Journal of Comparative Psychology
2007, Vol. 121, No. 1, 54–64

0735-7036/07/$12.00 DOI: 10.1037/0735-7036.121.1.54

Social Dominance in Preschool Classrooms

Anthony D. Pellegrini, Cary J. Roseth, Shanna Mliner, Catherine M. Bohn, Mark Van Ryzin, Natalie Vance, Carol L. Cheatham, and Amanda Tarullo
University of Minnesota, Twin Cities Campus

The authors examined preschoolers' aggressive and cooperative behaviors and their associations with social dominance. First and as predicted, directly observed aggressive interactions decreased across the school year, and same-sex aggression occurred more frequently than cross-sex aggression. Next, the authors examined the relation between aggression and reconciliation, cooperation, and social display variables. Teacher ratings of children's aggression related to observed aggression but not to observed "wins" of aggressive bouts. Instead, wins were related to cooperation and display variables. Finally, they examined the relative power of wins and cooperation in predicting 2 measures of social dominance. After age was controlled, wins alone predicted teacher-rated social dominance. Results are discussed in terms of different forms of competition and how school ethos affects these forms.

Keywords: social dominance, contest competition, scramble competition

Ethologists have documented social dominance across a number of social species (e.g., Bernstein, 1981; de Waal, 1982; Dunbar, 1988; Strayer, 1980) and conceptualized it in terms of an individual's ability to defeat a conspecific, often using aggression, in a contest for resources (Charlesworth & Dzur, 1987; de Waal, 1982; Hinde, 1980; McGrew, 1972). Most variants of social dominance theory posit that in new or emergent groups, such as pupils in a classroom at the start of a school year, aggression stabilizes after a period of initially high rates (e.g., Pellegrini & Long, 2003; Strayer, 1980). That is, in new groups, aggression is observed at relatively high rates as individuals sort out status, and with time, rates of aggression should decrease. Social dominance structure results from these dyadic contests (Bernstein, 1981; Hinde, 1978). Similar trends have also been documented for early adolescents' aggression as they make the transition from primary to secondary school (Pellegrini & Long, 2003).

These trends are probably due to subordinate individuals recognizing that the costs of challenging a more dominant individual outweigh the benefits, as they are likely to be defeated. Similarly, high-status individuals probably do not challenge subordinates because there is little to be gained (low benefits), whereas relatively high costs are likely to be incurred (e.g., social sanction, defeat). Although this hypothesis has been supported in adolescence (Pellegrini & Long, 2003), it has not been tested, to our knowledge, across an entire school year with preschool children.

A second assumption of many views of social dominance is that contests for resources occur more frequently between same-sex, relative to opposite-sex, conspecifics (Archer, 1992). This assumption, consistent with sexual selection theory (Darwin, 1871), among other theories, posits that males compete with males (e.g., Buss, 1989) for prioritized access to resources and subsequent dominance status. Females, too, compete with each other (Campbell, 1999; Kappeler & van Schaik, 2004) and subsequently exercise selective choice of resources. However, in studies of aggression, the sex of the target is often not reported (Archer, 2004; Eagly & Steffen, 1986; although see McGrew, 1972; Pellegrini & Long, 2002; Smith & Green, 1975, for exceptions). Given this theoretical orientation as well as the fact that sex segregation, or groups composed of all boys or all girls, typifies most preschool groups (Maccoby, 1998; Pellegrini, 2004b) and that propinquity among peers confers the risk of being the target of aggression (Hartup, 1983), we expect boys to target other boys in aggressive bouts and girls to target other girls.

Correspondingly, aggressive interactions should not be distributed across all of the same-sex individuals in a group; rather, they should be selectively directed at certain individuals. For example, individuals should only target peers with desired resources and those they think they can defeat (Archer, 1992). Examples of the selective uses of aggression can be found in the primary school bullying literature, whereby bullies systematically direct aggression at vulnerable peers (Perry, Kusel, & Perry, 1988; Schwartz, Proctor, & Chen, 2001). Consequently, we predict that individuals will not interact aggressively with all of the same-sex peers in their social groups.

The extent to which individuals interact aggressively with all of their peers also has implications for the use of dominance matrices, often used to rank individuals into dominance hierarchies. Researchers determine place in a dominance hierarchy by indexing individuals' observed dyadic competitive exchanges and ordering

Anthony D. Pellegrini, Cary J. Roseth, Catherine M. Bohn, Mark Van Ryzin, and Natalie Vance, Department of Educational Psychology, University of Minnesota, Twin Cities Campus; Shanna Mliner, Carol L. Cheatham, and Amanda Tarullo, Institute of Child Development, University of Minnesota, Twin Cities Campus.

We acknowledge the support of the staff, children, and families of the Shirley Moore Nursery School at the University of Minnesota, Twin Cities Campus; Megan Gunnar for comments on drafts of this article; statistical and design advice from Jeff Harring, Mike Harwell, and Jeff Long; and comments on the article from John Archer and Peter K Smith.

Correspondence concerning this article should be addressed to Anthony D. Pellegrini, Department of Educational Psychology, 214 Burton Hall, University of Minnesota, Minneapolis, MN 55455. E-mail: pelle013@umn.edu

these individuals in win:loss matrices (see McGrew, 1972; Sluckin & Smith, 1977; Strayer, 1980; Vaughn & Waters, 1981, for exemplary work in this area). For example, two children are competing for a snack, and one of them grabs it (the aggressive behavior). The child who gets the snack is coded as the winner, and the other is the loser. Dyadic win:loss comparisons are typically arranged in a matrix, and individuals are rank ordered from the most dominant (Rank 1 = alpha) to the least dominant. In this way, dominance rankings and transitivity indexes (e.g., A > B, B > C, therefore A > C) are based on the assumption that all individuals in a group interact with each other (Archer, 1992). Thus, competitive dyadic encounters are used in determining a dominance relationship, and the total number of such encounters, entered into a dominance matrix, is used to determine rank or structure, or an individual's status in relation to the larger group (Bernstein, 1981; Hinde, 1978).

In the present study, we used the number of "wins" in aggressive contests to predict two measures of social dominance. Operationally, aggressive exchanges (including both physical and social aggression) were indexed in this study in terms of the efficiency with which directly observed competitive bouts resulted in wins (resources acquired) across a school year (number of aggressive bouts − losses = wins). This metric assayed the effectiveness with which individuals used aggression to win contests.

Social dominance was assessed in two ways. First, teacher ratings of children's social dominance were used because teachers have thorough knowledge of children's aggression and social dominance, on the basis of their observations of children's daily interactions across many months (Hawley, 2002: Pellegrini & Long, 2003). The items in this measure (e.g., "dominates others," "gets what wants") assess dominance relationships. We also assessed the rank, or structural, aspect of social dominance by using the ticket paradigm (Cheatham & Mliner, 2003; Tarullo, Mliner, Gustafson, & Gunnar, 2003). Social dominance status in the ticket paradigm was operationalized as children's place in a queue to gain access to three special events. Our concern about teacher-imposed social rules and structure was one of the reasons for the development of the ticket paradigm. The validity of this procedure was maximized because teachers explicitly agreed not to intervene or to give clear rules to children about how to line up.

In brief, the ticket paradigm was conducted in the winter of the year, after the children had been together for 4 months. On 4 separate days (one practice and three test events), children were read a story about animals lining up in the order that they would attend a party and then were invited to line up themselves to receive tickets for the order in which they would attend a special event. The children in the front third of the line received tickets in one color to attend the event immediately, those in the middle third of the line received tickets to attend the event the next day, and those in the back third of the line received tickets to attend the event last. Tickets were numbered according to the children's place in line and were recorded as each child's rank for each trial event.

Characterizing behaviors that predict social dominance solely in terms of aggressive behaviors is assumed to be antithetical to the presumed value of social dominance relationships, which is to minimize aggression (de Waal, 1982; Hartup, 1983; Hawley, 2002; Keating & Heltman, 1994; McGrew, 1972; Pellegrini & Bartini, 2001; Sebanc, Pierce, Cheatham, & Gunnar, 2003; Strayer, 1980; Vaughn, Vollenweider, Bost, Azria-Evans, & Snider, 2003). From this perspective, aggression is costly to individuals, and they should try to minimize it by using a variety of strategies, including reconciliation, cooperation, and aggression, as well as display strategies, to establish and maintain social dominance (de Waal, 1982; Hartup, 1983; McGrew, 1972; Strayer, 1980). Aggressive behaviors can be physical (e.g., shoving a child to snatch a toy from a peer), verbal (e.g., calling a peer fat or stupid), or social (e.g., shunning, spreading rumors; Cairns, Cairns, Neckerman, Ferguson, & Gariepy, 1989; Crick & Grotpeter, 1995; Galen & Underwood, 1997) and may be used in contests for resources. Conversely, cooperative and reconciliatory behaviors can be used to maintain social contact or reconcile with peers after an aggressive contest and might be used by individuals to build or maintain alliances and minimize enemies (de Waal, 1982; McGrew, 1972). The balance between these affiliative and aggressive behaviors may help to stabilize relationships and group structure (Hartup, 1983). Affiliative behaviors in the present study included cooperative behaviors (i.e., children engaged in coordinated interaction) and postaggression reconciliation between peers.

In the fourth objective of this study, we examined the roles of winning aggressive bouts, peer reconciliation, cooperation, and social displays in children's social dominance. Winning aggressive bouts and cooperation should predict children's social dominance status, as they are both ways to efficiently access resources. Laboratory (Charlesworth & Dzur, 1987; Charlesworth & LaFreniere, 1983) and field (Ljungberg, Westlund, & Forsberg, 1999; McGrew, 1972; Sebanc et al., 2003; Strayer, 1980) research with preschool children supports the claim that children use these sorts of affiliative strategies, in addition to aggressive strategies, to access resources. For example, dominant individuals reconcile with peers after aggressive exchanges (de Waal, 1982; Ljungberg et al., 1999). Reconciliation among preschoolers can take varied forms, ranging from an explicit apology to less direct behaviors, such as initiating interaction or offering to help or share after the aggressive event (Ljungberg et al., 1999). By reconciling with their peers, individuals can keep them as allies in future competitions (de Waal, 1982). According to the direct observational work of Ljungberg et al. (1999), reconciliations can be peer mediated (e.g., apology, social contact) or adult mediated (e.g., teacher intervention). The frequency with which postaggressive peer reconciliation is observed, however, is often limited by adult intervention, especially in university lab preschools (e.g., Hartup, 1983; Smith & Connolly, 1980), where there is a greater teacher presence as well as an anticompetition ethos.

We also documented the degree to which winning aggressive bouts and cooperation predicted children's social dominance. Winning aggressive bouts and cooperation should predict children's social dominance status, as they are both ways, although certainly not the only ways, to access resources and win contests, either directly or through the use of allies maintained through cooperative interaction. Extant research suggests that aggression and cooperation not only co-occur (Hawley, 2002; McGrew, 1972; Pellegrini & Bartini, 2001; Strayer, 1980) but also both predict resource-holding power (Charlesworth & Dzur, 1987; Charlesworth & LaFreniere, 1983; McGrew, 1972).

Social displays are often associated with social dominance, as they communicate or advertise an individual's resource-holding power to conspecifics (Clutton-Brock & Albon, 1979). Social

displays have been measured by peer visual regard, or the number of children looking at a focal child (Chance, 1967; Vaughn & Waters, 1981; Waters, Gornal, Garber, & Vaughn, 1983), and physical size, as a proxy for physical prowess (Gangestad & Thornhill, 2004; Sell, 2005; Tokuda & Jensen, 1969). Indeed, the visual regard that children receive from their peers has been proffered as an indicator of social dominance (Chance, 1967; Hold-Cavell, 1985; Vaughn et al., 2003; Vaughn & Waters, 1981). As such, we posit that peer visual regard will be positively correlated with observed cooperation as well as with winning aggressive contests. It is probably the case that children become aware of their peers' resource-holding power by observing them in cooperative and aggressive encounters; consequently, this variable should index an individual's group centrality.

Physical size is another social display variable that communicates physical prowess and the potential to win contests. Bigger is often equated with stronger and tougher and consequently is considered an important contributor to both winning contests and social dominance status in the comparative literature (e.g., Clutton-Brock & Albon, 1979; Tokuda & Jensen, 1969). Consideration of physical size has received surprisingly little attention in the human developmental literature on social dominance (although see Hawley, 2002, for children, and for adults see Gangestad & Thornhill, 2004; Sell, 2005). Following Clutton-Brock and Albon (1979), we posit that physical size is an indirect indicator of physical prowess and thus should relate to efficient winning of aggressive bouts.

Physical size, along with cooperation, is conflated by children's age. (We acknowledge an anonymous reviewer for raising this issue.) During the preschool period, children become more cooperative with age, as this involves drawing on rapidly developing language and social–cognitive strategies (Hartup, 1983), and grow physically larger (Tanner, 1970). It is interesting that in the studies documenting children's use of both aggression and cooperation to predict social dominance (e.g., Charlesworth & Dzur, 1987; Charlesworth & LaFreniere, 1983; McGrew, 1972; Pellegrini & Bartini, 2001; Strayer, 1980), age was not statistically controlled; thus, we are uncertain of the unconfounded role cooperation and size play in social dominance. In the present study, we examine the role of these variables in predicting social dominance.

In summary, there were four objectives in this study. First, we tested the hypothesis that directly observed aggression would decrease across the school year. Second, we tested the hypothesis that observed intrasexual aggression would be greater than intersexual aggression. As part of this objective, we also examined the extent to which all members of a group interacted aggressively with each other. We predicted that children would not interact aggressively with all peers but instead would selectively choose their targets.

The behavioral and social display variables associated with winning aggressive bouts were also described. We predicted that display variables (physical size and peer visual regard), in addition to aggression and cooperation, would relate to winning agonistic bouts. Because aggression is infrequently observed in preschools, especially in university lab preschools (Hartup, 1983; Smith & Connolly, 1980), we also used teacher ratings of aggression and social dominance to complement the behavioral measures of each. The use of teacher ratings as valid indexes of aggression and dominance is widely accepted (e.g., Achenbach, McConaughy, & Howell, 1987; Hawley, 2002; National Institute of Child Health and Human Development Early Child Care Research Network, 2005; Pellegrini & Bartini, 2001) in the field. As part of this objective, we also examined the extent to which aggressive bouts were followed by peer reconciliation or adult intervention.

Method

Participants

A total of 65 children (ages 3.22 to 5.23 years; $M = 4.30$, $SD = 0.49$; 30 girls, 35 boys) enrolled in four separate classrooms in a large midwestern university laboratory preschool participated in this study. Girls ($M = 4.36$ years, $SD = 0.42$) did not differ in age from the boys ($M = 4.25$ years, $SD = 0.54$), $F(1, 57) = 1.22$, $p = .27$; nor did classrooms differ in age, $F(3, 57) = 0.735$, $p = .53$; and there was no Classroom $\times$ Sex interaction, $F(3, 57) = 1.015$, $p = .39$. Most children were from two-parent families, and most parents had college degrees. Across the school year, a total of 4 children were added, but they were not included in this study. Seventy-five percent of children were European American, 8% were African American, and 16% were from other backgrounds. The sample also included children for whom English was a second language (19% of the total) and others who had special needs (10% of the total).

In terms of the human participants review, procedures associated with this study were all reviewed and approved by the University of Minnesota's Institutional Review Board as well by the Shirley Moore Nursery School/Institute of Child Development review committee. In addition, parents and guardians consent to have their children involved in approved research as part of attending this school, although parents may opt out of any study or any study component and children may refuse to take part in any research activity. This did not occur for the following study; thus, all children in these classrooms took part in the research.

Procedures

Children from all four classrooms were observed across the school year by a team of four graduate student research associates. Additionally, each child's aggressive behavior and social dominance, among other aspects of social behavior not reported in this article, were rated by the classroom teacher at the end of the fall and spring semesters.

Behavioral observations. Children were observed according to scan and event sampling procedures and instantaneous and continuous recording rules (Pellegrini, 2004a), respectively. The four researchers conducted the observations after a training regimen of about 4 weeks that entailed videotape viewing and discussions, followed by live recording and discussion. After suitable levels of reliability were reached ($\kappa = .80$) in training, children were observed during their free play time in a number of venues in the preschool across the school year. In particular, they were observed in their classroom (where observers conducted the observations from observation booths through a one-way screen), on the playground, and in the gymnasium. In these latter two venues, observations were completed from vantage points unobtrusive to the children. Reactivity was minimal, as the children were accustomed to interacting with researchers and to researchers being present in their classroom.

In terms of the scan sample and instantaneous recording procedures, observers entered a classroom each day with a predetermined, randomized list of children to observe. They located individual children and recorded the relevant behavior in that same instant. All data were entered onto laptop computers via an SPSS spreadsheet. When researchers were observing children in the classroom, they sat behind one-way viewing screens; when they observed in the gymnasium, they sat on the floor; when they observed on the playground, they sat where they could or cradled the laptop in one arm, observed the child, and then entered the data. A variety of behaviors were instantaneously recorded, but those relevant to this article included peer visual regard (i.e., the number of individuals looking directly at the focal child) and the child's cooperative behavior. Cooperative behavior was defined as instances in which individuals were in immediate physical proximity (next to each other or in the same social group) and in which there was reciprocal social exchange involving mutual gazes, verbal interaction, or physical exchanges (e.g., pats on the back, passing and receiving a toy).

We established interrater agreement by comparing the coding of two simultaneous coders every 8 weeks between all observers across the 9-month school year. Reliability and retraining sessions were held on alternating months across the entire year, and the reliability coefficients were .70 for peer visual regard and .88 for cooperative interaction. In total, 485 scan sessions were recorded across the school year, for a total of 778 instantaneous scan samples across all children and, on average, 24.18 (SD = 6.03) scans per child across the school year. There was no evidence of significant classroom or sex differences for any observational measure.

Event sampling with continuous recording rules occurred when an observer saw an aggressive competitive bout, such as competition for a toy, a treat, a place in a queue, or a peer's attention. Children's behavior was recorded for the duration of the aggressive bout and for 4 min after the aggressive behavior terminated. For aggressive bouts, observers recorded the following information: the identity of the child who initiated the bout and the identity of the target of the aggression, the nature of the aggression (e.g., physical, verbal, and social aggression, including both direct and indirect forms such as shunning and spreading rumors, snatching an object, or displacing a peer in line or at an activity; $\kappa = .90$), and the context of the aggression (i.e., whether it was over an object, person, place in line, etc.). Aggression was scored both in terms of relative frequency (aggression/number of times a child was scanned) and in terms of a win index (total aggressive bouts − losses). Across the school year, a total of 173 aggressive events were observed.

We also coded the responses to the aggressive initiations (κ = .81). First, we coded whether there was a winner and a loser in the encounter and, if so, the identity of both. Winners and losers were determined when two children were competing for a resource, such as a place in line, a seat at a table, or a toy; the winner was the child who ended up with the resource directly after the contest, and the loser was the one who did not get it. We also coded the following responses: no response, leaves the field, cry, aggression (physical, verbal, social), counterdisplace, countersnatch, teacher intervention, and peer intervention. No response to an aggressive initiation simply involved the target not reacting, whereas leaving the field had the respondent moving away from the initiator. If the child sobbed or shed tears, it was coded as crying. Aggressive countermoves were coded in the same manner as the initiations, as were counterdisplacements and countersnatches. Teacher and peer interventions were coded if a teacher or a peer intervened in the dyad directly after the aggressive initiation.

We also coded the extent to which there was reconciliation between the children involved in aggressive bouts ($\kappa = .87$). We did this by following the children for 4 min after the observed aggression terminated (Ljungberg et al., 1999). Most generally, we coded whether there was social contact between the children after the termination of the aggressive bout, who initiated it, and the behavior used (invitation to play, body contact, apology, teacher-mediated contact, object offer, symbolic offer, self-ridicule, and comfort patting).

Physical size. Height and weight were assessed by a research associate during the winter and spring of the year. Physical size was defined as the average of each child's standardized (within each classroom) weight and height.

Teachers' ratings. In the late fall to early winter and in the spring of the school year, classroom teachers completed a rating scale of children's aggression and social dominance as part of a more general measure of social competence based on Dodge and Coie's (1987) Teacher Checklist. The choice of the administration time was based on earlier research with this measure (Pellegrini & Long, 2003). Children were rated on a 1–7 Likert-type scale for five items for aggression (e.g., "starts fights," "says mean things," "uses physical force"; Cronbach's $\alpha = .85$) and five items related to social dominance (e.g., "dominates classmates," "tells others what to do," "stands up for self"; Cronbach's $\alpha = .89$). We standardized responses within classrooms to create overall aggression and social dominance scores for each child.

The ticket paradigm. The ticket paradigm, developed by Cheatham and Mliner (2003; Tarullo et al., 2003), was conducted in the winter of the year, after the children had been together for 4 months. Pilot data using this paradigm were collected across 4 years in the preschool. The present results reflect data from this paradigm collected during 1 of those 4 years. In brief, the procedures involved a practice event, comprehension assessment, and three test events, conducted across many days. On each occasion, children were read a story about animals lining up in the order that they would attend a party and then were invited to line up themselves to receive tickets for the order in which they would attend a special event. Teachers, although present in the room, merely watched the procedure, intervening only if they observed that a child might get hurt. This never occurred. The children in the front third of the line received tickets in one color to attend the event immediately, those in the middle third of the line received tickets to attend the event the next day, and those in the back third of the line received tickets to attend the event last. Tickets were numbered according to the children's place in line and were recorded as each child's rank for each trial event. This ticket procedure was first conducted as a practice event to ensure that children grasped the concept and was followed with an individual assessment to determine understanding of the ticket procedures. The ticket event procedure was then repeated, on different days, for three trials of special events: monkey hunt, carnival, and jungle party. Dominance rank was computed as the average of ticket rank in line across the three trials. In terms of analyses, the place in line was reverse scored; thus, a reversed score of 1 indicated that a child

was at the end of the line. All children actually attended all special events. In terms of the reliability (test–retest) of the ticket paradigm, the intercorrelations between the three coded ticket events were all statistically significant (Events 1 and 2, $r = .33$, $p < .05$; Events 2 and 3, $r = .60$, $p < .001$; Events 1 and 3, $r = .41$, $p < .01$). Regarding the validity (concurrent and construct) of the procedure, it was positively and significantly correlated with teacher-rated social dominance ($r = .32$, $p < .009$).

Data Analysis

A concern for data analysis was the low frequency of physical and verbal aggression (see Coie & Dodge, 1998) and the possibility that counts of such behaviors would not follow a normal distribution. More likely, counts of aggression would be positively skewed with a mode of zero or one, making normalizing transformations highly problematic (e.g., the natural log of zero is undefined). Such distributions preclude the use of more traditional analytic methods, such as repeated measures analyses of variance and multivariate analyses of variance. Because of this, we used population-average, generalized linear models (GENMODs) for longitudinal data (Fitzmaurice, Laird, & Ware, 2004) to test our prediction that rates of aggression would decline over time. Specifically, we used a Poisson distribution for the response variable, a log-linear GENMOD to model rate trajectories, and the generalized estimating equation methods in the GENMOD procedure of SAS 9.1 to estimate parameters and test statistics. For all models, we specified the correlation structure as lag-one autocorrelation, as recommended in the literature (Fitzmaurice et al., 2004, Chapters 10–11).

Results

In the first objective, we tested the hypothesis that observed aggression would decrease across the school year. To test this hypothesis, we fitted the Poisson GENMOD

$$g(\mu_{ij}) = \beta_1 + \beta_2 t_{ij}, \quad (1)$$

where $\mu_{ij} = E(Y_{ij})$, the expected rate of occurrence of aggression for the *i*th individual at wave *j*; *g* is the mean transformation or *link function,* $\log_e E(Y_{ij})$, linking the log expected rate μ_{ij} to a linear combination of the covariates; and t_{ij} is the linear predictor. In this model, β_1 is the log expected rate of aggression at Wave 1 (the unconditional intercept) and β_2 indicates the linear increase in the log expected rate for a one-unit increase in time (i.e., linear trend). As shown in Table 1, the specific test of the linear trend was significant and negative, which means that the estimated log expected rate of aggression decreased over the three terms.

Table 1
Log Expected Rates of Aggression Over Time (N = 65)

Parameter	Estimate	*SE*	95% CI	*z*
Intercept (β_1)	−1.07	0.24	−1.55, −0.60	−4.43**
Linear Slope (β_2)	−0.53	0.22	−0.97, −0.08	−2.34*

Note. CI = confidence interval.
* $p < .05$. ** $p < .01$.

The parameter estimates reported in Table 1 can be used to derive the predicted equation,

$$g(\hat{\mu}_{ij}) = -1.078 - 0.5307 t_{ij}, \quad (2)$$

which, in turn, can be used to compute the estimated rate of aggression at each wave. Thus, Equation 2 shows that the aggression at one wave is multiplied by the slope, $e^{-0.5307} = 0.58$, to obtain the rate at the next wave. Figure 1 displays these numbers, showing that there was a 41% decrease in the rate of aggression from one wave to another and a 66% decrease from fall to spring. In sum, the results support the prediction that aggression would decrease over time.

In the second objective, we compared the mean frequency of same- and mixed-sex aggressive bouts. Paired sample *t* tests were used because the same children might have contributed to both scores ($r = .51$, $p < .01$). Consistent with the prediction, results showed that the mean frequency of same-sex bouts ($M = 0.13$, $SD = 0.26$) was significantly greater than the mean frequency of mixed-sex bouts ($M = 0.08$, $SD = 0.13$), $t(64) = 2.00$, $p < .05$ (two-tailed) (c[0.0001, 0.11], $d = 0.24$).

One explanation of differential rates of same- and mixed-sex aggressive bouts may be that peer groups (i.e., affiliative playmate groups) are already segregated. That is, aggressive bouts occur more frequently between playmates than between nonplaymates. This study's results support this possibility, as the mean frequencies of same-sex aggression and same-sex play groups were positively correlated ($r = .24$, $p < .05$).

To test this alternative explanation, we compared the mean frequencies of same- and mixed-sex play groups. Again, paired sample *t* tests were used because the same children might have contributed to both scores ($r = -.14$, $p = .24$). In this case, we found no significant differences in the mean frequency of same-sex ($M = 9.16$, $SD = 4.84$) and mixed-sex play groups ($M = 8.13$, $SD = 4.48$), $t(64) = 1.17$, $p = .24$ (two-tailed; c[−0.72, 2.78], $d = 0.21$). Thus, the results fail to support the view that the greater frequency of same- versus mixed-sex aggression can be explained by segregated play groups.

Also in relation to the study's second objective, we tested the assumption that individuals interact aggressively with all of their peers. In particular, we examined the distribution of aggressive interactions among all individuals within each of the four classrooms. The null hypothesis tested was that aggression within each classroom would be equally distributed among all class members. Using separate chi-square tests for each of the four classrooms, we found that the null hypothesis was rejected in every classroom: Classroom 1, $\chi^2(16) = 26.39$, $p < .05$; Classroom 2, $\chi^2(17) = 27.59$, $p < .05$; Classroom 3, $\chi^2(13) = 22.36$, $p < .05$; Classroom 4, $\chi^2(13) = 23.69$, $p < .05$. Thus, the results support the prediction that, within each classroom, aggression was not distributed equally across all individuals.

In the third objective, we examined the relations between winning aggressive bouts (wins) and cooperation, aggression, peer visual regard, and physical size. The descriptive statistics associated with this objective are displayed in Table 2, and the intercorrelations are displayed in Table 3. Results support the hypothesis that winning would be significantly associated with aggressive behaviors, cooperative behaviors, peer visual regard, and physical size. Table 4 shows these same correlations when we statistically controlled for age. In this analysis, results show that the relations

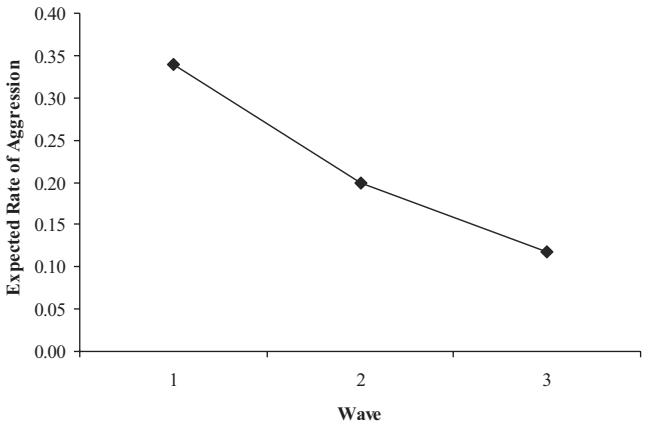

Figure 1. Expected rate of aggression across time ($N = 65$). Longitudinal trajectory based on predicted values reported in Table 1, inserting into Equation 1, and then taking the antilog of the right side of the predicted equation.

between aggressive wins and the other measures held, but aggressive wins and cooperation were no longer significant. Furthermore, in terms of predicting social dominance, number of aggressive wins was the only measure that still related to social dominance, as assessed by teachers' ratings but not the ticket paradigm, after we controlled for age.

As part of the third and fourth objectives, we also examined the degree to which aggressive interactions were followed by either reconciliation between peers or teacher intervention in the 4 min immediately following the initiation of the aggressive bout. Of the 173 aggressive bouts observed, the initiator reconciled his or her target in 32 cases (18%), whereas a teacher intervened on 72 occasions (41%). Neither reconciliation nor teacher intervention occurred in the remaining aggressive initiations. Finally, in the fourth objective, we examined behavioral predictors of two measures of social dominance. On the basis of the partial correlations presented in the previous objective (and see Table 4), only aggressive wins predicted teacher-rated social dominance.

Discussion

The hypothesis that aggressive behavior would decrease across the school year is supported. Although there was a decrease across the whole year, the significant drop in aggression was observed during the spring term, relative to the first two terms. The decrease of aggression across a school year has been empirically verified with adolescents (Pellegrini & Long, 2003), but it has not, to our knowledge, been verified across an entire preschool year. That these patterns have been documented in the comparative literature in newly formed social groups (e.g., Hinde, 1980) and now have been verified during childhood and adolescence (Pellegrini & Long, 2003) speaks to their robustness, suggesting that this is a general pattern typifying the role of aggression in the development of dyadic relationships and group structure.

The decrease in aggression is consistent with social dominance theory, which posits that aggression decreases because individuals recognize, with time, that the costs associated with aggressive contests outweigh the benefits. From this perspective, subordinate individuals might have recognized that the high costs (e.g., high likelihood of being defeated) associated with challenging more dominant individuals outweighed the relatively low benefits (e.g., access to abundant resources). Similarly, dominant individuals might also have recognized the low benefits (e.g., already being dominant over most individuals), relative to the high costs (e.g., teacher sanction) of aggressing against a subordinate peer, especially when the resources in the classroom were abundant. In the preschool studied in this report, there was an abundance of resources; thus, their value was relatively low—for example, there were many snacks, toys, and play spaces available for children to access.

The significant decrement in aggression during the spring term, relative to the two preceding terms, might have been due to the fact that during the spring term children were together continuously for a longer period of time than in other terms (Hold-Cavell, 1985). For example, the fall term had interruptions associated with Thanksgiving and Christmas breaks, and between winter and spring children were off for almost a month. At the start of the spring, they were getting familiar with each other again and remained together, uninterrupted by breaks, for the rest of the year; consequently, after this prolonged period, aggression decreased.

The decrease in aggression might have been due to other factors as well. First, and related to the social dominance explanation, the social cohesion of these classrooms might have been partially responsible for the decrease. That is, the population of the school remained relatively stable across the year, with only 4 new children being added (or a 6% change in the population). Such a minimal change in the classrooms' social structure might have helped to keep levels of aggression relatively low. Consistent with this interpretation, McGrew (1972) examined rates of aggression in preschool classrooms when new children were added to established classrooms and found that low levels of aggression were aimed at the new children and that the new children's initiation of aggression was low. McGrew suggested that children's rates of aggression were related to the social norms of the classrooms.

A related cause for the decrement in aggression might have been the fact that, over time, children were being socialized to school rules encouraging cooperative behavior and discouraging contests and aggressive behavior. That teachers intervened in many (41%) of the observed aggressive bouts is consistent with this interpre-

Table 2
Descriptive Statistics ($N = 65$)

Variable	*M*	*SD*
Aggression[a]	0.22	0.34
Aggression wins[b]	2.60	3.46
Peer visual regard[a]	0.35	0.20
Cooperation[a]	0.47	0.16
Teacher-rated aggression[c]	2.90	1.33
Teacher-rated dominance[c]	3.36	1.02
Physical size		
Height (m)	1.08	0.05
Weight (kg)	18.42	2.93

[a] Relative frequency was based on the number of observed behaviors divided by the total hours of observation for each individual child. [b] Relative frequency was based on number of wins divided by the total number of aggressive bouts. [c] Values are from the Teacher Checklist.

Table 3
Intercorrelations Between Observational, Teacher, and Ticket Paradigm Measures

Measure	1	2	3	4	5	6	7	8
1. Aggression	—	.24*	.42**	.00[a]	.54**	.49**	.21	.18
2. Aggression wins		—	.17	.30*	.34**	.22	.48**	.26*
3. Cooperation			—	−.12	.67**	.22	.18	.18
4. Physical size				—	−.04	.08	.27*	.29*
5. Peer visual regard					—	.27*	.14	.14
6. Teacher-rated aggression						—	−.01	.07
7. Teacher-rated dominance							—	.32**
8. Ticket paradigm								—

Note. $N = 65$.
[a] Value = .001.
* $p < .05$. ** $p < .01$.

tation. In further support of this socialization position, we found a positive and significant correlation between children's number of months in attendance at the school and observed cooperation ($r = .26$, $p < .05$). Furthermore, if the socialization hypothesis is correct, then one would expect that decreases in aggression over time would only be observed in classrooms with clear social norms. Correspondingly, schools with less clear social norms should produce prolonged aggression or even increases as children learn this is how these schools are organized.

Thus, a combination of group cohesion and teacher socialization may explain the decrement of aggression across the school year. To more directly examine the mechanisms by which children are socialized to school rules, researchers should document teachers' use of direct (e.g., reprimanding students for antisocial behavior and rewarding prosocial behavior) and indirect (e.g., modeling prosocial behavior) strategies for minimizing students' aggression and maximizing cooperation and how these strategies moderate children's aggressive and affiliative behaviors.

In the second objective, another basic assumption of social dominance, that aggressive bouts between same-sex peers would be greater than those between opposite-sex peers, was tested and supported for both boys and girls. This finding replicates other findings using peer nominations of aggression (Crick, Nelson, Morales, Cullerton-Sen, & Hickman, 2001; Ostrov, 2004) and direct observations for aggression in both school (preschool and middle school) and home settings (Ostrov, 2004; McGrew, 1972; Pellegrini & Long, 2002; Stauffacher & DeHart, 2005) as well as findings from the adult literature using a variety of measures of aggression (Archer, 2001). One interpretation for this finding with preschoolers is that same-sex aggression is an artifact of sexually segregated peer groups (Ostrov, 2004). That is, aggression between same-sex children may be due to the fact that children of this age interact in sexually segregated groups (Maccoby, 1998; Pellegrini, 2004b). In the current study, we found that aggression was against a same-sex peer more than against an opposite-sex peer. By comparison, in nonaggressive scans, children more generally were observed in mixed-sex groups. Thus, the great frequency of same-sex, relative to mixed-sex, aggressive bouts was not an artifact of childhood sex segregation.

That children in this study were observed in mixed-sex and same-sex groups with equal frequency merits discussion, in light of the frequently reported finding that children of this age segregate into same-sex groups (Maccoby, 1998; Pellegrini, 2004b). This difference is probably due to the ethos of the school in which these children were observed. Consistent with extant research (Bianchi & Bakeman, 1978), in schools, such as this one, that stress the development of each individual and strive to minimize limitations associated with sex role stereotyping, children less frequently segregate into same-sex groups. For example, in Bianchi and Bakeman's (1978) study, 69.0% and 41.4% of children's interactions were in same-sex groups in traditional and "open" schools, respectively.

One interpretation of the observed greater frequency of same-sex, relative to opposite-sex, peer aggression is derived from

Table 4
Controlling for Age: Partial Intercorrelations Between Measures

Measure	1	2	3	4	5	6	7	8
1. Aggression	—	.24*	.42**	.00[a]	.54**	.49**	.21	.18
2. Aggression wins		—	.17	.30*	.34**	.22	.48**	.26*
3. Cooperation			—	−.12*	.67**	.22	.18	.18
4. Physical size				—	−.04	.08	.27*	.29*
5. Peer visual regard					—	.27*	.14	.14
6. Teacher-rated aggression						—	−.01	.07
7. Teacher-rated dominance							—	.32**
8. Ticket paradigm								—

Note. $N = 65$.
[a] Value = .001.
* $p < .05$. ** $p < .01$.

sexual selection theory (Pellegrini, 2004b). Consistent with the theory, same-sex peers compete with each other for status and access to resources. Similar patterns have also been observed during adolescence (Pellegrini & Long, 2003) and adulthood (Archer, 2001)—periods in development when male and female groups are not segregated. These more general findings, as well as our own, support the hypothesis, derived from sexual selection theory, that individuals aim aggression at same-sex peers and, more speculatively, that these acts of aggression serve a dominance function (Pellegrini, 2004b).

As part of these analyses, we examined the degree to which individual children in each classroom engaged in aggressive interactions with every other individual in the classroom, an assumption basic to transitivity and status judgments commonly derived from dominance matrices (Archer, 1992). Analyses indicated that individuals did not interact aggressively with all of their peers. This finding leads us to question transitivity assumptions associated with the use of win:loss matrices to document group dominance structure, unless the assumptions basic to the matrices' use are empirically verified.

In the third objective, we examined processes associated with winning aggressive encounters. As part of this process, we documented the extent to which peers reconciled after aggressive bouts. Our approach to reconciliation was functional, and thus we did not use matched controls, similar to Ljungberg et al. (1999). To this end, we examined the extent to which aggressive bouts were followed by peer reconciliation. Peer reconciliations after aggressive bouts were less common than adult interventions. The low level of peer reconciliations might have been due to the relatively high number of adults in each classroom as well as the chosen postaggression time interval of 4 min (Ljungberg et al., 1999). Alternatively, teachers might have selectively intervened in those conflicts they thought children were not capable of reconciling. For example, we know that children who are not friends with each other are less likely to reconcile after a conflict, relative to friends (Hartup, 1996). Furthermore, in keeping with the notion that reconciliation can be mediated by a third party (e.g., Nacci & Tedeschi, 1976), teachers' interventions might have led to peer reconciliation. Future research should address this possibility. For example, do teachers model strategies, such as apology, that children later use to reconcile?

We also examined the extent to which cooperative and aggressive behaviors as well as social display variables (peer visual regard and physical size) were associated with winning aggressive bouts and, eventually, with two measures of social dominance. First, we note that the two measures of social dominance were significantly intercorrelated, although at a modest level, which suggests that each assesses a common dimension of competition. Consistent with our hypothesis, winning was related to cooperation, aggression, peer visual regard, and physical size. Conversely, teacher-rated aggression was related to frequency of observed aggression but not related to either measure of social dominance or winning aggressive bouts, which indicates that aversive behaviors alone were not effective in accessing resources or social dominance. These results are consistent with the view that social dominance involves the use of a variety of direct (e.g., winning aggressive bouts and cooperation) and indirect (e.g., physical size display) strategies (Hartup, 1983; Strayer, 1980; Vaughn et al., 2003; Waters et al., 1983).

The co-occurrence of relative frequency of aggression and cooperation, similar to the findings of Roper and Hinde (1978), suggests that children of this age are socially active, generating high levels of a variety of behaviors, including aggression and cooperation; as they mature and become socialized, aggression drops (Coie & Dodge, 1998) and cooperation increases. The socially dominant children are those who use aggression effectively and efficiently (to win), not just frequently.

In the next objective, we examined the extent to which these behaviors related to two measures of social dominance after controlling for children's age. That age is related to physical size (Tanner, 1970) and cooperative behavior (Hartup, 1983) suggests that it may be a proxy for a number of age-related processes that are related to social dominance. After controlling for age, we found that winning aggressive bouts was still related to teacher-rated social dominance only (not ticket paradigm status), whereas cooperation and physical size were not. This is not to say, however, that in interactions relating to either dimension of social dominance, children did not use physical size as one salient bit of information, along with a variety of age-related measures, in assessing their opponents' resource-holding power. Indeed, children may use contestants' physical size, as well as other age-related information, as a rough-and-ready proxy for a number of skills associated with winning contests (McGrew, 1972; Sluckin & Smith, 1977). Although our findings need to be replicated, they do suggest a need to reinterpret the previous research (e.g., Strayer, 1980) indicating that preschoolers use both aggressive and cooperative behaviors to achieve and maintain social dominance, as these researchers did not control children's age.

Peer visual regard, counter to our hypothesis, did not relate significantly to social dominance. The hypothesis was based on the extant literature documenting the relation between visual regard and various measures of social dominance, such as Q-sort measures (Waters et al., 1983), as well as cooperative, coercive, and aggressive behavior (Vaughn et al., 2003). In our study, too, peer visual regard was related to relative frequency of aggression, wins, teacher-rated aggression, and cooperation. Most of these relations also held after age was controlled. However, peer regard did not relate to either measure of social dominance, which suggests that being the focus of peer attention is very different from being socially dominant in a group and should not be considered as an alternative index of social dominance (Hinde, 1980).

The relation between wins and teacher-rated dominance remained significant even after age was controlled. Our results suggest that children were systematic in choosing the targets of their aggression, and this choice was probably based on their belief that they could defeat their targets in competitions. This ability to win aggressive contests was unsurprisingly related to teacher-rated social dominance, which included items such as "dominates classmates," "tells others what to do," and "stands up for self." That wins were related to social dominance even after we controlled for age suggests that the ability to win such competitions is a skill that develops early in childhood, before children enter preschool.

Wins, however, did not relate to social dominance as measured in the ticket paradigm, possibly because the ticket paradigm, unlike the teacher rating measure, is closer to assessing scramble competition rather than contest competition. Indeed, queuing for resources has been identified as a paradigm case of scramble competition (Parker, 2000), one that does not readily elicit direct

confrontational behaviors, like challenging and winning aggressive bouts. In contest competition, in which there are clear winners and losers for limited resources, individuals should use aggressive strategies to access desired resources, as was the case with teacher-rated dominance. Scramble competition, conversely, involves individuals scrambling to access resources. Generally, in scramble competition, individuals get some of a resource, although not enough to survive, whereas in contest competition, there are definite winners and losers, with the winner usually taking all (Parker, 2000). It is not surprising that scramble competitions may be less likely to involve aggressive strategies, relative to contests. Given these different patterns of results, future research should specify the types of competition involved in discussions of social dominance.

A limitation of this work relates to the sample. First, a sample of university preschools lacks generalizability to other contexts, as has been pointed out repeatedly over the past 45 years (Bronfenbrenner, 1979; Wright, 1960). Future research could use different settings as opportunities to test hypotheses related to the roles of resources and socialization regimens on children's social status and behavioral development. It is important to know the effect of different socialization regimens on the development of cooperation and aggression. Do children in classrooms in which cooperation and reconciliation are explicitly taught, relative to classrooms in which these skills are less systematically taught, become less aggressive and more cooperative? Does aggression decrease in one setting as a result of socialization and in the other as a result of dominance relationships?

A larger sample would also have been important to teasing out possible sex differences in uses of aggression in social dominance. That is, do girls use social forms of aggression, such as gossiping and shunning, and boys use more physical forms, such as pushing and hitting, in contests for resources? Consistent with a meta-analysis showing equivocal sex differences in social aggression during the preschool period (Archer, 2004) and no sex differences for the relations between social aggression and a measure related to social dominance (i.e., deception; Ostrov, 2006), sex was not implicated in the use of aggression in social dominance in the present study. It might be the case, however, that the role of social aggression in social dominance is not fully realized until later in development, when children are able to make more accurate discriminations between their social intentions, motives, and beliefs and those of their peers (Sutton, Smith, & Swettenham, 1999; Tomasello & Call, 1997).

Despite these limitations, this study adds to the literature on peer relations in a number of important ways. Most generally, it tests and supports hypotheses derived from theory, showing that winning aggressive bouts, even when age was controlled, predicted social dominance. The role of both cooperation and frequency of aggression in social dominance reported in the literature seems to be a result of age confounding cooperation. We have demonstrated that winning aggressive bouts was important in teacher-rated social dominance, whereas frequency of aggression and teacher-rated aggression were not. This distinction is especially important when dominance is considered in terms of winning contests for resources rather than (mistakenly, we think) in terms of aggressive behavior alone (Francis, 1988).

Additionally, this work further underscores the functional value of aggression in peer relations. Rather than considering all forms of aggression as indicative of social–cognitive deficits, this work, along with other research (Cairns, 1986; Farmer & Rodkin, 1996; Rodkin, Farmer, Pearl, & Van Acker, 2000), documents that certain aggressive strategies can be effective in social dominance. That our results replicate research with a more culturally diverse, Head Start sample (Vaughn et al., 2003) speaks to the robustness of these findings.

Finally, our extensive use of direct observational data to document social processes associated with social dominance across an entire school year (i.e., winning aggressive bouts, cooperative behavior, and social displays) addresses a voiced need in the literature (Underwood, 2003). Direct observations have not been used frequently to assess dominance relationships (although see Ostrov & Keating, 2004; Ostrov, Woods, Jansen, Casas, & Crick, 2004; Strayer, 1980; Vaughn et al., 2003; Vaughn & Waters, 1981). Direct observations of dominance-related and aversive behaviors minimize the bias issues associated with more frequently used self-report and peer nomination measures (Underwood, 2003).

References

Achenbach, T. M., McConaughy, S. H., & Howell, C. T. (1987). Child/adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. *Psychological Bulletin, 101,* 213–232.

Archer, J. (1992). *Ethology and human development.* Hemel Hempstead, England: Harvester Wheatsheaf.

Archer, J. (2001). A strategic approach to aggression. *Social Development, 10,* 267–271.

Archer, J. (2004). Sex differences in aggression in real-word settings: A meta-analytic review. *Review of General Psychology, 8,* 291–322.

Bernstein, I. (1981). Dominance: The baby and the bathwater. *Behavioral and Brain Sciences, 4,* 419–457.

Bianchi, B., & Bakeman, R. (1978). Sex-typed affiliation preferences observed in preschools: Traditional and open school differences. *Child Development, 49,* 910–912.

Bronfenbrenner, U. (1979). *The ecology of human development.* Cambridge, MA: Harvard University Press.

Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences, 12,* 1–49.

Cairns, R. (1986). An evolutionary and developmental perspective on aggressive patterns. In C. Zahn-Waxler, E. Cummings, & R. Iannatti (Eds.), *Altruism and aggression* (pp. 58–87). New York: Cambridge University Press.

Cairns, R. B., Cairns, B. D., Neckerman, H. J., Ferguson, L. L., & Gariepy, J.-L. (1989). Growth and aggression: I. Childhood to adolescence. *Developmental Psychology, 25,* 815–823.

Campbell, A. (1999). Staying alive: Evolution, culture, and women's intrasexual aggression. *Behavioral and Brain Sciences, 22,* 203–252.

Chance, M. R. A. (1967). Attention structure as a basis for primate rank order. *Man, 2,* 503–518.

Charlesworth, W. R., & Dzur, C. (1987). Gender comparisons of preschoolers' behavior and resource utilization in group problem solving. *Child Development, 58,* 191–200.

Charlesworth, W. R., & LaFreniere, P. (1983). Dominance, friendship, and resource utilization in preschool children's groups. *Ethology and Sociobiology, 4,* 175–186.

Cheatham, C. L., & Mliner, S. (2003, April). *Getting to go first: A measure of dominance.* Poster presented at the meeting of the Society for Research in Child Development, Tampa, FL.

Clutton-Brock, T. H., & Albon, S. D. (1979). The roaring of red deer and the evolution of honest advertisement. *Behaviour, 69,* 145–170.

Coie, J. D., & Dodge, K. A. (1998). Aggression and antisocial behavior. In N. Eisenberg (Ed.), *Carmichael's manual of child psychology* (Vol. 3, pp. 779–862). New York: Wiley.

Crick, N. R., & Grotpeter, J. K. (1995). Relational aggression, gender, and social-psychological adjustment. *Child Development, 66,* 710–722.

Crick, N. R., Nelson, D. A., Morales, J. R., Cullerton-Sen, & Hickman, S. E. (2001). Relational aggression in childhood and adolescence. In J. Juvonen & S. Graham (Eds.), *Peer harassment in school: The plight of the vulnerable and victimized* (pp. 196–214). New York: Guilford Press.

Darwin, C. (1871). *The descent of man, and selection in relation to sex.* London: John Murray.

de Waal, F. B. M. (1982). The integration of dominance and social bonding in primates. *Quarterly Review of Biology, 61,* 459–479.

Dodge, K. A., & Coie, J. D. (1987). Social information processing factors in reactive and proactive aggression in children's peer groups. *Journal of Personality and Social Psychology, 53,* 1146–1158.

Dunbar, R. I. M. (1988). *Primate social systems.* Ithaca, NY: Cornell University Press.

Eagly, A., & Steffen, V. J. (1986). Gender and aggressive behavior: A meta-analytic review of the social psychological literature. *Psychological Bulletin, 100,* 309–330.

Farmer, T. W., & Rodkin, P. C. (1996). Antisocial and prosocial correlates of classroom social positions: The social network centrality perspective. *Social Development, 5,* 174–188.

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2004). *Applied longitudinal analysis.* Hoboken, NJ: Wiley.

Francis, R. C. (1988). On the relationship between aggression and dominance. *Ethology, 78,* 223–237.

Galen, B. R., & Underwood, M. K. (1997). A developmental investigation of social aggression among children. *Developmental Psychology, 33,* 589–600.

Gangestad, S. W., & Thornhill, R. (2004). Female multiple mating and genetic benefits in humans: Investigations of design. In P. M. Kappeler & C. P. van Schaik (Eds.), *Sexual selection in primates: New and comparative perspectives* (pp. 90–113). New York: Cambridge University Press.

Hartup, W. W. (1983). Peer relations. In E. M. Hetherington (Ed.), *Handbook of child psychology* (Vol. 4, pp. 103–196). New York: Wiley.

Hartup, W. W. (1996). The company they keep: Friendships and their developmental significance. *Child Development, 67,* 1–13.

Hawley, P. H. (2002). Social dominance and prosocial and coercive strategies of resource control in preschoolers. *International Journal of Behavioral Development, 26,* 167–176.

Hinde, R. A. (1978). Dominance and role: Two concepts with two meanings. *Journal of Social Biology Structure, 1,* 27–38.

Hinde, R. A. (1980). *Ethology.* London: Fontana.

Hold-Cavell, B. C. L. (1985). Showing-off and aggression in young children. *Aggressive Behavior, 11,* 303–314.

Kappeler, P. M., & C. P. van Schaik (2004). Sexual selection in primates: Review and selective preview. In P. M. Kappeler & C. P. van Schaik (Eds.), *Sexual selection in primates: New and comparative perspectives* (pp. 3–23). New York: Cambridge University Press.

Keating, C. F., & Heltman, K. (1994). Dominance and deception in children and adults: Are leaders the best misleaders? *Personality and Social Psychology Bulletin, 20,* 312–321.

Ljungberg, T., Westlund, K., & Forsberg, A. J. L. (1999). Conflict resolution in 5-year-old boys. *Animal Behaviour, 58,* 1007–1016.

Maccoby, E. E. (1998). *The two sexes: Growing up apart, coming together.* Cambridge, MA: Harvard University Press.

McGrew, W. C. (1972). *An ethological study of children's behaviour.* London: Metheun.

Nacci, P. L., & Tedeschi, J. T. (1976). Liking and power as factors affecting coalition choices in the triad. *Social Behavior and Personality, 4,* 27–32.

National Institute of Child Health and Human Development Early Child Care Research Network. (2005). Trajectories of physical aggression from toddlerhood to middle childhood. *Monographs of the Society for Research in Child Development, 69*(4, No. 278).

Ostrov, J. M. (2004). *Forms and functions of aggression during early childhood: A longitudinal study.* Unpublished doctoral dissertation University of Minnesota.

Ostrov, J. M. (2006). Deception and subtypes of aggression during early childhood. *Journal of Experimental Child Psychology, 93,* 322–336.

Ostrov, J. M., & Keating, C. F. (2004). Gender differences in preschool aggression during free play and structured interactions: An observational study. *Social Development, 13,* 255–275.

Ostrov, J. M., Woods, K. E., Jansen, E. A., Casas, J. F., & Crick, N. R. (2004). An observational study of delivered and received aggression, gender, and social-psychological adjustment in preschool: "This white crayon doesn't work." *Early Childhood Research Quarterly, 19,* 355–371.

Parker, G. A. (2000). Scramble in behaviour and ecology. *Philosophical Transactions of the Royal Society of London, 355,* 1637–1645.

Pellegrini, A. D. (2004a). *Observing children in the natural worlds: A methodological primer* (2nd ed.). Mahwah, NJ: Erlbaum.

Pellegrini, A. D. (2004b). Sexual segregation in childhood: A review of evidence for two hypotheses. *Animal Behaviour, 68,* 435–443.

Pellegrini, A. D., & Bartini, M. (2001). Dominance in early adolescent boys: Affiliative and aggressive dimensions and possible functions. *Merrill-Palmer Quarterly, 47,* 142–163.

Pellegrini, A. D., & Long, J. D. (2002). A longitudinal study of bullying, dominance, and victimization during the transition from primary to secondary school. *British Journal of Developmental Psychology, 20,* 259–280.

Pellegrini, A. D., & Long, J. D. (2003). A sexual selection theory longitudinal analysis of sexual segregation and integration in early adolescence. *Journal of Experimental Child Psychology, 85,* 257–278.

Perry, D. G., Kusel, S. J., & Perry, L. C. (1988). Victims of peer aggression. *Developmental Psychology, 24,* 807–814.

Rodkin, P. C., Farmer, T. W., Pearl, R., & Van Acker, R. (2000). Heterogeneity of popular boys: Antisocial and prosocial configurations. *Developmental Psychology, 36,* 14–24.

Roper, T., & Hinde, R. (1978). Social play in a play group: Consistency and complexity. *Child Development, 49,* 570–579.

Schwartz, D., Proctor, L., J., & Chen, D. H. (2001). The aggressive victim of bullying. In J. Juvonen & S. Graham (Eds.), *Peer harassment in school: The plight of the vulnerable and victimized* (pp. 147–174). New York: Guilford Press.

Sebanc, A. M., Pierce, S. L., Cheatham, C. L., & Gunnar, M. R. (2003). Gendered social worlds in preschool: Dominance, peer acceptance and assertive social skills in boys' and girls' peer groups. *Social Development, 12,* 91–106.

Sell, A. (2005). *Regulating welfare tradeoff ratios: Three tests of an evolutionary-computational model of human anger.* Unpublished doctoral dissertation, University of California, Santa Barbara.

Sluckin, A., & Smith, P. K. (1977). Two approaches to the concept of dominance in preschool children. *Child Development, 48,* 917–923.

Smith, P. K., & Connolly, K. (1980). *The ecology of preschool behaviour.* London: Cambridge University Press.

Smith, P. K., & Green, M. (1975). Aggressive behavior in English nurseries and playgrounds: Sex differences and responses of adults. *Child Development, 45,* 211–214.

Stauffacher, K., & DeHart, G. B. (2005). Preschoolers' relational aggression with siblings and friends. *Early Education and Development, 16,* 185–206.

Strayer, F. F. (1980). Social ecology of the preschool peer group. In W. A.

Collins (Ed.), *Minnesota symposium on child development* (Vol. 13, pp. 165–196). Hillsdale, NJ: Erlbaum.

Sutton, J., Smith, P. K., & Swettenham, J. (1999). Social cognition and bullying: Social inadequacy or skilled manipulation. *British Journal of Developmental Psychology, 17,* 435–450.

Tanner, J. M. (1970). Physical growth. In P. H. Mussen (Ed.), *Carmichael's manual of child psychology* (3rd ed., Vol. 1, pp. 77–156). New York: Wiley.

Tarullo, A., Mliner, S., Gustafson, M., & Gunnar, M. (2003, November). *Behavioral correlates of dominance rank in preschool children.* Poster presented at the meeting of the International Society of Developmental Psychobiology, New Orleans, LA.

Tokuda, K., & Jensen, G. D. (1969). Determinants of dominance hierarchy in a captive group of pigtailed monkeys *(Macaca nemestrina). Primates, 10,* 227–236.

Tomasello, M., & Call, J. (1997). *Primate cognition.* New York: Oxford University Press.

Underwood, M. K. (2003). The comity of modest manipulation, the importance of distinguishing bad behaviors. *Merrill-Palmer Quarterly, 49,* 373–389.

Vaughn, B. E., Vollenweider, M., Bost, K. K., Azria-Evans, M. R., & Snider, J. B. (2003). Negative interactions and social competence for preschool children in two samples: Reconsidering the interpretation of aggressive behavior for young children. *Merrill-Palmer Quarterly, 49,* 245–278.

Vaughn, B. E., & Waters, E. (1981). Attention structure, sociometric status, and dominance: Interrelations, behavioral correlates, and relationships to social competence. *Developmental Psychology, 17,* 275–288.

Waters, E., Gornal, M., Garber, J., & Vaughn, B. E. (1983). Q-sort correlates of visual regard among preschooler peers: Validation of a behavioral index of social competence. *Developmental Psychology, 19,* 550–560.

Wright, H. (1960). Observational child study. In P. H. Mussen (Ed.), *Handbook of research methods in child development* (pp. 71–139). New York: Wiley.

Received April 17, 2006
Revision received October 4, 2006
Accepted October 9, 2006 ■