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Social Comparison at School: Can GPA and Personality Mutually Influence Each Other Across  
Time?

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### Abstract

**Objective:** Being a student is an important social role youth play during adolescence and how they approach this role has critical implications for their future development. This three-wave longitudinal study investigated the links between academic achievement (i.e., GPA) and personality traits, through the lens of social comparison mechanisms.

**Method:** Patterns of effects between students' GPA and personality traits were analyzed at group (i.e., comparing rank-order differences at group level; group effects) and individual (i.e., scores are compared to a student's own mean; within-person effects) levels. A total of 1,151 adolescents ( $M_{age} = 16.45$  years; 58.7% female) participated in the study.

**Results:** Most effects we depicted were from GPA to personality traits. At the group level, higher GPA fostered students' extraversion, agreeableness, and openness, while openness reinforced high levels of GPA. At the individual level, GPA was a protective factor against negative affect, as it drove longitudinal decreases in neuroticism.

**Conclusions:** GPA had a stronger role in personality formation when it reflected students' standing in the school compared to their peers (i.e., group effects) and to a lesser extent when it reflected changes at personal level (i.e., within-person effects).

*Keywords:* GPA, personality traits, student role, social comparison, adolescence

### Social Comparison at School: Can GPA and Personality Mutually Influence Each Other Across Time?

The student role is a core life role during adolescence (Eccles & Roeser, 2011). Adolescents interact with the school settings by following several normative academic standards for performance (e.g., high academic grades, homework requirements, involvement in mandatory school tasks) that are set by national school systems (e.g., grading systems differ from country to country) and that reflect how well they perform in the student role. These normative academic standards for performance shape how adolescents approach school and learning, as they often focus youth on self-evaluations based on social comparison with their peers (Marsh et al., 2018).

The relation between students' academic achievement (e.g., their GPA or Grand Point Average) and personality is an important topic of research in adolescence, being mostly investigated from the perspective of personality traits as predictors of students' GPA (see Poropat, 2009 for a review). Academic achievement is usually seen in current research as an outcome of personality formation in adolescence. Nonetheless, when we look at academic achievement (i.e., GPA) as a normative academic standard for performance, it seems plausible to investigate how GPA may also foster or inhibit personality formation in the second decade of life. Also, previous studies have only looked at the longitudinal associations between personality and GPA at group level (e.g., changes in this relation based on rank order differences between persons at the group level). Group-level analyses integrate both between- and within-person variance and cannot partial out the within-person variance (Curran & Bauer, 2011). As current research recommends (e.g., Hamaker, Kuiper, & Grasman, 2015), longitudinal studies could better inform applied interventions if we look at these relations from both group and person

standpoints. Considering these limitations, the present study sought to investigate longitudinal relationships between GPA and personality traits across a school year, from group-level and within-person perspectives. From a methodological standpoint, this endeavor is very important because "... the between-group and within-group relations may ultimately be the same, but the relation at one level is neither necessary nor sufficient to imply the same relation at another level" (Curran & Bauer, 2011, p. 587).

### **The Student Role as Core Life Role in Adolescence**

Being a student is a normative life role across adolescence. In fact, youth spend most of their time in educational settings, adhering to normative academic standards for performance that are created by their teachers and the school system (Organization for Economic Cooperation and Development-OECD, 2017). These normative academic standards for performance (e.g., doing homework, preparing for exams, learning for classes according to a curriculum) shape the way adolescents organize their lives in this time-span (Eccles & Roeser, 2011). Gradually, students change due to their immersion in the school, as they are exposed to daily experiences, expectations, and norms within the school environment. In adolescence they internalize these norms and develop their own habits to approach school-related tasks (e.g., how much effort and time they invest in school activities). As adolescents face complex school learning experiences and demands (e.g., new contents and achievement standards depending on their school-track), they may enhance or diminish their efforts for performing well at school (Bleidorn, 2012; Eccles & Roeser, 2011; Robbins et al., 2004). Therefore, the school environment becomes a frame of reference for the evaluation of personal development, fostering social comparison and promoting educational commitment, especially in students who adhere to normative academic standards for performance (e.g., they have good GPA, they do their homework).

The school is an important frame of reference for individual development, as students compare their own achievements and choices in different areas (e.g., grades, interests, educational aspirations) with the achievements and choices of other students in their schools (e.g., Trautwein, Lüdtke, Marsh, & Nagy, 2009). In many cultures school activities tend to be over-structured and requirements for academic achievement are mostly based on student comparisons among themselves and to a prototype of the academically achieved student (OECD, 2017). Hence, academic achievement can be seen as a core indicator of an adolescent's standing in his/her classroom and school compared to other students (i.e., social comparison), as "students think about the characteristics of groups of students and use this information to evaluate their own academic qualities" (Trautwein et al. 2009, p. 863).

Second, adhering to normative academic standards for performance can bolster educational identity commitments. Those who do well in school, may become more engaged in and content with their education. They may perceive that their educational commitment is validated and may hence strengthen their academic self-concept (Marsh et al., 2018). A recent longitudinal study focusing on group-level associations of GPA and educational identity found support for this idea, showing that adolescents' educational commitment is triggered by high GPA and weakened by low GPA (Pop, Negru-Subtirica, Crocetti, Opre, & Meeus, 2016). This longitudinal link from GPA to educational commitment further suggests that the school context, through its normative standards of performance, shapes how adolescents psychologically identify themselves with their educational choices.

Summing up, the school is a frame of reference for the evaluation of self-development in adolescence. Hence, GPA is a main indicator of a student's academic standing or position

compared to his/her peers. Additionally, high GPA, as a normative standard for academic performance, can support educational identity commitments.

### **The Relation between Normative Academic Standards for Performance and Personality**

A recent four-wave longitudinal study on German adolescents found that achievement of normative academic standards for performance (i.e., doing homework) can drive personality formation in this developmental time-frame (Göllner et al., 2017). The authors showed that doing homework, assessed for two school subjects (i.e., mathematics and German), was positively associated with conscientiousness across time. This longitudinal relation was bidirectional, in that adolescents who were invested in doing their homework at the beginning of the school year also increased in conscientiousness across the school year, and the other way around. Doing homework is a normative academic standard and this study brought some proof to the assumption that performing according to normative academic standards can contribute to personality formation during adolescence.

As students attend school, social actors (e.g., parents, teachers, peers) expect them to take responsibility for this role and to perform according to very specific demands (e.g., the school curriculum, mandatory assessments). While adult social roles have exit strategies (e.g., adults can leave their job), adolescents are in many respects limited in their opportunities to change the student role, especially during mandatory schooling. In this context, adolescent identity commitments are closely linked to performing in the student role, by following complex and binding role norms (Albarello, Crocetti, & Rubini, 2018). As we previously detailed, a core normative requirement for students is to perform well in school, as academic achievement is an important prerequisite for future personal and professional development (Poropat, 2009). From a longitudinal standpoint, academic achievement (i.e., GPA) is positively linked to educational

identity commitments and negatively related to reconsideration of educational commitments in adolescence (Pop et al., 2016). Hence, as adolescents become psychologically committed to this social role, academic achievement can provide a normative standard for self-evaluation in school settings (Marsh et al., 2018). Therefore, it is important to investigate from a longitudinal perspective if academic achievement can drive personality development during adolescence.

Existing research analyzed academic achievement as an outcome of students' personality in adolescence, focusing on how certain personality traits (e.g., conscientiousness) can predict academic achievement measured through grades (e.g., Nofle & Robins, 2007), standardized tests (e.g., Spengler, Lüdtke, Martin, & Brunner, 2013), promotion to the next educational cycle (e.g., Klimstra, Luyckx, Germeijs, Meeus, & Goossens, 2012), or satisfaction with school (e.g., Evans, Martin, & Ivcevic, 2018). In this manner, researchers underscored a relation from personality to academic achievement, hence indicating that in adolescence "who you are" influences "what you do" (i.e., selection effect) and mostly ignoring the role of a socialization effect (i.e., "what you do" influences "who you are"). School is a main social environment in adolescence and the student role is a life role daily enacted in this time-frame. A few studies indicated a link from academic achievement to personality in adolescence, but as they relied on cross-sectional data, they could not document longitudinal effects (e.g., Spengler et al., 2013). Hence, a longitudinal relation from academic achievement (i.e., GPA) to personality makes sense from a theoretical standpoint and it is important to test, to untangle how following normative requirements of this social role also possibly predicts personality traits across time.

### **Current Study**

This study focused on the possibility of a bidirectional relation between GPA and personality traits in adolescence. The dynamic of the relations between these constructs may

differ depending on the level of analysis. Group-level associations (i.e., rank-order comparisons) investigate how GPA and personality traits affect the relative position of individuals on these variables in the sample. Individual or within-person associations look at how GPA and personality traits are linked based on a student's own mean for these variables.

By looking at the group and within-person levels, we can see how (dis)similar are the patterns of longitudinal associations of these variables, when we take the group versus the person as reference point. To our knowledge, this is the first study that investigated the reciprocal associations between GPA and personality traits investigating a group-level and a within-person perspective. In general, within-person associations are understudied in longitudinal adolescent research (see Meeus, 2016 for review). Therefore, the present study may have wider implications for longitudinal adolescent research.

First, we aimed to investigate the reciprocal longitudinal group-level associations of GPA and personality traits by unravelling on how variations from the group mean score on one variable are related to changes observed on the other variable over time (Papp, 2004). We note that group-level changes include both between- and within-person changes, as individual differences in within-person change must take place to observe group-level change (i.e., rank-order change). During the school year, we expected personality traits like agreeableness, conscientiousness, and openness to be associated with relatively high levels of GPA, while Neuroticism to be related to relatively low levels of GPA (Noftle & Robins, 2007; Poropat, 2009; Spengler et al., 2013; Vermetten, Lodewijks, & Vermunt, 2001). Considering school as a frame of reference for personal development and evaluation in adolescence, we also explored if high levels of GPA enhance adolescents' agreeableness, conscientiousness, and openness, on the one hand, and reduce their neuroticism, on the other hand.

Second, we aimed to explore the reciprocal longitudinal within-person associations of GPA and personality traits. When examining the connections between GPA and personality traits at within-person level, we look at how deviations from an adolescent's own expected average score on one variable are related to changes in another variable over time (Papp, 2004). To the best of our knowledge, so far no longitudinal study has approached this relation from a within-person longitudinal perspective. Nevertheless, from a theoretical point of view, bidirectional effects can be expected. In fact, within-person changes in personality factors can have implications for academic achievement (Marsh et al., 2018) and variations in own's levels of academic achievement can also impact individuals' personality traits (Göllner et al., 2017). Increases in a student's positive personality traits (e.g., conscientiousness, openness to experience, agreeableness) and decreases in negative traits (e.g., neuroticism) could be longitudinally linked to an increase in his/her GPA. These changes may be related to the fact that school is a frame of reference for personal development in adolescence and personal resources may be channeled to foster one's educational achievement. Additionally, as GPA is a normative academic standard for performance, an increase in a student's own GPA across the academic year may also support increases in his/her positive personality traits and a decrease in his/her negative personality traits. These changes can be linked to the student's validation in the student role, through his/her academic achievement. Hence, we tentatively expected to depict bidirectional within-person associations between GPA and personality traits.

## Method

### Participants

Participants were adolescents from the 8<sup>th</sup> to the 12<sup>th</sup> grade ( $N = 1,151$ ;  $M_{age} = 16.45$  years;  $SD_{age} = 1.40$ ; range = 13-19 years; 58.7% female) recruited from seven high schools in

Northwest Romania for the longitudinal research project Transylvania Adolescent Identity Development Study (i.e., TRAIDES, Negru-Subtirica, Pop, & Crocetti, 2015). The sample comprised 971 adolescents at Time 1 ( $M_{age} = 16.46$  years;  $SD_{age} = 1.40$ ; 58% female), 934 adolescents at Time 2 ( $M_{age} = 16.81$  years;  $SD_{age} = 1.41$ ; 62.1% female), and 856 adolescents at Time 3 ( $M_{age} = 17.08$  years;  $SD_{age} = 1.39$ ; 61.7% female). Most of the adolescents lived with both biological parents or with one of their divorced parents (90.8%), while 8% were living with other students or relatives. In terms of financial support, most of the adolescents in the sample were fully financially supported by their parents (85.8%), 8.4% reported having some personal income (i.e., state-provided student allocation, scholarship), and 1.6% reported they were financially supported by relatives.

Overall, 22.71% of data were missing from Time 1 to Time 3. The range of missing items varied from 17.5% to 43.1% across the three waves. We used Little's (1988) Missing Completely at Random (MCAR) test to examine the missing data. Results revealed a normed  $\chi^2$  ( $\chi^2/df$ ) of 1.11, which indicates that data were probably missing at random (Bollen, 1989). Thus, all participants were included in our analyses and the missing data were estimated using the full information maximum likelihood (FIML) procedure in *Mplus 8.1* (Muthén & Muthén, 1998-2017).

### **Procedure**

Data for the present study were collected at three different time-points, 3-to-4 months apart, throughout the span of the academic year 2013-2014. At each measurement-point, adolescent students completed the same questionnaires in their classrooms, during school hours. Participation in the study was voluntary and confidential, with no financial compensation for the participants. At each wave, after giving their consent, students filled in the questionnaires in their

classrooms. The Faculty of Psychology and Educational Sciences of the first author's university and the schools' headmasters approved the present study. The approval was provided through a written collaboration protocol.

## Measures

**Big Five Personality Traits.** The 44-items Big Five Inventory (BFI, John & Srivastava, 1999) was used to assess extraversion (e.g., "I am someone who is talkative"; 8 items), agreeableness (e.g., "I am someone who has a forgiving nature"; 9 items), conscientiousness (e.g., "I am someone who perseveres until the task is finished"; 9 items), neuroticism (e.g., "I am someone who can be tense"; 9 items), and openness (e.g., "I am someone who is curious about many different things"; 10 items). The English version of the Big Five Inventory (BFI, John & Srivastava, 1999) was translated from English to Romanian<sup>1</sup> through the back-translation method (Brislin, 1986). Each item was evaluated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Some of the items (i.e., 16 items) were reverse-coded. Cronbach's Alphas for the five scales ranged from .64 to .77 at Time 1; from .68 to .79 at Time 2; and from .66 to .78 at Time 3 (see Table 1). The BFI was a reliable self-report measure of broad personality traits in adolescents from our sample, with similar model fit indices (e.g., Booth & Hughes 2014) and psychometric properties, as prior cross-cultural studies (e.g., Denissen, Geenen, van Aken, Gosling, & Potter, 2008; Donnellan & Lucas, 2008;

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<sup>1</sup> Initial analyses revealed that one item of the extraversion scale ("I see myself as someone who tends to be quiet") and two items of the openness scale ("I see myself as someone who prefers work that is routine"; "I see myself as someone who has few artistic interests") had negative loadings on the extraversion and openness factor respectively. Hence, for the present study, we excluded the three items from the scales. To check the factor structure for the Romanian version of the BFI, we performed confirmatory factor analysis (CFA) with the Maximum Likelihood Robust estimator (MLR; Satorra & Bentler, 1994) in *Mplus* 8.1, results indicating an acceptable fit of the original five-factor structure (John & Srivastava, 1999) to the current data ( $\chi_{SB}^2 = 545.265$ ,  $df = 80$   $p < .001$ , TLI = .803, CFI = .850, RMSEA = .078 [.072-.085], SRMR = .071).

Plaisant, Courtois, Reveillere, Mendelsohn, & John, 2010; Fossati, Borroni, Marchione, & Maffei, 2011).

**Academic achievement.** The self-reported grade point average (i.e., GPA, the mean of the GPAs obtained in all school subjects) was used to assess academic achievement. We asked adolescent students to report their GPA at each measurement point: at Time 1 (i.e., the beginning of the first semester of the academic year 2013-2014) they reported the GPA they achieved in the previous academic year; at Time 2 (i.e., the beginning of the second semester of the academic year 2013-2014), they reported the GPA they achieved in the previous semester of the current academic year; at Time 3 they reported the GPA they achieved in the second semester of the current academic year (i.e., 2013-2014). At the end of the academic year (i.e., 2013-2014) we had access to the official school records and we checked the accuracy of the self-reported GPA. In line with previous evidence (Credé & Kuncel, 2013), we found that self-reported GPA highly correlated with actual GPA ( $r = .95$ ). According to the Romanian grading system, grades range from 1 (minimum) to 10 (maximum). In order to pass from one semester to the next and from one academic year to the next, students must achieve a GPA at least equal or higher than 5.

### **Statistical Analyses**

**Group-level analyses.** The first aim of the present study was to analyze the directionality of effects between academic achievement and personality traits in adolescence at the group-level. To test whether academic achievement drives relative changes in personality traits in adolescents or whether it is the other way around, we conducted a traditional cross-lagged panel model (CLPM). Therefore, by controlling for the temporal stability of all constructs, we examined the extent to which rank-order differences in personality traits can be predicted from adolescents' rank-order variations on academic achievement and the extent to which rank-order differences in

academic achievement can be predicted from adolescents' rank-order variations on personality traits. For example, do adolescents with higher academic achievement compared to their peers also score higher on positive personality traits (e.g., conscientiousness, openness) compared to their peers at a later time? Additionally, we conducted ancillary sensitivity analyses using the latent difference score model (LDS) approach to check for the robustness of CLPM results. The results of LDS analysis replicated the results of CLPM (see the Supplementary Material for more details).

**Within-person analyses.** The second aim of the present study was to analyze the within-person effects of the relations between academic achievement and personality traits. To test whether changes in personality traits occur due to changes in one's own academic achievement levels and if changes in academic achievement levels occur due to changes in one's own personality traits, we conducted a random intercept cross-lagged panel model (RI-CLPM, Hamaker et al., 2015). Therefore, by controlling for the "trait-like stability" (Hamaker et al., 2015) of the constructs, we examined the extent to which changes in personality traits can be predicted from the adolescent's prior deviation from his/ her expected score on academic achievement and the extent to which changes in academic achievement can be predicted from the adolescent's prior deviation from his/her expected score on personality traits. For example, do adolescents whose GPA increased also register increases in positive personality traits (e.g., conscientiousness, openness) over time?

## Results

### Preliminary Analyses

As a preliminary step, longitudinal measurement invariance was tested for the personality measure. Results indicated that configural ( $\chi^2 = 2205.516$ ,  $df = 795$ ,  $CFI = .896$ ,  $RMSEA = .039$ ,

SRMR = .065), metric ( $\chi^2 = 2220.208$ ,  $df = 815$ , CFI = .897, RMSEA = .039, SRMR = .065), and scalar ( $\chi^2 = 2414.425$ ,  $df = 844$ , CFI = .885, RMSEA = .040, SRMR = .067) measurement invariance were established for personality traits across the three waves.

Descriptive statistics, Cronbach Alphas, and correlations among the study variables across the three waves are displayed in Table 1. The effect sizes for all correlations were interpreted according to Cohen's (1988) benchmarks: correlations with values around .10 indicate a "small" effect size, those around .30 indicate a "medium" effect size, and those around .50 indicate a "large" effect size. At all measurement-points, academic achievement (i.e., GPA) showed positive and significant small-to-medium correlations with all positive personality traits (i.e., extraversion, agreeableness, conscientiousness, and openness), while it negatively correlated with neuroticism (i.e., the negative personality trait).

### **Group-Level Cross-Lagged Analyses**

To examine reciprocal longitudinal associations between academic achievement (i.e., GPA) and personality traits (i.e., extraversion, agreeableness, conscientiousness, neuroticism, and openness) we conducted cross-lagged analyses in *Mplus 8.1*. Specifically, we tested for cross-lagged associations between academic achievement and each personality trait (e.g., extraversion measured at Time 1 predicting GPA at Time 2 and GPA at Time 1 predicting extraversion at Time 2), controlling for: (a) 3-to-4 months stability paths (e.g., openness at Time 1 predicting openness at Time 2); (b) 6-to-8 months stability paths (e.g., openness at Time 1 predicting openness at Time 3); and (c) within-time correlations among all the study variables. To evaluate the fit of each model, we analyzed the values of three indicators: the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). The TLI and CFI indicators with values higher than .90 suggest an

acceptable fit, while values higher than .95 suggest an excellent data fit. In addition, the RMSEA indicator with values lower than .08 suggests an acceptable fit, while values less than .05 implies a very good data fit (Byrne, 2012).

To model the reciprocal associations between academic achievement and personality traits as parsimoniously as possible, we tested whether cross-lagged effects and Time 2 – Time 3 within-time correlations (i.e., correlated changes in the cross-lagged framework) between academic achievement and personality traits were time-invariant. Therefore, we compared the baseline unconstrained model (Model 1) with: (a) the model assuming time invariance of cross-lagged associations (Model 2); (b) the model assuming time invariance of Time 2 - Time 3 within-time correlations (Model 3); and (c) the model assuming time invariance of both cross-lagged associations and of Time 2 - Time 3 within-time correlations (Model 4). Table 2 depicts model fit indices and model comparisons. To determine significant differences between these models at least two out of these three criteria had to be matched:  $\Delta\chi_{SB}^2$  significant at  $p < .05$ ,  $\Delta CFI \geq -.010$ , and  $\Delta RMSEA \geq .015$  (Chen, 2007; Cheung & Rensvold, 2002).

As displayed in Table 2, results confirmed the assumptions of time-invariance. Therefore, we retained as the final model the most parsimonious model (Model 4), with time-invariant cross-lagged associations and Time 2 – Time 3 within-time correlations. This model fit the data very well ( $\chi_{SB}^2 = 74.737$ ,  $df = 45$ ,  $CFI = .994$ ,  $TLI = .983$ ,  $RMSEA = .024$  [.014-.033]). Stability paths for all variables are reported in Table 3 and significant cross-lagged paths are presented in Figure 1.

Findings of cross-lagged path analyses revealed bidirectional associations between academic achievement and personality traits across the three waves. GPA had nevertheless more

systematic effects on personality traits than the other way around. Regarding the effects from academic achievement to personality traits, results pointed out that GPA heightened the broad personality traits of extraversion ( $\beta = .06$  [.017, .104],  $p = .006$ ), agreeableness ( $\beta = .05$  [.000, .096],  $p = .049$ ), and openness ( $\beta = .09$  [.049, .146],  $p = .000$ ). Regarding the effects from personality traits to academic achievement, results indicated that openness boosted GPA across time ( $\beta = .04$  [.002, .071],  $p = .038$ ). Though the cross-lagged paths depict small effects, these effects are meaningful when predicting change in longitudinal autoregressive models because, by controlling for stability effects, a significant amount of the variance in the outcome variable is removed (Adachi & Willoughby, 2015). Recent studies employing CLPM and RI-CLPM also depicted small effects for between- and within-person cross-lagged associations (e.g.,  $\beta$  values for between-person cross-lagged associations ranging between .09-.10, Dietvorst, Hiemstra, Hillegers, & Keijsers, 2018;  $\beta$  values for within-person cross-lagged associations ranging between .13-.14, Becht, Nelemans, Branje, Vollebergh, Koot, & Meeus, 2017).

In comparison to their peers, students with higher GPA became more sociable, confident, and amiable (i.e., more extraverted), and more adaptable, pleasant, and truthful (i.e., more agreeable). GPA and openness reinforced each other across the school year. High GPA boosted students' interests and aided their curiosity and imagination. Also, students who approached tasks in a creative and inquisitive manner, and searched for new experiences (i.e., high openness), had increases in GPA compared to their peers.

The results of the moderation analyses for the final CLPM that we retained (Model 4) indicated that this model equally applied to early-to-middle and middle-to-late adolescents ( $\Delta\chi^2(75) = 84.736$ ,  $p = .207$ ,  $\Delta CFI = -.002$ ,  $\Delta RMSEA = -.006$ ) and to boys and girls ( $\Delta\chi^2(75) = 107.527$ ,  $p = .008$ ,  $\Delta CFI = -.006$ ,  $\Delta RMSEA = .002$ ). The total sample comprised early-to-middle

adolescents ( $n = 462$ ,  $M_{age} = 15.04$ ,  $SD_{age} = 0.62$ , age range = 13-15 years) and middle-to-late adolescents ( $n = 689$ ,  $M_{age} = 17.39$ ,  $SD_{age} = 0.89$ , age range = 16-19 years).

### **Within-Person Cross-lagged Analyses**

To capture within-person dynamics of academic achievement and personality traits we conducted random intercept cross-lagged analyses in *Mplus* 8.1. Specifically, we included random intercepts for each construct (i.e., a factor with all loadings constrained to 1) to partial out stable between-person variance (Hamaker et al., 2015). This way, the cross-lagged paths obtained only refer to within-person dynamics. To enhance model parsimony, we tested and compared the unconstrained baseline model (M1) with the other three nested models (M2: model with constrained cross-paths; M3: model with constrained Time 2-Time 3 within-time correlations; M4: model with constrained cross-paths and Time 2-Time 3 within-time correlations). Table 2 presents the fit and model comparison results for each of these models. As the constrained models (M2, M3, M4) were not significantly different from the unconstrained model (M1) according to Chen's (2007) benchmarks, the most parsimonious model (M4) was retained as the final model. Results are presented in Figure 2 and Table 3.

The first part of the model (i.e., the top half of Figure 2) refers to stable between-person associations (i.e., the random intercepts; Becht et al., 2017; Hamaker et al., 2015; Mercer et al., 2017), related to the interplay between GPA, on the one hand, and extraversion, agreeableness, conscientiousness, and openness (i.e., positive personality traits) on the other hand. More precisely, stable high levels of GPA were related with stable high levels of extraversion, agreeableness, conscientiousness, and openness.

The second part of the model (i.e., the bottom half of Figure 2) captures how within-person fluctuations in GPA and personality traits overlap while controlling for between-person

differences (Becht et al., 2017; Hamaker et al., 2015; Mercer et al., 2017). The within-person effects were unidirectional, from GPA to personality traits. The cross-lagged paths that we depicted showed that when an adolescent had previously (e.g., in the previous semester) registered higher levels of GPA, he/she usually had lower levels of neuroticism in the current semester, compared to his/her own expected scores ( $\beta = -.10 [-.267, .142], p = .023$ ). This indicates that GPA may play a protective role against negative emotional reactions to danger, discomfort, or deprivation. Stability of within-person paths for GPA and personality traits are reported in Table 3.

### Discussion

Adolescence is a time-frame when being a student is a major social role. Academic achievement (i.e., GPA) is a core normative academic standard for performance in this role. Research has shown that GPA supports strong educational commitments across time (Pop et al., 2016). In this manner, students can affirm their reputation in a social group (i.e., adherence to group norms and expectations, social comparison with other members of the social group) and gradually define their personal identity (i.e., increasing personal commitment to their education). The present study investigated the reciprocal longitudinal connections between academic achievement and personality traits in adolescence. We tapped into these associations at group and individual level and we underscored distinct patterns of associations for each level. We found that at the group level (i.e., when comparing rank-order differences within the group), GPA drives increases in extraversion, agreeableness, and openness; we found a reciprocal positive association between GPA and openness. At the individual level (i.e., compared to a student's own mean), GPA is linked to decreases in neuroticism across time. The distinct group-level versus within-person associations have important theoretical and applied implications.

**GPA and Personality: Group-level Associations**

At the group level, analyses showed that academic achievement and personality traits support each other during the school year. Most of the effects we depicted were from the academic achievement to personality traits rather than the other way around. Specifically, high levels of GPA were positively associated with increases in adolescents' extraversion, agreeableness, and openness, while only high levels of openness were positively linked to increases in their GPA.

High GPA is an indicator for how well students perform in school compared to their peers, providing validation of their commitment to the student role and of their adherence to normative academic standards for performance. Thus, high achievers were more likely to be adolescents whose investment in the student role was validated by the school, which further enhanced their commitment to this role (Eccles & Roeser, 2011). As the school is a frame of reference for self-evaluation in adolescence (Trautwein et al., 2009), in our study, students' higher GPA compared to the mean GPA of their peers (i.e., group effects) may have fostered their educational commitment, through longitudinal links with positive personality traits. Across time, when compared with their peers, students with higher GPA became more sociable, assertive, and warm (i.e., more extraverted), and more compliant, friendly, and honest with others (i.e., more agreeable). These findings expand existing empirical evidence on how investment in academic normative behaviors (e.g., spending time studying, doing homework; Bleidorn, 2012; Göllner et al., 2017) is linked to personality formation in adolescence.

As expected, GPA and openness reinforced each other throughout the school year. On the one hand, high GPA widened students' interests and contributed to the increase of their curiosity and imagination. In the current study, GPA incorporated the results that students obtained in all

subjects in school (from science and languages, to arts). Therefore, the better they performed in all subjects compared to their peers (i.e., the more they invested in diverse school activities), the more interested they became to explore a wide range of aspects. On the other hand, students who were more curious, who approached tasks in a creative way, and steadily looked for new experiences (i.e., high openness), showed increases in their GPA compared to their peers. First, this bidirectional relation may be explained by the fact that GPA and openness are linked to participants' intelligence coefficient (IQ). Recent meta-analytic work indicated a high correlation between GPA and IQ ( $r = .54$ , Roth et al., 2015) and empirical studies demonstrated that openness to experiences is linked to IQ (e.g., Gignac, Stough, & Loukomitis, 2004). Second, the bidirectional association could also be explained in terms of the complexity and efficacy of learning strategies used by students high in openness. Previous studies revealed that these students are more likely to use deep-level learning strategies, which appeal to understanding, critical thinking regarding learning contents, and applying knowledge (Bidjerano & Dai, 2007; Spengler et al., 2013; Vermetten et al., 2001). In line with previous studies (Noftle & Robins, 2007; Smrtnik Vitulić & Zupančič, 2013; Spengler et al., 2013), this finding supports the positive role of openness for academic achievement.

In conclusion, at the group-level our findings support the idea that socialization effects may prevail over selection effects in the interplay between GPA and personality traits in adolescence. More precisely, achievement of normative standards for academic performance (i.e., high GPA versus low GPA) played a greater role in personality formation than personality traits had on students' GPA. These results bring proof that in adolescence “what you do” influences “who you are”.

### **GPA and Personality: A Protective Relation at the Within-Person Level**

The within-person analysis showed that adolescents whose GPA increased across time compared to their own average, reported decreases in neuroticism at the end of the school year. This unidirectional relation indicates that at the within-person level, GPA may act as a protective mechanism against irritability, hostility, anger, sadness, which are core components of this personality trait (McCrae & Costa, 2003). This finding may bring forward the role of increases in GPA compared to one's previous GPA as a form of positive feedback for performing in the student role. More specifically, it can indicate to a student that his/her performance in the student role is meaningful and worth investing in and he/she may feel less distressed in school. When students see that their GPA increased compared to their previous GPA (i.e., be it from a 7 to an 8 or from a 5 to a 6), they may reduce their negative emotional reaction to danger or frustration, compared to their own previous negative emotional reactions. This within-person decrease in neuroticism prompted by within-person increases in GPA indicates a different direction of associations compared to those found in previous, though mostly cross-sectional studies (e.g., Chamorro-Premuzic & Furnham, 2003). In previous studies GPA was mostly investigated as an outcome variable, while in our study the depicted relation is from GPA to neuroticism. It may be that in a RI-CLM framework these associations are more dynamic, as they are informed by previous values on the same construct at the within-person level (e.g., the level of neuroticism at Time 3 is compared to the same person's GPA at Time 2 and Time 1).

### **Social Comparison at Group versus Within-Person Level: Why Does GPA Drive Personality Formation in Adolescence?**

It is interesting to note that when separating within- from group-level effects, the pattern of reciprocal longitudinal relations changed and the sole relation that attained statistical significance was different from the relations we depicted for the group-level analyses. Recent

research underscored the importance of focusing on within-person effects in longitudinal cross-lagged models, to better depict how they work at the individual level and hence to increase the value of cross-lagged panel models for applied interventions (e.g., Hamaker et al., 2015). Some recent studies found similar associations at the group and within-person levels (e.g., Mercer et al., 2017), while others depicted opposite relations (e.g., Dietvorst et al., 2018). The distinct pattern of associations that we found in our study for the two levels of analysis tends to indicate that the dynamic of relations between GPA and personality is different at the group versus the individual level.

At group level (i.e., the student is compared to the mean of the group for that construct at each time-point), we depicted positive longitudinal associations from GPA to extraversion and agreeableness and a positive reciprocal relation between GPA and openness. It may be that group-level associations better reflect the role of the school context as a frame of reference for academic achievement (Marsh et al., 2018; Trautwein et al., 2009). Social comparison works at the group-level and, hence, GPA may be a driving force in constructing one's reputation in the school social group, as students compare themselves to and are appraised by others (e.g., teachers, classmates, parents) thorough this normative standard of achievement.

At the person-level (i.e., the student is compared to his/her own average score on the construct) we depicted only one significant negative association, from GPA to neuroticism. This indicates that students' increases in GPA (compared to their own previous average GPA) may lessen their neuroticism across time, bringing forward the protective role of GPA against negative emotional reactions to danger, discomfort, or deprivation. The fact that we found only one significant association at the within-level may suggest that changes in a student's GPA compared to his/her previous GPA is not as informative for self-development as a change

compared to the mean GPA of his/her peers. It may be that in itself, a change in an adolescent's GPA does not have a strong self-regulatory role, but that GPA is mostly valuable for personality formation when it reflects the student's position or standing in the school context. This finding is in line with existing work on social comparison in educational contexts (e.g., Trautwein et al., 2009).

### **Strengths, Limitations, and Suggestions for Future Research**

Our study tested for the first time the reciprocal longitudinal associations between GPA and personality in adolescence, at group and within-person level. The distinct pattern of relations that emerged at each level of analysis needs to be analyzed in future studies. We propose two directions to further investigate this relation more in-depth.

First, in this study, in line with existing research, we used students' GPA as a measure of their academic achievement (e.g., Poropat, 2009). Future studies could consider the multidimensionality of academic achievement, using also other measures, like standardized tests, grades for specific school subjects, or individualized assessments made by teachers and colleagues. By employing multiple measures, we could gain a more comprehensive understanding of adolescent academic achievement. The school context is a very complex and dynamic social environment and each dimension of academic achievement might capture specific aspects of a student's performance. For instance, in analyzing group versus within-person associations of academic achievement and personality, it is important to find out which measure is more sensitive to group versus person level changes. Do grades or standardized tests (or both) foster and in turn are fostered by specific personality traits when we look at the student group mean or at a student's own previous mean score on these variables?

Second, further expanding on the prior point, in our study we examined the school context solely looking at academic performance. Future studies could integrate core non-cognitive variables that are linked to academic achievement and that contribute to adolescent functioning in school. For instance, motivational constructs like academic self-concept and interest for specific school subjects can contribute to the way students engage in school tasks and consequently to the grades they get (e.g., Marsh & O'Mara, 2008; Marsh et al., 2018). A student who perceives his/her activities and performance in school as successful and who likes specific school subjects could become more engaged in school tasks and receive better grades. His/her personality traits would then model and in turn be modeled by this stance on school, promoting the strengthening of traits that are valued by this social context (Spengler et al., 2013). Also, the type of achievement goals that students endorse may mediate the relation between GPA and personality traits. Previous studies on university students (i.e., Corker, Oswald, & Donnellan, 2012) indicate that mastery approach goals play a key role in boosting the longitudinal relation between personality traits (i.e., conscientiousness) and academic achievement. Future studies could also integrate peer-reported information on these indicators of school adaptation, in order to better depict the multidimensionality of the relation between GPA and personality in the school social context.

### **Conclusions**

The present study shed more light on how GPA works as a frame of reference for self-development in adolescence, especially through mechanisms of social comparison, driving changes in personality traits. More specifically, we examined how GPA is related to personality traits (i.e., extraversion, agreeableness, conscientiousness, neuroticism, and openness) among adolescents during one school year. Adolescents who achieved higher GPA compared to their

peers, were more likely to become more extraverted, agreeable, and open to new experiences by the end of the school year. Being more open to experiences compared to their peers, helped adolescents to achieve higher GPA. Moreover, when adolescents outperformed their own previous achievements (i.e., they had higher GPA than they did before), they were more likely to become less neurotic as the end of the school year approached. These results indicate that GPA has a stronger role in personality formation when it reflects students' position or standing in the school context compared to their peers (i.e., group effects) and to a lesser extent when it reflects a change at the personal level (i.e., within-person effects).

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Table 1

*Reliabilities, Descriptive Statistics, and Correlations between Academic Achievement (GPA) and Personality Traits*

	Reliabilities $\alpha$	Descriptives $M(SD)$	GPA		
			T1	T2	T3
<i>Personality traits</i>					
Extraversion T1	.64	3.58 (0.63)	.18***	.17***	.13***
Extraversion T2	.69	3.60 (0.64)	.19***	.17***	.14***
Extraversion T3	.66	3.56 (0.64)	.20***	.18***	.19***
Agreeableness T1	.65	3.83 (0.55)	.23***	.22***	.18***
Agreeableness T2	.68	3.75 (0.56)	.18***	.19***	.16***
Agreeableness T3	.68	3.64 (0.60)	.19***	.19***	.20***
Conscientiousness T1	.70	3.49 (0.60)	.14***	.13***	.11***
Conscientiousness T2	.71	3.47 (0.59)	.11***	.13***	.14***
Conscientiousness T3	.67	3.41 (0.57)	.14***	.15***	.17***
Neuroticism T1	.68	2.64 (0.64)	-.03	-.02	-.02
Neuroticism T2	.70	2.71 (0.64)	-.01	-.01	-.01

Neuroticism T3	.66	2.78 (0.64)	-.06*	-.10***	-.09**
Openness T1	.77	3.43 (0.68)	.20***	.22***	.19***
Openness T2	.79	3.49 (0.69)	.27***	.30***	.26***
Openness T3	.78	3.41 (0.56)	.21***	.23***	.22***
<i>M (SD)</i>			8.48 (0.98)	8.39 (1.05)	8.44 (1.13)

*Note.* GPA = Grade Point Average; T1 = Time 1, T2 = Time 2, T3 = Time 3;  $\alpha$  = Cronbach's Alpha; M = Mean; SD = Standard Deviation; \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

Table 2

*Between- and Within-Person Cross-Lagged Panel Models (CLPM): Fit Indices and Model Comparisons*

Models	Model fit indices					Model comparison					
	$\chi_{SB}^2$	df	TLI	CFI	RMSEA [90% CI]	Models	$\Delta\chi_{SB}^2$	$\Delta df$	p	$\Delta CFI$	$\Delta RMSEA$ A
<i>Between-Person CLPM</i>											
M1: Baseline model	54.46 4	30	.979	.995	.027 [.015- .038]						
M2: Model with time-invariant cross-lagged paths	69.54 9	40	.981	.994	.025 [.015- .035]	M2- M1	14.92 1	10	.135	-.001	-.002
M3: Model with time-invariant T2-T3 within-time correlations	59.74 5	35	.982	.995	.025 [.013- .035]	M3- M1	5.359	5	.374	.000	-.002
M4: M2+M3	74.73 7	45	.983	.994	.024 [.014- .033]	M4- M1	20.05 8	15	.170	-.001	-.003
<i>Within-Person CLPM</i>											
M1: Baseline model	16.85 2	15	.997	1	.010 [.000- .031]						
M2: Model with time-invariant cross-lagged paths	33.77 0	25	.991	.999	.017 [.000- .031]	M2- M1	17.24 9	10	.069	-.001	.007
M3: Model with time-invariant T2-T3 within-time correlations	19.76 9	19	.999	1	.006 [.000- .027]	M3- M1	2.757	4	.599	.000	-.004
M4: M2+M3	40.32 5	29	.990	.998	.018 [.000- .031]	M4- M1	24.90 4	14	.036	-.002	.008

Note.  $\chi^2$  = Chi-Square; df = degrees of freedom; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation and 90% Confidence Interval;  $\Delta$  = change in parameter.  $\Delta\chi_{SB}^2$  model comparisons are based on Satorra and Bentler's (2001) scaled difference chi-square test statistic.

Table 3

*Stability Paths and Correlated Change for Academic Achievement (GPA) and Personality Traits*

	Stability paths		Correlated change	
	T1-T2	T2-T3	T2	T3
<i>Between-person CLPM</i>				
GPA	.90***	.82***	GPA	
Extraversion	.65***	.60***	.02	.02
Agreeableness	.60***	.60***	.08*	.06*
Conscientiousness	.64***	.63***	.08*	.07*
Neuroticism	.61***	.60***	-.03	-.03
Openness	.64***	.60***	.09*	.08*
<i>Within-person CLPM</i>				
GPA	-.08	.23	GPA	
Extraversion	.11	.06	.02	.02
Agreeableness	.26*	.31***	.10	.06
Conscientiousness	.18*	.16	.13	.09*
Neuroticism	.14	.11	-.05	-.04
Openness	.32***	-.01*	.22*	.08

*Note.* T = Time, GPA = Grade Point Average; \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

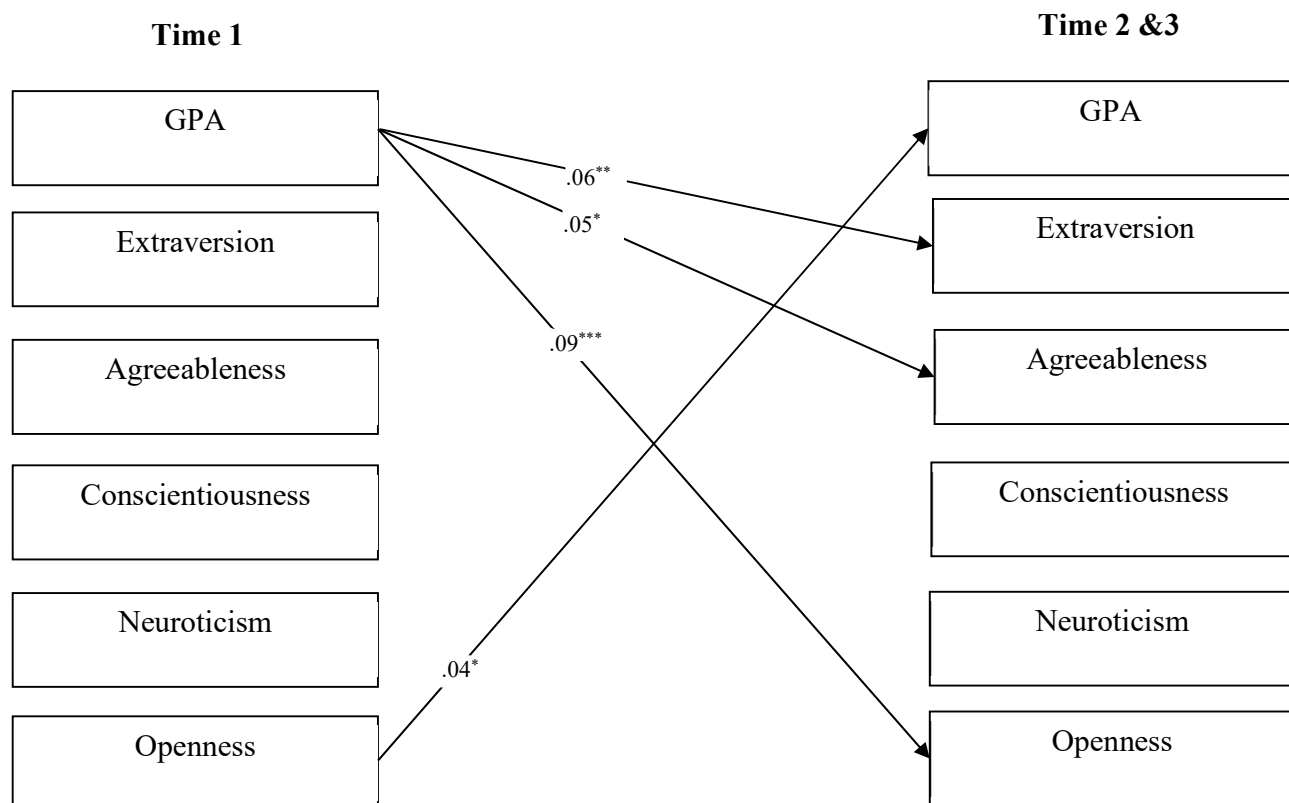


Figure 1. Significant standardized cross-lagged paths between GPA and personality traits. As we retained the model with time-invariant coefficients as the final one (Model 4), we only report two time-points and the cross-lagged paths are the average of the standardized coefficients. GPA = Grade Point Average;  $^*p < .05$ ,  $^{**}p < .01$ ,  $^{***}p < .001$ .

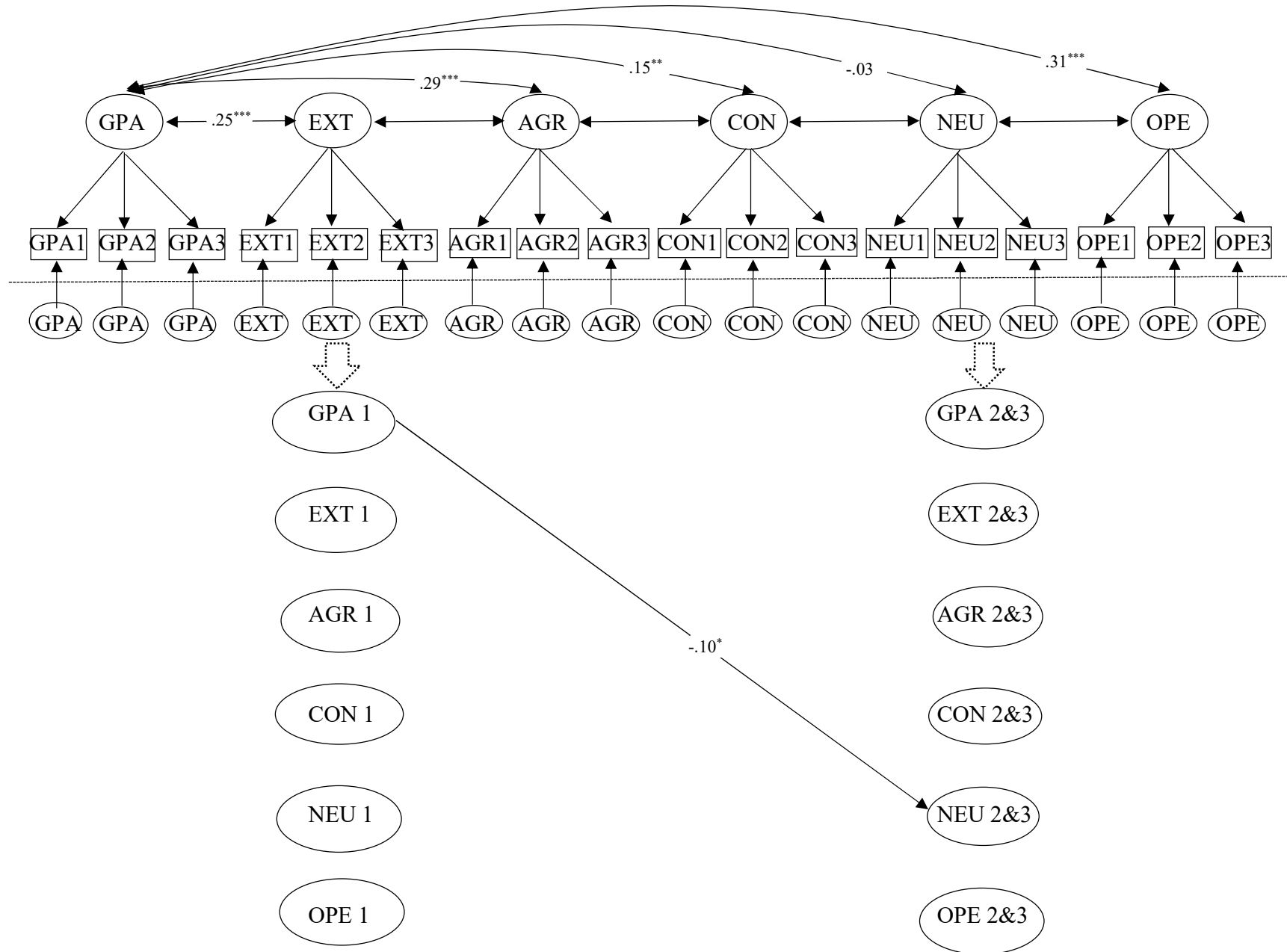


Figure 2. Standardized within-person cross-lagged paths between GPA and personality traits (Model 4). As this model has time-invariant coefficients, we only report two time-points. The cross-lagged paths are the average of the standardized coefficients. GPA= Grade Point Average, EXT= extraversion, AGR= agreeableness, CON= conscientiousness, NEU= neuroticism, OPE= openness; \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .