Longitudinal Trajectory Classes and Correlates of the Multidimensional Personality Questionnaire-Triarchic Psychopathy Scales from Adolescence to Young Adulthood

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Abstract

The present study examined longitudinal trajectory classes and correlates of triarchic psychopathy domains (Boldness, Meanness, and Disinhibition) from age 16 to 22, leveraging Multidimensional Personality Questionnaire (MPQ)-based triarchic scales data gathered on a large community sample (*n*s ranging between 483-775 across waves) oversampled for parental substance use disorder (SUD). Growth Mixture Models were conducted to examine longitudinal trajectory classes for each domain, and their associations with environmental covariates (e.g., neighborhood disadvantage and parental SUD) and outcomes at age 22 (e.g., violent behavior, antisocial personality disorder, and an overall problem index capturing internalizing symptoms and social problems). For Boldness, all participants fell in the same class showing relative stability over time. Comparable solutions were recovered for Meanness and Disinhibition (high-stable/increasing, mid-range decreasing, and low-decreasing). Links with external correlates supported well-known differences between Boldness and both Meanness and Disinhibition, and additionally revealed interesting differences between Meanness and Disinhibition, suggesting that environmental covariates better discriminated Meanness trajectory classes. These results demonstrate considerable developmental heterogeneity in these traits across adolescence into young adulthood, which relates to outcomes associated with antisociality and general life struggles. Further these findings support the the adequacy of the MPQ as an operationalization tool for longitudinal investigations on psychopathy.

Keywords: psychopathic personality; triarchic model; boldness; meanness; disinhibition

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Psychopathy is a form of personality pathology characterized by distinctive affective and interpersonal traits along with persistent behavioral deviancy (DeLisi, 2009; Hare & Neumann, 2008; Patrick et al., 2009). To reconcile different conceptualizations of psychopathy, Patrick et al. (2009) have developed a triarchic model that encompasses three bio-behavioral trait domains: boldness, meanness, and disinhibition. Boldness is the combination of stress immunity, fearlessness, and social dominance, and is theorized to correspond to the low pole of the bio-behavioral dimension of threat sensitivity. Meanness is defined by callousness, interpersonal antagonism, and aggression, and is conceptualized as the low pole of the bio-behavioral dimension of affiliative tendencies. Disinhibition is characterized by difficulties with emotion regulation and impulse control, representing the low pole of the bio-behavioral dimension of inhibitory control.

These three trait domains were developed as open constructs that can be operationalized using a variety of assessment methods, and are theoretically surrounded by distinct nomological networks (Patrick & Drislane, 2015; Sellbom, 2018; Somma et al., 2019). Specifically, the triarchic model was developed to facilitate embedding within the developmental psychopathology literature that boldness, meanness, and disinhibition have different etiological precursors, trajectories of change over time, and associated outcomes (Patrick, 2022; Patrick et al., 2009). Yet, only recently, progress in the assessment of the triarchic domains in adolescence has made it possible to pursue the developmental aims of the triarchic model of psychopathy (Bertoldi et al., 2021; Garofalo et al., 2021; Somma et al., 2016). The transition from adolescence to adulthood represents an especially interesting time span to uncover differential

pathways and correlates because the manifestation of psychopathology tends to become more differentiated as people grow older (Murray et al., 2016).

Research on personality development posits that personality traits change across the lifespan due to both physiological maturation and environmental influences (Caspi & Roberts, 2001; Funder, 1991). Generally, scholars have proposed a characterization of normative changes in personality traits related to psychological regulation directed towards maturity and growth from adolescence into early adulthood (Blonigen et al., 2008; McGue et al., 1993; Roberts & Mroczek, 2008; Vaidya et al., 2010) and this maturation may impact on the development of psychopathic traits in the transition to adulthood (McCuish & Gushue, 2022). However, individuals often vary greatly in developmental trajectories, which may be obscured when interpreting mean-level changes at an aggregate level (Roberts et al., 2001, 2006; Robins et al., 2001; Vaidya et al., 2002). On a given trait over time, some individuals may be relatively constant, others may increase, while still others may show decreases (Mroczek & Spiro, 2003; Vaidya et al., 2008). Against this background, the present study leveraged triarchic psychopathy scales (Brislin et al., 2015, 2017) data based on the Multidimensional Personality Questionnaire (MPQ; Tellegen, 1982) to examine longitudinal trajectories and correlates of boldness, meanness, and disinhibition across three waves of data from age 16 to age 22.

Developmental Correlates of Boldness, Meanness, and Disinhibition

Even though psychopathy has been primarily studied in adult populations, a growing body of research has extended the conceptualization and study of psychopathy to include its downward extension to childhood and adolescence (Andershed et al., 2002; Lynam, 1997; Salekin & Frick, 2005; Somma et al., 2018). This approach holds great promise as it allows potentially identifying targets for interventions that can prevent the full-blown manifestation of

psychopathy in adulthood (Frick et al., 2014). The developmental literature has focused mainly on the construct of callous-unemotional traits (Frick & White, 2008), which is largely akin to the triarchic construct of meanness and, as such, represents one of the dimensions that make up the broader psychopathy construct (Andershed et al., 2018; Patrick et al., 2009).

The triarchic model of psychopathy holds as one of its most important tenets that its three trait domains follow partly distinct developmental pathways and may contribute to different outcomes (Bertoldi et al., 2021; Patrick et al., 2009). Assessment of the triarchic model trait domains from adolescence into adulthood allows researchers to pursue the conceptual aim of examining individual differences in stability and change for each trait domain. Efforts of this kind can have important practical implications because the triarchic model trait domains can combine to different extents to form distinct manifestations of psychopathy (e.g., with selected elevations in boldness and disinhibition versus selected elevations in meanness and disinhibition; Patrick, 2022; Sellbom & Drislane, 2021). Therefore, knowledge of the potentially distinct patterns of correlates that characterizes trajectories of boldness, meanness, and disinhibition throughout development can inform clinical understanding of different constellations of psychopathic trait domains. To the extent that boldness, meanness, and disinhibition represent trait domains that – individually – cut across diagnostic spectra, this knowledge may be leveraged by psychopathology research more broadly (Krueger et al., 2021; Patrick, 2022).

Both theoretical (Patrick et al., 2009; Patrick & Drislane, 2015) and empirical work (Bertoldi et al., 2021; Dotterer et al., 2017; Green et al., 2020; Kyranides et al., 2017) have provided evidence for differential developmental precursors and correlates of the triarchic model trait domains. For instance, low levels of affective and behavioral inhibition have been linked with the emergence of meanness and disinhibition, resulting in different manifestations such as

insecure attachment (for meanness) and emotion dysregulation (for disinhibition). Meanness and disinhibition are also considered more susceptible to negative parental and environmental (e.g., neighborhood disadvantage) influences compared to boldness. In contrast, dispositional fearlessness has been linked to the emergence of both boldness and meanness, with the former representing a more adaptive and the latter a more maladaptive manifestation of a fearless temperamental disposition. Further, boldness has been associated mostly with adaptive correlates (e.g., low levels of traumatic experiences, negative affectivity and internalizing symptoms, secure attachment, social adjustment), although associations with maladaptive (e.g., narcissism, aggression) correlates have also been reported (Brislin et al., 2015; Eisenbarth & Garofalo, 2021; Garofalo et al., 2021). Conversely, meanness and disinhibition tend to be more consistently associated with maladaptive correlates, with meanness more prominently related to externalizing features of predatory nature (e.g., callousness, proactive aggression) and disinhibition with a broader array of dysfunctional correlates spanning internalizing and externalizing symptoms, including aggression and substance use, as well as cognitive and affective deficits, and social problems (Eisenbarth & Garofalo, 2021; Kyranides et al., 2017; Patrick, 2022; Patrick & Drislane, 2015).

Trajectories of Boldness, Meanness, and Disinhibition

In addition to having distinct etiological precursors, the triarchic psychopathy trait domains may also have distinct degrees of stability and change over time. This kind of information can be invaluable to identify those traits that are more amenable to change and to improve early identification of those most at risk of poor outcomes in adulthood (Bertoldi et al., 2021). Generally, psychopathic traits tend to be moderately stable in the transition from adolescence to adulthood (Loney et al., 2007; Neumann et al., 2011). Because studies on the

developmental course of the triarchic trait domains is only recently emerging, we also borrowed from studies that have focused on conceptually similar operationalizations of psychopathic traits (e.g., Blonigen et al., 2006). Taken together, some previous studies have shown a relatively higher degree of stability for boldness and disinhibition compared to meanness (Bertoldi et al., 2021; Blonigen et al., 2006). Other studies have shown that traits more closely linked to both meanness and disinhibition tend to follow a similar pattern and to decline more than boldness traits (Garofalo et al., 2021; Neumann et al., 2011; Ray, 2018). To the extent that meanness and disinhibition correspond largely to the antagonistic and disinhibited spectra of the broader externalizing super-spectrum (respectively), these findings are also consistent with the preponderance of evidence supporting the largely similar developmental trajectories of antagonistic and disinhibited externalizing spectra (Krueger et al., 2021). Finally, a recent study based on the Dunedin Multidisciplinary Health and Development Study, examined the stability of MPQ-based triarchic psychopathy scales from age 18 to 26 (Veltman et al., 2023): they found strikingly similar stability over this 8-year period (r_{range} = .59 – .62).

Investigating average starting levels and longitudinal trajectories of boldness, meanness, and disinhibition is an important first step, but does not account for the heterogeneity that may characterize individual trajectories (e.g., Pardini & Loeber, 2008). Thus, an important endeavor would be to identify sub-groups of individuals who differ in their starting levels and developmental trajectories to obtain a more nuanced understanding of the developmental course of psychopathic traits. To date, we are aware of no studies that have examined different patterns of stability and change of psychopathic traits adopting a triarchic model perspective, but relevant findings can be drawn from the psychopathy literature more broadly. Few studies (e.g., Hawes et al., 2018; Y. Lee & Kim, 2020; Salihovic et al., 2014) have investigated trajectories of change in

psychopathic traits from adolescence into early adulthood and results were consistent in reporting evidence for "high-stable" trajectories of individuals who would show high levels of psychopathic traits across the different time points. There was also consistent evidence of decreasing trajectories, albeit these groups varied in their starting levels across studies (e.g., with only high-decreasing trajectories reported, or only moderate-decreasing trajectories, or both). Two out of three studies also reported a low-stable group (Hawes et al., 2018; Y. Lee & Kim, 2020), whereas only one study found evidence of a group that showed increases in psychopathic traits (Hawes et al., 2018). These findings were fairly consistent when examining psychopathy at the total score level, or at the subscale level. Taken together, studies that have investigated group-based trajectories of psychopathic traits emphasize the importance of looking jointly at starting levels and trajectories of psychopathic traits, as it can provide incremental information over the examination of starting levels and trajectories separately. Yet, it is worth mentioning that the previous studies that examined subscales of psychopathy scales were based on the Youth Psychopathic Traits Inventory (Andershed et al., 2002), which is an operationalization more aligned with the meanness and disinhibition traits of the triarchic model, with limited if any coverage of boldness (Patrick & Drislane, 2015). Hence, drawing inferences on trajectories of boldness proves more difficult based on previous studies. However, boldness is considered theoretically a relatively more stable disposition that is less susceptible to environmental influences (Patrick et al., 2009). In addition, research on negative emotionality, whose low pole is a component of boldness, has showed variability in developmental trajectories, with the majority (around 40%) of people showing a decrease in negative emotionality over time (Donnelan et al., 2007), potentially suggesting an increase in boldness traits. In contrast, extraversion (which is also a characteristic of boldness) tends to decrease with age (Robins et al.,

2001; Vaidya et al., 2002) which would point to decreases in boldness as well, although it should be noted that individual differences in pattern of change over time have been documented for both negative emotionality and extraversion (Scollon & Diener, 2006).

Adult Outcomes Associated with Distinct Trajectories of Boldness, Meanness, and Disinhibition

An important next step beyond identifying different trajectories of stability and change in psychopathic traits is to examine their impact on adult outcomes in order to identify groups at higher risk and to clarify the importance of prevention efforts targeted for specific outcomes of interest, in line with the previously reported differential correlates of the triarchic trait domains. By and large, the studies described above revealed that stable trajectories of moderate to high psychopathic traits were those more consistently associated with unfavorable outcomes, most notably in terms of externalizing behavior (Hawes et al., 2018; Y. Lee & Kim, 2020; Salihovic et al., 2014). This is consistent with studies that linked higher starting levels (positively) as well as a decreasing slope on average (negatively) with maladaptive outcomes and criminal justice involvement (Bergstrøm & Farrington, 2021; Salekin, 2008; Virtanen et al., 2020). There was, however, less consistency as to whether high-decreasing or low-increasing groups were more at risk for maladaptive outcomes in the externalizing domain (Hawes et al., 2018; Salihovic et al., 2014). Only one study to date has examined the impact of group-based trajectories of psychopathic traits on adult outcomes. Hawes et al. (2018) reported that adolescents showing chronically high levels of psychopathy were at the highest risk to manifest higher levels of adult psychopathy, criminal offending, and aggression. However, these associations with adult outcomes were similar to those of youth following an increasing trajectory in psychopathic traits.

In contrast, youth on a decreasing trajectory manifested lower levels of maladaptive adult outcomes.

These previous studies pioneered a developmental approach to the study of change in psychopathic traits and its impact on adult outcomes, but were largely silent regarding distinct developmental pathways and associated outcomes for the different domains of the triarchic model of psychopathy. More broadly, examinations of adult outcomes beyond the externalizing domain have been limited. Recently, Veltman et al. (2023) examined concurrent and predictive association of MPQ-based triarchic psychopathy scale with external correlates spanning across internalizing and externalizing spectra. They found that boldness and disinhibition had relations with internalizing symptoms (depression, anxiety, neuroticism) with opposite sign (negative and positive, respectively) both concurrently and prospectively, while meanness was largely unrelated to internalizing symptoms. Further, only disinhibition had significant and positive associations with various indices of alcohol and substance use both concurrently and prospectively. Finally, meanness and disinhibition had similar patterns of associations with increased levels of convictions, variety of crimes, and self-reported delinquency, whereas boldness was significantly and positively related to variety of crimes (both concurrently and prospectively) and self-reported delinquency (concurrently) but not with convictions. Of note, the magnitude of these associations was smaller for boldness than for meanness and disinhibition (Veltman et al. 2023).

The Present Study

Against this background, the present study leveraged data from a large sample of at-risk youth whose scores on triarchic psychopathy dimensions could be obtained through reconfiguration of the MPQ (Tellegen, 1982) scales (Brislin et al., 2015, 2017; Garofalo et al.,

2021; Veltman et al., 2023). In this sample, we sought to examine the heterogeneity of developmental trajectories for boldness, meanness, and disinhibition across three waves of data from late adolescence (age 16) to young-adulthood (age 22) using a growth-mixture model approach (GMM; Muthén & Muthén, 2000). In addition, we validated emerging profiles of change in each dimension examining putative developmental precursors and adult outcomes. Due to the availability of data consistent with the conceptual work on the triarchic model, we specifically included both environmental (i.e., neighborhood disadvantage) and parental (i.e., parental substance use disorder) risk factors to predict the different trajectories of psychopathic traits. In addition, we examined both externalizing (i.e., violent behavior and antisocial personality disorder) and a more general index (i.e., including internalizing symptoms and social problems) of adult maladjustment ("overall problem index") as outcomes of the different trajectories of psychopathic traits. Because of the exploratory nature of both the study and the GMM analyses, we did not make any hypotheses regarding the number of classes recovered. However, based on past research during this age range, we might at least expect to recover trajectory classes which may show persistently high levels of meanness and disinhibition, which may subsequently be related to greater problematic behaviors (Hawes et al., 2018; Bjork & Pardini, 2015; Weller et al., 2021), and might be contrasted with trajectories that start at high levels, but decrease from adolescence to emerging adulthood (Bergstrøm & Farrington, 2021; Moffitt, 2006 Salekin, 2008; Virtanen et al., 2020).

In terms of adult psychopathology outcomes, a key distinction among the triarchic dimensions is that meanness and disinhibition, but not boldness, should be more aligned with – and potential precursors of – adult antisocial personality disorder (Garofalo et al., 2021; Krueger et al., 2002; Wall et al., 2014). In turn, it was expected that trajectories of meanness and

disinhibition may differ from trajectories of boldness in their association with antisocial personality disorder in adulthood, with important implications for intervening in youth more at risk to develop antisocial personality disorder. In contrast, based on previous cross-sectional findings (Brislin et al., 2015; Garofalo et al., 2021; Gray et al., 2019; Howard, 2017) it was expected that also boldness trajectories should be predictive of violence more broadly, suggesting a key distinction between the prediction of violent behavior as opposed to the formal diagnosis of antisocial personality disorder. Finally, further distinctions may emerge with respect to adjustment and internalizing symptoms across trajectories of the three triarchic domains, with boldness associated with better and meanness and disinhibition associated with worse outcomes in these domains (e.g., Veltman et al., 2023).

Method

Participants

The original dataset consisted of 775 children and their families, who were recruited into a longitudinal study of the etiology of substance abuse in adolescence (Tarter & Vanyukov, 2001). Families were selected based on the SUD status of the biological father of a 10-12 year old child. Fathers were either (1) SUD+, defined as current or past DSM-III-R diagnosis of SUD consequent to illicit use of substances other than alcohol (n=344), (2) SUD-, those fathers who had no current or past SUD or any other psychiatric diagnosis (n=350), or (3) SUD-, but with a current or past psychiatric diagnosis (n=81). Families were excluded if the father had a neurological disorder, schizophrenia, or uncorrectable sensory incapacity or if the child had a neurological injury which required hospitalization, IQ < 80, chronic physical disability, uncorrectable sensory incapacity, or psychosis. Although parents and children were assessed at several timepoints in this broader study, we only consider data from four waves: baseline assessment, when both parents and 10-12 year old child were enrolled into the project (T1; M_{age}

=11.41, *s.d.*= .92; N=775), and then approximately at age 16 (T2; M_{age} =16.09, *s.d.*= .45; *N* = 627), age 19 (T3; M_{age} =18.82, *s.d.*= .48; *N* = 585), and age 22 (T4; M_{age} =21.89, *s.d.*= .42; *N* = 497). Specifically, we used predictors assessed at T1, outcomes assessed at T4, and MPQ-Tri trajectories from T2 to T4. Attrition in this study was not progressive; that is, participants who missed an assessment could participate in subsequent waves. We report attrition-related analyses in the Online Supplementary Information. Child participants in the overall sample consisted of 70.7% males, 75.5% Caucasian, 21.8% African American, 2.7% Other /did not report). Participants were compensated for their time at the end of each assessment at a rate comparable to the U.S. minimum wage. The study was approved by the Institutional Review Board at the University of Pittsburgh.

Measures

Multidimensional Personality Questionnaire-Tri (MPQ; Tellegen, 1982)

The original version of the MPQ was administered to participants at each time point relevant to the current study, including 300 dichotomous (yes = 2 / no = 1) items. For the present study, we only used the 54 items that form Brislin et al.'s (2015, 2017) MPQ-Tri scales (see Garofalo et al., 2021 for full list of the item numbers, as well as the corresponding MPQ scale and subscales, and detailed psychometric analyses of these scales across assessments in this sample).

Covariates

At T1(when participants were 10-12 years old), the following covariates were assessed, in addition to demographic information (i.e., sex).

Parental SUD status. Parental SUD was included based on its longitudinal associations with a related index of psychological dysregulation, the Transmissible Liability Index, which

includes some content overlap with the MPQ-Tri Meanness and Disinhibition scales (Vanyukov et al., 2009; Weller et al., 2021). Parental SUD+ status was measured by the number of parents who met DSM-III-R criteria for a SUD, as assessed by an expanded Structured Clinical Interview for DSM-III-R (SCID; Leckman et al., 1982)[1]. Collectively, 31.4% of the sample had one parent with SUD+ diagnosis, and 18.4% with two SUD+ parents.

Neighborhood Disadvantage. We used Ross and Mirowsky's (2001) measure of neighborhood disadvantage as proxy for global environmental factors not solely limited to household socioeconomic status. This index represents a metric of neighborhood-based economic disadvantage, rather than any one participant's family own personal disadvantage level. Enrolled families' addresses were geocoded and matched to census tracts for either the 1990 or the 2000 U.S. Census, based on year of project recruitment. Census data from each tract representing the (1) rate of households living below the poverty level (POV), (2) the proportion of families with children with mother only as head of household (MHH), (3) the rate of owner-occupied housing units (OOH), and (4) the rate of adults over age 24 with college degrees (COL) living within the census tract were matched to family addresses. The neighborhood disadvantage variable was represented as $[(POV * 0.1) + (MHH * 0.1)] - [(OOH * 0.1) + (COL * 0.1)]/4$. The higher the value, the greater the degree of neighborhood disadvantage. A constant was added to make zero the origin point.

Outcomes

We used the following outcomes, which were measured at T4 (age 22):

Antisocial Personality Disorder (ASPD) Symptoms. ASPD symptoms were assessed using an interview based on the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) Axis II Disorders (SCID-II; First et al., 1997).

[1] The DSM-III-R taxonomy was employed because this research was initiated prior to publication of the current DSM-V manual. Diagnoses were formulated during a clinical conference chaired by a psychiatrist certified in addiction psychiatry and attended by another psychiatrist or a psychologist, along with the clinical associates who conducted the interviews. The best estimate procedure was used to formulate the diagnoses (Leckman et al., 1982).

Trained masters' level research associates conducted the SCID-II interviews; then, a diagnostic case conference with two psychiatrists or a psychiatrist and psychologist reviewed the diagnostic case files with the research assistants to make the diagnostic determination. The ASPD interviews produces a symptom count rating of the seven criteria for ASPD included in the DSM-IV (which remained unaltered in the current version of the DSM, i.e., DSM-5).

Drug Use Screening Inventory (DUSI)-Absolute Problem Density Profile. The DUSI-Absolute Problem Density Profile is a checklist that contains several indices of maladjustment related to substance use or other problematic areas, developed in the CEDAR dataset based on self-reported questions to items contained in the DUSI (Tarter, 1990). Specifically, dichotomous (yes/no) items inquire about problems in the following areas: substance use, behavioral problems, health status, psychiatric disorders, social competence, family system, school performance, work adjustment, peer relationships, and leisure/recreation. For each problem domain, affirmative responses are summed to produce a total score; the ABS domain scores can also be averaged to obtain an overall index of problematic aspects.

Self-Reported Violence. A self-reported index of violence was also available at T4, based on the Andrew Scale of Severity and History of Offenses (Andrew, 1974). This scale originally consisted of 65 dichotomous (yes/no) items inquiring about engagement in different type of behavior that was punished by the law at the time when the scale was developed. As such, it includes items that would be anachronistic and even discriminatory nowadays (e.g., homosexuality). For the present study, we used only an index that consisted of 21 items inquiring about self-reported violent behaviors (e.g., violent outbursts, fights, assaults, attempted murder).

Data Analytic Plan

Analyses were conducted using MPlus version 8.7 statistical software (Muthén & Muthén, 2017). The main analyses involved conducting a series of growth mixture models

(Muthén & Muthén, 2000) for each MPQ-Tri trait domain. For all models, we used full information maximum likelihood (FIML) to estimate parameters to address missing data. FIML provides unbiased parameter estimates when data are at least missing at random, which was the case in the current study (Little's MCAR χ^2 (27)= 31.37, p =.26, for all Tri-P variables across the three timepoints). As a default in the MPlus software for maximum likelihood estimators in GMM, FIML uses all the available information and incorporates incomplete data into the likelihood function, and most frequently provides essentially equivalent results to multiple imputation in a more straightforward way (T. Lee & Shi, 2021). With respect to class enumeration, we first tested the unconditional GMM for each of the MPQ-Tri trait domains (i.e., Boldness, Meanness, and Disinhibition) across the three time points using varying numbers of profiles within two different variance–covariance matrix specifications. These are (1) class-invariant unrestricted matrix, in which variances and residual covariances of the variables are estimated but constrained to be equal across classes (MPlus default; Muthén & Muthén, 2017), and (2) class-varying unrestricted matrix, which allows for the free estimation of variances and residual covariances (Johnson, 2021; Masyn, 2013). After specifying the variance-covariance structure, we tested models with incrementally larger number of classes. We selected the best-fitting model based on inspection of AIC, BIC, and sample-size adjusted BIC (SABIC) fit statistics, Lo-Mendell-Rubin Likelihood tests, and bootstrapped Likelihood-Ratio tests of competing models (starting from a single class model). We also took into consideration the interpretability of the recovered trajectory classes based on theoretical considerations, and the number of respondents assigned to the smallest class, which we set the cutoff value as => 10% (Rindskopf, 2003). We then compared the model fit statistics for the best fitting models across the different specifications to arrive at the final unconditional model for each trait domain. Once the latent class models were selected for each trait domain, covariates were considered for these models. We first identified potential covariates for inclusion via an initial automatic Bolck–Croon–Hagenaars (BCH) method which tests significant mean differences across trajectory classes (Asparoutiov & Muthén, 2021). Retained covariates were included in the conditional

model as direct paths to class membership (via multinomial regression). The associations between outcomes and latent class membership were tested using the automatic BCH procedure. GMM analyses were initially run with 1000 sets of random start values and models were run again with 2000 sets of random starts to ensure the best log likelihood was obtained and replicated. We set a standard significance threshold for $p < .05$ for all tests.

Results

Correlations Across Time

Table 1 shows the correlations for each of the MPQ-Tri trait domain scores across time points. These results demonstrate moderate to strong stability across the three time points for all three traits. Additionally, correlations for each trait domain showed stronger associations between successive assessments, with the strongest correlations between T3 (age 19) and T4 (age 22). We also examined the intercorrelations within-visit for the MPQ-Tri trait domains observed scores. MPQ-Boldness largely was not associated with either MPQ-Meanness or Disinhibition. However, Meanness and Disinhibition scores were moderately correlated across all visits.

[TABLE 1 HERE]

Correlations with Covariates

Table 1 also reports the correlations between the MPQ-Tri scores and the covariates. The pattern of correlations was generally robust across time. Specifically, males were more likely to report higher boldness and meanness across time points, and more disinhibition at T4. Additionally, the number of SUD+ parents were significantly associated with higher MPQ-Meanness and Disinhibition scores across all visits, with little differences in magnitude between the two trait domains within wave. In contrast, parental SUD status was weakly associated with T2 and T3 Boldness, but not at T4. Finally, we found that neighborhood disadvantage was weakly associated with greater disinhibition and meanness, and lower boldness across all visits.

Correlations with Outcome Measures

Next, we examined the correlations between outcome indicators and the MPQ-Tri scales. Consistent with our hypotheses, MPQ-Disinhibition and Meanness scores were positively

associated with all three indicators of maladaptive behaviors across all time points. Notably, the correlations for MPQ-Disinhibition were significantly stronger in magnitude than for MPQ-Meanness for the overall problem behavior index[2], but not for ASPD symptoms or self-reported violence. Conversely, our results revealed that boldness was positively, but weakly, associated with self-reported violence, but not the other behavioral indicators.

Unconditional Models

Our first goal was to determine the number of classes for each MPQ-Tri scale in unconditional models (see Table 2 for model fit comparisons, and Table 3 for slope and intercept values for each trajectory class).

[TABLE 2 AND 3 HERE]

Boldness

Inspection of the model-fit statistics suggested that no multi-class model provided a better fit than a linear growth model (i.e., 1-class solution). The trajectory was rather stable over time, not showing significant change in the overall trajectory from age 16 to 22, B=10.81, $p < .01$ and -.12, p=.10, for the intercept and slope factors, respectively. As such, when testing the effects of covariates, and the degree to which variability in the growth factors account for variance in outcomes, we adopt a simpler modeling strategy.

Meanness

Model testing with the class-invariant, non-diagonal variance covariance structure found that best log-likelihood was replicated in all models. However, the analyses produced a non-

[2] Significance was determined using Stieger's (1980) formula for comparing dependent correlations. For the overall problem behavior index, all Z-tests were significant, Z=2.44, p=.014, Z=3.55, p<.001 and Z=3.70, p<.001, for Time 2-4, respectively.

positive definite matrix warning, pointing to the estimate of the slope variance in models with three classes and greater. Thus, we proceeded by constraining the slope variance to zero for these models. Additionally, we increased the number of starts to 5000 for the 4- and 5-class to replicate the best log-likelihood. The 2-class model from the class-varying, non-diagonal structure also replicated the best log-likelihood. However, non-positive definite error messages were produced, even with 5000 random starts. Given that models with this specification have more parameters than its class-invariant, non-diagonal counterpart, non-convergence, and errors may be more likely to occur (Johnson, 2021).

BIC values favored a 3-class model, whilst the SABIC favored the 4- and 5-class models. However, because the smallest class in the 5-class model had 3.8% membership, we focused on the 3-and 4-class models as potential models. Both models included a high meanness class which remained stable across assessments (28.5% and 10.8% in the 3- and 4-class models, respectively) and a class with low levels of meanness which decreased over time (55.8% and 46.9%). Whereas the 3-class solution recovered a class that reported high meanness which decreased over time (15.6%), the 4-class model recovered a mid-high range, stable meanness class (22.9%), in addition to the mid-range decreasing group in the 3-class model (19.5%). Although both models fit well, we ultimately selected the 3-class model because (a) the adjusted LRT test was not significant for the 4-class model and (b) the drop in SABIC from the 3- to 4-class model was smaller than the drop between the 2- and 3-class model. Thus, to reiterate, the final unconditional model for MPQ-Meanness consisted of three distinct trajectory classes: (a) a high, stable class, (b) a low, decreasing class, and (c) a class which reported high meanness at 16, but whose meanness decreased over time.

Disinhibition

We again found that the best log-likelihood was replicated in all models tested with the class-invariant, non-diagonal variance-covariance specification. Similar to MPQ-Meanness, we received non-positive definite errors when testing 4-class models and beyond for MPQ-Disinhibition, and subsequently constrained the slope variance to zero for those models. Moreover, model tests with the class-varying, non-diagonal specification also produced non-positive definite errors, despite many random starts. Our model comparison process indicated that a 3-class solution was the most plausible for MPQ-Disinhibition, with the SABIC favoring the 3-class model and the LRT test was significant at $p < .05$. The three classes can be characterized as (a) a group with low levels of disinhibition which decreased over time (53.6%), (b) a group with mid-range reported disinhibition at age 16, which decreased over time (32.9%), (c) a high-disinhibition group which became more disinhibited across assessments (15.1%).

Conditional Models

Next, we fit conditional models to examine the degree to which (a) our selected covariates were associated with latent class membership for each MPQ-Tri scale model, and (b) the degree to which the latent class accounted for variance in the outcomes of interest. Direct paths from the covariates to growth factors were initially included in each analysis. Conditional model results are displayed in Table 4.

[TABLE 4 HERE]

Boldness

We first examined the degree to which neighborhood disadvantage, parental SUD, and child's sex predicted the growth factors for MPQ-Boldness. Greater intercept values were associated with fewer SUD+ parents, lower neighborhood disadvantage, and being male. Sex

was inversely associated with the slope growth factor indicating that female participants tended to show greater decreases in MPQ-Boldness over time compared to male participants. With respect to outcomes, the intercept only was significantly inversely associated with overall problem behaviors. However, the slope factor also was positively associated with violent events and greater ASPD symptom counts, in addition to the overall problem behavior index.

Meanness

The initial BCH procedure revealed that class membership was associated with differences in all three covariates. Specifically, the high, stable class was predominately male (90.5% vs. 76.1% and 58.7% for the midrange-decreasing and low-decreasing classes, respectively), overall $\chi^2 = 44.58$, $p < .001$). The mean number of SUD+ parents were significantly different across classes, overall $\chi^2 = 19.59$, $p < .001$.However, this effect was isolated to differences between the high-stable class and the the low, decreasing class only. Neighborhood disadvantage significantly differed across classes, overall $\chi^2 = 8.03$, $p = .018$, with the effect again due to differences between the low-decreasing, $M = 2.31$, $SE = .08$, and high stable classes, $M = 2.63$, $SE = .13$. The conditional model was fit and the associations between class and outcomes were examined.

With respect to outcomes, MPQ-Meanness trajectory class membership largely predicted the outcomes in a linear manner, with greater meanness indicating more problem behavior (see Table 5). Specifically, the high meanness class reporting the most ASPD symptoms and overall problem behavior at T4 than both the low-meanness and mid-range classes. Similarly, the high stable and high-decreasing meanness classes reported significantly more violent acts than the low, decreasing class.

[TABLE 5 HERE]

Disinhibition

Of the covariates, only parental SUD+ status significantly differed across classes with the initial BCH procedure, χ^2 =28.39, p<.01. Children in the low-decreasing Disinhibition trajectory class had fewer parents with SUD+ status than those in the other two classes. There were no significant differences between the high-increasing and midrange classes, χ^2 = 1.59, p = 0.207. The multinomial logistical regression aspect of the model which regressed class membership on parental SUD+ status, confirmed these results. With the high, increasing class as the reference group, children in the low-decreasing Disinhibition trajectory class had fewer parents with SUD+ status, whereas parental SUD+ status did not significantly predict class membership in the high-disinhibition class. In the conditional model, compared to the unconditional model, the slope of the midrange class was no longer significant, albeit it had negative sign. The high-increasing disinhibition trajectory class reported the highest levels of overall problems, violent acts, and ASPD symptoms, compared to the midrange and low-decreasing trajectory classes. Further, the midrange trajectory class was higher on these outcome measures than the low-decreasing disinhibition class.

Joint Class Membership Analyses between Meanness and Disinhibition

As a final step, given the conceptual and empirical overlap between meanness and disinhibition, we explored the degree to which trajectory class membership for meanness and disinhibition co-occurred with each other, and whether joint membership resulted in differences in our outcomes. As shown in Table 6, individuals who were in the low, decreasing class for one trait were also more likely to be in the low, decreasing class for the other (74.4% and 76.6% for

disinhibition and meanness, respectively). Similarly, for those who were in the high, increasing disinhibition class were also more likely to be in the high-stable meanness class (66.3%). However, this pattern was less apparent for those in the high, stable meanness class (26%). Instead, they were split between the midrange, stable (41.6%) or low-decreasing (32.4%) disinhibition classes.

[TABLE 6 AND 7 HERE]

We then tested the degree to which joint membership was associated with differences in the three outcomes in a MANOVA, given the dependent variables were correlated (mean r = .47). Because uneven cell sizes when considering all nine possible combinations were a potential concern, we used the Pillai's Trace multivariate test which is more robust to uneven cell sizes and heterogeneity of variances, compared Wilks' λ. We found significant effects for both meanness and disinhibition trajectory class membership on the combined dependent variables, Pillai's Trace =.084, F (6, 714) =5.22, p <.001 partial η^2 =.044 for Meanness, and Pillai's Trace =.18, F (6, 714) =11.49, p<.001, partial η^2 =.089. The interaction effect was not significant, Pillai's Trace =.03, F (12, 1074) =.85, p =.60. Thus, this analysis found no evidence for multiplicative effects between class memberships but instead suggests that both trajectory memberships contribute to variance in the outcomes in an additive manner[3]. To further illustrate, we calculated Cohen's d effect size estimates for the joint memberships of the linear contrasts (i.e., high and low classes only; see Table 7). As expected, those who belonged to the most

[3] Because of missingness, we also conducted the MANOVA using datasets (5) derived from a multiple imputation procedure, which achieves a similar end to that of the BCH procedure used previously. Because SPSS does not provide pooled estimates for MANOVA, we examined the pattern of results across the 5 datasets. The results were largely consistent across datasets, and did not deviate systematically from the non-imputed results. Further, we conducted linear regression analyses on the imputed dataset with dummy coding for class memberships, and interaction effects for meanness and disinhibition class memberships. Inspection of pooled estimates revealed an identical pattern of significant effects.

persistently high levels of both meanness and disinhibition showed the strongest effect sizes compared to membership in both low-level classes. These effects were .25 to 1 standard deviation greater than only belonging to either the high-stable meanness or the high-increasing disinhibition trajectory class, relative to joint low-level class membership for both traits. Further, comparing the effect sizes of the high/high joint class membership with the different high/low configurations (i.e., high Meanness and low Disinhibition vs. low Meanness and high Disinhibition) revealed interesting differences. Specifically, being in the high Disinhibition class seemed relatively more important (i.e., yielded a stronger effect size) to score higher on the overall problem index, whereas being in the high Meanness class seemed more important (i.e., yielded a stronger effect size) to score higher on violent behavior, and the two were comparably important to score higher on ASPD symptoms (i.e., yielded comparably strong effect sizes).

Discussion

The present study aimed to better conceptualize heterogeneity in the development of psychopathic traits from adolescence to young adulthood. To this end, we leveraged longitudinal MPQ data to investigate whether distinct trajectory classes of triarchic psychopathy trait domains exist, and to what degree that this heterogeneity may be associated with both antecedent factors and important outcomes, spanning parental, environmental, internalizing, and externalizing variables. Our results provide evidence that developmental patterns characterized by high levels of Meanness and Disinhibition, which remain stable or increase over time, were associated with greater maladaptive outcomes, such as antisocial behavior and work and family problems into young adulthood. Conversely, those who report lower levels of these traits, which declined over time, were the least likely to experience such problems.

As suggested by past research (e.g., Bertoldi et al., 2021; Blonigen et al., 2006; Garofalo et al., 2021; Patrick et al., 2009; Patrick & Drislane, 2015; Veltman et al., 2023), we showed that, on average, Boldness, Meanness, and Disinhibition showed moderate-to-strong stability over time. Further, Meanness and Disinhibition showed strong within-time correlations with one another, while Boldness was largely orthogonal to the other trait domains. Men scored higher than women on all three trait domains at each time point, with the exception of Time 4 (age 22) Disinhibition scores. By and large, these results are in line with theoretical expectations and prior studies (e.g., Bertoldi et al., 2021; Blonigen et al., 2006; Patrick et al., 2009; Patrick & Drislane, 2015), although we did not find substantial differences in rank-order stability between Boldness and Meanness or Disinhibition. A similar finding was reported by Veltman et al. (2023) who also used MPQ-Tri scales and measured their stability from age 18 to age 26.

In terms of bivariate associations with the covariates and outcomes included in the present study, results were strikingly consistent across time points. Among the covariates (assessed between the ages of 10-12 and therefore before the MPQ-Tri assessment), the number of parental SUD + parents were positively associated with Meanness and Disinhibition, and less strongly and less consistently with Boldness. Similarly, neighborhood disadvantage was positively related to Meanness and Disinhibition but negatively related to Boldness. For the outcomes (assessed at age 22), Meanness and Disinhibition had consistent associations with all maladaptive outcomes (violence, ASPD symptoms, and overall problem index). Specifically, Disinhibition showed the strongest associations with overall problem index, whereas associations with violence and ASPD symptoms were comparable for Meanness and Disinhibition. Finally, Boldness was only related to self-reported violence scores and was unrelated to ASPD symptoms and overall problem index. Taken together, these findings were also consistent with expectations

(e.g., Brislin et al., 2017; Dotterer et al., 2017; Garofalo et al., 2021; Kyranides et al., 2017; Patrick & Drislane, 2015; Veltman et al., 2023) and support the notion that Boldness is (a) less impacted by negative environmental influences and (b) less associated to maladaptive outcomes compared to Meanness and Disinhibition. The association between Boldness and self-reported violence is however meaningful as it suggests that also Boldness may be related to increased risk of violent behavior and therefore harm to others (see Brislin et al., 2015; Garofalo et al., 2021; Gray et al., 2019; Howard, 2017), while being unrelated to other symptoms of internalizing or externalizing disorders. These findings parallel and extend Veltman et al.'s (2023) findings who reported – in a slightly older sample – concurrent but not prospective associations between boldness and self-reported delinquency as well as concurrent and prospective associations between boldness and variety of crimes committed over an 8-year timespan.

The main contribution of our study consisted in the examination of trajectory classes of each triarchic psychopathy trait domain and their correlates. We found evidence that the triarchic personality traits may not only differ in developmental patterns, but also in the degree of heterogeneity in these trajectories. For instance, our Boldness findings were consistent with prior conceptual and empirical work (e.g., Bertoldi et al., 2021; Blonigen et al., 2006), suggesting negligible variability in the trajectories that participants followed over time; in fact, a simple linear model was the best fit to the data suggesting that participants were well represented as one single class that showed relative stability from age 16 to age 22, as indicated by a non-significant slope. The non-significant slope may be due to the embedment, within Boldness, of emotional stability and extraversion (Miller et al., 2016; Shou et al., 2018), which tend to decrease and increase with age, respectively. The stability and negligible variability in Boldness trajectories may be consequential for our understanding of the development of psychopathic traits: in fact,

this pattern of stability and limited variability appears to support that Boldness represents a temperamental liability to psychopathic personality, whereas patterns of change in overall levels of psychopathy across development hinge upon trajectories of Disinhibition and Meanness, which are described below in more detail.

In contrast to Boldness, we recovered three trajectory classes for Meanness and Disinhibition. For Meanness, consistent with previous studies, this solution included an high-stable class (e.g., Hawes et al., 2018; Y. Lee & Kim, 2020; Salihovic et al., 2014) which included roughly 28% of the total sample. A comparable proportion of participants also fell into a class characterized by high starting levels of Disinhibition, which increased over time (see Hawes et al., 2018 for similar results). Also consistent with previous studies was the finding of two decreasing trajectories, which in our case started with low levels (roughly 45-55% of the sample) or midrange levels (roughly 30-36% of the sample) of Meanness and Disinhibition. When looking at joint class membership between Meanness and Disinhibition, we found that individuals in the low-level classes converged to a substantial extent. Similarly, individuals in the high-increasing Disinhibition class were also more likely to be in the high-stable Meanness class. In contrast, those in the high-stable Meanness class were approximately equally distributed in the different Disinhibition classes, suggesting potentially different variations of psychopathic meanness as accompanied or not by high levels of disinhibition traits. Overall, this pattern appears to show a non-reciprocal overlap between Meanness and Disihibition.

This heterogeneity in development across the three triarchic traits were not only associated with both antecedent parenting (Parental SUD+ status) and environmental variables (neighborhood disadvantage), but also were associated with differences in outcomes which have been implicated with psychopathic traits. Starting (i.e., intercept) levels of Boldness were

negatively related to parental substance use disorder, neighborhood disadvantage, and the overall problem index, in line with correlational findings discussed above. Female participants showed lower initial levels of Boldness, and a relatively greater decrease in Boldness compared to male participants. Interestingly, relatively smaller decreases in Boldness were associated with more SUD+ parents, violence, ASPD symptoms, and overall problem index. This finding was novel and requires further scrutiny; it seems to show that, net of Boldness' overall stability and lack of association between Boldness and maladaptive correlates, those individuals who tend to remain more stable (i.e., decrease less) in Boldness from age 16 to age 22 are those more likely to report problems across the board. If replicated in further studies, this finding may therefore suggest that it is not the level, but a deviation from normative developmental trends, that is problematic in relation to Boldness.

Although the pattern of bivariate associations was very similar for Meanness and Disinhibition – something that has raised concerns about their operationalization in the MPQ-Tri (e.g., Garofalo et al., 2021) – associations of the trajectory classes with external correlates and outcomes revealed a few noteworthy distinctions alongside expected similarities (e.g., Bergstrøm & Farrington, 2021; Hawes et al., 2018; Y. Lee & Kim, 2020; Salekin, 2008; Salihovic et al., 2014; Virtanen et al., 2020). First, there was a gradient of severity such that there were higher levels of three outcomes – self-reported violence, ASPD symptoms, and overall problem index – moving from the low-decreasing to the high-stable/high-increasing trajectory classes, suggesting that individuals falling in each class differed significantly from the other two classes in prospective risk for violent behavior, ASPD symptoms, and overall psychopathology spanning internalizing and externalizing spectra (Blonigen et al., 2006; Patrick, 2022). One previously mixed finding that we could not address concerned comparisons between low-

increasing and high-decreasing trajectory classes (Hawes et al., 2018; Salihovic et al., 2014), which we did not identify in our sample. Second, parental SUD+ status was significantly less prevalent in the low-decreasing classes. For Meanness, there was also a significant distinction between mid-decreasing and high-stable trajectories, suggesting that relative differences in parental substance use disorder may be more discriminating for Meanness than Disinhibition traits over time. That is, the prevalence of parental SUD+ status would similarly characterize both midrange and high Disinhibition classes, whereas individuals in the high-stable Meanness trajectory had significantly higher prevalence of parental substance use disorder than the midrange-decreasing class. Third, levels of neighborhood disadvantage significantly differed among Meanness trajectory classes but did not among Disinhibition trajectory classes. Taken together, these findings tentatively suggest that environmental influences may better discriminate trajectories of Meanness than Disinhibition. Finally, Meanness classes showed significant difference with regard to biological sex, with men more represented in classes with higher levels of Meanness, whereas no sex differences emerged for Disinhibition classes. This finding is consistent with the possibility that sex differences are more pronounced for antagonistic compared to disinhibited forms of externalizing (Sica et al., 2021; Somma et al., 2016).

Follow-up exploratory analyses examined the impact of joint class membership across the Meanness and Disinhibition trajectories. This impact was additive rather than interactive, as shown by significant main effects and pairwise comparisons, alongside non-significant interaction effects. These findings suggest that belonging to high trajectory classes for both Meanness and Disinhibition conferred the greatest risk across internalizing and externalizing domains. This is consistent with premises of the triarchic model (Patrick & Drislane, 2015), according to which individuals high on Disinhibition are considered psychopathic if they also

score high on Meanness or Boldness. Further, belonging to the high Meanness trajectory class conferred relatively higher risk for externalizing (violence) while belonging to the high Disinhibition trajectory class conferred relatively higher risk for internalizing (overall problem index), and belonging to either class conferred comparable risk in terms of ASPD symptomatology. Taken together, also these findings corroborated joint and distinct correlates of Meanness and Disinhibition.

Limitations and Future Directions

The present study is among the first of its kind but is not exempt from limitation; these are discussed here as they represent directions for future research. The reliance on archival data allowed us to leverage an incredibly rich source of data that would require massive resources to gather, but naturally, we were limited by the original study design. Future research could build upon this study, including measures that could have broadened the scope of outcomes investigated. Relatedly, because these data were collected decades earlier, their generalization to current or future generations should be made with caution, although there are no obvious conceptual reasons to expect differences in trajectory classes of personality traits and their correlates. Another limitation concerns the focus on a relatively short time frame (6 years) that did not extend into adulthood as well as the lack of assessments dating back earlier in the development to directly investigate putative precursors or prospective outcomes. Finally, because the triarchic model conceptualizes psychopathy as a configuration of elevated traits across its domains, future studies may follow up on our exploratory examination of joint trajectories of Meanness and Disinhibition investigating joint patterns of change on the three dimensions of the triarchic model of psychopathy, for instance relying on parallel process latent growth curve models.

Conclusions

These limitations notwithstanding, the present study had several important strengths, such as the multi-method assessment over several years and the reliance on a large sample with an over-representation of at-risk individuals. Taken together, the present study showed meaningful differences between Meanness and Disinhibition, and more pronounced differences between them and Boldness, with respect to trajectory classes over time, and associations with potential precursors and outcomes. These findings can help refine theories of the development of psychopathic traits and can inform early identification and prevention of individuals at risk. To the extent that Boldness, Meanness, and Disinhibition are embedded within broader hierarchical frameworks of psychopathology (e.g., Mullins-Sweatt et al., 2022), the present findings can also be leveraged for both conceptual and practical applications in the broader field of psychopathology.

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Table 1

Longitudinal and cross-sectional associations for the Multidimensional Personality Questionnaire-Triarchic scales, covariates, and outcomes

	Boldness			Meanness			Disinhibition		
	T2	T3	T4	T2	T3	T4	T2	T3	T4
T2 (16 y)	**--**			--			--		
T3 (18-19 y)	.59	--		.57	--		.57	--	
T4 (22 y)	.54	.66	--	.55	.64	--	.50	.65	--
M	1.60	1.59	1.59	1.37	1.31	1.29	1.40	1.34	1.30
SD	.18	.19	.18	.20	.19	.19	.21	.20	.21

Within-Visit Intercorrelations

	Time 2			*Time 3*			*Time 4*		
	B	M	D	B	M	D	B	M	D
Boldness (B)	--			**--**			--		
Meanness (M)	.04	--		.01	--		.06	--	
Disinhibition (D)	.01	.58**	--	.03	.59**	--	-.01	.65**	--
Correlations with Covariates (age 10-12)									
Neighborhood Disadvantage	-.12**	.13**	.06	-.19**	.10**	.11**	-.11**	.11**	.12**
Parental SUD+	-.09*	.19**	.20**	-.10*	.18**	.19**	-.04	.24**	.25**
Sex (0 = male, 1=female)	-.17**	-.23**	-.07	-.24**	-.25**	-.08	-.26**	-.32**	-.14**
Correlations with T4 Outcomes (age 22)									
Self-reported violence (log)	.11*	.39**	.35**	.12**	.43**	.36**	.18**	.47**	.38**
ASPD Symptoms (log)	.03	.30**	.24**	.03	33**	.34**	.05	.43**	.44**
Overall Problem Behavior score	-.03	.31**	.41**	-.09	.34**	.48**	-.09	.51**	.63**

Note. Mean ages for visits are as follows: T1 M_{age} =11.41; T2 M_{age} =16.09; T3 M_{age} =18.82; T4 M_{age} =21.89. All correlations in the top half of the table significant at p <.001.

* p < .05. ** p < .01.

Table 2
Fit Indices for Competing Unconditional Growth Mixture Models

Model	Log-likelihood	# Par	AIC	BIC	Ss-adjust. BIC	Adj. LMR LRT	Entropy	Avg PP	% in smallest class
Boldness									
1-class LGM model	**720.79**	**8**	**-1425.56**	**-1389.16**	-1414.57				
CI-U, 2-class	728.06	11	-1434.12	-1384.029	-1418.00	13.82	.47	.81	25.0
CI-U 3-class	732.4	14	-1436.8	-1373.05	-1417.499	8.26*	.55	.74	9.8
Meanness									
1-class LGM model	598.78	8	-1181.56	-1145.13	-1170.53				
CI-U 3-class	**635.63**	**12**	**-1246.26**	**-1192.618**	**-1230.72**	**27.58***	**.58**	**.77**	**15.6**
CI-U, 4-class	643.39	15	-1256.775	-1188.466	-1236.09	14.76	.60	.74	10.7
CI-U, 5-class	650.87	18	-1265.75	-1183.776	-1240.93	17.19	.63	.75	3.6
Disinhibition									
1-class LGM model	493.76	8	-971.53	-935.09					
CI-U, 2-class	525.94	11	-1027.88	-977.79	-1012.71	59.34**	.60	.85	26.7
CI-U 3-class	**534.21**	**14**	**-1040.41**	**-976.66**	-1021.11	**17.64***	**.58**	**.79**	**15.1**
CI-U 4-class	535.96	15	-1041.91	-973.6	-1021.23	22.15	.59	.75	11.10

Note. * p <.05. ** p <.01. LGM = Latent Growth Model. CI-U = Profile invariant, unrestricted model LMR = Lo-Mendell-Rubin LRT test; AvgPP = Overall average probability of most likely latent class membership. Best models from each variance covariance specification reported. Class-varying variance-covariance structure models yielded non-positive definite matrixes, even though the best log-likelihood value was replicated. This warning indicates that either the level of variation is too low, or the sample size too small, to estimate more than 1 trajectory group with this classification. Thus, we do not report the results from those models.

Table 3

Intercept and Slope Estimated Means and Variance for Unconditional Latent Class Growth Analysis Models

			Means		Variances	
	Construct Class	**% in class**	**Intercept (SE)**	**Slope (SE)**	**Intercept (SE)**	**Slope (SE)**
Boldness						
	Linear growth model (1 class)	--	1.60** (.01)	-.01 (.004)	.022** (.002)	.004**(.001)
Meanness					*.01** (.002)*	-
	High, stable	28.5	1.49** (.03)	.02 (.02)		
	Midrange, decreasing	15.6	1.56** (.04)	-.15** (.03)		
	Low, decreasing	55.8	1.25** (.02)	-.03** (.01)		
Disinhibition					*.024** (.004)*	*.003 (.002)*
	High, increasing	15.1	1.52** (.03)	.07** (.02)		
	Midrange, decreasing	31.3	1.45** (.02)	-.02* (.01)		
	Low, decreasing	53.6	1.34** (.01)	-.09** (.01)		

Note. * $p < .05$. ** $p < .01$.

Table 4.

Growth Mixture Model-based Conditional Model Regression Results Predicting Delinquency Trajectory Class Membership.

		Covariates T1	
Construct Class	**Sex (m=0, f=1)**	**Neighborhood Disadvantage**	**# Parental SUD+**
Boldness			
Linear growth model			
Intercept factor	-.25**	-.18**	-.14**
Slope factor	-.60**	.16	.43*
Meanness		Estimates (SE, Odds Ratio)	
High, stable	--	--	--
Midrange, decreasing (1)	1.20** (.62, 3.31)	.13 (.14, 1.01)	-.55** (.31,58)
Low, decreasing (2)	2.47** (.47, 11.78)	-.26*(.13, .77)	-1.03** (.22,.36)
Disinhibition			
High, increasing			--
Midrange, stable			-.50** (.29, .61)
Low, decreasing			-.97** (.24, 38)

Note. T1 M_{age} =11.41; For Boldness, standardized parameter estimates for the direct paths from covariates to both intercept and slope factors are presented.For Meanness and Disinhibition, value represents odds ratio derived from the multinomial regression part of the GMM. Reference class was set as the group with the highest reported levels of the trait.

* p <.05. ** p <.01

Table 5

Class-Specific Mean Estimates for Growth Factors and Behavioral Outcomes

				Outcome Measures T4		
Construct Class	**% in class**	**Intercept (SE)**	**Slope (SE)**	**Violent Acts (log) (SE)**	**ASPD Symptoms (log) (SE)**	**Overall Problem Index (SE)**
Boldness						
Linear growth model	--	1.68**	-.01			
		(.01)	(.004)			
Intercept factor				.09	-.03	-.16**
Slope factor				.47**	.43**	.31**
Meanness						
High, stable	24.5	1.48**	.02	1.21[a]	.87[a]	32.04[a]
		(.02)	(.02)	(.09)	(.08)	(2.16)
Midrange, decreasing	23.3	1.53**	-.12**	.95[a]	.43[b]	14.22[b]
		(.04)	(.03)	(.13)	(.10)	(2.48)
Low, decreasing	52.0	1.23	-.03**	.47[b]	.21[b]	13.88[b]
		(.01)	(.01)	(.04)	(.03)	(.78)
Disinhibition						
High, increasing	14.0	1.53**	.06**	1.39[a]	.94[a]	36.05[a]
		(.04)	(.02)	(.12)	(.11)	(2.83)
Midrange, stable	30.7	1.4**	-.02	.77[b]	.54[b]	22.96[b]
		(.02)	(.02)	(.09)	(.08)	(1.77)
Low, decreasing	55.3	1.34**	-.09**	.54[c]	.18[c]	9.93[c]
		(.01)	(.01)	(.05)	(.03)	(.78)

Note. T4 M_{age} =21.89. Because a linear growth model fit best for MPQ-Tri Boldness estimates, standardized parameter estimates for both intercept and slope factor, are presented for outcomes. ** p < .001. Values with different alphabetical superscripts indicate significant mean differences across classes at p <=.01, based on automatic BCH procedure.

Table 6.

Joint Membership Counts for Meanness and Disinhibition Trajectory Classes.

		Meanness			
		High, stable	High, decreasing	Low, decreasing	Total
Disinhibition	High, increasing	**57**	10	19	*86*
	Midrange, Stable	91	26	77	*194*
	Low, Decreasing	71	37	**314**	*422*
Total		*219*	*73*	*410*	*702*

Table 7

Effect Size Estimates Comparing High and Low Joint Memberships of Meanness and Disinhibition.

DUSI-Overall Problem Index			Violence (Log)			ASPD Symptoms (Log)		
M/D	M/D	*d*	M/D	M/D	*d*	M/D	M/D	*d*
High/high (47)	Low/low (210)	2.03	High/high	Low/low	1.49	High/high	Low/low	2.06
High/high (47)	High/low (30)	1.29	High/high	high/low	0.68	High/high	high/low	0.91
High/high (47)	low/high (16)	0.31	High/high	low/high	1.11	High/high	low/high	0.98
Low/high	high/low	1.15	High/low	low/high	0.48	High/low	low/high	0.09
High/low	Low/low	.33	High/low	Low/low	0.73	High/low	Low/low	0.68
Low/high	Low/low	1.78	low/high	Low/low	0.22	low/high	Low/low	0.57

Note. Sample size for joint groups in parentheses. M=Meanness, D=Disinhibition.