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Article

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International Journal of
Offender Therapy and
Comparative Criminology
2024, Vol. 68(12) 1216–1233

DOI: 10.1177/0306624X221113532
journals.sagepub.com/home/ijo
SAGE

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Abstract

The aim of the current paper was to examine temperament profiles and temperament dimensions as risk factors for persistent criminal behavior in juveniles who offended (JOs). A sample of 137 male adolescents from a Swiss detention center and 137 age and sex matched community controls were included in the present study. Temperament was measured with the Junior Temperament and Character Inventory (JTCI). Using Latent Profile Analysis (LPA), three temperament profiles were found, a "moderate," an "adventurous-disinhibited" (higher levels of novelty seeking, lower levels of harm avoidance, reward dependence, and persistence), and a "worried-passive" profile (higher levels of harm avoidance, low persistence). None of the profiles and dimensions were associated with detention sample (i.e., JO) status. In JOs, the "novelty seeking" scale predicted recidivism after release from detention even when controlling for other covariates. Further research should address temperament profiles and temperament dimensions in larger samples of JOs to elaborate their relation to previous and future offending behavior.

Keywords

personality, JTCI, youth crime, criminal recidivism, psychiatric disorders, temperament

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Temperament and its influence on behavior has been part of scientific research for millennia (DeLisi & Vaughn, 2014). There are many theories about temperament and its influence on behavior (Waller et al., 2016; Wolkind & De Salis, 1982). For example, Eysenck (1991) describes temperament traits as underlying and influencing factors of one's personality guiding behavior. The relationship between temperament and the development of mental disorder is also part of a substantial body of research. Especially externalizing behavior and its causes have been examined extensively (Leve et al., 2005; Schwartz et al., 1996). Often, however, also internalizing behavior (Jylha & Isometsa, 2006) has a connection with temperament.

Nevertheless, most of the temperament concepts do not focus on specific behavior (problems) but try to model those specific aspects of personality, that describe the "style of behavior" (i.e., the "how") in contrast to the "meaning of behavior" (i.e., "what" and "why," Thomas & Chess, 1980) and, thus, follow the approach of rooting the temperamental aspects to biological-based systems (Gray, 1990) and/or to early differences in behavior that can be detected already in toddlers (Goldsmith et al., 1987; Kagan et al., 1989).

Cloninger's biopsychosocial model of personality can be regarded as an attempt to unify several approaches by combining and contrasting the area of "temperament" to the area of "character" (Cloninger et al., 1993). On the basis of longitudinal studies regarding personality development as well as pharmacological and neuroanatomic studies, and with respect to Gray's theory (Gray, 1990), Cloninger developed a concept of personality. First three and later four basic dimensions of personality were defined, differentiating "behavioral activation / approach" (e.g., impulsivity), "behavioral inhibition / avoidance" (e.g., shyness), "social responsiveness" (e.g., sensitivity), and "persistence" (e.g., maintenance). Cloninger called these dimensions "temperament" in reference to their biology-behavioral-based definition (Cloninger, 1987). The four different temperament dimensions refer to traditional stimulus-response patterns in terms of a quasi-automatic emotional reaction tendency, that is, readiness to get activated, inhibited, socially-influenced, or to show intrinsically maintained behavior. To cover the full scope of an individual's behavior style: (1) Novelty Seeking (NS) represents a stimulus response that initiates activation (stoic-calm vs impulsive-excitable), and is expressed by explorative behavior, impulsive decision making, speed and intensity of an emotional reaction, active avoidance of frustration and tendencies to exceed rules in the course of it; (2) Harm Avoidance (HA) represents a stimulus response that tends toward inhibition (carefree-uninhibited vs worried-cautious), and is operationalized by passive-avoidant tendencies such as anxiety, shyness, pessimistic worries and fatigue; (3) Reward Dependence (RD) represents a stimulus response which regulates behavior in regard to signals of social reward or non-reward (unsentimental-independent vs soulful-affectionate), and is described by spontaneous sensitivity and warmth as well as maintaining stable social relationships; (4) Persistence (P) represents a stimulus response characterized by maintenance (relaxed-pragmatic vs hardworking-persistent), and is operationalized by readiness for hard work, ambition, perseverance, and perfectionism (Goth & Schmeck, 2009).

Personality development is described as a lifelong process of continuous interaction between an individuals' temperament, self-concept, and social environment. In

this developmental process, some variants or temperament profiles have been described as risk factors for an antisocial development. Especially the "wild" temperament with high activation plus low inhibition plus low social responsiveness, which may lead to many negative social experiences in our "structured, achievement-oriented" society, which in the next step may lead to less opportunities to gain self-confidence and social skills, both reflecting a "mature" character (Cloninger et al., 1997).

Previous research has supported this particular profile (high NS + low HA + low RD) as a risk factor for later criminal behavior in community youth (Sigvardsson et al., 1987), for conduct disorder (CD) in a clinical sample of minors (Schmeck et al., 2001) and as correlate of psychopathy in a sample of juveniles who offended (JOs; Lennox & Dolan, 2014). Nevertheless, data describing adolescents' temperament characteristics and relating them to criminal behavior is scarce. Beaver et al. (2015) presented their concept of temperament, showing a connection between certain impairments in temperament and antisocial conduct. Lennox and Dolan (2014) looked at an antisocial sample and found a temperament triad related to criminal behavior. DeLisi et al. developed a temperament-based theory of antisocial behavior and suggested two determining temperamental factors: "Effortful control" (e.g., attention control, cognitive control, and behavior control) and "negative emotionality" (e.g., feelings of distress including anger, hostility, and irritability; DeLisi et al., 2018; DeLisi & Vaughn, 2014). Baglivio et al. (2016) found evidence for the robustness of this theory showing that low effortful control and high negative emotionality were predictive of the prevalence of criminal behavior and shorter time to recidivism in a large US sample of adjudicated youths. In addition, Wolff and Baglivio (2016) demonstrated that adverse childhood experiences are both directly and indirectly (via negative emotionality) related to recidivism.

Early prevention of criminal behavior and effective treatment of JOs is important in order to avert further damage in the lives of adolescents and their families. In therapeutic interventions, temperament profiles could be a helpful means of identifying adolescents who are at risk for future delinquency. For example, Rettew et al. (2008) tested Junior Temperament and Character Inventory (JTCI) temperament profiles in community adolescents using Latent Profile Analysis (LPA) and identified three subtypes, that is, (1) a disengaged subtype (low reward dependence and persistence), (2) a steady subtype (low novelty seeking, high persistence), and (3) a moderate subtype with scores in between.

The aim of the current study was to examine the relationship between temperament and offending behavior in more detail. First, we analyzed temperament profiles in a juvenile sample, including both JOs and juveniles from the general population, in order to identify specific subtypes. Secondly, we examined the JO subgroup in more detail to identify possible links between specific temperament profiles, mental disorders, and reoffending.

Methods

Participants and Procedures

In the present study we included a sample of male JOs in detention (Aebi et al., 2016) and an age and sex matched sample of adolescents from the community (Goth et al., 2012).

JO sample. All juveniles who were admitted to the Zurich Juvenile Detention Centre (Switzerland) between September 2010 and November 2012 were eligible. Juveniles with insufficient knowledge of the German language, serious medical conditions (e.g., acute state of human immunodeficiency virus, hepatitis, or other infectious diseases), and/or neurologic disorders (e.g., epilepsy), intellectual disability, and psychotic symptoms were excluded. Juveniles were approached within 5 days after admission and invited to participate in the study. Confidentiality was assured via signature of a confidentiality form. The design and procedures of the current study were previously published in detail (Aebi et al., 2016). Informed consent was obtained from the participants. In compliance with guidelines set for clinical studies by the ethics committee of the Canton of Zurich, the final approval for the study was given by the Swiss Federal Institute of Health. Out of a total of 226 eligible male juveniles, 4 (1.7%) refused to participate in the present study. Furthermore, 89 juveniles were excluded from the study due to insufficient knowledge of the German language ($n = 31$), cognitive impairment/psychotic symptoms ($n = 9$), release from detention prior to testing ($n = 6$), and missing or incomplete data ($n = 39$). The final sample, thus, consisted of 137 male JOs with a M_{age} of 16.39 years ($SD = 1.11$ years; range = 13–18 years).

Community sample. The original community sample consisted of 1,371 adolescents (591 boys and 780 girls) with a M_{age} of 14.80 years ($SD = 2.38$ years; range = 10–20 years). The community sample was assessed in three representative German public schools. Data collection took place in group-settings by class or grade for a duration of 1 hour. Prior to the assessment, the participants and their parents/guardians were informed about the study and their consent was obtained. The self-report questionnaires were administered to the students. Participation ranged from 66% to 89% ($M = 78\%$). The study was approved by the Ethics Committee Basel/Switzerland (EKBB) as well as by the Ministry of Education Hessen, Germany. Out of this original sample, a random sub-sample of age matched boys ($n = 137$; $M_{age} = 16.39$, $SD = 1.11$ years, range = 13–18 years) was drawn.

Measures

Demographic information. In the JO sample, age, nationality, and reason for the current detention (according to Swiss penal law) were coded directly from the prison files. Socioeconomic status (SES) was coded based on the occupations of maternal and paternal caregivers according to International Standard Classification of Occupations (ISCO-08) guidelines (International Labour Organisation, 2008) ranging from 1 (management position) to 9 (unskilled worker). Unemployed caregivers were coded as 10. In line with previous research in Switzerland (e.g., Aebi et al., 2016) low SES was scored when the SES of both caregivers was coded 9 or 10, or the SES of one caregiver was missing and the SES of the other caregiver was coded 9 or 10. In the community sample, age was coded from the JTCI questionnaires.

Junior Temperament and Character Inventory (JTCI). Cloninger (1987) and Cloninger et al. (1993) developed the Temperament and Character Inventory (TCI) before they

expanded the model and integrated different scientific approaches and combined biological, genetic, and clinical hypotheses. A first version of a questionnaire for children and adolescents based on this concept was developed by Luby et al. (1999). Goth and Schmeck (2009) provided the German version of the instrument for children and adolescents aged 12 to 18 years and thus a culture specific adaptation. The *JTCI 12-18 R* (Junior Temperament and Character Inventory—Revised) was constructed in German language in cooperation with Cloninger to reflect his revised operationalization (*TCI R*; Cloninger et al., 1999) using items with a five-step answer mode. It is part of a culture-adapted German test set providing equivalent scales for children (*JTCI 3-6 R, JTCI 7-11 R*) and adolescents (*JTCI 12-18 R*) on scale and defined subscale level (Goth & Schmeck, 2009). In the current study the scale reliabilities (Cronbach's alpha) ranged between .70 and .84 for the JO sample and between .79 and .85 for the community sample. In the original validation sample of the *JTCI 7-11 R*, construct validity had been shown with Confirmatory Factor Analysis (CFA) and promising results for diagnostic validity were demonstrated by covariations with current psychopathology (Goth, 2011).

The *JTCI 12-18 R* contains four temperament traits that are described as quasi-automatic emotional reaction tendencies (Goth & Schmeck, 2009): (1) novelty seeking (NS); (2) harm avoidance (HA); (3) reward dependence (RD); and (4) persistence (P).

Mental disorders (JO sample only). The presence of any disorder, any affective disorder, any anxiety disorder, any substance related disorder, any externalizing disorder (attention deficit hyperactivity disorder [ADHD], oppositional defiant disorder [ODD], and CD) were assessed using the Mini-International Neuropsychiatric Interview for Children and Adolescents (*MINI-KID*), a short structured clinical diagnostic interview designed to assess the presence of psychiatric disorders in children and adolescents (Sheehan et al., 2010). The assessment was carried out by experienced clinicians with a minimum of four years of specialty psychiatric training, thus ensuring diagnostic integrity. Diagnoses were based on algorithms appropriate for symptom count, age, duration, and impairment according to criteria defined in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). The MINI-KID has been shown to have good reliability and validity (Sheehan et al., 2010).

Criminal re-offending after release from detention. Information on recidivism was drawn from the crime registry of the Canton of Zurich. This computerized database contains all past and current transactions from all prosecution institutions and detention centers in the Canton of Zurich including information regarding the date of charges, types of offenses, dates of convictions or penalty orders, and the beginnings and endings of detentions or incarcerations. Re-offending was based on criminal charges. As information on criminal records was limited to people living in the Canton of Zurich, 35 juveniles from other Cantons had to be excluded from the criminal recidivism analyses ($n = 102$). All of the remaining youth had been released from detention and were followed up for 365 days after release.

Statistical Methods

We used Latent Profile Analysis (LPA) to determine potential sub-groups. In combining variable-centered with person-centered approaches, we can recover "hidden" groups within the population of interest and thus arrive at a higher differentiation of potential overlap (Oberski et al., 2015). In order to define profiles based on an empirical foundation, the responses to the four temperament scales of the JTCI of both samples (JOs and community controls) were included in the LPA. In the present study, LPA was performed in Mplus 7.31 (Muthen & Muthen, 2012). The analysis was performed by fitting a one-class model and gradually increasing the number of classes one at a time for model comparison, setting 20 different random starting values. One to five class models were compared and the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC), the sample size adjusted BIC (aBIC) as well as the entropy were used to determine the number of classes (Abram et al., 2004). Furthermore, the bootstrapped parametric likelihood ratio test (BLRT) was used in order to compare a model with K classes to a model with $k-1$ classes. Significant results indicate that the k class model fits the data better than the $k-1$ class model. In addition, we also examined the models with number of classes consisting of less than 20 cases. It is suggested that solutions with small number of cases may not be feasible (Marsh et al., 2009). Finally, when choosing a latent class model, one should also consider how reasonable the model is with respect to the research questions being investigated and the generalizability of the model to other populations (Abram et al., 2004). In order to test for measurement invariance we performed additional analyses including sample status (detention vs. community sample) as a covariate in the LPA.

Separate logistic regression models were performed to analyze (1) JTCI temperament scales (variable centered approach) and (2) JTCI profiles (person centered approach based on LPA classes) as predictors of sample status (JOs vs. community controls) and the presence of current mental disorders. In addition, univariate and multivariate Cox regression models were used to examine (1) JTCI temperament scales and (2) JTCI profiles as predictors of any criminal recidivism or violent recidivism within 365 days after release from detention. The JTCI "moderate" subtype (see below) was selected as the reference category in regression analyses because it represents the most discrete profile and most participants were assigned to this subtype. Age, foreign nationality, and low SES were included as covariates in multivariate model 1. The presence of any psychiatric disorder was included as covariate in multivariate model 2. The proportional hazard assumption was tested for each covariate by the use of the "cox.zph"-function of the survival package (Fox, 2002) in R statistic software (R Development Core Team, 2011).

Results

Descriptive Findings

Of the sample of 137 JOs, 64 (46.7%) were of foreign nationality (26.6% Kosovo, 14.1% Turkey, and 59.3% other countries). Furthermore, 37 (27.0%) were from families with a low SES. No significant differences were found between juveniles with a

Table 1. Descriptive Results of the JTCI Temperament Scales (Mean *T*-Scores, *SD*) in the JO and the Community Sample.

JTCI temperament scales	JO sample ($n = 137$)	Community sample ($n = 137$)	JO vs. community sample
	M (*SD*)	*M* (*SD*)	*t*
Novelty seeking	52.20 (9.78)	50.19 (8.82)	1.78 n.s.
Harm avoidance	46.27 (8.86)	48.36 (9.24)	−1.92 n.s.
Reward dependence	49.62 (8.96)	49.14 (8.80)	0.45 n.s.
Persistence	50.13 (9.71)	48.61 (9.99)	1.28 n.s.

Note. JO = juvenile who offended; JTCI = Junior Temperament and Character Inventory.

foreign nationality and juveniles with a Swiss nationality in regard to SES, $\chi^2(1) = 3.31$, $p = .07$. The juveniles were detained for various reasons: 19 (13.9%) were accused of non-sexual violent crimes (bodily harm and physical attack), 33 (24.1%) of robbery, 18 (13.1%) of property crimes, 10 (7.3%) of sexual crimes, and 57 (41.6%) of drug related crimes or traffic offenses.

Furthermore, 124 (90.5%) juveniles were found to meet criteria for at least 1 and 103 (83.1%) for two or more mental disorders. In detail, 43 juveniles were diagnosed with an affective disorder (31.4%), 43 with an anxiety disorder (31.4%), 112 with an externalizing disorder (81.8%), and 93 with a substance use disorder (67.9%).

T-scores based on the original validation sample of 12- to 18-year-old youth (Goth & Schmeck, 2009) of the JTCI temperament scales for the JO sample and the community sample are presented in Table 1. No differences between the two samples were found on any of the temperament scales.

LPA Based on Four JTCI Temperament Scales

Findings from the LPA did not yield to a clear solution: Among the LPA models, data fit was best for the two-class model according to the BIC and for the five-class model according to the AIC and aBIC (Table 2). According to the BLRT the four-class solution did not fit the data significantly better than the three-class solution. The four-class solution was found to have some classes with small numbers of participants and was found rather difficult to interpret. Based on these considerations and by taking into account previous findings of a three classes solution (Rettew et al., 2008) and interpretability of profiles described in the JTCI manual (Goth & Schmeck, 2009; e.g., high NS + low HA), we chose the three-class solution to be used in subsequent analyses. Hence, interpretability and intelligibility were more strongly emphasized than the other statistically given options. Additional analyses including sample status (JO vs. community sample) as a covariate in the LPA yielded quite similar results for the three-class-solution (AIC = 3,067.346, BIC = 3,139.609, aBIC = 3,076.193, entropy = 0.65; class 1: $n = 159$, class 2: $n = 88$, class 3: $n = 27$). Log-likelihood difference testing for MLR estimators including scaling correction factors (Muthen &

Table 2. Model Parameters of Latent Profile Analyses (LPA) Based on Four JTCI Temperament Scales in the JO Sample and Community Controls ($N = 274$).

Model	Log likelihood	AIC	BIC	aBIC	Entropy	BLRT (k vs. $k-1$ classes)	No. of classes $<n=20$
One-class	−1,553.153	3,122.306	3,151.211	3,125.845	—	—	0
Two-class	−1,528.466	3,082.933	3,129.903	3,088.683	0.60	$p < .001$	0
Three-class	−1,516.976	3,069.952	3,143.988	3,077.914	0.66	$p < .001$	0
Four-class	−1,508.881	3,063.763	3,146.865	3,073.937	0.71	0.06	1
Five-class	−1,499.311	3,054.623	3,155.790	3,067.008	0.73	0.03	1

Note. aBIC = sample size adjusted Bayesian information criterion; AIC = Akaike information criterion; BIC = Bayesian information criterion; BLRT = bootstrapped parametric likelihood ratio test.

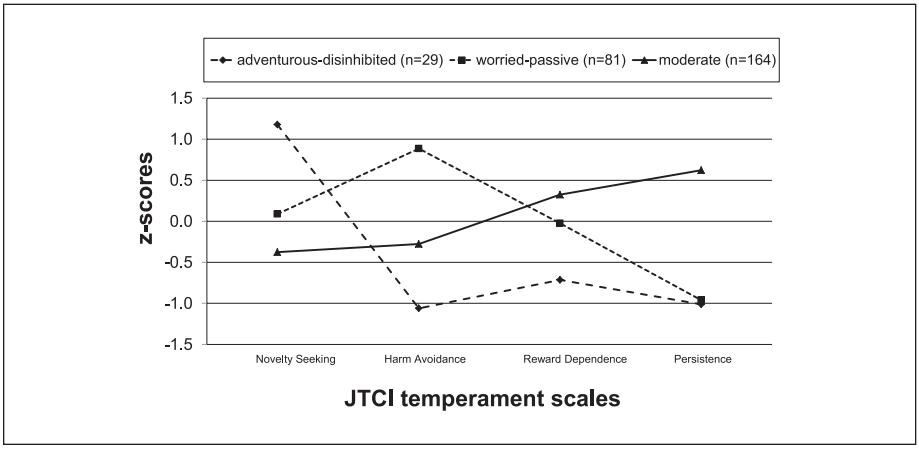

Figure 1. JTCI temperament profiles.

Muthen, 2012), of the original three-class model and the three-class model with sample status as covariate was not significant (χ^2 distributed test value = 2.608, $df = 2$, $p = .271$), suggesting that measurement invariance is not an issue here.

Mean z-scores of the four JTCI temperament scales for the three LPA based profiles are shown in Figure 1. Temperament profiles (each with a specific behavioral style), were labeled: (1) "moderate"; (2) "worried-passive"; and (3) "adventurous-disinhibited." Profile denomination focused on positive and less disturbance-oriented descriptors, which was considered more appropriate for the given developmental states of children and adolescents. The "moderate" profile consisted of 164 boys (87, 63.5% JO sample, 77, 56.2% community sample), the "worried-passive" profile consisted of 81 boys (32, 23.4% JO sample, 49, 35.8% community sample), and the "adventurous-disinhibited" profile consisted of 29 boys (18, 13.1% JO sample, 11, 8.0% community sample).

Associations of JTCI Temperament Scales and Profiles With JO Sample Status

Variable centered approach: Logistic regression revealed that none of the JTCI temperament scales was significantly associated with JO sample status (novelty seeking: OR = 1.25, 95% CI [0.98, 1.59]; harm avoidance: OR = 0.79, 95% CI [0.62, 1.00]; reward dependence: OR = 0.88, 95% CI [0.69, 1.12]; persistence: OR = 1.81, 95% CI [0.93, 1.50]). Person centered approach: Frequencies of boys with community vs. JO sample status did not differ between the three profiles ("moderate": 56.9% vs. 64.2%; "adventurous-disinhibited": 8.0% vs. 12.4%; "worried-passive": 35.0% vs. 23.4%; χ^2 (2) = 5.09, p = .08). Taking the "moderate" profile as reference category, neither the "worried-passive" profile (OR = 0.59, 95% CI [0.34, 1.02]) nor the "adventurous-disinhibited" profile (OR = 1.37, 95% CI [0.61, 3.10]) were found to be associated with JO sample status.

Associations of JTCI Temperament Scales and Profiles With Mental Disorders

The results of the logistic regression analyses with JTCI temperament scales as predictor variables and mental disorders as outcomes are shown in Table 3. The "novelty seeking" temperament scale was positively related to multiple mental disorders, the "harm avoidance" temperament scale was positively related to anxiety disorders and the "reward dependence" temperament scale was negatively related to externalizing disorders. The "worried-passive" profile showed a positive relation with anxiety disorder. No logistic regression was conducted for the JTCI profiles regarding the presence of externalizing and any disorders because all 17 participants in the "adventurous-disinhibited" JTCI profile showed externalizing disorders.

Association of JTCI Temperament Scales and Recidivism After Release From Detention

The proportional hazard assumption was confirmed for the temperament scales and profiles as well as the covariates included in the analyses ($p > .05$). Variable centered approach: Novelty seeking was the only JTCI temperament scale that was found positively associated with time to any and any violent re-offense in univariate as well as in multivariate analyses while considering the presence of any psychiatric disorder as control variable (Table 4). None of the remaining JTCI temperament scales was found related with criminal outcomes. Among demographic covariates in multivariate model 1 only age was found negatively related to time of any and any violent re-offense. The presence of any psychiatric disorder in multivariate model 2 was not found related to criminal outcomes.

Person centered approach: Taking the "moderate" profile as reference, neither the "adventurous-disinhibited" profile nor the "worried-passive" profile predicted time to

Table 3. JTCI Temperament Scales and Subtypes as Predictor of Mental Disorders in JOs ($N = 137$).

Variables	Any disorder OR [95% CI]	Affective disorders OR [95% CI]	Anxiety disorders OR [95% CI]	Substance related disorders OR [95% CI]	Externalizing disorders OR [95% CI]
JTCI temperament scales					
Novelty seeking	**3.45 [1.66, 7.19] $p < .001$**	**1.46 [1.00, 2.13] $p = .048$**	1.34 [0.92, 1.94]	**1.85 [1.24, 2.76] $p = .003$**	**2.40 [1.43, 4.14] $p < .001$**
Harm avoidance	1.27 [0.71, 2.27]	1.43 [0.99, 2.08]	**1.56 [1.07, 2.29] $p = .022$**	1.17 [0.81, 1.69]	1.11 [0.71, 1.71]
Reward dependence	**0.48 [0.26, 0.92] $p = .026$**	0.98 [0.68, 1.41]	1.09 [0.76, 1.57]	0.88 [0.61, 1.26]	**0.60 [0.37, 0.97] $p = .035$**
Persistence	0.56 [0.30, 1.07]	0.76 [0.53, 1.10]	0.69 [0.48, 1.00]	0.73 [0.50, 1.06]	0.68 [0.43, 1.09]
JTCI temperament subtypes (reference group: "moderate" subtype)					
"Adventurous-disinhibited" subtype	n/c	1.88 [0.64, 5.46]	1.64 [0.54, 4.94]	1.37 [0.44, 4.25]	n/c
"Worried-passive" subtype	n/c	1.60 [0.68, 3.77]	**2.65 [1.14, 6.17] $p = .026$**	2.04 [0.79, 5.25]	n/c

Note. JOs = juveniles who offended; JTCI = Junior Temperament and Character Inventory; CI = confidence interval; OR = odds ratios.
CI that do not include 1.00 indicate a significant OR at $p < .05$. Significant OR are in bold.

Table 4. JTCI Temperament Scales and Subtypes as Predictor of Criminal Recidivism in JOs ($N = 102$).

	Univariate model	Multivariate model[a]	Multivariate model[b]	Univariate model	Multivariate model[a]	Multivariate model[b]
	Time to any re-offending	Time to any re-offending	Time to any re-offending	Time to violent re-offending	Time to violent re-offending	Time to violent re-offending
Variables	HR [95% CI]	HR [95% CI]	HR [95% CI]	HR [95% CI]	HR [95% CI]	HR (95% CI]
JTCI temperament scales						
Novelty seeking	**1.36 [1.07, 1.73] $p = .013$**	1.27 [0.99, 1.64]	**1.33 [1.02, 1.73] $p = .035$**	**1.56 [1.14, 2.13] $p = .005$**	**1.43 [1.03, 1.98] $p = .003$**	**1.40 (1.00, 1.96] $p = .050$**
Harm avoidance	0.88 [0.69, 1.12]	0.90 [0.68, 1.19]	0.87 [0.66, 1.15]	0.92 [0.67, 1.28]	0.87 [0.60, 1.26]	0.84 (0.58, 1.21] –
Reward dependence	0.85 [0.66, 1.10]	0.82 [0.60, 1.12]	0.96 [0.73, 1.28]	0.94 [0.60, 1.28]	0.99 [0.69, 1.43]	1.21 (0.84, 1.76]
Persistence	0.96 [0.75, 1.23]	1.12 [0.82, 1.51]	1.07 [0.81, 1.43]	0.84 [0.61, 1.15]	0.95 [0.65, 1.40]	0.91 (0.62, 1.33]
Covariates						
Low SES		1.62 [0.93, 2.84]			1.79 [0.88, 3.63]	
Age		**0.73 [0.58, 0.92] $p = .008$**			0.75 [0.56, 1.01]	
Foreign nationality		0.68 [0.41, 1.13]			0.72 [0.38, 1.36]	
Any psychiatric disorder			1.43 [0.53, 3.82]			nc
JTCI temperament subtypes (reference group: "moderate" subtype)						
"Adventurous-disinhibited" subtype	1.14 [0.54, 2.43]	1.38 [0.64, 2.99]	1.07 [0.50, 2.28]	1.19 [0.45, 3.10]	1.37 [0.52, 3.62]	1.00 [0.38, 2.62]
"Worried-passive" subtype	0.83 [0.47, 1.48]	0.78 [0.44, 1.40]	0.81 [0.45, 1.43]	1.18 [0.58, 2.40]	1.10 [0.53, 2.28]	1.14 [0.55, 2.27]
Covariates						
Low SES		1.54 [0.90, 2.63]			1.79 [0.93, 3.46]	
Age		**0.72 [0.57, 0.90] $p = .004$**			**0.72 [0.54, 0.96] $p = .025$**	
Foreign nationality		0.72 [0.43, 1.18]			0.74 [0.39, 1.40]	
Any psychiatric disorder			1.69 [0.67, 4.24]			nc

Note. JOs = juveniles who offended; JTCI = Junior Temperament and Character Inventory; CI = confidence interval; HR = hazard ratios; ODD = oppositional defiant disorder; nc = not calculable.
[a]Controlled for low socio-economic status (SES), age, and foreign nationality.
[b]Controlled for any psychiatric disorder.
CI that do not include 1.00 indicate a significant HR at $p < .05$. Significant HR are in bold.

any or any violent re-offense (Table 4). The inclusion of demographic covariates (multivariate model 1) or the any psychiatric disorder (multivariate model 2) yielded to similar findings.

Discussion

The aim of the current study was to examine the relationship between temperament and criminal justice system involvement in youth in general as well as temperament and mental disorders and re-offending in JOs in more detail. We found that, according to LPA the three-class solution was most useful and therefore retained it. However, a specific profile associated with criminal justice system involvement was not found. Neither did we find a specific temperament profile to predict criminal recidivism. Temperament based on Cloninger's temperament concept was analyzed for the first time in a sample of JOs in detention compared to a community sample, using a variable-centered as well as a subtyping (person-centered/profile) approach. The present findings only partly converge with our previous assumptions and may challenge future studies on underlying temperament factors in JOs. We will discuss our research questions in more detail below.

First, three specific JTCI temperament profiles were identified in adolescent boys aged 13 to 18. With reference to the JTCI manual (Goth & Schmeck, 2009), adolescents from the "moderate" profile can be described as stoic-calm, modest, conforming and busy-persistent, steadfast, and rigid. Adolescents from the "worried-passive" profile could be described as showing worried-cautious characteristics, shyness, being fatigable, and pessimistic as well as hard to motivate intrinsically, on the lazy and half-hearted side. Adolescents from the "adventurous-disinhibited" profile could be characterized as impulsive-excitable and easy to activate and at the same time hard to stop, "cool" and easy-going.

Profiles in the present study were largely comparable to a previous study with younger children (Rettew et al., 2008). Both studies found a "moderate" profile and two profiles with more pronounced temperaments. However, the present study revealed an "adventurous-disinhibited" profile with high novelty seeking and rather low scores of harm avoidance, reward dependence, and persistence that is not completely overlapping with the "disengaged" profile of Rettew et al. (2008) which showed higher scores on the harm avoidance dimension. In addition, the "worried-passive" profile meaningfully differed from the "steady" profile in the previous study, which shows lower novelty seeking, lower harm avoidance, and higher persistence values. These results could indicate somehow more dysregulated and difficult temperament profiles among an older group including JO.

None of the JTCI temperament scales or profiles found related to detention sample status. Hence, a specific risk profile or protective profile of temperamental characteristics for serious juvenile offending leading to detention remained unidentified. This finding was quite unexpected and warrants some further explanations. Previous studies in adult and adolescent samples suggested a triad of high novelty seeking, low harm avoidance, and low reward dependence related to criminal behaviors. The "adventurous-disinhibited" profile found in the current study points to this profile but does not support the

suggested criminogenic risk of it. Not only did few adolescents from the community sample (8%) show this profile, but also just a small proportion of the JO sample (12%). A possible explanation could be related to the more homogeneous nature of the Swiss general population compared to other countries Although subsamples were matched on age and gender we cannot rule out that other non-measured factors have influenced the missing link between temperament profiles and JO sample status. For example, the exclusion of participants with language problems and missing information on JTCI may limit the JO sample to more socially adjusted juveniles.

In the JO sample, the JTCI dimensions, novelty seeking was positively associated with current mental disorders except for anxiety disorders, harm avoidance was positively associated with anxiety disorders, and reward dependence was negatively associated with externalizing disorders. Overall, these findings are in line with previous studies based on clinical and community samples that found novelty seeking most robustly associated with disruptive behavior problems (Asch et al., 2009; Hemphala et al., 2013; Kim et al., 2006; Rettew et al., 2004) and harm avoidance associated with internalizing problems (Asch et al., 2009; Hemphala et al., 2013; Kim et al., 2006). Cloninger et al. (1993) described one possible pathway between innate temperament including harm avoidance and self-concept development. Hence, high scores in harm avoidance may refer to self-esteem related problems. Furthermore, low levels of reward dependence may relate to a lack of social responsiveness and increase the risk of psychopathology and externalizing disorders. Regarding JTCI profiles, the "worried-passive" profile was found to be related to anxiety disorders. This finding is not surprising and confirms previous results on temperament style and anxiety symptoms in male youth (Latzman et al., 2016).

One of the most interesting aspects of the current study was the question if JTCI profiles can predict persistent criminal behaviors. None of the previous studies tested the potential of the JTCI scales to predict criminal recidivism in detained JOs. A specific combination of JTCI temperament traits that relates to a criminogenic profile per se does not seem to exist. A more elaborated theory of temperament using different constructs seems more appropriate to explain criminal behaviors in youth (Baglivio et al., 2016). Findings of Cox regressions showed a robust association of novelty seeking with later criminal and violent recidivism even when controlling for age, nationality, and SES. Novelty seeking seems closely related to the extraversion trait in the Big Five Personality concept (P. T. Costa & McCrae, 1992) and to impulsive sensation seeking in adolescents. On a biological level, high levels of novelty seeking may relate to a dominant behavioral activation system (Quay, 1993) and alterations in the dopaminergic system (V. D. Costa et al., 2014) that put some youth at risk for persistent criminal behaviors.

Strengths and Limitations

This is the first study that examined JTCI temperament dimensions and temperament profiles in a sample of male adolescents from a detention facility and an age-matched sample of male adolescents from community. It assessed mental disorders by a

structured psychiatric interview and considered officially registered re-offenses after release from detention as longitudinal outcome measure. Still, the present findings must be interpreted under consideration of some limitations. The detained sample only included adolescents of one juvenile correctional facility in Switzerland, which limits generalizability to other (international) correctional facilities, as well as to the applicability of the present results to individuals who have committed less serious crimes that had not led to detention. In addition, some participants from the JO sample had to be excluded because of missing and incomplete data and language problems. Moreover, it cannot be ruled out that some adolescents from the community sample might have engaged in criminal behavior. No information on criminal behaviors and mental disorders was available for the community sample. Furthermore, it cannot be excluded either that self-reported data contained some bias in the present JTCI ratings due to social desirability. The simultaneous assessment using the *JTCI* and the *MINI-KID* minimizes a diagnostic bias, however, we cannot exclude the possibility that previous mental disorders may have influenced responses in the JTCI. Further longitudinal studies are needed concerning the causal relation between temperament and mental disorders. The Registered re-offending may have represented more objective data, however, limited by the fact that a considerable number of crime remains in the dark and is thus not officially recorded. The recidivism data was collected from one Canton only and thus defines a further limitation. Also the follow-up length is short considering some base rates (i.e., sexually harmful behavior). Moreover, although the psychometric properties of the English version of the *MINI-KID* had shown to be good, the authors are not aware of any psychometric evaluations of the German version. LPA did not result in an unambiguous solution, what is also due to the rather small sample size to perform such methods. Finally, externalizing disorders were highly prevalent in the current JO sample, which made it difficult to find relevant differences in temperament subgroups.

Conclusions

Temperament could be described as a very early developmental factor for later personality. Some temperament profiles (i.e., "moderate," "worried-passive," and "adventurous-disinhibited") increase the risk for psychiatric outcomes. However, none of these temperament profiles can be regarded as criminogenic per se. The pathway to criminal behavior in youth is a complex phenomenon and seems to rely on multiple causes including personality factors, mental disorders, and psychosocial stressors (e.g., Aebi et al., 2014). Further longitudinal studies have to examine the role of early temperamental factors within the development of criminal behaviors. "Novelty seekers" as described by JTCI tend to be impulsive-excitable, exploratory, disorderly, extravagant, cheeky, and irritable. High scores on novelty seeking seem to be a risk factor for mental disorders and persistent criminal behavior. Alcohol and substance use disorders seem further linked to novelty seeking and later criminal behaviors (Foulds et al., 2017). In sum, the findings suggest that personality traits and mental disorders should be assessed carefully in detained JOs. Although there was no specific criminogenic temperament profile found, the JTCI could nevertheless prove to be a useful

instrument as part of a comprehensive psychiatric-psychological assessment and risk assessment in youth forensic settings. Early prevention of criminal behavior and effective treatment of JOs is important in order to avert further damage in the lives of adolescents and their families. In psychotherapy, temperament profiles could be a helpful tool to guide the treatment plan. Certainly, on an individual level, the JTCI may inform on developmental characteristics in a juvenile's personality that relate to internalizing and externalizing disorders as well as serious persistent crime.

Author Note

Kirstin Goth and Klaus Schmeck are co-authors of the German version of the Junior Temperament and Character Inventory published by Hogrefe, Goettingen.

Acknowledgment

We thank Metin Aysel, Silke Nessbach, and Hellvig Spinka who helped with data collection and Kelly d'Souza for checking the English language.

Declaration of Conflicting Interests

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

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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