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## Environmental Predictors of Within-Person Changes in Callous-Unemotional Traits among Justice-Involved Male Adolescents

Cortney Simmons , Haley Mitchell-Adams , and Arielle Baskin-Sommers 

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### ABSTRACT

**Objective:** Youth who display elevated callous-unemotional (CU) traits are at risk for negative developmental outcomes. Previous studies demonstrate that environmental conditions contribute to elevated levels of CU traits, but the majority of this work focuses on a single source of environmental influence. To better understand how environmental conditions contribute to changes in CU traits during adolescence, the current study examined the time-varying relation between CU traits, parent, peer, and community conditions.

**Method:** Using data from the longitudinal Pathways to Desistance study ( $N = 1,026$  males,  $M_{age} = 15.98$ ,  $SD = 1.16$ ; 40.94% Black, 34.11% Latino, 20.66% White, 4.29% Other), full-factorial fixed effect regression models were implemented to examine how parental hostility, antisocial peers, community violence, and neighborhood disorder are individually and interactively associated with within-person changes in CU traits during adolescence (15–21 years).

**Results:** Results indicated that proximal conditions (i.e., negative parenting, antisocial peers) had more consistent associations with CU traits than distal conditions (i.e., neighborhood disorder, community violence). Affiliation with antisocial peers was not significantly related to CU traits when youth were simultaneously exposed to high community violence and low neighborhood disorder. Further, the association between CU traits and impact of living in high disordered, high violence neighborhoods was stronger for younger youth.


**Conclusion:** Results indicate that the association among parents, peers, and CU trait development is more nuanced than previously suggested, such that the risk that each environmental condition poses is moderated by a youth's age and their exposure to distal conditions.

There is considerable heterogeneity in the etiology and presentation of antisocial behavior in youth. Some youth who engage in antisocial behavior appear to show a lack of empathy and concern for others, deficient guilt or remorse, and shallow or superficial expression of emotions. Clinical and developmental researchers have described this constellation of traits as callous-unemotional (CU), derived from the affective dimension of psychopathy (Frick et al., 2014). Compared to other antisocial youth, youth with elevated levels of CU traits display greater emotional problems (Fontaine et al., 2011), lower quality social relationships (Miron et al., 2020), poorer academic performance (Hwang et al., 2021), are more likely to exhibit severe and persistent forms of antisocial behavior (Docherty et al., 2019; Frick & Kemp, 2021; Kahn et al., 2013; McMahon et al., 2010; Pardini & Frick, 2013; Simmons et al., 2020), and are more likely to have legal system involvement during adulthood (Kahn et al., 2013). Even in the absence of antisocial behavior,

youth with elevated CU traits exhibit behavioral, social, and emotional difficulties (Herpers et al., 2016; Rowe et al., 2010).

Early characterizations of CU traits described them as stable, heritable characteristics (Frick et al., 2003; Lynam et al., 2008). Longitudinal research suggests youth with higher CU traits during childhood compared to their peers will likely have higher CU traits during adolescence (Obradović et al., 2007; S. W. Hawes et al., 2018). However, there is growing evidence of considerable individual-level change in CU traits over the life course (Fontaine et al., 2010; S. W. Hawes et al., 2018; Waller, Baskin-Sommers et al., 2018). For the majority of youth, CU traits decrease reliably from childhood to adolescence (Muratori et al., 2016; Takahashi et al., 2021) and into early adulthood (Byrd et al., 2018; Ray et al., 2019). Further, while research has shown that individual differences in CU traits are highly heritable (for review, see Moore et al., 2019), there is increasing evidence that environmental conditions play an important role in influencing the development of CU traits across

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adolescence (Fontaine et al., 2011; Hyde et al., 2016; Takahashi et al., 2021; Waller, Hyde et al., 2018). As such, it is imperative that researchers identify the environmental conditions associated with developmental change in CU traits and determine when they are particularly salient.

### **Development in Context: Association between Environmental Conditions and CU Traits**

Youth occupy multiple environments that each influence their development. According to ecological systems theory (Bronfenbrenner, 1977), families and peers act as different microsystems that influence youth development. These microsystems are nested within the meso-system, which captures the interrelations between two or more microsystems. Importantly, the ways in which these microsystems interact can influence youth development and behavior by exacerbating or attenuating the effects of the other. Neighborhood and community conditions, existing within the exosystem, also may directly contribute to youth development or indirectly by influencing the conditions within the microsystems. It is theorized that families and peers, as environmental conditions that are more proximal to the youth, have a stronger influence on developmental outcomes than neighborhood conditions, which are more distal.

Additionally, ecological systems theory posits that time influences the relation between youth and their environments. Specifically, the variety, quality, and impact of the environments may change as youth age and exert greater control over their time. For example, during adolescence, youth gain greater autonomy from their parents, and peers become increasingly salient sources of social influence (Bornstein et al., 2013; Kerr et al., 2003). More distal environmental conditions also may become more influential throughout adolescence as youth have more freedom and time to spend in their neighborhoods and community.

In line with Bronfenbrenner's theory (Bronfenbrenner, 1977), social contextual models of antisocial behavior suggest that antisocial behavior is a product of interaction between and within various environmental conditions, including harsh parenting, deviant peers, and unsafe neighborhoods (Scaramella et al., 2002). Importantly, these environmental conditions may influence development by altering the nature of other environmental conditions. Consistent with this idea, there is empirical evidence that distal environmental conditions can attenuate or strengthen the impact of proximal conditions (Leventhal & Dupéré, 2019; McBride Murry et al., 2011). For example, a study not focused on CU traits, examined the independent and interactive effects of violence exposure in the home, school, and community on

externalizing and internalizing symptoms (Mrug & Windle, 2010). Researchers found that the impact of witnessing violence at home had a stronger effect on anxiety, depression, and delinquency when the youth witnessed no community violence. Thus, examining both the individual and interactive effects of multiple environmental conditions may help identify the circumstances where youth are particularly vulnerable.

Findings from both cross-sectional and longitudinal studies suggest that proximal (e.g., negative parents, anti-social peers) and distal (e.g., community violence, neighborhood disadvantage) environmental conditions may contribute to CU trait development. For example, experiencing low emotional warmth and neglect from caregivers are consistently linked to elevated levels of CU traits in children and adolescents (Backman et al., 2021; Bisby et al., 2017; Kimonis et al., 2013; Waller et al., 2013). Additionally, affiliation with antisocial peers and low quality friendships (i.e., low interpersonal support) are linked to CU traits (Miron et al., 2020; Thornton et al., 2015; see, also Backman et al., 2018 for work in romantic relationships) and antisocial behavior more generally (Pardini et al., 2005). There also is evidence that proximal and distal environmental conditions may contribute to CU trait development by exposing youth to hostile conditions over extended periods of time. Exposure to maltreatment (Docherty et al., 2018; Kimonis et al., 2014; Sharf et al., 2014), community violence (Howard et al., 2012; Waller, Baskin-Sommers et al., 2018), and higher levels of neighborhood disadvantage (Ray et al., 2019; Waller, Baskin-Sommers et al., 2018) are associated with elevated CU traits.

### **Limitations of Research on the Relation between Environmental Conditions and CU Traits**

Most studies examining the environmental predictors of CU traits focused on risks contained in a single environment. Considering youth occupy multiple environments that simultaneously and interactively influence their development (Bronfenbrenner, 1977; Scaramella et al., 2002), these studies may over- or under-estimate the effects of particular environments or experiences (Evans et al., 2013). For example, Waller, Baskin-Sommers et al. (2018) examined how various parenting and community conditions assessed during adolescence (ages 14–18) differentiated CU trait trajectories into adulthood (Baskin-Sommers et al., 2015). In univariate models, where each environmental condition was examined separately, youth in the stable-high CU trajectory reported higher levels of parental hostility and lower levels of parental monitoring, knowledge, and warmth when compared to youth in the low CU trajectory. In the multivariate models, though,

parental warmth no longer differentiated the trajectories. Similarly, Byrd and colleagues (Byrd et al., 2018) found that maltreatment and negative parenting, which were significant predictors in univariate models, did not predict membership within high CU trait trajectories after accounting for a range of other childhood environmental conditions in the multivariate models. These studies indicate that considering single versus multiple sources of environmental influence may identify different developmental correlates of CU traits.

Additionally, much of the environment-CU research, regardless of whether it examines single environmental conditions or multiple conditions, is limited by the use of time-invariant (i.e., stable, unchanging) predictors of CU traits. Such approaches do not account for the possibility that exposure to environmental conditions and their effects on CU trait development may vary over time. To address this conceptual and analytic limitation, two recent studies employed time-varying analyses to examine age-related developmental changes in CU traits and their environmental correlates. Ray (2018) found that low parental warmth and witnessing community violence predicted CU traits at age 14.5 (the baseline timepoint in this study) but were not consistent predictors over time (through age 25). Interestingly, greater association with antisocial peers consistently predicted higher levels at CU traits from ages 14.5 to 25. In a second study, Ray et al. (2019) reported slightly different results for the parental warmth effects. Low parental warmth was consistently associated with high CU traits from ages 13 to 20. The inclusion of multiple time-varying environmental conditions provides useful information about the contribution of each factor to CU traits over time. However, the analytic models used in this research only employed main effects; that is, examining the association of each environmental condition above and beyond the effects of other relevant conditions. There has been no examination of the interaction between the environments and its association with CU traits.

### Current Study

To better understand how environmental conditions contribute to changes in CU traits during adolescence, the current study examined the relation between CU traits, parent, peer, and community conditions from ages 15 to 21 years in a racially/ethnically diverse sample of male youth who were arrested for serious crimes. Justice-involved adolescents exhibit higher mean levels

and variability in CU traits than community youth (Docherty et al., 2016) and are at elevated risk for exposure to environmental risk factors (Ford et al., 2013). Thus, this sample allows us to explore the CU-environment association among those who may be at the greatest risk for elevated CU traits.

Fixed effect regression models were used to examine how time-varying environmental conditions relate to within-person change in CU traits. Because these models treat individuals as their own control variables, all measured and unmeasured time-invariant conditions about the individuals and their environments are accounted for (Allison, 2009). Recognizing that youth develop in multiple environments and the association between environment and CU traits likely varies over time, a full-factorial approach (i.e., examining all possible interactions between the environmental conditions) was used to examine how each parent, peer, and community condition individually and interactively predicted changes in CU traits at different ages. These models allow for the exploration of complex relationships between different levels of environmental influence as proposed in developmental (Bronfenbrenner, 1977) and criminological theories (Scaramella et al., 2002).

The current study focused primarily on the development of CU traits based on evidence of distinct patterns of cognitive and socioemotional functioning among youth with elevated CU traits (Frick et al., 2014; Northam & Dadds, 2020; Waller & Wagner, 2019), and the relation between CU traits and important developmental outcomes (Bird et al., 2019; Fontaine et al., 2011; Miron et al., 2020), even in the absence of conduct problems (e.g., Herpers et al., 2012; Herpers et al., 2016; Rowe et al., 2010). Though CU traits are recognized as important characteristics in their own right (Frick & Kemp, 2021), some researchers suggest that it is useful to assess other traits of psychopathy (interpersonal traits and impulsive traits) in addition to CU traits (Andershed et al., 2018; Colins et al., 2018; Salekin et al., 2018). Therefore, we conducted supplemental analyses examining the associations between the environmental conditions and the interpersonal and impulsive traits of psychopathy, respectively.

Proximal environmental conditions are theorized to have a stronger influence on developmental outcomes than distal conditions (Bronfenbrenner, 1977). Therefore, we hypothesized that the proximal environmental conditions (negative parenting, antisocial peers) would be more strongly related to CU traits than the distal conditions (community violence, neighborhood disorder; Bronfenbrenner, 1977). Additionally, the impact of specific environments may change as youth age (Bronfenbrenner, 1977). Following from previous work (Bornstein et al., 2013; Ray, 2018; Ray et al.,

2019), we expected that the association between antisocial peers and CU traits would strengthen over time, while the association between negative parenting and CU traits would weaken. In line with prior empirical (Leventhal & Dupéré, 2019; Mrug & Windle, 2010) and theoretical work (Bronfenbrenner, 1977; Scaramella et al., 2002) suggesting that distal environmental conditions can attenuate or strengthen the impact of proximal conditions, we hypothesized that the distal conditions would have a primarily indirect relation with CU traits by moderating the associations between CU traits and the proximal conditions. However, we did not have specific hypotheses regarding the interactions between the various environmental conditions.

Youth with elevated levels of CU traits exhibit greater socioemotional, educational, behavioral, and persistent legal problems. By examining parent, peer, and community conditions simultaneously and testing how their effects vary over time, this study is poised to improve our understanding of the nuanced ways environmental conditions contribute to the development and maintenance of CU traits. Understanding the unique and joint risk that environmental conditions pose, and at what age these factors might exert the strongest effects, may help guide the design and use of treatments that address the environmental risk factors related to CU traits (Baskin-Sommers et al., 2022).

## Method

Data for this study were drawn from the longitudinal Pathways to Desistance Study (Schubert et al., 2004). The sample consisted of 1,170 male youth from Maricopa County, AZ and Philadelphia County, PA who were recruited into the study after being found guilty of a serious criminal offense (94% felony offenses). To be eligible for the study, individuals had to meet the following criteria: reside in Maricopa County, AZ or Philadelphia, PA, be found guilty of a serious offense, and be between the ages of 14 and 18 at the time of their committing offense. Informed parental consent and youth assent were attained before study initiation and before each interview. Youth consent was obtained once youth reached age 18. Youth completed a baseline interview after their adjudication hearing (first baseline interview completed in November, 2000; last baseline interview completed in March, 2003). Follow-up interviews were completed every six months for three years, and annually for additional four years (first follow up interview completed in May, 2001; last follow up interview completed in March, 2010). Sample retention was high (range = 84–94%,  $M = 90\%$ ). Trained research assistants administered questionnaires through

computer-assisted interviews that took place in a location convenient for the participants (e.g., participants' homes, public places). Participants were paid \$50 for their participation. All procedures were approved by the institutional review boards at Arizona State University, Temple University, and the University of Pittsburgh.

## Measures

### *Callous-Unemotional Traits*

The Youth Psychopathic Traits Inventory (Andershed et al., 2002) was used to assess youth CU traits. The Youth Psychopathic Traits Inventory was designed to assess psychopathy (as a unitary measure) and its subdimensions (Callous-Unemotional, Grandiose-Manipulative and Impulsive-Irresponsible Traits) among youth.

The 15-item self-report Callous-Unemotional subscale assessed remorselessness (e.g., "To feel guilt and regret when you have done something wrong is a waste of time"), unemotionality (e.g., "I usually feel calm when other people are scared"), and callousness (e.g., "I think that crying is a sign of weakness, even if no one sees you"). Youth responded on a 4-point Likert scale ranging from 1 ("Does not apply at all") to 4 ("Applies very well"). Several positively worded items in the subscale were reverse coded. A total CU traits score was computed by summing all the remorselessness, unemotionality, and callousness items (range,  $\alpha = .73$  to  $.79$ ).

### *Grandiose-Manipulative and Impulsive-Irresponsible Traits*

The Youth Psychopathic Traits Inventory also was used to assess the interpersonal and impulsive traits of psychopathy in youth. The 20-item self-report Grandiose-Manipulative subscale assessed the interpersonal traits, which includes traits such as dishonest charm (e.g., "I have the ability to con people by using my charm and smile"), grandiosity (e.g., "I'm better than everyone on almost everything"), lying (e.g., "Sometimes I lie for no reason, other than because it's fun"), and manipulation (e.g., "I can make people believe almost anything"). The 15-item self-report Impulsive-Irresponsible subscale assessed impulsive traits, which includes traits such as thrill seeking (e.g., "I like to be where exciting things happen"), impulsiveness (e.g., "I consider myself as a pretty impulsive person"), and irresponsibility (e.g., "I have often been late to work or classes in school"). Youth responded on a 4-point Likert scale ranging from 1 ("Does not apply at all") to 4 ("Applies very well"). Several positively worded items in the subscales were reverse coded. A total Grandiose-Manipulative traits score was computed by summing all the dishonest



charm, grandiosity, lying, and manipulation items, and an Impulsive-Irresponsible traits score was computed by summing all the thrill seeking, impulsiveness, and irresponsibility items. The Grandiose-Manipulative ( $\alpha = .91$  to  $.92$ ) and Impulsive-Irresponsible ( $\alpha = .82$  to  $.87$ ) total scores showed good internal consistency across each timepoint.

### **Negative Parenting**

The Quality of Parental Relationships Inventory (Conger et al., 1994) was used to assess negative parenting. The 21-item self-report measure assessed parental warmth (e.g., “How often does your mother let you know she really cares about you?”) and hostility (e.g., “How often does your mother get angry at you?”). Youth responded on a 4-point Likert scale ranging from 0 (“Never”) to 3 (“Always”). The warmth items were reversed coded to represent low warmth in the parent-child relationship and averaged to create a total warmth score (range,  $\alpha = .80$  to  $.85$ ). A parental hostility score was computed by averaging the hostility items (range,  $\alpha = .92$  to  $.93$ ). A total negative parenting score was computed by averaging the warmth and hostility scores.

### **Antisocial Peers**

Two measures were used to estimate exposure to antisocial peer influence and low interpersonal support. The Peer Delinquent Behavior measure (Thornberry et al., 1994) included two dimensions of antisocial activity among the youth’s peers: antisocial behavior and antisocial influence. The 7-item antisocial influence dimension assessed the prevalence of friends who encourage the youth to engage in delinquent behaviors (e.g., “During the recall period how many of your friends have suggested that you should sell drugs?”). Youth responded on a 5-point Likert scale ranging from 1 (“None of them”) to 5 (“All of them”). The items were summed to generate an antisocial peer influence score (range,  $\alpha = .93$  to  $.94$ ). The Friendship Quality scale, an adaptation of the Quality of Relationships Inventory (Pierce et al., 1997), assessed interpersonal support from the youth’s five closest friends. The 10-item self-report measure evaluated multiple forms of support (e.g., “How much can you count on the people for help with a problem,” “How close do you think you will be to these people in ten years”). Youth responded on a 4-point Likert scale ranging from 1 (“Not at all”) to 4 (“Very much”). All Friendship Quality items were reverse coded and summed to generate a low interpersonal support score (range,  $\alpha = .80$  to  $.82$ ). The antisocial peer influence and low interpersonal support scores were rescaled to be on the same 10-point metric using the proportion of maximum scoring method (Little,

2013). A total antisocial peer score was computed by averaging the rescaled antisocial peer influence and low interpersonal support scores.

### **Community Violence**

The Exposure to Violence Inventory (Selner-O’Hagan et al., 1998) was used to assess exposure to violent events in the youths’ community. Six items (0 = No, 1 = Yes) assessed whether the youth was a victim of violence (e.g., “Have you been chased where you thought you might be seriously hurt in the past six months?”), and seven items (0 = No, 1 = Yes) assessed whether the youth witnessed violence occur (e.g., “Have you seen someone else being raped, an attempt made to rape someone or any other type of sexual attack in the past six months?”). A total community violence score was computed by summing the victimization and witnessing violence items (range,  $\alpha = .72$  to  $.78$ ).

### **Neighborhood Disorder**

The Neighborhood Conditions Measure (Sampson & Raudenbush, 1999) was used to estimate disorder in the environment surrounding the youth’s home. The 21-item self-report measure assessed physical disorder (e.g., “cigarettes on the street or in the gutters,” “graffiti or tags”) and social disorder (e.g., “adults fighting or arguing loudly,” “people using needles or syringes to take drugs”) in the neighborhood. Youth responded on a 4-point Likert scale ranging from 1 (“Never”) to 4 (“Often”). A total neighborhood disorder score was computed by averaging the physical and social disorder items ( $\alpha = .96$ ).

### **Covariate: Offending**

Research has found that CU traits can distinguish a more severe subgroup of antisocial youth (Frick et al., 2014) and that youth exposed to certain environmental conditions also are more likely to exhibit antisocial behavior (Baskin-Sommers, 2016). There is evidence of a bidirectional association between CU traits and antisocial behavior, such that a youth’s antisocial behavior may contribute to the development and maintenance of their CU traits (Vaughan et al., 2021). While this sample had been involved in some form of antisocial behavior at the time of recruitment, this may not be true throughout the study period (Moffitt, 2018). Therefore, we included offending as a time-varying covariate in order to assess the unique associations between environmental conditions and CU traits, over and above the effect of youth behavior. The Self-Reported Offending measure (Survey et al., 1991) was used to evaluate youth involvement in antisocial and illegal activities. The 24-item measure assessed involvement in violent (e.g., been

in a fight, shot at someone) and nonviolent (e.g., entered a building to steal, drove drunk or high) acts. Youth indicated whether they had engaged in each act at least once (0 = No, 1 = Yes). A total offending score was computed by summing all violent and nonviolent items.

### **Analytic Plan**

Data from the 6-, 12-, 18-, 24-, 30-, 36-, 48-, and 60-month follow-up interviews were used in the analyses. Because we were interested in how CU traits changed across development (instead of how they changed from the first interview), the data were restructured so the data were aligned by participant age using the participants' date of birth, which often resulted in partial ages (16.2 years instead of 16). Because the first six interviews (i.e., the 6-, 12-, 18-, 24-, 30-, 36-month interviews) were conducted every six months, many participants had interviews that fell within the same age year (16.2 years and 16.9 years). With the exception of offending and community violence, these timepoints were combined by taking the average of both timepoints. For offending and community violence, combined variables were created by summing the number of offenses endorsed or the number of violent events witnessed or experienced during that age year. The age range in the resulting restructured data set was 14 years old to 24 years old. The final age range was restricted to 15 to 21 years old due to the small sample sizes at the upper and lower tails of the age range. The final analytic sample included 1,026 (40.94% Black, 34.11% Latino, 20.66% White, 4.29% Other) youth who were between the ages of 14 and 18 ( $M = 15.98$ ,  $SD = 1.16$ ) at recruitment. Descriptive statistics for the study variables are presented in Table 1 in the Supplemental Materials.

Fixed effect regression models estimated in Stata v14 were used to investigate associations between the environmental conditions and CU traits. Fixed effects regressions were ideal for the current study because they focus exclusively on understanding within-person variability. In essence, each individual is treated as his own "control variable," which means that all time-stable effects of time-invariant factors about the individual and his environment (e.g., race/ethnicity; early life experiences) are automatically controlled (Allison, 2009). As such, these models reduce the potential impact of selection effects, shared risk factors, and confounding variables, and offer stronger tests of environment-CU associations than traditional between-individual models. By focusing exclusively on within-person change, our analysis sought to understand why an individual's CU traits change year to year. This is a different question than one that asks why one individual's CU traits are higher

than another person's (typically answered in between-individual models). Fixed effects models accommodate missing data using conditional maximum likelihood estimation, which incorporates all available information to generate model estimates rather than relying on complete case analysis. Full factorial models were first estimated to examine the main and interactive effects of each environmental factor. Offending was included as a time-varying covariate in all models. For the supplemental analyses, these fixed effect regression models were repeated for Grandiose-Manipulative and Impulsive-Irresponsible traits.

### **Missing Data**

Of the seven timepoints examined, 85.58% of analytic sample had no missing data. Of the participants with missing data, 10.62% were missing data at one timepoint, 3.02% at two timepoints, 0.68% at three timepoints, and 0.10% missed five timepoints. We examined whether having missing data was associated with any of the study variables at each timepoint (Supplemental Table 2). Missing data was not associated with CU traits at any timepoint. There were some differences in negative parenting, antisocial peers, and community violence between those with and without missing data, however these differences were not consistent across timepoints or between variables. Given that missing data due to participant attrition is less problematic in within-individual models than between-individual models (Hill et al., 2017), it is unlikely that missing data had a substantive impact on the results produced from the analyses conducted in the present study.

## **Results**

### **Individual and Interactive Associations between Environmental Conditions and CU Traits**

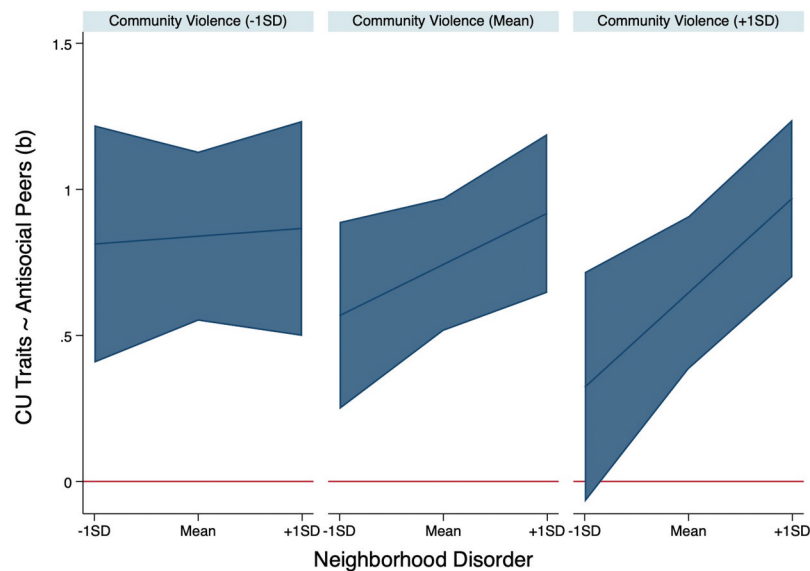
The first set of fixed effect regression models were used to examine within-person associations between CU traits and environmental conditions. Negative parenting and antisocial peers were positively associated with CU traits (Table 1, Model 1), such that greater exposure to negative parenting and antisocial peers was associated with increases in CU traits. There were no significant two-way interactions between the environmental conditions (Table 1, Model 2). However, there was a significant three-way interaction among antisocial peers, community violence, and neighborhood disorder (Table 1, Model 3). Post-hoc analysis indicated that greater exposure to antisocial peers was generally associated with increases in CU traits across levels of

**Table 1.** Fixed effect regression models with environmental conditions predicting youth CU traits.

	Model 1					Model 2					Model 3					Model 4				
	b	SE	t	p	95% CI	b	SE	t	p	95% CI	b	SE	t	p	95% CI	b	SE	t	p	95% CI
Age	<b>-0.37</b>	<b>0.08</b>	<b>-4.95</b>	<b>&lt;0.001</b>	<b>-0.52 -0.23</b>	<b>-0.36</b>	<b>0.08</b>	<b>-4.80</b>	<b>&lt;0.001</b>	<b>-0.51 -0.21</b>	<b>-0.36</b>	<b>0.08</b>	<b>-4.81</b>	<b>&lt;0.001</b>	<b>-0.51 -0.22</b>	<b>-0.37</b>	<b>0.08</b>	<b>-4.86</b>	<b>&lt;0.001</b>	<b>-0.52 -0.22</b>
Negative Parenting	<b>1.93</b>	<b>0.34</b>	<b>5.72</b>	<b>&lt;0.001</b>	<b>1.27 2.59</b>	<b>1.90</b>	<b>0.34</b>	<b>5.64</b>	<b>&lt;0.001</b>	<b>1.24 2.56</b>	<b>1.91</b>	<b>0.35</b>	<b>5.52</b>	<b>&lt;0.001</b>	<b>1.23 2.59</b>	<b>1.92</b>	<b>0.35</b>	<b>5.56</b>	<b>&lt;0.001</b>	<b>1.24 2.60</b>
Antisocial Peers	<b>0.81</b>	<b>0.11</b>	<b>7.41</b>	<b>&lt;0.001</b>	<b>0.60 1.03</b>	<b>0.78</b>	<b>0.12</b>	<b>6.79</b>	<b>&lt;0.001</b>	<b>0.56 1.01</b>	<b>0.74</b>	<b>0.12</b>	<b>6.33</b>	<b>&lt;0.001</b>	<b>0.51 0.97</b>	<b>0.72</b>	<b>0.12</b>	<b>6.13</b>	<b>&lt;0.001</b>	<b>0.49 0.95</b>
Community Violence	-0.09	0.07	-1.29	0.20	-0.22 0.04	-0.06	0.07	-0.87	0.39	-0.20 0.08	-0.04	0.07	-0.51	0.61	-0.18 0.10	-0.04	0.07	-0.57	0.57	-0.18 0.10
Neighborhood Disorder	0.30	0.21	1.44	0.15	-0.11 0.72	0.27	0.21	1.29	0.20	-0.14 0.69	0.17	0.22	0.79	0.43	-0.26 0.60	0.19	0.22	0.87	0.39	-0.24 0.62
Offending	<b>0.11</b>	<b>0.05</b>	<b>2.32</b>	<b>0.02</b>	<b>0.02 0.20</b>	<b>0.11</b>	<b>0.05</b>	<b>2.38</b>	<b>0.02</b>	<b>0.02 0.20</b>	<b>0.12</b>	<b>0.05</b>	<b>2.50</b>	<b>0.01</b>	<b>0.02 0.21</b>	<b>0.12</b>	<b>0.05</b>	<b>2.57</b>	<b>0.01</b>	<b>0.03 0.21</b>
Negative Parenting x Antisocial Peers	0.08	0.21	0.39	0.69	-0.32 0.49	0.08	0.21	0.39	0.69	-0.32 0.49	0.08	0.21	0.36	0.72	-0.33 0.49	0.00	0.21	-0.01	0.99	-0.42 0.42
Negative Parenting x Community Violence	-0.12	0.13	-0.96	0.34	-0.38 0.13	-0.12	0.13	-0.96	0.34	-0.38 0.13	-0.10	0.14	-0.71	0.48	-0.37 0.17	-0.11	0.14	-0.79	0.43	-0.38 0.16
Negative Parenting x Neighborhood Disorder	-0.71	0.37	-1.93	0.05	-1.43 0.01	-0.63	0.37	-1.72	0.09	-1.36 0.09	-0.63	0.37	-1.72	0.09	-1.36 0.09	<b>-0.76</b>	<b>0.38</b>	<b>-2.01</b>	<b>0.04</b>	<b>-1.49 -0.02</b>
Antisocial Peers x Community Violence	-0.01	0.04	-0.35	0.73	-0.08 0.06	-0.04	0.04	-1.13	0.26	-0.12 0.03	-0.04	0.04	-1.08	0.28	-0.12 0.03	-0.04	0.04	-1.08	0.28	-0.12 0.03
Antisocial Peers x Neighborhood Disorder	0.24	0.12	1.95	0.05	0.00 0.47	0.23	0.13	1.85	0.07	-0.01 0.48	0.23	0.13	1.85	0.07	-0.01 0.48	0.22	0.13	1.79	0.07	-0.02 0.47
Neighborhood Disorder x Community Violence	-0.05	0.08	-0.61	0.54	-0.19 0.10	-0.12	0.08	-1.48	0.14	-0.28 0.04	-0.12	0.08	-1.64	0.10	-0.29 0.03	-0.13	0.08	-1.74	0.08	-0.34 0.02
Negative Parenting x Antisocial Peers x Community Violence	-0.22	0.23	-0.93	0.35	-0.67 0.24	-0.22	0.23	-0.93	0.35	-0.67 0.24	-0.25	0.23	-1.06	0.29	-0.70 0.21	-0.25	0.23	-1.06	0.29	-0.70 0.21
Negative Parenting x Neighborhood Disorder	0.24	0.15	1.56	0.12	-0.06 0.54	0.24	0.15	1.56	0.12	-0.06 0.54	0.14	0.16	0.88	0.38	-0.18 0.47	0.14	0.16	0.88	0.38	-0.18 0.47
Negative Parenting x Antisocial Peers x Community Violence	<b>0.09</b>	<b>0.04</b>	<b>2.10</b>	<b>0.04</b>	<b>0.01 0.18</b>	<b>0.09</b>	<b>0.04</b>	<b>2.10</b>	<b>0.04</b>	<b>0.01 0.18</b>	<b>0.10</b>	<b>0.04</b>	<b>2.22</b>	<b>0.03</b>	<b>0.01 0.18</b>	<b>0.10</b>	<b>0.04</b>	<b>2.22</b>	<b>0.03</b>	<b>0.01 0.18</b>
Negative Parenting x Antisocial Peers x Community Violence																0.16	0.10	1.61	0.11	-0.03 0.35
Negative Parenting x Neighborhood Disorder																				

Note: Bolded text represents significant ( $p < 0.05$ ) estimates. Affiliation with antisocial peers was not significantly related to CU traits when youth were simultaneously exposed to high community violence and low neighborhood disorder.





**Figure 1.** Association between antisocial peers and callous-unemotional traits, moderated by community violence and neighborhood disorder.

Note: Figure depicts the predicted regression coefficient (solid blue line) and 95% CI band for antisocial peers at each level of community violence and neighborhood disorder. Affiliation with antisocial peers was not significantly related to CU traits when youth were simultaneously exposed to high community violence and low neighborhood disorder.

community violence and neighborhood disorder (Figure 1, Supplemental Table 3). However, there was no significant association between antisocial peers and CU traits when youth reported both high (+1 SD) levels of community violence and low levels of neighborhood disorder (+1 SD). There were no significant four-way interactions (Table 1, Model 4).

### **Age-Related Associations between Multiple Environmental Conditions and CU Traits**

The second set of fixed effect regression models were used to examine how the associations between CU traits and each environmental factor varied from ages 15 to 21 years. There was a significant two-way interaction between neighborhood and age (Table 2, Model 5), indicating that the strength of the association between neighborhood disorder and CU traits changed over time. Greater exposure to neighborhood disorder was associated with increases in CU traits, but only among youth ages 15 to 17 (Figure 2, Supplemental Table 4). The three-way interaction among negative parenting, community violence, and age was significant (Table 2, Model 6). At high (+1 SD) levels of community violence, greater exposure to negative parenting was associated with increases in CU traits among youth ages 15 to 19 (Figure 3, Supplemental Table 4). At average levels of community violence, greater exposure to negative parenting was associated with increases in CU traits at all

ages. Finally, at low (−1 SD) community violence, greater exposure to negative parenting was associated with increases in CU among youth ages 17 to 21. There also was a significant three-way interaction among neighborhood disorder, community violence, and age (Table 2, Model 6). At average or high (+1 SD) levels of community violence, greater exposure to neighborhood disorder was associated with increases in CU traits among youth ages 15 to 17 (Figure 4, Supplemental Table 4). At low community violence, neighborhood disorder was not associated with CU traits at any age. There were no significant four-way (Table 2, Model 7) or five-way interactions (Table 2, Model 8) between age and the environmental factors.

### **Supplemental Analysis**

Fixed effect regression models were estimated to examine the associations between each environmental factor and Grandiose-Manipulative and Impulsive-Irresponsible traits. These results indicated that the interactions with environmental conditions and the age-varying effects apparent with CU traits were largely replicated when examining the other psychopathic traits (Supplemental Tables 5–8). Similar to the effects with CU traits: (a) negative parenting and antisocial peers were positively associated with Grandiose-Manipulative and Impulsive-Irresponsible traits; (b) the three-way interaction among antisocial

**Table 2.** Fixed effect regression models with environmental conditions and age interactions predicting youth CU traits.

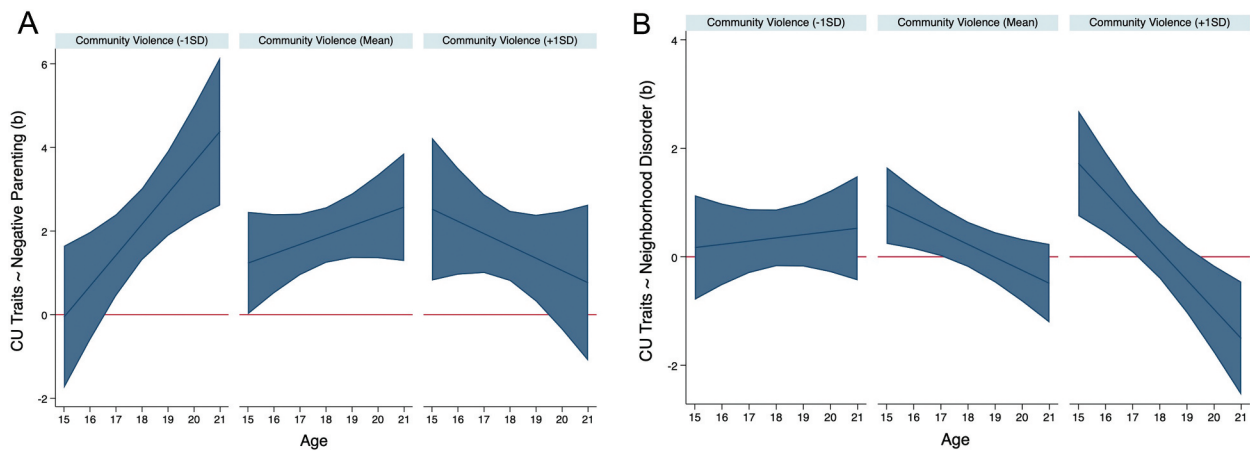
	Model 5					Model 6					Model 7					Model 8				
	b	SE	t	p	95% CI	b	SE	t	p	95% CI	b	SE	t	p	95% CI	b	SE	t	p	95% CI
Age	-0.38	0.08	-5.03	<0.001	-0.53 -0.23	-0.32	0.08	-3.79	<0.001	-0.48 -0.15	-0.33	0.08	-3.90	<0.001	-0.50 -0.16	-0.33	0.09	-3.92	<0.001	-0.50 -0.17
Negative Parenting	1.25	0.62	2.01	0.04	0.03 2.46	1.26	0.62	2.02	0.04	0.04 2.49	1.15	0.68	1.69	<0.001	-0.18 2.49	1.14	0.68	1.67	0.10	-0.20 2.48
Antisocial Peers	0.83	0.22	3.79	<0.001	0.40 1.26	0.81	0.23	3.48	<0.001	0.35 1.26	0.74	0.24	3.04	<0.001	0.26 1.21	0.71	0.24	2.88	<0.001	0.23 1.19
Community Violence	-0.17	0.12	-1.39	0.17	-0.42 0.07	-0.22	0.14	-1.64	0.10	-0.49 0.04	-0.16	0.14	-1.12	0.26	-0.44 0.12	-0.16	0.14	-1.15	0.25	-0.45 0.12
Neighborhood Disorder	0.91	0.36	2.55	0.01	0.21 1.61	0.92	0.36	2.56	0.01	0.22 1.63	0.81	0.38	2.12	0.03	0.06 1.56	0.82	0.38	2.15	0.03	0.07 1.58
Offending	0.11	0.05	2.40	0.02	0.02 0.20	0.12	0.05	2.52	0.01	0.03 0.21	0.12	0.05	2.62	0.01	0.03 0.21	0.13	0.05	2.67	0.01	0.03 0.22
Negative Parenting x Age	0.24	0.18	1.33	0.18	-0.11 0.59	0.21	0.18	1.14	0.25	-0.15 0.56	0.26	0.20	1.29	0.20	-0.13 0.65	0.26	0.20	1.32	0.19	-0.13 0.65
Antisocial Peers x Age	0.00	0.06	-0.05	0.96	-0.13 0.12	-0.02	0.07	-0.24	0.81	-0.15 0.12	-0.01	0.07	-0.15	0.88	-0.15 0.13	-0.01	0.07	-0.09	0.93	-0.15 0.13
Community Violence	0.03	0.04	0.84	0.40	-0.04 0.10	0.06	0.04	1.54	0.12	-0.02 0.14	0.05	0.04	1.22	0.22	-0.03 0.13	0.05	0.04	1.22	0.22	-0.03 0.14
Negative Parenting x Age	-0.21	0.10	-2.12	0.03	-0.40 -0.02	-0.24	0.10	-2.39	0.02	-0.43 -0.04	-0.23	0.11	-2.14	0.03	-0.43 -0.02	-0.23	0.11	-2.13	0.03	-0.44 -0.02
Neighborhood Disorder x Age																				
Negative Parenting x Antisocial Peers	-0.12	0.48	-0.26	0.80	-0.105 0.81	-0.39	0.49	-0.80	0.42	-1.05 0.81	-0.39	0.49	-0.80	0.42	-1.35 0.57	-0.40	0.51	-0.78	0.44	-1.40 0.60
Negative Parenting x Community Violence	0.63	0.29	2.13	0.03	0.05 1.21	0.64	0.33	1.95	0.05	0.05 1.21	0.64	0.33	1.95	0.05	-0.01 1.29	0.63	0.33	1.92	0.06	-0.01 1.28
Negative Parenting x Neighborhood Disorder	-0.76	0.77	-1.00	0.32	-2.27 0.74	-0.47	0.79	-0.60	0.55	-2.27 0.74	-0.47	0.79	-0.60	0.55	-2.02 1.07	-0.55	0.82	-0.67	0.50	-2.17 1.06
Antisocial Peers x Community Violence	-0.13	0.09	-1.51	0.13	-0.30 0.04	-0.17	0.10	-1.76	0.08	-0.30 0.04	-0.17	0.10	-1.76	0.08	-0.37 0.02	-0.17	0.10	-1.75	0.08	-0.37 0.02
Antisocial Peers x Neighborhood Disorder	0.39	0.28	1.37	0.17	-0.17 0.94	0.35	0.30	1.17	0.24	-0.17 0.94	0.35	0.30	1.16	0.25	-0.24 0.94	0.35	0.30	1.16	0.25	-0.24 0.94
Neighborhood Disorder x Community Violence	0.38	0.16	2.30	0.02	0.06 0.70	0.26	0.17	1.49	0.14	0.06 0.70	0.26	0.17	1.49	0.14	-0.08 0.59	0.25	0.18	1.36	0.17	-0.11 0.60
Negative Parenting x Antisocial Peers	0.09	0.14	0.60	0.55	-0.20 0.37	0.17	0.15	1.13	0.26	-0.20 0.37	0.17	0.15	1.13	0.26	-0.12 0.46	0.15	0.15	0.95	0.34	-0.16 0.45
Negative Parenting x Age	-0.25	0.09	-2.72	0.01	-0.43 -0.07	-0.24	0.10	-2.35	0.02	-0.43 -0.07	-0.24	0.10	-2.35	0.02	-0.44 -0.04	-0.24	0.10	-2.37	0.02	-0.44 -0.04
Negative Parenting x Community Violence																				
Violence x Age	0.02	0.22	0.10	0.92	-0.42 0.46	-0.04	0.23	-0.15	0.88	-0.42 0.46	-0.04	0.23	-0.15	0.88	-0.49 0.42	-0.05	0.24	-0.20	0.84	-0.53 0.43
Negative Parenting x Neighborhood Disorder	0.03	0.03	1.37	0.17	-0.02 0.08	0.04	0.03	1.38	0.17	-0.02 0.08	0.04	0.03	1.38	0.17	-0.02 0.09	0.04	0.03	1.37	0.17	-0.02 0.09
Antisocial Peers x Community Violence	-0.06	0.09	-0.65	0.51	-0.23 0.11	-0.05	0.09	-0.55	0.58	-0.23 0.11	-0.05	0.09	-0.55	0.58	-0.24 0.13	-0.05	0.09	-0.55	0.58	-0.24 0.13
Violence x Age																				
Antisocial Peers x Neighborhood Disorder	-0.15	0.05	-2.91	<0.001	-0.24 -0.05	-0.13	0.05	-2.53	0.01	-0.24 -0.05	-0.13	0.05	-2.53	0.01	-0.23 -0.03	-0.13	0.05	-2.41	0.02	-0.24 -0.02
Neighborhood Disorder x Community Violence																				

(Continued)

Table 2. (Continued).

	Model 5				Model 6				Model 7				Model 8			
	b	SE	t	p	95% CI	b	SE	t	p	95% CI	b	SE	t	p	95% CI	95% CI
Negative Parenting x Antisocial Peers x Community Violence	-0.14	0.24	-0.56	0.58	-0.61	0.34	-0.12	0.25	-0.47	0.64	-0.12	0.25	-0.47	0.64	-0.60	0.37
Negative Parenting x Antisocial Peers x Neighborhood Disorder	-0.66	0.61	-1.08	0.28	-1.86	0.54	-0.65	0.62	-1.06	0.29	-0.65	0.62	-1.06	0.29	-1.86	0.55
Negative Parenting x Neighborhood Disorder	0.73	0.39	1.85	0.06	-0.04	1.50	0.64	0.42	1.52	0.13	0.64	0.42	1.52	0.13	-0.18	1.46
Negative Parenting x Antisocial Peers Disorder	0.12	0.12	1.05	0.29	-0.10	0.35	0.12	0.12	1.05	0.29	0.12	0.12	1.05	0.29	-0.11	0.35
Negative Parenting x Antisocial Peers x Community Violence	0.00	0.07	0.05	0.96	-0.13	0.14	-0.01	0.04	-0.17	0.87	-0.01	0.04	-0.17	0.87	-0.08	0.06
Negative Parenting x Antisocial Peers x Neighborhood Disorder	0.14	0.19	0.72	0.47	-0.24	0.51	-0.01	0.07	-0.20	0.84	-0.01	0.07	-0.20	0.84	-0.16	0.13
Negative Parenting x Neighborhood Disorder	-0.17	0.13	-1.36	0.17	-0.42	0.08	0.13	0.19	0.66	0.51	0.13	0.19	0.66	0.51	-0.25	0.51
Negative Parenting x Antisocial Peers Disorder	-0.01	0.04	-0.22	0.83	-0.08	0.06	-0.17	0.13	-1.29	0.20	-0.17	0.13	-1.29	0.20	-0.43	0.09
Negative Parenting x Antisocial Peers x Community Violence											0.09	0.31	0.28	0.78	-0.52	0.69
Negative Parenting x Antisocial Peers x Neighborhood Disorder																
Negative Parenting x Antisocial Peers x Community Violence																
Negative Parenting x Neighborhood Disorder											0.02	0.09	0.20	0.84	-0.16	0.20

Bolded text represents significant ( $p < 0.05$ ) estimates. Exposure to community violence and age moderated the associations between negative parenting and CU traits, as well as neighborhood disorder and CU traits.



**Figure 2.** Association between negative parenting, neighborhood disorder, and callous-unemotional traits, by community violence and age. Note: Figure depicts the predicted regression coefficient (solid blue line) and 95% CI band for (A) negative parenting and (B) neighborhood disorder at each age by level of community violence. Among youth exposed to low community violence, the relation between CU traits and parents strengthened as youth aged. Conversely, for youth exposed to high levels of community violence, the strength of the association between negative parenting and CU traits decreased as they aged. When younger adolescents (ages 15 to 17) were exposed to average or high community violence, increased neighborhood disorder was associated with higher levels of CU traits.

peers, community violence, and neighborhood disorder significantly predicted Grandiose-Manipulative traits; (c) the three-way interaction among neighborhood disorder, community violence, and age significantly predicted Grandiose-Manipulative and Impulsive-Irresponsible traits; and, (d) the three-way interaction among negative parenting, community violence, and age predicted Grandiose-Manipulative traits.

There were several significant two-way environment interactions that were only associated with Impulsive-Irresponsible traits (Supplemental Table 7). For Impulsive-Irresponsible traits, there were significant two-way interactions between negative parenting and community violence, such that negative parenting was associated with increases in Impulsive-Irresponsible traits, however the strength of the association weakened as community violence increased (Supplemental Figure 1). There also was an interaction between antisocial peers and community violence, as well as community violence and neighborhood disorder. The association between Impulsive-Irresponsible traits and antisocial peers strengthened as neighborhood disorder increased (Supplemental Figure 2A). In contrast, the association between Impulsive-Irresponsible traits and community violence decreased as neighborhood disorder increased, such that the association was only significant for youth exposed to low

(−1 SD) levels of neighborhood disorder (Supplemental Figure 2B). There were no additional higher-order interactions only associated with Impulsive-Irresponsible traits.

## Discussion

Previous studies show a meaningful association between certain environmental conditions and elevated levels of CU traits, but the majority focus on a single environmental domain (Backman et al., 2018, 2021) or use time-invariant environmental conditions to predict membership in different CU trajectories (Byrd et al., 2018; Fontaine et al., 2010; Waller, Baskin-Sommers et al., 2018). The current study examined the individual and interactive associations between multiple environmental conditions and within-person changes in CU traits during adolescence. In line with our hypotheses, proximal parent and peer conditions (i.e., negative parenting and antisocial peers) had stronger associations with CU traits than distal neighborhood and community conditions. However, the level of risk conferred by parents and peers was not consistent across context or development. Consistent with theories suggesting that multiple environments operate in conjunction to shape youths' developmental outcomes (Bronfenbrenner, 1977; Scaramella et al., 2002), the association between antisocial peers and CU traits

was moderated by community violence and neighborhood disorder. Further, the association between negative parenting and CU traits either strengthened or decreased over time depending on the level of community violence to which youth were exposed. Together, these findings suggest that the relationships among parents, peers, and CU trait development are more nuanced than suggested by research that examines these environmental conditions individually.

### ***Individual and Interactive Associations between Environmental Conditions and CU Traits***

Increased exposure to negative parenting and antisocial peers was associated with higher levels of CU traits, consistent with previous research indicating that low quality parent and peer relationships put youth at risk for elevated CU traits (Backman et al., 2018, 2021; Miron et al., 2020; Ray, 2018; Ray et al., 2019). It is possible that frequent exposure to these proximal environmental conditions may limit youths' interactions with individuals who model or encourage prosocial behavior and empathy. Instead, youth may learn and receive direct or indirect reinforcement of antisocial tendencies, such as a lack of concern for the wellbeing of others and other CU traits. Thus, negative interpersonal relationships may place youth at risk for elevated CU traits by limiting opportunities for youth to observe and learn prosocial behaviors. This in turn may lead youth to adopt a view that such behaviors are normative and reduce their concerns about the physical and emotional consequences of their behavior.

In most community contexts and neighborhoods, antisocial peers predicted higher levels of increased CU traits. However, when youth were simultaneously exposed to high levels of community violence and low neighborhood disorder, greater affiliation with antisocial peers was not significantly associated with CU traits. One potential explanation for this finding is that youth living in neighborhoods with lower disadvantage may be particularly vulnerable to the effects of exposure to community violence, which occurs less frequently (Friedson & Sharkey, 2015) and may be viewed as more aberrant than in higher disadvantaged neighborhoods (Wright & Fagan, 2013). Indeed, prior research indicates youth with the lowest risks of victimization (e.g., higher household income, no prior experience with violence, low neighborhood poverty rate) are more impacted by negative experiences than those at

the highest risk (Turanovic, 2019). As a result, youth may focus more on their violence exposure, and antisocial peers may become less prominent and consequential to CU trait development. While the present study establishes a relation among antisocial peers, community violence, neighborhood disorder, and CU traits, elucidating the mechanisms underlying this relation is an important area for future research.

### ***Age-Related Associations between Multiple Environmental Conditions and CU Traits***

Exposure to community violence and age were found to moderate the associations between negative parenting and CU traits. Among youth exposed to low community violence, the relation between CU traits and parents strengthened as youth aged. This association is consistent with research highlighting the importance of negative parenting on the development of CU traits (Backman et al., 2021; Waller et al., 2013), but specifies that the relation may be most evident in youth with lower as compared to higher community violence exposure. Conversely, for youth exposed to high levels of community violence, the strength of the association between negative parenting and CU traits decreased as they aged. There are several potential explanations for why higher levels of exposure to community violence reduced the association between CU traits and negative parenting as youth developed. Violence exposure in the community when youth were older possibly dampened youth's concern about violence or hostile conditions within the home (Kerig et al., 2012; Waller et al., 2015). Alternatively, negative parenting in the home may have prompted youth to spend more time away from their parents and in their community, which might be more likely as youth age and gain independence (Kerr et al., 2003). More time in the community may result in greater exposure to violence, which further attenuates the relation between parenting and CU traits. Overall, the interaction among parenting, community violence, and age extends prior work by showing that the association between CU traits and parenting behaviors may depend on youth's exposure to other environmental conditions and identifying periods in development where parenting and community violence may be most influential.

An additional interesting finding observed in the present study was the significant interaction between



the distal environmental conditions. Neighborhood disorder initially was related to CU traits from ages 15 to 17, suggesting that younger adolescents may be more vulnerable to the impacts of living in disordered and disadvantaged neighborhoods. However, this association was further moderated by community violence exposure. When youth were exposed to low community violence, neighborhood disorder did not predict changes in CU traits at any age. When younger adolescents (ages 15 to 17) were exposed to average or high community violence, increased neighborhood disorder was associated with higher levels of CU traits. This finding suggests that higher levels of neighborhood disorder may not contribute to CU traits unless it is accompanied by violence exposure. Disadvantaged neighborhoods, thus, may primarily contribute to CU traits by placing youth in closer proximity to antisocial individuals and violence (Friedson & Sharkey, 2015) and where the belief that using violence to settle interpersonal disputes and gain respect is accepted (Anderson, 2000; Fine et al., 2020).

### Supplemental Analyses

The supplemental analyses revealed there is a fair amount of consistency in which environmental conditions related to all three psychopathic traits. As with CU traits, antisocial peers predicted higher levels of Grandiose-Manipulative traits, except among youth who were simultaneously exposed to high community violence and low neighborhood disorder. In addition, the relation between Grandiose-Manipulative traits and negative parenting strengthened over time among youth exposed to low community violence, while it weakened among youth exposed to high community violence. Moreover, the interaction among neighborhood disorder, community violence, and age significantly predicted all three traits, such that there was a positive association between neighborhood disorder and these traits, but only among younger adolescents exposed to average or high community violence. In addition to the environment associations similar to what was observed for CU traits, Impulsive-Irresponsible traits were predicted by interactions between negative parenting and community violence, as well as antisocial peers and neighborhood disorder. Although the strength of the associations varied across the level of the distal conditions, higher levels of negative parenting and antisocial peers were consistently associated with higher levels of Impulsive-Irresponsible traits. Thus, while there is some

variation in the environmental associations across the three traits, the overall pattern of findings aligns with theoretical work (Bronfenbrenner, 1977) and our hypothesis that the proximal risk factors such as negative parenting and antisocial peers are more consistently predictive of psychopathic traits than distal factors such as community violence and neighborhood disorder.

### Limitations and Conclusions

Before concluding, a number of limitations should be noted. First, our models examined the association between environmental conditions and CU traits, however, conditions and CU traits were measured in the same time-period and temporal ordering between conditions and traits was not examined. Previous research found that children's CU traits led to less parental involvement, attention, and monitoring over time, which reciprocally impacted the child's increase in CU traits over time (Hawes et al., 2011). Similar associations have been observed between CU traits and peer relationship quality (Miron et al., 2020). Future research should examine the bidirectional associations of the environmental conditions and CU traits over time. Second, the present sample investigated only male youth who were arrested for serious criminal offenses. Given our interest in the development of CU traits, it was necessary to examine these questions within a high-risk sample that had significant variability in CU traits and greater exposure to environmental conditions. Although female youth ( $n = 184$ ) were included in the Pathways to Desistance study, the small number of observations at each age did not allow for an examination of developmental effects in females. As such, future research should determine whether the results generalize to female youth and other demographic groups (e.g., clinical, community samples). Third, although we speculate that increased exposure to antisocial behaviors and reduced opportunities to observe and learn prosocial behaviors may explain why the environmental conditions are associated with higher levels of CU traits, this study did not assess these potential mechanisms. It is important for future research to identify the specific mechanisms underlying the associations between the environmental conditions and CU traits. Fourth, there is debate regarding the interpretation of interactions in fixed effect regression models (Shaver, 2019). Specifically, Shaver notes that interaction estimates in fixed effect regressions capture some between-person, as well as within-person, variation and may be sensitive to omitted variable bias. However, this cross-

contamination may be more consistent with theories regarding the interactive associations among environment conditions and within-person processes. Thus, while there is some impurity in the estimates, they may provide a closer approximation of the complex associations than what has been previously obtained. Finally, this study relied on self-report for all measures of environment and CU traits. As such, our approach may overestimate the associations due to shared method biases. To address this limitation, future research should utilize objective assessments of environmental risk or parent- and teacher-reports of youth CU traits.

Results of the current study provide important insights into the ways environmental conditions contribute to the development and maintenance of CU traits across adolescence. More specifically, evidence from the current study shows that the influence of environmental conditions on CU traits are not consistent between contexts and across adolescence. When evaluating only the unique associations between the environmental conditions and CU traits, negative parenting and antisocial peers appeared to have stronger associations with CU traits than community violence and neighborhood disorder. However, the level of risk conferred by parents and peers was not consistent across these broader environmental contexts. Overall, there are various potential environmental sources of vulnerability for the development of CU traits and sensitive periods for which these sources of vulnerability may exert the most impact. Understanding the sources and timing of environmental conditions on the development of CU traits may help to inform which and when interventions can be most effective for youth (Fleming & Kimonis, 2018; Hawes et al., 2014; White et al., 2013).

Together, these findings underscore the need for clinicians to assess and address risk in multiple contexts. Focusing on one environmental risk factor during assessment may limit the scope of treatment options and lead to the implementation of methods that fail to account for the interactive effects among environmental conditions. Instead, multisystemic interventions that identify and intervene on negative conditions in the multiple environments that youth inhabit should be potentially utilized among youth with or at risk for developing CU traits (Baskin-Sommers et al., 2022; Fonagy et al., 2018). Ultimately, a comprehensive, multi-systemic, approach to assessing and addressing the various environmental risks youth encounter may improve the effectiveness of prevention and intervention efforts designed to curb the development and impact of CU traits.

## Disclosure Statement

No potential conflict of interest was reported by the authors.

## Data Availability Statement

The data that support the findings of this study are openly available in the Inter-university Consortium for Political and Social Research (ICPSR) data archive at <https://doi.org/10.3886/ICPSR29961.v2>.

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