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PERSONALITY TRAITS PREDICT THE  
DEVELOPMENTAL COURSE OF EXTERNALIZING:  
A FOUR-WAVE LONGITUDINAL STUDY  
SPANNING AGE 17 TO AGE 29

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Personality Traits Predict the Developmental Course of Externalizing:

A Four-wave Longitudinal Study Spanning Age 17 to Age 29

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**Abstract**

**Objective:** The objective of the present study was to determine whether and how personality predicts the developmental course of externalizing problems, including antisocial behavior and substance dependence.

**Method:** In a large population-based longitudinal study ( $N=1252$ ), the 11 personality traits assessed by the Multidimensional Personality Questionnaire were measured at age 17, and DSM diagnoses of adult antisocial behavior, alcohol dependence, and drug dependence were obtained at ages 17, 20, 24, and 29. We fit a quadratic multiple indicator latent growth model where the three diagnoses loaded onto an externalizing factor.

**Results:** This model fit the data well, and externalizing increased until it started to decline at age 24. High aggression and low control were the most significant predictors of the development of externalizing, with aggression playing a significant role in the development of externalizing across the 12-year time span, and control predicting the development from age 17 to 24.

**Conclusions:** The findings highlight the importance of considering the developmental course of externalizing in the context of personality and suggest that the specific personality traits of aggression and control might be targeted in externalizing prevention and intervention programs.

**Keywords:** externalizing; externalizing development; Multidimensional Personality Questionnaire

**Personality Traits Predict the Developmental Course of Externalizing:  
A Four-wave Longitudinal Study Spanning Age 17 to Age 29**

Due to their prevalence and host of associated negative outcomes, it is important to understand predictors of antisocial behavior and substance use and their development. According to a recent survey of a large, nationally representative sample of adults, antisocial personality disorder has a prevalence rate of 3.6% in the general population (Compton, Conway, Stinson, Colliver, & Grant, 2005). More than 12% of the population exhibit adult antisocial behavior (i.e., they meet all criteria for antisocial personality disorder except showing evidence of childhood conduct disorder), and the prevalence rates for any alcohol use disorder and drug use disorder reach 30.3% and 10.3%, respectively. Furthermore, these disorders often co-occur (e.g., Regier et al., 1990). Deleterious associations with these disorders include lower education and income attainment, increased likelihood for divorce, comorbidity with other types of psychopathology, and increased self-reported criminal participation, including violent offenses, as well as court convictions (Compton et al., 2005; Kessler et al., 1996; Moffitt, Caspi, Harrington, & Milne, 2002).

While research has established a connection between personality, antisocial behavior, and substance use disorders, less is known about how personality is related to the developmental course of these disorders. In the current study, we consider antisocial behavior and substance use disorders as part of a common externalizing (EXT) spectrum. We focus specifically on the development of this spectrum from late adolescence through early adulthood and examine whether and how personality predicts this development.

**Antisocial Personality and Substance Use Disorders: Components of an Externalizing Spectrum**

There is mounting support for an EXT spectrum, which comprises antisocial personality disorder and substance use disorder. Supporting evidence includes, but is not limited to, systematic patterns of comorbidity among disorders, shared genetic risk factors, shared neural substrates, and quantitative modeling of EXT disorders. Antisocial personality and substance abuse tend to co-occur with unusually high frequency (Agosti, Nunes, & Levin, 2002; Ball, Tennen, Poling, Kranzler, & Rounsaville, 1997; Kidorf et al., 2004; Morgenstern, Langenbucher, Labouvie, & Miller, 1997; Rodríguez-Llera et al., 2006). For example, in one epidemiological study, the prevalence rate of substance abuse or dependence exceeded 83% in individuals with antisocial personality disorder (Regier et al., 1990). In addition, a common genetic risk factor has been found to underlie adult antisocial behavior, conduct disorder, and substance dependence (Kendler et al., 2003; Krueger et al., 2002), and neural systems related to behavioral disinhibition are connected with multiple disorders within the spectrum (Perry et al., 2011; Raine, Lencz, Bihrlé, LaCasse, & Colletti, 2000). Quantitative modeling also supports an EXT spectrum. Factor analytic studies show that conduct problems, antisocial behavior, and substance dependence problems load onto a common externalizing factor (Forbush & Watson, 2013; Kotov et al., 2011; Markon, 2011). In addition, there are several studies in which categorical models (where alcohol dependence, drug dependence, and antisocial personality disorder, for example, are categorically distinct from one another) are directly compared with dimensional models (where the disorders are elements of a single spectrum). This direct comparison has been made in at least five studies of adolescent and/or adult samples, focusing on either self- and other-reports of delinquent and aggressive behaviors or formal psychiatric diagnoses. In each study, dimensional models fit the data better than categorical models, indicating that symptoms of these disorders form a coherent EXT spectrum (Alamansa et al., 2011; Krueger, Markon, Patrick, &

Iacono, 2005; Markon & Krueger, 2005; Vrieze, Perlman, Krueger, & Iacono, 2012; Walton, Ormel, & Krueger, 2011). Indeed, the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) has a new organizational structure that reflects spectra of related disorders (pp. 12-13), one of which is the EXT spectrum, encompassing disorders with impulsive, disruptive conduct, and substance use symptoms. In the current study, we specifically focus on adult manifestations of this spectrum: antisocial behavior and substance use disorders.

### **Cross-sectional and Longitudinal Connections between Externalizing Disorders and Personality**

Research suggests that certain personality traits are associated with increased likelihood of having antisocial personality disorder and substance use disorders as the result of a shared genetic liability (Iacono, Malone, & McGue, 2008; Krueger et al., 2002; discussed in more detail below). Three meta-analyses revealed that low agreeableness and low conscientiousness are prominent features of antisocial personality disorder (Ruiz, Pincus, & Schinka, 2008; Samuel & Widiger, 2008; Saulsman & Page, 2004). While the broad traits of neuroticism and extraversion show near zero (extraversion) or modest (neuroticism) relationships with antisocial personality disorder, extraversion's excitement seeking facet and neuroticism's hostility and impulsivity facets show moderate relationships with the disorder (Ruiz et al., 2008; Samuel & Widiger, 2008), highlighting the importance of examining specific personality facets. In terms of substance use disorders, meta-analytic findings suggest that low conscientiousness and high neuroticism are characteristic of individuals with these disorders (Kotov, Gamez, Schmidt, & Watson, 2010; Ruiz et al., 2008), as are low agreeableness (Ruiz et al., 2008) and constraint (Kotov et al., 2010). Moving beyond individual diagnoses, in two cross-sectional studies,

Krueger and colleagues examined the correlations between personality traits and an EXT factor, consisting of adult antisocial behavior (all symptoms of antisocial personality disorder except having conduct disorder diagnosis) alcohol dependence, cannabis dependence, and (other) drug dependence diagnoses. EXT was distinguished by low constraint (Krueger, McGue, & Iacono, 2001). In a second study, Krueger and colleagues (2002) reported good fit of a model in which constraint was included as a component of an EXT factor along with adult antisocial behavior, conduct, alcohol dependence, and drug dependence diagnoses.

Not only are there predictable patterns of relationships between personality and EXT disorders contemporaneously, but personality traits have been shown to predict future EXT diagnoses as well. Characteristics observed as early as toddlerhood can predict behavior in early adulthood. Indeed, inhibited and under-controlled three-year-old children show an increased risk for alcohol-related problems at age 21, and under-controlled children are also more likely to meet diagnostic criteria for antisocial personality disorder at age 21 (Caspi, Moffitt, Newman, & Silva, 1996). High novelty seeking and low harm avoidance at age 11 predict alcohol abuse in young adults aged 27 (Cloninger, Sigvardsson, & Bohman, 1988). High negative emotionality and low constraint observed in late adolescence have been shown to predict antisocial personality disorder (Krueger, 1999) and alcohol and drug dependence disorders during early adulthood, roughly three years later (Elkins, King, McGue, & Iacono, 2006), whereas high novelty seeking and psychoticism at age 18 predict diagnoses of drug and alcohol dependence, respectively, seven years later (Sher, Bartholow, & Wood, 2000).

As seen above, the relationships between EXT and a varied assortment of personality traits, most often traits at the broad domain level, have been cited in the literature. These seemingly distinct traits are known to relate to one another in a hierarchical fashion (John,

Naumann, & Soto, 2008; Markon, Krueger, & Watson, 2005). We can summarize the above findings using the framework of Tellegen's Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 2008), which was used in the current study. The MPQ consists of 11 scales that are often organized into three broad domains, positive emotionality, negative emotionality, and constraint. As reviewed above, from the Big Five model, low agreeableness and low conscientiousness are consistently linked with EXT, as is high neuroticism, though to a lesser degree (Kotov et al, 2010; Ruiz et al., 2008; Samuel & Widiger 2008; Saulsman & Page, 2004). From Tellegen's model, constraint and negative emotionality are also consistently linked with EXT (Elkins et al., 2006; Krueger, 1999; Krueger et al., 2001; Krueger et al., 2002; Ruiz et al., 2008). This makes sense given the association between these Big Five factors and constraint and negative emotionality (Markon et al., 2005). The MPQ constraint scales of control and traditionalism load on conscientiousness. The MPQ constraint scale of harm avoidance joins the MPQ negative emotionality scales of aggression and alienation, loading on agreeableness. The final negative emotionality scale, stress reaction, is the best marker of neuroticism from the MPQ. Aside from the Big Five model, other specific scales that show associations with EXT can be aligned with an MPQ counterpart as well. These include novelty seeking (Cloninger et al., 1988; Sher et al., 2000) and harm avoidance (Cloninger et al., 1998), which relate to MPQ constraint.

### **The Developmental Course of Externalizing Disorders: Does Personality Play a Role?**

To be sure, links between EXT disorders, namely antisocial personality disorder and substance use disorders, and particular personality traits are well-established. Not only are EXT disorders and personality linked in cross-sectional studies (for reviews, see Kotov et al., 2010; Ruiz et al., 2008; Samuel & Widiger, 2008; Saulsman & Page, 2004), but personality can predict



future onset of EXT disorder diagnoses (Caspi et al. 1996; Cloninger et al., 1988; Elkins et al., 2006; Krueger, 1999; Sher et al., 2000). Yet the development of a disorder involves more than just onset, and the developmental course is also of interest. That is, what happens after the onset of the disorder? Does it worsen, persist, or desist? There is a ubiquitous finding concerning the normative developmental course of EXT behaviors; they tend to increase until early adulthood, at which point they peak then begin to rapidly decline, following what is commonly referred to as the age-crime curve (Hirschi & Gottfredson, 1983). For example, using the same data set employed in the current study, Burt and colleagues documented an increase in antisocial personality disorder symptoms from age 17 to 20, followed by a plateau for women and a decrease for men until age 24 (Burt, McGue, Carter, & Iacono, 2007). Vrieze and colleagues noted a similar trend for substance dependence symptoms in this data set (Vrieze, Hicks, Iacono, & McGue, 2012).

While there is a general consensus that the normative developmental pattern of EXT disorders generally follows an inverted-U shaped trajectory, peaking in early adulthood, and that personality traits such as low constraint and high negative emotionality predict the onset of these disorders, less is known about whether personality plays a role in influencing the developmental trajectory beyond the onset. To our knowledge, there are no such studies of this nature investigating DSM diagnoses of antisocial personality disorder or substance use disorders. There are, however, studies examining whether childhood temperament and personality predict the developmental course of EXT problems such as aggression and delinquency during childhood (Leve, Kim, & Pears, 2005; Miner & Clarke-Stewart, 2008; Owens & Shaw, 2003; Prinzie, Onghena, & Hellinck, 2005). For example, in one cohort-sequential study of children aged 4 through 9 years, EXT problems decreased over time (Prinzie et al., 2005). Benevolence had a

negative effect on the intercept, indicating that high benevolence was related to lower initial levels of EXT. Emotional stability had a positive effect on the slope, indicating that emotionally stable children showed a faster decrease in EXT behaviors. In a second study, the influence of impulsivity and fear/shyness at age 5 on the development of EXT problems through age 17 was examined (Leve et al., 2005). A linear decrease in EXT during this time was observed.

Impulsivity and fear/shyness had significant effects on the intercept, which reflected the level of EXT at age 17 (due to centering the intercept factor at age 17). Higher impulsivity and lower fear/shyness were associated with higher EXT at age 17. Impulsivity had a positive effect on the slope, indicating that children with greater impulsivity decreased at a faster rate, and fear/shyness had a negative effect, indicating that children with high fear/shyness decreased at a slower rate.

It is important to supplement these studies to examine the extent to which personality continues to impact the development of EXT later in life, particularly from late adolescence into early adulthood when EXT behaviors exhibit a great deal of change. It is also important to determine whether personality can predict the developmental course of EXT when EXT is defined by manifest psychiatric disorders rather than behaviors assessed by means of checklists. Moreover, it is valuable to examine which specific personality facets predict this developmental course, rather than examining broad domains such as the Big Five. We aimed to fill these gaps in the literature with the current study.

### **Current Study**

The objective of the current study was to determine whether and how specific personality traits measured by the MPQ predict the developmental trajectory of DSM EXT diagnoses, specifically, adult antisocial behavior, alcohol dependence disorder, and drug dependence

disorder. We accomplished this using a large and unique data set assessing personality during late adolescence (age 17) and tracking DSM diagnoses at four time points from age 17, through early adulthood, until age 29. Given prior findings that EXT shows significant change during this time (Burt et al., 2007; Hirschi & Gottfredson, 1983; Vrieze et al., 2012), this is a critical developmental period to study. We considered the three diagnoses as part of a common EXT factor and modeled its development over time, then inspected whether and how late adolescent personality predicts the EXT factor's developmental course. Given prior findings, we expect high aggression and low control to be most strongly related to the development of EXT, followed by high stress reaction to a lesser degree.

## Method

### Participants

The original intake sample consisted of 1252 individuals (674 females and 578 males) from 626 reared-together, same-sex twin pairs participating in the Minnesota Twin Family Study (MTFS), a prospective study designed to identify genetic and environmental factors that influence the development of substance abuse and related psychopathology in a population-based sample. For more information on the MTFS design and recruitment procedures, see Iacono, Carlson, Taylor, Elkins, and McGue (1999), or Iacono and McGue (2002). Data from the 17-year-old twin cohort were used in the present report. Four waves of assessment were carried out at target ages of 17, 20, 24, and 29 years of age. Actual mean ages at each wave were 17.48 ( $SD = .46$ ), 20.67 ( $SD = .57$ ), 24.70 ( $SD = .97$ ), and 29.62 ( $SD = .61$ ) years, respectively.

Participants with complete data for the full clinical assessment described below included 1111 individuals (88.7%) at age 20, 1117 (89.2%) at age 24, and 1168 (93.3%) at age 29. We

compared the age 17 diagnoses of individuals who missed all follow-up assessments with those who attended some or all follow-ups. There was a significant relationship for drug dependence only ( $r_{\phi} = .08$ ); individuals who did not return for any follow-up assessments were more likely to be diagnosed with drug dependence at age 17 than those who did return for some or all follow-ups. Notably, however, only 1.8% of the sample did not complete at least one follow-up, and there were no significant differences between those who missed at least one follow-up and those who attended all follow-ups. We also compared the age 17 broad personality traits (discussed below) of individuals who missed all follow-up assessments with those who attended some or all follow-ups. Individuals who did not return for any follow-up assessments were not significantly different in terms of the personality factors of positive emotionality, negative emotionality, or constraint at age 17 than those who did return for some or all follow-ups. Individuals who missed at least one follow-up assessment had significantly lower positive emotionality ( $d = .23$ ) and constraint ( $d = .27$ ) at age 17 than those who were present for all follow-up waves of assessment.

The sample is broadly representative of the population of Minnesota based on 1990 US Census demographic data for families with children living at home (Holdcraft & Iacono, 2004). Consistent with Minnesota demographics for the birth years sampled, 97% were Caucasian. Iacono et al. (1999) found only minimal differences between participants and non-participants on socioeconomic indicators and no differences in self-reported rates of parental psychopathology. Moreover, twins are neither systematically different in personality (Johnson, Krueger, Bouchard, & McGue, 2002) nor in rates of psychopathology (Kendler, Martin, Heath, & Eaves, 1995) from singletons.

## **Measures and Procedure**

**DSM Diagnoses.** During their visits, twins were interviewed separately by different interviewers, each of whom had a B.A. or M.A. in psychology and went through extensive training. Twins were assessed for alcohol and drug dependence (i.e., cannabis, amphetamines, cocaine, hallucinogens, inhalants, opiates, PCP, tranquilizers, or sedatives) using a modified version of the expanded Substance Abuse Module of the Composite International Diagnostic Interview (CIDI; Robins et al., 1988) and for adult antisocial behavior (i.e., Criterion C symptoms of antisocial personality disorder) with the Structured Clinical Interview for DSM-III-R Personality Disorders (SCID-II; Spitzer, Williams, Gibbon, & First, 1990). Diagnoses were based on DSM-III-R criteria (the diagnostic system in use when MTFS intake began; American Psychiatric Association, 1987) to maintain continuity across the four assessments. Age 17 intake diagnoses were based on a lifetime assessment (with the exception of adult antisocial behavior symptoms, which by definition are assessed since the age of 15 only), whereas diagnoses at follow-ups (ages 20 and beyond) were based on symptoms occurring in the interval since the preceding assessment.

Symptom presence was determined by consensus of two individuals with advanced clinical training (supervised by a Ph.D. clinical psychologist), who reviewed examples of each symptom, including frequency and severity. Diagnoses of adult antisocial behavior (AAB), alcohol dependence (AD), and drug dependence (DD) were then assigned. Reliability of the consensus substance disorder diagnoses was .92 or greater (Iacono et al., 1999). Although AAB is not a separate DSM diagnosis (i.e., antisocial personality disorder additionally requires conduct disorder before age 15), if four symptoms are used to define a diagnosis of AAB, the reliability of the consensus diagnosis was .78 or greater.

**Multidimensional Personality Questionnaire.** At age 17, the twins completed the self-report 198-item version of the Multidimensional Personality Questionnaire (MPQ; Tellegen & Waller, 2008). The MPQ consists of 11 scales including well-being, social potency, achievement, social closeness, stress reaction, alienation, aggression, control, harm avoidance, traditionalism, and absorption.<sup>1</sup>

### **Statistical Analyses**

Latent growth models (LGM) were fit where systematic within-person change is modeled as a function of growth curve parameters (i.e., intercept, linear slope, and quadratic slope). Each individual is assumed to have his or her own unique set of growth curve parameters, and ultimately the mean and variance of these parameters across individuals is estimated, thus providing a coherent representation of the pattern of change over time. We fit quadratic models to account for the non-linear trajectory that externalizing diagnoses and behaviors tend to follow (Burt et al., 2007; Vrieze et al., 2012). The time scores of the slope factor were fixed to 0, 3.19, 7.22, and 12.14 to take into account the unequal intervals between waves of assessment.

While it is typical to study a single behavior or disorder with a basic LGM, an extension of that model involving multiple indicators of a single latent trait can provide us the means to determine the extent to which the development of several disorders is interrelated (McArdle, 1988; Stoel, van Den Wittenboer, & Hox, 2003). Therefore, we fit a multiple indicator growth model, a higher order factor model where the growth curve parameters are second-order factors. The four first-order factors, which account for the covariance among the separate diagnoses (i.e., AAB, AD, and DD diagnoses) at each time point, were age 17, 20, 24, and 29 EXT. Such

multiple indicator growth models require measurement invariance of the factor indicators' loadings and thresholds across time (Muthén & Muthén, 2012).

After fitting an unconditional LGM to evaluate the developmental pattern of EXT, we fit a conditional LGM, regressing the growth parameters on the personality traits to assess the extent to which personality accounts for individual differences in the developmental course of EXT. We included gender as a covariate to control for any effect of gender on development (Burt et al., 2007; Vrieze et al., 2012).<sup>2</sup> Our primary goal was to understand the role of age 17 personality in the developmental course of EXT so we interpreted the effect of the personality traits on the growth factors. However, the linear slope and quadratic factors are confounded to some extent, rendering separate interpretations of the effects of covariates on these factors difficult. Therefore, to further facilitate our understanding of the effects of the covariates at each time point, we recentered the time scores at each wave and focused our interpretation on the intercept at that wave. That is, time is typically centered at the first wave of assessment by fixing its factor loading on the latent trajectory to 0. In a simple case where the time intervals are evenly spaced, the factor loadings for a linear slope would be 0, 1, 2, and 3 for a four-wave study. One can recenter at any time point by changing these factor loadings. For example, if one were to fix the factor loadings to -1, 0, 1, and 2, the centering point would now be the second wave of assessment. The intercept would now be defined at that age, and the influence of covariates at that age could now be interpreted. Specifically, the intercept “factor is interpreted as the level of the growth process at that time point” (Muthén, 2000, p. 121). The regression coefficients for the intercept at each time point are not the same as an ordinary regression, regressing the intercept at each time point on the personality traits; instead growth modeling “considers the intercept factor as the more fundamental dependent variable given that it

represents the systematic part of the developmental trajectory” (p. 120). In the current study, we centered the model at each of the four time points and interpreted the effect of covariates on the intercept at each time point. As these four models are reparameterizations of one another, the model fit remains the same regardless of the centering point. This strategy is statistically advantageous as it leads to a more powerful analysis and is commonly adopted to circumvent the problem of attempting to interpret the effects of covariates on confounded growth factors (Audrain-McGovern et al., 2004; Biesanz, Deeb-Sossa, Papadakis, Bollen, & Curran, 2004; Bradshaw, Koth, Thornton, & Leaf, 2009; Muthén, 2000; Muthén & Muthén, 2000).

Models were fit using Mplus Version 7 (Muthén & Muthén, 2012) with a robust weighted least squares estimator and theta parameterization. To account for the nonindependence of the twins’ diagnoses, we used the complex option of the analysis command, which corrects the standard errors and chi-square test of model fit. We considered several fit statistics when evaluating the models including CFI, TLI, and RMSEA. CFI and TLI values exceeding .95 and RMSEA values below .05 were considered indicative of good fit. All significance tests are reported at the  $p < .05$  level.

## Results

### Descriptive Statistics and Correlations

Descriptive statistics and correlations are presented in Table 1. For each of the three diagnoses, the prevalence rates increased from age 17 to age 20 when they peaked. Thereafter, they decreased slightly from age 20 to 24 then decreased more rapidly to age 29. Despite these mean-level changes, there was substantial rank order stability within diagnoses. The average phi



correlation across time for antisocial behavior diagnoses was .65. Average correlations across time for alcohol and drug dependence diagnoses reached .61 and .66, respectively.

We also inspected the pattern of correlations among diagnoses within each time point. The diagnoses were coherent within each time point with mean correlations ranging from .56 at age 24, to .74 at age 17. This high degree of interrelatedness lends support to the idea that the individual diagnoses are part of a common EXT spectrum.

Finally, we examined the correlations between the diagnoses and the personality traits. Aggression was most consistently (positively) related to the diagnoses across time, followed by control and harm avoidance, which were negatively related to the diagnoses.

### **Latent Growth Models of Externalizing Factor**

**Unconditional model.** We compared the fit of a quadratic growth model with no growth and linear growth models with chi-square difference tests using the DIFFTEST option in Mplus. The no growth vs. quadratic test was significant ( $\chi^2 = 48.68, p < .001$ ), indicating the no growth model fit significantly worse than the quadratic model. The linear vs. quadratic test was also significant ( $\chi^2 = 55.67, p < .001$ ), indicating the linear model fit significantly worse than the quadratic model. The quadratic multiple indicator LGM with the AAB, AD, and DD diagnoses loading onto an EXT factor fit the data well (CFI = .97, TLI = .97, RMSEA = .03). The mean intercept, which is the initial status at age 17, was fixed at 0. The average unstandardized linear slope was estimated to be .28, indicating a linear increase in EXT from age 17 to 29. The average unstandardized quadratic was estimated to be -.02, reflecting the curvilinear pattern of change over time where EXT increases until age 24 then decreases to age 29. Both of these were

statistically different from 0. The variances of the linear (.03) and quadratic (.00) parameters were not significantly different from 0. See Figure 1.

**Conditional models.** After simultaneously adding the covariates of gender and personality traits to the model to predict the growth parameters, the model fit the data well (CFI = .95, TLI = .94, RMSEA = .02).

Table 2 shows the standardized regression coefficients. Females increased in EXT at a slower linear rate than males but showed less of a subsequent decline after age 24. Increased aggression and decreased control significantly predict higher levels of EXT at age 17. Aggression also significantly predicted the growth of EXT beyond age 17; higher aggression led to a slower linear increase and a more pronounced decline in EXT after age 24.

However, as mentioned above, the linear and quadratic factors are confounded to some extent and separate interpretations are not recommended. Therefore we varied the centering point and evaluated the covariates' effect on the intercept at each time point to provide us with a clearer picture as to if and how the covariates' effects changed across time. This is the preferred method (Muthén, 2000); therefore we focus our discussion on these findings. Figure 2 shows the effects of the personality traits on the EXT factor from age 17 to 29 once we varied the centering point. Standardized partial regression coefficients are shown in the figure. Positive values signify a risk factor for the diagnosis while negative values signify a protective factor. To simplify the figure, personality traits that were not significant predictors of the intercept at any time point are not included. The coefficients were significantly different from 0 for aggression at all ages, and for control at ages 17, 20, and 24. The positive partial regression coefficients for aggression indicate that it leads to increased levels of EXT, while control's negative coefficients indicate

that it leads to decreased levels of EXT. Social potency leads to increased EXT at age 20 while traditionalism leads to decreased EXT at age 29. Finally, being female serves as a protective factor after age 17. The complete list of regression coefficients indicating the covariates' effects on the intercept can be found in Table 2.

### **Discussion**

Given the toll externalizing disorders take on the afflicted individuals and society at large, it is imperative to acquire a full understanding of the development of EXT and any factors that may contribute to that development. In the current prospective study extending over a 12-year period, we modeled the development of an EXT factor consisting of adult antisocial behavior, alcohol dependence, and drug dependence diagnoses at four time points from age 17 to 29, and examined whether and how personality traits at age 17 affected this development. This data set provided us with a unique opportunity to expand our knowledge beyond personality's influence on childhood EXT behavior development assessed with checklists (Leve et al., 2005; Miner & Clarke-Stewart, 2008; Owens & Shaw, 2003; Prinzie et al., 2005) to include personality's influence on formal psychiatric diagnoses of EXT in adulthood, specifically during a critical developmental period for EXT. Moreover, we were able to carry out a fine-grained facet-level inspection of personality, rather than focusing only on broad personality domains as has been primarily done in prior research. The findings of the current study indicate that personality is a significant predictor of the developmental course of EXT disorders. Specifically, our findings show that a) adult antisocial behavior, alcohol dependence, and drug dependence diagnoses can be modeled as part of an overarching EXT factor, b) EXT shows a curvilinear developmental pattern, increasing until age 24 then decreasing rapidly until age 29, and c) high aggression and low control are consistent predictors of the 12-year development of EXT.

Our multiple indicator growth model, with the individual diagnoses loading onto a single EXT factor, fit the data well, lending further support for the existence of an EXT spectrum, which includes shared temperamental antecedents, biomarkers, genetic and environmental risk factors, and comorbidity (for a review, see Krueger & South, 2009). The growth trajectory of this factor also conformed to a developmental course commonly observed for EXT disorders (i.e., an escalation until early adulthood followed by a significant decline; Burt et al., 2007; Jackson, Sher, & Wood, 2000; Moffitt, 1993; Vrieze et al., 2012) and was consistent with research at earlier ages showing that individual EXT diagnoses do not follow distinctive developmental trajectories but rather develop in concert with one another (Hicks et al., 2007).

The primary objective of the study, however, was to determine whether personality traits would predict this developmental course. Previous research has established that low constraint and high negative emotionality are contemporaneous markers of EXT disorders and predict the future onset of the disorders (Elkins et al., 2006; Kotov et al., 2010; Krueger, 1999; Krueger et al., 2001). It is not surprising then that these traits also predict the developmental course of EXT as was shown in the current study. Indeed, we anticipated that the specific traits of control from the constraint factor, and aggression from the negative emotionality factor, would significantly predict the development of EXT. Control was a significant predictor of the growth of EXT until age 29, with its effect lessening across time. Moreover, the constraint scale of traditionalism significantly predicted the increase in EXT at age 29. Aggression significantly predicted the growth of EXT across the 12-year span, with the strength of its effect waning and waxing. Contrary to our expectations, the negative emotionality scale of stress reaction was not significantly related to EXT's development, yet the positive emotionality scale of social potency increased the risk of EXT at age 20. These findings further emphasize the importance of

examining facet-level personality traits rather than focusing solely on the broad domains. For example, while previous research suggested that low constraint and high negative emotionality have cross-sectional and longitudinal ties with EXT disorders (Elkins et al., 2006; Kotov et al., 2010; Krueger, 1999; Krueger et al., 2001), our findings demonstrate that not all facets from these domains actually predict EXT's development.

What can account for the ubiquitous finding of the link between EXT and aggression and control? Recall aggression and control are components of a more general constraint factor (Markon et al., 2005). There is evidence suggesting the common co-occurrence of disinhibition (vs. constraint), substance dependence, and antisocial behavior can be accounted for by a highly heritable EXT factor (Krueger et al., 2002). Indeed, we have argued elsewhere that a common genetic liability to behavioral disinhibition underlies a disinhibited personality style, antisocial personality, substance use disorders, and childhood disruptive disorders (Iacono et al., 2008). This common liability can explain why constraint is associated with EXT disorders in cross-sectional and longitudinal studies and why constraint-related traits, most notably control, predicts the developmental course of EXT disorders.

## **Implications**

Knowledge that personality predicts not only the onset of EXT but also its subsequent developmental course should impel clinicians to consider prevention and intervention strategies targeting personality factors. Individual differences are observable very early in life (Shiner & Caspi, 2003) and are highly stable over time (Roberts & DelVecchio, 2000), thus enabling us to identify those at risk for EXT at a young age. While that answers the question of to whom prevention programs should be directed, what remains is the question of what type of prevention

or intervention programs would be successful. Focusing on red flag personality characteristics, such as aggression, control, social potency, and traditionalism, would be one possibility. For example, low control is closely linked with conscientiousness (Markon et al., 2005), which shows a normative tendency to increase with age, notably during early adulthood when EXT involvement declines (Roberts, Jackson, Berger, & Trautwein, 2009; Roberts, Walton, & Viechtbauer, 2006). Rather than taking a passive stance and waiting for individuals to “grow up” (e.g., increase in conscientiousness or control) and to “mature out” of EXT, a more proactive approach could be taken. Efforts to promote traditionalism in late adolescence, for example, might pay off in terms of slowing the development of EXT. Studies have shown that personality traits are indeed malleable. These include studies showing that pharmacological (Tang et al., 2009), therapeutic (De Fruyt, Van Leeuwen, Bagby, Rolland, & Rouillon, 2006), and experimental interventions (Jackson, Hill, Payne, Roberts, & Stine-Morrow, 2012) are effective in changing personality traits. With specific regard to EXT behaviors, Conrod and colleagues have shown that personality-targeted interventions are effective in reducing alcohol and illicit drug use (Conrod, Castellanos, & Mackie, 2008; Conrod, Castellanos-Ryan, & Mackie, 2011; Conrod, Castellanos-Ryan, & Strang, 2010; Conrod et al., 2013). Individuals identified with particular at-risk personality profiles take part in a coping skills intervention program targeting the personality traits linked with substance abuse. The program also targets motivational factors that link the personality traits and substance use.

### **Limitations and Future Directions**

There were many strengths of the present study, and we were able to fill a gap in the literature by establishing the role of personality in influencing the developmental course of DSM EXT diagnoses during a critical period, though the study is not without its own limitations. First,

our sample restricts our ability to generalize our findings. Not only are we limited to the age range of 17 to 29, but our sample is largely Caucasian, consistent with Minnesota demographics for the birth years sampled.

Second, there is evidence that EXT contains subfactors in addition to an overarching EXT propensity (Krueger, Markon, Patrick, Benning, & Kramer, 2007; Patrick, Kramer, Krueger, & Markon, 2013). For example, there is support for a two-factor model making a distinction between oppositional behavior disorders which typically arise in childhood, such as attention-deficit/hyperactivity disorder and oppositional defiant disorder, and social norm violation disorders, such as conduct disorder, adult antisocial disorder, and substance use disorders (Farmer, Seeley, Kosty, & Lewinsohn, 2009; Witkiewitz et al., 2013). Our data were focused solely on social norm violation disorders during adulthood, limiting our ability to identify subfactors within the broader EXT spectrum and personality's effect on other subfactors' development. Related, we did not elaborate on the relationship between personality and this EXT factor's facets (i.e., AAB, AD, and DD) independently, which might be worth considering given that prior research has shown that alcoholism and drug use disorder, for example, show distinguishable relationships with fine-grained personality traits (e.g., McGue, Slutske, & Iacono, 1999). In this particular study, however, we found that the pattern of relationships was largely the same for AD and DD at the broad trait level. Positive emotionality was not related to either at any age, and negative emotionality and constraint were related to DD at all ages and to AD at all ages except 24.

In addition, there were a few minor age 17 personality and diagnostic differences between those who attended all follow-up visits and those who missed one or more follow-up visits (i.e., individuals who did not return for any follow-up assessments were more likely to be

diagnosed with drug dependence at age 17, and individuals who missed at least one follow-up had significantly lower positive emotionality and constraint at age 17 than those who were present for all follow-ups). However, there were no differences in diagnoses between those who missed at least one follow-up and those who attended all of them, nor were there any personality differences between individuals who did not return for any follow-ups and those who did. For the few differences that reached statistical significance, the magnitude of the effects was not large. Therefore, we deem it unlikely that this would have impacted our findings.

Finally, we focused solely on how personality would impact the growth of EXT. We did not examine the reverse or a reciprocal relationship, although it is likely that EXT impacts the development of personality as well. For example, an early onset and a persistent course of alcohol dependence may lead to non-normative changes in negative emotionality (Hicks, Durbin, Blonigen, Iacono, & McGue, 2011). In addition to its relationship to substance use, the co-development of personality and antisocial behavior has also been discussed. For example, as conscientiousness increases, EXT decreases (Roberts et al., 2009). Further, when compared to other developmental trajectories, individuals who desist in antisocial behavior concomitantly exhibit steeper decreases in novelty seeking and steeper increases in reward dependence over time (Blonigen, Littlefield, Hicks, & Sher, 2010). These findings, coupled with those of the current finding, highlight the importance of examining the co-development of EXT and personality in future research.

## **Conclusion**

Our findings suggest that late adolescent personality predicts the developmental course of formal psychiatric diagnoses of EXT at a critical point during emerging and early adulthood,



thus expanding the literature beyond personality's ability to predict the development of childhood EXT behaviors assessed with checklists. Although our findings were largely expected, this unique data set enabled us to fill this void in the literature, and the remarkably low rate of attrition characterizing the sample over a 12-year period (i.e., less than 2% were completely lost to follow-up, and over 93% completed the most recent follow-up at age 29) increases confidence in our findings. With the knowledge that certain traits, most notably high aggression and low control, predict the developmental course of EXT, clinicians should consider prevention and intervention strategies targeting these specific personality factors to reduce the prevalence of EXT diagnoses and their negative impact.

### **Declaration of conflicting interests**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Table 1

*Prevalence rates and correlations among externalizing diagnoses and personality traits from age 17 to 29*

	<u>Age 17</u>			<u>Age 20</u>			<u>Age 24</u>			<u>Age 29</u>		
	AAB	AD	DD	AAB	AD	DD	AAB	AD	DD	AAB	AD	DD
<u>Age 17</u>												
AAB												
AD	<b>.74</b>											
DD	<b>.72</b>	<b>.76</b>										
<u>Age 20</u>												
AAB	<b>.52</b>	<b>.41</b>	<b>.33</b>									
AD	<b>.51</b>	<b>.69</b>	<b>.47</b>	<b>.52</b>								
DD	<b>.55</b>	<b>.46</b>	<b>.63</b>	<b>.74</b>	<b>.59</b>							
<u>Age 24</u>												
AAB	<b>.56</b>	<b>.56</b>	<b>.52</b>	<b>.70</b>	<b>.61</b>	<b>.73</b>						
AD	<b>.45</b>	<b>.51</b>	<b>.32</b>	<b>.41</b>	<b>.69</b>	<b>.51</b>	<b>.49</b>					
DD	<b>.48</b>	<b>.42</b>	<b>.51</b>	<b>.61</b>	<b>.44</b>	<b>.74</b>	<b>.71</b>	<b>.48</b>				
<u>Age 29</u>												
AAB	<b>.55</b>	<b>.51</b>	<b>.47</b>	<b>.77</b>	<b>.35</b>	<b>.71</b>	<b>.81</b>	<b>.32</b>	<b>.63</b>			
AD	<b>.42</b>	<b>.56</b>	<b>.35</b>	<b>.49</b>	<b>.59</b>	<b>.55</b>	<b>.53</b>	<b>.59</b>	<b>.58</b>	<b>.62</b>		
DD	<b>.57</b>	<b>.57</b>	<b>.55</b>	<b>.69</b>	<b>.54</b>	<b>.72</b>	<b>.63</b>	<b>.61</b>	<b>.80</b>	<b>.75</b>	<b>.65</b>	
WB	-.06	<b>-.11</b>	-.06	-.09	-.03	-.01	.22	-.03	-.07	-.06	.00	<b>-.11</b>
SP	-.02	-.05	.11	-.01	.04	<b>.34</b>	<b>.39</b>	-.02	.07	.26	<b>.25</b>	-.06
Ach	-.07	<b>-.14</b>	-.08	-.08	-.04	.00	.09	-.06	-.06	.00	.03	<b>-.13</b>
SC	-.10	<b>-.13</b>	-.05	-.06	-.07	-.04	.01	-.08	-.05	-.08	-.04	-.07
SR	-.08	-.04	.16	-.03	-.02	<b>.31</b>	.08	-.03	.03	.02	.09	<b>-.10</b>
AI	-.03	-.03	.17	.01	.04	<b>.35</b>	<b>.34</b>	.04	.01	<b>.36</b>	.20	-.07
Ag	<b>.26</b>	<b>.09</b>	<b>.39</b>	<b>.14</b>	<b>.20</b>	<b>.37</b>	<b>.50</b>	<b>.18</b>	<b>.22</b>	<b>.46</b>	<b>.49</b>	.00
Con	<b>-.15</b>	<b>-.18</b>	-.12	<b>-.14</b>	<b>-.13</b>	-.08	-.11	<b>-.09</b>	<b>-.12</b>	-.07	-.03	<b>-.15</b>
HA	<b>-.17</b>	<b>-.12</b>	-.11	<b>-.16</b>	<b>-.11</b>	<b>-.17</b>	<b>-.17</b>	<b>-.13</b>	<b>-.17</b>	-.09	-.07	<b>-.18</b>
Tr	-.10	<b>-.12</b>	-.08	<b>-.14</b>	-.09	-.07	-.05	-.08	<b>-.12</b>	-.05	-.10	<b>-.14</b>
Ab	-.03	-.01	<b>.26</b>	-.08	.01	<b>.18</b>	<b>.43</b>	.06	-.01	.18	.01	-.01

Diagnosis frequency	3.5	7.5	3.1	3.7	14.7	7.9	3.5	13.5	6.0	1.3	8.2	4.1
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*Note.* AAB = adult antisocial behavior, AD = alcohol dependence, DD = drug dependence, WB = well being, SP = social potency, Ach = achievement, SC = social closeness, SR = stress reaction, Al = alienation, Ag = aggression, Con = control, HA = harm avoidance, Tr = traditionalism, and Ab = absorption. bold = significant at  $p < .05$ .



Table 2

*Effects of personality traits on growth parameters*


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	<u>age 17</u> <u>intercept</u>	<u>age 17</u> <u>linear slope</u>	<u>age 17</u> <u>quadratic slope</u>	<u>age 20</u> <u>intercept</u>	<u>age 24</u> <u>intercept</u>	<u>age 29</u> <u>intercept</u>
female	-.03	<b>-.42</b>	<b>.37</b>	<b>-.25</b>	<b>-.35</b>	<b>-.20</b>
well being	-.08	.12	-.18	-.04	-.05	-.14
social potency	.26	-.13	.12	<b>.24</b>	.20	.20
achievement	-.15	.13	-.19	-.12	-.13	-.22
social closeness	-.07	.18	-.16	.01	.05	-.01
stress reaction	.03	.19	-.27	.11	.09	-.08
alienation	-.05	.07	-.08	-.02	-.02	-.05
aggression	<b>.53</b>	<b>-.61</b>	<b>.65</b>	<b>.33</b>	<b>.23</b>	<b>.43</b>
control	<b>-.68</b>	.44	-.24	<b>-.56</b>	<b>-.34</b>	-.20
harm avoidance	.04	-.22	.23	-.06	-.10	.00
traditionalism	-.13	.06	-.11	-.13	-.15	<b>-.19</b>
absorption	.17	-.13	.15	.14	.12	.15

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*Note.* Standardized partial regression coefficients are given. bold = significant at  $p < .05$ .

Figure 1

*Externalizing factor's latent growth curve from age 17 to 29*

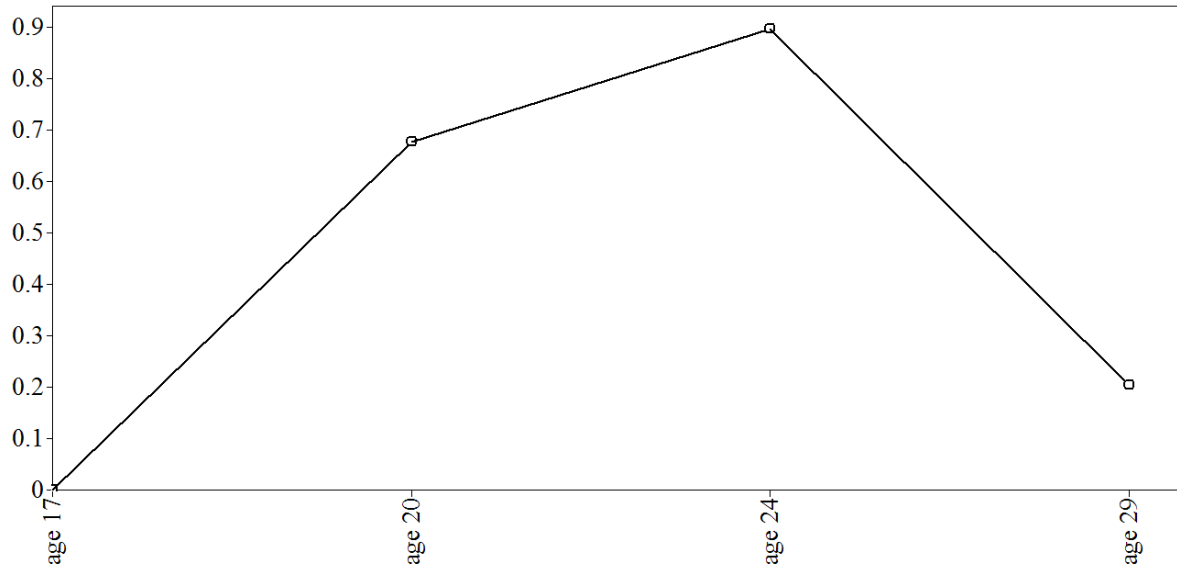
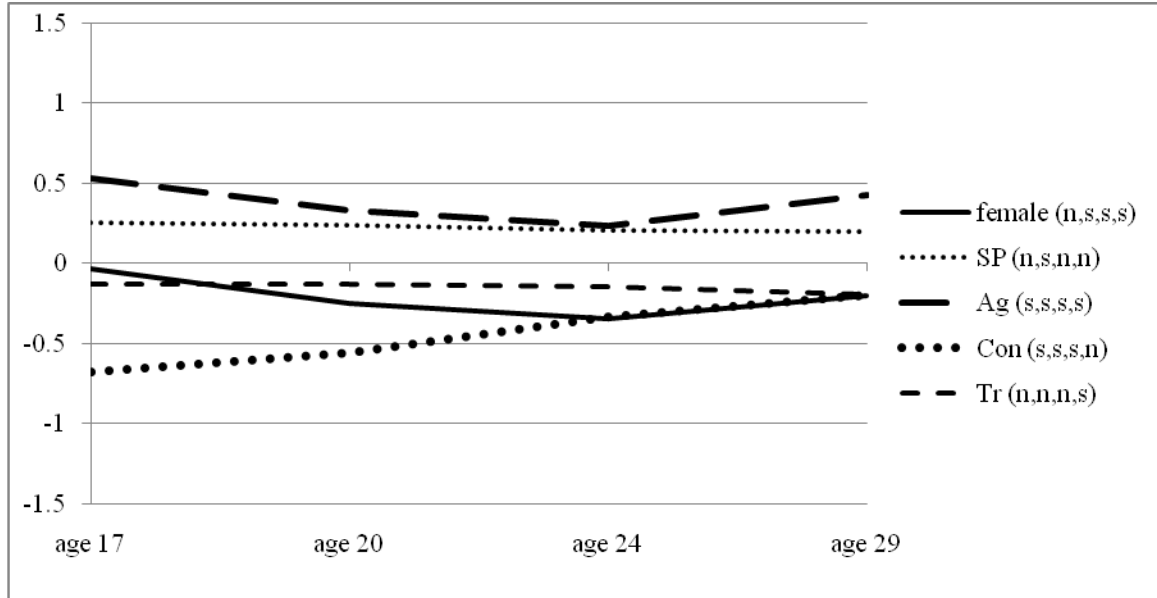


Figure 2

*Effects of personality on externalizing factor from age 17 to 29*



*Note.* Standardized partial regression coefficients are plotted on the y axis. s = significant at  $p < .05$ , n = not significant at  $p < .05$  (e.g., “n,s,n,n” indicates the trait is a significant predictor at age 20 only). SP = social potency, Ag = aggression, Con = control, and Tr = traditionalism.

**Footnotes**

<sup>1</sup> We examined the degree of item-symptom overlap to ensure any observed personality-externalizing relationships were not solely the result of this. There is some similarity between the AAB irritability/aggressiveness symptom and the MPQ aggression scale, but not enough to warrant concern. Of the 18 MPQ aggression items, only five mention the desire for, enjoyment of, or act of physical aggression. Likewise, while there is some conceptual overlap between the AAB failure to plan ahead symptom and the MPQ control scale, the AAB symptom requires either traveling with no plan in terms of residence or work, or not having a fixed address for a month or more. The control items do not specifically mention these behaviors. Moreover, these are only two of the ten DSM-III-R (American Psychiatric Association, 1987) AAB symptoms, and these specific symptoms are not necessary for diagnosis. Finally, AAB is only one component of the externalizing factor we model and associate with personality.

<sup>2</sup> We attempted to fit a multi-group model to test whether gender moderates the effect of personality on externalizing trajectories. This model failed to converge given the extremely low variance of some of the diagnoses for females.