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Early Predictors of Callous and Unemotional Traits: The Role of Infant, Toddler, and Parent Temperament

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Abstract

Etiological factors contributing to callous and unemotional (CU) traits, and early manifestations of child temperament and caregiver attributes, in particular, require further study. In addition, this research must account for overall child behavioral/emotional dysregulation. The present study does precisely this, considering infant, toddler, and parent temperament as predictors of CU traits, controlling for concurrent child behavior problems. Parent and infant temperament information was obtained at 4 and 12 months, with toddler temperament and CU traits measured at 2 years of age (N= 85). The Child Behavior Checklist (CBCL) was utilized to measure total behavior problems, also providing an indicator of CU traits (α= .65). Hierarchical regressions indicated that CU traits were associated with infant fear, but not toddler temperament correlates, as well as maternal high intensity pleasure. These links are relevant to preventative efforts and to understanding the intergenerational transmission of risk for conduct disorder and psychopathy.

Key words: callous and unemotional traits, infancy, temperament, socioemotional development.

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Novelty and Significance

What is already known about the topic?

- Callous and unemotional (CU) traits are stable and heritable, and associated with patterns of limited emotional expression, guilt, and empathy.
- Deficits in the processing of emotional stimuli, decreased sensitivity to punishment cues, and low fearlessness are also linked to CU traits.
- CU traits predict increased risk of later maladaptive behavior and conduct problems.

What this paper adds?

- Infant, toddler, and maternal temperament were considered as predictors of CU traits while controlling for concurrent child behavior problems.
- Results indicated that CU traits were associated with infant fear and maternal high intensity pleasure, but not toddler temperament correlates.
- This research advances understanding of early preventative efforts and intergenerational transmission of risk for conduct disorder and psychopathy.

Callous and unemotional (CU) traits reflect an affective and interpersonal style that distinguishes a subgroup of antisocial youth. Identifiable by a lack of guilt, emotional expression, and inability to recognize feelings and needs of others, the combination of these characteristics appears stable across childhood (Frick, Kimonis, Dandreaux, & Farrell, 2003). Children exhibiting CU traits have difficulty regulating their emotions, and researchers have compared this presentation to aspects of adult psychopathic personality ("psychopathy"; Frick, Stickle, Dandreaux, Farrell, & Kimonis, 2005). CU traits present in childhood are associated with an increased risk of maladaptive behavior, severe and violent antisocial behavior, and conduct problems (Enebrink, Anderson, & Langstrom, 2005). For these reasons, a CU trait specifier was incorporated in the Diagnostic and

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Statistical Manual-5th Edition (DSM-5; American Psychiatric Association, 2013) and is considered a negative prognostic indicator for Conduct Disorder (CD). This specifier, listed as "with limited prosocial emotions," is intended to improve diagnostic validity, understanding the life-course trajectory of CD, and treatment outcomes for youth.

In a 2008 review, Frick and White reported that CU traits were associated with conduct problems to a lesser degree relative to other dimensions of psychopathy, such as narcissism and impulsivity. However, more robust associations between CU traits and aggression, compared to narcissism or impulsivity, have been reported (Enebrink et alia, 2005). Specifically, CU traits were critical in identifying a subgroup of antisocial youth who demonstrated severe aggressive behaviors, more typically instrumental (e.g., pre-planned bullying) than reactive (e.g., retaliation) aggression (Frick, Cornell, Barry, Bodin, & Dane, 2003; Kruh, Frick, & Clements, 2005). In addition, for children with conduct problems, CU traits were significant predictors of more stable and severe antisocial behavior (e.g., increased rate of police contact, increased likelihood of familial history of antisocial personality disorder, earlier age at onset of CD symptoms; Christian, Frick, Hill, Tyler, & Frazer, 1997).

Frick and colleagues (2014) described the behavior of antisocial youth with CU traits as distinct from other antisocial youth and more like adults with psychopathic traits or Antisocial Personality Disorder. Specifically, three dimensions similar to adult antisocial or psychopathic personality have emerged in the child CU literature, including a) a deficient affective experience, b) manipulative behavior and a narcissistic view of self, and, c) an impulsive and irresponsible behavioral style (Cooke, Michie, & Hart, 2006; Hare, 1999). CU traits predicted delinquency and identified a group of antisocial and conduct-disordered youth at an increased risk for early-onset, concurrent, and later delinquency, controlling for conduct problems (Frick, Ray, Thornton, & Kahn, 2014). Thus, CU attributes demonstrated predictive utility above and beyond disruptive behavior symptomatology.

Additional evidence for differentiation of CU traits from other childhood externalizing disorders comes from confirmatory factor analyses demonstrating that CU trait items could be distinguished from those targeting Oppositional Defiant (ODD), Attention-Deficit/Hyperactivity Disorder (ADHD), and CD problems (Dadds, Fraser, Frost & Hawes, 2005; Pardini, Obradovic, & Loeber, 2006). Overall, CU traits have been associated with more severe conduct problems, aggression, and delinquency, and require a deeper understanding considering these links.

The heritability and stability of CU traits have been assessed using parent and youth self-report measures. The literature suggests antisocial youth with CU traits have a distinct biological profile, in addition to unique cognitive, emotional, and personality characteristics (Loney, Frick, Ellis, & McCoy, 1998; Viding, Blair, Moffitt, & Plomin, 2005). There is a substantial genetic influence on the development of CU traits (Muñoz & Frick, 2007), mostly independent of other psychopathic personality dimensions and antisocial behavior. Two large twin studies reported similar amounts of variation in CU traits accounted for by heredity (i.e., 43% and 42%; Larsson, Andershed, & Licktenstein, 2006; Taylor, Loney, Bobadilla, Iacono, & McGue, 2003).

The literature is consistent in support of relations between abnormalities in the processing of negative emotional stimuli and CU traits (Blair & Coles, 2000). Antisocial youth with CU traits reported differences in cognitive processing of fear-related stimuli relative to antisocial youth without CU traits, specifically less sensitivity to punishment cues and more positive outcome expectancies in aggressive situations with peers (Fisher

& Blair, 1998; O'Brien, & Frick, 1996). Furthermore, deficits have been reported in the processing of fear and distress in others, which may indicate that children high in CU traits have a limited or shallow experience of fear and thus fail to recognize fear accurately in interpersonal situations (Kimonis, Frick, Fazekas, & Loney, 2006).

Given the same level of conduct problems, children high in CU traits demonstrated lower trait anxiety and were less distressed by the consequences of their behavior problems compared to those whose parents did not endorse CU traits (Frick, Lilienfeld, Ellis, Loney, & Silverthorn, 1999). Mills-Koonce and colleagues (2015) considered group differences in fear reactivity in infancy among children with Conduct Problems (CP) and CU, CP without CU, or no CP in later childhood. Although group differences were not apparent at 6-months, 15-month-old children who later developed CU traits displayed higher intensity fear behavior and higher fear reactivity indicated by various biomarkers including respiratory sinus arrhythmia and cortisol (Mills-Koonce *et alia*, 2015). However, Viding and colleagues (2012) reported lower amygdala activity for boys with conduct problems and high CU traits. These findings reveal the complexities of CU etiology, suggesting divergent predictions depending on the context and timing of temperament assessment.

Multiple studies demonstrate associations among temperament and personality attributes and CU traits, with unique relations relative to antisocial behavior and conduct problems. A study by Willoughby and colleagues demonstrated that among children with ODD, those with low and high CU traits exhibited distinct temperament profiles. Specifically, those low in CU traits demonstrated emotion dysregulation, whereas children with high levels of CU traits displayed low fearfulness (Willoughby, Waschbusch, Moore, & Propper, 2011). Fearlessness and thrill-seeking behavior are positively correlated with CU traits (Essau, Sasagawa, & Frick, 2006), whereas trait anxiety and neuroticism show negative associations (Pardini, Lochman, & Powell, 2007). Although sensation-seeking is often conceptualized as a component of extraversion (e.g., Evans & Rothbart, 2007; Rothbart, Ahadi, & Evans, 2000), results concerning the latter broader dimension have been mixed. For example, CU traits moderated the relationship between extraversion and antisocial behavior. Specifically, high levels of CU traits and extraversion predicted high levels of externalizing behavior in a community sample (Daoud, 2013). However, other studies suggested extraversion and CU traits are unrelated (de Wied, van der Baan, Raaijmakers, Ruiter, & Meeus, 2014), and some have reported a negative association between the two (Roose *et alia*, 2012). In general, there is considerable value in examining fine-grained temperament scales, as opposed to the overarching factors, as these component dimensions often have been shown to have differential predictive utility, contributions to temperament types, and growth trajectories across infancy (Gartstein *et alia*, 2017; Gartstein & Hancock, 2019; Lengua, 2006; Oldenhinkel, Hartman, de Winter, Veenstra, & Ormel, 2004), thus will be considered in this study. Although the literature addressing child temperament precursors of CU traits has begun to accumulate, maternal temperament has not been considered as a contributor to early markers of CU, despite the substantial heritability noted earlier.

Insights into the fundamental aspect of CU traits have theoretical implications for developmental models of aggressive and severe antisocial behavior. This understanding can also inform preventative efforts addressing disruptive behavior and delinquency. It is suggested that temperamental deficits in emotional reactivity confer risk for typical development of guilt and empathy and could potentially result in the manifestation of CU traits (Waller & Hyde, 2018). Thus, understanding the mechanisms behind the emergence

of CU traits could inform potential protective factors facilitating the development of empathy and prosocial behavior. Despite emerging research reviewed herein, an adequate understanding of how temperament in early childhood and maternal attributes factor into the etiology of CU traits is currently lacking and will be addressed in this investigation.

The present study addresses a gap in the research by considering parent, infant, and toddler temperament as predictors of emerging CU traits, controlling for concurrent child behavior problems. Based on the preponderance of the existing literature, a child temperament profile marked by fearlessness, extraversion, and low effortful control was expected to confer risk for CU traits. We predicted these temperament contributions for infant and toddler temperament traits. A similar pattern of effects was anticipated for maternal temperament, which has not been previously empirically examined as a predictor in this context.

METHOD

Participants

This study was approved by the Institutional Review Board (IRB) of Washington State University and consent was obtained from each participant, This project constitutes a secondary data analysis performed with existing data (n= 85). A community sample of 148 English speaking mothers with 4-month-old infants from adjacent communities in Eastern Washington and Northwestern Idaho was recruited through birth announcements released by hospitals and published in a local newspaper, as well as the primary prevention program, First Steps. First Steps provided information about this research, along with psychoeducation aimed at preventing child maltreatment, to all parents of newborn infants in the local hospitals. The project staff contacted potential participants by telephone. None of the potential participants recruited through the help of the First Steps program declined participation, although seven families who were contacted based on the published birth announcements decided not to take part in this research.

Families with healthy 4-month-old infants (i.e., no history of significant medical or birth complications, born full-term (>37 weeks of gestation), without developmental delays/disabilities) were eligible to participate. Mothers were asked to complete temperament questionnaires at several time points, with the final infant evaluation conducted at 12 months of age considered for this study. Of the original families, 85 (39 female children) responded to these surveys. Non-responders either could not be reached (either the telephone number had been disconnected, or the family did not respond to recruitment calls and letters; n= 40) or declined participation (n= 23). The remaining 85 families included infants (49.2% female) of primarily Caucasian (91.9%), married (93.1%), and well-educated (M= 15.87, SD= 2.29 years) mothers, whose family income fell at or above $30,001 (62.8%).

Instruments

Measures at Time 1 (4 months of age):

Adult Temperament Questionnaire (ATQ; Evans & Rothbart, 2007; Rothbart, Ahadi, & Evans, 2000). This self-report instrument contains 177 items that form 13 scales, loading onto four broad factors: Negative Affect (Fear- 11 items; Discomfort-13 items;

Frustration-13 items; Sadness-14 items), Extraversion/Surgency (Sociability-14 items; Positive Affect-11 items; High Intensity Pleasure-13 items), Effortful Control (Inhibitory Control-11 items; Attentional Control-12 items; Activation Control-12 items), and Orienting Sensitivity (Neutral Perceptual Sensitivity, Affective Perceptual Sensitivity, Associative Sensitivity). Respondents were asked to use a 7-point Likert scale, which reflects how representative each statement is of the participants' temperament. For this study, the over-arching factors of Negative Affect, Extraversion, Effortful Control, and Orienting Sensitivity were utilized. Satisfactory psychometric properties, including adequate internal consistency (α >.80 on 13 of the 18 scales), and significant associations between dimensions of the ATQ and the "Big 5" personality factors, have been reported (Evans & Rothbart, 2007; Rothbart et alia, 2000). ATQ over-arching factors of Effortful Control, Negative Affect, Extraversion, and Orienting Sensitivity demonstrated generally good internal consistency in this sample (α range .62 to .81, mean α= .74). For the subscales, internal consistency ranged from .31 to .77 (mean α= .60).

Demographics Questionnaire. Information concerning parent/family background characteristics was obtained to describe the sample. Specifically, parents were asked to respond to questions regarding age, education, income, ethnicity, marital status, and occupation.

Measures at Time 2 (12 months of age):

Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003). This parent-report measure of temperament was developed for infants between 3- and 12-months of age. The IBQ-R contains 191 items, which yield 14 scales shown to form three over-arching factors: Positive Affectivity/Surgency (Activity Level, Smiling/Laughter, Approach, High Intensity Pleasure, Perceptual Sensitivity, and Vocal Reactivity), Negative Emotionality (Fear, Distress to Limitations, Sadness, and negatively loading Falling Reactivity), and Regulatory Capacity/Orienting (Duration of Orienting, Soothability, Cuddliness/Affiliation, and Low Intensity Pleasure). Individual items are rated on a 7-point scale reflecting the frequency of occurrence of different manifestations of temperament in the past week (two weeks for less frequent events, such as encounters with unfamiliar settings/adults). Reliability of the IBQ-R has been supported for mothers and fathers, as well as samples from different cultures, with Cronbach's α values ranging from .77 to .96 (Gartstein, Knyazev, & Slobodskaya, 2005; Gartstein, Slobodskaya, & Kinsht, 2003; Parade & Leerkes, 2008). Furthermore, there is evidence supporting the predictive and construct validity of scores of this instrument (Gartstein & Bateman, 2008; Gartstein *et alia*, 2010; Gartstein & Marmion, 2008). The IBQ-R factors of Negative Emotionality, Positive Affectivity/Surgency, Regulatory Capacity/Orienting, and their subscale components, were utilized as infant temperament predictors in this study. Internal consistency of the 14 IBQ-R factors and scales in the present sample was generally good, with the Cronbach's α values ranging from .65 to .96 (mean α= .82).

Measures at Time 3 (about 22 months of age):

Early Childhood Behavior Questionnaire (ECBQ; Putnam, Gartstein, & Rothbart, 2006). This parent-report questionnaire was designed in a manner that parallels the IBQ-R, extended in content to apply to more advanced toddler temperament capabilities between the ages of 18 months and 36 months of age. The ECBQ contains 201 items that form 18 scales, in turn comprising three temperament factors: Negative Emotionality (Discomfort, Fear, Sadness, Frustration, Motor Activation, Perceptual Sensitivity, Shyness, and Soothability, loading negatively), Surgency/Extraversion (Impulsivity, Activity Level, High-intensity Pleasure, Sociability, and Positive Anticipation), and Effortful Control (Inhibitory Control, Attention Shifting, Low-intensity Pleasure, Cuddliness, and Attention Focusing). Items are rated on a 1-7 Likert scale reflecting the frequency of occurrence of the different manifestations of temperament in the past two weeks. Internal consistency of the ECBQ scales and factors was demonstrated in the current study, with overall Cronbach's alphas ranging from .64 to .92. Longitudinal stability correlations were generally large over 6- and 12-month spans and moderate to large from 18 to 36 months, with considerable inter-rater agreement for primary and secondary caregivers

(Putnam *et alia*, 2006). Construct and predictive validity were also demonstrated for ECBQ factor and scale scores with respect to the Children's Behavior Questionnaire (Rothbart, Ahadi, Hershey, & Fisher, 2001), an established temperament measure for use with older children, as well as the Child Behavior Checklist (Gartstein, Putnam, & Rothbart, 2012).

Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000). This established parent-report questionnaire of behavior problems, designed for use between 18 months to five years of age, was administered during follow-up data collection. This version of the CBCL contains 100 items, which utilize the 3-point Likert scale (0-Not True; 1-Somewhat/Sometimes True; 2-Very/Often True) common to all Achenbach System of Empirically Based Assessment (ASEBA) instruments. The standard scoring approach recommended by Achenbach and Rescorla (summing symptom/problem scores for the items relevant to each scale of interest) was followed in deriving the total behavior composite score used as a covariate, and in computing the CU score, serving as the dependent variable in this study. Reliability and validity of scores of this measure have been established, with adequate criterion-related validity (Achenbach & Rescorla, 2000), inter-rater (*r* ranging from .40 to .75) and test-retest reliability (*r*= .80s and .90s), with good internal consistency in the present sample (Cronbach's α values .78-.88). The CBCL (Achenbach & Rescorla, 2000) was utilized to provide an indicator of total behavior problems (minus CU items), considered as a covariate, as well as to derive a measure of CU traits (Bedford *et alia*, 2015; Trentacosta *et alia*, 2016). The latter was initially based on five items (#27: Doesn't seem to feel guilty after misbehaving, #58: Punishment doesn't change his/her behavior, #67: Seems unresponsive to affection, #70: Shows little affection toward people, #72: Shows too little fear of getting hurt), because of existing evidence for stability and utility of this CU indicator (Trentacosta *et alia*, 2016; Waller *et alia*, 2017). However, three of these CU items (27, 58, 72) were utilized in the present study in order to maximize internal consistency (α= .65).

Procedure

Mothers reported demographic factors and their own temperament when their child was 4 months of age. Mothers provided information concerning infant temperament when the children were approximately 12 months of age. Between 18 and 33 months (*M*= 22 months), mothers reported on toddler temperament and emerging child behavioral/emotional problems. Questionnaires included in this investigation were mailed to the mothers and completed at home, at their convenience.

Data Analysis

Using SPSS software, partial correlations between temperament factors and subscales derived from the IBQ-R, ECBQ, and ATQ, and CU scores were computed, controlling for total child behavior problems (minus CU items). Three hierarchical multiple regression analyses were subsequently performed to identify significant unique contributions of parent and child temperament and early CU traits. In order to reduce the number of predictors, only infant, toddler, and maternal temperament scores that were shown to be significantly associated based on computed partial correlations were included. That is, infant (fear and cuddliness), toddler (fear, shyness, high intensity pleasure, and activity level), and maternal (discomfort, frustration, and high intensity pleasure) temperament attributes were considered as predictors of CU traits to determine which dimensions made independent contributions. For all of these models, CU traits were regressed on child behavior problems first (block one), in order to control for their contemporaneous contribution. Infant, toddler, and maternal temperament predictors (respectively) were added in the second step. Although over-arching factors were included in correlational

analyses to enable comparisons with existing literature, we focused on the component fine-grained dimensions in the hierarchical multiple regression models. This analytic strategy was selected because more narrowly defined temperament attributes are associated with unique effects that do not parallel those observed for the over-arching factor, and fine-grained dimensions have been implicated in existing CU research (e.g., fearfulness, soothability; Willoughby *et alia*, 2011). Moreover, as noted fine-grained temperament scales often behave differently than the over-arching factor to which these belong and/or other scales that comprise the same factor (Gartstein & Hancock, 2019; Gartstein *et alia*, 2017; Lengua, 2006; Oldenhinkel, Hartman, de Winter, Veenstra, & Ormel, 2004).

Results

Descriptive statistics of primary caregiver and infant demographics are presented in Table 1, and descriptive statistics are presented in Table 2. Although many IBQ-R indicators were not significantly correlated with CU, reliable associations were observed for fear (r= -.27, p= .02), and cuddliness (r= .23, p= .05), scales (Table 3). A greater number of statistically significant associations were found for ECBQ (Table 4) and ATQ scores (Table 5). CU trait scores were significantly negatively correlated with the negative affect factor of the ECBQ (r= -.32, p= .006), as well as component fear (r= -.35, p= .003), and shyness (r= -.34, p= .004), subscales. CU traits were also positively correlated with the Surgency/Extraversion factor (r= .26, p= .03), and the underlying

Table 1. Descriptive Statistics of Primary Caregiver and Infant Demographics.

Variables		*M*	Range	*SD*	%
Maternal Age (years)		28.67	20-42	5.27	
Infant Sex	Males				50.8%
	Females				49.2%
Maternal Ethnicity	Caucasian				91.9%
	African American				3.7%
	Asian				2.9%
	Hispanic/ Latino				1.5%
Most Frequent Maternal Occupations	Student				27.1%
	Office Administrator/Secretary				5.7%
	Teacher				4.3%
	Registered Nurse				4.3%
Maternal Higher Education Attainment	Less Than High School	15.87 years	10-20 years	2.29 years	2.8%
	High School Diploma				6.4%
	Some College				26.2%
	Bachelor's Degree				39.7%
	Graduate Degree				24.8%
Living Arrangement	Married				93.1%
	Divorced/Separated				1.6%
	Single				3.8%
	Remarried				1.5%
Family Income	$0 – $7,000				5.2%
	$7,001 – $10,000				3.0%
	$10,001 – $13,000				5.2%
	$13,001 – $16,000				4.5%
	$16,001 – $20,000				9.0%
	$20,001 – $30,000				10.4%
	$30,001 – $50,000				29.9%
	$50,001 – $75,000				17.2%
	Over $75,000				15.7%

Note: SES= Socioeconomic status; Coded from the occupational information obtained from mothers (Nakao & Treas, 1989).

Table 2. Descriptive statistics.

	Variables	Range	M	SD
IBQ-r	Positive Affectivity/ Surgency	-7.93-10.31	0.26	3.77
	Activity Level	2.79-5.89	4.40	0.68
	Smiling/ Laughter	2.53-6.65	4.58	0.90
	Approach	2.18-6.875	4.90	0.85
	High Intensity Pleasure	3.22-7	5.61	0.66
	Perceptual Sensitivity	1.44-6.17	3.72	0.94
	Vocal Reactivity	1.8-6.62	4.63	0.86
	Negative affect	-6.08-6.92	-0.09	2.34
	Fear	1.09-4.63	2.42	0.71
	Distress to Limitations	1.94-5.34	3.75	0.69
	Sadness	1.67-5.26	3.55	0.71
	Falling Reactivity	3.43-6.42	5.15	0.61
	Regulatory Capacity/Orienting	-5.37-6.60	0.22	2.25
	Duration of Orienting	1.94-6.63	3.88	0.86
	Soothability	2.19-6.03	3.67	0.56
	Cuddliness/Affiliation	2.93-6.88	5.56	0.66
	Low Intensity Pleasure	3.30-7.00	5.01	0.68
ECBQ	Negative Affect	-8.44-7.53	0.00	3.08
	Fear	1-4.36	2.30	0.71
	Shyness	1-5.67	3.45	1.03
	Discomfort	1-4.11	2.28	0.70
	Sadness	1.1-5.08	2.84	0.79
	Frustration	1.75-6.08	3.56	0.82
	Soothability	3.33-6.86	5.45	0.64
	Motor Activation	1-3.45	2.05	0.60
	Perceptual Sensitivity	1.4-6.18	3.78	1.10
	Surgency/ Extraversion	-6.22-4.53	0.00	2.10
	Sociability	2-7	5.32	0.96
	Positive Anticipation	2.4-6.4	4.66	0.85
	High Intensity Pleasure	2.67-6.5	4.84	0.89
	Impulsivity	2.6-6.5	4.95	0.69
	Activity Level Energy	3-6.33	4.78	0.70
	Effortful Control	-8.69-7.13	0.00	2.90
	Inhibitory Control	1.9-5.7	3.83	0.84
	Attention Shifting	2.67-5.89	4.46	0.61
	Low-intensity pleasure	3.27-6.33	4.81	0.69
	Cuddliness	2.92-6.5	5.08	0.76
	Attention focusing	2.92-6.18	4.40	0.75
ATQ	Negative Affect	2.17-5.72	3.97	0.65
	Fear	1.57-6	3.78	0.93
	Sadness	2.43-6.29	4.38	0.79
	Discomfort	1.83-6.83	4.12	1.02
	Frustration	1.33-5.83	3.58	0.96
	Extraversion	2.71-6.12	4.51	0.67
	Sociability	2.4-7	5.19	1.03
	Positive Affect	2.2-7	4.88	0.80
	High Intensity Pleasure	1.29-6.14	3.75	1.06
	Effortful Control	3.21-6.05	4.63	0.62
	Inhibitory Control	2-6	4.28	0.73
	Attentional Control	1.8-6.8	4.73	0.95
	Activation Control	3.29-6.57	4.90	0.85
	Orienting Sensitivity	2.87-6	4.53	0.62
	Associative Sensitivity	2.2-6.8	4.47	1.03
	Neutral Perceptual Sensitivity	1.8-6.8	4.91	0.88
	Affective Perceptual Sensitivity	2.2-5.8	4.20	0.81
CBCL Total Behavior Problems (Minus CU items)		1-68	27.30	13.55
CU Traits		0-5	0.82	1.28

Note: Scale scores are averages of items, whereas IBQ-R and ECBQ factors are computed as sums after *z*-scoring the scales.

Table 3. Pearson's correlation between IBQ-R factors and subscales and CU traits.

Scales	*CU (r)*	*p*
Positive Affectivity/ Surgency	.10	.42
Activity Level	-.03	.81
Smiling/ Laughter	.17	.14
Approach	-.02	.86
High Intensity Pleasure	.14	.24
Perceptual Sensitivity	-.02	.87
Vocal Reactivity	-.02	.90
Negative affect	-.11	.38
Fear	-.27*	.02
Distress to Limitations	-.09	.46
Sadness	-.09	.48
Falling Reactivity	-.07	.56
Regulatory Capacity/Orienting	.18	.13
Duration of Orienting	.07	.59
Soothability	.16	.19
Cuddliness/Affiliation	.23*	.05
Low Intensity Pleasure	.02	.87

Note: $^{*}= p < .05$.

Table 4. Pearson's correlation between ECBQ factors and subscales and CU traits.

Scales	*CU (r)*	*p*
Negative Affect	-.32**	.006
Fear	-.35**	.003
Shyness	-.34**	.004
Discomfort	-.19	.11
Sadness	-.22	.06
Frustration	.04	.74
Soothability	.16	.18
Motor Activation	.05	.71
Perceptual Sensitivity	-.01	.95
Surgency/Extraversion	.26*	.03
Sociability	.20	.09
Positive Anticipation	.02	.90
High Intensity Pleasure	.27*	.02
Impulsivity	.06	.63
Activity Level Energy	.25*	.04
Effortful Control	.10	.42
Inhibitory Control	-.14	.26
Attention Shifting	.22	.07
Low-intensity pleasure	.16	.18
Cuddliness	.16	.19
Attention focusing	.03	.94

Notes: $^{**}= p < .01$, $^{*}= p < .05$.

Table 5. Pearson's correlation between ATQ factors and subscales and CU traits.

Scales	*CU (r)*	*p*
Negative Affect	-.28*	.02
Fear	-.19	.11
Sadness	-.01	.91
Discomfort	-.35**	.003
Frustration	-.25*	.04
Extraversion	.36**	.002
Sociability	.15	.22
Positive Affect	.08	.50
High Intensity Pleasure	.40**	.001
Effortful Control	.24*	.04
Inhibitory Control	.23	.06
Attentional Control	.21	.09
Activation Control	.12	.33
Orienting Sensitivity	-.03	.80
Associative Sensitivity	.14	.26
Neutral Perceptual Sensitivity	-.04	.77
Affective Perceptual Sensitivity	-.18	.13

Notes: $^{**}= p < .01$, $^{*}= p < .05$.

sub-dimensions of Activity Level (r= .25, p= .04), and High-Intensity Pleasure (r= .27, p= .02). Toddler CU traits were positively correlated with maternal Effortful Control (r= .24, p= .04), and Extraversion (r= .36, p= .002), and negatively correlated with maternal Negative Affect (r= -.28, p= .02). At the subscale level, CU traits were positively correlated with maternal High-Intensity Pleasure (r= .40, p= .001). Associations in the negative direction were noted for maternal Discomfort (r= -.35, p= .003), and Frustration (r= -.25, p= .04).

Three hierarchical multiple regression analyses were performed to identify unique significant associations between infant, toddler, and maternal temperament and CU traits. In the first hierarchical model (Table 6), infant fear (β= -.182, p= .037) significantly negatively predicted propensity toward CU. Fine-grained dimensions of

toddler temperament (Table 7) were not associated with statistically significant effects for CU traits. Considering maternal temperament in the third model (Table 8), high intensity pleasure (β= -.220, p= .036) significantly negatively predicted child CU traits. As noted, all analyses were conducted controlling for total child behavior problems (minus CU items), to establish CU trait specific predictors, accounting for overall child behavioral/emotional dysregulation.

Table 6. Hierarchical regression of infant temperament and CU traits.

Step 1		Model Statistics		
	R^2	F	p	
	.438	55.439	<.001**	
Predictors		Predictor Statistics		
	β/b	SE	t	p
CBCL	.662/.071	.010	7.446	<.001**
Step 2		Model Statistics		
	$R^2\Delta$	$F\Delta$	p	
	.063	4.363	.016*	
Predictors		Predictor Statistics		
	β/b	SE	t	p
CBCL	.657/.070	.009	7.708	<.001**
IBQ-R Fear	-.182/-.397	.187	-2.122	.037*
IBQ-Cuddliness	.152/.326	.184	1.774	.080

Notes: $^{**}= p < .01$, $^{*}= p < .05$.

Table 7. Hierarchical regression of toddler temperament and CU traits.

Step 1		Model Statistics		
	R^2	F	p	
	.438	55.439	<.001**	
Predictors		Predictor Statistics		
	β/b	SE	t	p
CBCL	.662/.071	.010	7.446	<.001**
Step 2		Model Statistics		
	$R^2\Delta$	$F\Delta$	p	
	.106	3.919	.006*	
Predictors		Predictor Statistics		
	β/b	SE	t	p
CBCL	.673/.072	.010	7.316	<.001**
ECBQ Fear	-.172/-.352	.201	-1.755	.084
ECBQ Shyness	-.117/-.158	.141	-1.122	.266
ECBQ High Intensity Pleasure	.124/.200	.159	1.260	.212
ECBQ Activity Level/Energy	.049/.102	.210	0.485	.629

Notes: $^{**}= p < .01$, $^{*}= p < .05$.

Table 8. Hierarchical regression of maternal temperament and CU traits.

Step 1		Model Statistics		
	R^2	F	p	
	.451	57.489	<.001**	
Predictors		Predictor Statistics		
	β/b	SE	t	p
CBCL	.662/.072	.010	7.582	<.001**
Step 2		Model Statistics		
	$R^2\Delta$	$F\Delta$	p	
	.102	5.072	.003*	
Predictors		Predictor Statistics		
	β/b	SE	t	p
CBCL	.668/.072	.009	7.801	<.001**
ATQ Discomfort	-.097/-.129	.151	-0.858	.394
ATQ Frustration	-.063/-.099	.150	-.659	.512
ATQ High Intensity Pleasure	.220/.322	.150	2.142	.036*

Notes: $^{**}= p < .01$, $^{*}= p < .05$.

DISCUSSION

Callous and unemotional traits are relatively stable and heritable, and associated with patterns of limited emotional expression, guilt, and empathy. In childhood, CU traits are associated with increased risk of maladaptive behavior and conduct problems.

Research has indicated that children with conduct problems and high levels of CU traits showed the most adverse outcomes in later years, such as hyperactivity, peer problems, emotional difficulties, and negative maternal attitudes (Fontaine, McCrory, Boivin, Moffitt, & Viding, 2011). Improved understanding of CU traits in early development can be transformative to early intervention and prevention efforts.

The present study focused on early childhood etiology, specifically infant and toddler temperament, along with maternal attributes and their contributions to CU. Based on the existing literature, a child temperament profile consisting of fearlessness, extraversion, and poor effortful control was expected to confer risk for CU traits. A similar pattern of effects was anticipated for maternal temperament, which, to our knowledge, has not been previously empirically examined as a predictor in this context.

Hypotheses were partially supported, as CU traits were negatively correlated with infant fear and cuddliness and toddler negative affect, fear, and shyness. In addition, CU traits were negatively correlated with maternal negative affect as well as discomfort and frustration. These findings are consistent with the literature as parents have described ODD-CU youth as less fearful and exhibiting less negative reactivity (i.e., smaller changes in negative affect when exposed to a distressing task) than ODD-only youth (Willoughby *et alia*, 2011). Rothbart and others have proposed that fear serves to arrest approach-oriented action, and this inhibition, albeit less advanced than the executive function-based effortful control (Gartstein, Putnam, Aron, & Rothbart, 2016), facilitates socioemotional development (Rothbart *et alia*, 2000). CU traits have also been associated with deficits in the processing of emotional stimuli (Blair & Coles, 2000), decreased sensitivity to punishment cues, and more positive outcome expectancies in aggressive situations (Pardini, Lochman, & Frick, 2003). Our findings are, in part, consistent with this pattern of results as temperament is conceptualized as embodying all aspects of emotion-outward behavioral expression and internal processing (Gartstein *et alia*, 2016). A tendency to exhibit lower levels of fear would entail a different emotional processing style, potentially less sensitive to emotion-eliciting stimuli, cues of punishment, and non-reward in particular.

CU traits were positively correlated with infant cuddliness/affiliation, toddler surgency, high-intensity pleasure, and activity level, as well as parent temperament factors of extraversion, effortful control, and high-intensity pleasure. Our findings are consistent with the literature associating CU traits and thrill-seeking behavior (Essau et alia, 2006), along with studies linking high levels of extraversion (e.g., high intensity pleasure, impulsivity) and disruptive behavior disorders more broadly (Huey & Weisz, 1997; Oldehinkel, Hartman, De Winter, Veenstra, & Ormel, 2004). Furthermore, lower scores on extraversion, combined with lesser neuroticism, were related to lower levels of antisocial behavior in early adolescence, suggesting that higher levels of extraversion can be related to deficits in behavioral inhibition (Jackson & Center, 2002). Links between extraversion and CU traits have differed with respect to the direction of effects (Decuyper, De Bolle, De Fruyt, & De Clercq, 2011), insofar as detachment (conceptualized as the opposite of extraversion) was reported as positively associated with CU traits (Latzman, Lilienfeld, Latzman, & Clark, 2013). Positive associations of infant cuddliness and maternal effortful control with early CU traits in this study were not anticipated, thus require replication for a comprehensive interpretation. However, somewhat similar relations were found in adolescence. Specifically, adolescents with moderate psychopathic traits, and at risk of engaging in unprovoked, violent behavior, also exhibited moderate to high levels of positive characteristics, specifically, agreeableness and conscientiousness (Lee,

Salekin, & Iselin, 2010). Overall, inconsistencies in the literature suggest that there are varying facets to CU, which may be expressed differently among subgroups of children, and CU traits are likely subject to developmental effects.

Perhaps most importantly, results of the multiple regression analyses indicated that infant fearlessness (fearfulness reversed) and maternal high intensity pleasure were uniquely associated with child CU traits, after accounting for concurrent behavior problems. The pattern of results observed for infant fearfulness and CU traits are consistent with findings of CU traits being associated with deficits in processing fear exhibited by others (Kimonis *et alia*, 2006), lower fearfulness (Willoughby et alia, 2011), differences in fear reactivity among those with and without CU traits (Mills-Koonce *et alia*, 2015), and fear being associated with adult callousness and psychopathic personality traits (Patrick, Fowles, & Krueger, 2009). Importantly, our findings indicate that indicators of low fearfulness in infancy confer risk of CU traits above and beyond overall concurrent behavior problems, and are more consequential than concurrent fear reactivity.

Maternal high intensity pleasure was also significantly associated with child CU traits after controlling for concurrent preschool behavior problems. Child high intensity pleasure represents an aspect of Extraversion that is related to disruptive behavior disorders, and in combination with high levels of CU, presents with risk for both rule-breaking and aggression (Daoud, 2013). Thus, maternal high intensity pleasure conferring risk supports our hypothesis that mothers' temperament would contribute to the etiology of child CU traits, in a similar pattern anticipated for childhood temperament. Nonetheless, this association requires further investigation and replication for conclusive interpretation.

In addition, hierarchical multiple regression results suggest that emerging CU traits may be more strongly associated with infant rather than toddler temperament attributes. It should further be noted that the covariate included in this study -overall concurrent behavior problems, was consistently and significantly related to CU traits in each of the regression models considering infant, toddler, and maternal temperament, respectively (β= .657, p <.001; β= .673, p <.001; β= .668, p <.001). The latter is not surprising given the existing literature (Frick et alia, 2005), and the fact that CU traits and Total Behavior Problem scores were both derived from the CBCL, albeit CU items were excluded from this composite index (Trentacosta et alia, 2016). This pattern of results speaks to the importance of considering overall behavior problems when examining predictors of CU traits in childhood.

Behavioral profiles of children with CU traits are likely partially genetically driven, though more complex pathways involving maternal temperament may also influence the development of such traits. Our results indicate that maternal temperament, self-reported when children were 4 months of age, predicted toddler CU scores, and this effect could be viewed as consistent with prior evidence of heritability for CU traits (Emde et alia, 1992; Viding *et alia*, 2005). In addition, research has shown maternal temperament influences parent/child interactions, which can mediate genetic effects and result in variability of CU trait expression (Pasalich *et alia*, 2016; Waller *et alia*, 2012; Waller & Hyde, 2018).

This study has several limitations, perhaps most notably is its sole reliance on mothers' report. It has been shown that maternal report of temperament may be influenced by the caregiver's current affective state, recent experiences or interactions with the child, and a potential response bias (Brody & Carter, 1982; Rothbart, 1981), thus additional sources of temperament information (e.g., observations, physiological markers) should be considered in the future. Furthermore, future studies should include

larger and more representative samples. In addition, three CBCL items considered in this study may not reflect the most optimal measure of CU traits. The low internal consistency of the three CU items should also be considered a limitation. Therefore, a more comprehensive assessment of CU traits in early childhood and distal evaluations of these traits should be conducted. The low internal consistency (i.e., Cronabach's below .60; DeVellis, 1991) of several ATQ scales (Sadness, Inhibitory Control, Neutral Perceptual Sensitivity, Affective Perceptual Sensitivity, Associative Sensitivity) represents another limitation of this study, and may have hindered finding additional significant associations with CU traits.

The present findings have implications for our understanding of the intergenerational transmission of risk for conduct-related disturbances. In terms of clinical implications, this work contributes to the development of interventions for children with CU traits and disruptive disorders. The results of this study and subsequent research addressing the etiology of CU traits can improve the identification of markers of risk and allow for more targeted interventions to facilitate early prosocial skills, perspective-taking, and empathy building.

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