CHARACTERIZING AND VALIDATING PROACTIVE AND REACTIVE AGGRESSION CLASSES IN A PROSPECTIVE SAMPLE

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ABSTRACT

Characterizing and Validating Proactive and Reactive Aggression Classes in a Prospective Sample

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Research investigating aggressive behavior among youth is plentiful; however, the field contains mixed findings in terms of risk factors, correlates, sequelae, and treatment response, suggesting that individuals who exhibit aggressive behaviors are heterogeneous. The current project utilized a person-centered perspective to characterize youth who differ in frequency and quality of aggressive behaviors and a variable-centered approach to validate these classes. Specifically, the aims of the current study were (a) to use latent class analysis (LCA) to identify classes of youth that are characterized by qualitatively and quantitatively different types of aggressive behaviors, and (b) to examine the external validity of the identified aggression classes in a large, prospective sample. Participants included 648 children (M = 11.42 $\pm$ .92 years; 76% Caucasian) assessed at five time points between the ages of 10 and 25 as part of a longitudinal project conducted through the Center for Education and Drug Abuse Research at the University of Pittsburgh. Analyses suggest five distinct aggression profiles in the sample; individuals exhibiting (1) primarily reactive aggression, (2) primarily proactive aggression (3) mixed reactive and proactive aggression, (4) loss of control (endorsement of a subset of reactive aggression items), and (5) low reactive and proactive aggression. Classes differed in their levels of executive functioning, peer processes, lack of guilt, internalizing symptoms, and provocation to aggression. Specifically, individuals who engaged in primarily proactive, primarily reactive, or mixed aggression exhibited significantly lower ECF than individuals in the low aggression class. Individuals who engaged in mixed aggression experienced greater peer rejection, associations with deviant peers, internalizing symptoms, and lack of guilt than individuals who exhibited low aggression at specific time points. Of note, individuals who engaged in primarily proactive aggression were more likely to experience internalizing symptoms than individuals who engaged in reactive or low aggression in late childhood and early adolescence and were more likely to report lack of guilt after misbehaving than members of other aggression classes across late childhood and early adulthood. Differences among classes in terms of these variables better characterize and validate the subgroups of aggressive youth identified in the latent class analysis. The study fills gaps in the literature by identifying concurrent and prospective correlates of aggression classes and decreasing the heterogeneity found in aggression-related research by considering the qualitative and quantitative ways in which individuals differ on aggression using a dimensional approach. These findings enhance understanding of risk processes related to aggression and inform interventions that focus specifically on ameliorating deficits displayed by youth with different aggression profiles.

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CHAPTER 1
INTRODUCTION

Disruptive behavior disorders affect approximately 3%-8% of children under the age of 18 (Loeber, Capaldi, & Costello, 2013) and account for one-third to one-half of referrals to child psychology clinics (Dulcan, 2010). Aggression, specifically, has been associated with a host of negative outcomes in adolescence and adulthood, such as violent offending, arrest, incarceration, and antisocial personality disorder (Card & Little, 2006; Pardini & Fite, 2010; Reef, Diamantopoulou, van Meurs, Verhulst, & van der Ende, 2011; Vitaro, Brendgen, & Tremblay, 2002). Understanding aggressive behavior has significant public health implications and research in this field is beginning to inform empirically based treatment and prevention programs (Lochman & Wells, 2002). However, literature regarding risk factors, symptom clusters, and treatment predictors associated with aggressive behavior and externalizing disorders remains murky, as there is a great deal of heterogeneity and contradictory findings within the broader field (Dodge & Pettit, 2003; Drabick, Bubier, Chen, Price, & Lanza, 2011; Frick & Viding, 2009; Loeber et al., 1993; Moffitt, 2008). For instance, some research has demonstrated that aggressive behavior is associated with social rejection, executive functioning deficits, chronic family adversity, and adult criminality, whereas other research fails to replicate these findings or finds that these factors hold true only among some individuals (Carter, Gray, Baillargeon, & Wakschlag, 2013; Loeber, Keenan, Lahey, Green, & Thomas, 1993; Tolan & Leventhal, 2013). Such heterogeneity has prompted research aimed at identifying homogeneous subgroups of aggressive youth (Burke et al., 2002, 2005; Drabick, Price, Lanza, & Chen, 2010; Loeber, Burke, Lahey, Winters, & Zera, 2000; Stringaris & Goodman, 2009).

When considering aggressive behaviors, one of the most commonly identified distinctions is between reactive and proactive aggression (Brown, Atkins, Osborne, & Milnamow, 1996; Dodge & Coie, 1987; Poulin & Boivin, 2000; Raine et al., 2006). Reactive aggression refers to defensive, explosive, affectively driven responses to perceived threats or goal obstruction and is theoretically rooted in Dollard, Doob, Miller, Mowrer, and Sears's (1939) frustration-anger theory of aggression. In this framework, reactive aggression is motivated by frustration and is exacted through impulsive, angry, or hostile acts (Vitaro & Brendgen, 2005) and these responses are thought to be related to general difficulties regulating negative emotions (Dodge & Coie, 1987). Individuals who engage in reactive aggression show deficiencies in social and coping skills such as negotiating, sharing, and handling teasing (Crick & Dodge, 1994; Vitaro, 2002).

In contrast to reactively aggressive behaviors, proactive aggression encompasses behaviors that are premeditated, less emotional, and predatory in nature (Brown et al., 1996; Dodge & Coie, 1987; Poulin & Boivin, 2000; Raine et al., 2006; Vitaro & Brendgen, 2005). Individuals who engage in proactive aggression are purported to have learned over time that aggressive behavior yields rewarding results and continue to perpetrate aggressive acts even when unprovoked (Dodge & Coie, 1987). Proactive aggression therefore follows the tenets of Bandura's (1973) social learning model of aggression and is often referred to as "instrumental aggression."

The distinction between proactive and reactive aggression has been shown to be reliably measured and internally valid (Brown et al., 1996; Dodge & Coie, 1987; Poulin & Boivin, 2000; Raine et al., 2006) and differences in the cognitive, temperamental, and regulatory qualities of youth who engage in reactive and proactive aggression have been identified (Vitaro et al., 2002). Though youth often display a combination of the two types of aggression (Dodge, 1991), there is strong evidence for factorial and functional distinctions (Little, Henrich, Jones, & Hawley, 2003), as well as etiological, developmental, and conceptual differences (reviewed in Vitaro & Brendgen, 2005). Subtypes of aggression are likely associated with different trajectories, as well as correlates of those trajectories. For example, youth who engage in reactive aggression may show cognitive, social, and internalizing problems that worsen over time and youth who engage in proactive aggression may exhibit normative cognitive abilities and symptom levels (e.g., Fanti, Frick, & Georgiou, 2009; Fite, Hendrickson, Rubens, Gabrielli, & Evans, 2013; Fite, Rubens, Preddy, Raine, & Pardini, 2014; Frick, Kimonis, & Aucoin, 2008; Marsee, Weems, & Taylor, 2008; Muñoz, Raine et al., 2006; Vitaro et al., 2002 White, Jarrett, & Ollendick, 2013).

Given heterogeneity among aggressive youth, a useful approach for evaluating aggression involves a person-centered analysis (such as latent class analysis), which allows identification of patterns of aggression that differ in terms of frequency and/or quality of aggression among individuals (Bates, 2000; Muthén & Muthén, 2000). The pattern of overlap between aggression subtypes makes detecting group differences through typical methods (e.g., correlational or multiple regression analyses, group-based analyses) difficult and patterns may not emerge as significant because of the small number of individuals high on proactive aggression but low on reactive aggression (Muñoz et al., 2008). Therefore, person-centered methods often are recommended for studying aggression subtypes (Barker et al., 2006; Frick, 2006). The present dissertation uses latent class analysis (LCA) because this method can identify more homogenous groups of individuals (i.e., classes) based on similarities in different dimensions (e.g., proactive vs. reactive aggressive behaviors) and degree within dimension (e.g., high vs. low aggression) (Muthén & Muthén, 2000; Nylund, Asparouhov, & Muthén, 2007). Importantly, this approach allows for the potential identification of a class of individuals who engage in elevated levels of both reactive and proactive aggression, a group that has received relatively less attention in the literature.

As one way of determining whether identified classes have external and/or predictive validity, variable-centered analyses that consider whether classes differ on correlates assessed at different time points (i.e., tests of equality of means) were then conducted. Further, if the classes differ in meaningful ways, the results could provide beneficial information for the development of targeted prevention and intervention programs. Research indicates that aggressive subtypes are associated with different patterns of cognitive deficits, types of peer processes, frequencies of internalizing symptoms, and responses to provocation (Card & Little, 2006). In the following sections, the findings that support these variables as potential validators of aggressive classes are reviewed.

Executive Cognitive Functioning

Though the precise definition of executive cognitive functioning (ECF) has been debated for decades, the "unity-but-diversity" viewpoint presented by Miyake et al. (2000) has been largely accepted by the field and posits that there are distinct, but correlated, components of ECF (i.e., working memory, shifting, response inhibition) that differentially predict performance on higher level planning tasks. Given support for this view in the literature (Lehto, Juujärvi, Kooistra, & Pulkkinen, 2003) particularly in the context of aggressive subtypes (Poland, Monks, & Tsermentseli, 2015), the present study focused on abilities such as inhibition, attentional control, working memory, cognitive flexibility, planning, and problem-solving rather than alternative conceptualizations such as self-control and neuropsychological performance.

Across developmental periods, poor performance on ECF tasks has been associated with externalizing and antisocial behavior more broadly (Giancola et al., 1998; Moffitt & Lynam, 1994; Raine, 2002; Raine et al., 2005; reviewed in Sergeant et al., 2002) and physical aggression specifically (Giancola, Martin, Tarter, Pelham, & Moss, 1996; Séguin et al., 1999; Séguin, Nagin, Assad, & Tremblay, 2004). A meta-analysis (Morgan & Lilienfeld, 2000) demonstrated that antisocial individuals display ECF abnormalities such as disinhibition, motoric control problems, working memory deficits, perseverative behaviors, planning deficits, and information-processing problems (Coolidge, DenBoer, & Segal, 2004; Séguin, Arseneault, Boulerice, Harden, & Tremblay, 2002). Findings of this meta-analysis indicate that antisocial individuals performed .62 standard deviations worse on tests of executive function (medium to large effect size) than comparison groups.

However, research suggests that not all individuals with aggression problems show deficits across all areas of ECF (Blair, 2004, 2006; Drabick et al., 2011; Oosterlaan, Scheres, & Sergeant, 2005; Pennington & Ozonoff, 1996; Teicher & Golden, 2000; Thorell & Wahlstedt, 2006; van Goozen et al., 2004). Individuals who engage in proactive aggression or premeditated crimes have been shown to perform similarly to non-aggressors on ECF tasks (Blair, 2004; Levi, Nussbaum, & Rich, 2010).

Very few studies have examined how ECF relates specifically to proactive and reactive aggression among children and adolescents. A recent study (Ellis, Bahr, & Lochman, 2009) reported that among boys aged 9 to 12, reactive aggression was associated with deficits in response inhibition and planning ability, but proactive aggression was not significantly associated with performance on any ECF tasks. Similarly, White et al. (2013) found that among children aged 6 to 16, reactive aggression was associated with poor behavior regulation (inhibitory control, shifting, emotional control) and metacognition (initiation, working memory, planning and organization, and monitoring), whereas proactive aggression was not associated with ECF deficits. These studies support the notion that mixed results in the examination of ECF and externalizing problems may be due to the presence of ECF deficits among youth who engage in reactive aggression, and age-appropriate levels of ECF among youth who engage in proactive aggression (Blair, 2004, 2010; Drabick et al., 2010). Therefore, ECF may differentiate and serve as an external validator for classes that differ in terms of frequency and/or quality of aggressive behaviors.

Peer Processes

Evidence suggests that peers view reactively aggressive acts more negatively than proactively aggressive acts (Dodge & Coie, 1987; Poulin & Boivin, 2000). Beginning in middle childhood, children express disapproval of others' aggressive behavior (Hay, Zahn-Waxler, Cummings, & Iannotti, 1992) and explosively aggressive children are often viewed warily by peers (Dodge et al., 1997). Among typically developing children, concerns regarding peer rejection contribute to conformity in nonaggressive behavior. However, children who engage in reactive aggression are posited to lack the regulatory skills to inhibit their aggressive impulses and the social skills to adeptly navigate provocative peer contexts (Burleson, 1982; Dodge et al., 2003). Reactive aggression has been associated with many off-putting characteristics such as poor leadership abilities, unskilled navigation of unfair or unsuccessful situations, an intolerance of teasing, and an inability to negotiate, share, or cooperate (Crick & Dodge, 1994; Day et al., 1992; Price & Dodge, 1989; Vitaro, 2002). As such, reactive aggression has been uniquely linked with peer rejection (Dodge et al., 1997; Fite et al., 2012a; Raine et al., 2006). Over time, such rejection likely becomes exacerbated, as early levels of aggression-related rejection are associated with increased social rejection at later time points (Bierman & Wargo, 1995).

Unlike their reactively aggressive counterparts, individuals who engage in proactive aggression are more likely to be rated as popular, be perceived as leaders, and have a number of friends, particularly friends who are delinquent and also proactively aggressive (Boivin & Poulin, 1997; Poulin & Boivin, 2000; Vitaro, Gendreau, Tremblay, & Oligny, 1998). Researchers posit that individuals who engage in proactive aggression are more likely to associate with deviant peers than individuals who engage in reactive aggression because they have stronger social skills, are generally more accepted by peers, and are less anxious/withdrawn (Vitaro et al., 1998). Further, antisocial behaviors associated with proactive aggressors such as lying, theft, disobedience, and coercion are more likely to be viewed by peers as mature, status affirming, and influential as children enter adolescence (Bukowski, Sippola, & Newcomb, 2000; Cillessen & Mayeux, 2004; Schwartz, Gorman, Nakamoto, & McCay, 2006). Consistent with the idea of behavioral homophily, (i.e., the tendency to seek out and affiliate with peers most like oneself), deviant peers are likely to select and attract similarly deviant individuals (Dishion et al., 1991; Kandel, 1978, 1996). Previous research indicates that associations with deviant peers increase from early to mid-adolescence (Elliott & Menard, 1996; Warr, 1993) and friends' proactive aggressiveness is associated with increases in children's own proactive aggression levels, whereas friends' reactive aggression has no significant influence on children's own levels of reactive aggression (Poulin & Boivin, 2000). Thus, peer factors may differentiate the aggression subtypes, with individuals engaged in proactive aggression displaying high associations with deviant peers and individuals engaged in reactive aggression experiencing high peer rejection.

Lack of Guilt

Reactive, but not proactive, aggression has been linked with feelings of shame and remorse (Cima, Raine, Meesters, & Popma, 2013; Fanti et al., 2009; Frick & Morris, 2004). Individuals who engage in reactive aggression likely do so impulsively with reduced consideration of consequences because of attenuated regulatory processes (e.g., poor inhibition; Blair, 2004; Vitaro & Brendgen, 2005). When calm, these individuals report knowing that it is wrong to intentionally harm someone and feel badly about misbehavior (Arsenio et al., 2009).

Conversely, youth who engage in proactive aggression justify provoked and unprovoked aggression based on the material and psychological gains attained in the process (Arsenio et al., 2009; reviewed in Blair, 2010). Individuals who engage in proactive aggression anticipate positive emotions following provoked and unprovoked aggression, focus on the goals achieved by aggression, and underestimate the angry emotions of their victims (Arsenio et al., 2009; Dodge et al., 1997). Among typically developing youth, learning that antisocial behaviors are morally wrong occurs through aversive conditioning. The distress of the victim and social disapproval from others triggers emotional responding and teaches the individual that social norm violations evoke negative responses and should be avoided. Individuals who engage in proactive aggression may not be deterred by social cues resulting from antisocial behavior (i.e., negative reactions from others), making it more likely that they will persist in aggressing (Blair, 2004, 2006; Frick & Morris, 2004). Research indicating that antisocial individuals are driven to attain rewards and exhibit decreased sensitivity to threat, punishment, and negative emotional expressions from themselves and others supports these hypotheses (Scerbo et al., 1990). Importantly, proactive aggression has been associated with callous-unemotional (CU) traits (Barry et al., 2007; Fite, Raine, Stouthamer-Loeber, Loeber, & Pardini, 2010; Fite et al., 2009) and individuals who score high on measures of CU traits tend to lack remorse or guilt. The lack of guilt among this group likely emboldens these individuals to continually use others for their own gain (Frick, Bodin, & Barry, 2000). Therefore, lack of guilt may differentiate and serve as an external validator for classes, with individuals who engage in proactive aggression showing greater endorsement of lack of guilt than individuals who engage in reactive or low aggression.

Internalizing Symptoms

Given that individuals who engage in reactive, but not proactive, aggression are more likely to feel guilty about their behavior and to be rejected by their peers, it is not surprising that reactive aggression has been linked with internalizing symptoms such as depressed mood and anxiety (reviewed in Bubier & Drabick, 2009; Card & Little, 2006; Fite et al., 2014; Marsee et al., 2008; Vitaro et al., 2002). Furthermore, reactive, but not proactive, aggression is associated with emotional reactivity, emotion dysregulation, and mood disorders (Hubbard et al., 2001; Vitaro et al., 2002; Xu et al., 2009). Anxiety likely precedes reactive aggression, though shared processes, such as hypervigilance and difficult temperament, may place individuals at risk for both anxiety and reactive aggression (Bubier & Drabick, 2009). As mentioned above, reactive aggression has been linked to the frustration-anger theory of aggression (Dollard et al., 1939), which suggests that explosive, affectively driven responses are motivated by frustration arising from goal obstruction (Vitaro & Brendgen, 2005). Anxious individuals often seek to withdraw from provoking situations, but when this goal is thwarted, negative emotions (i.e., frustration, anger) are thought to arise and increase the likelihood that reactive aggression will be utilized (Bubier & Drabick, 2009; Orobio de Castro, Koops, van Boxtel, & Merk, 2007). Among individuals with reactive aggression, anxiety may drive associations with internalizing problems. Fite et al. (2010) found that depression, anxiety, and stress at age 16 and age 26 were more strongly associated with reactive than proactive aggression, but after controlling for the stability of these internalizing symptoms, only anxiety remained a significant predictor in adulthood.

Reactive aggression also has been linked to depressive symptoms (Card & Little, 2006; Dodge et al., 1997; Fite, Stoppelbein, & Greening, 2009; Fung et al., 2013; Hubbard et al., 2001; Raine et al., 2006) and a high incidence of completed suicide (Angst & Clayton, 1998). Additionally, individuals who engage in reactive aggression are more likely to be socially isolated (Dodge & Coie, 1987; Dodge et al., 1997; Prinstein & Cillessen, 2003) and victimized by peers compared to individuals who engage in proactive aggression (Day et al., 1992; Poulin & Boivin, 2000; Shields & Cicchetti, 1998;

Xu & Zhang, 2008), which increases the likelihood of developing internalizing symptoms (Dodge et al., 1997).

Evidence of the positive correlation between reactive aggression and internalizing symptoms is compelling, but extant research supporting a negative relation between proactive aggression and internalizing symptoms has been mixed. In a meta-analysis of the relation between aggressive subtypes and internalizing problems (Card & Little, 2006), the direction and strength of the individual correlations were highly variable. Two studies found a significant negative relation between proactive aggression and internalizing symptoms, whereas one study found a significant positive correlation and five studies showed no significant correlation. Across the eight studies, a small, positive zero-order correlation between reactive, but not proactive, aggression and internalizing problems was identified. A recent longitudinal study showed that adolescent reactive, but not proactive, aggression was associated with depression and anxiety symptoms 3 years later, but only among adolescents who had high levels of peer rejection and/or poor communication with their parent (Fite et al., 2014). It is likely that individuals who engage in reactive aggression experience a persistence of internalizing symptoms (Fite et al., 2010), whereas individuals who engage in primarily proactive aggression exhibit fewer internalizing symptoms over time, consistent with the general trend among normative young adults (Pine, Cohen, Gurley, Brook, & Ma, 1998). Thus, classes based on reactive and proactive aggression items would likely be differentiated by internalizing symptoms, with individuals who engage in reactive aggression displaying greater internalizing symptoms than individuals who engage in proactive or low aggression.

Provocation to Aggression

Though experimental aggression paradigms are well established, very few studies have examined whether performance on these paradigms differs across aggression subtypes or subgroups of youth who differ in their aggression profiles (Giancola et al., 1995; Muñoz et al., 2008). Some studies found that behavioral responses to provocation did not differentiate aggression subtypes because aggressive responding was associated with both proactive and reactive aggression (Atkins, Osborne, Bennett, Hess, & Halperin, 2001; Phillips & Lochman, 2003). However, in a study examining the aggressive responses of 85 male juvenile detainees (ages 13-18), differentiation among aggressive subtypes was found after considering provocation level during the aggression task (Muñoz et al., 2008). Though individuals of all groups (mixed reactive-proactive, reactive-only, and low aggression) engaged in high levels of retaliatory aggression during the high provocation condition, differentiation was established at the low and no provocation conditions; specifically, individuals high on reactive aggression showed an increase in aggressive responding in the low provocation condition relative to the other groups. Individuals in the mixed aggression class showed high levels of aggressive responses across high, low, and no provocation conditions. Though no proactive-only group was identified, the findings suggest that aggressive responding occurs among youth who exhibit both reactive and proactive aggression even in the absence of provocation, whereas the reactive-only group appears uniquely prone to aggressive responding in minimally provocative conditions.

These findings also support broader conceptualizations of qualitatively and quantitatively different aggression classes. Individuals who engage in reactive aggression are believed to be more emotionally volatile, resentful, vindictive, and spiteful (Burke, 2009; Drabick, Price, Lanza, & Chen, 2010) and are therefore likely to react with increasing hostility as rewards are removed by a purported "opponent." Conversely, individuals who engage in proactive aggression enact aggression to attain rewards or get their way (Raine et al., 2006) and aggress irrespective of provocation. Proactive aggression is not reliably associated with emotional or cognitive deficits (Dodge & Pettit, 2003; Frick & Morris, 2004; Pardini et al., 2003) and instead has been linked with callousness, fearlessness, and decreased sensitivity to the negative emotions of others (Barry et al., 2007; Fite et al., 2009, 2010). Overall, these results suggest that each aggressive subtype may exhibit different behavioral patterns in response to provocation and these patterns likely align with the broader conceptualizations of each subtype of aggression. Given the mixed findings related to provocation to aggression in the literature, examining aggressive responding in a large, prospective study is expected to provide additional validation of the identified classes.

The Current Study

Heterogeneity exists within the broad conceptualizations of externalizing behaviors and there is a dearth of person-centered, longitudinal analyses that consider how distinct subgroups of youth who differ in frequency and/or type of aggressive behavior may be characterized and validated (Vitaro & Brendgen, 2005). The present study utilized LCA to identify distinct subgroups (i.e., classes) of youth who exhibit differing aggressive behavior profiles characterized by proactive and reactive aggressive behaviors measured during early adolescence. The external validity of the classes was then assessed by evaluating whether and to what extent observed aggression profiles differed on auxiliary variables (i.e., external validators) collected during childhood, adolescence, and young adulthood, including internalizing (i.e., anxiety and depression) symptoms, ECF, peer variables, lack of guilt, and aggressive responding. Data were drawn from an existing sample of individuals (described in greater detail below) who were assessed across five time points: ages 10-12 years (Time 1), 12-14 years (Time 2), 16 years (Time 3), 19 years (Time 4), and 25 years (Time 5). It was proposed that individuals who engage in reactive aggression would be characterized by low ECF, high peer rejection, low deviant peer associations, more frequent feelings of guilt, and high levels of internalizing problems. Conversely, individuals who engage in proactive aggression are predicted to exhibit average ECF, high deviant peer association and low peer rejection, low feelings of guilt, and low levels of internalizing problems. Individuals who exhibit high levels of both forms of aggression are hypothesized to exhibit the lowest feelings of guilt and fall between the primarily proactive and primarily reactive classes in terms of internalizing symptoms, ECF, peer rejection, and associations with deviant peers. Specific aims and hypotheses of the proposed study are outlined below.

Aim 1. To identify subgroups of aggressive youth (person-centered analysis).

The first aim of the current project was to identify subgroups or classes of youth that are characterized by different aggressive behaviors in early adolescence (ages 12-14, Time 2). It was expected that multiple classes would be identified by the LCA. Hypotheses regarding classes were formed based on literature validating the presence of aggressive behavior subtypes in the general population (reviewed in Vitaro & Brendgen, 2005).

Hypothesis 1. It was hypothesized that the following four classes would emerge from the LCA: individuals who engaged in (a) primarily proactive aggression, (b) primarily reactive aggression, (c) both proactive and reactive aggression, and (d) low levels of aggression. Though all four of these classes have been identified in prior research (reviewed in Vitaro & Brendgen, 2005), very few studies have examined these distinctions from a person-centered approach, which allows for consideration of qualitative and quantitative differences in aggressive behaviors among individuals. Identifying these classes between the ages of 12-14, when children are transitioning into middle school and undergoing changes associated with puberty, can capture aggression processes while children are still in a formative period of development. Further, conducting the aggression analyses early in adolescence allowed for consideration of individuals before the normative adolescent spike in externalizing, reward-seeking, and risk-taking behaviors occurs (Blumstein et al., 1986; reviewed in Maughan et al., 2004; Steinberg, 2008, 2010), which could saturate the data.

Aim 2. Examine the external validity of the identified aggression classes by evaluating differences among classes on auxiliary variables (i.e., internalizing problems, ECF, peer processes, lack of guilt, and provocation to aggression) (variable-centered analyses).

Following the identification of latent classes, tests of equality of means across classes were used to examine the external validity of the identified classes; specifically, whether and to what extent classes differ on ECF, peer processes, lack of guilt, internalizing symptoms, and provocation to aggression.

Hypothesis 2a - ECF. Given growing evidence that ECF deficits are associated with reactive aggression, but age-appropriate levels of ECF are found among youth who engage in proactive aggression (Blair, 2004, 2010; Drabick et al., 2010; Ellis et al., 2009; White et al., 2013), it was hypothesized that the primarily reactive class would have the lowest levels of ECF abilities, while the primarily proactive aggression class would perform similarly to the low aggression class and exhibit high ECF abilities. The ECF performance of the class elevated on both reactive and proactive aggression was hypothesized to fall between the performance of the primarily reactive and primarily proactive classes, given that these individuals likely possess the necessary cognitive functioning to enact proactive aggression, but these abilities may get overridden when provocative situations are encountered.

Hypothesis 2b – Peer Factors. Given associations between peer rejection and reactive aggression (Boivin et al., 1998; Fite et al., 2013; Fite, Rathert, Colder, Lochman, & Wells, 2012; Raine et al., 2006), it was hypothesized that the primarily reactive aggression class would exhibit the highest levels of peer rejection relative to the other classes. The low aggression class was hypothesized to have the lowest levels of peer rejection, followed by the primarily proactive aggression class. The mixed aggression class was hypothesized to fall in between the primarily proactive and primarily reactive classes in terms of peer rejection, as evidence suggests that youth who exhibit both proactive and reactive aggression may be relatively popular and happy in their peer relationships (Day, Bream, & Pal, 1992).

Unlike their reactively aggressive counterparts, individuals who engage in primarily proactive aggression are more likely to have a number of friends, particularly friends who are delinquent and also proactively aggressive (Poulin & Boivin, 2000). Thus, it was hypothesized that the primarily proactive aggression class would be more likely to endorse associating with deviant peers than the primarily reactive aggression class or the low aggression class. The mixed aggression class was hypothesized to display intermediate levels of associations with deviant peers, as the engagement in reactive aggression may turn non-aggressive peers away, whereas engagement in proactive aggression may encourage the selection and attraction of similarly aggressive youth in accordance with the principle of behavioral homophily (Kandel, 1978, 1996).

In terms of prospective associations, it was hypothesized that the primarily reactive and mixed aggression classes would continue to show significantly more peer rejection than the primarily proactive class and the low aggression class at each of the five time points. It was also hypothesized that mean levels of associations with deviant peers would remain elevated among the primarily proactive class compared to the other classes. Associations with deviant peers increase generally from early to mid-adolescence (Elliott & Menard, 1996; Warr, 1993), and individuals who engage in proactive aggression are particularly influenced by friends' proactive aggression (Poulin & Boivin, 2000), so were hypothesized to report even higher levels of associating with deviant peers than individuals in the other classes.

Hypothesis 2c - Lack of Guilt. Consistent with research indicating that reactive aggression is associated with feelings of shame and remorse (Dodge, Lochman, Harnish, Bates, & Pettit, 1997), it was hypothesized that the primarily reactive aggression class would be would be less likely to report *lack* of guilt following misbehavior (collected at Times 1-5) than the primarily proactive aggression class. The reactive and proactive combined aggression class was hypothesized to show the highest levels of lack of guilt, as a previous study demonstrated that adolescents characterized by high levels of CU traits were more likely to exhibit combined proactive and reactive aggression than either type of aggression alone (Fanti et al., 2009). It was predicted that lack of guilt would be lowest in the primarily reactive aggression class compared to the primarily proactive and mixed classes, particularly at later time points, as research suggests that steep increases in perspective-taking (Cauffman & Steinberg, 2000; Steinberg & Cauffman, 1996) and moral reasoning (Armon & Dawson, 1997) occur during mid- to late adolescence and early adulthood.

Hypothesis 2d – Internalizing symptoms. Groups characterized by higher levels of reactive aggression were hypothesized to experience higher levels of internalizing symptoms than classes lower on reactive aggression. This hypothesis was grounded in research indicating that reactive aggression is associated with stress (Fite et al., 2010), intense and poorly regulated negative emotions (Burke, 2009; Dodge & Coie, 1987; Drabick et al., 2010) and internalizing problems more broadly (Fite et al., 2014; Marsee et al., 2008; Vitaro et al., 2002). For the class exhibiting mixed aggression, moderate levels of internalizing symptoms (lower than the primarily reactive aggression class and higher than the primarily proactive class) were expected in line with prior research (Vitaro et al., 2000). Developmentally, depressive symptoms show a normative decrease after adolescence (Pine et al., 1998). Differences in internalizing symptoms among the aggression classes (e.g., between the reactive aggression class and other classes) may be particularly pronounced at later time points, because the normative decline in internalizing symptoms will likely reduce noise in the data, leaving the most persistent and severe symptoms (theorized to occur in the reactive class) to contrast those exhibited by other classes.

Hypothesis 2e – Provocation to aggression. The present study also examined whether aggression responses on a provocation to aggression task differ across the aggression classes in differing provocation conditions (low or high). It was hypothesized that the primarily reactive class would aggress the most (i.e., subtract more points) under conditions of high provocation. The primarily proactive class was hypothesized to aggress under both provocation conditions. Individuals who engage in proactive aggression purportedly enact aggression to attain rewards or get their way (Raine et al., 2006), suggesting that during the task, individuals who engage in proactive aggression would act aggressively in both provocation conditions to bully the “opponent” into subtracting fewer points on future trials. The low aggression class was hypothesized to aggress the least in both provocation conditions.

CHAPTER 2
METHOD

Participants

The present study involved secondary analysis of data collected at the Center for Education and Drug Abuse Research (CEDAR) at the University of Pittsburgh as part of a National Institute on Drug Abuse (NIDA)-funded longitudinal study. The aims of the original CEDAR project primarily included examining the etiology of substance use disorders using a longitudinal research design. Recruitment of biological fathers with a history of substance use disorder, psychiatric disorder, or no psychiatric diagnoses who had a 10-12 year old child (index child) was conducted through substance use treatment programs, social service agencies, newspaper and radio advertisements, public service announcements, and random digit telephone calls. Utilizing many recruitment sites decreased the risk of sampling bias (Merikangas et al., 1998).

Index children were classified into the following categories according to their father's lifetime prevalence of mental health disorders: (a) history of substance use disorder, (b) history of other psychiatric diagnosis not including substance use disorder, or (c) no lifetime history of psychiatric diagnosis. Fathers were screened for substance abuse or dependence disorder history using *DSM-III-R* criteria (1987), which was the most recent version of the *DSM* when the study began. Index children were studied over a 20-year period. Assessments began in 1990 and by 2009, 775 families had been recruited.

Recruitment and baseline assessments occurred when index children were 10-12 years (Time 1; N = 775, 72% male). Follow-up assessments were completed when index children were 12-14 years (Time 2; n = 651; 71% male), 16 years (Time 3; n = 618, 73% male), 19 years (Time 4; n = 582, 73% male), and 25 years (Time 5; n = 468, 71% male).

Recruitment of female index children began later than males because of changes in NIH gender equity regulations after the CEDAR project commenced. The sample was predominantly Caucasian (78%; 18% African-American, 4% other ethnicities). Families were excluded from the study on the basis of a history of neurological disorders, schizophrenia, or uncorrectable sensory incapacity in the father; or neurological injury requiring hospitalization, IQ less than 70, chronic physical disability, uncorrectable sensory incapacity, or psychosis in the index child. More extensive recruitment source information and procedures, as well as inclusionary and exclusionary criteria, are described in detail elsewhere (Clark et al., 1997; Tarter & Vanyukov, 2001).

Procedure

Procedures were approved by the University of Pittsburgh Institutional Review Board. Adult participants were provided with informed consent, as well as information about the goals, procedures, risks, and benefits of the research protocol. Of the fathers recruited who met criteria to participate, 87% consented. Minor children provided assent. ECF tasks were completed at Time 1. Mothers reported on child internalizing symptoms, lack of guilt, and peer rejection at Times 1 and 2. Index children reported on their aggression at Time 2; associations with deviant peers at Times 1, 2, and 3; and internalizing symptoms and guilt at Times 1-5. The provocation to aggression task was completed at Time 1.

Measures

Reactive Aggression. The reactive aggression items were derived using results from a factor analysis conducted on the same dataset used in the present study by Giancola et al. (1996). Five items were drawn from two self-report inventories. These data were collected when participants were 12 to 14 years of age (Time 2). Two items were chosen from the Irritability Scale, which is a 30-item, 6-point Likert-type measure of impulsive aggression (Caprara et al., 1985). The Irritability Scale has been shown to have adequate internal consistency, test-retest reliability, and construct validity across different cultural contexts. Content validity was demonstrated by interrelations with other irritability measures, and construct and discriminant validity was demonstrated in a series of experimental studies. The items selected for the LCA were (1) “Sometimes when I am angry I lose control over my actions” and (2) “Sometimes I shout, hit, and kick to let off steam.” Response anchors were 1 (*completely true*), 2 (*fairly true*), 3 (*generally true to a certain extent*), 4 (*generally false to a certain extent*), 5 (*fairly false*), and 6 (*completely false*). Some responses, such as “completely false” had a low base rate within the sample and resulted in positively skewed data. Thus, anchors 1-3 were collapsed into a “true” category and anchors 4-6 were collapsed into a “false” category. Collapsing items in this manner also allowed the responses from this questionnaire to parallel responses to the Hostility Guilt Inventory (below).

The other three items were chosen from the Hostility Guilt Inventory, a 38-item true/false measure of hostile aggression (Kazdin, Rodgers, Colbus, & Siegel, 1987). The Hostility Guilt Inventory has been demonstrated to be internally consistent (as demonstrated by coefficients of reliability and significant item-total score correlations) and distinguishes children who do and do not meet diagnostic criteria for conduct disorder. The three items selected for the LCA were as follows: (3) “People who are always bugging you are asking for a punch in the nose,” (4) “I often feel like a bomb ready to explode," and (5) "Whoever makes fun of me or my family is asking for a fight." Response options were 0 (*true*) or 1 (*false*).

Although the Irritability Scale and the Hostility Guilt Inventory both contain additional items, the five selected items were used in seminal work examining reactive aggression in the present sample and the items demonstrated convergent validity in a confirmatory factor analysis (Giancola et al., 1996). The confirmatory factor analysis with a forced 1-factor solution for these 5 items revealed that factor loadings for these items were .68, .72, .52, .70, and .70, respectively. Many of the additional items on each scale did not as successfully tap the construct of reactive aggression, but rather focused on different constructs like rebelliousness ("When someone makes a rule I don't like, I would often like to break it"), irritability (e.g., "Sometimes people bother me just by being around"), or negative feelings without accompanying aggressive actions specified (e.g., "It makes me very upset to have somebody make fun of me"). Other items were not clearly delineated as reactive or proactive because of a lack of context (e.g., "Sometimes I really want to pick a fight"). Therefore, the set of items used previously by Giancola et al. (1996) were believed to be appropriate selections for the construct of reactive aggression.

Proactive Aggression. A total of 4 items assessing proactive aggression were selected from three sources: a modified version of the Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS; Kaufman et al., 1997; Puig-Antich et al., 1981), the Disruptive Behavior Disorder Scale (Pelham, Evans, Gnagy, & Greenslade, 1992), and the Child Behavior Checklist (CBCL; Achenbach, 1991b) completed at Time 2 based on their correspondence to the construct of proactive aggression. One item was selected from the index child's K-SADS Diagnostic Interview, which uses *DSM-IV* criteria to rate children on a variety of symptoms and disorders. Index children were asked, "Were you physically cruel to people?" Response options were 0 (*no*), 1 (*yes*). From the Disruptive Behavior Disorder Scale, a measure derived from *DSM-III* criteria, the selected item was "Often deliberately does things that annoy other people, e.g., grabs other children's hats." Response options were 0 (*not at all*), 1 (*just a little*), 2 (*pretty much*), or 3 (*very much*) and responses from both mother and teacher were utilized. From the CBCL (Achenbach, 1991b), mothers reported on the index child. The item was "Cruelty, bullying, or meanness to others." Participants responded using a 3-point scale, rated as 0 (*almost never*), 1 (*sometimes*), or 2 (*always*). These 4 items assess a variety of elements known to be hallmarks of proactive aggression, including provoking others and purposefully causing harm (Poulin & Boivin, 2000; Raine et al., 2006). Some response choices had a low base rate within the sample and resulted in positively skewed data. Thus, the "sometimes" and "always" anchors were collapsed. As with the reactive aggression construct, the inclusion of other items available in the dataset was not feasible because these items assessed aggression broadly (e.g., "Did you hit someone with the idea of hurting them") without evaluating the context. Thus, the items selected to assess proactive aggression were chosen for their ability to assess the deliberate, unprovoked cruelty characteristic of proactive aggression.

Internalizing Symptoms. Reports of children's internalizing symptoms were obtained at Times 1-5. At Times 1 and 2, mothers reported on index children's internalizing symptoms using the CBCL (Achenbach, 1991b), a widely used standardized measure of behaviors, problems, and competencies. The CBCL utilizes a composite internalizing (anxiety and depression) subscale for children, based on research demonstrating that anxiety and depression often co-occur and a lack of clear distinction between the two sets of symptoms, especially using a developmental perspective (e.g., Angold et al., 1999; Brady & Kendall, 1992; Moffitt et al., 2007). At age 16, children reported on their own internalizing symptoms using the Youth Self-Report (YSR; Achenbach, 1991c; Achenbach & Edelbrock, 1987), a complementary version of the CBCL. At ages 19 and 25 individuals self-reported on internalizing symptoms using the Young Adult Self-Report (YASR; Achenbach, 1997), another parallel version of the CBCL designed for use with individuals over age 18. Sample items include "I feel worthless or inferior" and "I am nervous or tense." Participants responded using a 3-point scale, selecting 0 (*almost never*), 1 (*sometimes*), or 2 (*always*). Different reporters were used given research supporting higher reliability in parent-report of internalizing symptoms among younger children and self-report among older youth (Edelbrock, Costello, Dulcan, Kalas, & Conover, 1985). *T* scores were utilized to maximize interpretability (scores between 60-63 are subclinical and scores >64 are clinical).

Overall, the CBCL, YSR, and YASR are considered reliable and valid measures, as suggested by high correlations with other measures of internalizing problems (Achenbach, 1991a, 1991b, 1991c, 1997; Achenbach, Dumenci, & Rescorla, 2001) and discriminant analyses in which high percentages (i.e., 80%) of children were correctly classified into referred or non-referred statuses (Achenbach & Rescorla, 2001). These measures have been normed and validated in many studies with various populations (Achenbach, 1991a, 1991b, 1991c, 1997; Myers & Winters, 2002). Additionally, the internalizing subscale has been shown to be a valid and reliable way of assessing problematic behaviors among clinical and community-based samples (Achenbach, 1991a, 1991b, 1991c, 1997).

Lack of Guilt. Lack of guilt was assessed at Times 1-5. At Times 1 and 2, the participant's mother reported on child lack of guilt using the CBCL (Achenbach, 1991b). On the item "Doesn't seem to feel guilty after misbehaving," mothers responded 0 (*not true*), 1 (*somewhat or sometimes true*), or 2 (*very true or often true*). At Time 3, participants self-reported lack of guilt using the YSR (Achenbach, 1991c). On the YSR, the item used to assess guilt was, "I don't feel guilty after doing something I shouldn't" and the response anchors were 0 (*not true*), 1 (*somewhat or sometimes true*), or 2 (*very true or often true*). At Times 4 and 5, participants self-reported lack of guilt using the YASR (Achenbach, 1997) and the item and response anchors were the same as on the YSR.

Peer Rejection. Peer rejection was assessed at age Times 1-5 using items from the CBCL (mother-reported at Times 1 and 2), the YSR (self-reported at Time 3), and the YASR (self-reported at Times 4 and 5). Four items used across inventories asked about getting along with other kids, getting teased a lot, not being liked by other kids, and feeling that others are out to get them. Response anchors were 0 (*not true*), 1 (*somewhat or sometimes true*), or 2 (*very true or often true*). The selected items demonstrate face and content validity. Research conducted on a sample of 289 racially diverse adolescent males (M = 16 years) from the Pittsburgh Youth Study found adequate internal consistency for these four items (α = .77; Fite et al., 2014). To create an index of peer rejection, scores on the four items were summed and ranged from 0 to 8.

Associations with Deviant Peers. At Times 1, 2, and 3, youth reported on the proportion of their friends who engaged in delinquent and antisocial behaviors over the previous six months (e.g., hit someone with the idea of hurting that person, used alcohol) using 15 items from the Peer Delinquency Scale (PDS) of the Pittsburgh Youth Study Interview (Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998). Items assess how many friends the participant knows who engaged in variety of delinquent behaviors (e.g., skipping school without an excuse, drug use, using weapons or force to rob others) in the past 6 months (Moss, Lynch, Hardie, & Baron, 2002). Items were rated on a scale from 0 (*none of my friends*) to 4 (*all of my friends*) and a summed score was used for each participant to reflect the overall degree of exposure to deviant peers. Among the current sample, higher overall scores on the PDS have been linked to neurobehavioral disinhibition (Feske et al., 2008) and increased risk for youth conduct problems and substance use (Moss et al., 2002; Moss, Lynch, & Hardie, 2003). The Cronbach alpha computed for the PDS in the current sample was 0.76 (Blackson, 1994) and Loeber et al. (1991) reported a similar Cronbach alpha (0.84) in a separate study of boys (N = 500).

Provocation to Aggression. At Time 1, a modified version (Pelham et al., 1991) of the Taylor (1967) reaction-time (RT) task was administered to evaluate aggression in response to provocation. Participants competed against a presumed "opponent" on a RT task to win points that could be exchanged for prizes. The opponent was actually the preprogrammed responses of a computer. Upon winning a trial, participants earned 100 points and had the opportunity to subtract 0-100 points from their opponent. Upon losing a trial, participants lost 0-100 points depending on the number of points their opponent subtracted. Aggression was operationalized as the number of points participants subtracted from their opponent. This type of task has been shown to be a valid measure of aggressive behavior (Giancola et al., 1995; Giancola & Zeichner, 1995; Murphy et al., 1992; Pelham et al., 1991).

On the computer, participants attempted to hit a key as quickly as possible following a visual cue. After winning a trial, participants told the experimenter and opponent the number of points they wished to subtract. After losing a trial, participants heard an ostensibly live (tape-recorded) message telling them the number of points subtracted by their opponent. Participants won 32 trials and lost 16 trials. Half of all losing trials were "high provocation" trials, where the opponent subtracted 80-100 points from the participant and half were "low provocation" trials, where the opponent subtracted 0-20 points. Low provocation phrases (e.g., "You almost won this time, I guess I won't take any points from you") and high provocation phrases ("A two year old plays faster than you! I'll take 100 points again") were displayed as well. Aggression was operationalized as the number of points subtracted from the opponent after a winning trial, considering the provocation condition of the most recent losing trial. Therefore, two variables were considered: the sum of points subtracted following high provocation trials and the sum of points subtracted following low provocation trials.

Executive Cognitive Functioning (ECF). At Time 1, youth completed a battery of executive control functioning tests that were administered by trained clinicians. Scores on these tests (specified below) constitute a single first-order factor that has been used to discriminate youth at high and low risk for substance use disorders and to predict reactive aggression (Aytaclar et al., 1999; Giancola et al., 1996). Similar to previous research (Aytaclar et al., 1999), the 6 tests were combined into a single-factor score and z-scored in the present study. The following tasks were administered: Stroop Color Word Test (Stroop, 1935), Porteus Mazes Test (Porteus, 1965), Vigilance Test (Schneider & Detweiler, 1987), Motor Restraint Test (Parsons, Tarter, & Edelberg, 1972), Forbidden Toys Test (Cole, Usher, & Cargo, 1993; Silverman & Ragusa, 1992), and Block Design Test of the WISC-III-R (Wechsler, 1972).

For the Stroop Color Word Test, children were required to say the colors of word stimuli while ignoring the word name (e.g., to say “blue” when the word “red” is printed in a blue font) using a computer-based presentation. The ability to suppress perceptual interference is an indicator of attentional control (Stroop, 1935). For the Porteus Mazes Test, youth traced a path on increasingly difficult mazes. The Porteus Mazes Test is a commonly used test of planning ability (Porteus, 1965). The Vigilance Test (Schneider & Detweiler, 1987) involved participants viewing rapidly changing computer displays of four single letters in a 2×2 matrix, and they were required to hit the space bar when 1 of 2 target letters appeared. Impulse errors were measured as commissions to non-target stimuli (e.g., responding when the child should instead inhibit). The Motor Restraint task (Parsons et al., 1972) required youth to trace the outline of a 180° arc as slowly as possible on a computer monitor using a light-pen. The indicator of performance for the Motor Restraint task was the total time taken to complete 5 trials. In the Forbidden Toy task (Cole et al., 1993; Silverman & Ragusa, 1992), participants performed a chip-sorting task in the presence of toys with which they were instructed not to play, while observed through a mirror by two experimenters, who rated the frequency of off-task distraction. The two raters’ mean scores (interrater reliability correlation coefficient = .98) were used to indicate off-task behavior. This task measures on-task persistence despite distraction from surrounding stimuli, requiring intact attention, concentration, and inhibition abilities (Cole et al., 1993; Silverman & Ragusa, 1992). For the Block Design task (Wechsler, 1972), youth completed a series of timed trials in which they were required to organize blocks into patterns that matched a model design presented by the examiner. The Block Design task assesses visual abstract processing and problem solving.

Socioeconomic status. Household socioeconomic status (SES) was indexed using Hollingshead ratings (Hollingshead, 1990).

Statistical Analyses

To carry out the aims of the present study, analyses (1) examined whether classes of youth who differ in frequency and/or quality of aggressive behaviors can be identified, and (2) validated the classes by examining differences among classes on a variety of auxiliary variables (i.e., internalizing symptoms, ECF, peer processes, lack of guilt, and provocation to aggression). LCA was used to empirically identify subgroups of youth with different aggression profiles based on responses to the previously described self-reported reactive and proactive items. Comparisons of means across these aggression classes (omnibus between-group analyses followed by pairwise comparisons if the omnibus test is significant) then were conducted with the auxiliary variables at available time points.

Analyses were conducted using Mplus 7.11 (Muthén & Muthén, 1998-2013) statistical software. To address missing data, Mplus uses Full-Information Maximum Likelihood (FIML) estimation, which conducts parameter estimation and estimates standard errors all in one step using all available data (Graham, 2009). Other strategies for managing missing data (e.g., listwise or pairwise deletion, mean imputation) may result in biased analyses (Bodner, 2008; Graham, 2009; Little & Rubin, 2002). FIML assumes that the missing data are either missing completely at random (MCAR) or missing at random (MAR) and does not estimate the missing data, as would be the case with mean- or regression-based imputation techniques. FIML fits the covariance structure model directly to the observed (and available) raw data for each participant (Enders, 2001). This approach allows for maintenance of participants with missing data in model estimation and yields smaller errors in parameter estimates and standard errors relative to other strategies for addressing missing data (Enders, 2001; Graham, 2009; Newman, 2003).

Aim 1. To identify subgroups of aggressive youth

To address the first aim, latent class analysis (LCA) was conducted using Mplus. LCA (Muthén & Muthén, 2000) empirically derives groups of individuals based on the aggregation of observed items (5 reactive aggression items, 13 proactive aggression items). LCA is a person-centered data reduction method for identifying unmeasured class membership among participants using categorical and/or continuous observed variables, capturing unobserved heterogeneity in outcomes (Heinen, 1996; McCutcheon, 2002). LCA was used to estimate models examining subgroups of children with varying levels of aggression at Time 2 (ages 12-14). LCA refers to these groups of individuals as latent categorical classes. Empirically deriving latent classes of observed items is considered to be more effective than using a traditional classification with cut-off scores (Nylund et al., 2007a), as using arbitrary cut-off scores could lead to false positives or negatives because of classification errors, reduced ability to predict differences in outcomes, challenges identifying and generalizing rates of behaviors, and reduced validity in identifying groups of youth who may benefit from intervention efforts. Thus, LCA was an appropriate approach for identifying subgroups of youth who differ in their aggression profiles based on responses to reactive and proactive aggression items.

LCA uses both statistical indices and conceptual or practical implications in selection of the best-fitting model (Nylund et al., 2007b). The 1-class model, which is the independence model based on the observed means in the data, is fit first (Nylund et al., 2007b). Next, the number of classes incrementally increases until the model no longer converges and/or no longer is conceptually sound. Two model parameters are evaluated to assess model fit: item probability parameters and class probability parameters. Item parameters correspond to conditional item probabilities, which are dependent on latent class membership (Nylund et al., 2007b). The item probability parameter describes the probability that an individual in a given latent class has of endorsing that item. The class probability parameters contain information regarding the prevalence of each class in the population (i.e., the relative frequency of this class membership). Conditional item probabilities relay substantive meaning for each class. Values were plotted in an item probability plot, which facilitates interpretation of the latent classes and illustrates each class's profiles of item endorsement (Nylund et al., 2007b). The fit of each model to the data was determined by the conceptual model and model fit parameters (described below), with an emphasis on model parsimony. Each model was compared to the model with one fewer class (Nylund et al., 2007b).

As there is no single "gold standard" of statistical fit indices for LCA, a combination of indices was used to assess model fit and determine the optimal number of classes, based on recommendations by Nylund and colleagues (2007a). For the current study, the Bayesian Information Criterion (BIC; Schwartz, 1978); sample-size adjusted BIC (ABIC; Sclove, 1987); Akaike Information Criterion (AIC; Akaike, 1987); and Bootstrap Likelihood Ratio Test (BLRT; McLachlan & Peel, 2000; Nylund et al., 2007a) were used to assess model fit. For the BIC, ABIC, and AIC, lower values correspond to better fitting models. As the BIC penalizes a large number of parameters or small class sizes, this index generally identifies the best fitting model as one with larger class sizes and fewer parameters. The BLRT estimates log likelihood differences, and compares the fit of a model with *k* classes to a model with *k-1* classes to determine if model fit significantly improves with an additional class. The BLRT and BIC indices are considered the most reliable indicators of model fit in LCA (Nylund et al., 2007a).

Other tests for model comparison include entropy scores, which indicate the distinguishability of latent classes and the precision with which participants are placed into classes (Masyn, Henderson, & Greenbaum, 2010). Entropy values closer to one indicate clearer delineation of classes (Celeux & Soromenho, 1996). Posterior class probabilities were estimated as well, which are an index of the individual's probability of belonging to each class of the fitted model, given the individual's observed response pattern for aggression items. Posterior probabilities are based on the model's estimated item probabilities and estimated prevalence of each latent class. Class size was also taken into consideration, as small classes (<5%) may not be conceptually meaningful, suggest over-fitting of the data, and reduce the likelihood of model replication in future studies. Finally, model selection was based on the conceptual model and theories underpinning the analyses, the interpretability of the number of classes, and practical considerations, including how well the identified classes corresponded to hypothesized classes.

Aim 2. To examine the external validity of the identified aggression classes by evaluating whether classes differ on auxiliary variables.

The next set of analyses examined whether the classes identified in Aim 1 differ in terms of levels of internalizing problems, ECF, peer processes, lack of guilt, and provocation to aggression. Tests of equality of means were conducted to determine whether and to what extent classes differ regarding (a) internalizing symptoms at Times 1-5; (b) ECF at Time 1; (c) peer rejection at Times 1-5; (d) associations with deviant peers at Times 1-3; (e) guilt at Times 1-5; and (f) aggressive responding in the provocation to aggression task at Time 1. Age, child sex, paternal group status (substance abuse/psychiatric diagnosis or no diagnosis), and SES also were examined as auxiliary variables to determine whether classes differ on these variables. For the test of equality of means, class membership was held constant and weighted based on posterior probabilities, and χ^2 statistics for omnibus tests, along with pairwise comparisons across latent classes, were provided (Iampietro, Giovannetti, Drabick, & Kessler, 2012). These pairwise comparisons were interpreted only if the omnibus test is significant. All analyses were determined to be significant if $p < .05$.

CHAPTER 3
RESULTS

Descriptive Statistics

Of the 775 individuals who participated in the CEDAR study, 648 (84%) completed at least one item used to assess proactive and reactive aggression. Listwise deletion was used to remove participants who did not complete any of the proactive or reactive aggression items. Independent samples *t*-tests indicated that the final subgroup of participants did not differ from those with missing data on sex ($t(773) = 1.10$, $p = .27$, two-tailed, $d = .08$), ethnicity ($t(773) = -1.26$, $p = .21$, two-tailed, $d = .-09$), or socioeconomic status ($t(773) = .59$, $p = .56$, two-tailed, $d = .04$), but those with missing data were significantly older, $t(773) = -3.07$, $p = .002$, two-tailed, $d = -.22$. The percentage of youth endorsing each aggression item was included in the LCA model, as well as means and standard deviations for the external validators are reported in Table 1.

Point biserial correlations among aggression variables are reported in Table 2. The proactive items (variables 1-4) were significantly correlated with one another, though the magnitude of correlation between the first three proactive items with the teacher-reported item was lower than correlations among the other proactive items. The reactive items (variables 5-9) were significantly correlated with one another with approximately the same magnitude as the correlations among proactive items. Considering the size of the sample, correlations between proactive items and between reactive items could be characterized as mild. The proactive items were least correlated with the reactive items, though significance was still reached for many of these relations.

Table 1
Descriptive Statistics for Aggression Items and External Validators

LCA Items	Time Point	% Endorsed "Yes"	
Cruelty, bullying or meanness to others	2	16.18	
Physically cruel to people	2	11.43	
Deliberately annoys (self-report)	2	49.15	
Deliberately annoys (teacher report)	2	30.32	
Loses control over actions	2	45.88	
Shouts, hits and kicks to let off steam	2	35.61	
Whoever makes fun of me or my family is asking for a fight	2	35.77	
People who bug me are asking for a punch in the nose	2	19.75	
I often feel like a bomb ready to explode.	2	19.91	
External Validator Items	Time Point	*M*	*SD*
Peer delinquency	1	3.10	4.27
	2	5.09	6.21
	3	8.70	7.94
Low Provocation	1	399.51	237.20
High Provocation	1	733.27	105.71
Executive Cognitive Functioning	1	-0.03	0.99
Peer rejection	1	0.67	1.22
	2	0.69	1.25
	3	0.85	1.35
	4	0.58	1.16
	5	0.40	0.92
Doesn’t feel guilty after misbehaving	1	0.20	0.45
	2	0.27	0.53
	3	0.40	0.60
	4	0.31	0.52
	5	0.20	0.42
Internalizing Symptoms (*T* score)	1	48.69	9.39
	2	51.76	9.87
	3	46.17	10.66
	4	45.46	10.48
	5	46.29	11.23

Note. Average age of participants at each time point: Time 1: 10-12 years, Time 2: 12-14 years, Time 3: 16 years, Time 4: 19 years, Time 5: 25 years.

Table 2
Point Biserial Correlations Among Aggression Items

Variable	1	2	3	4	5	6	7	8
1. Cruelty, bullying or meanness to others								
2. Physically cruel to people	0.39**							
3. Deliberately annoys (self-report)	0.31**	0.31**						
4. Deliberately annoys (teacher report)	0.17**	0.16**	0.23**					
5. Sometimes I lose control over my actions	0.11**	0.15**	0.16**	0.17**				
6. Sometimes I shout, hit and kick to let off steam	0.15**	0.10*	0.16**	0.13**	0.40**			
7. Whoever makes fun of me or my family is asking for a fight	0.09*	0.05	0.14**	0.24**	0.27**	0.18**		
8. People who bug me are asking for a punch in the nose	0.05	0.19**	0.15**	0.18**	0.26**	0.28**	0.39**	
9. I often feel like a bomb ready to explode	0.10*	0.10*	0.07	0.14**	0.25**	0.28**	0.30**	0.33**

** $p < .01$; * $p < .05$.

Aim 1. To identify subgroups of aggressive youth using LCA

LCA models were conducted with items reflecting proactive and reactive aggression (Table 3). The one-class model was fit first, followed by models with two, three, four, five and six classes. Examination of Table 3 indicates that the BLRT for the six-class model was not significant, suggesting worse model fit than the five-class model. After eliminating the six-class model, the sample-size adjusted BIC was found for the five-class model. The BLRT indicated that the five-class model provided an improvement in fit from the four-class model. The sample-size adjusted BIC continued to drop until the five-class solution was reached (Figure 1). In addition to the fit indices supporting adoption of the five-class model, the class sizes are adequate (*n*s = 58, 113, 65, 74, 338) and produce unique profiles on the variables of interest, suggesting that these classes capture meaningful differences in aggression. These analyses were repeated with increased starting values and the same five-class solution was obtained each time. LCA models including age, ethnicity, sex, SES, and paternal diagnostic status (i.e., substance abuse/psychiatric diagnosis or no diagnosis) as auxiliary variables were also run.

Table 3

Fit Indices for Latent Class Analysis Models with 1-6 Classes

# Classes	# Free Parameters	Log Likelihood	AIC	BIC	ABIC	BLRT p-value	Entropy	Smallest Class n (% of sample)
1	9	-3049.94	6117.88	6158.14	6129.57	N/A	1	648 (100%)
	19	-2825.33	5688.66	5773.66	5713.34	<.001	0.678	215 (33%)
3	29	-2770.63	5599.26	5729.01*	5636.93	<.001	0.744	52 (8%)
4	39	-2744.09	5566.17	5740.65	5616.83	<.001	0.791*	62 (10%)
5	49	-2719.00	5536.02	5755.24	5599.66*	<.001*	0.733	58 (9%)
6	59	-2707.93	5533.86	5797.82	5610.50	0.286	0.722	54 (8%)

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; ABIC = sample-size Adjusted BIC; BLRT = Bootstrap Likelihood Ratio Test.
*Indicates best fitting model according to each index.

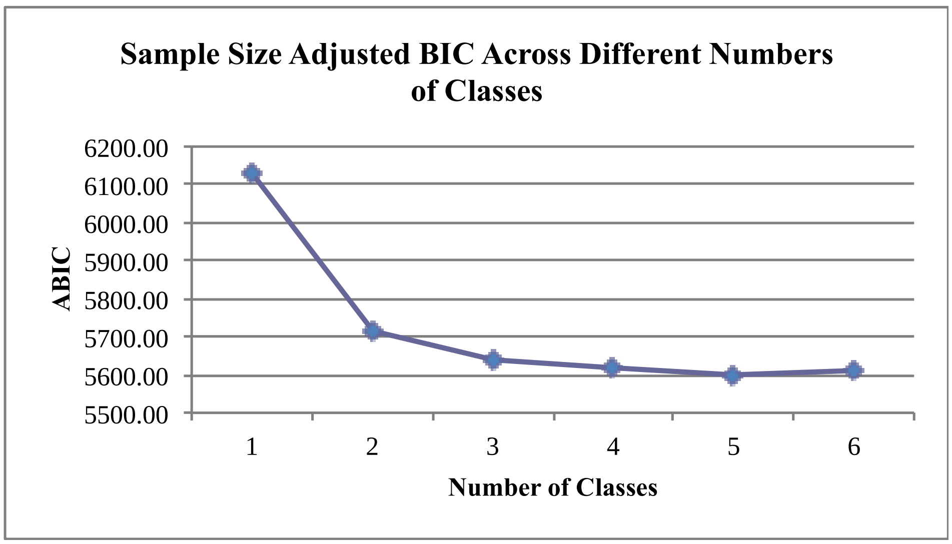

Figure 1. Sample size adjusted BIC across different numbers of classes.

Conceptual considerations and the theoretical framework were used to characterize the five-class model. Conditional item probabilities across the five classes are reported in Table 4 and illustrated in Figure 2.

Table 4
Conditional Item Probabilities Across the Five Classes

	Percent Endorsed				
LCA Items	Mixed Reactive/ Proactive	Primarily Reactive	Primarily Proactive	Loss of Control	Low Aggression
Cruelty, bullying or meanness to others	0.53	0.00	0.60	0.16	0.04
Physically cruel to people	0.42	0.04	0.49	0.08	0.00
Deliberately annoys (self-report)	1.00	0.43	1.00	0.46	0.30
Deliberately annoys (teacher report)	0.57	0.59	0.61	0.20	0.12
Loses control over actions	0.94	0.67	0.36	1.00	0.20
Shouts, hits and kicks to let off steam	0.84	0.48	0.28	0.87	0.13
Whoever makes fun of me or my family is asking for a fight	0.92	0.89	0.20	0.11	0.17
People who bug me are asking for a punch in the nose	0.68	0.51	0.11	0.15	0.03
I often feel like a bomb ready to explode	0.60	0.44	0.09	0.26	0.05

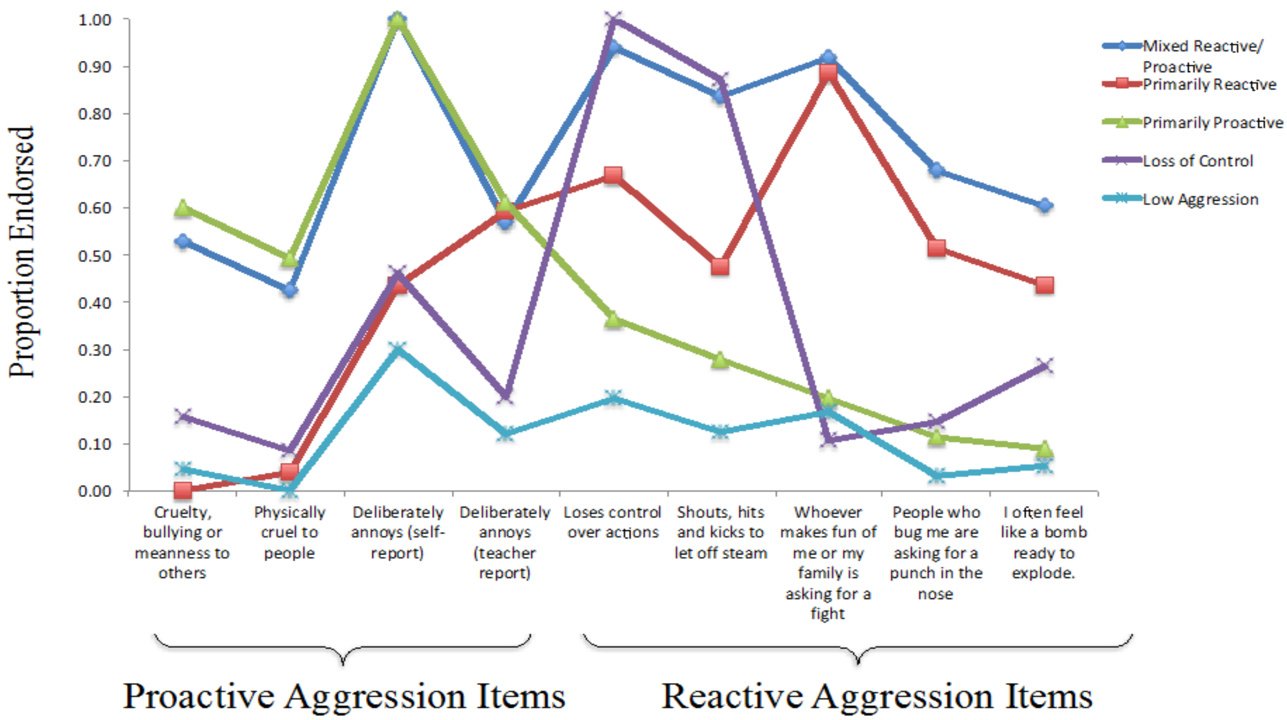

Figure 2. Conditional item probability plots of aggressive behaviors for the five-class model at age 13 (N = 648).

Consistent with LCA conventions, the classes were named based on the frequency and quality of symptom profiles. High and low distinctions were utilized when approximately more or less than 50% of the class endorsed items, respectively. Class 1, termed the mixed aggression class, contained individuals with high scores on reactive and proactive items (n = 58, 9%). This class displayed particularly high levels of reactive aggression, reflected in high rates of endorsement (60%-94%) for all five items. Approximately half of individuals in this class endorsed the first two proactive items "cruelty, bullying, or meanness to others" and "physically cruel to people." These are low base rate items and these values are similar to those found in the primarily proactive class described below. Endorsement of the remaining proactive items involving deliberately annoying others (self and teacher report), taken with high endorsement of reactive items, suggest that these individuals engage in above-average levels of both forms of aggression.

Individuals in Class 2, termed the primarily reactive aggression class, exhibited high reactive aggression scores (n = 113, 17%). This class endorsed relatively high rates (44%-89%) of the five reactive aggression items. Members of this class were particularly likely to endorse aggression in response to provocation (i.e., "whoever makes fun of me or my family is asking for a fight") and loss of control over actions. Though this class was also likely to endorse proactive items involving deliberately annoying others, there was virtually no endorsement of the more severe forms of proactive aggression (cruelty, bullying), suggesting that this class is closely aligned with a reactive rather than proactive aggression characterization.

Members of Class 3, termed the primarily proactive class, exhibited high proactive aggression scores and low reactive aggression scores (n = 65, 10%). This class was very likely to endorse the four proactive aggression items (60%-100% endorsement) and less likely to endorse reactive aggression items (9%-36%). Members of this group had the highest levels of endorsement of all four proactive aggression items and some of the lowest levels of reactive aggression item endorsement, increasing confidence that engagement in primarily proactive aggression was captured.

Individuals in Class 4, termed the loss of control class, exhibited lower proactive scores than the mixed or primarily proactive classes, but conflicting reactive item endorsement (i.e., high endorsement of losing control over actions and shout, hitting, and kicking to let off steam, but low endorsement of other reactive aggression items) (n = 74, 11%). Conceptually, this class may lose control over actions without experiencing the corresponding emotions described in the remaining reactive aggression items.

Lastly, Class 5, termed the low aggression class, was characterized by low scores on reactive and proactive aggression items (n = 338, 52%). The low aggression class had the lowest endorsement of all items with two exceptions. On the "Cruelty, bullying, or meanness to others" and "Whoever makes fun of me or my family is asking for a fight," items, the low aggression class had slightly higher endorsement than the primarily reactive and loss of control class, respectively.

Paternal Group Status, Ethnicity, Age, SES, and Sex. Table 5 shows the means and standard deviations for demographic variables by class. Members of the proactive aggression class were more likely to have fathers with a substance use disorder or other psychiatric disorder diagnosis than members of the low aggression class (χ^2=3.954, p=.047, φ =.078). To examine whether the distribution of aggressive behaviors and classes identified were different among children whose fathers did not meet diagnostic criteria for a psychiatric or substance use disorder compared to children in the sample as a whole, a separate LCA was conducted among children whose fathers did not meet diagnostic criteria for any disorder (n = 308). Results of this LCA indicated that class distinctions and patterns of aggressive behaviors in the 5-class model generally paralleled those in the model containing all 648 participants. This similarity in results suggests that although the low aggression class is more likely to contain children drawn from the group with no paternal diagnoses, all five classes are represented in the group of children with no paternal diagnosis, increasing the potential generalizability of these findings.

An omnibus chi-square test examining SES differences between the classes was also significant ($\chi^2 = 38.31$, $p < .01$, $\varphi = .243$). Pairwise analyses revealed that the SES of the primarily reactive class was significantly lower than all other classes (χ^2s > 5.56, ps < .018, φs > .180). The omnibus chi-square test assessing class differences in sex was significant ($\chi^2 = 23.62$, $p < .01$, $\varphi = .191$). Pairwise analyses revealed that members of the mixed, primarily reactive, and primarily proactive classes were more likely to be male than members of the low aggression class (χ^2s > 5.20, ps < .02, φs > .107). The omnibus tests for between-class differences in ethnicity ($\chi^2 = 7.37$, $p = .117$) and age ($\chi^2 = 1.39$, p = .858) were not significant.

Aim 2. To examine the external validity of the identified aggression classes by evaluating whether and to what extent classes differ on auxiliary variables.

Mean raw scores and *SD*s for the external validators across classes and omnibus chi-square test statistics are reported in Table 6. Classes significantly differed in auxiliary variables, suggesting distinct groups were captured by the LCA.

Table 5

Mean Raw Scores for the Demographic Variables Across Classes and Omnibus χ2 Tests

Categorical Variables

	Class 1: Mixed	Class 2: Reactive	Class 3: Proactive	Class 4: Loss of Control	Class 5: Low	Omnibus χ2 test		Pairwise Comparisons
	% Endorsed	% Endorsed	% Endorsed	% Endorsed	% Endorsed	χ2	*p*	
Sex (% male)	0.84	0.78	0.88	0.76	0.61	23.62*	0.00	1,2,3 > 5
Paternal Group (% with substance abuse/psychiatric diagnosis)	0.68	0.57	0.62	0.56	0.45	3.95*	0.05	3 > 5
Ethnicity (% Non-Caucasian)	0.29	0.43	0.16	0.14	0.26	7.37	0.12	-

Continuous Variables

	Class 1: Mixed		Class 2: Reactive		Class 3: Proactive		Class 4: Loss of Control		Class 5: Low		Omnibus χ2 test		Pairwise Comparisons
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	χ2	*p*	
Age	11.48	1.26	11.23	1.38	11.40	1.05	11.39	1.17	11.29	1.05	1.39	0.86	-
SES	40.75	20.13	32.11	20.03	40.30	16.58	43.99	18.02	44.73	15.98	38.31*	0.00	1,3,4,5 > 2

* $p < .05$.

Table 6

Comparisons of External Validators in the Five Class Model

		Class 1: Mixed		Class 2: Reactive		Class 3: Proactive		Class 4: Loss of Control		Class 5: Low Aggression		Omnibus χ2 test		Pairwise Comparisons*
	Time	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*χ2*	*p*	
Executive Cognitive Functioning	1	0.35	1.41	0.25	1.61	0.25	1.04	0.00	1.37	-0.26	1.08	29.33	0.00	1,2,3 > 5
Peer Rejection	1	1.29	2.09	0.65	2.10	1.19	1.51	0.96	1.90	0.35	1.21	34.16	0.00	1,4,3 > 5; 3 > 2
	2	1.35	1.87	0.86	2.46	1.39	1.95	1.02	2.22	0.29	1.03	51.55	0.00	1,2,4,3 > 5
	3	1.75	2.61	0.90	2.13	0.94	1.73	1.45	2.24	0.52	1.36	30.05	0.00	1,4 > 5
	4	1.13	2.23	0.84	2.27	0.73	1.57	0.68	2.06	0.35	1.36	15.49	0.00	1,2 > 5
	5	0.65	1.86	0.21	1.85	0.37	1.31	0.58	2.24	0.36	1.78	2.22	0.70	-
Associations with Deviant Peers	1	5.55	8.18	4.39	7.11	3.12	5.20	3.46	6.82	2.08	3.66	29.59	0.00	1,2 > 5
	2	8.47	9.84	7.43	10.53	5.51	6.68	5.01	9.26	3.56	6.05	33.88	0.00	1,2,3 > 5; 1 > 4
	3	15.26	13.74	13.11	15.36	9.72	8.58	7.15	9.23	6.20	8.20	55.54	0.00	1,2,3 > 5; 1,2 > 4; 1 > 3
Lack of Guilt	1	0.48	0.92	0.20	0.72	0.57	0.80	0.13	0.52	0.08	0.40	37.35	0.00	1 > 4,5; 3 > 2,5
	2	0.63	1.03	0.19	0.86	0.92	0.94	0.20	0.69	0.12	0.46	50.68	0.00	1 > 2,5,4; 3 > 2,5
	3	0.89	1.01	0.43	1.06	0.60	0.72	0.28	0.75	0.29	0.66	30.77	0.00	1 > 2,5,4; 3 > 5,4
	4	0.55	0.97	0.37	1.02	0.47	0.84	0.26	0.78	0.23	0.63	12.85	0.01	1,3 > 5
	5	0.27	0.79	0.15	1.03	0.47	0.95	0.02	0.57	0.18	0.79	11.99	0.02	3 > 2,5,4
Internalizing Symptoms	1	56.39	14.20	47.57	15.90	51.74	11.40	50.06	11.85	46.56	10.22	38.63	0.00	1 > 2,5,4; 4 > 5; 3 > 2,5
	2	62.20	12.92	49.08	17.20	58.37	11.02	52.80	14.26	48.71	10.31	104.14	0.00	1 > 2,5,4,3; 3 > 2,5,4; 4 > 5
	3	48.44	15.89	48.94	23.95	45.92	15.12	49.34	18.00	44.30	16.42	10.18	0.04	4 > 5
	4	50.99	16.71	46.67	18.69	46.19	13.78	47.10	15.97	43.67	13.60	15.29	0.00	1>5
	5	48.61	18.03	46.37	22.59	43.37	14.79	50.86	18.55	45.61	15.09	8.40	0.08	-
Low Provocation	1	460.69	465.33	377.81	476.24	459.23	367.46	490.56	347.54	360.92	360.64	11.68	0.02	4 > 5
High Provocation	1	722.96	252.14	761.01	139.27	758.99	93.64	744.51	130.12	716.98	183.44	8.83	0.07	-

Note. Class 1 = high reactive/proactive (n = 58); Class 2 = primarily reactive (n=113); Class 3 = primarily proactive (n=65); Class 4 = loss of control (n=74); Class 5 = low aggression (n=338)
Age of participants: 10-12 at Time 1, 12-14 at Time 2, 16 at Time 3, 19 at Time 4, and 25 at Time 5.
*All pairwise comparisons are significant at the p < .05 level.

Executive Cognitive Functioning (ECF). An omnibus chi-square test revealed significant between-class differences in ECF (Figure 3). Pairwise comparisons indicated that the mixed, primarily proactive, and primarily reactive classes exhibited significantly lower ECF than the low aggression classes (χ^2s > 9.10, *ps* < .003, φs > .142). The ECF of the loss of control class did not significantly differ from the other classes (χ^2s < 2.33, *ps* > .127).

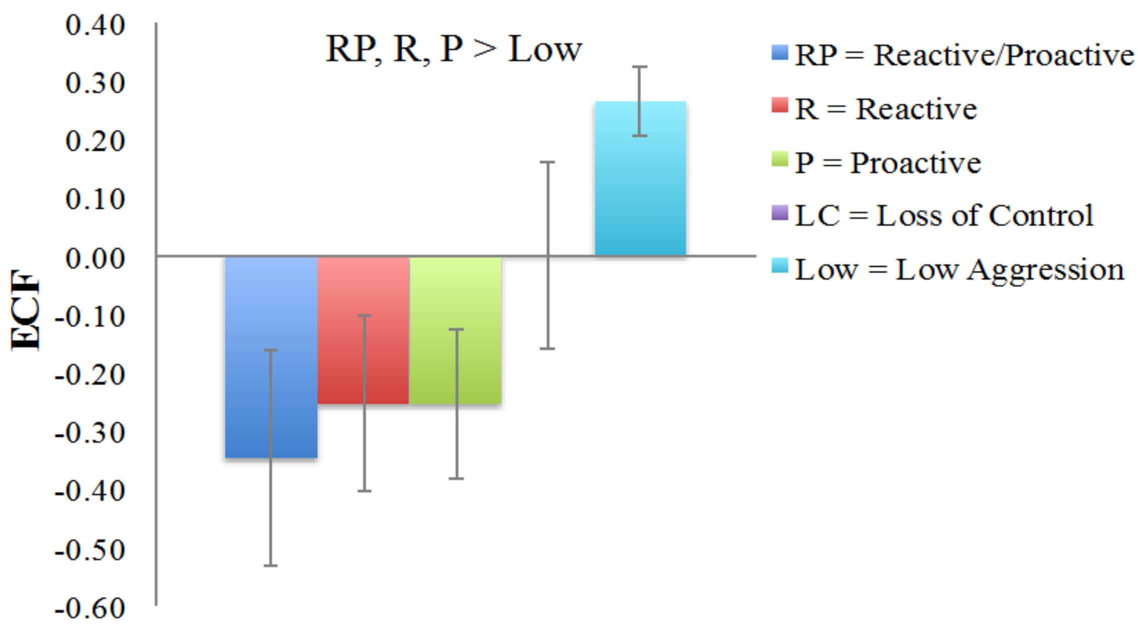

Figure 3. ECF across 5 classes at ages 12-14, with error bars displaying standard error.

Peer Rejection. Omnibus chi-square analyses revealed significant class differences in peer rejection at Times 1, 2, 3, and 4, but not Time 5 (Figure 4). At Time 1, the mixed, loss of control, and primarily proactive classes experienced significantly greater peer rejection than the low aggression class (χ^2s > 6.70, *ps* < .010, φs > .128). The primarily proactive class experienced significantly greater peer rejection than the primarily reactive class (χ^2 = 3.86, *p* = .049, φ = .147).

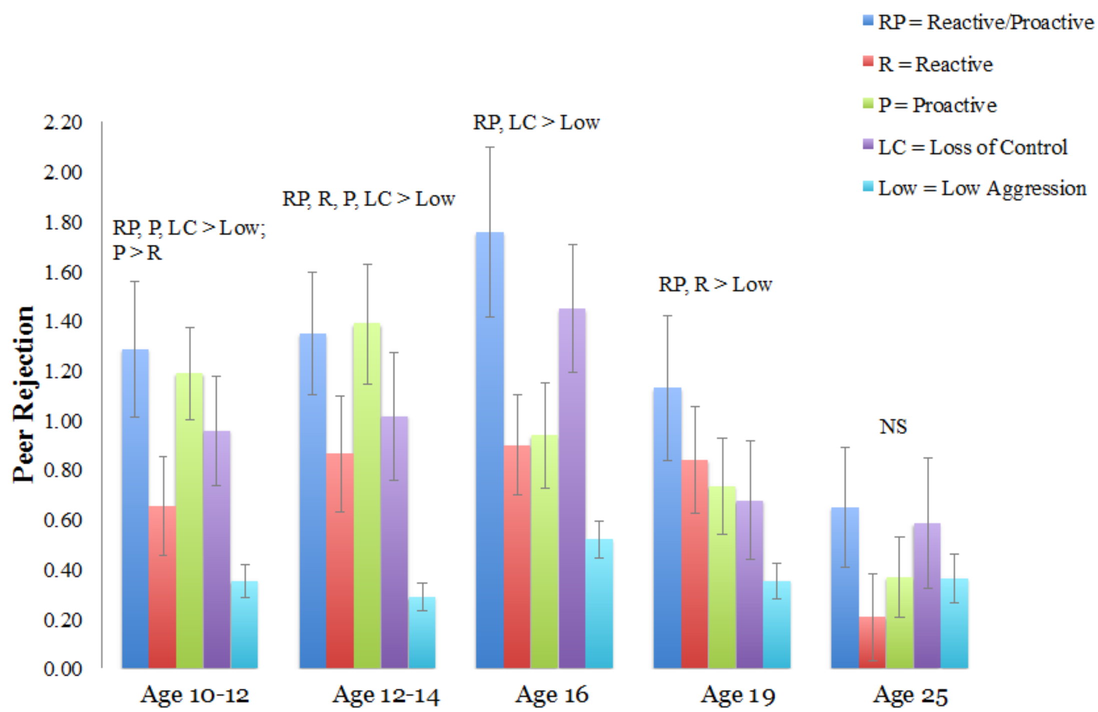

Figure 4. Mean peer rejection across 5 classes at ages 10-12, 12-14, 16, 19, and 25, with error bars displaying standard error.

At Time 2, all classes experienced greater peer rejection than the low aggression class (χ^2s > 5.31, *ps* < .021, φs > .109). At Time 3, the mixed and loss of control classes exhibited greater peer rejection than the low aggression class (χ^2 = 12.72, p < .001, φ =. 179; and χ^2 = 11.38, p = .001, φ = .166, respectively). At Time 4, the mixed and primarily reactive classes exhibited greater peer rejection than the low aggression class (χ^2 = 6.76, p = .009, φ = .131; and χ^2 = 4.11, p = .043, φ = .096, respectively). At Time 5, chi-square test assessing class differences in peer rejection was not significant (χ^2 = 2.22, p = .695).

Thus, the mixed aggression class persistently displayed the highest levels of peer rejection, the primarily proactive aggression class displayed higher levels of peer rejection than the reactive class in late childhood, and the loss of control class peaked in peer rejection in mid-adolescence. At age 16, rejection in the primarily proactive class decreased dramatically and rejection in the loss of control class increased to replace the proactive class as the second most rejected class. Peer rejection increased for all classes, with the exception of the proactive aggression class, from late childhood into adolescence. All classes displayed a subsequent decrease in peer rejection, such that the lowest levels were recorded in adulthood.

Associations with Deviant Peers. An omnibus chi-square test revealed significant between-class differences for associations with deviant peers (Figure 5). Pairwise comparisons indicated that at Time 1, the mixed and primarily reactive classes exhibited higher associations with deviant peers than the low aggression class ($\chi^2 = 10.39$, $p = .001$, $\varphi = .162$; and $\chi^2 = 9.79$, $p = .002$, $\varphi = .147$, respectively). At Time 2, the mixed, primarily reactive, and primarily proactive classes exhibited higher associations with deviant peers than the low aggression class (χ^2s > 4.36, *ps* < .037, φs > .104). The mixed class had higher associations with deviant peers than the loss of control class ($\chi^2 = 4.08$, $p = .043$, $\varphi = .176$). At Time 3, the mixed, primarily reactive, and primarily proactive classes exhibited higher associations with deviant peers than the low aggression class (χ^2s > 8.44, *ps* < .004, φs > .145). In addition, the mixed and primarily reactive classes exhibited higher associations with deviant peers than the loss of control class ($\chi^2 = 14.47$, $p < .001$, $\varphi = .331$; and $\chi^2 = 9.96$, $p = .002$, $\varphi = .231$, respectively). The mixed class exhibited higher associations with deviant peers than the primarily proactive class ($\chi^2 = 6.41$, $p = .01$, $\varphi = .228$). Thus, taken together, the mixed aggression class consistently reported the highest associations with deviant peers, followed by the primarily reactive class. Both classes were significantly higher in associations with deviant peers than the low aggression class across time points. Though the reactive class reported higher associations with deviant peers than the proactive class, this difference was not significant at any time point. Over time, all classes showed increases in associations with deviant peers.

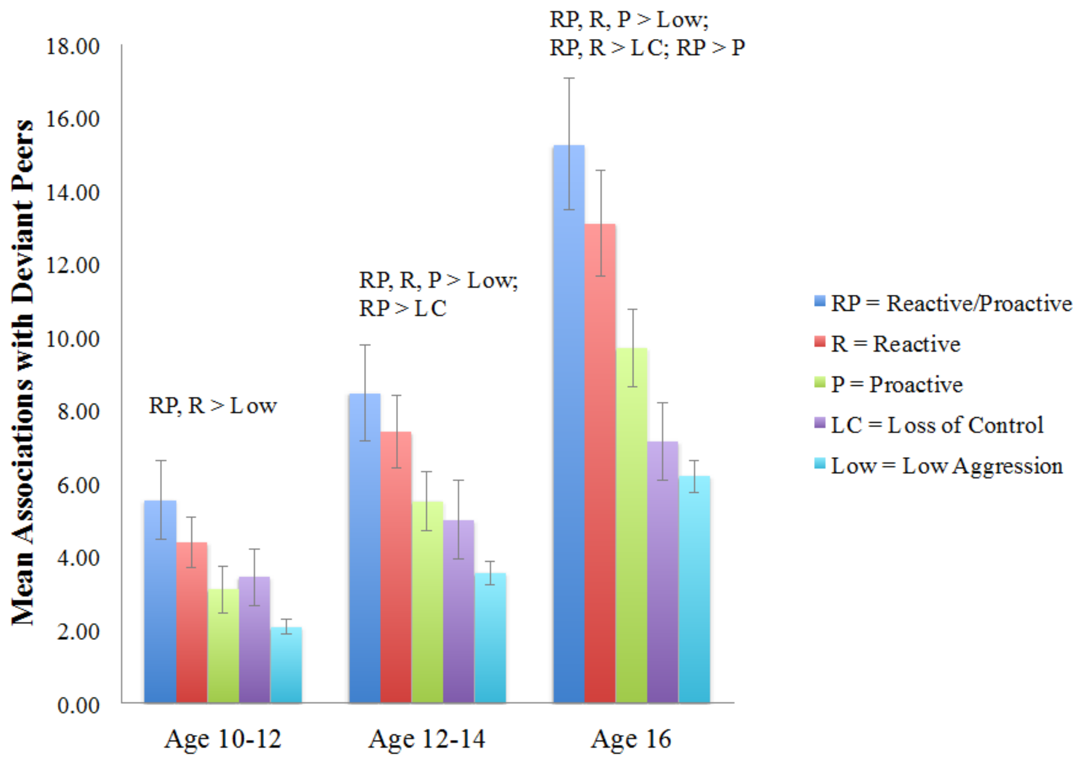

Figure 5. Mean peer delinquency across 5 classes at ages 10-12, 12-14, and 16, with error bars displaying standard error.

Lack of Guilt. An omnibus chi-square test revealed significant class differences in reported guilt (Figure 6). Pairwise comparisons indicated that at Time 1, the mixed class exhibited significantly higher levels of lack of guilt than the loss of control and low aggression classes ($\chi^2 > 6.52$, *ps* < .011, φs > .222). Also, the primarily proactive class displayed significantly higher levels of lack of guilt than the primarily reactive class ($\chi^2 = 9.32$, $p = .002$, φ = .229) and the low aggression class ($\chi^2 = 21.23$, $p < .001$, φ = .230). At

Time 2, the mixed class exhibited significantly higher levels of lack of guilt than the primarily reactive, loss of control, and low aggression classes (χ^2s > 6.13, *ps* < .013, φs > .189). Again, the primarily proactive class displayed significantly higher levels of lack of guilt than the primarily reactive ($\chi^2 = 19.07$, $p < .001$, φ=0.327) and low aggression ($\chi^2 = 32.23$, $p < .001$, φ = .283) classes. At Time 3, the mixed class exhibited significantly higher levels of lack of guilt than the primarily reactive, loss of control, and low aggression classes (χ^2s > 5.94, *ps* < .015, φs > .186). The primarily proactive class displayed higher levels of lack of guilt than the loss of control ($\chi^2 = 9.23$, $p = .002$, φ = .151) and low aggression ($\chi^2 = 6.21$, $p = .013$, φ = .211) classes. At Time 4, the mixed and primarily proactive classes exhibited significantly higher levels of lack of guilt than the low aggression class ($\chi^2 = 4.67$, $p = .031$, φ = .108; and $\chi^2 = 6.21$ $p = .013$, φ = .125, respectively). At Time 5, the primarily proactive class exhibited significantly higher levels of lack of guilt than the primarily reactive, loss of control, and low aggression classes (χ^2s > 4.50, *ps* < .034, φs > .158).

Thus, both the mixed and proactive aggression classes displayed highest levels of lack of guilt across all time points and were significantly higher than levels of guilt in the low aggression class. The proactive class endorsed greater lack of guilt than the reactive class across all time points, but these differences were only significant at ages 10-12, 12-14, and 25. Overall, lack of guilt peaked in mid-adolescence (with the exception of the proactive class which peaked at age 12-14), and dropped thereafter, such that the lowest levels were recorded in adulthood.

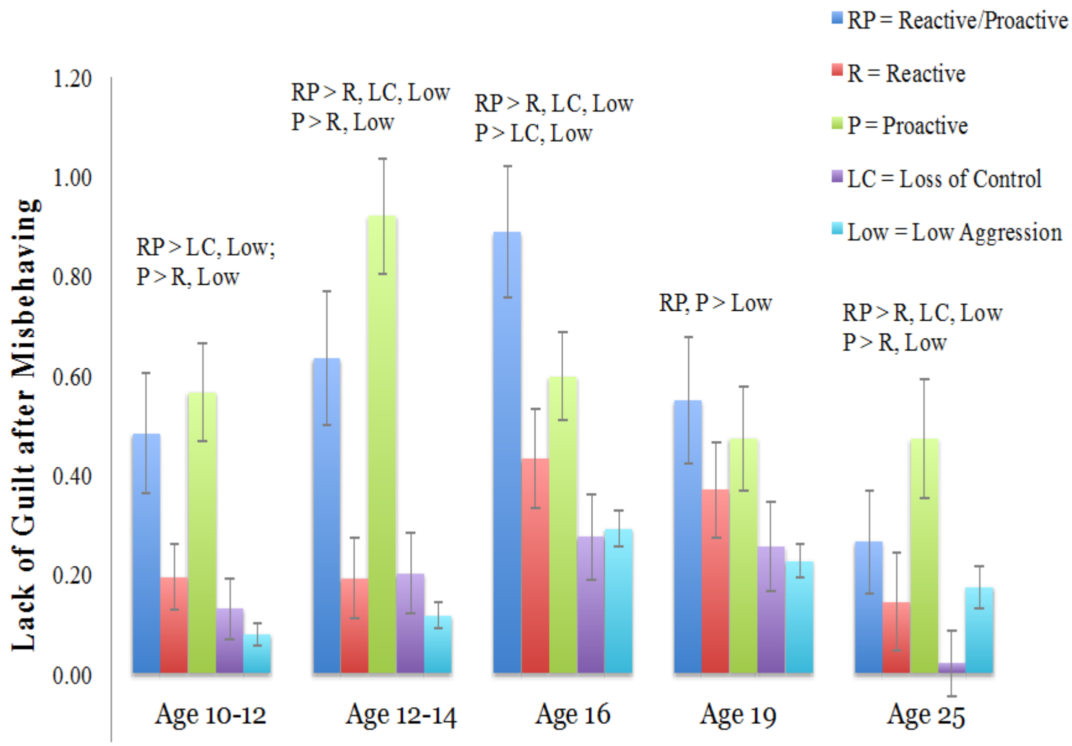

Figure 6. Mean lack of guilt after misbehaving across 5 classes at ages 10-12, 12-14, 16, 19, and 25, with error bars displaying standard error.

Internalizing Symptoms. The omnibus chi-square analyses assessing class differences on internalizing symptoms were significant at Times 1, 2, 3, and 4, but not Time 5 (Figure 7). At Time 1, the mixed class had significantly higher internalizing *T* scores than the primarily reactive, loss of control, and low aggression classes (χ^2s > 7.23, *ps* < .007, φs > .234). The primarily proactive class had higher internalizing *T* scores than the primarily reactive ($\chi^2 = 4.07$, $p = .044$, $\varphi = .151$) and low aggression ($\chi^2 = 10.61$, $p = .001$, $\varphi = .162$) classes. The loss of control class had higher internalizing *T* scores than the low aggression class ($\chi^2 = 5.32$, $p = .021$, $\varphi = .114$). At Time 2, the mixed aggression class had significantly higher internalizing *T* scores than all other classes (χ^2s > 4.45, *ps*

<.035, φs > .190). The primarily proactive class had significantly higher internalizing *T* scores than the primarily reactive, loss of control, and low aggression classes (χ^2s > 6.26, *ps* <.012, φs > .212). The loss of control class had higher internalizing *T* scores than the low aggression class ($\chi^2 = 5.25$, $p = .022$, φ = .113). At Time 3, the loss of control class had significantly higher internalizing symptoms than the low aggression class ($\chi^2 = 4.67$, $p = .031$, φ = .106). At Time 4, the mixed aggression class had higher internalizing *T* scores than the low aggression class ($\chi^2 = 10.33$, $p = .001$, φ = .162). At Time 5, the chi-square test assessing class differences on internalizing symptoms was not significant ($\chi^2 = 8.40$, $p = .078$).

Taken together, internalizing symptoms result in the greatest differentiation of aggression classes during late childhood and early adolescence. The mixed aggression and proactive aggression class appear to have particularly high symptoms during this period of development, significantly higher than the reactive and low aggression classes. Afterwards, the symptoms of the mixed aggression class and the proactive aggression class declined. The loss of control class had higher internalizing symptoms than the low aggression class at the first three time points and these symptoms did not appear to decline in the same manner of the mixed and proactive classes once adulthood was reached.

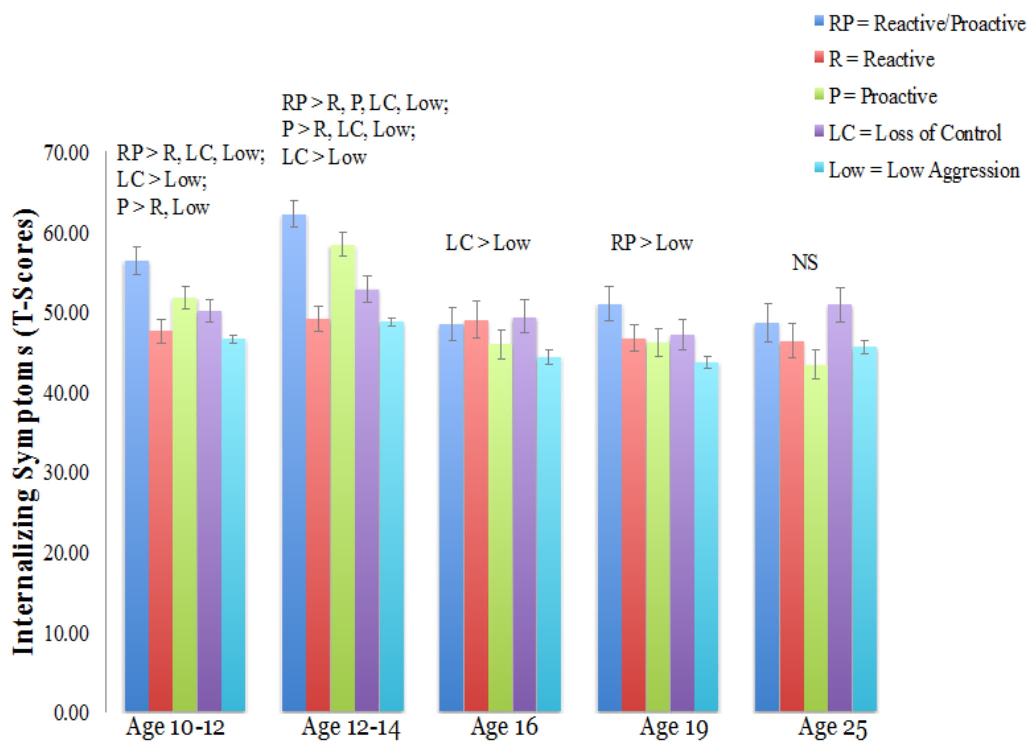

Figure 7. Mean internalizing symptoms across 5 classes at ages 10-12, 12-14, 16, 19, and 25, with error bars displaying standard error.

Provocation to Aggression. The omnibus chi-square test assessing class differences on low provocation trials was significant (χ^2 = 11.68, p = .020, φ = .134). Pairwise comparisons indicated that the loss of control class displayed higher levels of aggression (operationalized as the number of points deducted from opponents during winning trials following a low provocation loss) than the low aggression class (χ^2 = 7.90, p = .005, φ = .139). On high provocation trials, the omnibus chi-square test was not significant (χ^2 = 8.825, p = .066, φ = .117).

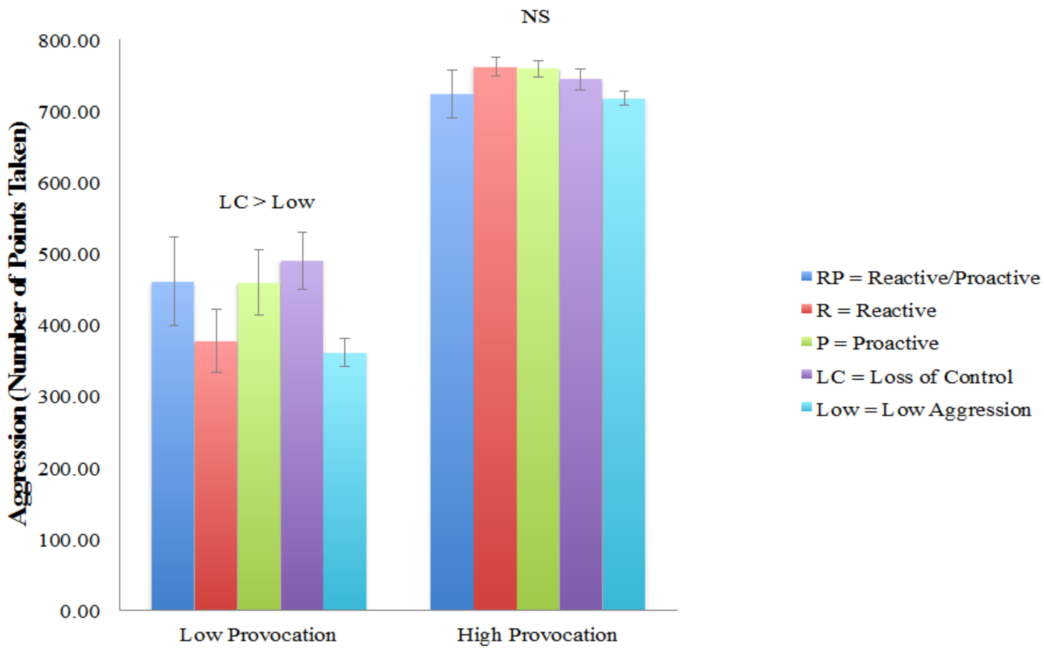

Figure 8. Mean number of points taken across 5 classes during low and high provocation conditions at ages 10-12, with error bars displaying standard error.

CHAPTER 4
DISCUSSION

Although the existence of proactive and reactive aggression subtypes is well established, less is known about whether and to what extent these aggressive behaviors and associated factors form homogenous subgroups that are distinct in frequency and quality. Historically, considering aggressive behaviors unitarily created mixed findings in the broader field of aggression research, leading to questions about whether some identified associations only hold true for certain subgroups of individuals. The present study contributes uniquely to the literature by parsing subgroups in a large, prospective sample and conceptualizing multiple ways in which these subgroups differ. Primarily proactive, primarily reactive, mixed reactive/proactive, and low aggression groups emerged, along with a loss of control class, a novel addition to the literature. The primarily reactive and primarily proactive classes showed the greatest distinctions from one another in late childhood/early adolescence, with the primarily proactive class exhibiting greater peer rejection, lack of guilt, and internalizing symptoms than the primarily reactive class. Engagement in mixed aggression was associated with a host of deleterious factors. Compared to individuals who exhibited low aggression, individuals who engaged in mixed aggression experienced significantly greater peer rejection from late childhood to late adolescence, associations with deviant peers during late childhood and adolescence, and internalizing symptoms and lack of guilt during late childhood and late adolescence. Of note, individuals who engaged in mixed, primarily proactive, and primarily reactive aggression exhibited significantly lower ECF than individuals in the low aggression class. Given these distinctions, these findings highlight the need for continued efforts to consider aggression as a multifaceted construct with distinct and varied subgroups when generating prevention and intervention plans.

Aim 1. Identify subgroups of aggressive youth (person-centered analysis)

Consistent with hypotheses, multiple classes that differed in frequency and quality of aggression were identified. The mixed, primarily proactive, primarily reactive, and low aggression classes replicate groups found in extant literature (reviewed in Vitaro & Brendgen, 2005). The pattern of endorsed aggressive items suggests that even among members of the low aggression group, mild engagement in aggressive behaviors (e.g., deliberately bothering others) is fairly typical.

The identification of a loss of control aggression class was unique. Members of this class were very likely to endorse the items “loses control over actions” and “shouts, hits, and kicks to let off steam.” Though these items are characteristic of reactive aggression more broadly, endorsement of these two items, and not the remaining three reactive aggression items (“People who are always bugging you are asking for a punch in the nose,” “I often feel like a bomb ready to explode,” and “Whoever makes fun of me or my family is asking for a fight”) or the proactive aggression items depict an individual who is impulsively aggressive, perhaps without the emotional buildup of anger or frustration suggested in the remaining three items. This distinction presents the possibility of further heterogeneity within the reactive aggression subtype. There may be individuals who experience escalating rage in response to specific triggers and act out aggressively (primarily reactive class), whereas others may act impulsively without control when exasperated or frustrated (loss of control class). Of note, in the supplementary LCA conducted with only members of the no paternal diagnosis group, the loss of control class was still represented, suggesting that this class is robust.

Aim 2. Examine the external validity of the identified aggression classes by evaluating differences among classes on auxiliary variables

Few investigations consider aggression subtypes within the context of typical child and adolescent development, or examine factors that may provide external validation of these subtypes and thereby potentially increase opportunities for early identification of at-risk youth. The following factors served to better characterize the identified classes.

ECF. The mixed, primarily proactive, and primarily reactive classes exhibited significantly lower ECF than the low aggression class. Although it was hypothesized that the high reactive aggression class would have the lowest levels of ECF abilities, the mixed, primarily reactive, and primarily proactive classes were similarly deficient in ECF relative to the low aggression class. Though no causal implications can be made, the finding that individuals engaged in primarily proactive aggression have lower ECF counters the majority of previous findings showing no relation between ECF and proactive aggression (Blair, 2004, 2010; Drabick et al., 2010; Ellis et al., 2009; White et al., 2013). However, a recent study demonstrated that among young children (ages 3-6), individuals who engaged in proactive relational aggression were more likely to display poor planning skills, but strong working memory skills (Poland et al., 2015). Further, poor inhibition was associated with higher levels of both reactive and proactive aggression. Another study showed ECF deficiencies among male athletes who exhibited both proactive and reactive aggression (Micai, Kavussanu, & Ring, 2015). The authors posited that poor set shifting, rule acquisition, spatial planning, and working memory led to problems with impulse control, being flexible, and thinking through actions and consequences. Taken together, these studies suggest that individuals who engage in reactive aggression likely lack the regulatory skills to inhibit negative emotions, leading to aggressive choices, and individuals who engage in proactive aggression may lack the planning skills necessary to choose less antisocial actions when trying to attain their goals.

It is unclear why the loss of control class' ECF was not as low as the other aggression classes. Given the level of peer rejection and internalizing problems in this class, perhaps the factors associated with losing control involve emotion dysregulation more than ECF problems. Future research examining these associations would be necessary to test this possibility. Employing measures such as those assessing affect and impulsivity in the context of decision-making (e.g., gambling contexts) may assist in clarifying the relationship between affect and cognition among the aggression classes.

Peer rejection. In general, results suggest that individuals who engaged in aggression of any subtype were more likely to experience peer rejection during late childhood than the low aggression class. Individuals in the mixed aggression class were particularly likely to be rejected compared to individuals in the low aggression class at ages 10-12, 12-14, 16, and 19. At age 10-12, members of the proactive class were significantly more likely to experience peer rejection than members of the reactive class. This finding was contrary to the hypothesis, given literature demonstrating unique associations between reactive, but not proactive, aggression and peer rejection (Dodge et al., 1997; Fite et al., 2012a; Raine et al., 2006). However, during middle childhood, there are low base rates of proactive aggression and children at this age are likely to express disapproval of others' aggressive behavior, particularly if it is personal or premeditated in nature (Hay, Zahn-Waxler, Cummings, & Iannotti, 1992). Further, these children have not yet entered adolescence, when it is common for individuals to become less rejecting of aggressive, antisocial peers and instead begin to view such behavior as mature, status-affirming, and influential (Bukowski, Sippola, & Newcomb, 2000; Cillessen & Mayeux, 2004; Schwartz, Gorman, Nakamoto, & McCay, 2006). Thus, in the late childhood period, individuals who engage in proactive aggression may be particularly at-risk for peer rejection.

Similarly, there may be a developmental explanation for the rejection of members of the mixed aggression class and the primarily reactive class at age 19. Rejection at this age may reflect a general dislike of impulsive, dysregulated, risky forms of aggression that are beginning to desist within the normative population because of increases in inhibitory control and psychosocial maturity (Raine et al., 2005; Steinberg, 2007, 2008). The high rejection of the loss of control class at ages 10-12, 12-14, 16, and 19 may occur for similar reasons. Across late childhood and adolescence, impulsive and explosive acts of aggression may be difficult for peers to anticipate and comprehend, creating a sense of unease or wariness that culminates in rejection. Further examination of the mediating or moderating factors at play regarding this class (e.g., emotion dysregulation, poor communication skills) is warranted.

By age 25, there were no significant differences in peer rejection across classes, which is likely indicative that by adulthood, individuals are through high school and have self-selected less rejecting peers and environments. Alternatively, it is possible that aggressive individuals have fewer friends in general at this age and the quality of these relationships may be suboptimal and deviant despite not being as rejecting, though the current dataset does not provide clarifying peer information in adulthood to test these notions. In sum, the peer rejection experienced by the mixed, primarily proactive, and primarily reactive aggression classes is best explained by considering developmental factors.

Associations with deviant peers. As expected, individuals in the mixed, primarily proactive, and primarily reactive aggression classes were more likely to associate with deviant peers than individuals in the low aggression class. Studies have demonstrated high popularity ratings among members of primarily proactive aggression groups (Poulin & Boivin, 2000), and it was hypothesized that this group would have the highest associations with deviant peers. However, the mixed and reactive classes consistently had the highest peer delinquency scores. The mixed aggression class likely exhibits a higher number of aggressive behaviors in general, and therefore attracts more delinquent acquaintances in accordance with the principle of behavioral homophily (Kandel, 1978, 1996). It is unclear why the primarily reactive class had such high associations with deviant peers, but this class also experienced less rejection than the proactive group (significantly less during the 10-12 time point), so perhaps this class was better able to befriend peers (including more deviant classmates) during late childhood. Peer socialization and deviancy training (Dishion, Spracklen, Andrews, & Patterson, 1996) may also play a role in the development and maintenance of reactive aggression in this class. As the sample aged from 10-12 to 16, self-reported associations with deviant peers rose across classes as predicted, given normative increases in deviancy and risky behaviors during adolescence (Elliot & Menard, 1996; Steinberg, 2008; Warr, 1993).

Lack of Guilt. Individuals in the mixed aggression classes felt less guilty after misbehaving than individuals in the loss of control class at ages 10-12, 12-14, 16, and 25, the reactive class at ages 12-14, 16, and 25, and the low aggression class at all time points. Individuals in the primarily proactive class felt less guilt after misbehaving than individuals in the primarily reactive class at ages 10-12, 12-14, and 25. These findings align with evidence that individuals with high levels of callous-unemotional traits (e.g., lack of remorse and empathy, being uncaring) were more likely to exhibit combined proactive and reactive aggression than either type of aggression alone (Fanti et al., 2009). Lack of guilt particularly distinguished the proactive class from other classes in late childhood and early adulthood. It is likely that individuals in this class choose proactive behaviors in part because of the combination of heightened sensitivity to rewards and low sensitivity to the feelings of others whom they harm in the process (Arsenio et al., 2009; reviewed in Blair, 2010).

Consistent with research indicating that reactive aggression is associated with feelings of shame and remorse (Dodge, Lochman, Harnish, Bates, & Pettit, 1997), individuals in the primarily reactive aggression class were less likely to experience lack of guilt after misbehaving than the primarily proactive or mixed aggression classes. This pattern of findings aligns with previous research demonstrating that individuals who engage in reactive aggression understand that their reactions are hurtful (Arsenio et al., 2009) and their responses stem from an inability to control negative emotions in the moment rather than from callous or calculated attempts to harm others (Vitaro & Brendgen, 2005).

As predicted, lack of guilt among individuals across all classes was lowest at age 25, when research suggests that increases in perspective-taking (Cauffman & Steinberg, 2000; Steinberg & Cauffman, 1996) and moral reasoning (Armon & Dawson, 1997) occur.

Internalizing symptoms. Members of the mixed aggression class exhibited the highest internalizing symptoms at ages 10-12, 12-14, and 19 followed by the proactive aggression class at ages 10-12 and 12-14, and the loss of control class at ages 10-12 through 16. It is plausible that higher intensity of aggressive behaviors (exhibiting both forms) and having difficulty maintaining control is broadly indicative of poor coping and interaction strategies, which are associated with a greater likelihood of internalizing symptoms (Hughes & Ensor, 2011; Rinsky & Hinshaw, 2011). The finding that proactive aggression is associated with internalizing symptoms is somewhat surprising, as most research has not supported this association (Fite et al., 2014; Marsee et al., 2008; Vitaro et al., 2002). However, within this sample, it has been noted that individuals in the mixed aggression class experience peer rejection during this late childhood and early adolescent period. Given the association between peer rejection and internalizing problems (Dodge et al., 1997; Fite et al., 2014; Prinstein, Cheah, & Guyer, 2005), these factors may be at play within these groups.

Internalizing symptoms of members of the reactive class did not differ from symptoms in the low aggression class at any time point. This result is also surprising, as reactive aggression has been associated with internalizing problems (Fite et al., 2010).

Peer rejection was relatively low for the primarily reactive class during the same time periods, which may explain this finding. Although developmentally, depressive symptoms have been shown to decrease after adolescence (Pine et al., 1998), this trend is not observed in the current dataset. By age 25, the classes are indistinguishable in internalizing symptom severity and an overall reduction in symptoms is not apparent. This may be due to a floor effect, as the whole sample displays average *T* scores (<60) that are within the normative range (<60) throughout the five time points. A series of one-sample *t*-tests indicated that at ages 10-12, 16, 19, and 25, the sample scored significantly lower than the normed score of 50.

Provocation to aggression. Under conditions of high provocation, there were no significant differences in enacted aggression across classes; individuals were equally likely to subtract a higher number of points when provoked. However, under low provocation conditions, individuals in the loss of control class were more likely to subtract points than members of the low aggression class. Given the impulsivity that may be characteristic of members of the loss of control class, it makes sense that these individuals may act with an aggressive impulse regardless of the hostility present in the situation.

Individuals who engage in proactive aggression purportedly enact aggression to attain rewards or get their way (Raine et al., 2006), so it was surprising that the mixed and proactive aggression classes did not engage in significantly more aggression than the low aggression class in either provocation scenario. One explanation for the lack of significant findings may be inadequate believability of the computerized opponent. Some of the phrases utilized may not have been realistic (e.g., “Nice try, speedo! I beat you again dork!”), which may have revealed that the opponent was contrived and influenced participant responses. Also, while the low provocation condition yielded a variety of responses, the high provocation condition yielded responses that were negatively skewed from a tendency to take away the maximum number of points. Future studies may utilize *in vivo* provocation tasks with age-matched confederates to maximize external validity. For example, the hot sauce task (Lieberman, Solomon, Greenberg, & McGregor, 1999) assesses aggression against a live confederate following provocation in a presumed food-tasting task. Additionally, many aggression paradigms assess retaliatory aggression, but do not provide opportunities for unprovoked, proactive aggression to occur and may not be particularly realistic or provide choices among means of responding (Ritter & Eslea, 2005). The development of such tasks may provide insightful information about the role of provocation in the aggression subtypes.

Strengths, Limitations, and Future Directions

Among the strengths of this study were the use of a large, prospective sample, the consideration of subgroups to better characterize aggression, and a close examination of factors that have historically yielded mixed associations with aggression. Further, the design of the study afforded the opportunity to consider developmental patterns of factors associated with aggression subtypes. Overall, these features lend confidence that the results contribute to greater clarity in the diverse presentations of aggression. Further, these findings enhance understanding of risk processes related to aggression and can inform interventions that focus specifically on ameliorating deficits displayed by youth with different aggression profiles.

Despite these strengths, several limitations exist in the current study. First, though the person-centered statistical techniques proposed are the most appropriate to test the research questions related to frequency and quality of aggressive behaviors, there is no "gold standard" indicator for evaluating model fit. As such, consideration of multiple indices concurrently and attention to the conceptual model were utilized to ensure best practices and appropriate generalizability of the findings.

Although there are well-validated instruments for measuring reactive and proactive aggression (e.g., Cima et al., 2013; Raine et al., 2006), these instruments were not available in the present dataset. Therefore, items were selected based on their ability to conceptually map onto the constructs of proactive and reactive aggression. The selected items approximate items on the standard questionnaires and were expected to accurately assess aggression as it is typically defined. However, it is possible that the non-standard items resulted in classes that do not reflect typical conceptualizations of proactive and reactive aggression. Further, some class distinctions, particularly the formation of the primarily reactive class, were constructed despite low-level endorsement of some items from the proactive aggression domain. It is well established that youth often display a combination of the two types of aggression (Dodge, 1991), so this is not surprising, but perhaps classifications with even more specific labels (e.g., reactive aggression with endorsement of annoying others) would capture subgroups more accurately. The lack of clear-cut distinctions between classes, though typical, may influence generalizability to other samples.

Because reactive and proactive aggression items were only available at ages 10-12, causal links between the aggression subtypes and the auxiliary variables could not be tested. Future research may use a person-centered design to examine the interplay between peer processes, internalizing symptoms, lack of guilt, and provocation and aggressive behaviors across developmental periods and whether these factors influence transitions in class membership over time. Additionally, lack of guilt was indexed with one item. Ideally, a multi-item measure of guilt or remorse (akin to the inventory of callous-unemotional traits) would be used.

Given constraints regarding availability of variables and onset of data collection in this archival dataset, aggression subtypes and transitions between classes could not be examined longitudinally or prior to age 12-14. However, examining auxiliary variables from ages 10 to 25 provided a rich source of information across a range of domains of these aggression classes. Variables such as ECF, provocation to aggression, and deviant peer associations also were not assessed in early childhood or in later adolescence or adulthood; thus, although these processes undergo expected developmental changes, the present study cannot address these changes prospectively. Assessing children between the ages of 12 and 14 captured a formative period in development in which transitions and changes related to puberty, peer groups, and school abound. However, examining aggressive behaviors at this time period and not later does not capture the normative adolescent spike in externalizing, reward-seeking, and risk-taking behaviors (Blumstein et al., 1986; reviewed in Maughan et al., 2004; Steinberg, 2008, 2010).

Further, the primary analyses concerned a subsample of the CEDAR dataset who responded to items related to proactive and reactive aggression. There were no significant differences between individuals who were and were not missing data on these aggression items with regard to sex, ethnicity, or SES. However, missing individuals were significantly older. In addition, when examining differences between the classes in the final model, members of the (a) primarily proactive aggression class were more likely to have fathers with substance use or psychiatric disorders than members of the low aggression class, (b) reactively aggressive class were more likely to come from families with lower SES than other classes, and (c) mixed, primarily reactive, and primarily proactive classes were more likely to be male than members of the low aggression class. Therefore, one limitation is the generalizability of the sample, though it is reassuring to know that the classes were reproduced in a secondary LCA containing only participants with no paternal diagnosis history.

Conclusions and Clinical Implications

In conclusion, a number of main findings emerged from the present study. First, individuals who engaged in aggression were not equivalent in terms of quality and frequency of behaviors and these differences were validated with a variety of auxiliary factors. Second, engagement in both reactive and proactive aggression concurrently was most problematic; mixed aggression was associated with internalizing symptoms, peer rejection, peer delinquency, lack of guilt, and ECF deficits. Third, engagement in primarily proactive aggression was linked with greater peer rejection, lack of guilt, and internalizing symptoms than engagement in primarily reactive aggression at a number of developmental periods. Taken together, these findings can inform prevention and intervention efforts by increasing specificity in identification of at-risk youth. In the future, developmentally sensitive assessments should include not only aggressive behaviors, but contextual (e.g., peer processes) and child (e.g., ECF) variables that may influence individuals' behaviors. Each of these areas could inform case conceptualization (e.g., initiating, maintaining, or exacerbating factors), as well as provide potential opportunities for intervention, as some of these variables may be targets of treatment. Interventions aimed at bolstering deficient ECF skills, decreasing susceptibility to peer rejection, and treating internalizing symptoms in late childhood, for instance, could be particularly impactful.

Already, evidence has accrued demonstrating efficacy of group-based interventions that consider peer processes and problem-solving difficulties for youth with conduct problems, such as the Coping Power Program (Lochman & Wells, 2002, 2004; Lochman, Wells, & Lenhart, 2008). Assessing ECF and peer variables can facilitate the development of more effective treatment plans and goals for youth, as well as provide additional treatment targets and outcomes to consider and potentially monitor. Future research should evaluate whether using explicitly tailored interventions to match the needs of each aggression subtype influences treatment outcome. In one such study, Phillips and Lochman (2003) utilized two interventions targeting reactive and proactive aggression in a laboratory setting. The reactive aggression intervention taught a simplified version of the Coping Power Program and the proactive aggression intervention taught individuals to reconsider goal-related reasons for aggressing, recognize coercive patterns, and generate prosocial solutions. The proactive intervention reduced both reactive and proactive aggressive responses, whereas the reactive intervention did not reduce aggressive responses overall, but did reduce feelings of anger.

Similarly, Barker et al. (2010) tested the effects of a 2-year aggression prevention program (social skills and parenting skills) with disruptive boys aged 7 to 9. Reactive and proactive aggression trajectories were measured after the intervention (between ages 13 and 17). Compared to boys in a control group, boys who received the intervention were significantly less likely to remain in the reactive aggression trajectory in adolescence. No significant intervention effects were found for proactive aggression, though a trend towards improved outcomes was identified.

Given the promise of these interventions, generating increasingly targeted treatments using the knowledge gleaned from characterizations of classes such as those in the present study may help ameliorate aggression and promote positive development across youth development and into early adulthood. Examining meaningful correlates of aggression in the present study provided valuable information relevant to risk factors and informs such interventions. Future research may continue these efforts and consider additional contextual variables (e.g., school factors, substance use) and potential moderators (e.g., parental support, temperament) to facilitate risk identification and identify further avenues for intervention tailored to individuals who engage in different forms of aggression.

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