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DOMINANCE IN PRESCHOOL CLASSROOMS: CHANGE ACROSS A SCHOOL YEAR

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ABSTRACT

We examined the ways in which preschool children's agonistic and cooperative behaviors related to their social dominance. First, two common assumptions associated with theories of social dominance were tested. We hypothesized that directly observed agonistic interactions would decrease across the school year and that same-sex agonism would be greater than cross-sex agonism. Both of these hypotheses were supported. The relation between agonistic behaviors, affiliation (cooperation and reconciliation), and social display variables (physical size and peer visual regard) and "wins" in agonistic bouts was also examined. Results indicated that agonism was more frequently followed by adult intervention than peer reconciliation. Further, agonistic and cooperative behaviors and social display variables related to "wins" in resource contests. Finally, we examined the relative power of "wins", cooperation, and physical size in predicting social dominance (assessed in a series of resource acquisition tasks). Physical size and "wins" were inter-correlated in predicting social dominance but cooperation and physical size made unique and significant contributions. Results are discussed in terms of the ways in which contests for resources were affected by the school ethos.

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I. INTRODUCTION

Social dominance is a basic characteristic of social group structure (Hartup, 1983; Hinde, 1980). Ethologists have documented dominance relationships across a number of social species (e.g., Bernstein, 1981; deWaal, 1982; Dunbar, 1988; Strayer, 1980) and conceptualized social dominance in terms of individuals' relative resource holding status in a particular niche (Charlesworth & Dzur, 1987; deWaal, 1982; Hinde, 1980; McGrew, 1972). From this perspective, individuals use a variety of affiliative and agonistic behaviors and strategies to access and hold resources (deWaal, 1982; Hartup, 1983; McGrew, 1972; Strayer, 1980). Affiliative behaviors, such as cooperation, are used to maintain social contact with peers (deWaal, 1982; McGrew, 1972). On the other hand, agonistic behaviors can be direct (e.g., physical and verbal aggression and snatching a toy from a peer) and indirect, or relational (Crick & Grotpeter, 1995), competitive behaviors and strategies (e.g., shunning, spreading rumors) and also used in resource acquisition contests. The balance between these affiliative and agonistic behaviors helps to stabilize group structure (Hartup, 1983).

Theory related to social dominance focuses on behavioral changes associated with group formation, a form of "micro-genetic" development, or change within a specific niche (Wertsch, McNamee, McLane, & Budwig, 1980). Specifically, most variants of social dominance theory posit that the social structure of new or emergent groups, such as pupils in a classroom at the start of a school year, stabilizes after a period of initially high agonism, (e.g., Pellegrini & Long, 2003; Strayer, 1980). With time and the corresponding change in group structure, rates of agonism should decrease as group structure is stabilized. This prediction follows from the assumption that social dominance relationships, once established, minimize competition because individuals recognize the costs and benefits of competing with peers for resources. Similar

trends have also been documented for early adolescents' aggression as the make the transition from primary to secondary school (Pellegrini & Long, 2003). Low dominance children probably recognize that the costs of challenging a more dominant individual outweigh benefits, as they are likely to be defeated. Similarly, high status individuals do not challenge subordinates because there is little to be gained (low benefits) while relatively high costs can be incurred (e.g., social sanction, defeat). While 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 competition for resources occurs more frequently between same-sex peers than between opposite-sex individuals (Archer, 1992). This assumption is based on sexual selection theory (Darwin, 1871) which posits that males compete with males (e.g., Buss, 1999) for dominance and prioritized access to resources. Females, too, compete with each other (Campbell, 1999; Kappeler & van Schaik, 2004) and subsequently exercise selective choice of resources. However, in studies of agonism and aggression, the sex of the target is often not reported (Archer, 2004; Eagly & Steffen, 1986; though see McGrew, 1972; Smith & Green, 1975 for exceptions). Following this theoretical orientation, as well as the fact that sex segregation typifies most preschool groups (Maccoby, 1998; Pellegrini, 2004a) and that propinquity among peers confers the risk of being the target of aggression, we expect boys to target other boys in agonistic bouts and girls to target other girls, even after the likelihood of same-sex cooperation associated with sex segregation is taken into account.

Correspondingly, agonistic interactions should not be distributed across all of the same-sex individuals in a group, but rather competitive interactions should be selectively directed at

certain individuals. For example, individuals should only challenge peers with desired resources and those they think they can defeat in competitive encounters (Archer, 1992). Examples of the selective uses of aggression can be found in the primary school bullying literature as well, where bullies systematically direct aggression at vulnerable peers (Perry, Kusel, & Perry, 1988; Schwartz, Proctor, & Chen, 2001). Consequently, we predict that individuals should not interact competitively with all of the same-sex peers in their social groups.

The extent to which individuals interact with all of their peers also has implications for the use of "dominance matrices", often used to document the dominance structure of groups. Place in a dominance matrix is determined by indexing individuals' observed dyadic agonistic exchanges and ordering 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 may be competing for a snack and one of them grabs it (the agonistic 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 dominance matrix and individuals are rank ordered from the most dominant (Rank 1 = alpha) to least dominant. In this way dominance rankings and transitivity indexes (e.g., A > B, B>C, therefore A>C) are based on the questionable assumption that all individuals in a group interact with each other (Archer, 1992).

This logic, which suggests that dominance hierarchies function as a queue for access to resources (Kappeler & van Schaik, 2004), led to the development of a task, the "ticket paradigm", where all children in a classroom competed simultaneously for a resource (Cheatham & Mliner, 2003; Mliner, Cheatham, Tarullo, & Gunnar, under review; Tarullo, Mliner, Gustafson, & Gunnar, 2003). Social dominance status in the ticket paradigm was operationalized as children's place in queue to gain access to three special events (after one

practice event). 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 us.

Briefly, the ticket paradigm was conducted in the winter of the year, after the children had been together for four months. On four 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, the middle third of the line received tickets to attend the event the next day, and the back third of the line received tickets to attend the event last. Tickets were numbered according to their place in line and were recorded as each child's rank for each trial event. This task is consistent with the position that social dominance is, at root, an index of resource accessing and holding power (Charlesworth & Dzur, 1987; deWaal, 1982).

From our perspective (Pellegrini & Bartini, 2001; Sebanc, Pierce, Cheatham, & Gunnar, 2003) and that of others (e.g., Hartup, 1983; McGrew, 1972; Strayer, 1980; deWaal, 1982; Vaughn, Vollenweider, Bost, Azria-Evans, & Snider, 2003), characterizing behaviors predicting social dominance solely in terms of agonistic or aggressive behaviors, alone, is antithetical to the presumed value of social dominance relationships, which is to *minimize* competition and foster affiliation. Thus, the relative importance of affiliative and agonistic variables in accessing resources should be integrated into the larger theoretical discussion about different forms of competition for those resources. Specifically, contest and scramble competitions are two strategies, at opposite ends of a continuum, describing the ways in which resources are accessed

(Kappeler & van Schaik, 2004). In the former case individuals use physical force and threats to access resources, typically in situations where resources are scarce and, especially, when competition is for high stakes resources. From this view, we would expect contest competition strategies to be used more frequently during adolescence and adulthood when heterosexual relationships are important (Pellegrini & Long, 2003). Scramble competition, on the other hand, is characterized by more indirect strategies, such as the use of displays, rather than confrontational, strategies. Scramble competition usually typifies situations where individual have equal access to resources and they "scramble", rather than compete, to access them. The ticket paradigm can be characterized as more scramble than contest competition because all children, eventually, got access to the resources.

From this view, dominance-related behavior should include agonistic (e.g., direct and indirect aggression as well as attempts to displace peers) and affiliative behaviors (e.g., reconciliations and cooperation), as well as the social displays associated with these dominance-related behaviors (e.g., peer visual regard and physical size) (Clutton-Brock & Albon, 1979; Gangstad & Thornhill, 2004; McGrew, 1972; Sell, 2005). Operationally, agonistic exchanges 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 agonistic bouts – losses = wins). This metric assayed the effectiveness with which individuals used agonism to access resources, without relying on dominance matrices, where assumptions associated with their use are not typically met.

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 dominant children use both affiliative

and agonistic strategies to access resources. For example, dominant individuals may reconcile with peers after agonistic exchanges (deWaal, 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 agonistic event (Ljungberg et al., 1999). By reconciling with their peers, dominant individuals can keep them as allies while simultaneously maintaining dominance (deWaal, 1982).

Following the direct observational work of Ljungberg and colleagues (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 post-agonistic peer reconciliations are observed, however, is often limited by adult intervention, especially in university lab schools (e.g., Hartup, 1983; Smith & Connolly, 1980) where there is a greater teacher presence as well as a strong anti-competition ethos.

By extension, cooperative behavior with peers is valued in these preschools and should also be related to both winning in agonistic bouts and ticket dominance status. Extant research suggests that agonism and cooperation not only co-occur (McGrew, 1972; Pellegrini & Bartini, 2001; Strayer, 1980) but they also both predict resource holding power (Charlesworth & Dzur, 1987; Charlesworth & LaFreniere, 1983; McGrew, 1972). Additionally, children's use of both agonistic and affiliative behavior to access resource may be indicative of a socially competent child- one who uses a variety of strategies to access resources (Hartup, 1983; Vaughn et al., 2003; Waters et al., 1983).

Social displays associated with agonistic and cooperative behaviors should also be important in contests for resources as they inform, or "advertise", an individual's social prowess to peers (Clutton-Brock & Albon, 1979), such as general social competence, as measured by peer

visual regard (Chance, 1967; Vaughn & Waters, 1981; Waters et al., 1983) and physical size, as a social display proxy for physical prowess (Gangstad & Thornhill, 2004; Sell, 2005; Tokuda & Jensen, 1969). The visual regard that children receive from their peers is an indicator of preschool children's social competence (Waters et al., 1983) and social dominance (Chance, 1976; Hold-Cavell, 1985; Vaughn, Vollenweider, Bost, Azria-Evans, & Snider, 2003; Waters & Vaughn, 1981). As such, we posit that peer visual regard will be positively correlated with observed cooperation as well as with winning agonistic contests and ticket paradigm status. It is probably the case that children become aware of their peers' competence and resource holding power by observing them in cooperative and agonistic encounters. This awareness should, in turn, impact responses of their peers in resource competition.

Physical size is another "display" variable as it is a proxy for physical prowess. Bigger is often equated with stronger and "tougher" and consequently is considered an important contributor to social dominance status in the comparative literature (e.g., Clutton-Brock & Albon, 1979; Tokuda & Jensen, 1969). Surprisingly, consideration of physical size has received very little attention in the child developmental literature on social dominance (for adults see Gangstad & Thornhill, 2004; Sell, 2005). Following Clutton-Brock and Albon (1979), we suggest that physical size is an indirect indicator of physical prowess at accessing resources, thus should relate to efficient winning agonistic bouts. Additionally, physical size should account for unique and significance variance, beyond directly observed agonism and cooperation, in the prediction of ticket paradigm status.

To summarize, there were four objectives in this study. First, we tested the hypothesis that directly observed agonistic interactions would decrease across the school year. In the second objective we tested the hypothesis that observed agonism between same-sex children

would be greater than agonism between opposite-sex children. As part of this objective the extent to which all members of a group interacted agonistically with each other was also examined. We predicted that children would not interact agonistically with all peers, but instead selectively choose their targets.

Third, the processes associated with the winning agonistic bouts were described. We predicted that display variables (physical size and peer visual regard), in addition to agonism and cooperation would relate to winning agonistic bouts. Since aggression is infrequently observed in preschools, and especially in university lab preschools (Hartup, 1983; Smith & Connolly, 1980), we used teacher ratings to complement the behavioral measure of agonism. The use of teacher ratings as valid indices of aggression is widely accepted (e.g., Achenbach, McConaughy, & Howell, 1987; NICHD Early Child Care Research Network, 2005; Pellegrini & Bartini, 2000) in the field. As part of this objective we also examined the extent to which agonistic bouts were followed by peer reconciliation or adult intervention.

In the fourth objective of this study we documented the degree to which winning agonistic bouts, cooperation, and display variables predicted children's ticket paradigm status. Winning agonistic bouts and cooperation should predict children's ticket paradigm status as they are both ways in which to efficiently access resources. We also predicted that the social display variables physical size and peer visual regard would account for unique and significant variance in ticket paradigm status, beyond agonism efficiency and cooperative behavior.

II. METHOD

Participants

A total of 65 children (ages 3.22 to 5.23 years; $M = 4.30$, $SD = .49$; 30 girls, 35 boys) enrolled in four separate classrooms in a large Midwestern university laboratory preschool

participated in this study. Girls (M = 4.36 year, 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 (F (3, 57) = 0.735, p = .53), nor was there a classroom by 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 four children were added, but they were not included in this study. 75% of children were European American, 8% were African American children, 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 subjects 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 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, among other aspects of social behavior not reported here, was rated by one teacher, at the end of the fall and spring semesters.

Behavioral observations. Children were observed following scan and event sampling procedures and instantaneous and continuous recording rules (Pellegrini, 2004b), respectively. The four researchers conducted the observations after a training regimen of about four weeks that

entailed videotape viewing and discussions, followed by live recording and discussion.

After suitable levels of reliability were reached (k= 0.8) in training, children were observed during their free play time in a number of venues in the preschool across the school year. Specifically, they were observed in their classrooms (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 probably minimal as the children were accustomed to researchers being present in their classrooms.

In terms of the scan sample/instantaneous recording procedures, observers entered a classroom each day with a pre-determined, randomized list of children to observe. All data were entered onto laptop computers using an SPSS spreadsheet. A variety of behaviors were instantaneously recorded but those relevant to this paper included: peer visual regard (i.e., the number of individuals looking directly at the focal child) and the child's cooperative behavior (i.e., as gauged by physical proximity in conjunction with mutual gaze, or verbal interaction).

Inter-rater agreement was established by comparing the coding of two simultaneous coders, every eight weeks across the nine month school year. Reliability and retraining sessions were held on alternating months across the entire year and the reliability coefficient for peer visual regard was k = .70 and for cooperative interaction k = .88. In total, 485 scans sessions were recorded across the school year, resulting in 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 agonistic bout, or any contest for a resource, such as a toy, a treat, place in a queue, or a peer's

attention. Children's behavior was recorded for the duration of the agonistic bout and for 4 minutes after the agonistic behavior terminated. For agonistic bouts, observers recorded the following information: the identity of the child who initiated the bout and the identity of the target of the agonism, the nature of the agonism (e.g., physical, verbal, and social aggression, snatching an object, or displacing a peer in line or at an activity, k= .90), and the context of the aggression; that is, was it over an object, person, place in line, etc. Agonism was scored both in terms of relative frequency (Agonism/Number of times a child was scanned) and in terms of a "win" index (Total agonistic bouts- Losses). Across the school year a total of 173 events were observed.

We also coded the responses to the agonistic initiations (k = .81). First, we coded whether there was a winner and a loser in the encounter and if so, his or her identity. Winners/losers were determined if 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 not getting it. We also coded the following responses: No response, leaves the field, cry, aggression (physical, verbal, social), counter-displace, counter-snatch, teacher intervention, and peer intervention. *No response* to an agonistic 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*. Agonistic counter moves were coded in the same manner as the initiations, as were counter-displacements and counter-snatches. Teacher and peer interventions were coded if a teacher or a peer intervened in the dyad directly after the agonistic initiation.

We also coded the extent to which there was reconciliation between the children involved in agonistic bouts (k= .87) . This was done by following the children for four

minutes after the observed agonism terminated (Ljungberg et al., 1999). Most generally, we coded if there was social contact between the children after the termination of the agonistic, bout, who initiated it, and the behavior employed (invitation to play, body contact, apology, teacher mediated contact, object offer, symbolic offer, self-ridicule, and comfort patting).

Physical size. Height and weight was assessed during the winter and spring of the year roughly at the beginning and end of the ticket dominance procedures. Physical size was defined as the average of each child's standardized (within each classroom) weight and height.

Teacher ratings. In the late fall/early winter and in the spring of the school year, classroom teachers completed a rating scale of social competence for each child. The choice of the administration time was based on earlier research with this measure (Pellegrini & Long, 2003). The rating scale was an adapted form of the Teacher Checklist (Dodge & Coie, 1987). Children were rated on a 1-7 scale for five items for aggression (e.g., starts fights, says mean things, uses physical force; Cronbach *alpha* = .89) and their scores were the aggregate of the fall/spring ratings.

The Ticket Paradigm. The ticket paradigm was conducted in the winter of the year, after the children had been together for four months by Gunnar and colleagues (Cheatham& Mliner, 2003; Tarullo et al; 2003; Mliner, Cheatham, Tarullo, & Gunnar, under review). Data using this paradigm were collected across 4 years in the preschool. The present results reflect data from this paradigm collected during one of those 4 years. For complete description of the procedures, see Mliner et al (under review). Briefly, 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, while 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, the middle third of the line received tickets to attend the event the next day, and the back third of the line received tickets to attend the event last. Tickets were numbered according to their 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 in order to ensure children grasped the concept, and followed with an individual assessment to determine understanding of the ticket procedures (see Mliner et al., under review). 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. The inter-correlations between each of 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, $r = .41$, $p < .01$.

Data analysis. A concern for data analysis was the low frequency of physical and verbal agonism (see Coie & Dodge, 1998), and that counts of such behaviors would not follow a normal distribution. More likely, counts of agonism 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), and thereby also precluding more traditional analytic methods such as repeated measures analyses of variance and multivariate analyses of variance (ANOVA/MANOVA). To address these concerns we used population-average, *generalized linear models* (GENMOD) for

longitudinal data (Fitzmaurice, Laird, & Ware, 2004, LIST ALL Chap. 10-11) to test our prediction that rates of agonism 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 (GEE) 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.

III. RESULTS

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

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

where $\mu_{ij} = E(Y_{ij})$, the expected rate of agonism 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. β_1 is the log expected rate of agonism at wave 1 (the unconditional intercept) and β_2 indicates the linear increase in log expected rate for a one-unit increase in time (i.e., linear trend). Table 1

Table 1. Parameter estimates for Model 1: Expected rates of agonism over time.

Parameter	Estimate	SE	95% Confidence Limits		Z	p-value
Intercept (β_1)	-1.078	0.2431	-1.5544	-0.6016	-4.43	< .0001
Linear Slope (β_2)	-0.5307	0.2266	-0.9747	-0.0866	-2.34	0.0192

shows that the specific tests of linear quadratic trend was significant and negative, meaning that the estimated log expected rate of agonism decreased over the three terms. More specifically, the predicted equation

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

can be used to compute estimated rate of agonism at each wave, with the slope, $e^{-0.5307} = 0.58$, indicating that a rate at one wave is multiplied by 0.58 to obtain the rate at the next wave. Thus, in support of the hypothesis that agonism decreased with time, there was a 41% decrease in rate of agonism from one wave to another, and a 66% decrease from the fall to spring (see Figure 1).

In the second objective, we compared the targets of agonistic bouts initiated by boys and initiated by girls. Of all the agonistic bouts recorded during the year, more involved same-sex children (M = .139, SD = .262) than mixed-sex groups (M = .083, SD = .133). Under the null hypothesis, same- and mixed-sex agonism should be equally likely, meaning their respective average frequencies will not be significantly different. Alternatively, we test the hypothesis that same-sex agonism will occur more often than mixed-sex agonism. Paired sample t-tests were used because the same children may have contributed to both scores (r = .51, p < .01); the results supported our hypothesis: t (64) = 2.00, p < .05.

Because same-sex agonism and same-sex play groups were correlated (r = .24, p < .05), we also compared the frequency of same - versus mixed-sex peer groups (i.e., the number of males and females recorded in each scan sample), the thinking being that if same-sex agonism occurs more frequently than mixed-sex agonism, this may be related to gender segregation of peer groups or, the frequency of same-sex play groups as opposed to mixed-sex play groups.

Again, paired sample t-tests were used because the same children may have contributed to both scores (r = .24, p < .05). At p = .05 (using a two-tailed test), we found no significant difference between same- versus mixed-sex play-group frequencies: t (64) = -1.17, p = .24, suggesting that the greater frequency of same- versus mixed-sex agonism differed from the comparable frequencies of same- versus mixed-sex play groups.

The next series of analyses were important in testing assumptions that individuals interact with all of their peers - an assumption underlying transitivity indexes derived from dominance matrixes. To this end, we examined the distribution of agonistic interactions between all individuals within each of the four classrooms, positing that the interactions are selectively directed at individuals, and not distributed across all individuals in each class. More specifically, the null hypothesis tested was that agonism within each classroom was equally distributed among all class members. Separate *chi*-square analyses for each of the four classrooms showed that, in every classroom, the observed frequencies of agonism differed from those expected under the null hypothesis by more than could be attributed by chance: Classroom 1 ($df = 16$) : $\chi^2 = 26.39$, $p < .05$; Classroom 2: χ^2 ($df = 17$) = 27.59, $p < .05$; Classroom 3: χ^2 ($df = 13$) =22.36, $p < .05$; Classroom 4: χ^2 ($df = 13$) = 23.69, $p < .05$. Said differently: Within each classroom agonism was not distributed across all individuals.

Table 2. Descriptive Statistics

	Mean	SD
Observed Agonism*	.22	.34
Agonistic Wins**	2.6	3.46
Peer Visual Regard*	.35	.20
Observed Cooperation*	.47	.16
Teacher Rated Aggression+	2.9	1.33
Physical Size		
Height (meters)	1.08	.05
Weight (kg)	18.42	2.93

N= 65 * Relative to all scans conducted ; ** mean total observed; + 1-7 scale

In the third objective we examined the relations between winning agonistic bouts, and cooperation, agonism, peer visual regard, and physical size. The descriptive statistics associated

with this objective are displayed in Table 2. Results supported the hypothesis that the winning was associated with agonistic behaviors, cooperative behaviors, peer visual regard, and physical size.

As part of the third objective, we also examined the degree to which agonistic interactions were followed by either reconciliation between peers or teacher intervention in the four minutes immediately following the initiation of the agonistic bout. Of the 173 agonistic events observed, in 32 cases (18%) the initiator reconciled his/her target and on 72 occasions (41%) a teacher intervened. The remaining agonistic initiations were not followed by reconciliations or interactions during the next 4-minutes.

In the fourth objective, we examined the relations between cooperative, agonistic, and display (physical size and peer visual regard) measures and the ticket paradigm measure (as indexed by the mean queue place observed in three ticket events). The correlations between each of these measures are displayed in Table 3.

Table 3. Correlations for Measures of Affiliation, Agonism, Display, and Ticket Paradigm Status

	2	3	4	5	6	7
Agonism1	.24*	.21	.007	.54**	.49**	.19
AgonisticWins2		.32**	.32**	.34**	.22	.25*
Cooperation3			.14	.09	.22	.32**
Physical Size4				-.04	.09	.28*
Peer Visual Regard5				.27*	.16	
Teacher Rated Aggression6					.08	
Ticket Paradigm Status7						

N= 65, * $p < .05$; ** $p < .01$

As predicted, winning agonistic bouts (*not* frequency of agonism or teacher rated aggression),

cooperation, and physical size predicted ticket dominance status. Inconsistent with the hypothesis, peer visual regard did not predict ticket dominance status.

As part of the fourth objective we also examined the importance of cooperation and winning agonistic bouts in relation to the one display variable (physical size) significantly associated with ticket paradigm status. Separate hierarchic regression models, displayed in Table 4, were calculated and the relative importance of physical size and winning and cooperation was examined.

Table 4. Summary of Hierarchical Regression Analysis for Variables Predicting Ticket Paradigm Status ($N = 65$)

Variable	B	SE B	β
Agonistic Wins & Physical Size			
Step 1			
Agonistic Wins	-0.05	0.02	-0.25*
Step 2			
Agonistic Wins	-0.04	0.02	-0.18
Physical Size	-0.19	0.10	-0.22

Note. $R^2 = .06$ for Step 1 ($p < .05$); $\Delta R^2 = .04$ for Step 2, ($p > .05$, not sig.). *$p < .05$.

Cooperation & Physical Size			
Step 1			
Cooperation	-1.01	0.59	-0.21
Step 2			
Cooperation	-1.19	0.57	-0.25*
Physical Size	-0.26	0.10	-0.31*

Note. $R^2 = .04$ for Step 1 ($p > .05$, not sig.); $\Delta R^2 = .09$ for Step 2, ($p < .05$). *$p < .05$

Results indicated that physical size and cooperation each made unique and significant contributions to ticket paradigm status. Physical size and winning agonistic bouts, on the other

hand, were correlated. When each was entered first, the other did not account for significant variance.

IV. DISCUSSION

The hypothesis that agonistic behaviors would decrease with time was supported. While there was a decrease across the whole year, the significant drop in agonism was observed during the spring term, relative to the first two terms. The decrease of agonism across a school year has been empirically verified with adolescents (Pellegrini & Long, 2003), but it has not, to our knowledge, been verified during the preschool period. That these patterns have been documented in the comparative literature (e.g., Hinde, 1981) and now have been verified during childhood and adolescence speaks to their robustness, suggesting that this is a general pattern typifying the role of agonism in the development of group structure.

Dominance theory also posits that agonism decreases because individuals recognize, with time, the costs and benefits associated with agonistic encounters. More specifically, lower status individuals may have recognized that the costs associated with challenging higher status individuals outweighed the benefits, especially when the value of resources was low. In the preschool examined in this study there was an abundance of resources, thus, their value was relatively low; for example, there was an abundance of snacks, toys, and play spaces available for children to access. Correspondingly, while low levels of conflict between children were seen as constructive by school staff (Guidelines and Disciple Policies from Shirley Moore Nursery School, personal communication, 12/13,2005), children's use of anti-social strategies was sanctioned in this school, thus making the use of these strategies costly. Future research could more directly test the effects of costs and benefits of resources and strategies by presenting children with filmed, contrived agonistic bouts with clear winners and losers, asking children if

they would challenge winners and losers for resources of varying value, and what strategies they would use. As the value of resources increases, individuals should suggest higher cost strategies (e.g., one more likely to bring a strong sanction).

That agonism is related to availability of props in preschool classrooms also has implications for early education: An abundance of resources should moderate agonism, though experimental manipulation of resource availability (e.g., Smith & Connolly, 1980) would provide a more direct evidence for this hypothesis.

The significant decrement in agonism during the spring terms, relative to the two preceding terms, may 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, agonism decreased.

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

norms of the classrooms. In our case, the social norms valued cooperation, not agonism.

A related cause for the decrement in agonism may have been due to the fact over time children were being socialized to school rules encouraging cooperative behavior and discouraging agonistic behavior. That teachers intervened in many (41%) of all observed agonistic bouts is consistent with this interpretation. 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 ($r = .26$, $p < .05$). Further, if the socialization hypothesis is correct, then one would expect that decreases in agonism over time would only be observed in classrooms with clear social norms. Correspondingly, schools with less clear social norms should produce prolonged agonism or even increases as children learn this is how these schools are organized. Future studies might contrast the two types socialization regimens with regard to emergence of dominance structure and agonism.

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

In the second objective, another basic assumption of social dominance and sexual selection theory, that agonistic 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 et al, 2001;Ostrov, 2004)

and direct observations for aggression in both school (preschool and middle school) and home settings (Ostrov, 2004; McGrew, 1972; Pellegrini & Long, 2003; 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 agonism is an artifact of sexually segregated peer groups (Ostrov, 2004). That is, agonism between same-sex children may be due to the fact that children of this age interact in sexually segregated groups (Maccoby, 1998; Pellegrini, 2004a). In the current study, however, we found that same-sex agonism was independent of the more general tendency for same-same children to interact with each other.

Our interpretation of the observed greater frequency of same-sex, relative to opposite-sex, peer agonism is derived from sexual selection theory (Pellegrini, 2004a). Consistent with the theory, same-sex peers compete with each other for status and subsequent 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 sexual selection theory derived hypothesis that individuals aim agonism at same-sex peers and, more speculatively, they are used to serve a dominance function (Pellegrini, 2004a).

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

verified.

In the third objective processes associated with winning agonistic encounters were examined. To this end, we first examined the extent to which agonistic bouts were followed by peer reconciliation. Peer reconciliations after agonisitc bouts were less common than adult interventions. The low rate of peer reconciliations may have been due to the relatively high number of adults in each classroom as well as the chosen post-agonism time intervals of 4-minutes (Ljungberg et al, 1999). Alternatively, teachers may have selectively intervened in those conflicts where 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). It would be interesting to see if teachers intervened into conflicts between nonfriends more than friends.

We also examined the extent to which cooperative and agonistic behaviors as well as display variables were associated with winning agonistic bouts. Consistent with our hypothesis, winning was related to cooperation, agonism, peer visual regard, and physical size. On the other hand, teacher rated aggression was not related to winning, indicating that aversive behaviors alone were not effective for winning agonisitc encounters. These results are consistent with the view that effectively accessing resources is a dimension of social competence and involved the use of a variety of direct (e.g., agonism and cooperation) and indirect (displays) strategies (Hartup, 1983; Strayer, 1980; Vaughn et al, 2003; Waters et al, 1983).

This interpretation is corroborated by the results associated with the fourth objective. Winning agonistic bouts, cooperation, and physical size were associated with ticket paradigm status while the frequency of agonism and teacher rated aggression were not. Children who were dominant in the ticket paradigm task were not aggressive, but instead they used a *combination* of

strategies, "winning" agonistic bouts, cooperation, and physical size displays, to access their place in the ticket queue. The strategies that allowed children to win agonistic bouts were the same that allowed them to be dominant. That is, winning agonistic bouts and ticket paradigm status may have been alternative measures of the same thing. More micro-analytic, observational work is need to examine the specific ways in which agonistic, cooperative, and display strategies unfolded in time in the process of accessing resources (Underwood, 2003). Further, it would also be interesting to apply these methods to the ticket paradigm more closely, using multiple video-cameras to record the behaviors and strategies used by children in queuing-up. For example, do children use the same strategies in the queue as they do in their classrooms to access resources?

The results from the regression analyses showed that physical size and winning agonistic bouts were inter-correlated in predicting ticket paradigm status. Consistent with Clutton-Brock and Albon (1977), size may have been a proxy for agonistic prowess in predicted ticket paradigm status. Physical prowess is recognized by preschoolers in contests for desirable resources (McGrew, 1972; Sluckin & Smith, 1977). Cooperation and physical size, however, each predicted unique and significant portions of the variance in ticket paradigm status, supporting the view that both cooperation and agonism were involved in preschool children's social dominance (Hartup, 1983; Strayer, 1980).

Peer visual regard, counter to the hypothesis, did not relate significantly to ticket paradigm status. The hypothesis was based on the extant literature documenting relation between visual regard and various measures of social dominance, such as Q-sort measures (Waters et al, 2003), as well as coercive and aggressive behavior (Vaughn et al, 2003). In our study, too, peer visual regard was related to relative frequency of agonism and teacher rated

aggression, but not cooperation. The importance of cooperation, relative to agonism, in ticket paradigm status was probably due to both the more general school policy where teachers stressed cooperation as well as the fact that a number of adults were also supervising the ticket paradigm. Consequently, cooperative and display strategies, not agonism, were the preferred means by which to win competitive encounters and access resources. Further, the scramble competitive nature of the ticket paradigm may also have biased children to use less agonistic strategies. It would be interesting to examine the strategies used by children in a more contest-oriented scenario, where only a few children gained access to resources. Theory predicts that this situation would be typified by more agonism and than a scramble contest.

The relative importance of display variables and cooperation in accessing resources is also consistent with the idea that scramble, rather than contest, competition typified these preschools. The scramble and contest distinction is useful for a number of reasons and should be considered in future research. First, it places social dominance clearly in the realm of contests for access to different sorts of resources. Second, it eliminates dichotomizing dominance as involving either agonism or agonism and cooperation. Third, and perhaps most importantly, it situates behavioral development, generally, and dominance strategies, more specifically, as involving a *number* of alternative strategies- rather than just one (Caro & Bateson, 1986)- to accomplish developmental tasks. Choice of a strategy depends on costs and benefits for particular individuals in particular niches. For example, different strategies may be used by high and low dominance children in differently provisioned classrooms. Future research should examine the extent to which strategies used to access resources depend on both the availability and type of resources being contested for different individuals.

A limitation of this work relate to the sample. First, a sample of university preschools

lack 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. In the preschool in which this research was conducted the written policy recognized that "conflict between and among children is not only inevitable but *necessary* [italics added]. It opens the door to viewpoints of others." Given this position, it is important to know the effect of different socialization regimens on the development of cooperation and aggression. Do children in classrooms where cooperation and reconciliation is explicitly taught, relative to classrooms where these things are less systematically taught, become less aggressive and more cooperative? Does aggression decrease in one setting due to socialization and in the other due to dominance relationships? Relatedly, is agonism more important for children's social status in resource poor contexts, relative to resource rich contexts?

Further, and specific to the middle class nature of the sample specifically, our results are similar to other studies using very different samples. That is, Vaughn and colleagues (2003) studied two samples of preschool children: A community sample and a Head Start sample. First, the Head Start sample was more aggressive than the community sample on ½ of the measures, but there were no differences due to ethnicity between the samples. Second, and perhaps most important to addressing the role of agonism in social dominance with the type of sample: There were no between sample differences for the roles of aggression and cooperation predicting social competence. In short, while our sample is middle class school policy certainly did not suppress children's conflict. Further, and at the empirical level, our results, like those using other, and much more diverse, samples support the hypotheses regarding the role of agonism and affiliation in social dominance.

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

Further, a larger and more diverse sample may shed new light on the issue of how indirect agonism relates to another measure of social status- "perceived popularity" (Cillessen & Mayeux, 2004). Following Cillessen and Mayeux, it maybe the case that girls' indirect agonism, more than boys, relates to them having higher perceived social status and this perceived status, like peer attention, may result in greater access to resources. The use of "perceived popularity" may be an especially useful construct in studying social dominance as it assesses children's perceptions of who is popular and, by implication, central to a group.

Despite these limitations, this study has added to the literature on peer relations in a number of important ways. Most generally, this study tested and supported hypotheses derived from theory showing that both agonistic and cooperative behaviors as well as physical size predicted access to resources in the ticket dominance task. We demonstrated that winning agonistic encounters was important in the ticket paradigm while frequency of agonism and teacher rated aggression was not. This distinction is especially important when dominance is

considered in terms of resource control, rather than (mistakenly we think) aversive behavior alone. We also demonstrated that relative importance of physical size as a proxy for agonistic behavior as a predictor of ticket dominance status. To our knowledge, this has not been documented in the child development literature.

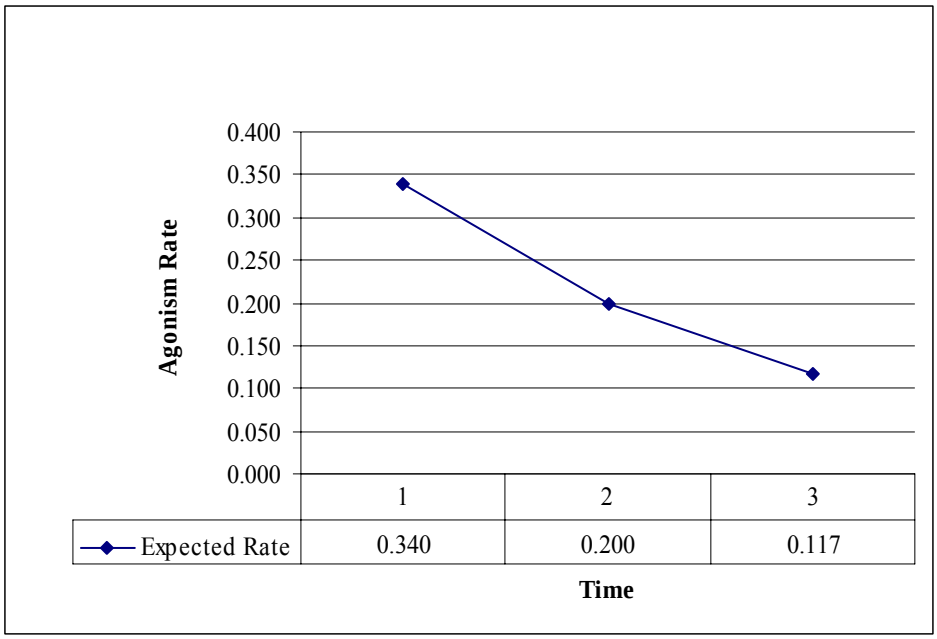
Correspondingly, we differentiated two types of contests that characterize social encounters: scramble or contest competition. To our knowledge this has not been done in the developmental literature. Social dominance is typically defined in solely in terms of attributes related to contest competition, with no mention of differentiating scramble from contest competition. This is an important distinction to the extent that it highlights the fact that different social strategies are used in each form of contest. Further, this distinction moves social dominance away from a person-centered trait typified by direct agonistic strategies towards a more context sensitive construct where the strategy used depends upon the value and availability of the resources being contested.

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 agonistic strategies, especially when paired with affiliative ones, can be effective in accessing resources. That our results replicate research with a 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 resource acquisition across an entire school year (i.e., winning agonistic bouts and ticket paradigm status) addressed a voiced need in the literature (Underwood, 2003). Direct observations have not been frequently used to assess dominance relationships (though see Ostrov

& Keating, 2004; Ostrov, Woods, Jansen, Casas, & Crick, 2004; Strayer, 1980; Vaughn & Waters, 1981; Vaughn et al., 2003). Direct observations of dominance-related and aversive behaviors minimize the bias issues associated with more frequently used self-report, peer nomination, and teaching rating measures (Underwood, 2003).

Figure 1. Estimated Rate of Agonism Across Time



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