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Regular Article

Proactive and reactive aggression: Developmental trajectories and longitudinal associations with callous–unemotional traits, impulsivity, and internalizing emotions

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Abstract

Research on proactive and reactive aggression has identified covariates unique to each function of aggression, but hypothesized correlates have often not been tested with consideration of developmental changes in or the overlap between the types of aggression. The present study examines the unique developmental trajectories of proactive and reactive aggression over adolescence and young adulthood and tests these trajectories' associations with key covariates: callous–unemotional (CU) traits, impulsivity, and internalizing emotions. In a sample of 1,211 justice-involved males (ages 15–22), quadratic growth models (i.e., intercepts, linear slopes, and quadratic slopes) of each type of aggression were regressed onto quadratic growth models of the covariates while controlling for the other type of aggression. After accounting for the level of reactive aggression, the level of proactive aggression was predicted by the level of CU traits. However, change in proactive aggression over time was not related to the change in any covariates. After accounting for proactive aggression, reactive aggression was predicted by impulsivity, both at the initial level and in change over time. Results support that proactive and reactive aggression are unique constructs with separate developmental trajectories and distinct covariates.

Keywords: callous–unemotional traits; impulsivity; internalizing emotions; proactive aggression; reactive aggression

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Introduction

Aggressive behavior is defined as actions resulting in harm to another person (Anderson & Bushman, 2002). This construct has been the topic of decades of research in an effort to understand which individuals are at risk for exhibiting high levels of aggressive behavior, the development and trajectory of aggressive behavior over the life span, and the social, emotional, and interpersonal consequences of high levels of aggression. A key aspect of aggression that has emerged from this research is the differentiation between different functions of aggression, which include proactive aggression (i.e., aggressive behavior without antagonism, used to achieve specific goals) and reactive aggression (i.e., aggressive behavior in reaction to a perceived threat; Dodge, 1991; Dodge & Coie, 1987). Importantly, research has supported different correlates of the two functions, which could inform causal theory and guide intervention (Dodge, 1991; Dodge et al., 1997; Dodge & Coie, 1987; Merk et al., 2005; Poulin & Boivin, 2000).

Specifically, reactive aggression is consistently correlated with measures of poor impulse control and high rates of negative affect. Many studies have found that reactive aggression is more closely linked to impulsivity than proactive aggression (Card & Little, 2006; Duan et al., 2021; Fite et al., 2009b; Latzman & Vaidya, 2013; Urben et al., 2018). For example, a study of 242 elementary school-age children reported that a group of children characterized by reactive aggression showed higher levels of impulsivity compared to a group characterized by proactive aggression (Carroll et al., 2018). Similar associations have also been found later in adolescence, with trajectories of hyperactive and impulsive symptoms between the ages of 7 and 15 being more strongly associated with trajectories of reactive aggression than proactive aggression (Murray et al., 2020). Several studies have also investigated the differential associations between the two functions of aggression and negative affect (i.e., depression, anxiety, and anger) and have reported that reactive aggression is also more strongly related to various forms of negative affect (Fite et al., 2009a; Fite et al., 2010; Hartley et al., 2018; McAuliffe et al., 2006; Moore et al., 2019). While many studies in this domain focus on reactive aggression's relationship with anger (McAuliffe et al., 2006; Moore et al., 2019), several studies have also linked reactive aggression to increased internalizing emotions such as depression, suicidal behavior, and anxiety (Fite et al., 2009a, 2010; Hartley et al.,

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2018; McAuliffe et al., 2006). These findings are consistent with the frustration-aggression theory which suggests that heightened negative emotions in reaction to provocation or an inability to modulate such emotions places an individual at greater risk for making aggressive responses to provocation (Berkowitz, 1993; Finkel & Hall, 2018).

In contrast to these findings on reactive aggression, proactive aggression has been associated with reduced emotional responses to distress and expectations of positive outcomes of aggressive behavior (Aggensteiner et al., 2022; Hubbard et al., 2001; Lozier et al., 2014; Marsee & Frick, 2007; Moore et al., 2019; Smithmyer et al., 2000). Additionally, callous–unemotional (CU) traits (i.e., lack of guilt, lack of empathy or concern for others, lack of concern over performance in important activities, and shallow or deficient affect; Frick et al., 2014) have been linked to proactive aggression in several studies (Fanti et al., 2009; Frick et al., 2003; Marsee & Frick, 2007; Urben et al., 2018). While several studies have also found support for both functions of aggression being related to CU traits (Elowsky et al., 2022; Frick et al., 2003), evidence indicates that the associations are stronger and more consistent for proactive aggression (Marsee et al., 2011). For example, Fite et al. (2010) examined the longitudinal associations between the two functions of aggression and CU traits and found that reactive aggression (measured at age 16) was concurrently but not longitudinally associated with CU traits (measured at ages 16 and 26), but that proactive aggression was both concurrently and longitudinally associated with CU traits. In addition, those high on proactive aggression also show a cognitive style in which they expect their aggressive behavior to result in positive outcomes (Arsenio et al., 2004; Hubbard et al., 2001; Smithmyer et al., 2000). It is important to note, however, that this cognitive style is also associated with CU traits (Frick et al., 2014) and may contribute to the higher rate of proactive aggression shown by individuals high on these traits. Importantly, these correlates are consistent with social learning theory, which proposes that individuals who have experienced positive consequences from past aggressive acts (i.e., accomplishing their intended goal) will be more likely to use this method to accomplish their goals in the future (Bandura, 1973).

Thus, research on the two functions of aggression has great potential for advancing theories for the development of aggressive behavior and for guiding interventions that target mechanisms unique to each type of aggression. However, this research has been limited by a number of factors. First, behavior associated with the two functions of aggression are often highly correlated, ranging from .40 to .90 across samples of youth with the typical estimate being approximately .70 (Card & Little, 2006; Little et al., 2003; Poulin & Boivin, 2000). Further, research has consistently shown an asymmetry in the overlap between the two types of aggression. Specifically, there appears to be a significant number of children who only show reactive aggression, whereas most children who show high levels of proactive aggression also show high rates of reactive aggression (Brown, et al., 1996; Dodge & Coie, 1987; Marsee et al., 2014). The fact that the combined aggressive group is typically more aggressive overall has led some researchers to question whether the two functions of aggression reflect different patterns of behavior with unique causal mechanisms or whether proactive aggression is simply an indicator of severity of aggressive behavior (Bushman & Anderson, 2001; Walters, 2005). Also, this pattern of overlap may obscure differential correlates to the two functions of aggression, since those high on proactive aggression may also show elevated rates of reactive aggression. Failure to consider this correlation among the aggressive subtypes may explain some of the inconsistent findings in past research on the differential correlates (Latzman & Vaidya, 2013; Murray et al., 2020; Pérez Fuentes et al., 2016). Thus, theories to explain the different functions of aggression need to not only explain the different correlates to the two types of aggression but also explain the high correlations. For example, there is evidence to suggest that persons high on proactive aggression may appear to show anger in response to provocation but lack the emotional arousal typically associated with such responses (Hubbard et al., 2002; Jambon et al., 2019; Muñoz et al., 2008; Song et al., 2020). Thus, those high on proactive aggression could appear to show reactive aggression but fail to show the same emotional correlates as other persons who show reactive aggression. Further, the overlap in the types of aggressive behavior means that research studying the correlates to aggressive behavior need to consider ways of controlling for this overlap, either by using person-centered analyses that group persons into aggressive typologies (e.g., non-aggressive, reactive aggressive only, or combined proactive and reactive aggressive; Marsee et al., 2014) or by studying the variance unique to each function of aggression (i.e., controlling for the other function of aggression; Fite et al., 2010; Fite et al., 2017; Paré-Ruel et al., 2022).

A second limitation in existing research on the unique correlates to proactive and reactive aggression is that much of the research has been correlational (Carroll et al., 2018; Duan et al., 2021; Fite et al., 2009a; Fite et al., 2009b; Marsee et al., 2011; Marsee & Frick, 2007; Urben et al., 2018) or, if longitudinal, it has not used a design that separates predictors of the severity of aggression over time from predictors of changes in the level of aggression over time (Fite et al., 2010; Frick et al., 2003; McAuliffe et al., 2006). This is a critical consideration because predictors of severity of aggression (i.e., the intercept of the trajectory) may not be the same as predictors of changes in this severity over time (i.e., the slope of the trajectory). Further, consideration of developmental changes is particularly important when studying aggression in adolescence, given that past research has found that aggressive behavior displays significant change over the course of development. While studies of the trajectories of aggression over time often find that at least some individuals have aggression which is largely stable or increases slightly over time, most findings support that aggression generally decreases from childhood to young adulthood (Bongers et al., 2004; Fite et al., 2008; Jennings & Reingle, 2012; Maldonado-Molina et al., 2010; Nagin & Tremblay, 1999; Storvall & Wichstrøm, 2003; Xie et al., 2011). However, much of the literature on changes in aggression over time have focused on the childhood or adolescent period, with little research focusing on the trajectory of aggression during the transition to adulthood (for an exception, see Fite et al., 2010 which studied aggression at ages 16 and 26).

Unfortunately, much of the research on the developmental trajectories of aggressive behavior has not considered the two functions (i.e., proactive and reactive aggression) separately. When research has separated the different functions, it has usually found that both functions of aggression follow generally similar patterns to those found in the broader aggression literature (Barker et al., 2010; Cui et al., 2016; Fite et al., 2008; Ojanen & Kiefer, 2013). However, while studies are largely consistent in finding that reactive aggression tends to be more common across development than proactive aggression (Barker et al., 2010; Cui et al., 2016; Fite et al., 2008), findings have been mixed regarding the degree of change in proactive aggression over time compared to reactive aggression (Barker et al., 2010; Ojanen & Kiefer, 2013). These conflicting results highlight the need for greater research in this area; in

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addition, the possibility of different trajectories suggests that when trying to predict changes in aggressive behavior over time, it is important to not only account for the severity of the other function of aggression but also to account for the change in the other function of aggression over time. In the only study to do this, results indicated that, after accounting for the other function of aggression, the trajectories of both functions of aggression did not change (Fite et al., 2008). However, this study did not investigate how change in the two types of aggression was related to hypothesized correlates, leaving it unknown how key variables are uniquely related to the trajectories of aggression over time.

Current study

Thus, in the present study, we study several variables that have consistently shown differential correlations with the two functions of aggression in past research: impulsivity, internalizing emotions, and CU traits. Impulsivity and internalizing emotions have been more consistently associated with reactive aggression, and CU traits have been associated with proactive aggression. While we hypothesized that the differential associations would be similar to those found in past work, we employed several major advances in our research design. First, we controlled for the shared variance in the two functions of aggression in studying these associations. Second, we utilized a longitudinal design in which the two functions of aggression, as well as the hypothesized correlates, were assessed multiple times. Using an accelerated multiple cohort design, we were able to model the trajectories of the two functions of aggression and their correlates over a developmental period from ages 15 to 22, allowing us to test the predictors of both the level of aggression over time and changes in this level across a developmental period that has not been the focus of a great deal of past research (i.e., the transition to adulthood). Finally, we extended past research to include a high-risk, justice-involved sample, which is in contrast to most past work that has focused on community samples. This design feature is important because it led to a sample with higher levels of aggression and, in particular, proactive aggression, which tends to show a fairly low base rate in community samples (Card & Little, 2006; Poulin & Boivin, 2000). When studying trajectories over time, it is important to have significant variability in these variables of interest in order to detect clear developmental trends and to identify predictors of these trends.

Method

Participants

The current study utilized data collected as a part of the Crossroads Study, a multisite longitudinal study of male youths involved in the juvenile justice system. Eligible participants for the Crossroads Study were male English-speaking adolescents who were arrested for the first time between the ages of 13 and 17 ($M_{age} = 15.29$) in three jurisdictions in the United States (Orange County, California; Philadelphia, Pennsylvania; and Jefferson Parish, Louisiana). All participants were arrested for offenses of mild to moderate severity. Qualifying offenses included property offenses such as vandalism and theft (48%), drug offenses such as possession of a controlled substance (23%), and person offenses such as assault and battery (20%). The total sample consisted of 1,216 male adolescents. Forty-six percent of the sample self-identified as Latino, 37% identified as Black, 15% identified as White, and 2% identified as another race or ethnicity. The sample represented a range of socioeconomic statuses, measured through parental educational attainment; approximately 27% of the sample did not have a parent who completed high school, 35% had at least one parent who completed high school, and 38% had at least one parent who completed education beyond high school. Further information about the demographic characteristics of the sample and the primary aims of the Crossroads study can be found elsewhere (Cauffman et al., 2021).

Procedure

Institutional review board approval was obtained at sponsoring institutions at each site. Contact information for eligible youths were obtained for all youth who met the inclusionary criteria. As a part of the informed consent and assent procedures, youths and their parent or guardian were informed that their participation in the study would not influence their treatment in the justice system. In addition, they were informed that all information was protected from involuntary disclosure by a Privacy Certificate obtained from the Department of Justice. Within six weeks of their arrest, participants were interviewed in convenient locations (i.e., home, library, fast food restaurant, detention center, jail, etc.) by a trained interviewer. Interviews were conducted over the phone if the youth moved outside of the study area, if the facility in which they lived did not allow in-person interviews, or due to the COVID-19 pandemic. Structured interviews were administered using a standardized protocol with laptop computers equipped with all study questionnaires.

Follow up interviews were conducted every 6 months for the first three years, then yearly (with the exception of Year 6) for another 4 years. Six-month intervals were not used in current analyses. Data for the current study was therefore collected at seven time points (baseline, Year 1, Year 2, Year 3, Year 4, Year 5, and Year 7). Compensation started at $50 for the baseline interview and increased by $15 for each interview, up to $140 which was provided at Year 3 through Year 7. Retention rates were high across time points; 94% of the sample were retained at Year 1, 93% at Year 2, 91% at Year 3, 87% at Year 4, 84% at Year 5, and 76% at Year 7. Participants who dropped out of the study by Year 7 did not differ on any baseline study variables (i.e., proactive aggression, reactive aggression, CU traits, impulsivity, or internalizing emotions) when compared to participants who persisted throughout the study.

Measures

Proactive and reactive aggression

The proactive and reactive overt aggression scales from the Peer Conflict Scale (PCS; Marsee et al., 2011; Marsee & Frick, 2007) were used to measure the two functions of aggression. Although the PCS also includes relational aggression scales, these scales were not used in current analyses due to past findings that relational aggression may be more important in female samples (Marsee et al., 2014). All items were rated on a scale from 0 ("not at all true") to 3 ("definitely true"). The proactive overt aggression scale consisted of 10 items (i.e., "I start fights to get what I want", "I carefully plan out how to hurt others") which were summed to form a total score reflecting greater proactive aggression. The reactive overt aggression scale also consisted of 10 items (i.e., "I threaten others when they do something wrong to me", "If others make me mad, I hurt them") which were summed to form a total score reflecting greater reactive aggression. These scales of the PCS have been correlated with laboratory measures of aggression and other

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indicators of violence (Muñoz et al., 2008) and the two subscales have been found to be associated with differences in several hypothesized correlates. Specifically, the reactive aggression scale has been uniquely associated with reaction to provocation and poor emotion regulation, while the proactive aggression scale has been uniquely associated with CU traits and biased outcome expectations for aggressive behavior in other samples of adolescents and young adults (Marsee et al., 2011; Marsee & Frick, 2007; Muñoz et al., 2008; Vagos et al., 2021). In the present sample, both scales showed acceptable to good internal consistency across time points (Cronbach's αs = .72 – .82 for proactive aggression; Cronbach's αs = .82 – .86 for reactive aggression).

CU traits

CU traits were measured using the Inventory of Callous–Unemotional Traits (ICU; Kimonis et al., 2008). The ICU consists of 12 positively-worded items reflecting greater CU traits (i.e., "I do not feel remorseful when I do something wrong") and 12 negatively-worded items reflecting lower CU traits (i.e., "I am concerned about the feelings of others"), each rated on a scale from 0 ("not at all true") to 3 ("definitely true"). After reverse-coding negatively-worded items, items were summed to create a total score that reflected greater CU traits. Although past work has found that this measure of CU traits can be broken into subscales, the total score was used in the current study due to consistent findings of a general factor that accounts for a large portion of the variance of subscales and that is associated negatively with empathy and positively with aggression in a variety of child, adolescent, and adult samples (Cardinale & Marsh, 2020; Ray & Frick, 2020). Across time points, Cronbach's α ranged from .76 to .80 for this scale.

Impulsivity

Impulsivity was measured using the Weinberger Adjustment Inventory (WAI) Impulse Control Scale (Weinberger & Schwartz, 1990). Items measure level of impulsive control (i.e., "I should try harder to control myself when I'm having fun", "I do things without giving them enough thought") that are rated on a scale from "false" (1) to "true" (5). For the current analyses, items were inversely scored and summed, so that higher scores indicated greater levels of impulsive responding. This scale has been related to antisocial behavior and poor self-control in adolescent and young adult samples (Jones, 2017; Monahan et al., 2009). Internal consistency was acceptable across time points (Cronbach's α = .74 – .79).

Internalizing emotions

A composite score from an abridged version of the Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) was used to measure internalizing emotions. The RCADS is a well-validated measure of internalizing symptomatology, as indicated by correlations with other measures of depression and anxiety in child and adolescent samples (Chorpita et al., 2005), as well as in young adult samples (McKenzie et al., 2019). While the full RCADS includes several subscales reflecting multiple internalizing disorders, only the major depressive disorder (MDD; i.e., "I feel sad or empty") and generalized anxiety disorder (GAD; i.e., "I worry about things") subscales were administered during the Crossroads Study. One item which was conceptualized as a part of the separation anxiety disorder (SAD) scale ("I worry when I go to bed at night") has shown split loadings with the GAD factor (Chorpita et al., 2000); as such, this item was included in the current version of the RCADS. For current analyses, all depression and anxiety items were summed to provide a composite measure of internalizing emotions, such that higher scores indicated greater depression and anxiety. The composite internalizing emotions scale showed good internal consistency across time points (Cronbach's α = .87–.92).

Data analysis

For data analyses, we used an accelerated multiple cohort design (Galbraith et al., 2017). Individuals were placed into six cohorts based on their age at baseline: age 13 ($n = 136$), age 14 ($n = 210$), age 15 ($n = 300$), age 16 ($n = 310$), age 17 ($n = 259$), and age 18 ($n = 1$; one participant who was 17 at the time of their arrest had turned 18 by the time of the baseline interview). While individuals in the age 13 cohort had data collected at ages 13–20, individuals in the age 18 cohort had data collected at ages 18–25. All data collected at each age was collapsed into a single variable regardless of cohort (e.g., age 17 data consisted of baseline data from the age 17 cohort, Year 1 data from the age 16 cohort, etc.), resulting in a single dataset with data collected between ages 13 and 25. Although no age had complete data, ages with valid data for less than one-third of the sample were excluded; therefore, data collected at ages 13 ($n = 136$), 14 ($n = 337$), 23 ($n = 253$), 24 ($n = 204$), and 25 ($n = 1$) were not included in model estimation. Five participants who only had data available at ages 13 and/or 14 were therefore excluded from analyses. As such, the final dataset consisted of 1,211 individuals with data collected between ages 15 and 22, though participants did not have data collected at all of these yearly intervals (age 15 [$n = 625$], age 16 [$n = 908$], age 17 [$n = 1137$], age 18 [$n = 1109$], age 19 [$n = 960$], age 20 [$n = 838$], age 21 [$n = 651$], age 22 [$n = 433$]). Missing data due to attrition/age gaps were estimated using the MLR estimator, a full information maximum likelihood estimator with robust standard errors, in Mplus 8.4. If individual items were missing for any questionnaires, a prorated total score was calculated if at least 80% of the questionnaire was valid.

First, to determine the shape of the trajectory of all study variables, a linear growth model was fit to each type of aggression (i.e., proactive and reactive aggression) and each covariate (i.e., CU traits, impulsivity, and internalizing emotions). Past research has detected some non-linear trends in aggression over development (Barker et al., 2010; Cui et al., 2016; Fite et al., 2008; Murray et al., 2020). For example, Fite et al. (2008) found that proactive and reactive aggression reached a peak in early adolescence and decreased into later adolescence. Thus, to determine if a non-linear trajectory better fit the data, a quadratic slope factor was then added to each model, and improvement in model fit was tested using chi-squared difference tests, RMSEA (root mean square error of estimation), CFI (comparative fit index), TLI (Tucker-Lewis index), and SRMR (standardized root mean square residual; Hu & Bentler, 1999).

The best-fitting univariate models (i.e., linear or quadratic) for each variable were then combined into multivariate directional growth models (i.e., one for proactive aggression and one for reactive aggression; Bollen & Curran, 2006). In order to test hypotheses regarding associations between covariates and the two types of aggression while controlling for the other type of aggression, intercepts and slopes (both linear and quadratic, where relevant) of aggression were regressed onto the intercepts and slopes of covariates and the other type of aggression. For example, the intercept of proactive aggression was regressed onto intercepts of CU traits, impulsivity, internalizing emotions, and

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Table 1. Descriptive statistics across ages

	Proactive aggression	Reactive aggression	CU traits	Impulsivity	Internalizing emotions
Age	Mean (SD), Min–max	Mean (SD), Min–max	Mean (SD), Min–max	Mean (SD), Min–max	Mean (SD), Min–max
15	1.41 (2.80), 0–19	4.86 (5.10), 0–28	26.41 (8.37), 0–55	21.67 (7.00), 8–38	10.30 (7.25), 0–41
16	1.33 (2.61), 0–23	4.44 (4.95), 0–27	25.78 (8.28), 3–55	21.43 (6.85), 8–40	10.29 (7.84), 0–48
17	1.18 (2.54), 0–22	4.20 (4.96), 0–28	25.08 (8.32), 2–53	21.44 (6.97), 8–40	10.87 (8.38), 0–46
18	0.85 (2.06), 0–22	3.25 (4.32), 0–30	23.41 (8.27), 0–53	20.93 (6.98), 8–40	10.32 (8.27), 0–44
19	0.77 (1.99), 0–16	3.10 (4.36), 0–30	22.49 (8.35), 1–48	20.95 (7.17), 8–40	10.02 (8.12), 0–45
20	0.62 (1.67), 0–16	2.83 (3.95), 0–27	22.08 (8.52), 1–52	20.55 (6.71), 8–38	10.83 (8.78), 0–49
21	0.67 (1.91), 0–19	2.41 (3.63), 0–21	21.21 (8.86), 1–45	20.24 (7.08), 8–40	10.83 (9.11), 0–51
22	0.66 (1.89), 0–21	2.53 (3.87), 0–21	20.98 (8.68), 0–51	20.34 (7.47), 8–40	10.11 (8.70), 0–51

reactive aggression. Further, the linear slope of proactive aggression was regressed onto linear slopes of CU traits, impulsivity, internalizing emotions, and reactive aggression. Finally, the quadratic slope of proactive aggression regressed onto quadratic slopes of CU traits, impulsivity, internalizing emotions, and reactive aggression. These analyses were repeated for reactive aggression.

Results

Single variable growth models

Descriptive statistics for all study variables across age are shown in Table 1. As shown in Table 2, the addition of a quadratic slope factor improved model fit for all variables. Therefore, all variables were assumed to have a quadratic growth structure, and quadratic slopes were included for all variables in multivariate growth models. Proactive aggression had a mean intercept of 1.62 ($p < .001$), a mean linear slope of −0.32 ($p < .001$), and a mean quadratic slope of 0.03 ($p < .001$). Reactive aggression had a mean intercept of 5.30 ($p < .001$), a mean linear slope of −0.77 ($p < .001$), and a mean quadratic slope of 0.05 ($p < .001$). The intercepts, linear slopes, and quadratic slopes for both proactive and reactive aggression all had significant variances ($p < .05$), indicating that investigation of covariates that can predict this variance is warranted. Change in proactive and reactive aggression between ages 15 and 22 is depicted in Figure 1. This figure shows first that, as expected, the level of reactive aggression was substantially higher than proactive aggression across the entire developmental period. Further, also as predicted, both types of aggression decreased over time, with this decrease being greatest during the earlier (i.e., adolescent) ages. Proactive aggression reached a minimum at approximately age 20 followed by a very slight increase after this age.

Proactive aggression multivariate growth

The proactive multivariate growth model with quadratic slopes for all variables displayed good model fit (RMSEA = .02, CFI = .99, TLI = .98, SRMR = .04). Regression parameters for the multivariate quadratic growth model of proactive aggression are reported in Table 3. The intercept of proactive aggression was positively predicted by the intercepts of reactive aggression (β = .69, $p < .001$) and CU traits (β = .15, $p < .01$), but the linear and quadratic slopes of proactive aggression were not significantly related to the linear and quadratic slopes of reactive aggression or CU traits.

Table 2. Comparison of linear and quadratic growth models for all study variables

Model	χ^2, df	$\Delta\chi^2$, df	RMSEA	CFI	TLI	SRMR
Proactive aggression: linear	63.72, 31	–	.03	.95	.95	.07
Proactive aggression: quadratic	37.47, 27	20.50, 4**	.02	.98	.98	.05
Reactive aggression: linear	80.09, 31	–	.04	.96	.96	.05
Reactive aggression: quadratic	46.64, 27	30.02, 4**	.03	.98	.98	.04
CU traits: linear	110.07, 31	–	.05	.96	.97	.07
CU traits: quadratic	68.51, 27	40.22, 4**	.04	.98	.98	.03
Impulsivity: linear	52.82, 31	–	.02	.99	.99	.05
Impulsivity: quadratic	40.39, 27	12.84*	.02	.99	.99	.04
Internalizing emotions: linear	94.30, 31	–	.04	.95	.96	.06
Internalizing emotions: quadratic	66.22, 27	26.91, 4**	.04	.97	.97	.04

Note: Because MLR estimator was used, change in χ^2 and significance values represent corrected χ^2 values after using scaling formulas provided by Muthén and Muthén (2005).
*$p < .05$.
**$p < .001$.

Impulsivity and internalizing emotions were not related to the intercept, linear slope, or quadratic slope of proactive aggression.

Reactive aggression multivariate growth

The reactive multivariate growth model also displayed good model fit (RMSEA = .02, CFI = .99, TLI = .98, SRMR = .04). Results with reactive aggression were consistent across the intercepts, linear slopes, and quadratic slopes. As shown in Table 3, at all three levels of analysis, reactive aggression was positively predicted by proactive aggression ($\beta_{intercept} = .74$, $p < .001$; $\beta_{linear} = .73$, $p < .001$; $\beta_{quadratic} = .78$, $p < .001$) and impulsivity ($\beta_{intercept} = .16$, $p < .001$; $\beta_{linear} = .19$, $p < .001$, $\beta_{quadratic} = .24$, $p < .01$), but CU traits and internalizing emotions were not significantly related to reactive aggression.[1]

[1]Analyses were also conducted including IQ (measured at baseline by a proxy variable consisting of the Vocabulary and Matrix Reasoning subscales from the Wechsler Abbreviated Scale of Intelligence; Wechsler, 1999) as a time-invariant covariate in multivariate directional growth models. The addition of IQ as a covariate did not change pattern of study results.

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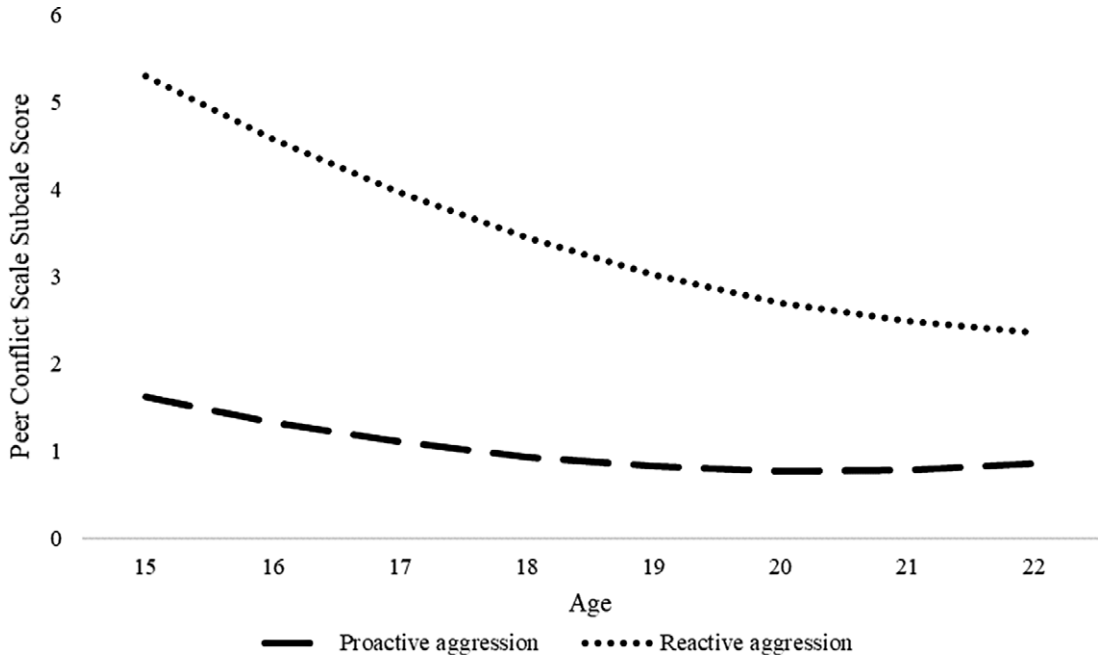

Figure 1. Quadratic trajectories of proactive and reactive aggression in adolescence & young adulthood.

Table 3. Multivariate quadratic growth model results for proactive and reactive aggression

Covariate	Intercept B (SE)	Linear slope B (SE)	Quadratic slope sB (SE)
Outcome: Proactive aggression			
Reactive aggression	0.38 (0.04)**	0.72 (0.42)	0.25 (0.21)
CU traits	0.06 (0.02)*	0.06 (0.10)	0.19 (0.14)
Impulsivity	0.00 (0.02)	−0.56 (0.61)	−0.25 (0.18)
Internalizing emotions	0.04 (0.02)	0.07 (0.17)	−0.10 (0.12)
Outcome: Reactive aggression			
Proactive aggression	1.32 (0.08)**	1.22 (0.17)**	1.31 (0.27)**
CU traits	0.01 (0.02)	0.00 (0.04)	−0.05 (0.10)
Impulsivity	0.14 (0.02)**	0.22 (0.06)**	0.40 (0.14)*
Internalizing emotions	0.04 (0.03)	0.05 (0.03)	0.06 (0.06)

Note: Standardized results are reported in text.
*$p < .01$.
**$p < .001$.

Discussion

This study aimed to investigate the distinct correlates to proactive and reactive aggression, using a longitudinal design that can test for predictors of severity and predictors of change over time. Further, the longitudinal design allowed us to control for the severity and level of change in the other function of aggression, which is critical given the pattern of overlap between the two functions of aggression and the potential differences in trajectories over time.

Consistent with a great deal of past research, this study found that reactive aggression was more common across the entire developmental range studied (Brown et al., 1996; Dodge & Coie, 1987; Marsee et al., 2011; Marsee et al., 2014) and that both forms of aggression decreased across adolescence and into young adulthood (Bongers et al., 2004; Fite et al., 2008; Nagin & Tremblay, 1999; Storvall & Wichstrøm, 2003; Xie et al., 2011). However, our finding of a quadratic trend for both forms of aggression suggests that this decrease in aggression was less later in adolescence and into young adulthood (Loeber & Hay, 1997). Importantly, our findings suggested that this quadratic trend was similar for both proactive and reactive aggression.

Some of these findings could be consistent with suggestions that the less frequent proactive aggression is better considered an indicator of severity, rather than an indicator of another type of aggression (Bushman & Anderson, 2001; Walters, 2005). Also consistent with such a contention, multivariate growth models for proactive aggression revealed that the intercept (or starting value at age 15) of proactive aggression was positively related to the intercept of reactive aggression, indicating that individuals with higher levels of proactive aggression also tended to have higher levels of reactive aggression. However, contrary to a model of proactive aggression only being an indicator of severity, we found that, after controlling for the association between proactive and reactive aggression, the

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remaining variance in the intercept of proactive aggression was predicted by the intercept of CU traits. That is, individuals with higher levels of proactive aggression also had higher levels of CU traits. This finding is consistent with past research showing that CU traits are more consistently related to proactive aggression, particularly when controlling for reactive aggression (Fite et al., 2009b, 2010; Marsee et al., 2011; Urben et al., 2018). Although not tested in this study, this link between proactive aggression and CU traits could be due to the tendency of individuals with elevated CU traits to overestimate the positive outcomes of aggression and, as a result, make aggression more likely to occur in anticipation of instrumental gain (Frick et al., 2014).

Another unique aspect of our study design is that our use of growth models allowed us to separate predictors of the severity of aggression from predictors of the change in aggression over time. Interestingly, none of our predictors, including CU traits and reactive aggression, significantly predicted changes in proactive aggression over time. This finding could be due to our choice of risk factors that were largely dispositional characteristics of the youth (e.g., CU traits, impulse control, internalizing emotions), whereas changes in proactive aggression may be more related to contextual factors (e.g., parenting practices) that could determine whether or not the aggressive behavior is reinforced over time. This possibility needs to be tested in future research, but our results highlight the importance of separating potential predictors of the severity of aggression with predictors of change in the levels of aggressive behavior over time.

As expected, the intercept, linear slope, and quadratic slope of proactive aggression predicted the intercept, linear slope, and quadratic slope of reactive aggression. Once variance due to this overlap was accounted for in analyses, impulsivity provided additional predictive utility for the intercept, linear slope, and quadratic slope of reactive aggression, which is consistent with a great deal of past research (Card & Little, 2006; Murray et al., 2020; Urben et al., 2018). Thus, for reactive aggression, greater overall levels of impulsivity and greater change in impulsivity over time predicted both greater levels of reactive aggression and greater change in reactive aggression over time. Consistent with our hypotheses and past research, CU traits did not predict the severity and degree of change in reactive aggression once the severity and degree of change in proactive aggression was controlled (Fite et al., 2010; Marsee et al., 2011). These findings support the theory that reactive aggression is closely tied to an individual's reduced ability to inhibit their impulses, causing them to react strongly to perceived provocation (Bertsch et al., 2020; Finkel & Hall, 2018).

Contrary to predictions and past research (Fite et al., 2009a, 2010), neither severity nor level of change in reactive aggression was predicted by our measure of internalizing emotions. This is inconsistent with theoretical predictions that reactive aggression often occurs in the context of high emotional arousal (Dodge et al., 1997; Dodge & Coie, 1987). It should be noted, however, that past research linking internalizing emotions to reactive aggression did not control for more general problems with impulse control (Fite et al., 2009a, 2010). Thus, controlling for more general difficulties in behavioral and emotional regulation may eliminate any predictive power related to the expression of internalizing emotions.

All interpretations of our current findings must take into account several limitations in the study design. While the current high-risk and justice-involved sample was helpful for studying aggressive behavior by resulting in a sample with greater variability in such behaviors when compared to community samples, this sample limits our ability to generalize our results to other types of samples. Also, by studying justice-involved adolescents, we were forced to limit our data collection to only boys, which means that our findings need to be tested in samples of girls. There is evidence that aggression may be expressed differently in girls (Marsee et al., 2014), making such tests critical for determining the generalizability of our results. Finally, our results relied on self-report measures for assessing both aggression and our hypothesized predictors. While this could not account for differences in which predictors were related to aggression, it could have inflated the overall level of associations due to shared method variance.

Despite these limitations, our findings have important implications for the conceptualization, measurement, and treatment of aggressive behaviors in adolescents and young adults. Most importantly, these findings provide additional evidence that, despite significant overlap, proactive and reactive aggression are distinct constructs with unique developmental influences that need to be studied in a way that controls for the variance accounted for by the other function of aggression. Further, these findings suggest that aggression needs to be assessed in a way that separately studies proactive and reactive aggression and allows for aggressive individuals to have tailored treatments. For example, an individual with a largely reactive style of aggression, impulse control may be an important target of intervention; for an individual who also shows proactive types of aggression, increasing empathy and emotion recognition may be a more important target of treatment (Frick, 2012). In addition to supporting the importance of separate consideration of proactive and reactive aggression in research and practice, these findings also have important implications for the constructs of CU traits and impulsivity. For example, both CU traits and impulsivity have been considered a part of the larger construct of psychopathy (Frick, 2022). However, current findings suggest that these two constructs show unique associations with separate forms of aggression, indicating that considering these together in a composite measure of psychopathy may reduce predictive utility of the separate constructs, especially as they help to explain different patterns of aggressive behavior.

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