COGNITIVE AND AFFECTIVE THEORY OF MIND IN CHILDREN WITH CALLOUS-UNEMOTIONAL TRAITS

by

Emma Satlof-Bedrick

B.A. in Psychology, Emory University, 2011

M.S. in Psychology, University of Pittsburgh, 2012

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This dissertation was presented

by

Emma Satlof-Bedrick

It was defended on

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and approved by

Stephanie Stepp, PhD, Associate Professor, Department of Psychiatry

Aidan Wright, PhD, Assistant Professor, Department of Psychology

Jennifer Silk, PhD, Associate Professor, Department of Psychology

Heather Bachman, PhD, Associate Professor, Department of Psychology in Education

Dissertation Advisor: Celia Brownell, PhD, Professor, Department of Psychology

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Emma Satlof-Bedrick, PhD

University of Pittsburgh, 2017

Children with callous-unemotional (CU) traits, the childhood analogue of psychopathy, represent a subset of children with conduct disorder who demonstrate the most severe and persistent antisocial behavior (Frick & Ellis, 1999). Attention is being increasingly turned towards the etiology and identification of early warning signs of these traits, but little is known about their developmental antecedents and correlates. The current study aims to examine a unique social cognitive pattern observed in children with CU traits such that compared to their typically developing peers, they have intact cognitive Theory of Mind (ToM) skills in combination with pervasively deficient affective ToM skills (Jones et al., 2010; Schwenck et al., 2012). That is, they are able to understand what others think, know, and believe, but struggle to understand how other people feel and why.

The current study examines the relationship between CU traits and cognitive and affective ToM in girls from ages 6—17 years. The aims were to 1) identify and distinguish applied affective ToM and applied cognitive ToM; 2) examine predictive associations between CU traits, conduct disorder, and both ToM factors; and 3) examine the stability in CU traits in girls from age 6 to age 17, the stability of applied ToM in early adolescence, and the bidirectional relationship between CU traits and applied ToM over time.

The two-factor ToM model demonstrated excellent model fit, suggesting that looking at cognitive and affective ToM skills separately yields meaningful information about developing

social cognitive skills. As hypothesized, CU traits in girls demonstrated relatively high stability across all ages. CU traits at ages 6 and 11significantly positively predicted applied cognitive ToM and negatively predicted applied affective ToM at the following ages. Contrary to our hypotheses, CU traits at ages 14 and 17 were not significantly predicted by applied ToM skills at the previous age, suggesting limited bidirectionality.

Taken together, these findings support the idea that children with CU traits exhibit a unique ToM profile. By continuing to examine this profile, we will better understand developmental precursors of CU traits, the implications CU traits have for peer relationships, and the best targets for CU-specific interventions.

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1.0 INTRODUCTION

Examinations of antisocial and aggressive behavior have, until recently, primarily focused on conduct disorder (Frick et al., 2003). Children with conduct disorder can cause a host of issues for those around them ranging from personal slights to bullying peers to acts of extreme vandalism, theft, and violence (Frick & Ellis, 1999). These children are a heterogeneous group among whom those who also have callous-unemotional (CU) traits, the childhood analogue of psychopathy, present particular problems. Children with conduct disorder who also have CU traits demonstrate the earliest, most severe, and most persistent antisocial behavior (Frick & Ellis, 1999; Frick, Cornell, Barry, Bodin, & Dane, 2002; Frick, 2009; Frick, Ray, Thornton, & Kahn, 2014). These children are at heightened risk compared to their conduct disordered peers, and yet they also exhibit resistance to standard treatment protocols (Kimonis & Armstrong, 2012; Hawes & Dadds, 2005; Waschbusch, Carrey, Willoughby, King, &Andrade, 2007; Dadds, Cauchi, Wimalaweera, Hawes, Brennan; 2012). More research is therefore needed to identify early markers of CU traits, which are increasingly viewed as a developmental disorder (Blair, 2017), in order to understand the etiology and developmental trajectories of these traits and to develop more effective treatments.

Callous-unemotional (CU) traits are defined by a lack of empathy or guilt even after hurting others, failure or refusal to show emotion, and the manipulation of others for personal gain (Frick, Bodin, & Barry, 2000; Frick, 2009). Currently, CU traits are classified as a specifier to conduct disorder (Frick & Moffit, 2010). The prevalence rates of conduct disorder and CU traits vary between samples, but current estimates suggest that between 3-5% of boys and girls under the age of 18 meet criteria for conduct disorder (Canino et al., 2010; Kahn et al., 2012),

and 10-32% of children under the age of 18 with conduct disorder also meet criteria for the CU specifier (Kahn et al., 2012). Interestingly, several studies have found that between 2-7% of girls in high-risk community samples between ages 6 and 14 (Pardini, Stepp, Hipwell, Stouthamer-Loeber, & Loeber, 2012) and girls and boys ages 5 to 18 (Kahn et al., 2012) meet criteria for CU traits but not conduct disorder. These traits have been reliably measured in children as young as 4 (Kimonis et al., 2015), but it may be possible to identify predictors or warning signs even earlier. Because of their uniqueness and severity, relative to both typically developing children and children with conduct disorder, the search for underlying mechanisms of CU traits is both important and challenging.

Research on CU traits is a relatively young field and it began, in part, as an attempt to explain the heterogeneity in conduct disorder. This focus on distinguishing CU traits and conduct disorder means that much of the work to date has focused on defining CU features (e.g. lack of guilt after misbehaving, lack of empathy) and validating measures rather than identifying the underlying etiology. As a result, we know very little about the developmental timing, correlates, or precursors of CU traits, information that is integral to the broader understanding of how and why such traits develop. This search for antecedents also points towards a need for a more developmental, as opposed to strictly clinical, perspective in research on CU traits.

The current study will examine a unique developmental pattern observed in children with CU traits such that, compared to their typically developing peers, they have intact or heightened cognitive Theory of Mind (ToM) skills in combination with pervasively deficient affective ToM skills (Jones, Happe, Gilbert, Burnett, & Viding, 2010; Schwenck et al., 2012; Centifanti, Meins, Fernyhough, 2015; Anastassiou-Hadjicharalambous & Warden, 2008; Woodworth & Waschbusch, 2008; Blair & Coles, 2000; Loney et al., 2003; Wolf & Centifanti, 2013). That is,

they are able to understand what others think, know, and believe, but struggle to understand how other people feel and why. The aim is to better understand this unique pattern of cognitive and affective ToM and to examine the bidirectional relationship between CU traits and ToM from early childhood to late adolescence. In so doing, the broader goal is to integrate theory and research from developmental psychology, particularly the ToM and bullying literature, with perspectives on CU traits, providing a fuller understanding of the development of this important but puzzling disorder.

Not only do children with CU traits differ from typically developing children, they are also markedly different from children with conduct disorder in several key cognitive and affective domains. When compared to children with conduct disorder, children with CU traits exhibit temperamental differences such that they have significantly lower inhibition and heightened thrill-seeking (Frick & Morris, 2004), heightened sensitivity to reward and reduced sensitivity to punishment (O'Brien & Frick, 1996), and lack of guilt or anxiety after transgressing or behaving antisocially (Frick & Ellis, 1999). These differences have been observed both by researchers in structured laboratory tasks and by clinicians (Dadds et al., 2012; Kimonis & Armstrong, 2012). Further, there is clear evidence that interventions for children with antisocial behavior problems and conduct disorder do not work for children with CU traits because they focus so heavily on strategies that require emotion understanding (Kimonis & Armstrong, 2012; Haas et al., 2011), a skill that children with CU traits consistently struggle with.

However, deficits in emotion understanding, pervasive though they may be, do not mean that children with CU traits have no understanding of those around them. In fact, these children are especially skilled at and prone to lying, manipulation, and proactive or instrumental

aggression (Frick, 2009; Fanti, Frick, & Georgiou, 2009), all of which require the ability to take the perspective of another to understand and reason about their intentions, thoughts, and beliefs, though not their emotions. Indeed, children with CU traits do not differ from typically developing children in terms of their cognitive perspective taking or belief understanding as measured by traditional or applied tasks (Jones, Happe, Gilbert, Burnett, & Viding, 2010; Schwenck et al., 2012). However, there are still very few studies that have directly compared cognitive and affective perspective-taking in children with CU traits (Schwenck et al., 2012; Sebastian et al., 2012). The current study seeks to contribute to this small literature and, importantly, will be the first to directly examine applied cognitive and affective ToM skills as opposed to standard laboratory tasks.

As more recent work on the etiology of CU traits has turned its focus towards cognitive and developmental differences (see Jones & Viding, 2007), this pattern of affective deficits combined with intact or heightened metacognitive skills has become increasingly relevant. Given that this pattern seems to be unique to children with CU traits (Jones et al., 2010; Schwenck et al., 2012) it may prove to be a key developmental marker that researchers can use as efforts turn towards early identification and targeted intervention. Because affective and cognitive ToM can be reliably measured in the first few years of life, and the trajectories of typical development of these skills are well known, they are ideal targets for study. There has been some work focusing on the cognitive v. affective profile of children with CU traits, positing that it is the direct opposite of the pattern observed in Autism Spectrum Disorder, another case of developmental psychopathology whose causal factors and contributors are still unknown (Jones et al., 2010). There has been little work, however, examining this profile of intact cognitive ToM combined with deficient affective ToM as a mechanism or predictor of developing CU traits. Moreover,

because most of the previous research is correlational, the direction of the relationship between CU traits and ToM remains unclear. In other words, we don't know if children with CU traits end up with poor affective ToM as a result of their behavioral characteristics and associated social and emotional experiences, or whether children who start out with poor emotion processing and understanding are at risk for developing CU traits.

The current study will examine the unique pattern of metacognitive and affective skills and their bidirectional relationship with CU traits from early childhood to late adolescence in a large community sample. Importantly, this study utilizes an all female sample. The CU trait literature is heavily skewed towards boys, and we consequently know much less about the stability or correlates of CU traits in girls. The current study has three primary aims. The first aim is to identify and distinguish cognitive and affective ToM in a low-income, female sample at risk for conduct disorder. In the current study, ToM will be operationalized as a set of applied skills that both require the ability to understand others as well as the ability to utilize this understanding in the context of peer relations. The second aim of the current project is to examine the predictive relationship between CU traits and each of the two components of ToM, with cognitive ToM in adolescence hypothesized to be positively predicted by CU traits in early childhood and affective ToM in adolescence hypothesized to be negatively predicted by early CU traits. It is further hypothesized that both aspects of ToM will differentiate CU traits from conduct disorder such that both sets of applied ToM skills will be unrelated to conduct disorder. Lastly, the stability of CU traits in girls and the bidirectional relationships between cognitive and affective ToM and CU traits will be examined over time from early childhood to late adolescence.

Notably, the sample used in this study is all girls, a population vastly understudied in the CU trait literature. Because boys are believed to have a higher incidence of CU traits, they are often targeted for both theoretical and practical (recruitment, juvenile justice system) reasons. The reliance on boys is a constant criticism of the CU trait literature, and while studies are increasingly including mixed-gender samples or even all female samples (e.g. Pardini, Stepp, Hipwell, Stouthamer-Loeber, & Loeber, 2012), there is still a dearth of understanding of CU traits and their correlates in girls.

Below, background information on ToM will be provided, focusing on both theoretical conceptions and operational definitions of ToM as well as the typical developmental trajectory of ToM. The difference between affective and cognitive ToM will be explained, and the literature on how these factors relate to CU traits will be reviewed. Attention will specifically be paid to the bullying literature, and the contributions of this body of work to the understanding of CU traits and applied ToM will be discussed. The review will focus on the unique pattern of intact cognitive and deficient affective ToM in children with CU traits, with particular attention paid to how applied ToM skills, such as lying or poor peer relationships, are associated with CU traits.

1.1 THEORY OF MIND: DEFINITIONS AND OPERATIONALIZATIONS

Theory of Mind (ToM) encompasses the understanding of and reasoning about all types of mental entities (Wellman, 1990), including knowledge of intentions, perceptions, desires, thoughts, beliefs, emotions, and attitudes, as well as understanding their causes and their

relations to behavior (Flavell, 2000). ToM may be broken down into two fundamental domains, cognitive and affective. These will be reviewed separately.

1.1.1 Cognitive Theory of Mind

Cognitive ToM, often simply termed Theory of Mind in the literature, is defined by the understanding of cognitive entities such as thoughts, beliefs, and false beliefs (Bartsch & Wellman, 1989). Importantly, this understanding is representational in nature, meaning that it requires the child to understand that people act based on their own personal representations of the world (e.g. their own beliefs), whether or not those representations match reality (Perner, 1991; Flavell, 2000). Cognitive ToM is typically measured using false belief tasks (e.g. Wimmer & Perner, 1983) and cognitive perspective-taking tasks (e.g. Baron-Cohen Leslie, & Frith 1985) in which children are asked to reason about a character's belief given that character's—as opposed to the child's own—knowledge about the given situation.

One specific offshoot of mental state reasoning that has come to define cognitive ToM in the literature is belief understanding, especially false-belief. The classic false belief task was developed by Wimmer and Perner (1983). The task involves the experimenter presenting the child with the character Maxi, his mother, and a piece of chocolate. Maxi places the chocolate in the cabinet and then leaves the scene. While Maxi is gone, his mother moves the chocolate to the drawer. Maxi then returns and the child is asked where Maxi will look for his chocolate. If the child can represent Maxi's false belief, the child will know that Maxi will look in the cabinet. Importantly, 3-year-olds do not score at chance on this task; rather they consistently state that Maxi will look in the drawer for the chocolate. False belief reasoning has been found to emerge

at around 4 years of age for typically developing children in most cultures tested (Wimmer & Perner, 1983; Wellman, Cross, Watson, 2001).

Because false belief is easy to operationalize and measure while still capturing the most basic and essential skill of cognitive ToM, it has come to define and dominate the field. In fact, when researchers refer to "Theory of Mind" they are usually referring only to the false belief task (Wellman, Cross, & Watson, 2001; Ruffman, 2014). In their extensive review and meta-analysis of cognitive ToM and specifically false belief tasks, Wellman, Cross, and Watson (2001) argue that because a false belief contradicts reality, children's ability to reason about false beliefs necessarily requires the ability to differentiate between real-world external events and individual mental states and representations of them (p. 655; Dennett, 1979). Therefore, if a child can pass a false belief task, that child can be assumed to have a concept of mental representations that includes the knowledge that these representations are individual, can be manipulated, and can contain information incongruent with the object of the belief.

This narrower operationalization of ToM has been criticized, however, for potentially limiting studies of the broader theoretical construct of Theory of Mind. While false belief understanding is one ToM skill, it is not the *only* ToM skill; a Theory of Mind encompasses more than a single hurdle or task that children fail at ages two and three but pass at ages four, five, and beyond. There is variability within the belief paradigm itself, such that children understand multiple, varied true beliefs before single false beliefs (Wellman & Liu, 2004), but also evidence that children first understand less complex mental states (e.g. desires, preferences) around age 2 and progress towards more complex understanding as they age (Wellman & Woolley, 1990). Wellman and Liu (2004) proposed a 5-step, developmental scale (further validated in Wellman, Fuxi, & Peterson, 2011) from roughly ages 2-6 to formalize the idea that

the larger construct of Theory of Mind is made up of many theories of mind that develop early and advance over time. They include, in this developmental time period, understanding desires, differing true beliefs, beliefs based on incomplete information, false belief, and the fact that people may display emotions incongruent with their true, internal feelings. These findings have been extended to theories of mind in older children involving sarcasm (Peterson, Wellman, & Slaughter, 2012), and to include advanced interpersonal applications of ToM including relational aggression (e.g. Ronald, Happe, Hughes, Plomin, 2005), discussed in detail below.

1.1.2 Affective Theory of Mind

Affective ToM, often termed emotion understanding, is defined by understanding and reasoning about affective mental entities such as emotions. This ability is more difficult to operationalize than cognitive ToM because the tasks used to measure it vary so widely. Three key skills will be focused on here: basic emotion understanding and labeling, empathy, and affective perspective-taking or reasoning.

Basic emotion understanding is often measured by tasks requiring the child to label or name different emotion facial expressions. There is a rich body of literature suggesting that differentiating and labeling emotional facial expressions are among the first emotion understanding skills that typically developing children acquire (Walker-Andrews & Dickson, 1997). The ability to differentiate among emotion faces emerges in the first year of life and the ability to actively label these faces develops throughout childhood, with the ability to label positive emotions developing before the ability to label negative emotions (Young-Browne,

Rosenfeld, & Horowitz, 1977; Walker-Andrews, 1997; Denham, 1986; Ensor & Hughes, 2005; Widen, 2013).

Empathy is an emotional response to others' affect and is typically measured facially or physiologically as heart rate or skin conductance responses to vignettes of others who are hurt/scared/in distress, or via self-report (e.g. children rating how emotionally affected they felt after seeing videos of others in distress; Schwenck et al., 2012). The literature on CU traits distinguishes between "cognitive empathy" and "affective empathy," but these terms are used differently by other parts of the field (Jones et al., 2015; Lui, 2014). Affective empathy in the CU trait literature has become defined by physiological arousal or self-report of emotional reactivity to others' distress, with cognitive empathy defined as self-reported understanding when children are asked about how they would reason about or react to another's distress. While the term cognitive empathy was originally intended, and is still used by some, to refer to affective perspective-taking or reasoning about the emotions of others, its meaning has become ambiguous in the CU literature. For this reason, the term cognitive empathy will not be used here and will be replaced by "affective perspective taking" when understanding of or reasoning about emotions is being measured. The term "empathy" will be reserved for instances when emotional responses or arousal to others' affect are being measured (by any means).

Affective perspective-taking is commonly measured by giving children vignettes and asking them to predict and/or explain what the characters might be feeling, or by asking children about their skills in understanding feelings (e.g. "I can't understand why other people get upset," Griffith Empathy Measure, Dadds et al., 2008). Basic affective perspective-taking skills typically develop between the ages of 4 and 7 (Pons, Harris, DeRosnay, 2004), becoming more complex over the course of childhood (e.g., understanding mixed emotions). This timeline makes sense

given that the development of belief understanding influences the ability to reason about others' emotion states. Belief understanding is necessary, for example, for a child to know that someone's (mistaken) belief that a monster is inside a wrapped gift box would make that person scared of the box as opposed to happy and excited to open it (Harris et al., 1989; Pons, Harris, & de Rosnay, 2004).

1.1.3 Typical Development

For typically developing children, affective ToM both developmentally precedes and serves as a mechanism for the development of basic cognitive ToM (see Satlof-Bedrick, *in prep*, for review), and the two sets of skills continue to interact and influence each other as children age (see above). The predominant theory of how ToM develops (Gopnik & Wellman, 1994), posits that children first understand non-representational mental states such as basic emotions and desires, then non-representational beliefs or true beliefs that do not contradict reality (i.e. no false belief understanding), to eventual understanding of representational beliefs and perceptions (Gopnik & Wellman, 1994, p. 264). Children develop theories about basic emotions such as happiness, sadness, or fear first and as they age their understanding progresses towards increasingly more mental and representational states, including emotions that follow from false beliefs.

The empirical literature has borne this developmental progression out. In a study with children ages 3, 4, and 5, Hughes and Dunn (1998) found that belief understanding was correlated with concurrent emotion understanding at all three time points with age and language controlled. In addition to the correlations found at each age, emotion understanding at age 3

significantly predicted later belief understanding even with early belief understanding controlled (Hughes & Dunn, 1998). This suggests that early affective ToM is not only correlated with but significantly predicts and contributes to children's developing cognitive ToM. A more recent longitudinal study similarly found that emotion understanding at age 3 significantly predicted cognitive ToM at age 4 with language controlled, but the reverse was not true (O'Brien et al., 2011), further reinforcing this conclusion. For typically developing children, affective ToM not only developmentally precedes cognitive ToM but also serves as a key mechanism in its development.

1.2 AFFECTIVE VS. COGNITIVE THEORY OF MIND AND CALLOUS-UNEMOTIONAL TRAITS

Children with callous-unemotional (CU) traits present a unique problem to typical models of ToM development insofar as they demonstrate intact cognitive ToM despite marked deficits in emotion understanding whereas in typical development these skills go hand-in-hand. Children with CU traits are especially skilled at and prone to lying, manipulation, and proactive or instrumental aggression (Frick, 2009; Fanti, Frick, & Georgiou, 2009), all of which require the ability to take the perspective of another and are thus ToM-relevant skills. Indeed, children with CU traits do not differ from typically developing children in terms of their cognitive perspective taking or false belief understanding (Jones, Happe, Gilbert, Burnett, & Viding, 2010). Emotion understanding and affective perspective taking in children with CU traits, on the other hand, has been found time and again to be deficient compared to that of typically developing children

(Anastassiou-Hadjicharalambous & Warden, 2008; Woodworth & Waschbusch, 2008; Blair & Coles, 2000; Loney et al., 2003; Wolf & Centifanti, 2013).

Given this marked difference from the typical developmental picture, it is worth noting that even children with Autism Spectrum Disorder, often the subjects of ToM comparisons, follow the typical model. Because they demonstrate affective deficits early in childhood, we would predict that they would have later deficits in cognitive ToM, a prediction supported by empirical research (Baron-Cohen, Leslie, Frith, 1989). In this way, children with Autism Spectrum Disorder further support typical models of developing ToM. In contrast, children with CU traits directly challenge such models by successfully developing cognitive ToM despite pervasive affective deficits. It is precisely because this pattern is uniquely associated with CU traits that we hypothesize its specific importance to understanding their development.

1.2.1 Cognitive Theory of Mind

The small literature in this area clearly and consistently shows that children with CU traits do not differ from typically developing children in terms of cognitive ToM whether measured using standard false belief tasks, other cognitive perspective-taking tasks, or applied ToM skills such as lying. An illustrative study of 9-16 year old boys collected three different measures of ToM including first-order reasoning about false beliefs, a second-order ToM task requiring more advanced reasoning about false beliefs (detailed below), and an animated ToM task (Jones, Happe, Gilbert, Burnett, & Viding, 2010). The animated ToM task, while sometimes criticized for being too different from traditional tasks, had previously been used successfully to

show deficient ToM skills in children with Autism Spectrum Disorder. In this study, boys with CU traits performed no differently on any of the three measures from typically developing boys. This finding is especially important given its inclusion of a more difficult second-order ToM task which requires children to reason out what character A incorrectly believes about character B's beliefs. Another study done with boys ages 6-17 replicated these results using the same animated ToM task and found again that boys with CU traits were no different from typically developing boys in terms of their ToM understanding, which demonstrates that the older age of the previous participants was not driving the effects (Schwenck et al., 2012). Moreover, these studies both included age- and language-matched samples of boys with ASD and in both cases the ASD group showed marked deficits in ToM performance compared to the typically developing and CU samples. The boys with ASD serve as an atypical control and provide evidence that the selected tasks and age groups are appropriately sensitive to pick up on performance differences uniquely driven by psychopathology.

The lack of difference in cognitive ToM skills between typically developing children and children with CU traits has been reported in neuroimaging studies as well. When boys ages 10-16 completed a false belief task in an fMRI scanner, children with CU traits did not differ from typically developing children in any of the examined brain areas (Sebastian et al., 2012) and these results were replicated in another study of boys in the same age group (O'Nions et al., 2014). These two studies used identical tasks although they were necessarily somewhat different than previously discussed ToM tasks due to the constraints of the fMRI procedure. It is therefore important to note that the basic structure of these tasks was the same, requiring boys in the scanner to predict characters' actions given their beliefs, and had been previously validated in a study of typically developing adolescent and adult males (Sebastian et al., 2012) These imaging

studies provide support for the consistent behavioral data and, taken together, the literature seems clear in showing no demonstrable behavioral or neurological differences in cognitive ToM between typically developing children and children with CU traits. Thus, not only is performance on cognitive ToM tasks of children with CU traits the same as typically developing children, but they also represent protagonists' thoughts and beliefs in the same way.

Applied Cognitive Theory of Mind: In addition to these classic cognitive ToM skills, children with CU traits also demonstrate heightened proactive or instrumental physical and relational aggression (Pardini & Byrd, 2012; Centifanti et al., 2015; Marsee, Silverthorn, & Frick, 2005; Marsee & Frick, 2007). Proactive relational aggression, or aggression initiated in order to gain social status or dominance, has been studied extensively in the bullying literature as a type of aggression requiring advanced cognitive ToM skills. It has traditionally been discussed in the context of "Machiavellian" or "ringleader" bullies who utilize their ToM to select the ideal victim and setting in order to gain social status without alienating their peers or causing their peers to identify with the victim and not with them (Sutton, Smith, & Swettenham, 1999a; Crick & Grotpeter, 1995; Happe & Frith, 1996). These ringleader bullies stood in stark contrast to the traditional model (Crick and Dodge, 1994) of the *reactive* bully who was physically aggressive as a means of compensating for lack of social skills and understanding. Ringleader bullies engaged in bullying not as a retaliatory measure against some misattributed hostile action (Crick & Dodge, 1994) but proactively for instrumental gains in social dominance. Proactive relational aggression, typically involving making up and spreading lies or rumors about others to increase one's own social standing, requires manipulating the beliefs of others, a clear ToM skill. What is telling a lie if not implanting a false belief in someone else's mind?

In their study of "Nasty and Nice ToM" Ronald, Happe, Hughes and Plomin (2005) created and validated a 4-factor scale of prosocial and antisocial behavior which included Nasty ToM, i.e., antisocial behavior requiring ToM and consisting of items such as "telling lies" and "blames others." ("Nice ToM" is a measure of applied affective ToM and will be discussed below). This Nasty ToM factor, made up of items extremely similar to those on relational aggression scales such as the Children's Peer Relationship Scale (CPR; Crick & Grotpeter, 1995), stands in contrast to their regular "Nasty" factor, antisocial behavior that does not require ToM and which includes items like "gets on well with other children" and "kind to animals" (both reverse-scored). There is a long history in the bullying literature of studying relational aggression as a ToM skill, with studies consistently finding proactive relational aggression to be related to cognitive ToM (Monks, Smith, & Swettenham, 2005; Marsee, Weems, & Taylor, 2008; Malti, Gasser, & Gutzwiller-Helfenfinger, 2010; Hao & Liu, 2016; Gini, 2006; Gasser & Keller, 2009). Other studies, like the one discussed above, have explicitly labeled relational aggression as a ToM skill (Ronald, Happe, & Frith, 2005; Happe & Frith, 1996; Frith, 1994; Sutton, Smith, & Swettenham, 1999a&b).

In other words, in order to successfully perform the kind of relational aggression children with CU traits are so prone to and skilled at, they need to possess finely honed cognitive ToM skills to both select their victims and achieve their goals of social dominance without being too alienating to those they seek to dominate. In sum, it seems clear not only that children with CU traits do not exhibit deficits in traditional cognitive ToM but that when applied ToM skills such as lying or manipulating are considered, children with CU traits may have a strategic metacognitive advantage when it comes to social dominance, admittedly potentially less so for likability.

1.2.2 Affective Theory of Mind

Children with CU traits have been found to be deficient in affective skills ranging from the more basic emotion labeling tasks up through more complex emotion-based reasoning and affective perspective-taking tasks. Deficits in emotion understanding and affective perspective-taking are especially important, as deficient empathy is a defining feature of CU traits and therefore unsurprising. Other kinds of emotion understanding difficulties demonstrate how pervasive the affective deficit is and that the empathy deficit is only one piece of the puzzle.

Emotion Recognition and Labeling. Even at this basic level of emotion understanding, children with CU traits exhibit marked deficits. Specifically, children with CU traits struggle as compared to children with ASD, conduct disorder, or typically developing children with identifying negative emotional expressions including sad and fearful faces and faces demonstrating physical pain (Schwenck et al., 2012; Woodworth & Washbusch, 2008; Stevens, Charman, & Blair, 2001; Wolf & Centifanti, 2013). One study of 11 – 14-year-olds found that scores on the Psychopathy Screening Device were inversely related to overall recognition and identification of emotion faces, and the CU subscale was related specifically to deficits in recognizing sad and fearful faces (Blair & Coles, 2000). Similarly, in an eye-tracking study of 8 – 17-year-olds, children with CU traits were found to have specific deficits in recognizing fearful faces, commonly labeling them neutral or as disgust (Dadds et al., 2006). Based on the evidence available, it therefore seems that something specific to CU traits is associated with deficits in attending to, processing, and recognizing emotion faces, especially when those emotions are negative.

Empathy. Children with CU traits, as expected, demonstrate a consistent lack of empathy whether measured physiologically or via self- or other-report (Jones et al., 2010; Anastassiou-Hadjicharalambous & Warden, 2008; Pasalich, Washbusch, Dadds, & Hawes, 2014; Jones et al., 2010; Pardini & Byrd, 2012; Lui, 2014; Dadds et al., 2009; Kimonis et al., 2015). In one study, 6- to 17-year-old boys with ASD, CD, CD plus CU or who were typically developing watched a series of negative video vignettes and answered questions on how emotionally affected they felt after each clip on a scale of 1-10 (Schwenck et al., 2012). Only the children with CD and CU traits were different from the other groups, reporting significantly lower affective responses.

Interestingly, another study found that while children ages 7.5-11 with CD both with and without CU traits self-reported low empathy and emotional arousal after watching a video of a child in a scary situation, the physiological data told a different story (Anastassiou-Hadjicharalambous & Warden, 2008). Children with CD without CU traits showed high levels of physiological arousal (heart rate) consistent with those of typically developing children while children with CU traits had both lower baseline and lower percent change in heart rate after seeing the video. This suggests that while children with CD may aggressively posture and self-report low levels of empathy, the significantly reduced empathy observed in children with CU traits is backed up by similarly reduced physiological arousal.

This low empathic physiological arousal is supported by studies examining 13-year-olds' skin conductance while they viewed distressing and threatening photos (Blair, 1999) and 10- to 12-year-olds' amygdala reactivity when viewing fearful faces in an fMRI scanner (Jones, Laurens, Herba, Barker, & Viding, 2009). Each study found that, compared to typically developing children or children with CD without CU traits, boys with CU traits were significantly less aroused at baseline (for HR and skin conductance) and after viewing situations

or photos that successfully induced a physiological or neurological (amygdala) empathic response in the other groups. In addition to demonstrating significantly reduced empathy in children with CU traits, these studies also suggest significantly lower baseline levels of arousal thereby supporting theories of CU traits that cast lying, manipulating, and hurting others as a sensation-seeking means of achieving the typical baseline arousal levels found in children without CU traits (Frick & Morris, 2004; Frick & Ellis, 1999). In other words, it is possible that children with CU traits may use their cognitive ToM in order to provoke reactions from others, which then induces their own reactivity, because others' emotional reactions do not have an effect on them.

Affective Perspective-Taking. Given the noted lack of empathic concern for others, it is perhaps unsurprising that children with CU traits also perform poorly on affective perspective-taking tasks. One study of 16 – 18-year-old boys and girls (Lui, 2014) measured affective perspective taking by giving participants 12 emotional vignettes and asking them to identify and to justify the emotional response in each case, as well as using items from the Griffith Empathy Measure (Dadds et al., 2008; e.g. "I can't understand why other people get upset"). CU traits were found to significantly negatively predict affective perspective taking (Lui, 2014). Similarly, a cross-sectional study of boys and girls between the ages of 3 and 13 found significant negative correlations between CU traits and the Griffith Empathy Measure of affective perspective-taking (Dadds et al., 2009). The authors of this study note that these findings are especially important as they demonstrate that even girls with CU traits show marked deficits in emotion understanding and reasoning and, by early adolescence, the deficits are actually stronger in girls than boys. Another study measured both girls and boys at a young age, 3 – 6 years, and found significant

negative correlations between the Griffith Empathy Measure of affective perspective-taking and CU traits controlling for conduct problems (Kimonis et al., 2015).

These affective perspective-taking deficits are supported in the neuroimaging literature. The same study discussed above, the only study to our knowledge that directly compares cognitive and affective perspective-taking in children with CU traits, that found no functional differences between typically developing boys and boys with CU traits on measures of cognitive perspective-taking, did find significant differences in affective perspective taking. Specifically, there was notably decreased amygdala reactivity in the affective task for boys with CU traits (Sebastian et al., 2012). These results consistently suggest that children with CU traits have poorer understanding and reasoning about others' emotions and their causes.

Applied Affective Theory of Mind. As applied cognitive ToM skills such as lying, manipulating, and proactive relational aggression have been considered, so too must applied affective ToM skills. Affective ToM, in its applied form, enables children to positively engage with peers in a way that both creates and sustains relationships. Affective understanding and perspective-taking are keys skills necessary in successful social approach, engagement, and maintenance. "Children who can identify the expression on a peer's face or comprehend the emotions elicited by common social situations are more likely to react prosocially to their peer' displays of emotion…Interactions with such an emotionally knowledgeable age-mate would likely be viewed as satisfying, rendering that playmate more likable" (Denham et al., 2003, p.239).

The well-known Crick and Dodge (1994) social information processing theory of aggression organizes social cognition in relation to peer relationships as stages beginning with the encoding of social cues, the interpretation of these cues in relation to the child's specific

goals, selecting and enacting appropriate behavior, and then the peer evaluation that follows the chosen behavior (p. 76). Each of these stages involves affective ToM, and it should be immediately apparent that children with CU traits would have difficulty here. Given their poor ability to process basic emotion cues like facial expressions, their poor emotion reasoning and understanding, and their low empathy, the first two stages would likely be extremely difficult for children with CU traits in the emotional mix of everyday peer interactions. Further, given their poor ability (or disinterest) in understanding and encoding their peers' emotional cues, children with CU traits are less likely to enact appropriate behavior because they have difficulty interpreting the cues to help them determine what is "appropriate." Moreover, children with CU traits are more interested in social dominance than social harmony (Pardini & Byrd, 2012), therefore their beliefs about "appropriate" behavior will be very different given their different, more antisocial, goals.

In the bullying literature affective ToM has been called "Nice ToM," in contrast with Nasty (cognitive) ToM as discussed above, and includes items like "considerate of other people's feelings" and "comforts a child who is upset" (Ronald, Happe, & Frith, 2005). In the CU trait literature, affective ToM is most often called "cognitive empathy," or reasoning about others' emotions, measured with items such as "can't understand why other people get upset" and "doesn't seem to notice when I get sad" (Griffith Empathy Measure; Dadds et al., 2008). Being deficient in processing and reasoning about emotions would put children with CU traits at a clear disadvantage for "Nice ToM."

Given the importance of affective competence in developing social skills, CU traits may well be a perfect storm for the least successful peer relationships or the most successful antisocial behavior. In fact, many in the bullying literature have suggested that while enhanced

cognitive ToM typically manifests as relational aggression, the factor most likely to prevent or at least moderate this particular ToM application is affective understanding (Centifanti, Qualter, Padgett, 2011; Gasser & Keller, 2009; Gini, 2006; Hao & Liu, 2016; Malti, Gasser, & Gutzwiller-Helfenfinger, 2010). It would therefore seem that children with CU traits possess the heightened cognitive ToM necessary for relational aggression, an increased drive for social dominance making them more likely to be aggressive, and deficient affective understanding that might otherwise modulate their aggression. Children with CU traits are thus the most likely and probably most successful bullies.

While studies have found that children with CU traits perform poorly on questionnaire measures of affective ToM (Dadds et al., 2009; Centifanti, Qualter, Padgett, 2011), very little is known about how CU traits specifically, as opposed to more general antisocial behavior, are related to peer interactions other than bullying and proactive aggression. One study reported that psychopathic traits in 6—12 year-old boys were correlated with peer rejection but not popularity (Piatigorsky & Hinshaw, 2004), but another found that while narcissism and impulse control in 9—12 year-old boys and girls were correlated with social competence and sociometric status, CU traits were not correlated with these social outcomes (Barry, Barry, Deming, & Lochman, 2008). Thus, while there is some psychopathology literature examining CU traits and emotion understanding, and some developmental literature examining emotion understanding and peer and social skills, there is a gap in the literature on how CU traits relate to peer relations and social skills. Moreover, the small body of literature that does exist is inconsistent. The current study seeks to address these issues by specifically examining CU traits in relation to applied affective ToM in children as measured by social skills and affective understanding with peers.

1.2.3 Summary

Evidence suggests a unique social cognitive pattern for children with CU traits such that they are deficient in terms of affective ToM while demonstrating intact cognitive ToM. They have been shown to struggle with many core aspects of affective understanding from basic face expression identification (Woodworth & Washbusch, 2007; Stevens, Charman, & Blair, 2001; Wolf & Centifanti, 2013) to empathic concern for others (Schwenck et al., 2012) to affective perspective-taking (Sebastian et al., 2012; Lui, 2014; Dadds et al., 2009; Kimonis et al., 2015). These self-reported and behavioral emotion processing deficiencies have also been found in studies utilizing eye-tracking technology (Dadds et al., 2006), fMRI measures (Sebastian et al., 2012), and measures of heart rate and skin conductance (Anastassiou-Hadjicharalambous & Warden, 2008) suggesting that there is something fundamentally different about the way children with CU traits experience, understand, and respond to emotion, although this has not been thoroughly examined in young children. By all accounts, children with CU traits do not seem to develop affective comprehension in any way that resembles that of typically developing children or even of children with conduct disorder who don't have these traits.

However, this lack of understanding of others does not extend beyond the affective domain. Children with CU traits pass all types of cognitive ToM tasks including first- and second-order false belief tasks (Jones et al., 2010; Schwenck et al., 2012) as well as cognitive perspective-taking tasks (Sebastian et al., 2012). Moreover, children with CU traits outperform their typically developing peers when it comes to applied ToM skills such as lying to and manipulating others (White, Gordon, & Guerra, 2015; Thornton, Frick, Crapanzano, & Terranova, 2013; Munoz & Frick, 2012; Marsee & Frick, 2007; Centifanti et al., 2015).

This intact or heightened cognitive ToM in the absence of affective ToM challenges typical developmental models of ToM (see Satlof-Bedrick, *in prep*) in a way that other ToM profiles, most notably those associated with Autism Spectrum Disorder, do not. That this pattern is unique to CU traits is what makes it valuable. Because so much of the research on CU traits has focused on defining and validating the construct, relatively little is known about mechanisms of development or further characteristics of these traits outside of lack of guilt or empathy. In this pattern of cognitive and affective ToM there lies the possibility of another profile, like the differentially heightened sensitivity to reward and insensitivity to punishment, that can serve as an early warning sign of a problem, a means of differentiating CU traits from other disorders, and a means of improving and tailoring interventions for these notoriously difficult to treat children. The current study will examine how this specific profile relates to CU traits over time.

1.3 STABILITY OF CALLOUS-UNEMOTIONAL TRAITS

As the "trait" name implies, CU traits are thought to be relatively stable, in terms of rank order, across childhood and adolescence (Munoz & Frick, 2007; Frick et al., 2003; Obradovic, Pardini, Long, & Loeber, 2007), but the existing evidence is not entirely consistent or complete. CU traits have been demonstrated to be stable across middle childhood and into adolescence and early adulthood (McMahon, Witkiewitz, & Kotler, 2010; Lynam, Caspi, Moffitt, Loeber, & Stouthamer-Loeber 2007; Barry et al., 2008), though other studies have found that only children with the most severe cases of CU traits at age 13 went on to meet criteria for psychopathy in adulthood (Loeber, Burke, & Pardini, 2009).

Some have proposed models of individual rather than rank order stability. In other words, there may be trajectory profiles of CU traits similar to those found in general antisocial behavior, such that some children have stable high or stable low CU traits over development, while others increase or decrease between childhood and the onset of adolescence (e.g. Fotaine, McCrory, Boivin, Moffit, & Viding, 2011), but that by the teenage years the traits have crystallized and remain relatively stable through adulthood (Lynam, Caspi, Moffit, Loeber, & Stouthamer-Loeber, 2007). Most studies have focused on rank order stability and have been conducted over relatively narrow (4-5 year) time periods beginning in middle to late childhood. There have been fewer examinations looking at stability of CU beginning in early childhood and continuing through adolescence. There is, furthermore, evidence that despite the relative stability of CU traits some children seem to grow out of them (Frick et al., 2003).

Stability of CU Traits in Girls. While the link between cognitive ToM and relational aggression, especially proactive relational aggression, has been made in the developmental literature, and the link between CU traits and proactive relational aggression has been made in the developmental psychopathology literature, these two lines of work remain largely distinct. The explicit link from cognitive ToM to CU traits to proactive relational aggression has not really permeated the literature. This link may be especially important for girls with CU traits, already an under-studied population, as there is evidence that girls with CU traits are more generally relationally aggressive than boys (Marsee & Frick, 2007; Centifanti et al., 2015). Similarly, while basic affective deficits have been found in children with CU traits, less is known about the implications for these basic deficits in terms of applied emotion understanding and peer relationship skills, which, again, could be especially pronounced for girls. Moreover, while the evidence of heightened relational aggression in children with CU traits can be explained as

applied cognitive ToM, it remains unclear what applied affective ToM would look like, especially in girls with these traits.

The implications of the current study also extend into theories of gender differences both in general and within the CU trait domain. The strength of the studies that use only boys is that they often directly compare children with CU traits to children with conduct disorder or conduct problems, both of which are also more studied in boys, and therefore are able to offer evidence based on the specific cognitive and emotional profile of CU traits as opposed to simply the behavioral symptoms (e.g. lack of inhibition, aggressive or antisocial behavior) noted in these other disorders as well. Moreover, researchers have speculated that the profile of girls with CU traits would differ because girls were thought to have significantly greater affective skills than boys (Centifanti, Qualter, & Padgett, 2011). In other words, the heightened affective skills hypothesized in girls are believed to exist even in the presence of traits defined in part by lack of empathy. The current study utilizes an all female sample. If the pattern of intact or heightened cognitive ToM combined with deficient affective ToM holds, the study will provide direct empirical evidence that girls with CU traits look much like boys with CU traits and will strengthen the CU trait construct by demonstrating that it is not bound by gender.

The literature on the prevalence of conduct disorder and CU traits in girls is relatively scarce and mixed. As Keenan, Loeber, and Green (1999) point out in their review of the literature on conduct disorder in girls, researchers used to believe that conduct disorder primarily affected boys, but current evidence suggests that girls are in fact routinely diagnosed with conduct disorder. More recent studies have backed up this assertion, demonstrating that conduct disorder is present and demonstrates high rank order stability in girls as it does in boys. However, prevalence estimates for conduct disorder in girls have been inconsistent (Keenan et

al., 2010; Fontaine, Carbonneau, Vitaro, Barker, & Tremblay; 2009). Some have argued that these inconsistencies are explained by the age of the participants such that early-onset conduct disorder is much more prevalent in boys, but adolescent-onset conduct disorder is roughly equally prevalent in boys and girls (Moffit & Caspi, 2001; Silverthorn & Frick, 1999). Others, though, have found that adolescent-onset conduct disorder is rare in girls (Keenan, Wroblewski, Hipwell, Loeber, & Stouthamer-Loeber, 2010), citing the most common age of onset as age 7 (Keenan et al., 2010).

We know even less about prevalence or stability of CU traits in girls. One finding that has contributed to the belief that CU traits may be less common in girls is the reasonably consistent finding that girls with conduct disorder are more likely than boys with conduct disorder to suffer from comorbid internalizing problems such as depression and anxiety (Keenan, Loeber, & Green, 1999; Hipwell et al., 2011; Loeber & Keenan, 1994). Because CU traits are inversely associated with internalizing problems (Frick & White, 2008), researchers may have believed that girls with conduct disorder were at lower risk for developing CU traits than boys with conduct disorder. This has not been borne out in the literature, though few studies on CU traits in girls have been published. Interestingly, recent studies have found that girls can exhibit CU traits even in the absence of conduct disorder (Pardini et al., 2012; Kahn et al., 2012). Moreover, studies have found similar prevalence rates of CU traits in girls and boys (Larsson, Andershed, & Lichtenstein, 2006), and that standard measures of CU traits fit boys and girls equally well (Essau, Sasagawa, & Frick, 2006) though some have suggested that these traits may be more heritable for boys than girls (Viding, Frick, & Plomin, 2007).

Prevalence aside, the literature is also mixed in terms of correlates and manifestations of CU traits in girls vs. boys. Some have suggested, for example, that boys with CU traits may be

more prone to physical aggression while girls with CU traits may be more prone to relational aggression (Viding, Simmonds, Petrides, & Frederickson, 2009). Others have found that CU traits strongly predict all types of aggression regardless of gender (Penney & Moretti, 2007). Clearly, more research is needed to understand what CU traits look like in girls both in terms of their prevalence and stability and of their social-cognitive correlates.

1.4 THE CURRENT STUDY

The current study was conducted using data collected as part of the Pittsburgh Girls Study (PGS) to examine the relationship between CU traits and cognitive and affective ToM in a sample of girls from ages 6 to 17 years. These data include measures of CU traits and conduct disorder along with measures of social skills and relational aggression, which were used to create new measures of applied theory of mind that were hypothesized to be associated in unique ways with CU traits. Using these data, the current study 1) identifies and distinguishes applied affective ToM and applied cognitive ToM, which permits testing predicted associations between CU traits and ToM; 2) examines predictive associations between CU traits, conduct disorder, and both ToM factors; and 3) examines the stability in CU traits from age 6 to age 17, the stability of applied ToM in early adolescence, and the bidirectional relationship between CU traits and applied ToM over time.

1.4.1 Aim 1: Applied Theory of Mind

The first step will be to determine whether applied affective ToM and applied cognitive ToM can be identified and distinguished. The applied cognitive ToM measure was created using items from the Children's Peer Relationship Scale (CPR; Crick & Grotpeter, 1995), designed to measure relational aggression. The applied affective ToM measure was created using items from the Social Skills Rating System (SSRS; Gresham & Elliott, 1990), a measure of interpersonal engagement and skill. A confirmatory factor analysis was used to test the hypothesized two-factor structure in these data, namely, that the two constructs will be coherent, distinguishable, and independent.

1.4.2 Aim 2: Distinguishing Conduct Disorder and CU Traits

The second aim focuses on the relationship between early CU traits, in childhood, and later applied cognitive and affective ToM, in pre-adolescence, with a focus on how the two applied ToM factors distinguish CU traits from conduct disorder. It is hypothesized that 1) CU traits at age 6 will significantly negatively predict applied affective ToM at age 11 and significantly positively predict applied cognitive ToM at age 11; and 2) this effect will be specific to CU traits such that conduct disorder at age 6 be unrelated to both ToM factors at age 11. Structural equation modeling was used to examine these distinct predictive relationships.

1.4.3 Aim 3: The Relationship Between CU Traits and Applied Theory of Mind Over Time

The final aim is to explore the relationship between CU traits and applied ToM as children develop over childhood and adolescence. A cross-lagged panel model was utilized to examine the stability of CU traits from early childhood (age 6) through late adolescence (endpoint age 17), stability of applied cognitive and affective ToM in early adolescence (ages 11-14), and how the two applied ToM factors relate to CU traits over time.

As discussed above, most of the available evidence on the relationship between CU traits and cognitive ToM is correlational or focuses on demonstrating a lack of deficit, and includes samples with wide age ranges often spanning multiple developmental periods (e.g. Jones et al., 2010; Dadds et al., 2009; Schwenck et al., 2012). There is thus no strong evidence for the direction of this relationship or its consistency over time. Moreover, there is evidence and theory to suggest that applied affective ToM would be both predictive of and predicted by CU traits (Kimonis et al., 2015; Dadds et al., 2008; Satlof-Bedrick & Brownell, *in prep*). It is therefore hypothesized that: 1) CU traits at ages 6, 11, and 14 will be stable, i.e., will significantly predict CU traits at each successive age; 2) applied cognitive ToM will positively predict CU traits over time while applied affective ToM will negatively predict CU traits over time; and 3) as a reflection of the bidirectional relationship between CU traits and ToM, CU traits will positively predict applied cognitive ToM and negatively predict applied affective ToM over time.

2.0 METHOD

2.1 PARTICIPANTS

The current study utilized data from a subset of the participants in the Pittsburgh Girls Study (PGS). The data are from an urban community sample (N=2,450) of girls and their primary caregivers. Recruitment occurred in 1999-2000 in low-income neighborhoods, in which 25% or more of the families were living at or below the poverty level. These neighborhoods were oversampled and fully enumerated, while a random sample of 50% of households in all other neighborhoods were enumerated (from Stepp et al., 2014; see Hipwell et al., 2002 for further details on study design and recruitment). The PGS utilizes an accelerated longitudinal design of four age-based cohorts followed from early childhood, beginning at age 5 (cohort 5), age 6 (cohort 6), age 7 (cohort 7), or age 8 (cohort 8), through early adulthood at age 23. Data from cohorts 5 and 6 (N=1,218) will be utilized in order to maximize the data at the youngest available ages. Though age 5 is the youngest measured by the PGS, relatively few children were recruited at this age. Moreover, all children recruited at age 5 were measured at age 6. Thus, age 6 (in both cohorts) was used as the first time point in order to maximize data available.

Each cohort was assessed annually through age 23. The current analyses utilized a subset of data from four time points with measures for CU traits, conduct disorder, and applied ToM (see Table 1 for a list of measures available at each age). CU traits and conduct disorder were

measured at ages 6, 11, 14, and 17. Applied cognitive and applied affective ToM were estimated at ages 11 and 14. While it might be more ideal to identify the ToM constructs at age 6 to permit prediction of later CU traits from early childhood ToM, the relevant measures are not available at age 6 in this data set. Instead, applied ToM will be first identified at age 11, a key transition point in development when such skills are especially meaningful and important in children's interpersonal relationships.

2.1.1 Missing Data

The PGS has exceptional response rates. 93 participants in cohorts 5 and 6 (N=1218) were missing data for one or more of the current measures. All 93 of these participants were excluded from analyses, yielding a final sample size of N=1,125, all of whom had data on all measures submitted to analysis. See Table 2 for descriptive statistics.

2.2 MEASURES

In-home interviews were conducted annually for both the girl and her primary caregiver by trained interviewers using laptop computers, and families were compensated for participation. See appendix C for full instruments, Table 1 for which measures were utilized at each age, and Table 4 for intercorrelations among all measures.

2.2.1 Callous-Unemotional Traits

CU traits (termed psychopathic traits at the time the study began) were assessed using primary caregiver reports on the Psychopathy Screening Device (PSD; Frick, Bodin, & Barry, 2000) at ages 6, 11, 14, and 17 (see Appendix C). The PSD was developed as the child version of the adult Psychopathy Checklist Revised (PCL-R; Hare, 1991). It consists of 20 items, analogous to the PCL-R, including items such as "my child is concerned about the feelings of others" (reverse-scored) and "my child does not show feelings or emotions." Items were the same at all ages, and each item was coded on a 3-point scale (0=not at all true, 1=sometimes true, 2=definitely true). There is debate in the literature about the factor structure and validity of the PSD (Vitacco, Rogers, & Neumann, 2003; Hare & Neumann, 2008; Poythress, Dembo, Wareham, & Greenbaum, 2006; Lee, Vincent, Hart, & Corrado, 2003) which has, for these reasons, largely been replaced by the newer Inventory of Callous-Unemotional Traits (ICU; Frick, 2004). Due to this widespread disagreement, and the higher internal consistency and construct validity demonstrated by total scores as opposed to individual factor scores, items were summed in the current analyses to create a total score of psychopathic traits, which could vary from 0 to 40, with higher scores indicating higher levels of CU traits at each age. The internal consistency was adequate to good at ages 6, 11, 14, 17 (Cronbach's α = .77, .86, .86, and .85, respectively).

This measure was designed such that a score of 30 out of a possible 40 would be the cutoff criteria for a "diagnosis" (this measure was designed before CU traits were recognized in the DSM), but is most commonly used dimensionally to examine variability in CU traits as they relate to other factors (Frick, Bodin, & Barry, 2000; Poythress, Dembo, Wareham, &

Greenbaum, 2006). The mean score in the current sample hovered around 10 across ages (see Table 3 for descriptive statistics for all measures; see Figures 1-4 for frequency distributions of PSD scores at each age). This is consistent with previous studies utilizing both community samples and samples of boys and girls who had been clinically referred for conduct problems (Frick, Bodin, & Barry, 2000; Frick, Kimonis, Dandreaux, & Farell, 2003), but lower than those observed in incarcerated boys and girls (Lee, Vincent, Hart, & Corrado, 2003; Vitacco, Rogers, & Neumann, 2003). None of these previous studies found gender differences in scores on the PSD.

2.2.2 Conduct Disorder

Conduct disorder symptom severity was assessed at age 6 via primary caregiver report on the Child Symptom Inventory: Conduct Disorder Subscale (Gadow & Sprafkin, 1994; see Appendix C). In accordance with previous literature, conduct disorder was measured and included in the analyses in order to distinguish antisocial behavior and conduct disorder from CU traits. The Conduct Disorder subscale consists of 15 items, each corresponding with the DSM-IV diagnostic criteria in place when data collection began. Symptom severity was scored on a 4-point scale (0=never, 1=sometimes, 2=often, 3=very often) resulting in one summed total score of severity, with higher scores indicating more severe symptomology. The internal consistency was adequate at age 6 (Cronbach's α = .70). It is worth noting that scores were extremely low at age 6 (M=1.23, sd=1.87; see Table 3 for descriptive statistics). In their review of initial findings of the PGS, Keenan and colleagues (2010) note that of the girls who met criteria for conduct

disorder during the time of the study, 92% had an age of onset between 7-9, and the other 8% had an age of onset between ages 10-14 (p.6).

2.2.3 Applied Cognitive Theory of Mind

Applied cognitive ToM was measured at ages 11 and 14 using three child-reported items on the Children's Peer Relationship Scale (CPR; Crick & Grotpeter, 1995), a five-item scale designed to measure relational aggression (see Appendix C). Three items were rationally chosen on an a priori basis based on how strongly ToM skills were recruited by these acts. This method is consistent with previous literature, which has marked relational aggression as one real-world application of ToM skill as it requires the aggressor to manipulate the beliefs and perceptions of their peers to influence a given peer's status (Sutton, Smith, Swettenham, 1999a&b; Happe & Frith, 1996; Gasser & Keller, 2009; Gini, 2006; Hao & Liu, 2016). The three items were coded on a 3-point scale (1=never, 2=sometimes, 3=a lot) and include: "I tell lies about someone so that the other kids won't like that person anymore," "I try to keep certain people from being in my group when it is time to play or do an activity," and "When I'm mad at someone, I get back at them by not letting the person in my group anymore." Items 4 and 5 were excluded from the current analyses: "I tell my friends I will stop liking them unless they do what I say" and "I try to keep others from liking someone by saying mean things about them." Item 4 was excluded because it was judged not to recruit ToM to the same degree as the other items, and item 5 was excluded so as not to be redundant with item 1 and over-inflate internal consistency. Because this was a confirmatory factor analysis, factor loadings, as opposed to Cronbach's alpha, were used as indicators of internal reliability.

2.2.4 Applied Affective Theory of Mind

Applied affective Theory of Mind was measured at ages 11 and 14 using three child-report items on the 37-item Social Skills Rating Scale: Elementary Version (Gresham & Elliot, 1990; see Appendix C). The items were rationally chosen to reflect applied affective ToM skills, namely the ability and/or propensity to reason about the emotions of others, a skill sometimes referred to as "cognitive empathy" in the CU trait literature (Dadds et al., 2008; Centifanti, Qualter, Padgett, 2011). The three items were coded on a 3-point scale (0=never, 1=sometimes, 2=often) and include: "I let my friends know I like them by telling or showing them," "I listen to my friends when they talk about problems they are having," and "I try to understand how my friends feel when they are angry, upset, or sad." These items clearly recruit ToM. The first requires an understanding that peers do not have access to your internal judgments about them, so external action (telling or showing) is required. Listening to friends who have problems requires affective reasoning, in order to understand that a friend is having a problem, as well as interest in another's affect. The third item is explicitly affective reasoning. Items that were judged not to recruit ToM skills were excluded. Examples of these excluded items include: "I ask before using other people's things" and "I finish classroom work on time."

3.0 RESULTS

All analyses were performed using Mplus 7.4 (Muthén & Muthén, 2014). For all analyses, model fit was evaluated using several fit indices. Because the chi-square statistic (χ^2) is highly influenced by sample size and is likely to be overly sensitive to negligible departures from exact model fit when the sample sizes are large, as they are in the current study, several other indices of overall model fit were used: comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Good model fit was defined by the following criteria: RMSEA < .05, CFI > .95, TLI > .95, SRMR < .08 (Hu & Bentler, 1999). Adequate model fit was defined by the following criteria: RMSEA < .08, CFI > .90, TLI > .90, SRMR < .08 (Hu & Bentler, 1999).

3.1 AIM ONE: CONFIRMING A TWO-FACTOR THEORY OF MIND MODEL

The goal of this analysis was to identify two factors, one representing applied cognitive ToM and one representing applied affective ToM, and determine whether this two-factor model fit the data well. A confirmatory factor analysis was performed using data at age 11, the first age at which the data were available, with the three items from the CPR used to estimate a latent

factor of applied cognitive ToM and the three items from the SSRS used to estimate the latent factor of applied affective ToM; the two latent factors were allowed to correlate.

Model fit was excellent ($\chi^2_{(8)}$ = 11.036, *ns*; *RMSEA* = .018, *CFI* = .997, *TLI* = .994, *SRMR* = .017). All three applied cognitive ToM indicators loaded significantly onto a single latent factor: lies to make other kids not like someone (λ = .543, p < .001), tries to exclude specific peers (λ = .751, p < .001), and excludes peers to get even (λ = .554, p < .001). Similarly, all three applied affective ToM indicators loaded significantly onto the latent factor: tells or shows friends that she likes them (λ = .517, p < .001), listens to friends when they talk about problems (λ = .606, p < .001), and tries to understand friends when they are angry, sad, or upset (λ = .661, p < .001). The two latent factors were significantly negatively correlated (r = -377, p < .001; see Table 5 for factor loadings).

These findings suggest that these measures reflect applied cognitive and affective ToM as distinct sets of skills, and that defining them as such in this study fits the data very well. The negative correlation is consistent with the valenced nature of the factors. That is, the applied cognitive ToM factor is antisocial in nature while the applied affective ToM factor is prosocial, thus it is not surprising to find that these are negatively associated. Given the available data, it was not possible to generate either neutral or similarly valenced applied ToM factors. For this reason, the next set of analyses is especially important both to distinguish conduct disorder from CU traits and to ascertain that the basic valence of the factors is not driving any effects.

3.2 AIM TWO: APPLIED THEORY OF MIND SKILLS, CU TRAITS, AND CONDUCT DISORDER

The goal of this analysis was to determine whether there were distinct predictive relationships for CU traits versus conduct disorder with applied ToM. Specifically, analyses 1) examined the predictive relationship between CU traits at age 6 and the two latent factors of applied ToM at age 11; and 2) determined whether this effect was specific to CU traits rather than general antisocial behavior. To do this, the latent factors of applied cognitive ToM and applied affective ToM at age 11 were regressed on CU traits and on conduct disorder at age 6. The two latent applied ToM factors were allowed to correlate, and CU traits were allowed to correlate with conduct disorder.

This model was found to be a good fit for the data (($\chi^2_{(16)}$ = 20.148, *ns*; *RMSEA* = .015, *CFI* = .996, *TLI* = .993, *SRMR* = .017). Applied cognitive ToM was again negatively correlated with applied affective ToM at age 11 (r = -.345, $p < .01$), as it had been in the previous analysis and, consistent with previous literature (Frick & Dickens, 2006), CU traits at age 6 were significantly correlated with conduct disorder at age 6 (r = .484, $p < .01$). Moreover, as hypothesized, CU traits at age 6 significantly positively predicted applied cognitive ToM at age 11 ((β = .193, $p < .001$) and significantly negatively predicted applied affective ToM at age 11 ((β = -.238, $p < .001$). Critically, as hypothesized, conduct disorder at age 6 was unrelated to applied cognitive ToM at age 11 ((β = .045, *ns*) and to applied affective ToM at age 11 ((β = -.044, *ns*).

These findings suggest that children with higher levels of CU traits early in childhood will demonstrate intact or heightened real-world cognitive ToM skills in late childhood but

markedly deficient real-world affective ToM. Crucially, early conduct disorder was not related to later applications of ToM skills suggesting that it is not simply antisocial vs. prosocial behavior driving these effects, but a specific relationship between CU traits and applied ToM skills and behaviors.

3.3 AIM 3: APPLIED THEORY OF MIND AND CU TRAITS OVER TIME

The goal of this set of analyses was to examine the rank order stability of CU traits in girls from childhood through adolescence, the stability in applied ToM in early adolescence, and the bidirectional relationship between applied ToM and CU traits over time. Because conduct disorder was found to be unrelated to either ToM factor, it was excluded from these analyses.

Before addressing the primary question of interest, the measurement invariance of the latent ToM factors and the measure of CU traits were investigated. To do this, factor loadings across ages were constrained to equality, factor means were fixed at 0 for identification, factors at both ages were allowed to covary, and item residual variances were allowed to covary. Given these constraints, good model fit would indicate that the measure can be considered invariant across time; in other words, that the factor is measuring identical constructs at each age. Using the above strategy, the test of measurement invariance fit the data well for both applied cognitive ToM ($\chi^2_{(7)} = 19.932$, $p = .005$; *RMSEA* = .04, *CFI* = .987, *TLI* = .973, *SRMR* = .029) and applied affective ToM ($\chi^2_{(7)} = 12.387$, $p = .089$; *RMSEA* = .026, *CFI* = .994, *TLI* = .988, *SRMR* = .024).

Scores on the PSD from age to age were highly correlated: ages 6 and 11 ($r = .688$, $p < .001$); 11 and 14 ($r = .718$, $p < .001$); 14 and 17 ($r = .778$, $p < .001$). However, measurement

invariance was not established for CU traits. Between ages 6 to 11, only half of the fit indices demonstrated adequate fit ($\chi^2_{(63)}$ = 3238.796, $p < .001$; *RMSEA* = .057, *CFI* = .730, *TLI* = .713, *SRMR* = .060). A similar picture emerged from ages 11 to 14 ($\chi^2_{(63)}$ = 2947.304, $p < .001$; *RMSEA* = .055, *CFI* = .789, *TLI* = .776, *SRMR* = .058) and ages 14 to 17 ($\chi^2_{(63)}$ = 2980.786, $p < .001$; *RMSEA* = .056, *CFI* = .783, *TLI* = .770, *SRMR* = .058). Thus, although children who scored higher at one age on the PSD also did so at the next assessment age, the construct of CU traits as measured with the PSD was variable over time. This is likely due to how applicable certain items are to children at these widely different ages; however, the PSD as a whole is still capturing something meaningful and stable about CU traits. As such, this measure was retained for analysis but the limitation of measurement non-invariance is noted here and will be discussed further below.

With issues of measurement (in)variance addressed, attention can be turned to the specific aims of this analysis. The goals were to 1) determine the stability of CU traits in girls from early childhood through adolescence, and 2) examine the bidirectional relationship between CU traits and the two latent factors of applied ToM over time. The applied ToM measures were not available at every age, only at 11 and 14 years. Therefore, a modified four-wave cross-lagged panel design was utilized. To determine the stability of CU traits between ages 6 and 17, the CU trait measure at ages 17, 14, and 11 were auto-regressed on the previous age. To examine the relationship between CU traits and applied ToM over time, applied cognitive and affective ToM at ages 11 and 14 were regressed on CU traits at the previous age. Finally, CU traits at ages 14 and 17 were regressed on both applied ToM factors at the previous age. CU traits at ages 11 and 14 were allowed to covary with the applied ToM factors at those ages, as were the two ToM factors at each age.

Overall, this model demonstrated good fit for the data ($\chi^2_{(83)} = 250.048$, $p < .001$; *RMSEA* =.042, *CFI* = .959, *TLI* = .941, *SRMR* = .034). CU traits at each age significantly predicted CU traits at the next age: ages 6 to 11 ($\beta = .602$, $p < .001$); ages 11 to 14 ($\beta = .641$, $p < .001$); ages 14 to 17 ($\beta = .672$, $p < .001$). While these stability estimates should be interpreted with caution given the measurement variance, the findings seem to suggest that CU traits in girls, as in boys, are relatively stable across development. The latent factors of applied ToM were also relatively stable, with applied cognitive ToM at age 11 significantly predicting itself at age 14 ($\beta = .405$, $p < .001$), and applied affective ToM doing the same ($\beta = .525$, $p < .001$). The two latent ToM factors were significantly negatively correlated at age 11 ($r = -.327$, $p < .001$) and age 14 ($r = -.279$, $p < .001$).

As shown previously in the results for Aim 2, CU traits at age 6 significantly positively predicted applied cognitive ToM at age 11 ($\beta = .231$, $p < .001$) and significantly negatively predicted applied affective ToM at age 11 ($\beta = -.264$, $p < .001$). Similarly, CU traits at age 11 significantly positively predicted applied cognitive ToM at age 14 ($\beta = .134$, $p < .001$) and significantly negatively predicted applied affective ToM at age 14($\beta = -.134$, $p < .001$)[1]. However, contrary to our hypothesis, the reverse prediction was not significant. That is, neither applied cognitive ToM at age 11 ($\beta = .031$, *ns*), nor applied affective ToM at age 11($\beta = -.036$, *ns*), significantly predicted CU traits at age14. Similarly, CU traits at age 17 were not significantly predicted by applied cognitive ToM ($\beta = .032$, *ns*) at age 14. CU traits at age 17 were, however, weakly predicted by applied affective ToM at age 14 ($\beta = -.065$, $p = .040$). Moreover, CU traits at age 11 were not significantly correlated with applied cognitive ToM at

[1] With conduct disorder controlled, the predictive effects were weaker but the pattern of significance did not change. Model fit indices demonstrated worse fit for this model.

the same age (r = .049, *ns*) and only significantly with applied affective ToM (r = -.126, p = .004). Interestingly, though, by age 14 CU traits were significantly correlated with both applied cognitive ToM (r = .143, p < .001) and applied affective ToM (r = -.126, p = .004).

These results suggest a relatively high degree of rank-order stability in CU traits in an all-female sample from childhood through adolescence. Moreover, as hypothesized, earlier CU traits significantly positively predicted later applied cognitive ToM and significantly negatively predicted later applied affective ToM. Contrary to our hypothesis, bidirectionality did not apply; that is, applied ToM skills at age 11 did not significantly predict CU traits at age 14, nor did applied cognitive ToM predict CU traits at age 17. While applied affective ToM at age 14 did predict CU traits at age 17, the association was weak. Thus, by adolescence, CU traits are predictive of later applications of ToM with one's peers, but the reverse is not true.

4.0 DISCUSSION

The current study, conducted exclusively with girls, had three primary goals: to identify and distinguish cognitive and affective ToM skills as they occur in real-world social situations as opposed to laboratory tasks, i.e. *applied* ToM; to determine the predictive relationship between childhood CU traits and later applied ToM, and to establish that early conduct disorder was not related to later ToM skills; and to examine the rank order stability of CU traits and the bidirectional relationship between CU traits and applied cognitive and affective ToM over adolescence. Regarding the first goal, as hypothesized, cognitive and affective applied ToM were distinguished as separate factors, and the two-factor structure demonstrated excellent model fit. Regarding the second goal, as hypothesized, CU traits at age 6 significantly positively predicted applied cognitive ToM and negatively predicted applied affective ToM at age 11. Importantly, and also as hypothesized, conduct disorder at age 6 was unrelated to both applied ToM factors at age 11, making clear that it was not antisocial behavior in general driving the effects, but rather something specific to CU traits. With respect to the third goal, CU traits in girls demonstrated relatively high stability across all ages. Consistent with the pattern from age 6 to age 11, CU traits at age 11 significantly positively predicted applied cognitive ToM and significantly negatively predicted applied affective ToM at age 14. However, contrary to our hypotheses, CU

traits at ages 14 and 17 were not significantly predicted by applied ToM skills at the previous age, suggesting limited bidirectionality.

This study is the first, to our knowledge, to explore the relationship between ToM and CU traits in an all-female sample, and to focus on applied ToM skills rather than traditional laboratory tasks. CU traits, as the "trait" label would suggest, demonstrated high rank order stability in girls across ages from childhood through adolescence. Because research on CU traits has utilized predominantly or entirely male samples, there has been a question as to whether girls with these traits might look different, especially in their social cognitive understanding. Based on findings from research with typically developing boys and girls (see Bennett, Farrington, & Huesmann, 2005 for review), and a persistent intuition that girls are more affectively attuned than boys, some researchers have speculated that girls with CU traits might perform better than boys on measures of social or emotional understanding (Centifanti, Qualter, & Padgett, 2011), while others have argued that girls with CU traits are likely to be the most socially aggressive and least likely to reason about the emotions of others (Dadds et al., 2009). The current findings present a picture of CU traits in girls consistent with the previous literature with male samples. Findings from each set of analyses will be discussed individually, followed by general conclusions, limitations, and future directions.

4.1 CONFIRMING A TWO-FACTOR THEORY OF MIND MODEL

The main goal of the first analysis was to establish that a two-factor structure, an applied cognitive ToM latent factor and an applied affective ToM latent factor, could be derived and

distinguished from each other. In the current study, applied cognitive ToM was operationalized as the particularly ToM-relevant component of relational aggression, while applied affective ToM was operationalized as the particularly ToM-relevant component of peer social skills.

The construct of applied cognitive ToM has been discussed under several banners in the ToM and bullying literatures, most commonly as relational or social aggression (Crick & Grotpeter, 1995), but sometimes as ringleader bullying (Sutton, Smith, & Swettenham, 1999), Machiavellianism (Sutton & Keogh, 2000), or Nasty ToM (Ronald et al., 2005). What these have in common with the larger construct of applied theory of mind is that they involve the manipulation of others' beliefs, essentially creating negative false beliefs in others about a selected peer. When Crick and Dodge (1994) first proposed their influential social information processing model of bullying, they described bullies as essentially lacking the social cognitive skills needed to positively engage with their peers, instead misattributing hostility to those around them even when no hostility was intended. This often resulted in *reactive* antisocial behavior, e.g. hitting someone because of the misperception that they hit you first when, in fact, they had simply slipped and accidentally bumped your arm, or starting a nasty rumor about someone because you mistook their innocent joke for malicious mocking. That is, bullies bullied because they were deficient in social understanding and reacting inappropriately because of that deficiency, an idea backed up by their poor performance on laboratory ToM and social information processing tasks (Gasser & Keller, 2009).

Another type of bully was also identified, though: the *proactive* bully. This type bullied not as an inappropriate reaction to their peers but intentionally, for instrumental gains in social dominance. Sometimes called ringleader or Machiavellian bullies, these children possessed heightened rather than reduced ToM skills. These ringleader bullies also tended to be more

relationally aggressive as opposed to physically aggressive, not hitting their peers but instead selectively excluding them, spreading lies about them, and making fun of them (Crick & Grotpeter, 1995). This kind of social aggression requires manipulating the beliefs of others, which, as discussed above, is a clear application of cognitive ToM (Sutton & Smith, 1999; Ronald, Happe & Frith, 2005; Crick & Grotpeter, 1995). Not only does this kind of bully not perform poorly on laboratory ToM tasks (Sutton, Smith, & Swettenham, 1999), they must actually possess finely honed ToM skills in order to most effectively select their target and plan a course of action that yields the desired effect, the descent of their victim on the social hierarchy and their own ascent, without creating such a vulnerable victim that their peers rise to support them (Sutton, Smith, & Swettenham, 1999; Aresnio & Gold, 2006). The unifying feature of this ringleader bully and proactive relational aggression literature is that cognitive ToM is always noted to be the fundamental, underlying skill driving these behaviors. Interestingly, the literature on applied cognitive ToM uniformly focuses on antisocial behavior: Children are utilizing their cognitive ToM skills to subjugate or dominate others.

Applied affective ToM, is, on the other hand, discussed as a prosocial skill, necessary for social harmony and positive peer relations (e.g. Denham, 2007; Denham et al., 2003). The ability and desire to understand the emotional state of someone else, commonly referred to as cognitive empathy in the CU literature (e.g. Dadds et al., 2008), seems so inherently prosocial that many have hypothesized that it is the crucial feature in differentiating children who apply their ToM skills in "nice," socially harmonious, vs. "nasty," socially dominating, ways (Gasser & Keller, 2009; Gini, 2006; Kaukiainen et al., 1999; Björkvist, Österman, & Kaukiainen, 2000; Renouf et al., 2010). This line of thinking posits that if children can understand others' distress, and take the affective perspective of their peers, they will be less aggressive because their empathic

concern for those around them will outweigh their desires for personal gain. Evidence supports this claim, with affective understanding found to be consistently negatively correlated with antisocial behavior, to predict lower antisocial behavior, and to moderate the relationship between cognitive ToM and relational aggression (Centifanti et al., 2011; Gomez-Garibello & Talwar, 2015; Krettenauer, Malti, & Sokol, 2008).

It has been argued that examinations of social cognition should not separate cognitive and affective skills, as any child who did not utilize both sets of skills in social situations would be necessarily pathological (Crick & Dodge, 1994). The reasoning is that applying cognitive skills in the absence of affective skills could only be antisocial, because there would be no motivation to behave prosocially (positive and warm peer responses and bonding) or punishment for behaving antisocially (negative peer responses). Further, Crick and Dodge argued, antisocial behavior is pathological. Therefore, cognitive ToM in the absence of affective ToM, according to this argument, is necessarily pathological. This argument, however, ignores the fact that there are motivations for prosocial behavior even excluding positive emotional reactions from peers. For example, children might behave prosocially strategically, to get external rewards, such as stickers and treats, from their teachers and parents, or to become popular and dominant among their friends.

Momentarily putting aside issues of pathology, some researchers have simply argued that the different capacities underlying social cognition are domain-specific, including one domain for cognitive skills and one for affective skills. As evidence, these researchers cite the bullying literature, which frequently separates cognitive and affective skills and makes clear that cognitively understanding others, as happens when one needs to lie to them, does not imply or require affective engagement (Malti, Gasser, & Gutzwiller-Helfenfinger, 2010; Smetana, 2006;

Stams et al., 2006). The argument in this case is that cognitive and affective skills are separate sets of skills under one social-cognitive umbrella, and children sometimes utilize both sets of skills but sometimes only one or the other.

Even according to those who believe that separate use of cognitive and affective skills implies pathology, research on CU traits has license to separate these skills, as, according to the DSM-V, CU traits are pathological. In fact, children with CU traits may be ideally suited for studies of the domain-specificity of social cognition given their intact or heightened cognitive ToM skills and their deficits in affective understanding. Their social cognitive skills are clearly domain-specific and don't extend to the affective domain. We argue that research on CU traits has an imperative to separate cognitive and affective skills or risk dramatically underestimating the ToM power these children have. This underestimation might lead researchers to incorrectly conclude that children with CU traits have deficits in understanding even when they do not, hindering progress in understanding the etiology and correlates of these traits. This underestimation might also lead clinicians to attempt interventions poorly suited to these children, treating them as reactive bullies who are aggressive because they don't understand others rather than proactive bullies who are aggressive because their goals are for dominance, not harmony, among their peers.

A two-factor ToM structure illustrates that separating children with CU traits' applied ToM skills by domain, cognitive and affective, yields a more accurate and complete picture of their social cognition than one general measure could. This distinction is likely especially important for children with CU traits in general and especially for girls with CU traits, who have previously been found both to be particularly relationally aggressive (Marsee & Frick, 2007) and

to perform worse than boys with CU traits on measures of affective perspective-taking (Dadds et al., 2009).

Thus, when considered within this greater context, the findings from this study help to integrate literature in typical and atypical development. That is, cognitive and affective ToM skills are domain-specific even while falling under the same, larger construct of social cognition. This has the potential to inform research on the typical development of social cognition because it suggests that considering these domains separately can further elucidate our understanding of developing social skills.

4.2 APPLIED THEORY OF MIND SKILLS, CU TRAITS, AND CONDUCT DISORDER

The main goal of the second analysis was to examine the predictive relationship between early CU traits and later applied cognitive and affective ToM, and to establish that this association is unique to CU traits, unaccounted for by antisocial behavior. While the antisocial valence of our applied cognitive ToM factor and prosocial valence of our applied affective ToM factor is consistent with previous literature (Ronald, Happe, Hughes, & Plomin, 2005), it might have led to the belief that any relationship between these factors and CU traits was being driven by basic antisocial behavior. Thus, it was important to establish as well that early conduct disorder was unrelated to later applied ToM.

As hypothesized, CU traits at age 6 significantly positively predicted applied cognitive ToM and significantly negatively predicted applied affective ToM at age 11. Moreover, conduct

disorder at age 6 was unrelated to later applied cognitive and affective ToM showing that CU traits specifically are associated with this pattern of intact cognitive ToM but deficient affective ToM. These findings are in line with a small but consistent literature demonstrating that children with CU traits do not perform poorly on traditional measures of cognitive ToM including first- and second-order false belief tasks (Centifanti, Meins, Fernyhough, 2015), animated false belief tasks (Jones, Happe, Gilbert, Burnett, & Viding, 2010; Schwenck et al., 2012), or cognitive perspective-taking tasks (Sebastian et al., 2012). There have been relatively few studies focusing on cognitive ToM in children with CU traits, likely because there is a presupposition of no differences or deficits in this domain (Blair et al., 1996; Dolan & Fullam, 2004). The current findings lend further support to the theory that children with CU traits do not lack skills related to a cognitive theory of mind, and, importantly, extend previous findings by examining ToM skills in a real-world, social context.

Emotion understanding has been measured more widely in children with CU traits. This again mirrors the typical development literature in which cognitive ToM tends to be defined by false belief tasks while emotion understanding has been measured with a broader variety of tasks. Children with CU traits have previously been found to perform poorly on a range of affective tasks including basic emotion recognition and labeling (Schwenck et al., 2012 Woodworth & Washbusch, 2008; Stevens, Charman, & Blair, 2001; Wolf & Centifanti, 2013; Blair & Coles, 2000; Dadds et al., 2006), affective perspective-taking (Sebastian et al., 2012; Lui, 2014), and reasoning about the emotions of others (Dadds et al., 2009; Kimonis et al., 2015).

There is an ongoing debate in the CU trait field about the mechanism underlying poor performance on affective ToM tasks. One argument is that children with CU traits fundamentally

lack the ability to understand or reason about the emotions of others (e.g. Blair & Coles, 2000), with some suggesting that there are physiological and neurological bases for these deficits (e.g. De Brito et al., 2009; Jones, Happe, Gilbert, Burnett, & Viding, 2010; Jones, Laurens, Herba, Barker, & Viding, 2009). Others have argued that children with CU traits perform poorly on these tasks because the emotions of others are less salient to them, but that if and when they are trained to orient to the eyes and mouths of others they are able to identify emotional expressions (Dadds et al., 2006; Dolan & Fullamn, 2004; Dadds et al., 2012).. Still others agree that while there is a clear pattern of poor performance on affective tasks, the underlying etiology is not yet known and more studies directly attempting to understand the basis for this poor performance are needed (see Herpers et al., 2012 for review). As the answer to the etiology question is beyond the scope of the present study, the "cannot" vs. "will not" argument will be sidestepped, and we will align ourselves with this third group and simply state that girls with CU traits *do* not engage in affective reasoning.

The type of affective reasoning measured by the affective ToM factor in the current study is similar to the Griffith Empathy Measure (GEM; Dadds et al., 2008), a parent-report measure which includes items such as "My child can't understand why other people get upset." This is sometimes termed "cognitive empathy," referring to reasoning about others' emotions, as opposed to "affective empathy," which refers to feeling the emotions of others. This distinction reflects the idea that children with CU traits, which are defined in part by a deficit in affective empathy, are capable of reasoning about others' emotions ("cognitive empathy") even though they do not feel empathic concern based on that reasoning ("affective empathy"). The data supporting this idea are mixed. One study of 16-18 year old males and females found that CU traits were negatively correlated with cognitive empathy, measured by the GEM, and with scores

on an affective perspective-taking task requiring them to label and explain a character's emotion (Lui, 2014). However, another study of 3-13-year-old males and females found that CU traits were significantly negatively associated with affective empathy, feeling the emotions of others, but not with cognitive empathy, reasoning about the emotions of others (Dadds et al., 2009). The current study supports the idea that girls with higher levels of CU traits do not care or seek information about the emotions of those around them. This is in line with the traditional view of CU traits, that children with these traits do not understand the feelings of others and are not motivated to try to better this understanding (Blair & Coles, 2000). Our findings are also in line with previous research on proactive relational aggression that has consistently found this type of aggression to be linked with deficits in affective understanding and reasoning (Gasser & Keller, 2009; Gini, 2006). The current findings are especially illuminating because CU traits were measured dimensionally, as opposed to using a strict cutoff point. This allowed for the examination of children who meet diagnostic criteria for these traits but also children who may have high but sub-clinical levels. This dimensional approach also allows for greater contextualization, as our results are relevant for both the psychopathology and typical development literatures. The findings are particularly valuable because the applied affective ToM factor was created from self-reported items and is therefore more reflective of the girls' actual social tendencies in peer group settings as opposed to their parents' view, as in the GEM, of behaviors they may or may not be privy to.

Aside from the few studies that have utilized the GEM, the previous CU trait literature has utilized laboratory tasks to investigate cognitive and affective ToM skills. These studies along with discussions of whether children with CU traits cannot or will not engage in affective reasoning are critically important to understanding the etiology of these traits. It is equally

important, though, to examine the real-world utilization of affective and cognitive understanding in order to gain insight into the sequelae of these traits. One real-world context within which to examine applied ToM is peer relations. Social hierarchy becomes increasingly salient to children as they age out of childhood and into adolescence (Kupersmidt & Coie, 1990). Evidence suggests that social standing is especially important to children with CU traits (Pardini & Byrd, 2012). Peer interactions, therefore, are an ideal context within which to examine naturally-occurring ToM. The current study is consistent with previous findings that children with CU traits demonstrate intact or heightened cognitive ToM but deficient affective ToM, and extends these findings by using self-report measures of real-world, applied ToM.

4.3 APPLIED THEORY OF MIND AND CU TRAITS OVER TIME

The main goal of the third analysis was to examine the stability of CU traits in girls from childhood through adolescence and explore the predictive relationship between CU traits and applied ToM over time. We hypothesized that CU traits would be stable at each successive age, and as in aim two, that CU traits would significantly positively predict applied cognitive ToM and significantly negatively predict applied affective ToM at the next age. We were also interested in whether the relationship between CU traits and applied ToM was bidirectional such that applied ToM would predict CU traits at the next age.

The findings revealed relatively high rates of stability in CU traits at each age, consistent with previous literature that these traits become cohesive and consistent around age 5-6 (see Waller et al., 2017 for a review). This finding is especially important given the paucity of CU

research focusing on or inclusive of girls. The current findings demonstrate that CU traits are similarly stable in girls and boys. This supports the idea that children with CU traits, relative to children with conduct disorder, reflect a more homogenous group in terms of both etiology and presentation (Frick & Ellis, 1999). In other words, the presence of CU traits may override gender effects observed in other types of psychopathology.

As shown in the previous analysis in which CU traits at age 6 predicted applied ToM at age eleven, CU traits at age 11 also significantly positively predicted applied cognitive ToM and significantly negatively predicted applied affective ToM at age 14. These effects held when conduct disorder was controlled for in the model. The predictive relationship between CU traits at age 11 and ToM at age 14 was somewhat less strong than at the previous age, suggesting that the effects of CU traits on ToM may be stronger earlier in development, closer to when many foundational ToM skills are first developing. Consistent with this speculation was the finding that applied ToM in early adolescence, at ages 11 and 14, did not significantly predict CU traits at the next ages, 14 and 17 respectively. Moreover, concurrent relations between CU traits and applied ToM did not emerge until age 14. Taken together, these findings suggest that core CU characteristics, such as empathy deficits or lack of guilt after mistreating others, emerging in early childhood may shape children's experiences in and expectations for peer group functioning going forward and, thereby, their applied ToM. That is, perhaps early CU traits alter key aspects of a child's developing social experience such that, for example, others' emotions are not explicable or salient, and this altered social experience affects later advanced applications of ToM. It is also possible that ToM, including understanding varying and false beliefs and more applied skills, may affect and interact with CU traits as the skills are developing, such that, for example, children with CU traits are disinterested in or unable to understand others emotions but

still motivated to interact with their peers in order to gain a high position on the social hierarchy. This may lead these children to rely on their cognitive ToM skills and, finding that strategy successful, be less motivated to try to hone any affective skills. By adolescence, this pattern of intact cognitive but deficient affective ToM may be crystallized from years of positive reinforcement in the form of goal attainment it no longer affects the continuing trajectory of CU traits. This hypothesis could be tested using ToM-relevant tasks that can be administered as early as 18-months (e.g. Repacholi & Gopnik, 1995) with scaled tasks continuing through early childhood (Wellman & Liu, 2004). Moreover, efforts are underway to validate measures of CU behaviors and traits as early as age 3-4 (Kimonis et al., 2015). Future studies should include a variety of ToM tasks in a prospective, longitudinal study of CU traits beginning in infancy. This way, the impact of different ToM skills (e.g. understanding preferences, desires, false belief, varying belief, lying) could be examined for their concurrent and prospective effects on the development of CU traits.

4.4 GENERAL CONCLUSIONS

Current findings support previous studies that have demonstrated CU traits to be marked by a profile of intact or heightened cognitive ToM combined with deficient affective ToM. These prior studies have used laboratory measures of ToM including false belief tasks, emotion recognition and labeling, and cognitive and affective perspective-taking tasks. The current study contributes to and extends the previous findings by demonstrating that this profile holds for real-world measures of cognitive and affective ToM, as well as for the gold-standard laboratory

measures. The current study also found that high levels of CU traits can be observed in girls, even in the absence of conduct problems, and that girls with higher levels of CU traits demonstrate the same ToM profile previously observed in boys (Jones et al., 2010).

These findings further confirm and help to solidify this profile, and suggest that more developmental attention be paid to ToM as a marker of CU traits. Historically, fearlessness and insensitivity to punishment have been found repeatedly and consistently to be correlated with, predictive of, and predicted by CU traits such that these two factors are now considered early hallmarks of these traits (Frick & White, 2008; Frick & Morris, 2004; Frick, 2009). The evidence supporting the pattern of intact or heightened cognitive ToM combined with deficient affective ToM in CU traits is growing, and this pattern is unique to children with CU traits compared to typically developing children, children with conduct problems, and children with ASD. Moreover, ToM skills can be measured in early childhood and are therefore prime targets for use in future work seeking to identify casual mechanisms in the development of CU traits. In other words, early ToM may provide a potential entry point for identifying risky genetic profiles or vulnerabilities, especially given recent evidence that ToM may be heritable (Lackner, Sabbagh, Hallinan, Liu, & Holden, 2012; Sabbagh & Seamans, 2008), since CU traits are known to be more genetically influenced than conduct disorder. There has been some correlational work suggesting, for example, that there are key amygdala differences in children with CU traits that may cause some of the affective deficits, but these studies have been done in older children who have already been diagnosed with CU traits (Jones et al., 2009; O'Nions et al., 2014).

The current study also contributes to the extant bullying literature. There has long been a debate as to whether bullies suffer from social-cognitive deficits and simply react more often to their misattributions of others' hostile act (e.g. Crick & Dodge, 1994), or whether some bullies

are gifted with enhanced cognitive and metacognitive understanding that allows them to move up the social hierarchy effectively by manipulating and dominating those around them (e.g. Sutton, Smith, & Swettenham, 1999). Most have reacted to this debate by proposing that there are two types of bullies, reactive and proactive, each with their own social cognitive profile. The current study helps to integrate the bullying literature with the CU literature by supporting the claim that proactively, relationally aggressive girls do indeed possess a high level of cognitive ToM. Moreover, the current findings support the idea that emotion understanding may be a key mechanism in differentiating children who apply their cognitive ToM for prosocial vs. antisocial purposes (Gini, 2006; Hao & Liu, 2016; Gasser & Keller, 2009).

As focus on CU traits increasingly turns towards younger children in the hopes of identifying not just developmental precursors of these traits but ideal points for targeted intervention, ToM skills may prove especially relevant. Children with CU traits are not reactively aggressive because they cannot understand their peers, but rather understand their peers so well they can use them to their own advantage. Where children with CU traits are lacking is their propensity to reason or care about the feelings of others. This may narrow the point of intervention since a key mechanism in understanding the instrumental aggression exhibited by children with CU traits, i.e. the deficits in affective reasoning specifically, combined with a drive for social dominance and the cognitive skills to achieve it, has been identified. Future interventions could focus, for example, on teaching children with CU traits that positive peer interactions are associated with higher peer status. This strategy paints the desired behavior, prosocial interactions with peers, as a means of achieving the child's goal, high social status, without needing to recruit skills that these children struggle with, affective understanding. This type of intervention might also be well-suited for proactive bullies who, as in our sample,

likely have high but sub-clinical levels of CU traits. These findings, along with those that have, for example, found that children with CU traits are insensitive to punishment but especially sensitive to reward, have helped to identify features of CU traits while also lighting the path towards more targeted interventions, moving away from the current reliance on interventions designed for children with conduct disorder that have been found to be ineffective for children who also have CU traits (Kimonis & Armstrong, 2012; Hawes & Dadds, 2005; Waschbusch, Carrey, Willoughby, King, &Andrade, 2007; Dadds, Cauchi, Wimalaweera, Hawes, Brennan; 2012).

4.5 LIMITATIONS AND FUTURE DIRECTIONS

The findings from the current study are subject to several limitations, including the available measure of CU traits. The PSD was the first measure of psychopathic traits designed for use in people under the age of 18, but it was not designed with young children in mind. The current study was not able to establish measurement invariance across ages (6 years to 17 years) in the PSD, suggesting that this measure is capturing different constructs or facets of the psychopathy construct at different ages. Only a few years later, the PSD was replaced with the Inventory of Callous-Unemotional Traits (ICU; Frick et al., 2004), which was intended to focus on the cognitive and affective components of psychopathy and to be appropriate for a wider age range. Future research is needed to explore whether the current findings would hold using the ICU as opposed to the PSD.

Moreover, while both the mean and mode for scores on the PSD were relatively high, only one child met the clinical cutoff point, a score of 30 out of a possible 40. The current findings therefore speak to the relationship between higher levels of CU traits and applied ToM skills as opposed to the ToM skills in children with clinically diagnosable CU traits. This is a strength of the study in that our data afford dimensional examinations of CU traits, thereby allowing us to gain insight into the effects and correlates of these traits even at sub-clinical levels. However, these data do not permit us to make claims about children with diagnosable CU traits, only about children with varying high levels of these traits. It is possible that the observed effects between CU traits and applied ToM would be even stronger in children who meet diagnostic criteria for CU traits, thus the current findings suggest future studies examining traditional and applied ToM skills in these children. The current findings also support the idea that high levels of CU traits may be present in children who do not exhibit conduct problems (Pardini et al., 2012). It is possible that children with high, sub-clinical levels of CU traits in the absence of conduct disorder present a unique profile, potentially marked by high levels of proactive aggression and/or poor peer relationships. Despite the DSM-IV classification of CU traits as a specifier to conduct disorder, current findings suggest that future studies should seek to examine CU traits in children with and without conduct disorder in order to more fully understand the cognitive, affective, and behavioral profiles of these traits.

The current study was also limited by the fact that the ToM measures were only available at two of the ages. Given that both the predictive and concurrent relationships between CU traits and ToM looked different at ages 11 and 14, it is clear that multiple ages will need to be assessed to derive a fuller picture. It is possible, as discussed above, that applied ToM at age 6 might have predicted CU traits at later ages. In early childhood, these skills are just developing which might

allow for more interactions with other skills and cascading effects. In later childhood and early adolescence, set patterns of ToM understanding and application may be more ingrained and automatized. It is equally possible, however, that because the current ToM measures focused on applied skills, the relationship would have been stronger later in adolescence when social standing among peers is more important (Kupersmidt & Coie, 1990). One might reasonably argue that as the peer hierarchy becomes more salient to adolescents, children with CU traits might be especially likely to be more relationally aggressive and less solicitous of their peers' emotions as they become increasingly more focused on and rewarded by their own social dominance. In this case applied ToM, as operationalized here, might be most strongly correlated with CU traits at this later time in adolescence.

Future studies should aim to examine both basic and applied developing ToM prospectively in children at risk for CU characteristics, and in younger children as opposed to adolescents with these traits, to get a more complete picture of how CU traits determine and are determined by cognitive and affective understanding. In particular, it will be important to know when the CU-specific profiles for basic cognitive and affective ToM skills and applied ToM skills begin to emerge and consolidate. More generally, we need to understand more about the origins and pathways to functional vs. dysfunctional ToM. Our findings are consistent with previous research that suggests affective understanding may be the key mechanism in differentiating prosocial and antisocial, or typical and pathological, trajectories of ToM development (Centifanti, Meins, Fernyhough, 2011), but more work is needed to specifically test this claim. Examinations of children with CU traits stand to make significant contributions to the typical development literature on the development of emotion understanding. Children with CU traits demonstrate that cognitive ToM can be achieved by multiple pathways that do not

necessarily include affective ToM. This is in contrast to typically developing children for whom emotion understanding is a key mechanism in developing cognitive ToM (see Satlof-Bedrick, *in prep)*, suggesting an equifinality not previously studied in the ToM literature. Moreover, studying children with CU traits can further our understanding of how different types of emotional competence within the broad affective ToM category develop. For example, it is unclear whether empathy is a prerequisite for all types of emotion understanding, or whether some aspects, perhaps reasoning about emotions, may develop without it.

In these future examinations of children with CU traits, more attention should be paid to existing tasks that have afforded examinations of nuances in ToM understanding in typically developing children. It would be interesting, for example, to examine how children with CU traits perform on emotion-false belief tasks (Harris et al., 1989; Harris, Pons, deRosnay, 2004) in which children need to predict a character's emotional reaction based on their belief, e.g. character A believes there is a monster in the opaque box; character B believes there is a present in the opaque box. If children with CU traits could correctly reason about the emotion resulting from that belief (fear vs. excitement), it would mean that these children are capable of some affective reasoning. If, on the other hand, children with CU traits could not infer the correct emotion even as they understand the varied beliefs of the character, it would confirm that children with CU traits are unable to reason about affective states even in contexts they otherwise understand. Future studies should also aim to establish measures of the "prosocial" applications of cognitive ToM, for example engaging in relational aggression to come to the defense of a friend or victim, in order to determine whether kids with CU traits can or will do this. Measures of the antisocial use of affective ToM, such as using or manipulating others' feelings for one's own self ends, would be similarly informative If we want to claim that children

with CU traits are capable of cognitive and metacognitive reasoning but not affective reasoning, that in essence their social-cognitive skills are domain specific such that they have deficits in one domain but not the other, further research is needed to probe the boundaries of these cognitive and affective domains.

Self-oriented or introspective ToM should also be examined in children with CU traits. If their motivation for applying cognitive ToM center around social manipulation and domination, we would expect their introspective awareness to be significantly lower compared to their other-oriented awareness. Several studies of typically developing children have found that even after passing false belief tasks, children often struggle to report on their own thoughts, especially when they are not engaged in a goal-directed task such as doing a puzzle or solving a problem (Satlof-Bedrick & Johnson, 2015; Flavell, Green, & Flavell, 2000). Utilizing these tasks in studies of children with CU traits will both contribute to understanding the motivation and utility of their developing cognitive ToM, and also to the typically developing literature on ToM by strengthening the small but consistent body of work on the difficulties of introspective metacognition.

It is also possible that ToM was not predictive of later CU traits in the current study because of task artifacts given that the applied ToM measures were self-report whereas the measure of CU traits was parent-report. The current standard measure of CU traits, the Inventory of Callous-Unemotional Traits (ICU, Frick et a., 2004) is almost always administered as self-report, at least in adolescent samples (Essau, Sasagawa, Frick, 2006). Ideally, future studies will utilize parent- and self-report measures in order to rule out reporter artifacts but also to shed light on how well children's views of their own CU and applied ToM behaviors map on to their parents' views of them. Future studies could also measure peers' views on children with CU

traits, both as a research tool to understand more about peer relationships of these children but also potentially as a tool recruited in an intervention like the one described above, in which children with CU traits are taught that positive peer interactions lead to higher social standing.

Finally, the present study was both strengthened and limited by its all-female sample. This sample is important because girls with CU traits are dramatically under-studied. However, single-sex samples cannot provide answers for arguments about possible sex differences in either CU traits or applied ToM. Future studies including equal numbers of males and females are needed in order to determine whether there are differences in affective ToM in girls vs. boys with CU traits, and to further validate the profile of intact cognitive ToM combined with deficient affective ToM. These mixed-gender studies will also be important for understanding whether girls and boys with CU traits apply their ToM differently, e.g. whether girls with CU traits are more relationally aggressive than boys with CU traits.

In conclusion, children with CU traits exhibit a unique profile of social cognition such that they are able to understand and manipulate the beliefs of others, but they are less able or willing to understand others' emotions. By continuing to examine this profile, we will better understand developmental precursors of CU traits, the implications CU traits have for peer relationships, the best targets for CU-specific interventions, and the most effective means through which to try to alter the trajectory of these traits in early childhood.

APPENDIX A: TABLES

Table 1: Measures available at each assessment age

	Age			
Measure	Age 6	Age 11	Age 14	Age 17
Callous-unemotional traits	X	X	X	X
Conduct disorder	X			
Applied cognitive ToM		X	X	
Applied affective ToM		X	X	

Table 2: Demographic Information

	Cohorts 5 & 6, All	*Cohorts 5 & 6, Included*	*Cohorts 5 & 6, Excluded*
n	1218	1125	93
Caucasian	40.4%	39.4%	52.7%
African American	53.4%	54.0%	46.2%
Asian	1.2%	1.2%	1.1%
Multi-racial	4.8%	5.2%	0.0%
Missing	0.2%	0.2%	0.0%
	% (% Missing)	*% (% Missing)*	*% (% Missing)*
Single Parent (6)	41.5%	42.3% (.3%)	32.3% (15.1%)
Single Parent (11)	38.9%	42.0% (1.7%)	2.2% (89.2%)
Single Parent (14)	42.7%	46.0% (5.4%)	2.2% 94.6%)
Single Parent (17)	41.9%	45.1% (10.5%)	3.2% (91.4%)
<12 years ed. (6)	16.5%	17.2% (.3%)	7.5% (84.9%)
<12 years ed. (11)	12.6%	13.7% (1.3%)	0.0% (89.2%)
<12 years ed. (14)	12.9%	13.9% (5.5%)	1.1% (94.6%)
<12 years ed. (17)	10.8%	11.6% (10.5%)	1.1% (91.4%)
Public Assist. (6)	39.4%	40.7% (.4%)	23.7% (15.1%)
Public Assist. (11)	36.0%	38.8% (1.4%)	3.2% (89.2%)
Public Assist. (14)	35.7%	38.6% (5.5%)	1.1% (94.6)
Public Assist. (17)	35.6%	38.3% (10.5%)	2.2% (91.4%)

Table 3: Means, standard deviations, and ranges for all measures

Measure	Age 6	Age 11	Age 14	Age 17
Callous-unemotional traits	10.46 (4.93)	10.14 (5.34)	11.02 (5.71)	10.75 (5.59)
Conduct disorder	1.23 (1.87)			
Applied cognitive ToM				
Tells lies		1.30 (.51)	1.19 (.42)	
Tries to exclude		1.24 (.47)	1.26 (.46)	
Excludes to get even		1.29 (.50)	1.33 (.52)	
Applied affective ToM				
Tells/shows friends she likes		1.57 (.58)	1.46 (.59)	
Listen to friends' problems		1.78 (.45)	1.77 (.445)	
Tries to understand friends' emotions		1.65 (.52)	1.74 (.452)	

Callous-unemotional traits were scored on a measure with a possible range of 1-40; conduct disorder was scored on a measure with a possible range of 0-45; applied cognitive ToM was scored such that each item had a possible range of 1-3; applied affective ToM was scored such that each item had a possible range of 0-2.

Table 4: Intercorrelations among all measures

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. PSD Age 6	1																
2. PSD Age 11	.603	1															
3. PSD Age 14	.527	.653	1														
4. PSD Age 17	.478	.614	.697	1													
5. ACToM 1 Age 11	.156	.158	.105	.162	1												
6. ACToM 2 Age 11	.125	.095	.074	.128	.414	1											
7. ACToM 3 Age 11	.156	.111	.078	.116	.275	.424	1										
8. ACToM 1 Age 14	.122	.125	.121	.115	.228	.190	.169	1									
9. ACToM 2 Age 14	.174	.127	.170	.103	.120	.096	.164	.379	1								
10. ACToM	.150	.142	.167	.134	.150	.178	.160	.375	.470	1							

3 Age 14																
11. AAToM 1 Age 11	-.147	-.156	-.126	-.131	-.121	-.120	-.114	-.059	-.047	-.061	1					
12. AAToM 2 Age 11	-.166	-.155	-.143	-.102	-.157	-.139	-.129	-.111	-.035	-.054	.324	1				
13. AAToM 3Age 11	-.159	-.159	-.103	-.123	-.181	-.175	-.177	-.126	-.037	-.033	.338	.398	1			
14. AAToM 1 Age 14	-.160	-.206	-.205	-.176	-.089	-.091	-.069	-.132	-.109	-.101	.210	.196	.259	1		
15. AAToM 2 Age 14	-.166*	-.142	-.175	-.152	-.070	-.098	-.115	-.210	-.110	-.167	.161	.244	.218	.343	1	
16. AAToM 3 Age 14	-.123	-.139	-.143	-.098	-.048	-.084	-.056	-.128	-.089	-.120	.154	.217	.209	.357	.432	1
17. CD Age 6	.482	.355	.333	.297	.100	.087	.094	.153	.114	.137	-.101	-.074	-.112	-.064	-.061	-.069	1

Note: Correlations greater than r=.06 were significant at p<.05; correlations between .06-.08 were significant at p<.01; correlations above .08 were significant at p<.001.

PSD=total score on psychopathy screening device; ACToM 1=applied cognitive ToM item one, tells lies to make other kids not like someone; ACToM 2=applied cognitive ToM item two, tries to exclude peers; ACToM 3=applied cognitive ToM item three, excludes to get even; AAToM 1=applied affective TOM item one, lets friends know she likes them by telling or showing them; AAToM 2=applied affective ToM item 2, listens to her friends when they talk about problems they are having; AAToM 3=applied affective ToM item 3, tries to understand how her friends feel when they are angry, sad, or upset; CD=total score on child symptom inventory: conduct disorder subscale.

Table 5:
Confirmatory Factor Analysis: Applied ToM Factor Loadings

Factors	*Applied Cognitive Theory of Mind*	*Applied Affective Theory of Mind*
Individual items		
Lies to make other kids not like someone	.543**	
Tries to exclude specific peers	.751**	
Excludes peers to get even	.554**	
Tells or shows friends she likes them		.517**
Listens to friends when they talk about problems		.606**
Tries to understand friends when they are angry, sad, upset		.661**

** p <.001; The two factors were correlated (r = -.377, p<.001)

Table 6: Aim Two – Path Coefficients

Path	B	S.E.	*p*
Age 6 CU → Age 11 Applied Cog ToM	.193	.041	.000
Age 6 CU → Age 11 Applied Aff ToM	-.238	.041	.000
Age 6 CD → Age 11 Applied Cog ToM	.045	.041	.267
Age 6 CD → Age 11 Applied Aff ToM	-.044	.042	.291

Table 7: Aim Three – Path Coefficients

Path	B	S.E.	*p*
Age 6 CU → Age 11 CU	.602	.019	.000
Age 11 CU → Age 14 CU	.641	.019	.000
Age 14 CU → Age 17 CU	.673	.019	.000
Age 6 CU → Age 11 ACToM	.231	.036	.000
Age 6 CU → Age 11 AAToM	-.264	.036	.000
Age 11 CU →Age 14 ACToM	.134	.037	.000
Age 11 CU → Age 14 AAToM	-.134	.038	.000
Age 11 ACToM → Age 14 CU	.031	.032	.335
Age 11 AAToM → Age 14 CU	-.036	.034	.291
Age 11 ACToM → Age 14 ACToM	.405	.044	.000
Age 11 AAToM → Age 14 AAToM	.525	.043	.000
Age 14 ACToM → Age 17 CU	.032	.031	.299
Age 14 AAToM → Age 17 CU	-.065	.031	.040

ACToM=applied cognitive theory of mind; AAToM=applied affective theory of mind

APPENDIX B: FIGURES

Figure 1: Frequency distribution of scores on the PSD at age 6

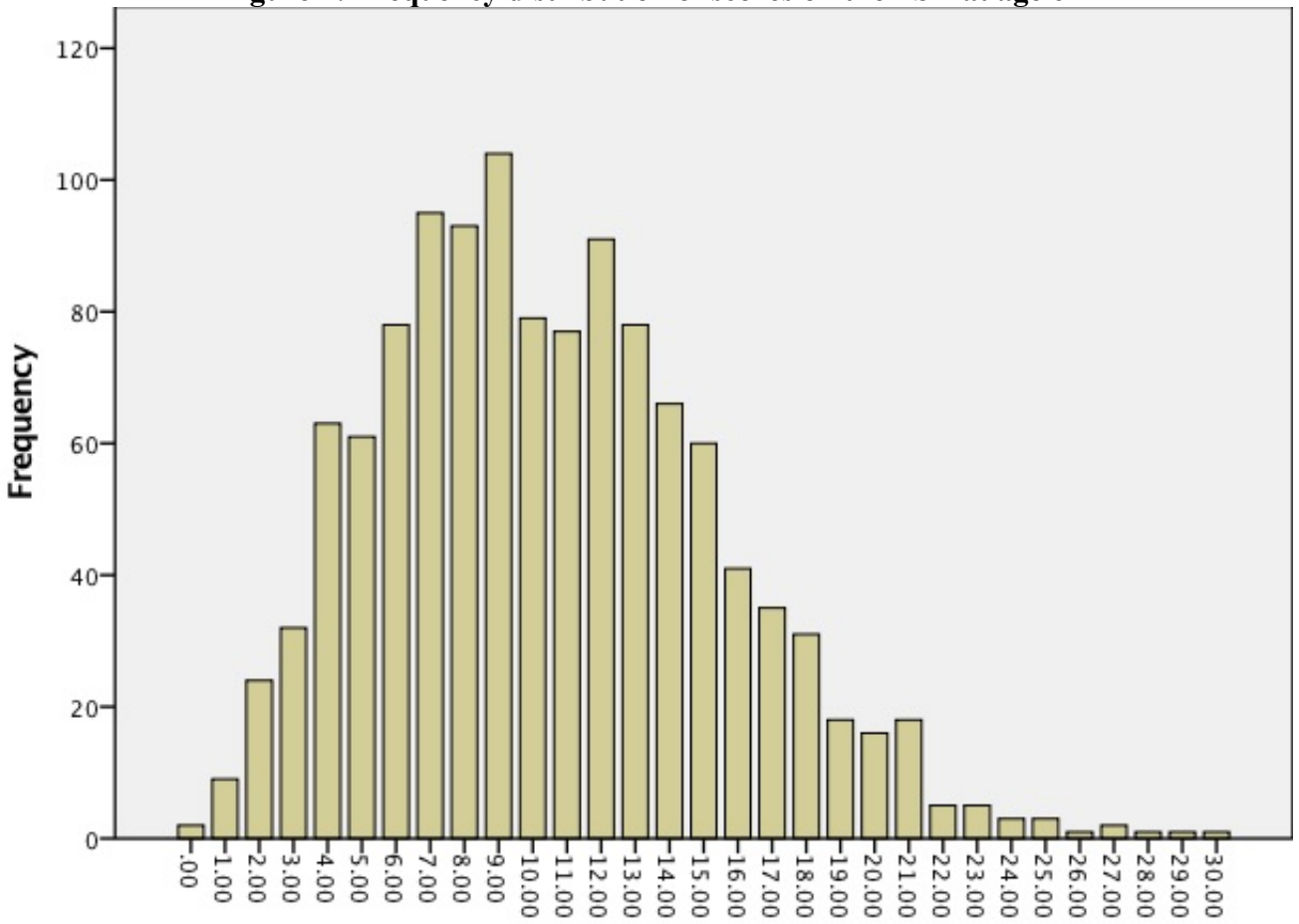


Figure 2: Frequency distribution of scores on the PSD at age 11

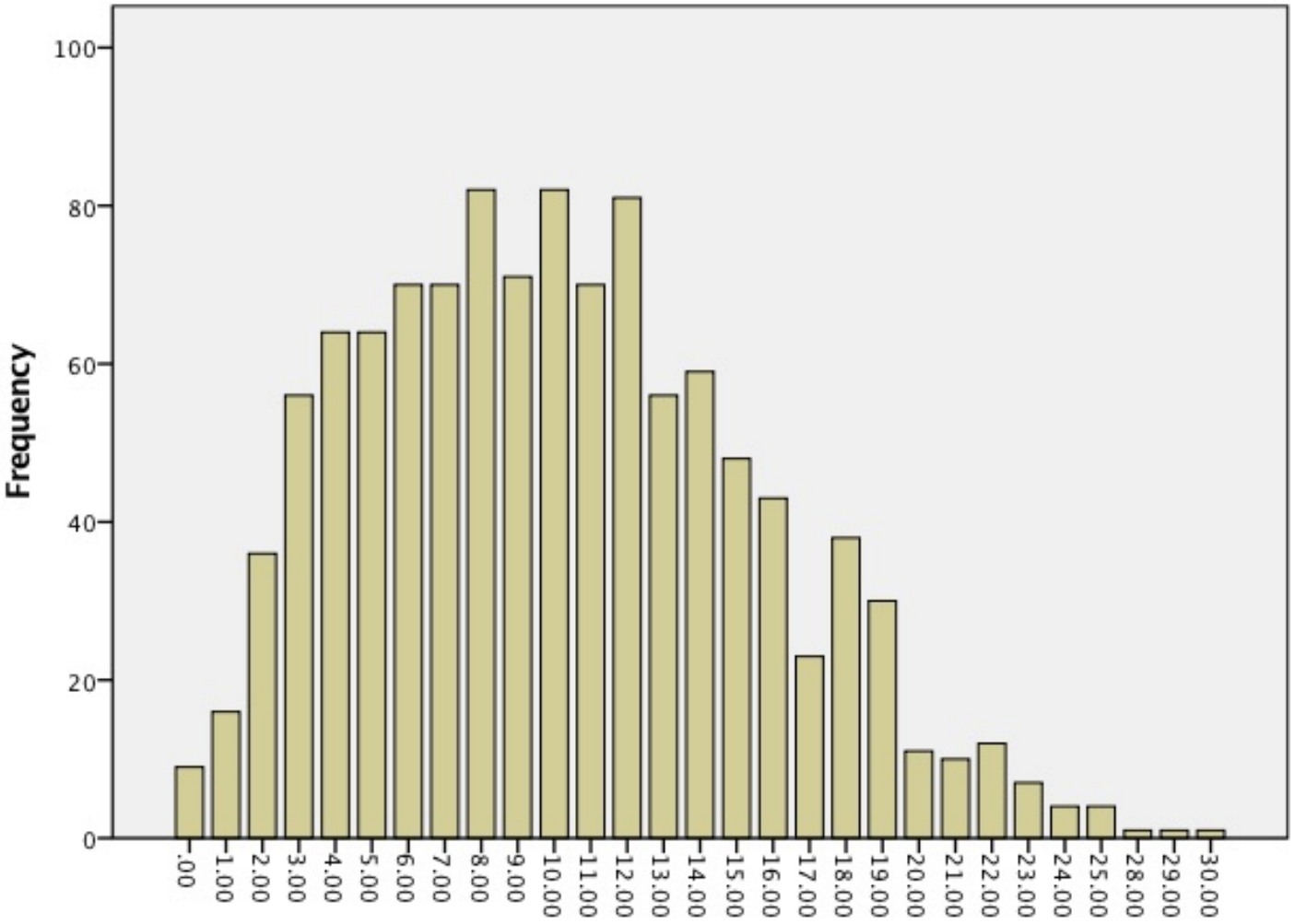


Figure 3: Frequency distribution of scores on the PSD at age 14

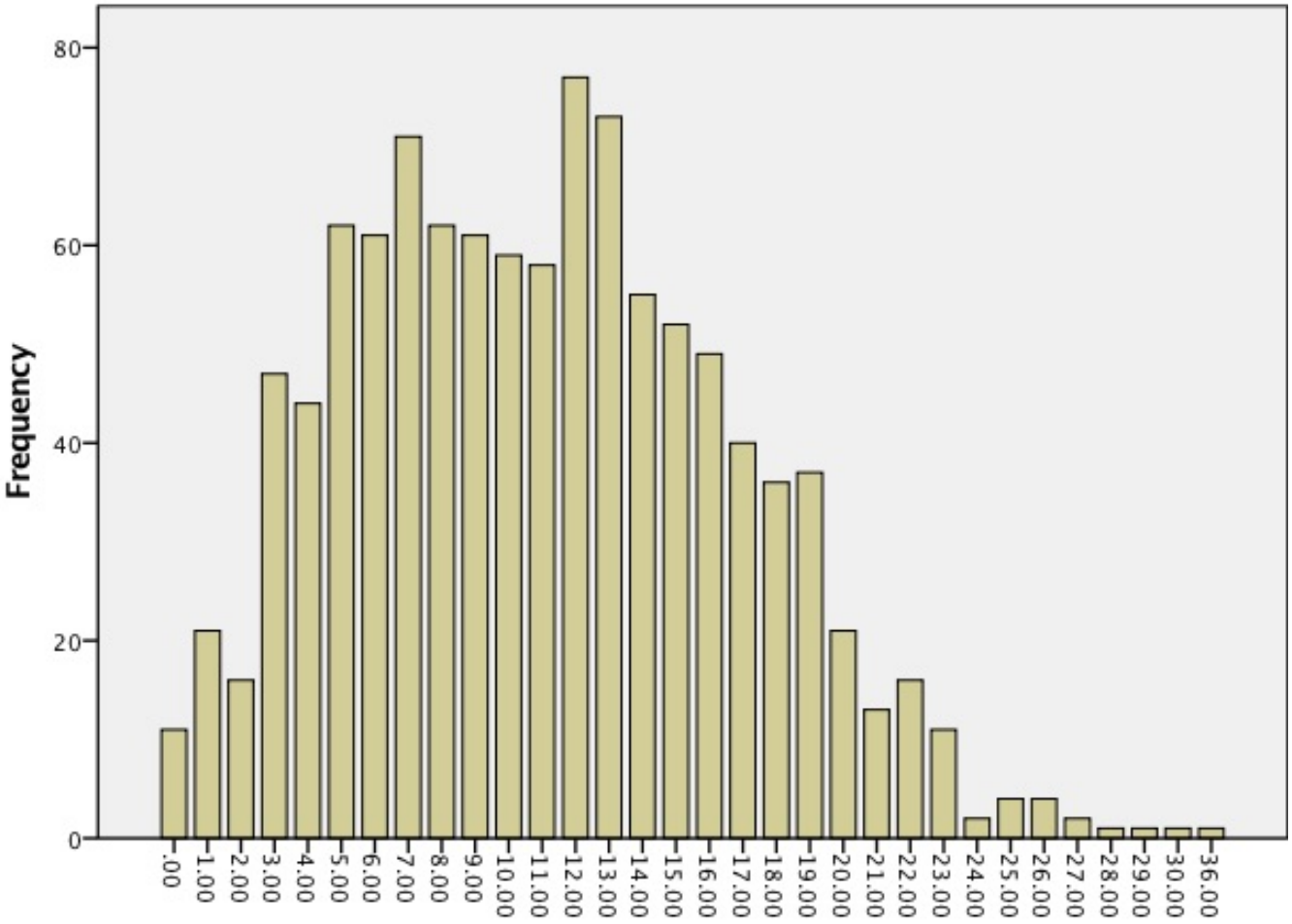


Figure 4: Frequency distribution of scores on the PSD at age 17

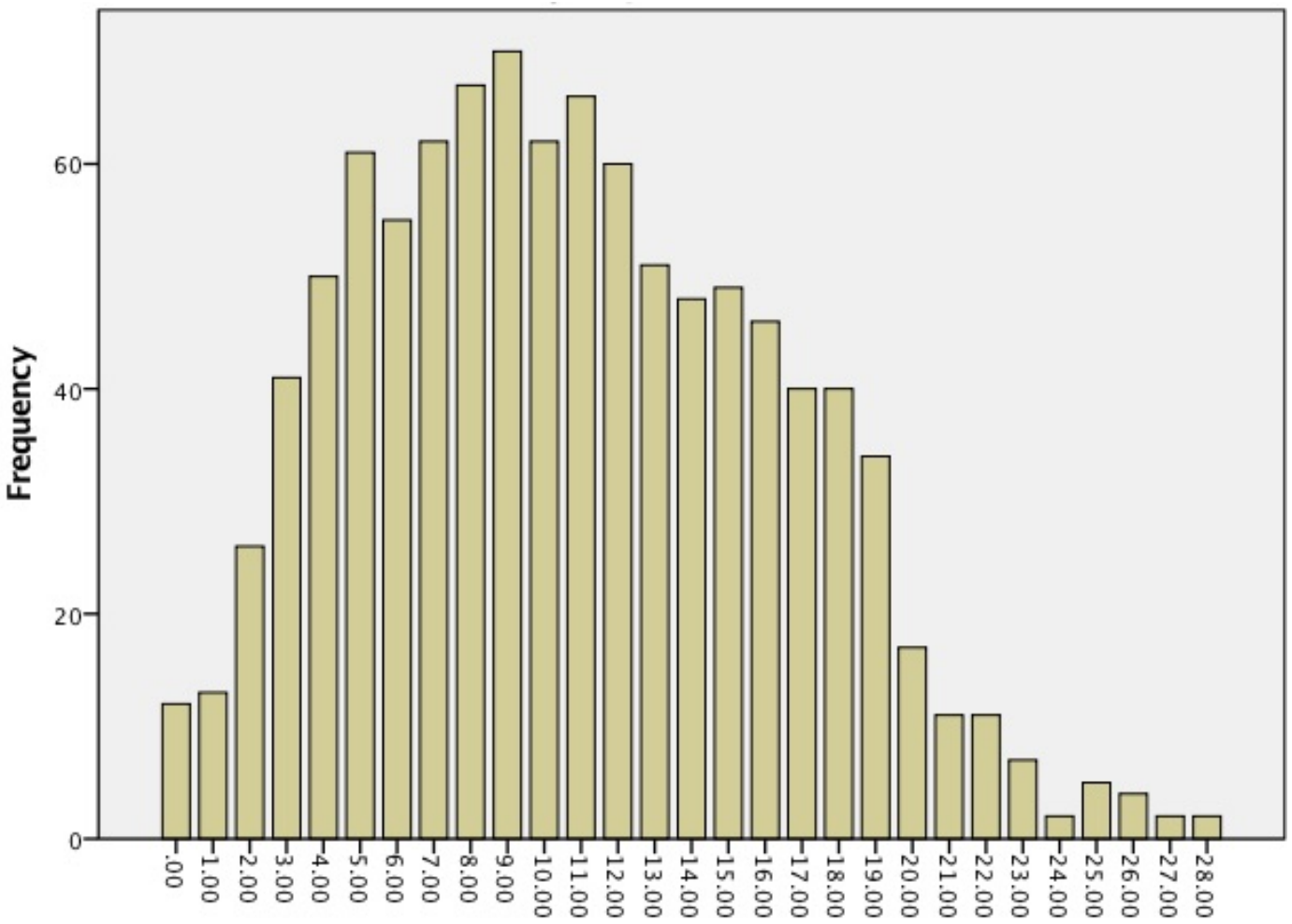


Figure 5: Aim 2 – Results

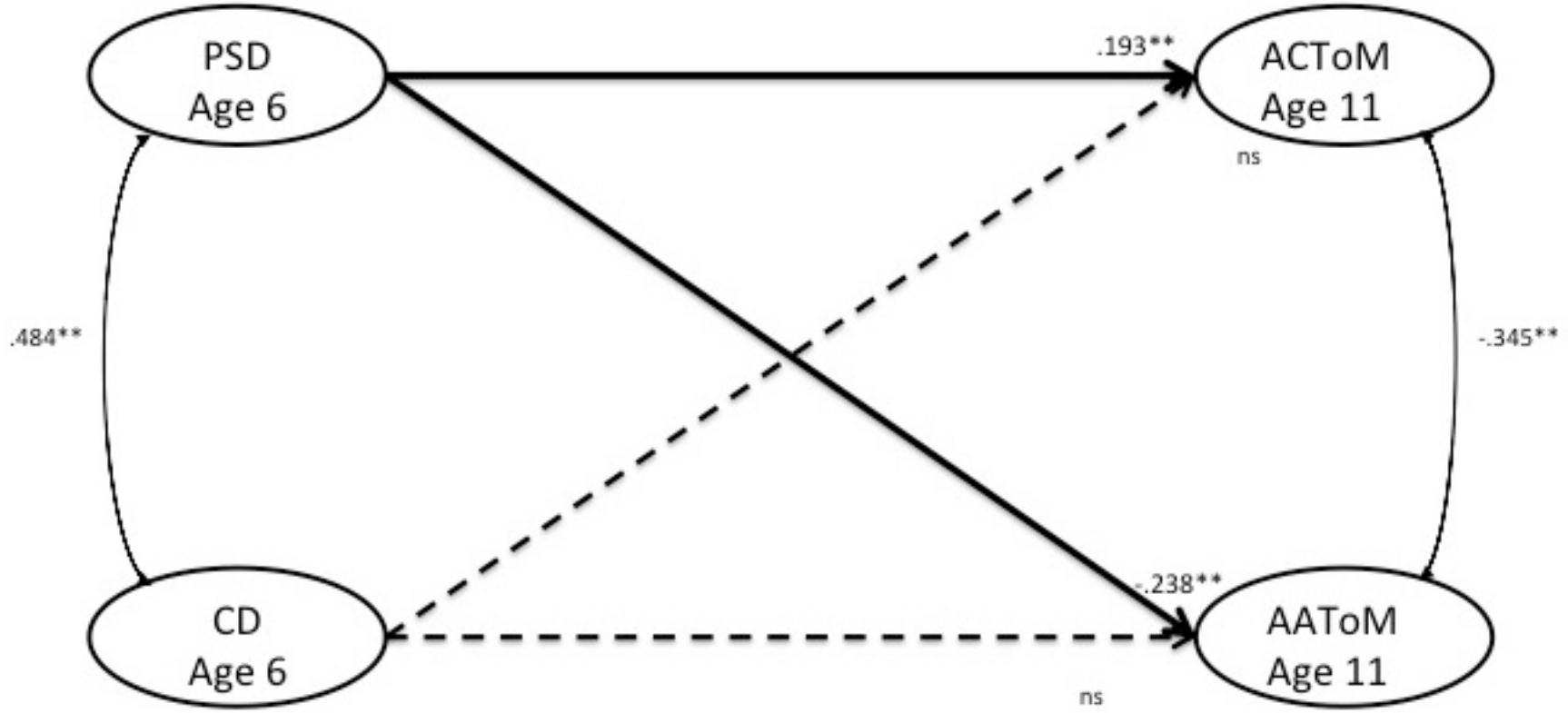
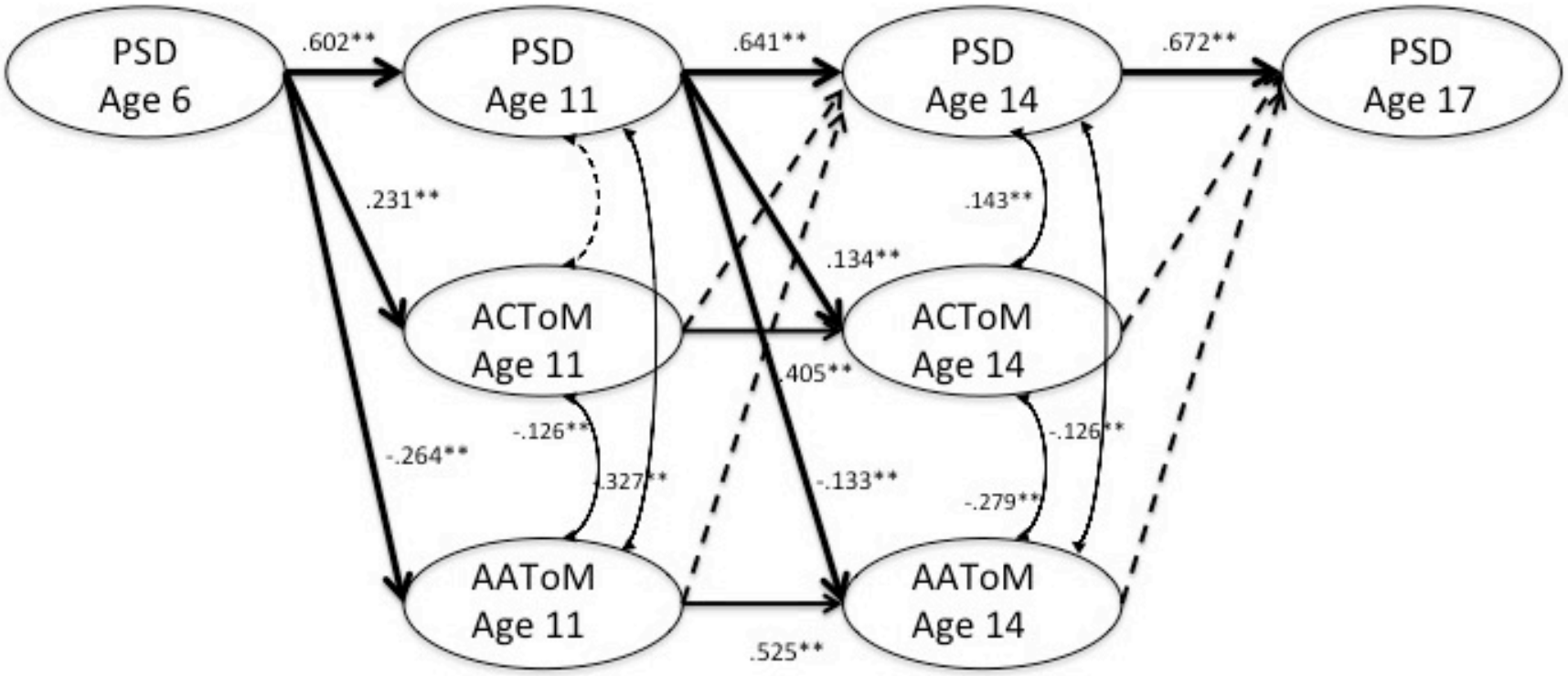


Figure 6: Aim 3 – Results



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