, 0.82, 0.82, and 0.81 respectively. The percentage of within-wave missingness not due to attrition is 3%, 4%, 1%, and 2% for each wave respectively.

Although there are both self-report and parent-report measures for conscientiousness in the China Family Panel Studies, the parent-report scale was used for three reasons. First, the BFQ-C was validated as a questionnaire that can be used either as a self-report or other-report

measure rated by teachers or parents (Barbaranelli et al., 2003). Second, strong factorial invariance, which is a prerequisite for fitting CUFFS models (Isiordia & Ferrer, 2018), was not achieved for self-report measures with children from any cohort of interest (See Table S1). The parent-report measure did, however, demonstrate strong factorial invariance with the chosen age group of children (results below). Third, children had at most three self-report assessments because only those aged 10 to 15 years old rated their levels of conscientiousness. Modeling change across four time points allowed a more reasonable examination of nonlinearity (Hancock et al., 2001).

Child Gender

The information about the child gender was collected at baseline and each follow-up in the family roster questionnaire (Xie et al., 2017). One member from each family filled out the basic demographic information for all family members. Therefore, the child gender was provided by either the child or their family members. In the present analyses, female is coded as 0 and male as 1. The percentage of missingness is 2%.

Analyses

Longitudinal Measurement Invariance

We fitted a series of confirmatory factor analyses to examine longitudinal measurement invariance, which is fundamental to fitting CUFFS models and investigating changes in a construct (Isiordia & Ferrer, 2018; Brown, 2015). To identify the model and scale the latent variable, we used the latent-standardization identification method for all models in this section. Models were tested using the Lavaan package in R (Version 0.6-7; Rosseel, 2012). Maximum likelihood estimation was used because our examination of the data distributions did not show excessive non-normality.

We tested longitudinal measurement invariance across the four waves following a sequence of iteratively more restrictive models that assessed configural, weak, and strong invariance, respectively (Brown, 2016). For all tested models, correlated errors were allowed for each item across time to account for method covariance. For configural invariance, the same factor structure was specified at all four time points without any cross-time equality constraints. Latent variances at all time points were fixed to one and latent means were fixed to zero. Next, factor loadings were constrained to be equal across waves to examine weak variance. The latent variance at Time 1 was fixed to one but freely estimated at the other three time points. Last, we examined strong invariance by constraining the indictor intercepts to be equal across time points. Latent variances were specified as in Step 2. The latent mean at Time 1 was fixed to zero so that the mean structure portion could be identified, but latent means were freely estimated at all other time points. If strong invariance is achieved, we can meaningfully compare factor means across time.

Global model fit was evaluated based on the following goodness-of-fit indices: The Comparative Fit Index (CFI), the Tucker-Lewis index (TLI), the Standardized Root Mean Square Residual (SRMR), and the root mean square error of approximation (RMSEA). We followed the cutoff criteria suggested by Hu and Bentler (1999):1) CFI and TLI values are close to or greater than .95; 2) SRMR values are close to or below .08; 3) RMSEA values are close to or below .06.

To evaluate whether a certain level of invariance was achieved or not, we examined changes in goodness-of-fit indices after the equality constraints were imposed following the suggestions by Cheung and Rensvold (2002). Although differences in χ^2 have been commonly used to measure the degree of invariance, they are dependent on sample size and therefore we used changes in CFI (ΔCFI), which is less affected by sample size, as an alternative. We

followed the suggestion that invariance is achieved if the global model fit is acceptable and CFI decreased by .01 or less (Cheung & Rensvold, 2002).

Curve of Factors Models

After strong invariance was achieved for the measure, we fitted univariate CUFFS models to examine changes in the latent variable across the study period. Models were tested using the Lavaan package in R (Version 0.6-7; Rosseel, 2012). As with the CFA models, we estimated these models using maximum likelihood estimation.

In the first-order model, we used the marker-variable identification method by fixing the first indicator's loading to be 1 and intercept to be 0. It should be noted, however, that estimates of growth parameters depend on the choice of marker variable and the specified values of its loading and intercept (Yang et al., 2020). We constrained indictor intercepts to be equal across waves, as strong invariance was confirmed. Factor variances were also constrained to be equal over time, as is often done to reflect stability of the residuals in growth curve modeling, and first-order latent means were fixed to zero. Same-item correlated residuals were allowed across time to account for method covariance.

For the second-order structure, we tested linear and quadratic growth models (Model 1 and Model 2 respectively) successively. Covariances between all first-order factors and between first-order factors and second-order growth factors (i.e., intercept, linear slope, and quadratic slope) were fixed to zero. Second-order growth factor means and variances were freely estimated. For the linear model, both the intercept and linear slope freely varied across individuals. With four time points, we were able to also fit a quadratic model without adding extra constraints (Hancock et al., 2001), as visualized in Figure 1. We also fitted an unstructured growth model as a robustness check, and results supported a quadratic trend (See Table S2).

Fit indices and estimates of growth factors were used to evaluate the acceptability of the models. Gender was then added to the best-fitting model to test its effects on the intercept and slope(s) (see Figure 1).

Results

Descriptive Statistics

Table 1 presents the descriptive statistics for all scale items across the four time points. Overall, a positive trend was observed for all items' mean scores from the first to the last assessment. The largest increases, however, were observed from Time 1 to Time 2, after which mean scores either continued to increase, increased and then decreased, or leveled off. Values of skewness (range= -1.94 to .06) and kurtosis (range=-1.59 to 5.27) showed no excessive non-normality (Kline, 2011).

Longitudinal Measurement Invariance

Table 2 shows fit indices for each level of longitudinal measurement invariance. Global model fit indices suggested good fit for all tested models. Results showed that weak invariance was met with only a small decrease in CFI (ΔCFI = .005). Strong invariance was also supported with only .005 change in CFI.

CUFFS Models

Mean-level Conscientiousness Development

Model fit indices indicated that the liner CUFFS model (Model 1) fitted the data well. Table 3 presents model fit indices and parameter estimates from this model. The quadratic CUFFS model (Model 2) produced negative but nonsignificant variances for the linear (p =.762, 95% CI [-.21, .15]) and quadratic slopes (p =.486, 95% CI [-.03, .01]). Thus, we refitted a quadratic model (Model 3) with the variance of the quadratic slope and corresponding

covariances constrained to zero. Model 3 produced no negative variances and showed good global model fit (see Table 3). Results from the likelihood ratio test showed that Model 3 did not show significant worse model fit compared to Model 2 ($\Delta\chi^2$(df = 3) = 4.429, p =.22). A likelihood ratio test also indicated that Model 3 significantly increased the model fit when compared to Model 1, the linear model ($\Delta\chi^2$(df = 1) = 6.853, p =.009). The estimated mean of the quadratic slope was also statistically significant (p=.009, 95% CI [-.10, -.01]). Therefore, Model 3 was accepted as the best-fitting model for the data. Model fit indices and parameter estimates of Model 3 are presented in Table 3.

Based on Model 3, estimates of growth parameters showed that the initial mean-level parent-report conscientiousness was statistically significant (κ_i = 3.30, p <.001, 95% CI [3.22, 3.37]), which varied across children (ϕ_i = .19, p <.001, 95% CI [.12, .26]), as we expected in Hypothesis 2a. Results also showed a significant average linear increase of .21 (p <.001, 95% CI [.12, .30]) in mean-level conscientiousness scores for each subsequent wave, and the increase decelerated from assessment to assessment (see Figure 2). No significant variances were found for the random linear or quadratic slopes among the children (ϕ_l = .01, p = .210, 95% CI [-.01, .02]; ϕ_q was fixed to zero). Hence, Hypotheses 1a and 1b were supported, but Hypothesis 2b was not. No significant covariance was found between the intercept and linear slope (ϕ_{il} = .01, p = .596, 95% CI [-.03, .02]), indicating no relationship between children's baseline conscientiousness level and their rate of change. Raw and standardized factor loadings for Model 3 are shown in Table 4.

Gender Differences

We added gender as a predictor for the intercept in Model 3. We did not examine the effects of gender on the slopes because no significant variances were found for the random linear

or quadratic slopes among the children. Gender was significantly associated with the intercept (γ_{raw} = -.22, γ_{std} = -.26, $p < .001$, 95% CI [-.32, -.13]). As we expected, girls showed a higher average conscientiousness than boys did, but they did not significantly differ in the rate of change (see Figure 2).

Discussion

The existing literature indicates mean-level conscientiousness changes across the transition into adolescence. Few of these studies, however, were conducted with samples from non-Western countries. With a nationally representative sample from China, the current study examined mean-level conscientiousness development from late childhood to early adolescence. We tested curve of factors (CUFFS) models with four waves of longitudinal data from 661 children aged 8 years old at baseline. Contrary to findings from many studies in Western contexts, our findings suggest that mean-level conscientiousness increases during the transition into adolescence with a decelerating rate of growth. We also found significant between-person variance and a gender difference in average levels of conscientiousness.

Studies (e.g., Durbin et al., 2016; Soto et al., 2011; Soto, 2016; Tackman et al., 2017) of longitudinal changes or age differences in personality dimensions during the transition to adolescence in Western contexts often document declines in some aspects of personality, such as conscientiousness and agreeableness, and thus support the disruption hypothesis (Soto & Tackett, 2015). We attribute differences between the present findings and those found in prior work to cross-cultural differences in mechanisms underlying the development of conscientiousness. Based on the social investment theory (Roberts et al., 2005), expectations and experiences associated with age-graded roles are a major driver of personality change. The role expectations for children and youth vary between China and many Western contexts due to

differences in both the public school system and cultural values. In China, there are generally high expectations from both school and parents for children's hard work, goal-oriented behaviors, self-control, and conformity to social rules (Chan & Chan, 1999; Zhang et al., 2002). These expectations also become stronger as children transition into public middle schools, where students need to prepare for high school entrance examinations. As a result, Chinese adolescents are likely to experience an increased investment in schoolwork, which likely underlies a corresponding growth in conscientiousness. This is especially likely given that many of the items used to measure conscientiousness in the present study emphasized behaviors that promote school success and Chinese youth have reported viewing school engagement as higher during teen years than earlier periods (Qu et al., 2016). In addition, Chinese children may be more likely to experience guilt in a guilt-provoking situation due to a greater use of shame and guilt induction among Chinese parents (Helwig et al., 2014). These feelings or the anticipation of the feelings would in turn motivate Chinese adolescents to be more responsible in order to avoid any negative outcomes that may be caused by a lack of conscientiousness (Jackson & Hill, 2019).

Taken together, although not a cross-cultural study itself, the current study indicates potential cross-cultural differences in mechanisms contributing to changes in conscientiousness at the transition into adolescence and thus the pattern of change. Indeed, a cross-cultural study by Chopik and Kitayama (2018) found contrasting patterns of change in mean-level conscientiousness during adulthood between the United States and Japan. Those authors identified social roles, health goals, and cultural values as possible mechanisms underlying the observed differences. Future studies need to closely examine the exact mechanisms for changes from childhood to adolescence.

The nonlinear rate of change observed in the present study provides further evidence that

conscientiousness development does not follow a simple linear path. The rate of growth may be related to changes in role expectations at different periods. With participants from an older age group, one study shows that the increase in conscientiousness was stronger during the transition into college, vocational training, or work than the change between later time points (Lüdtke et al., 2011). Although showing a quadratic shape of change as well, our findings show that the strongest increase happened before the transition into middle school. This may be due to students and their parents' anticipation of the increased schoolwork during lower secondary education compared to primary school, which leads to the earlier preparation for new academic challenge in the coming years. This could also be the result of the complex interaction between biological, cognitive, psychological, and social changes during this period. Thus, prediction based solely on age-graded roles may lack specificity. Future studies should therefore articulate the mechanisms driving nonlinear personality development. Given that parent-reports were used, the difference in change patterns found between the current study and previous ones may also reflect differential parental sensitivity to their children's personality changes, which could be examined by future studies as well.

In addition to overall mean-level trends in conscientiousness development, we found significant between-person differences in initial level of conscientiousness. This finding is not surprising given that self-regulation, a core developmental component for conscientiousness, also shows considerable heterogeneity within cultures (Wanless et al., 2013). Previous studies focusing on similar periods of time (de Haan et al., 2013; Van den Akker et al., 2014) have also found significant variance in conscientiousness among youth from Western contexts. Although individuals may share similarities in proximal contexts due to the macro-level influence of culture, individual characteristics and unique local environments contribute to levels of

conscientiousness (Eisenberg et al., 2014) and lead to differences among youth within any given context.

Contrary to our hypothesis, no significant interindividual differences were found in these children's rate of increase in conscientiousness or changes in the rate of change (i.e., linear and quadratic slopes, respectively). This may reflect the high continuity in interindividual differences in conscientiousness levels from childhood to adolescence suggested by prior research (De Fruyt et al., 2006). It is also possible that, given that the conscientiousness scores were reported by parents, this finding reflects high continuity in parents' perceptions of their child's position on conscientiousness levels relative to other people in the child's peer group. As a result, we would see no difference in change patterns across children. The observed lack of between-person variance may also indicate that age-graded social roles defined by the shared educational context for most Chinese students are the major driver of change in conscientiousness during the transition into early adolescence. Once their life paths become more diverse after they transition out of the secondary education system, for example, the change patterns of their conscientiousness may show more differences than similarities (Lüdtke et al., 2011).

Our findings also suggest a gender difference in conscientiousness levels. Consistent with previous research (e.g., Van den Akker et al., 2014), girls were more conscientious than boys in late childhood. The difference in conscientiousness levels between girls and boys during the transition into adolescence may be due to the biological sex differences in brain development, with female brains maturing faster than males' (Lenroot & Giedd, 2010). This can also be explained by differences in childhood socialization (De Bolle et al., 2015). Although a recent study reported no difference in Chinese parents' socialization values of hard work and obedience for girls versus for boys during early childhood (Chen, 2020), other socialization agents may still

contribute to the gender difference in conscientiousness. For example, male privilege has been reported in Chinese kindergartens, with boys often receiving more attention and care from teachers (Chen & Rao, 2011). With this privilege taken granted by both teachers and students, this study found that girls had to earn more attention from teachers with their good behaviors, which may contribute to girls' higher levels of consicentiousness later.

There are some limitations of this study. First, the measurement invariance across national samples of this conscientiousness scale has not been tested. Therefore, it is possible that differences in change patterns might be due to differences in the latent construct being assessed in different contexts. Future cross-cultural studies should use scales that have been tested for measurement invariance across populations. In addition, several items of the scale used to measure conscientiousness specify the occasion (i.e., schoolwork-related situations) of the behavior, whereas other studies often measure conscientiousness in a more general context (e.g., De Fruyt et al., 2006; Durbin et al., 2016; Soto et al., 2011). Because previous research suggests that conscientiousness may show fluctuations from occasion to occasion (Wagner et al., 2019), these items may have only captured conscientiousness levels specific to the academic setting. Future research should therefore consider a wider variety of questionnaire items that measure changes in the conscientiousness construct across settings, such as an academic setting versus housework. Second, the use of a single cohort due to the requirement of measurement invariance by CUFFS limited our ability to examine potential cohort effects, and thus we could not disentangle cohort effects from true developmental change in conscientiousness. We were not able to examine period effects, either. Future research could examine cohort effects by including multiple cohorts and examining convergence of findings between youth from differing cohorts. Period effects can similarly be tested, for example, by including a refreshment sample at the

second assessment and comparing same-aged first-time participants at the first time point to those who were first assessed at the second point (Lucas & Donnellan, 2011). Third, the four-wave data only allowed us to examine conscientiousness development from late childhood to early adolescence and fit the quadratic model as the best non-linear model. With more waves of data, future research could examine conscientiousness changes over a longer period of time and other non-linear shapes of change (e.g., cubic). Fourth, although the measure contains items assessing different dimensions of conscientiousness, we did not examine the change of each dimension separately. Previous research on adults and adolescents in Western contexts indicates differential age differences or longitudinal changes between facets of conscientiousness (de Haan et al., 2017; Jackson et al., 2009), so future research with adolescents in non-Western contexts also needs to examine changes at the facet level. Fifth, we used only parent-report data in the current study, and future studies may capture conscientiousness changes based on data from multiple informants. Sixth, our study focused on examining and describing conscientiousness changes among Chinese youth, but the mechanism of change for this population remains unclear. Future studies should examine specific predictors (e.g., parental expectations, self-regulation, guilt induction) with this population to better inform the mechanism underlying the change. For example, researchers may study the concurrent links between conscientiousness and parental expectations. It is also worth examining how cross-cultural differences in parental practices of guilt induction during childhood may contribute to differences in conscientiousness during and after the transition into adolescence. Research should also continue to examine any within-group differences among Chinese youth by various demographic factors, such as urbanicity, ethnicity, and income. Last, this study only examined the change of conscientiousness among Chinese youth. Future studies should also investigate the development of the other Big 4 traits among

Chinese children and adolescents.

Despite these limitations, the current study is among the first to explore mean-level conscientiousness development across the transition into adolescence in a non-Western context. The use of CUFFS models allowed us to examine changes in the latent construct of conscientiousness and the interindividual differences in intraindividual changes at the same time, which was not achieved by many studies with similar goals. In summary, our findings partially challenge the disruption hypothesis based on previous studies with Western samples and suggest that the development of conscientiousness may look different in contexts where there are considerable differences in factors driving its development.

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Table 1

Descriptive Statistics for All Parent-report Conscientiousness Items across Four Waves

	Item	Mean	SD	Skewness	Kurtosis
Time 1	1	3.36	1.03	-.51	-1.23
	2	2.95	1.12	.06	-1.49
	3	3.48	.98	-.87	-.59
	4	3.25	1.03	-.39	-1.42
	5	3.86	.71	-1.94	4.49
	6	3.31	1.01	-.48	-1.23
	7	3.11	1.10	-.20	-1.49
Time 2	1	3.47	1.04	-.57	-.99
	2	3.14	1.08	-.10	-1.59
	3	3.60	.95	-.99	-.14
	4	3.38	1.04	-.50	-1.20
	5	3.99	.60	-1.64	5.27
	6	3.44	1.04	-.60	-.99
	7	3.27	1.13	-.27	-1.35
Time 3	1	3.60	1.05	-.71	-.67
	2	3.31	1.09	-.31	-1.34
	3	3.68	.97	-1.01	.14
	4	3.53	1.01	-.74	-.67
	5	4.01	.70	-1.59	4.25
	6	3.56	.99	-.80	-.50
	7	3.33	1.10	-.46	-1.19
Time 4	1	3.48	1.12	-.65	-.77
	2	3.23	1.14	-.18	-1.39
	3	3.63	.98	-.94	-.18
	4	3.49	1.05	-.62	-.93
	5	4.00	.76	-1.49	3.24
	6	3.68	.92	-.96	-.01
	7	3.46	1.04	-.71	-.75

Note. N = 661. All items were rated on a five-point Likert-type scale: 1 = disagree a lot; 2 = disagree; 3 = neither agree nor disagree; 4 =agree; 5= agree a lot.

Table 2

Fit Indices of Longitudinal Measurement Invariance

	Configural invariance	Weak invariance	Strong invariance
χ^2(df)	451.528** (302)	484.905** (320)	524.271** (338)
$\Delta\chi^2$(Δ df)		33.377* (18)	39.366** (18)
CFI	.960	.955	.950
ΔCFI		.005	.005
TLI	.949	.947	.944
ΔTLI		.002	.003
RMSEA(90%CI)	.027 (.022, .033)	.028 (.023, .033)	.029 (.024, .034)
SRMR	.043	.049	.050

Note. N = 661. * p<.05. ** p<.01.

Table 3

Model Fit Indices and Parameter Estimates from the Linear and Quadratic CUFFS Models for the Parent-report Conscientiousness Scores

	Model 1				Model 2				Model 3			
	Est (std)	***SE***	***P***	***95% CI***	***Est (std)***	***SE***	***P***	***95% CI***	***Est(std)***	***SE***	***P***	***95% CI***
Means												
Intercept (k_i)	3.33 (7.6)	.04	<.001	[3.26, 3.40]	3.30 (8.12)	.04	<.001	[3.22, 3.37]	3.30 (7.52)	.04	<.001	[3.22, 3.37]
Linear (k_l)	.10 (1.00)	.01	<.001	[.07, .13]	.21(—)	.04	<.001	[.12, .30]	.21 (2.12)	.04	<.001	[.12, .30]
Quadratic (k_q)					-.04 (—)	.01	.008	[-.07, -.01]	-.04 (—)	.01	.009	[-.10, -.01]
Variances												
Random Intercept (ϕ_i)	.19	.04	<.001	[.12, .26]	.17	.04	<.001	[.10, .25]	.19	.04	<.001	[.12, .26]
Random Linear Slope (ϕ_l)	.01	.01	.216	[-.01, .02]	-.03	.09	.762	[-.21, .15]	.01	.01	.210	[-.01, .02]
Intercept-Linear Slope (ϕ_{il})	-.01	.01	.613	[-.03, .02]	.04	.05	.438	[-.06, .13]	-.01	.01	.596	[-.03, .02]
Random Quadratic Slope (ϕ_q)					-.01	.01	.486	[-.03, .01]				
Intercept-Quadratic Slope (ϕ_{iq})					-.02	.01	.250	[-.04, .01]				
Linear-Quadratic Slope (ϕ_{lq})					.02	.03	.577	[-.04, .07]				
Model fit												
χ^2(df)	537.564 (346)				526.282 (342)				530.711 (345)			
CFI	.948				.950				.950			
TLI	.943				.945				.945			
RMSEA (90%CI)	.029 (.024, .034)				.029 (.024, .033)				.029 (.024, .033)			
SRMR	.054				.051				.053			

Note. N = 661. In Model 3, the variance of the random quadratic slope (ϕ_q) and the covariances involving the random quadratic slope (ϕ_{iq} and ϕ_{lq}) are all fixed to zero. Standardized estimates (both latent and observed variables are standardized) are reported in parentheses.

Table 4

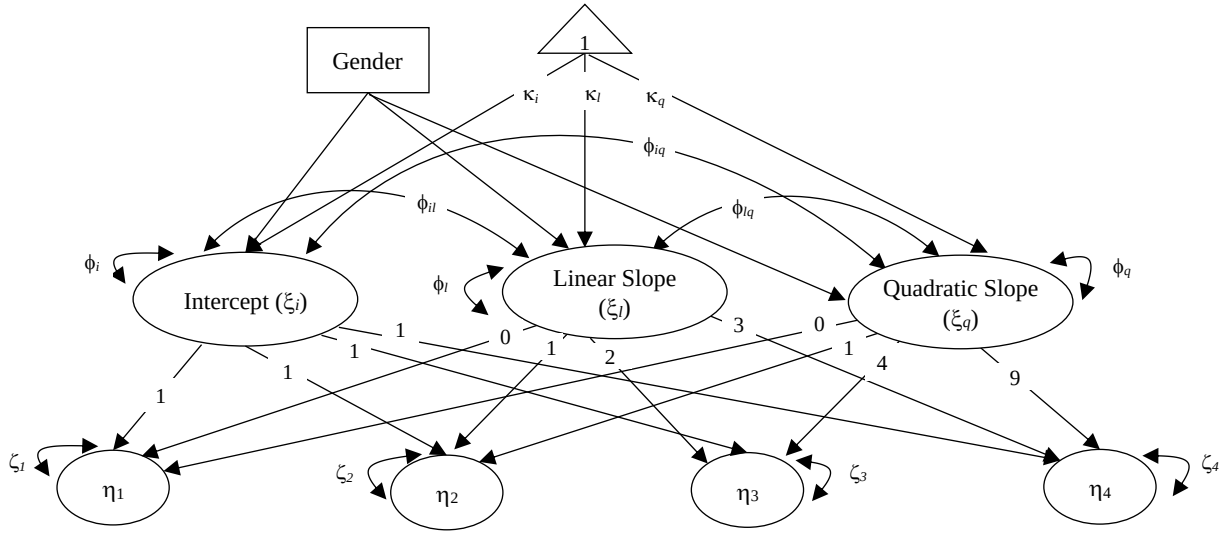
Raw and Standardized Factor Loadings for the Final Quadratic CUFFS Model

Item	Raw	SE	Standardized
1	1.00		.66
2	1.14	.05	.67
3	.84	.04	.58
4	.99	.04	.65
5	.40	.03	.39
6	.86	.04	.59
7	.88	.05	.55

Note. $N = 661$.

Figure 1

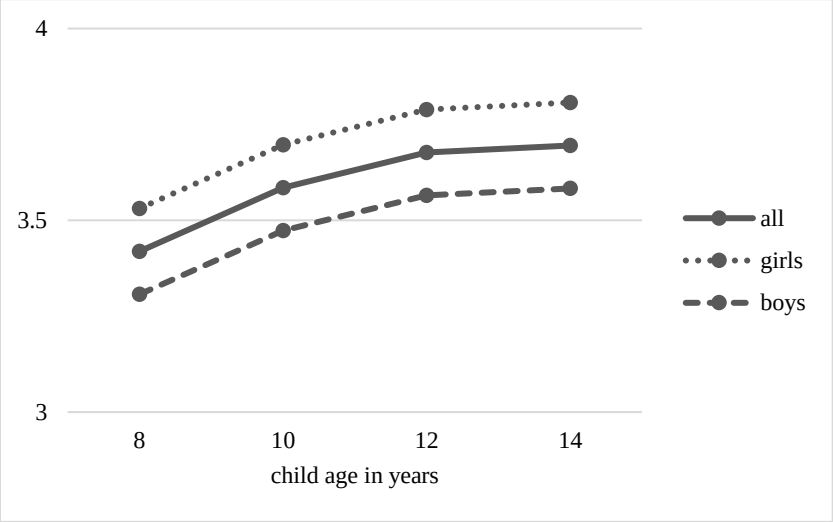
Path Diagram of the Quadratic CUFFS Model



Note. Only the growth model is presented here for clarity. Pattern coefficients for the intercept and linear slope factors are the same in the linear CUFFS model.

Figure 2

Estimated Mean-level Conscientiousness Change Trajectories



Note. $N = 661$; $n_{girl} = 283$; $n_{boy} = 362$.

Table S1

Fit Indices of Longitudinal Measurement Invariance for the Child-report Measure

	Configural invariance	**Weak invariance**	**Strong invariance**
Cohort 2000 (*N = 644*)			
χ^2(df)	212.084 ** (114)	219.858 ** (124)	302.426 ** (134)
$\Delta\chi^2$(Δ df)		7.774 (10)	82.568** (10)
CFI	.918	.920	.859
ΔCFI		-.002	.061
TLI	.949	.901	.839
ΔTLI		.048	.062
RMSEA (90%CI)	.037 (.029, .045)	.035 (.027, .043)	.045 (.038, .043)
SRMR	.106	.109	.112
Cohort 1999 (*N = 672*)			
χ^2(df)	1485.383**(114)		
$\Delta\chi^2$(Δ df)			
CFI	.622		
ΔCFI			
TLI	.492		
ΔTLI			
RMSEA (90%CI)	.136 (.130, .142)		
SRMR	0.089		

Note. N = 661. * p<.05. ** p<.01.

Appendix I

Parent-report Conscientiousness Scale of CFPS

English Item	Chinese Item
The child studies very hard.	这个孩子学习很努力。
The child checks homework several times after it is finished.	这个孩子会在完成家庭作业之后检查数遍，看看是否正确。
The child does not play until homework is finished.	这个孩子只在完成家庭作业之后才玩。
The child can concentrate on one thing.	这个孩子做事时注意力集中。
The child obeys rules.	这个孩子遵规守纪。
Once starting something, the child will complete it.	这个孩子一旦开始去做某个事情时，无论如何都必须完成它。
The child likes to put things in order.	这个孩子喜欢把自己的物品摆放整齐。

Note. The version used in CFPS is in simplified Chinese.