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Aggression Predicts Changes in Peer Victimization that Vary by Form and Function

Karin S. Frey[1] · **Zoe Higheagle Strong**[2]

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Abstract Peer victimization is predictive of serious problems in adjustment, especially among children who are both victimized and aggressive. This study investigated how different types of aggression contribute to later victimization. Specifically, we examined prospective relationships between the types of aggression that children perpetrated and the types that they experienced at the hands of others. Trained observers coded schoolyard behavior of 553 children in grades 3–6 during the initial year of a bullying intervention program. Both observed aggression and victimization were specified by form (direct, indirect) and function (proactive, reactive). Total hourly rates of victimization were highest in the upper grades. Direct-reactive aggression uniquely predicted increases in victimization, while direct-proactive aggression predicted decreases, particularly in direct-proactive victimization. Indirect-proactive aggression (e.g., derogatory gossip) predicted increases in indirect-proactive victimization only in the control group. Indirect-reactive aggression and victimization occurred too rarely to detect change. Aggression-victimization relationships did not differ for boys and girls. Discussion considers why children might risk direct reactive aggression in the face of increased victimization. Different sequelae for different forms and functions of aggression highlight the need to resolve theoretical ambiguities in defining proactive and reactive aggression.

Keywords Victimization · Reactive aggression · Proactive aggression · Direct aggression · Indirect aggression · Observed behavior

Persistent peer victimization predicts serious indicators of childhood maladjustment, including declines in academic achievement (Buhs et al. 2006) and increased internalizing and externalizing behaviors (Arseneault et al. 2008; Reijntjes et al. 2011). Prospective studies indicate that some victimized children experience long-lasting emotional problems (Rudolph et al. 2011b; Schwartz et al. 2015; Wolke et al. 2012). Young people who are both victimized and aggressive tend to suffer the highest rates of peer victimization (Frey et al. 2014), maladjustment (Toblin et al. 2005), and suicidality (Klomek et al. 2009). Therefore, this study investigates how young people's aggression may provoke or diminish future victimization.

Because victimized persons are often disadvantaged in terms of social power (Sentse et al. 2015), it is unrealistic to expect them to stop attacks entirely on their own (Ttofi and Farrington 2011). Nevertheless, as social participants, victims both influence and are influenced by their peer environment. Victims' reactions may be affected by their own self-regulatory beliefs and skills (Cooley and Fite 2016), classroom norms (Frey et al. 2016; Sentse et al. 2014), past histories with other participants (Hubbard et al. 2001; Veenstra et al. 2007), and in-the-moment influences from friends and bystanders (Frey et al. 2015). Within the fluid context of a peer group, the nature of a victim's response rewards or disappoints perpetrators, and may contribute to group norms regarding retaliation.

✉ Karin S. Frey
karinf@uw.edu

Zoe Higheagle Strong
zoe.strong@wsu.edu

[1] Educational Psychology, College of Education, University of Washington, Miller box 353600, Seattle, WA 98105-3600, USA

[2] Educational Psychology, College of Education, Washington State University, Pullman, WA, USA

Self-reported behavior (Bellmore et al. 2013; Orobio de Castro et al. 2012) and experimental laboratory research (Williams 2007) indicate that aggression is a common response to victimization. In the heat of the moment, retaliation is a high-risk strategy. On the one hand, it may stop the abuse immediately, while on the other hand, it may extend the duration and increase the probability of injury (Hawkins et al. 2001). Surveys with older youth suggest that some types of aggression but not others contribute to later victimization (Camodeca et al. 2002; Lamarche et al. 2006; Salmivalli and Helteenvuori 2007). Studies have typically focused on one type of aggression. Because aggression types co-vary, measuring only one type may lead to specious associations that disappear when the contributions of other types of aggression are controlled. This study examines victimization processes and the environmental contingencies that may reinforce or discourage aggression. It fills a serious gap in the literature by identifying how multiple types of schoolyard aggression uniquely contribute to a child's later risk of victimization.

Types of Victimization

Progress in understanding victimization has been hampered by the lack of a standard taxonomy and definition (Sandstrom and Cillessen 2003). Studies on bullying define *victim* as one who has less power than an aggressor who repeatedly attacks without provocation. Other studies take a more general stance, defining victim as anyone who is targeted for aggression, or simply fail to provide a definition. This study systematically indicates the type of victimization by both the form of attack (e.g., hit, insult, rumor), and the apparent function or goal of the attack (e.g., impulsive reaction to provocation or a well-regulated instrumental attack).

Direct and Indirect Forms We follow previous research in categorizing victimization according to the form of aggression directed at individuals (Bjorkqvist et al. 1992). While early research focused on the suffering of those targeted for *overt* or *direct* aggression—physical attacks, threats, and demeaning comments to the target—more recent work shows that forms of aggression aimed at injuring a child's reputation and peer relationships contributes to later maladjustment as much or more than direct aggression does (see meta- analysis, Card et al. 2008; Gibb et al. 2012). *Relational* and *indirect* aggression are overlapping terms describing non-physical types of aggression. Relational aggression may be performed directly, as when one child threatens to end a relationship (Vitaro et al. 2006) or indirectly, as when a rumor harms a person's reputation. Perpetrators of indirect aggression may be unknown (Garandeau and Cillessen 2006), making resolution or retaliation difficult. Since confrontational and non-confrontational aggression may have different relationships to retaliation and later victimization, this study makes the distinction between direct and indirect aggression.

Proactive and Reactive Functions Less frequently, types of victimization are categorized by the presumed function or goal of the aggression. The designations *proactive* and *reactive*, or instrumental and hostile, distinguish specific functions of aggression associated with different research traditions (Card and Little 2006). Each tradition attempts to explicate the functions and processes underlying aggression. Bandura's social learning theory (Bandura 1973) emphasized reinforcement as a motive for aggression that was both strategic and proactive. The frustration aggression model (Berkowitz 1962) focused on aggression motivated by hostile reactions to provocations. Both functions were integrated into a social information processing model of aggression (Dodge 1991). Research continues to find elements that distinguish them. Proactive and reactive aggression are linked to different genes (Brendgen et al. 2006) and to contrasting patterns of frontal lobe activation (Rodman et al. 2016). Considerable research indicates that each type is associated with distinct beliefs and social processing characteristics (see Card and Little 2006, for meta-analysis; and Hubbard et al. 2010, for review). Further, reactive aggression is associated with self-regulation deficits, ineffectual aggression, and peer rejection. Conversely, proactive aggression is often associated with popularity, as well as dominance goals and bullying (Card and Little 2006; Prinstein and Cillessen 2003).

Since every aggressive act varies by both form and function (Ostrov et al. 2013), identifying both dimensions is necessary to provide unconfounded estimates of each type's contributions to the risk of later victimization (Little et al. 2003). It is equally important to specify the type of victimization, although that degree of precision is rare in the literature. This study addressed these gaps by specifying the form (direct, indirect) and function (reactive, proactive) of both the aggression perpetrated by the child and victimization experienced by the child.

How Might Aggression Contribute to Later Victimization?

The social consequences and level of risk for later victimization are likely to vary based on the specific characteristics of a child's aggressive behaviors. Aggression that is dysregulated and ineffectual may be more easily shrugged off than aggression that subordinates the target. Reactive aggression predicts later increases in peer rejection while proactive aggression predicts decreases (Evans et al. 2015; Ostrov et al. 2013). Indeed, young people's direct-reactive aggression, but not direct-proactive aggression is linked to direct victimization concurrently (Camodeca et al. 2002; Lamarche et al. 2006;

Schwartz et al. 1998) and prospectively among boys (Salmivalli and Helteenvuori 2007). Although it seems likely that those high in direct-reactive aggression could be targets of demeaning gossip as well as face-to-face aggression, these studies did not include indirect forms of victimization that may be experienced more typically by girls.

Conversely, other research in middle childhood has examined potential links across direct and indirect forms without identifying the aggressive function (Leadbeater et al. 2006; Ostrov and Godleski 2013). Thus, it may be premature to conclude that in middle childhood, aggression only relates to victimization that shares the same form of attack. Links between direct aggression and indirect victimization, for example, may be obscured if direct-reactive and direct-proactive aggression contribute in opposite directions. Using a prospective design, this study extends prior research on direct-reactive aggression by examining whether it increases risks for three types of victimization; direct-reactive, direct-proactive, and indirect-proactive (indirect-reactive occurred too rarely to detect change).

Unlike direct reactive aggression, no research that we are aware of has found direct-proactive aggression to be predictive of later victimization. Assessment issues may be a factor in past failures to find relationships, as untrained reporters may conflate proactive and reactive aggression (Card and Little 2006). Further, proactively aggressive children appear to be more successful at avoiding responsibility for their aggression than reactively aggressive children (Little et al. 2003). If proactive aggression is associated with higher assessment error than reactive aggression, links between proactive aggression and later victimization could be masked unless they are quite robust. Real-time coding of behavior is an underutilized tool that may provide the precision needed to investigate sequelae of direct-proactive aggression.

Thus, the relationship between direct-proactive aggression and victimization warrants a fresh look. After all, children high in direct-proactive aggression believe it will lead to success (Hubbard et al. 2010; cf., Kempes et al. 2006). Furthermore, trajectory analyses indirectly suggest that some chronically bullied children might escape their status by bullying others (Barker et al. 2008). Boivin et al. (2001) identified a group of direct aggressors who were rarely harassed and became increasingly aggressive from third to sixth grade. Such trends are consistent with the conceptualization of proactive aggression as a reward-seeking activity that is often successful (Runions 2013).

Children who exhibit high rates of indirect-proactive aggression may also be shielded from direct victimization. For instance, indirect aggressors often have positive social skills (Card et al. 2008; Heilbron and Prinstein 2008), which may result in alliances that are protective with respect to direct aggression (Huitsing and Veenstra 2012). Channeling hostility into more covert avenues may also limit witnesses (Garandeau and Cillessen 2006). Children high in indirect-proactive aggression do appear to be at risk for gossip and other forms of indirect victimization (Prinstein and Cillessen 2003), whereas links to direct victimization in general have not been identified (Leadbeater et al. 2006; Ostrov and Godleski 2013). In order to adequately test whether prospective links between aggression and victimization are form-specific in elementary school, this study uses measures that specify both the form and function of aggression and later victimization.

Since teachers and students may have difficulty distinguishing proactive and reactive aggression (Card and Little 2006), we used highly trained observers to identify aggressive function and form. Increasingly rare due to high costs, research based on directly observed behavior has made crucial contributions to our understanding of aggression and victimization (e.g., Craig et al. 2000; Dishion et al. 1996; Ostrov et al. 2013; Schwartz et al. 1998). In this study, second-by-second coding provided an uncommon level of measurement precision (Ladd and Kochenderfer-Ladd 2002)—hourly rates of schoolyard aggression and victimization specified by both function and form.

Hypothesized Prospective Relationships

The goal of this study is to fill key gaps in the literature by examining the prospective links between children's aggression and subsequent victimization. We hypothesized that the unique contributions of aggression would vary by the form and function of both aggressive actions and victimization. Regarding changes in direct victimization, we predicted the following:

1. Children's high rates of direct-reactive aggression in the fall would predict *increases* in both direct-reactive and direct-proactive victimization in the spring. No prediction was made for indirect-proactive victimization.
2. Children's high rates of direct-proactive aggression in the fall would predict *declines* in both direct-reactive and direct-proactive victimization in the spring. No predictions were made for indirect-proactive victimization.

With respect to indirect proactive victimization, our hypothesis was that high rates of indirect-proactive aggression in the fall would predict *declines* in indirect-proactive victimization in the spring. We made no predictions regarding links between indirect proactive aggression and either direct-reactive or direct-proactive victimization.

Rates of indirect-reactive victimization (see Table 1) and aggression were too low to yield reliable models of change. Thus, predictions or analyses for these variables were unwarranted.

Table 1 Hourly victimization rates as a function of victimization type, gender and grade

Victimization type									
Grade	N	Direct-reactive		Direct-proactive		Indirect-reactive		Indirect-proactive	
		M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Girls									
3rd	79	0.65	0.14	0.21	0.08	0.12	0.03	0.36	0.07
4th	83	0.67	0.14	0.19	0.08	0.06	0.03	0.40	0.07
5th	58	0.90	0.16	0.28	0.09	0.14	0.03	0.76	0.08
6th	50	1.35	0.17	0.39	0.10	0.12	0.03	0.90	0.09
Boys									
3rd	78	1.15	0.14	0.25	0.08	0.06	0.03	0.16	0.07
4th	87	1.59	0.13	0.41	0.08	0.07	0.03	0.17	0.07
5th	57	1.81	0.16	0.46	0.10	0.08	0.03	0.24	0.08
6th	61	2.07	0.16	0.56	0.09	0.09	0.03	0.29	0.08

Estimated marginal means control for group and time of year

Potential Moderation of Aggression-Victimization Links

The data collected in this study was a part of a randomized-control design evaluating the effects of a universal, elementary school-based program, *Steps to Respect: A Bullying Intervention Prevention Program* (Frey et al. 2009). This provided an opportunity to explore whether aggressive actions taken by students in the context of an intervention might have different relationships to victimization compared to those observed in the control group. Linkages observed in the control group but not in the experimental group, for example, might suggest that existing environmental contingencies that support victimization were being disrupted. Because direct, blinded observations do not rely on student reputations or the need to mentally collate observations over time, they may be sensitive to early markers of change, without being biased by expectations of intervention efficacy. Thus, exploratory analyses compared nested models with and without interaction terms for goodness of fit. We made no specific predictions.

Methods

Participants

Elementary students were drawn from six schools located in two mid-sized cities in the Pacific Northwest of the U.S. School selection was based on (a) educators' willingness to be randomly assigned to either an intervention or delayed control group for an anti-bullying intervention, and (b) the participation of another school with similar student demographics from the same district. The percentage of students eligible for free and reduced lunch at the schools ranged from 21% to 60%. Adherence to ethical guidelines was strictly enforced. Active parental consent was obtained for 64% of all students (n = 1090), and written students assent was obtained from those students. The observational sample was created by random assignment of consented students within classrooms. Ten students (usually five girls and five boys) from each grade 5 and 6 intervention classroom were randomly selected for observations, along with 10 students from each grade 3–6 control group classroom. In addition, twelve students from each grade 3 and 4 intervention classroom were selected for observations over multiple years. Of an initial total of 615 students, 44 left their schools during the study (7.2%) and 18 (2.9%) were absent too often to complete observations at either time 1 or time 2. Comparisons of fall aggression and victimization rates showed no significant differences between the retained sample (n = 553, 48.8% girls, 54.2% in the intervention group) and the 62 who were lost to attrition.

Thus, the final sample consisted of 226 students in grades 5 and 6 (ages 10–13, M = 10.8, 49.1% intervention group) and 327 students in grades 3 and 4 (ages 8–10, M = 8.9, 57.8% intervention group). Ethnicity was 9.1% African American, 11.1% Asian American, 70.3% European American, 7.4% Hispanic American, and 1.8% Indigenous American. Students who spoke English as a second language accounted for 12.1% of the sample, although schoolyard conversations appeared to be exclusively in English.

Program Characteristics

The intervention addressed three potential levels of change (Frey et al. 2009). These included (1) school-wide improvements in policies, procedures, and staff training (November); (2) developmentally appropriate lessons to address social norms and social-emotional skills at the classroom level (January to early March); and (3) individual coaching for

students involved in bullying episodes (January to June). Lessons emphasized empathy, decision-making, and the role of bystanders in bullying. Students rehearsed friendship skills, emotion regulation strategies, constructive responses to bullying, and inhibition of retaliatory efforts by victims and bystanders. After lesson completion, teachers were encouraged to continue offering in-the-moment prompts and encouragement of compassionate and responsible behavior.

Data Collection Procedures

Overview Students were observed in two waves, from late September through December, and then again from late March through June. Trained observers used a coding manual in conjunction with a custom-programmed handheld device to record a priori codes for behaviors. Typically, each student was observed once a week for 5 min over a 10 to 12-week period, with the order of observation determined randomly determined each week. Lunch and recess times were generally staggered for the primary and intermediate grades. Morning recess was 15 min long, and afternoon recess was typically 25 to 35 min long. This schedule provided enough repetitions to minimize censoring effects (Stoolmiller et al. 2000) and staggered sampling times over the broadest range of conditions (e.g., pre-holiday, rainy and sunny weather). Mean total observation times were 50 min at each wave (Mode = 50.0; range = 38.20–59.93). Observers coded each focal-student behavior in real time (Sackett 1977). Aggressive behaviors directed to focal students were coded as victimization events. When conversations required extended proximity, observers reduced reactivity by periodically shifting positions, continuously keeping the students in sight with direct or peripheral vision. Students appeared minimally reactive, commenting that the observers "don't do anything".

Observational Coding System The coding manual and definitions were created after observing in vivo and videotaped behavior. These observations indicated that indirect aggression could be coded relatively easily due to episode length. Observers received custom-programmed handheld devices that aligned with the coding manual for coding purposes. A touch-screen format opened multiple screens in a response-contingent order, thereby reducing operator error. Screen 1 identified the actor (e.g., behavior of focal student or behavior directed to focal student). Screen 2 identified aggressive, non-aggressive, or bystander behaviors. Indicating aggression on screen 2 automatically led to screen 3 for coding aggressive form and function.

Observer Training Fourteen of fifteen paid observers, blind to condition and specific hypotheses, successfully completed training. Training phase 1 (200 h) covered ethical guidelines, operational definitions, borderline decision-making, error correction, and data collection protocols. Much of the time was spent coding videotaped schoolyard behaviors in real time, receiving immediate feedback, and resolving misunderstandings. In order to advance to in vivo coding, each coder had to reach a minimum standard (mean kappa of 0.70) of agreement with a highly experienced master coder, who was also blind to condition. Training phase 2 (40–50 h of schoolyard coding) allowed ample time for students to habituate to the presence of observers. For at least eight hours, each observer coded simultaneously with a master coder, receiving feedback on accuracy, and reviewing discrepancies. Prior to spring data collection, coders underwent 20 h of booster training before advancing to Training phase 2. At both time points, data collection started after kappas (indicated below) averaged at least 0.70. To prevent decay, master coders continuously performed agreement checks (15% of sessions, n = 868) on coder accuracy throughout data collection.

Observer Accuracy Two coders were said to agree on a behavior when they indicated the same code within 1.0 s of each other. Agreement of qualifier codes (aggressive form and function) was event- rather than time-dependent. Consistent with the exacting training, percentage agreements were above 89% and overall kappa was excellent (κ = 0.80). Kappas were also excellent when computed for separate behaviors (reported below) despite typically low levels found when infrequent events diverge from 0.5 (Xu and Lorber 2014).

Aggression and Victimization Codes *Aggression* (κ = 0.76) was coded when a focal student's hurtful action or statement targeted a peer (aggressive behavior) or a peer targeted the focal student (victimization). Verbal statements were coded as aggressive if they included a threat, pejorative name, or demeaning comment even when the speaker (but not the target) was smiling or laughing. Coders were trained to distinguish between aggression and rough play. The latter was accompanied by mutual *felt* smiles and laughter. Rough play sometimes devolved into aggression, with corresponding shifts from positive to negative expressions. These instances were coded as rough play followed by either aggression or victimization.

Form (κ = 0.81) was coded as *direct* if the aggressor was directly confrontational and the victim could observe the act. This included physical acts (e.g., tripping, pinching, shoving), threats (e.g., "I am going to beat you so low."), and demeaning comments and gestures (e.g., name-calling, nose-pinching to imply that a student smells bad). It was *indirect* if the aggression occurred out of the target's sensory awareness, including gestures (e.g., eye-rolling), demeaning comments (e.g., "She is so ugly"), or plans to harm that third party (e.g., conspiring to exclude).

Function (κ = 0.80) was *proactive* if initiated without an apparent provocation. Aggression was coded as *reactive* if it

occurred in retaliation, during a disagreement (e.g., dispute about whether a player was *safe*), or following other types of provocation such as cutting in line.

Combining qualifier codes (two forms by two functions) yielded four types of aggression / victimization: direct-reactive, direct-proactive, indirect-reactive, and indirect-proactive.

Results

Descriptive Statistics of Gender and Grade Differences in Victimization

Hourly rates (total events / total time in hours) of each type of victimization were analyzed with 2 (gender) by 4 (grade) by 2 (intervention group) by 2 (time of year), repeated measures analyses. Log transformations yielded better distributions than hourly rates. Since analyses of log transformed and raw data yielded virtually identical results, we present results for the hourly rates to ease interpretation. For descriptive results, we tested all interactions, and report those that were significant.

Direct-Reactive Victimization Direct-reactive was the most frequent type of victimization type encountered by students (all *p*s < 0.01). As shown in Table 1, boys, $M = 1.65$, experienced higher victimization rates than girls, $M = 0.90$, F (1, 537) = 51.90, $p < 0.001$, $\eta^2 = 0.09$. Direct-reactive victimization increased with grade, F (3, 537) = 10.26, $p < 0.001$, $\eta^2 = 0.05$.

Direct-Proactive Victimization Boys, $M = 0.42$, were more frequently victimized by direct-proactive aggression than girls, $M = 0.27$, F (1, 537) = 6.01, $p = 0.02$, $\eta^2 = 0.01$. A significant two-way interaction, F (3, 537) = 2.92, $p = 0.04$, $\eta^2 = 0.02$, subsumed main effects of grade, F (3, 537) = 2.68, $p = 0.05$, $\eta^2 = 0.02$, and time of year, F (1, 537) = 15.92, $p < 0.001$, $\eta^2 = 0.03$. Among students in grades 5 and 6, but not those in grades 3 and 4, rates of direct-proactive victimization increased in the spring.

Indirect-Proactive Victimization Contributions of gender, F (1, 537) = 50.29, $p < 0.001$, $\eta^2 = 0.09$, and grade, F (3, 537) = 8.58, $p < 0.001$, $\eta^2 = 0.05$, were modified by a significant two-way interaction, F (3, 537) = 3.47, $p = 0.02$, $\eta^2 = 0.02$. Girls in Grades 5 and 6 experienced higher rates of indirect-proactive victimization than all other students (*ps* < 0.05).

Indirect-Reactive Victimization As shown in Table 1, indirect-reactive victimization was rarely observed. Not surprisingly, given the restricted range, we found no significant differences between or within groups. Rates of indirect-reactive aggression were also too rare to predict later change and no further analyses were performed on these variables.

Correlations between Fall and Spring Overall correlations between reactive and proactive aggression, $r(552) = 0.36$, $p < 0.001$, and between direct and indirect aggression, $r(542) = 0.20$, $p < 0.001$, were similar to those found in other observational studies (Card and Little 2006; Card et al. 2008). As shown in Table 2, correlations between the two direct forms of aggression were moderately strong at both time points, while those between the two direct forms of victimization were slightly lower. In the fall and spring, direct-reactive aggression showed the highest correlations with the corresponding type of victimization. Autocorrelations on the diagonal show modest stability. Separate analyses for boys and girls, and grades 3–4 and 5–6 were very similar, with one exception. Fall and spring rates of direct-proactive victimization were correlated among boys, r (282) = 0.36, $p < 0.001$, but not among girls, r (269) = 0.05, *ns*.

Multi-Level Data Structure and Analytic Plan

Problems of non-independence in group variance estimates can arise for nested data. In this case, individuals were nested within classroom and school. Initial null models validated the need for multi-level modeling, and subsequent analyses evaluated competing mixed models. The best-fitting model for each type of victimization was then expanded to determine whether results applied to each gender and grade level and were robust after controlling for alternative types of victimization. All models were tested using full-information maximum-likelihood estimation, and included random effects of

Table 2 Concurrent correlations for types of aggression and victimization

	Type of Aggression			Type of Victimization		
	DirRA	DirPA	InPA	VdirRA	VdirPA	VinPA
DirRA	**0.28**	**0.47**	**0.19**	**0.40**	**0.19**	0.07
DirPA	**0.39**	**0.14**	**0.12**	**0.29**	**0.15**	0.06
InPA	0.05	0.11	**0.20**	0.09	0.03	**0.23**
VdirRA	**0.45**	**0.23**	−0.02	**0.24**	**0.34**	0.10
VdirPA	**0.15**	**0.13**	−0.04	**0.32**	**0.28**	0.05
VinPA	0.07	0.08	**0.25**	0.02	0.00	**0.17**

Cells below the diagonal provide intercorrelations in the fall. Cells above the diagonal provide intercorrelations in the spring. The diagonal cells (underlined) provide autocorrelations between fall and spring. Correlations significant at $p < 0.01$ are in bold

DirRA direct-reactive aggression, *DirPA* direct-proactive aggression, *InPA* Indirect-proactive aggression, *VdirRA* direct-reactive victimization, *VdirPA* direct-proactive victimization, *VinPA* Indirect-proactive victimization

the intercept. In order to measure change in each type of victimization, hourly rates observed in spring were regressed onto rates observed in fall. The unstandardized residuals were used as an index of relative change. Whereas negative scores on these variables correspond to declines in victimization over time—relative to peers—positive scores signify increases over the same interval.

Null Models First, null random-effects models were fitted to decompose the variances in the victimization residuals into the variance due to differences across schools, across classrooms nested within schools, and across individuals nested within classrooms and schools (all random factors). In each case, most of the predictable variance was found at the individual level. The classroom-level also accounted for significant variance in direct-reactive victimization, *ICC* = 0.12, *Wald Z* = 3.06, direct-proactive victimization, *ICC* = 0.11, *Wald Z* = 2.87, and indirect-proactive victimization, *ICC* = 0.07, *Wald Z* = 2.01, all *p*s < 0.05. Contributions at the school level were negligible (all *Wald Z* < 1), accounting for less than 1% of the variance in each variable. Thus, subjects were nested in classrooms for all analyses.

Competing Nested Models Likelihood ratio tests evaluated competing nested models. An additional check was provided by Akaike's Information Criterion (AIC). Simple effects models tested the contributions of three types of aggression and four control factors (gender, grade level, classroom, and intervention group). Intervention group and classroom, both level two factors, represented fixed and random-effects, respectively. Variables in the simple effects models comprised a subset of the parameters estimated in group-moderated models. The latter were fitted to include the contributions of aggression rates to changes in each type of victimization as simple predictors, as well as when moderated by intervention group assignment. When describing the best-fitting models, we cite nonsignificant results only when they pertain to specific predictions.

Best-Fitting Models of Changes in Direct Victimization

As shown in Table 3, the reductions in the −2 log likelihood values represented by the moderated models were insufficient to justify adoption for either direct-reactive (−3.6, 3 *df*) or direct-proactive victimization (−1.3, 3 *df*). The lower values of AIC obtained for the simple models also indicated that they were the better-fitting models. As predicted, high rates of direct-reactive aggression in the fall preceded increases in spring direct-reactive and direct-proactive victimization. In contrast, high rates of direct-proactive aggression in the fall preceded the predicted *decreases* in direct-proactive victimization. The simple model showed that fall direct-proactive aggression was only marginally associated with decreases in spring direct reactive victimization. Rates of fall indirect-proactive aggression were not predictive of rate changes in either type of direct victimization. Random effects modeling indicated that classrooms remained significant predictors of changes in being targeted for direct-proactive victimization, *PE* = 0.23, *SE* = 0.08, Wald *Z* = 2.75, *p* < 0.001.

Best-Fitting Model of Changes in Indirect-Proactive Victimization

Because descriptive analyses showed a significant interaction of gender and grade level when predicting changes in indirect-proactive victimization, the interaction term was added to both the simple and moderated models as a control variable. As shown in Table 4, the moderated model provided a significant reduction in the −2 log likelihood value (−9.2, 3 *df*, *p* = 0.05) compared to the simple model. The AIC values also indicated the moderated model to be preferable. As predicted, high fall rates of direct-reactive aggression preceded increases in indirect-proactive victimization, whereas the predicted relationship between direct-proactive aggression and later decreases in indirect-proactive victimization was not significant. The relationship between fall rates of indirect-proactive aggression and spring rates of indirect-proactive victimization was significantly moderated by intervention group. Decomposition of the interaction showed that high rates of fall indirect-proactive aggression preceded increases in indirect-proactive victimization in the control group, *PE* = 1.11, *SE* = 0.39, *t*(251) = 2.82, *p* = 0.01, but not in the intervention group, *PE* = −0.15, *SE* = 0.24, *t* < 1.

Generalizability of Aggression-Victimization Relationships to Boys and Girls

Because girls experienced lower rates of direct-reactive victimization and higher rates of indirect-proactive victimization than boys did, secondary analyses evaluated the generalizability of aggression-victimization relationships for boys and girls. The best fitting model for each type of victimization served as the starting point. Multilevel models for direct victimization (direct-reactive and direct-proactive) expanded simple effects models to include interactions of each type of aggression with gender. Neither the reductions in the −2 log likelihood values for direct-reactive victimization (−0.5, *df* = 3) or for direct-proactive victimization (−1.7, *df* = 3) were significant. Both moderated models resulted in higher AIC values than those obtained for the simple models. Contributing parameters remained significant when interaction terms for gender were introduced. Thus, both boys and girls showed the same relationships between fall aggression and spring victimization.

Looking next at indirect-proactive victimization, the expanded model (adding interactions of gender with each fall aggression rate) was compared to the group moderated model.

Table 3 Fall aggression rates predict direct-reactive and direct-proactive victimization

Fall variable	Change in direct-reactive victimization rate						Change in direct-proactive victimization rate					
	Simple model			Group moderated model			Simple model			Group moderated model		
	PE	*SE*	*t* ratio	PE	*SE*	*t*	PE	*SE*	*t*	PE	*SE*	*t*
Intercept	−0.16	0.19	< 1	−0.12	0.20	< 1	−0.21	0.18	1.17	−0.20	0.19	1.06
Gender-girls	−0.46	0.12	3.76**	−0.44	0.12	3.57**	0.23	0.12	1.90†	0.25	0.12	2.02*
Grade	0.33	0.17	1.93†	−0.33	0.17	1.92†	0.25	0.17	1.52	0.25	0.17	1.52
Group	0.64	0.17	< 1	0.00	0.22	< 1	0.07	0.16	< 1	0.04	0.21	< 1
DirRA	0.45	0.21	2.11*	0.44	0.29	1.54	0.85	0.21	3.98**	0.85	0.29	2.92*
DirPA	−0.57	0.34	1.66†	−1.04	0.45	2.29*	−1.04	0.34	3.05**	−0.92	0.45	2.02*
InPA	0.01	0.36	< 1	0.26	0.46	< 1	0.51	0.36	1.42	0.19	0.46	< 1
Grp x dirRA				0.05	0.42	< 1				−0.03	0.42	< 1
Grp x dirPA				1.11	0.69	1.61				−0.29	0.69	< 1
Grp x inPA				−0.60	0.70	< 1				0.76	0.70	1.09
−2 log likelihood			1967.7			1964.1			1967.2			1965.9
AIC			1985.7			1988.1			1985.2			1989.9

Intervention group was entered as a level 2 variable. Dependent variables are expressed as residualized changes in hourly rates of victimization

DirRA direct-reactive aggression, *DirPA* direct-proactive aggression, *InPA* Indirect-proactive aggression

†$p < 0.10$

*$p < 0.05$

**$p < 0.01$

Table 4 Fall aggression rates predict indirect-proactive victimization

Fall variable	Change in indirect-proactive victimization rates					
	Simple model			Group moderated model		
	PE	*SE*	*t*	PE	*SE*	*t*
Intercept	0.34	0.11	3.06**	0.35	0.12	2.99**
Gender-girls	0.66	0.12	5.62*	0.60	0.12	5.16**
Grade	0.54	0.12	4.66**	0.52	0.12	4.46**
Gender x grade	0.54	0.15	3.67**	0.50	0.15	3.38**
Group	−0.09	0.08	1.04	0.01	0.12	< 1
DirRA	0.42	0.13	3.22**	0.41	0.17	2.37*
DirPA	−0.40	0.21	1.89†	−0.28	0.28	1.01
InPA	0.39	0.22	1.82†	−0.13	0.28	< 1
Grp x dirRA				−0.06	0.25	< 1
Grp x dirPA				−0.24	0.42	< 1
Grp x inPA				1.27	0.42	3.00**
−2 log likelihood			1418.5			1409.3
AIC			1438.5			1435.3

Intervention group was entered as a level 2 variable. The dependent variable is the residualized change in hourly rate of victimization.

DirRA direct-reactive aggression, *DirPA* direct-proactive aggression, *InPA* Indirect-proactive aggression

†$p < 0.10$

*$p < 0.05$

**$p < 0.01$

The reduction in the −2 log likelihood value (−1.8, *df* = 7) was not significant and AIC values increased when interaction terms were added. Thus, high fall rates of direct-reactive aggression were significant predictors of increases in spring rates of indirect-proactive victimization for both boys and girls, and high fall rates of indirect-proactive aggression predicted increases in spring rates of indirect-proactive victimization for boys and girls in the control group.

Specificity of Aggression-Victimization Relationships

The best-fitting models for the three types of victimization showed similarities in the pattern of relationships with fall aggression. In order to determine whether aggression types were uniquely associated with changes in each victimization variable, the best-fitting models for each type of victimization were compared to expanded models in which the two other types of victimization were entered as control variables (e.g., direct-proactive victimization and indirect-proactive victimization were added as control variables in the model predicting change in direct reactive victimization). In each case, the expanded models led to increases in the information criteria and nonsignificant reductions in −2 log likelihood values (all reductions <2.9, *df* = 2). Parameter estimates and significance levels associated with each type of aggression were virtually the same in the three expanded models as they were in the

models that did not control for alternative types of victimization.

In sum, each type of children's fall aggression made unique contributions to changes in each type of victimization even after controlling for two other types of victimization. High rates of direct-reactive aggression predicted increases in all three types of victimization. High rates of indirect-proactive aggression did not predict changes in either type of direct victimization, but was associated with increases in spring rates of indirect-proactive victimization among children in the control group. In contrast to other types of aggression, direct-proactive aggression was associated with *decreases* in direct victimization. These prospective relationships were applicable to both boys and girls.

Discussion

This study replicates prior observations that found high rates of elementary schoolyard aggression (Craig et al. 2000). Across the day, students in our study spent close to an hour in the schoolyard. By the sixth-grade, boys and girls were on the receiving end of nearly three aggressive acts in total during that hour. Going beyond this disturbing statistic, the study advanced understanding of aggression and victimization dynamics in important ways. Not only do these results extend our understanding of how aggressive actions affect risk of victimization, they also highlight the costs and benefits associated with different types of aggression, which may have implications for the development of and persistence of those behaviors.

Aggression Predicts Later Victimization in Diverse Ways

First, this study identified the unique relationships between aggression and subsequent changes in victimization that are defined by the function of aggression, reactive or proactive, as well as the form or method of attack. While each aggression type predicted later victimization, the strength and direction of the relationships were unique. These differences provide insight into the functional logic underlying those links. Young people vary in the types of aggression they usually engage in, and that variation contributes to differing peer environments—including the potential of rewards for some children and increased victimization for others.

Direct Aggression Direct-reactive aggression predicted rate increases in all types of victimization. By virtue of its reciprocal nature, reactive aggression may lead to retaliation and counter-retaliation cycles, thereby increasing reactive attacks (Winstock et al. 2004). The links between reactive aggression and peer rejection (Evans et al. 2015; Ostrov et al. 2013) may also increase children's vulnerability to proactive aggressors who prey on the marginalized (Veenstra et al. 2007) through direct or indirect means of attack. The ineffectual aggressive responses typical of highly reactive aggressors pose another risk—extending and intensifying bullying episodes (Wilton et al. 2000).

As with survey methodologies, these observations showed direct-reactive aggression to be more common than direct-proactive aggression (Kempes et al. 2006; Raine et al. 2006). Why persist in aggression that is not rewarded by reductions in victimization? Based on short-lived proximal outcomes (Snyder et al. 2003), the younger children in the study may believe it to be a protective strategy. Early adolescents, however, do not believe that retaliation is effective (Camodeca and Goossens 2005), even though they approve of it more than their younger peers (O'Brennan et al. 2009). Many report a sense of resignation–believing that social pressures will force them to retaliate eventually (Farrell et al. 2010). Moving into adolescence, perceived cultural norms and self-identity concerns may become increasingly important contributors to retaliatory actions (Frey et al. 2015). Not only is retaliation considered morally justified (Bellmore et al. 2013; Perren et al. 2012), some believe it to be the *duty* of the aggrieved party (Orobio de Castro et al. 2012).

In contrast to direct-reactive aggression, direct-proactive aggression predicted decreased victimization—most consistently in the case of unprovoked direct attacks typical of bullying relationships. These results are consistent with theoretical models of proactive aggression as a reward-directed activity (Runions 2013). They provide empirical support to suggestions (Barker et al. 2008) that direct-proactive aggression might offer some children a pathway out of victimization. Aggression is a risky strategy; standard errors for the links between direct-proactive aggression and victimization were higher than those for direct-reactive aggression. Children who adopt aggressive tactics in a bid for better treatment may find their social options diminished if their skills prove insufficient. Primarily proactive aggressors have positive social skills (Heilbron and Prinstein 2008) that promote social acceptance (Evans et al. 2015). Positive behaviors combined with the effective use of aggression (Hawley 2003) may be key to success.

We found no evidence that gender interacted with aggression in predicting victimization. Direct aggression includes face-to-face verbal attacks in addition to physical ones. Research that looks only at relationships between physical aggression and victimization might not find links for girls, due to their low rates of engaging in physical attacks (Card et al. 2008).

Indirect Aggression and Cross-Form Relationships Consistent with prior work (Leadbeater et al. 2006; Ostrov and Godleski 2013), indirect-proactive aggression preceded increased victimization of the same type, at least

within the control group. Absence of a link within the intervention group is consistent with beneficial effects found in the first year of program implementation (Low et al. 2010). Indirect-proactive aggression was not related to changes in direct victimization. Direct aggression did contribute to changes in indirect-proactive victimization, however. Past failure to find cross-form relationships might be due to failures to specify both form and function. In this study, high rates of direct-reactive aggression preceded increases in indirect-proactive attacks, while high levels of direct-proactive aggression preceded non-significant decreases in indirect-proactive attacks. Without specifying function, divergent trends for each type of direct aggression could potentially mask links to later indirect-proactive victimization.

The low rates of indirect-reactive aggression that we observed (22% of all indirect aggression) prevent conclusions about prospective links to victimization. Those rates also raise questions about observers' ability to identify indirect-reactive aggression. Youth this age, however, report a similar proportion (20%) during interviews (Xie et al. 2002, but see surveys such as Ojanen and Kiefer 2013). Still, it is possible that some of the indirect aggression that appeared to be proactive was instead well-regulated, delayed retaliation.

The latter uncertainty highlights an area of theoretical ambiguity. Descriptions of reactive and proactive aggression may confound goals (e.g., retaliation, dominance) with self-regulatory abilities (Runions 2013). Although reactive aggression is considered dysregulated and impulsive, not all examples of retaliation fit that description (Rudolph et al. 2011a). Some revenge is carefully planned to insure avengers will hold the upper hand. Such strategies can serve dual functions, that of exacting revenge and asserting dominance (Kempes et al. 2006). Our study validates the importance of a functional perspective while illustrating the need to disentangle goals and self-regulatory ability. Dodge (1991, 2006) has emphasized the role of impulsivity in reactive aggression. Perhaps regulatory deficits and desperation to defend oneself are more definitive of reactivity than revenge motives.

Does Aggression Have Reciprocal Effects with Victimization?

A meta-analysis of ten studies published as recently as 2004 indicated bidirectional influences between aggression and victimization (Reijntjes et al. 2011). More recent work has found links between victimization and later aggression in middle childhood (Cooley and Fite 2016; Giesbrecht et al. 2011; Ostrov and Godleski 2013). Function-specific analyses, however, have not shown an association between direct victimization and later direct-proactive aggression, and results are mixed with regard to later direct-reactive aggression (Lamarche et al. 2007; Salmivalli and Helteenvuori 2007). Further, relationships sometimes depend on moderators such as having aggressive friends (Lamarche et al. 2007) or strong needs for social approval (Llewellyn and Rudolph 2014). These contradictory findings indicate a need for continued theory-based research that specifies both form and function.

Limitations and Future Directions

Children's need for social approval may be important for determining whether children *feel* that they have been victimized, a crucial question not addressed by this study. Children who are preoccupied by peer approval and status, for example, may be prone to label individual acts such as we observed as *hostile* (Rudolph et al. 2011a), and to respond aggressively. We relied on reporters who were blind to intervention status and persistent peer reputations for aggression and victimization. Thus, we cannot speak to the social and psychologically important aspects of subjective victimization that are typically captured in peer and self-reports.

In addition to the restrictions of a single-informant approach (Ladd and Kochenderfer-Ladd 2002), are limitations specific to observations carried out only on schoolyards. Electronic forms of aggression may initiate or escalate school conflicts (Mishna et al. 2012). Even in the schoolyard, observations capture a small sample of aggressive events. With low rate events, this may result in high error terms and a corresponding lack of power. In our study, children's rates of indirect-reactive victimization were so low that they could not be analyzed. While we cannot entirely eliminate the possibility that observers systematically miscoded indirect reactive aggression as proactive, the close association of indirect-reactive aggression and anger (Marsee and Frick 2007) suggests that indirect reactive aggression would be fairly salient. An alternative possibility, supported by Xie's in-depth interview results (Xie et al. 2002) is that only a minority of indirect aggression is impulsive.

Discrepancies between interviews and observations on the one hand, and surveys on the other (e.g., Ojanen and Kiefer 2013) highlight the need to explicitly test developmental models of aggression rates that are specified by form, goal and impulsivity. Vitaro et al. (2006) suggest that increased self-regulatory ability may explain age-related increases in overall rates of indirect aggression. If so, such ability might also enable young people to strategically postpone indirect retaliation for an opportune time (Frey et al. 2015).

Given the theoretical importance of perceived popularity for understanding aggression (Heilbron and Prinstein 2008), it is unfortunate that the current study lacks measures of social acceptance or popularity. Because this study was carried out in

a region of the U.S. where many parents strongly disapprove of such measures (see also Mayeux et al. 2007), we did not attempt to include them in our toolkit. Such considerations highlight the potential importance of regional variations in cultural norms–even within national boundaries. Regional differences in revenge norms (Cohen et al. 1996), for example, deserve far more attention than they have received in the developmental or the prevention literature.

Coexisting with these limitations are several strengths. This study had an unusually large sample for in vivo observations, allowing multilevel analyses that controlled for shared variance within classrooms, and for investigation of possible moderation by gender, grade, and intervention group. In a field that often lacks precision in measurement (Ladd and Kochenderfer-Ladd 2002), the observations provided veridical estimates of rates per hour and minimized bias with observers that were blind to condition. Like other studies using trained observers (Card and Little 2006), our study showed less overlap in reactive and proactive aggression than is typical of untrained reporters. Such specificity in both aggressive form and function may have enabled the discovery of divergent trends in the associations of aggression types with later victimization.

Conclusions

Although other work has shown that direct-reactive aggression predicts later increases in direct victimization among boys (Salmivalli and Helteenvuori 2007), our study is the first to reveal a heightened risk for later direct and indirect victimization among both boys and girls. High rates of indirect-proactive aggression, on the other hand, predicted elevated risk for experiencing the same treatment, but had no relation to direct victimization. The results for direct-proactive aggression stand in sharp contrast, suggesting that high rates might protect against victimization in some circumstances. The latter finding offers support for the argument that benefits accrue to aggressors who are successful in wielding power (Boivin et al. 2001; Hawley 2003; Leadbeater et al. 2006).

As a whole, these results provide a cautionary note regarding failure to specify the aggressive form and function perpetrated and experienced by children. The need for greater specificity also highlights theoretical ambiguity in the classification of well-regulated retaliation. Further research is needed to confirm whether the primary distinction between reactive and proactive aggression is one of motive or regulatory capacity. This clarification could advance the effectiveness of intervention strategies by providing a clearer understanding of etiology and enabling practitioners to better match intervention practices to the needs of individual children.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures were in accordance with the ethical standards of the local Institutional Review Board and with the 1964 Helsinki declaration and its later amendments or comparable Ethical standards.

Informed Consent Informed consent was obtained from individual participants included in the study.

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